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CHEROKEE NATIONAL CAPITOL MUSEUM

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RAA Project No. 7010

SECTION 01110 — SUMMARY OF WORK

PART 1- GENERAL

RELATED DOCUMENTS

A. Work of this section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents and Owner provided General Conditions.

SUMMARY

A. The work of this contract consists of the general construction and installation of exhibits for The Cherokee National Capitol Museum comprising approx. 2,840 square feet of permanent exhibit space highlighting the Cherokee Nation history from immemorial to the present day. The permanent exhibit space is located on the second floor of the Cherokee National Capitol Building located in Tahlequah, Oklahoma, which is a National Historic landmark.

CONTRACTS

A. This Exhibit Fabrication and Installation contract includes all exhibit furnishings, fabricated graphics, casework, environments, scenic work, interactives, mounts, media and AV Integration.

B. See Division 1 Section “Project Coordination” for a description of work and responsibilities included under each separate contract. Each contract is performed concurrently and coordinated closely with construction activities performed on Project under other contracts. The Exhibit Fabricator, from here on referred to as the “Exhibit Contractor” or “XC”, will be responsible for coordination with the Owner’s Prime Contractors on site which will include but not limited to:

    1. General Construction Contractor, designated as the “General Contractor” or “GC”. This contract includes the base building and related site work and Interior Fit out.

    2. Cherokee Nation AVIT, who will run low voltage cable as required and indicated in the Architects Construction documents.

C. The Exhibit Contractor will be responsible for solicitation of proposals and sub-Contracts for this Project which include the following:

    1. Exhibit AV Systems Integration Contractor. This contract includes all exhibit-related audio visual systems, controls, playback and display equipment.
    2. Media Producer(s). These contracts include the production of all media including interactive media, film media and other software for exhibits.

LOCATION

A. The site for the new museum is within the National Historic landmark Cherokee National Capitol Building located in Tahlequah, Oklahoma.

EXHIBIT FABRICATOR'S USE OF PREMISES

B. The project site will be closed to the public during construction.

C. Exhibit Fabricator shall at all times conduct his operations to ensure the least inconvenience to the public.

D. Confine storage of materials to within staging areas defined by the Owner.

E. Hauling Restrictions: Comply with all State load restrictions in the hauling of materials. Load restrictions on all roads are identical to the state load restrictions with such additional regulations as may be imposed by the Owner. Information regarding rules and regulations for vehicular traffic on roads may be obtained from the Owner. A special permit will not relieve Exhibit Fabricator of liability for damage that may result from moving of equipment.

FIELD VERIFICATION

A. Field verify all new and existing dimensions affecting the work of this contract before ordering products.

PERMITS, FEES AND NOTICES

A. The Exhibit Fabricator shall obtain and pay for all permits, licenses and certificates required by the State's Laws for the proper execution and completion of their work. The Exhibit Fabricator shall furnish proof of payment for all such permits, licenses and certificates, or proof that no permits, licenses and certificates are required. This proof must be furnished prior to the second request for payment.

B. The Exhibit Fabricator shall give all notices and comply with all applicable codes, laws, ordinances, regulations, rules and orders of any public authority bearing on the performance of the work. If the Exhibit Fabricator observes that any of the Contract Documents is at variance therewith in any respect, it shall promptly notify the Owner in writing. Any necessary modifications will be made by the Owner. If the Exhibit Fabricator performs any work knowing it be contrary to such applicable laws, ordinances, regulations, rules or orders, and without such written notice to the contracting officer, it assumes full responsibility therefore and shall bear all costs attributable thereto.

C. The Exhibit Fabricator shall obtain and pay for permits required for temporary traffic lane closings, no parking zones, and sidewalk closings as required by the City and the State. The street closings, no parking designations, and sidewalk closings are required from the commencement of construction through construction completion. The Exhibit Fabricator shall furnish proof of payment for all such permits.

D. The Exhibit Fabricator shall comply with Cherokee Nation Tribal Employment Rights office rules and regulations.

PART 2 – MEASUREMENT AND PAYMENT

A. Payment will be based upon an approved schedule of values. No payments for work complete will be made until Exhibit Fabricator provides proof of payment for material and performance bonds.

END OF SECTION 01110

SECTION 01050 — APPLICABLE STANDARDS

PART 1 – GENERAL

1.01 DESCRIPTION

A. Work of this section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents and Owner provided General Conditions.

B. Work Included:

1. In the Contract Documents reference is made to codes and standards which establish qualities and types of workmanship and materials and which establish methods for testing and reporting on the pertinent characteristics.

2. Where materials or workmanship are required by these Contract Documents to meet or exceed the specifically named code or standard, it is the Exhibit Fabricator's responsibility to provide materials and workmanship that meet or exceed the specifically named code or standard.

3. It is also the Exhibit Contractor's responsibility, when so required by the Contract Documents or requested by the Exhibit Designer, to deliver to the Exhibit Designer all required proof that the materials or workmanship, or both, meet or exceed the requirements of the specifically named code or standard. Such proof shall be in the form requested by the Exhibit Designer.

B. Related work: Specific naming of codes or standards occurs on the Drawings and in other Sections of these Specifications.

1.02 QUALITY ASSURANCE

A. Rejection of non-complying items: the Exhibit Designer reserves the right to reject items incorporated into the work that fail to meet the specified minimum requirements. The Exhibit Designer further reserves the right to accept non-complying items subject to an adjustment in the contract amount as approved by the Exhibit Designer and the Exhibit Contractor without prejudice to other recourse the Exhibit Designer may take.

B. Applicable standards listed in these specifications include, but are not necessarily limited to, standards and requirements promulgated by all pertinent government agencies having jurisdiction.

END OF SECTION

SECTION 01305 — PROJECT COORDINATION

PART 1-GENERAL

1.01 RELATED DOCUMENTS

A. Work of this section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents and Owner provided General Conditions.

1.02 SUMMARY

A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General project coordination procedures.
2. Conservation.
3. Coordination and Survey Drawings.
4. Administrative and supervisory personnel.

B. Related Sections: The following Sections contain requirements that related to this Section:

1. Division 1 Section “Summary of Work” for a description of the division of Work among Separate contracts and responsibility for coordination activities not in this Section.
2. Division1 Section “Project Schedule” for preparing and submitting the Contractor’s Construction Schedule.
3. Division 1 Section “Project Closeout” for coordinating Contract closeout.

1.03 COORDINATION

A. Project Coordinator shall be responsible for coordination between the General Construction Contract and the Exhibit Construction Contract.

1. The Exhibit Contractor shall assign a Project Coordinator.
2. The Project Coordinator is responsible for coordination of Exhibit Contract Work and the Work of General Construction.
3. The Exhibit Contractor shall appoint a qualified Exhibit Project Manager to act as a single point of contact and coordinate all aspects of the Exhibit Contract Work with the GC’s Project Coordinator and other prime contractors.

1.04 EXHIBIT PROJECT COORDINATOR

A. Exhibit Project Coordinator: Project Coordinator shall be experienced in administration and supervision of building construction, including exhibit construction work.

1. Coordination activities of Project Coordinator include, but are not limited to, the following:

a. Provide overall coordination of the Work.
b. Coordinate shared access to work spaces.
c. Coordinate product selections for compatibility.
d. Provide overall coordination of temporary facilities and controls.
e. Coordinate, schedule, and approve interruptions of permanent and temporary utilities, including those necessary to make connections for temporary services.
f. Coordinate construction and operations of the Work with work performed by each contract.
g. Prepare Coordination Drawings to coordinate work by more than one contract.
h. Coordinate sequencing and scheduling of the Work. Include the following:
i) Initial Coordination Meeting: At earliest possible date, arrange and conduct a meeting with separate contractors and the Owner and Exhibit Designers for

sequencing and coordinating the Work; negotiate reasonable adjustments to schedules.

ii) Prepare a combined Contractor's Construction Schedule for entire Project. Base schedule on Preliminary Construction Schedule. Secure time commitments for performing critical construction activities from separate contractors. Show activities of each contract on a separate sheet. Prepare a simplified summary of sheet indicating combined construction activities of contracts.

iii) Distribute copies of schedules to the Owner, and separate contractors.

i. Provide quality-assurance and quality-control services.

j. Coordinate sequence of activities to accommodate tests and inspections, and coordinate schedule of tests and inspections.

k. Provide information necessary to adjust, move, or relocate existing utility structures affected by construction.

l. Locate existing permanent benchmarks, control points, and similar reference points, and establish permanent benchmarks on Project site.

m. Provide field surveys of in-progress construction and site work and final property survey.

n. Provide progress cleaning of common areas and coordinate progress cleaning of areas or pieces of equipment where more than one contractor has worked.

o. Coordinate cutting and patching.

p. Coordinate protection of the Work.

q. Coordinate firestopping.

r. Coordinate preparation of Project Record Documents if information from more than one contractor is to be integrated with information from other contractors to form one combined record.

s. Collect Record Specification Sections from other contractors, collate Sections into numeric order, and submit complete set.

t. Coordinate preparation of operation and maintenance manuals if information from more than one contractor is to be integrated with information from other contractors to form one combined record.

2. Responsibilities of Project Coordinator for temporary facilities and controls include, but are not limited to, the following:

a. Provide common-use field office for use by all personnel engaged in construction activities.

b. Provide telephone service for common-use facilities.

1.05 EXHIBIT PROJECT MANAGER

1. The Exhibit Project Manager must have a experience coordinating exhibit fabrication and installation with a general contractor on a project of similar scale and type. Coordination responsibilities of the Exhibit Project Manager include the following:

a. Provide overall coordination of the Exhibit Contract Work with the Project Coordinator and all other Prime Contractors.

b. Attend all Project Coordination Mtgs, Quality Control Inspections, Pre-Installation Mtgs and Project Closeout Mtgs. See Division 1 – Project Meetings.

c. Coordinate product selections for compatibility.

d. Prepare and submit all Shop Drawings, RFIs and Submittals.

e. Coordinate and schedule use of permanent and temporary utilities, including those necessary to make connections for temporary services as required for the Exhibit Contract Work.

f. Review Coordination Drawings and coordinate work with the General Contractor. Prepare a Site Survey verifying all conditions in the field and prepare Shop Drawings.

g. Coordinate sequencing and scheduling of the Work described in the Exhibit Contract Documents. Include the following:

i) Initial Coordination Meeting: at earliest possible date, arrange and conduct a meeting with separate contractors for sequencing and coordinating the Work; negotiate reasonable adjustments to schedules.

ii) Prepare an Exhibit Fabrication and Installation Schedule (Exhibit Schedule) and coordinate its incorporation within the Overall Construction Schedule with the work of other prime contractors.

iii) Base the Exhibit Schedule on Preliminary Construction Schedule.

iv) Secure time commitments for performing critical fabrication and installation activities.
v) Indicate and include construction milestones including turnover conditions for exhibit installation and AV systems installation, mount making and object installation.

h. Provide quality-assurance and quality control services specified.
i. Coordinate sequence of activities to accommodate tests and inspections, and coordinate schedule of tests and inspections.
j. Locate existing permanent benchmarks, control points, and similar reference points, and establish new permanent benchmarks on Project site.
k. Provide a field survey of all dimensions and conditions on the site as-built in preparation for exhibit shop drawings.
l. Coordinate protection of the work.
m. Coordinate preparation of project record documents and provide to Project Coordinator.
n. Collect Record Specification Sections and provide to Project Coordinator for inclusion in the master document.
o. Coordinate preparation of operation and maintenance manuals and provide to Project Coordinator for inclusion in the master document.

2. Responsibilities of Exhibit Project Manager for temporary facilities and controls include, but are not limited to, the following:

a. Share and maintain common-use field office and office equipment for use by all personnel engaged in construction activities.

1.06 CONTRACTS, GENERAL

A. Extent of Contract: Unless the Contract Documents contain a more specific description of the work, the names and terminology on drawings and in specification sections determine which contract includes that specific element of the project.

1. Unless otherwise indicated, work for each contract shall be complete systems and assemblies, including products, components, accessories, and installation required by the Exhibit Contract Documents.
2. Local custom and trade-union jurisdictional settlements do not control the scope for the Work of each contract. When a potential jurisdictional dispute or similar interruption of work is first identified or threatened, affected contractors shall negotiate a reasonable settlement to avoid or minimized interruption and delays.
3. Trenches needed for the work of each contract shall be provided by the General Construction Contract.
4. Cutting and patching needed for the work of each contract shall be provided by the General Construction Contract.
5. Firestopping needed for the work of each contract shall be provided by the General Construction Contract.
6. Within five working days after preliminary horizontal bar-chart-type construction schedule submittal has been received from Project Coordinator, the Exhibit Project Manager shall submit a matching preliminary horizontal bar-chart schedule showing construction operations sequenced and coordinated with overall construction.

B. Substitutions: Each contractor shall cooperate with other contractors involved to coordinate approved substitutions with remainder of the Work.

C. Temporary Facilities and Controls: In addition to specific responsibilities for temporary facilities and controls indicated in this Section and in Division 1 Section “Temporary Facilities and Controls,” each contractor is responsible for the following:

1. Installation, operation, maintenance, and removal of each temporary facility usually considered as its own normal construction activity, and costs and use charges associated with each facility.
2. Plug-in electric power cords and extension cords, supplementary plug-in task lighting, and special lighting necessary exclusively for its own activities.

3. Its own field office, complete with necessary furniture, utilities, and telephone service.
4. Its own storage and fabrication sheds.
5. Temporary enclosures for its own construction activities.
6. Waste disposal facilities, including collection and legal disposal of its own hazardous, dangerous, unsanitary, or other harmful waste materials.
7. Progress cleaning of it's own areas on a daily basis.
8. Secure lockup of its own tools, materials, and equipment.
9. Construction aids and miscellaneous services and facilities necessary exclusively for its own construction activities.

D. Temporary heating, cooling, and ventilation: The General Construction Contract is responsible for temporary heating, cooling, and ventilation, including utility-use charges.

E. Use Charges: Divide cost of providing and using common-use temporary services and facilities, including use charges, among the General Construction Contract and the Exhibit Contract. The Contract Sum of each contract shall include cost of providing and using temporary services and facilities, including use charges.

F. Use Charges: Comply with the following:

1. Sewer Service: Include the cost for sewer service use by all parties engaged in construction activities at Project site in the General Construction Contract.
2. Water Service: Include the cost for water service, whether metered or otherwise, for water used by all entities engaged in construction activities at Project site in the General Construction Contract.
3. Electric Power Service: Include the cost for electric power service, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site in the General Construction Contract.

A. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections, which depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in the sequence needed to obtain the best results, especially when the installation of one part of the work depends on the installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. If necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's Construction Schedule.
2. Preparation of the Schedule of Values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Pre-installation conferences.
7. Project closeout activities.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work.

1.07 SUBMITTALS

A. Coordination of Prime Contractors. Each Prime Contractor shall notify in writing any occurrence where their work may interfere with the work of other Prime Contractors. Conflicts that become apparent during coordination meetings shall be brought to the attention of the affected Prime Contractors and conflicts shall be resolved prior to commencement of by any Prime Contractor of the effected work. The Exhibit Contractor shall arrange a meeting with the Prime Contractors to discuss any and all areas of conflict, resolve the conflicts, prepare any necessary coordination drawings, and submit the drawings to the Owner, Designer and other Prime Contractors for review.

B. Site Survey and Exhibit Coordination Drawings: The Exhibit Project Manager shall conduct his own site survey, verifying dimensions and conditions of the site as-built and document any coordination issues with other Prime Contractors. This work shall be done and submitted to the Designer as a submittal, prior to the commencement of shop drawings and fabrication of exhibits. The site survey may utilize the drawings prepared by the General Contactor or the Designer but these drawings in no way constitute a substitute for field verification of as-built dimensions. The site survey should be scaled dimensioned drawing(s) 1/8”=1’-0” scale drawings (30” x 42” sheet size) that indicate;

1. Any special or typical conditions requiring coordination of the Exhibit Contract Work with the Work of other prime contractors.
2. Required installation sequences.
3. Any variance with Contract Documents in dimensions or conditions as-built.
4. Any proposed changes to the Exhibit Contract Documents to rectify errors or omissions, or to account for variances.

The Site Survey and Exhibit Coordination Drawings must be completed and all issues resolved in conference with the Owner and the Exhibit Designer prior to the commencement of any Work by the Exhibit Contractor.

C. Staff Names: Within 15 days of starting construction operations, submit a list of principal staff assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.

1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone.

1.08 TURNOVER CONDITIONS

A. During turnover of exhibit space from General Contractor to Exhibit Fabricator, it is the responsibility of the GC to establish and achieve turnover dates for dust controlled and dust free environments on the construction schedule.

The following milestones must be established in the construction schedule for coordination of work between the Exhibit Fabricator, General Contractor (GC), AV Systems Integrator and museum staff and contractors who will be installing specimens and artifacts.

1. Dust Controlled Environment

This environment is established when the General Contractor’s scope of work in all exhibit spaces is substantially complete. These spaces are broom cleaned & turned over to the Exhibit Contractor free and clear of all gang boxes, obstructions, construction materials, trash

and debris. General access to the exhibit areas by non- Exhibit Contractors are to be limited and tightly controlled. Clear and unobstructed access paths for Exhibit Contractors to and from loading docks & exhibit areas are required and are coordinated with the General Contractor.

If a "phased installation" is required, the General Contractor is to provide temporary barriers to divide work areas and to ensure adequate isolation of exhibit areas. “Adequate isolation" can be defined as a framed plywood barrier (or other mutually agreed upon device or material) to inhibit dust infiltration and insure security against theft or vandalism, if required."

The Exhibit Contractor will commence delivery of exhibit cases and components; the AV Systems Integrator will phase in delivery and installation of AV equipment and components, the Mount making Contractor will phase in delivery and installation of large-scale artifacts and specimens.

Construction Turnover Conditions (at Dust Controlled) indicates:

a. All wall, floor, ceiling construction finishes are completed.

b. Windows and doors are installed.

c. The space is water-tight.

d. Normal or temporary power and preliminary grounding systems are completed and emergency power and integration of all systems are in progress.

e. All GC (or sub GC) responsible lighting is complete.

f. HVAC systems will have start up completed and are operational with clean filters and are distributing continuous conditioned air within 5 degrees F of an agreed upon set point.

g. Sprinkler system piping is completed, but the system will not be active.

h. All conduit paths are completed with anti-short bushings installed on the conduit ends.

i. All sharp edges on the cable trays and ladders will be covered or filled.

j. Drag lines are installed in all conduit paths.

k. Final adjustments (e.g. lighting systems, electrical hardwiring of exhibits, etc.) are a comeback operation.

2. Dust Free Environment

A Dust Free Environment is established when all Contractors work in all exhibit spaces is completed to the point of zero dust generation from remaining work. All of the building’s systems are performing as they will under normal operating conditions.

The Exhibit Contractor will deliver and install exhibit elements (e.g. graphics, photos, facsimiles, etc.). The AV Systems Integrator will integrate, install, balance and test all AV equipment and systems components. The Media Producers will install and test all media software. The Exhibit Lighting Designer will aim and balance the exhibit lighting and the Mount making Contractor will deliver and install mounts and small scale and/or sensitive/valuable artifacts and specimens.

Construction Turnover Conditions (at Dust Free) indicates:

a. HVAC systems will be fully commissioned and operational and approved by the Architect and the Owner.

b. Clean filters and are distributing continuous conditioned air as described in the conservation standards – Section 01811 Air Management.

c. Permanent power is provided.

END OF SECTION 01305

SECTION 01312 – PROJECT MEETINGS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

A. Work of this section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents and Owner provided General Conditions.

B. Schedule meetings and conferences throughout progress of Work; each session scheduled, administered, and presided by entity indicated. Requirements for meetings and conferences include:

1. Prepare an agenda for each conference and meeting.

2. Distribute written notice to participants seven days in advance of scheduled date.

3. Make physical arrangements.

4. Record minutes and attendees; include significant proceedings and decisions.

5. Reproduce and distribute copies of minutes within three days after each meeting.

6. Distribute one copy of minutes to each participant and to entities affected by decisions made at meeting

7. Distribute one copy of minutes each to Exhibit Designer, Architect and Owner.

8. Maintain in field office one copy of agenda and minutes for each conference and meeting.

C. Representatives attending meetings shall be qualified and authorized to act on behalf of entity each represents.

1. Exhibit Designer and Professional Consultants may attend meetings to ascertain that Work is consistent with the Exhibit Contract Documents.

2. Architect may also be present at meetings and may propose agenda items.

D. The Exhibit Contractor is responsible for all costs associated with travel to and from Coordination Meetings.

1.02 PRE-CONSTRUCTION CONFERENCES

1. Schedule pre-construction conferences no later than seven days prior to commencement of Work. Convene at Project site. The Exhibit Contractor presides over meeting and is responsible for minutes

B. Attendees:

1. Exhibit Project Coordinator.
2. Exhibit Project Manger.
3. Representatives of all Prime Contractors.
4. Owner's Construction Manager.
5. Owner's Representatives
6. Exhibit Designer.
7. Architect.
8. Professional Consultants.
9. Others as appropriate.

C. Minimum Agenda:

1. Administrative and Procedural Issues:

    a. Designation of key personnel.
    b. Review and clarify responsibilities of parties to contract.
    c. Communications procedures.
    d. Review of proposed Contractors, materials, equipment, and products.
    e. Application for payment procedures; schedule of values, proposal requests, change orders.
    f. Critical work sequencing; long lead-time items.
    g. Submittal and construction progress schedules.
    h. Submittal requirements; complete, correct, and timely submittals; scheduled dates.
    i. Procedures for submitting product data, shop drawings, samples, and other submittals.
    j. Product options and substitutions procedures.
    k. Procedures for requests for interpretations (RFI), minor changes, field decisions, construction change directives, proposal requests, change orders, and filing claims.
    l. Procedures for testing and inspection, including timely notification
    m. Responsibilities and limitations of authority of geotechnical engineer and testing laboratories; distribution of reports.
    n. Procedures for maintaining Project Record Documents.
    o. Schedule for progress meetings.
    p. Issue notice to proceed.

2. Review of Exhibit Plan and all Exhibit Contract Documents.

3. Review of Owner Furnished Reference and Source Materials including:
    a) original art work for reproduction.
    b) artifacts and objects.

5. On-Site inspection & measurement of artifacts
    a) meet with museum conservation and mount making staff
    b) discuss artifact mount making procedures
    c) verification of artifact dimensions and weights.

6. Exhibit Contractor familiarization with the project site and project office.

    a) site walk and survey

1.03 PROGRESS MEETINGS

1. Schedule periodic meetings as necessary by progress of Work; day, location, and time to be determined. Convene at Project site a minimum of one monthly Project Coordination Meeting prior to installation (the rest being conducted by teleconference). The Exhibit Contractor presides over meeting and is responsible for minutes.

B. Attendees:

1. Exhibit Project Coordinator.
2. Exhibit Project Manger.
3. Representatives of all Prime Contractors (as appropriate to agenda).
4. Owner's Construction Manager.
5. Owner's Representatives
6. Exhibit Designer.
7. Architect.
8. Professional Consultants.
9. Others as appropriate.
10. Others as appropriate to agenda.

C. Minimum Agenda:

1. Approval of minutes of previous meeting.

2. Work Progress Since Previous Meeting:
   a. Current activities.
   b. Critical activities.
   c. Deviations from schedule.

3. Field observations, problems, conflicts, and decisions.

4. Deficiencies:
   a. Identification of items.
   b. Status of correction.

5. Requests for Interpretations (RFIs):
   a. Status of clarification.
   b. Status of proposal requests.

6. Changes and Modifications:
   a. Status of change orders.
   b. Pending changes.
   c. Pending claims and disputes.
   d. Clarification decisions of Owner or Exhibit Designer.

7. Problems and conflicts that impede planned progress.

8. Construction Progress and Submittal Schedules:
   a. Off-site fabrication and delivery schedules..
   b. Effect of proposed changes on construction progress schedule and coordination.
   c. Submittal schedules, status of submittals, and effect on construction progress schedule.
   d. Corrective measures to regain projected schedule.

9. Planned progress during succeeding Work period.

10. Adequacy of work forces.

11. Coordination between elements of Work.

12. Maintenance of Project Record Documents.

13. Other business relating to progress of Work.

D. Meeting Minutes:

1. Include column to indicate who is required to take action and date action is to be completed. Each of these items requiring action will be carried in subsequent minutes of meeting as "old business" until noted as "resolved."

2. As minimum, separate into following categories:
   a. Old business.
   b. New business.
   c. Work progress.
   d. Deficiencies.
   e. RFIs.
   f. Proposed changes.
   g. Schedules.
   h. Submittals.
   i. Other business, including events to be accomplished by next meeting.

1.04 OFF-SITE PROGRESS MEETINGS AND QUALITY CONTROL REVIEWS

A. Schedule Off-Site Meetings and Quality Control Reviews at the Exhibit Contractor's facility in coordination with regular progress meetings. These meeting shall occur when it is necessary to review mock-ups and prototypes prior to completion of work for each section. The Exhibit Contractor presides over meeting and is responsible for minutes.

B. Attendees:

1. Exhibit Project Coordinator.
2. Exhibit Project Manger.
3. Owner's Construction Manager.
3. Owner's Representatives
4. Exhibit Designer.
5. Professional Consultants.
6. Others as appropriate.

C. Minimum Agenda:

1. All items in regular Progress Meetings as noted above.
2. Review of Work completed to date.
3. Determination of conflicts and impediments to progress of the Work.
4. Resolution of impediments.

D. Meeting Minutes:

1. Record observations, recommendations and directives offered by the attendees.

1.05 PRE-INSTALLATION CONFERENCES

A. Schedule pre-installation conferences required in individual Specification sections. Convene at Project site prior to commencing Work of the section.

B. Attendees:

1. Exhibit Project Coordinator.
2. Exhibit Project Manger.
3. Owner's Construction Manager.
3. Owner's Representatives
4. Exhibit Designer.
5. Professional Consultants.
6. Local Subcontractors (installer, applicator, or erector).
7. Material or equipment supplier.
8. Manufacturers' representative.
9. Others directly affecting, or affected by the work.
10. Testing agency (if necessary).

C. Minimum Agenda:

1. Access to work and conditions of proper installation.
2. Site mobilization and utilization:

    a. Use of premises; office and storage areas ; Owner's requirements.
    b. Temporary utilities and services
    c. Waste management plan and procedures.
    d. Conditions of installation, such as substrates, existing and surrounding conditions, and environmental conditions.

3. Conditions detrimental to installation.
4. Preparation procedures, including protection of adjacent work.
5. Verify installers' receipt and understanding of installation instructions.
6. Review submittals, installation procedures, and sequence.
7. Review coordination with other work.
8. Evaluate delivery schedule and Construction Progress Schedule.
9. Observe sample installation.
10. Required protection procedures.

1.06 CLOSEOUT CONFERENCE

A. Schedule Project Closeout conference with sufficient time to prepare for requesting Final Completion.

B. Attendees:

1. Exhibit Project Coordinator.
2. Exhibit Project Manger.
3. Owner’s Construction Manager.
4. Owner’s Representatives (museum staff, facilities operations and security personnel, etc)
5. Exhibit Designer.
6. Others as appropriate.

C. Minimum Agenda:

1. Start-up of facilities and systems.
2. Operations and Training and Exhibit Maintenance Manuals.
3. Testing, adjusting, and balancing.
4. System demonstration and observation.
5. Operations and Training and maintenance instructions for the museum’s personnel.
6. Exhibit Contractor’s inspection of work.
7. Exhibit Contractor’s preparation of an initial "punch list."
8. Procedure to request Exhibit Designer inspection to determine date of substantial completion.
9. Completion time for correcting deficiencies.
10. Inspections by authorities having jurisdiction.
11. Certificate of occupancy and transfer of insurance responsibilities.
12. Partial release of retainage.
13. Preparation for final inspection.

1. Closeout submittals
   a. Project Record Documents.
   b. Operating and maintenance documents.
   c. Operating and maintenance materials.
   d. Warranties and bonds.
   e. Affidavits.

2. Final application for payment.
3. Final cleaning.
4. Exhibit Contractor’s demobilization of site.
5. Maintenance.

END OF SECTION 01312

SECTION 01323 — PROJECT SCHEDULE

PART 1 – GENERAL

1 .1 RELATED DOCUMENTS

A. Work of this section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents and Owner provided General Conditions.

1 .2 DESCRIPTION

A. Summary: The work of this section consists of project schedule requirements including preparation of a project schedule, schedule updates, schedule revisions and time impact analysis. The project schedule shall be based upon the Critical Path Method (CPM) for planning, scheduling and reporting progress of the Work.

B. Purpose: The purpose of the project schedule is to ensure adequate planning, coordination, scheduling, and reporting during execution of the work by the Exhibit Contractor. The project schedule will assist the Exhibit Contractor, General Contractor's Project Coordinator and Owner in monitoring the progress of the work, evaluating proposed changes and potential impacts to overall schedule.

1 .3 SUBMITTALS:

A. As specified in Section 01330

B. Project Schedule: Within 5 calendar days after Notice to Proceed, submit one electronic copy (pdf) and 3 paper copies of the proposed project schedule, and accompanying CPM Schedule Reports to the Owner.

C. Project Schedule Updates: Submit estimates of the completion time required for each scheduled activity. The submittal shall include 3 paper copies and one electronic copy of the previous month's Schedule Update indicating actual activity start and/or complete dates, revised (current) remaining durations, and percent complete information. The Exhibit Contractor shall also indicate in writing those activities the Exhibit Contractor plans to work on during the following update month, any anticipated conditions which may delay the work, or any additional information necessary to support the above.

D. Project Schedule Revisions and Time Impact Analysis: Submit one electronic copy and two paper copies of a Time Impact Analysis. Each analysis shall demonstrate how the Exhibit Contractor proposes to incorporate a modification, change, delay, or Exhibit Contractor request into the project schedule.

1 .4 PRELIMINARY REQUIREMENTS

A. Meeting: The Exhibit Contractor shall meet with the Owner on the day of the preconstruction conference to conduct a joint review of the project schedule requirements of the contract to assure the Owner of the Exhibit Contractor's and subcontractors' understanding of the requirements of this section.

B. Exhibit Contractor's Schedule Representative: Before or at the preconstruction conference, designate in writing and provide the qualifications of an authorized representative in the Exhibit Contractor's organization who shall be responsible for coordinating with the Exhibit Designer and Owner during the preparation and maintenance of the project schedule.

1 .5 PROJECT SCHEDULE

A. Schedule Development:

1. The late finish date shown on the schedule shall be the same date as the last day of the contract period.

2. The Exhibit Contractor shall carefully plan the durations between scheduled activities so as not to effect the completion of the work. The Exhibit Contractor's project schedule shall consist of procurement activities (including mobilization, submittal, and the fabrication and delivery of key and long-lead procurement items) and construction activities.

3. The Exhibit Contractor's project schedule shall consist of, but not be limited to, the following for each activity:

a. Identify each and every activity number with numerical designations (maximum 5-digit). Numbering of activities shall be in increments of 10 digits.

b. Concise description of the work represented by the activity (maximum 48 characters). Avoid the use of non-standard abbreviations. The work related to each activity shall be limited to one work trade.

c. Activity duration in whole working days with a maximum duration of 15 work days each, unless otherwise approved by the Owner, except for non-construction activities including mobilization, shop drawing and sample submittals, fabrication of materials, delivery of materials and equipment.

d. Identify if activity is a ‘critical path’ activity.

4. In developing the project schedule, ensure that work of all sub contractors at all tiers, as well as the prime work, is included and coordinated in the project schedule.

5. The project schedule as developed shall show the sequence and interdependence of activities required for complete performance of the work. Ensure all work sequences are logical and the project schedule shows a coordinated plan of the work.

6. Proposed duration assigned to each activity shall be the Exhibit Contractor's best estimate of time required to complete the activity considering the scope and resources planned for the activity.

7. Resource loading of each activity shall list all personnel by labor category and equipment type and capacity proposed to complete the activity in the duration shown.

8. Consider seasonal weather conditions in planning and scheduling all work influenced by high or low ambient temperatures, wind and/or precipitation to ensure completion of all work within the contract time. Show anticipated weather conditions on project calendar.

B. Joint Review, Revision, and Acceptance:

1. Within seven calendar days of receipt of the Exhibit Contractor's proposed project schedule, the Exhibit Designer, the Owner and Exhibit Contractor shall meet for joint review, correction, or adjustment of the proposed project schedule. Any areas which, in the opinion of the Owner or the Exhibit Designer, conflict with timely completion of the project shall be subject to revision by the Exhibit Contractor.

2. In the event the Exhibit Contractor fails to define any element of work, activity, or logic, and the Owner review does not detect this omission or error, such omission or error, when discovered by the Exhibit Contractor, the Exhibit Designer or Owner, shall be corrected by the Exhibit Contractor at the next monthly project schedule update and shall not affect the contract time.

3. Within seven calendar days after the joint review between the Exhibit Contractor, the Project Coordinator and Owner, the Exhibit Contractor shall revise and resubmit the project schedule in accordance with agreements reached during the joint review.

4. Upon acceptance of the project schedule by the Owner, the project schedule will be used to evaluate the Exhibit Contractor's monthly applications for payment based upon information developed at the monthly project schedule update meeting.

1 .6 PROJECT SCHEDULE UPDATES

A. General: Update the project schedule on a monthly basis throughout the entire contract time and until project substantial completion.

B. Procedure: The Exhibit Contractor shall meet with the Owner and Exhibit Designer each month at a project schedule update meeting to review actual progress made through the status date of the project schedule update, including dates activities were started and/or completed and the percentage of work completed on each activity started and/or completed. In case of disagreements at the schedule update meeting concerning actual progress to date, the Owner's determination shall govern.

1 .7 PROJECT SCHEDULE REVISIONS

A. Required Revisions: If, as a result of the monthly schedule update, it appears the project schedule no longer represents the actual prosecution and progress of the work, the Owner will request, and the Exhibit Contractor shall submit, a revision to the project schedule. The Exhibit Contractor may also request reasonable revisions to the project schedule in the event the Exhibit Contractor's planning for the work is revised. If the Exhibit Contractor desires to make changes in the project schedule, the Exhibit Contractor shall notify the Owner in writing, stating the reason for the proposed revision. Accepted revisions will be incorporated into the project schedule at the next monthly schedule update.

B. Procedure: If revision to the project schedule is contemplated, the Exhibit Contractor or Owner shall so advise the other in writing at least seven calendar days prior to the next schedule update meeting, describing the revision and setting forth the reasons therefore. Government-requested revisions to the project schedule will be presented in writing to the Exhibit Contractor, who shall respond in writing within seven calendar days.

1 .8 TIME IMPACT ANALYSIS FOR CONTRACT MODIFICATIONS, CHANGES, DELAYS, AND EXHIBIT CONTRACTOR REQUESTS

A. Requirements: When contract modifications or changes are initiated, delays are experienced, or the Exhibit Contractor desires to revise the project schedule, the Exhibit Contractor shall submit as part of the proposal for modified work to the Owner a written time impact analysis illustrating the influence of each modification, change, delay, or Exhibit Contractor request on the contract time.

B. Time Extensions: Activity delays shall not automatically mean that an extension of the contract time is warranted or due the Exhibit Contractor. It is possible that a modification, change, or delay will not affect existing critical path activities or cause non-critical activities to become critical. A modification, change, or delay may result in only absorbing a part of the available total float that may exist within an activity chain of the project schedule, thereby not causing any effect on the contract time. Time extensions will be granted in accordance with the terms of the contract.

C. Float: Float is not for the exclusive use or benefit of either the Owner or the Exhibit Contractor. Extension of the contract time will be granted only to the extent the equitable time adjustments to the activity or activities affected by the modification, change, or delay exceeds the total (positive or zero) float of a critical path activity and extends the contract completion date.

D. Procedure: Each time impact analysis shall be submitted within the time period stated in a request for proposal, or the time period designated under the clauses entitled Changes or Default. In cases where the Exhibit Contractor does not submit a written request for extension of time and a time impact analysis within the designated time, it is mutually agreed that the particular modification, change, delay, or Exhibit Contractor request does not require an extension of the contract time. Upon acceptance, the time impact analysis shall be incorporated into the project schedule at the next monthly schedule update.

END OF SECTION 01323

SECTION 01330 — SUBMITTALS

PART 1 - GENERAL

1 .1 RELATED DOCUMENTS

A. Work of this section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents and Owner provided General Conditions.

1 .2 DESCRIPTION

A. The work of this section consists of submittal requirements before and during construction.

1 .3 RELATED REQUIREMENTS

Section 01770 Project Closeout

1 .4 SUBMITTAL AND APPROVAL PROCEDURES

A. All submittals shall be transmitted using the form provided at the end of this section. No action will be taken on a submittal item unless accompanied by the transmittal form. No verbal communication or other documented form of communication shall serve as a substitution for required submittals and the required forms and transmittals.

B. As specified in the individual sections, forward submittals to Exhibit Designer at least 45 days before need for a final approval. Exhibit Designer and Consultants require 14 days (exclusive of shipping time) for review and notation of each submittals. Assume that each submittal will require repeat submittals and incorporate enough time in the schedule to accommodate at least 3 rounds of submission and review for each submittal required.

C. Unless a different number is specified, submit one original and two copies of each shop drawing, three copies of manufacturer's catalog sheets (cut sheets), three specimens of each sample, and three copies of all other submittals requested.

D. All submittals must be provided as full size hardcopies, not delivered electronically.

1. Site Survey and Exhibit Coordination Drawings: Include the following information with each copy of survey drawings:

a. Date.

b. Date of revisions (when applicable).

c. Exhibit Contractor's certification that coordination drawing has been checked for accuracy by filed measurement of existing conditions and for compliance with contract documents.

d. Details of fabrication, coordination, assembly and erection including connections and engagement to contiguous work.

e. Any special or typical conditions requiring coordination of the Exhibit Contractor's Work with the Work of other Prime Contractors.

f. Note required installation sequences.

g. Note any variances with Exhibit Contract Documents in dimensions or conditions as-built.

e. Note any proposed changes to the Exhibit Contract Documents to rectify errors or omissions, or to account for variances.

f. The term "by others" shall not be used. All work to be performed by others shall be identified by Exhibit Contractor or subcontractor name, discipline, or trade.

2. Shop Drawings: Include the following information with each copy of shop drawings:

a. Date.

b. Date of revisions (when applicable).

c. Exhibit Contractor's certification that shop drawing has been checked for compliance with contract documents.

d. Details of fabrication, assembly and erection including connections and engagement to contiguous work.

e. Materials used (including all hardware and fasteners)

f. All required dimensions.

f. The term "by others" shall not be used. All work to be performed by others shall be identified by Exhibit Contractor or subcontractor name, discipline, or trade.

2. Samples: Samples shall be large enough to illustrate clearly the functional characteristics and full range of color, texture, pattern and workmanship.

3. Manufacturers' Catalog Sheets: Submit only pertinent pages; mark each copy of standard printed data to identify specific products proposed for use.

4. Manufacturer's Installation Instructions: When contract documents require compliance with manufacturer's printed instructions, provide one complete set of instructions for Owner and keep another complete set of instructions at the project site until substantial completion for their records.

E. Owner reserves the right to require submittals in addition to those called for in individual sections.

F. Approved Equals:

1. For each item proposed as an "approved equal," submit supporting data, including:

    a. Drawings and samples as appropriate.

    b. Comparison of the characteristics of the proposed item with that specified.

    c. Changes required in other elements of the work because of the substitution.

    d. Name, address, and telephone number of vendor.

    e. Manufacturer's literature regarding installation, operation, and maintenance, including schematics for electrical and hydraulic systems, lubrication requirements, and parts lists. Describe availability of maintenance service, and state source of replacement materials.

2. A request for approval constitutes a representation that Exhibit Contractor:

    a. Has investigated the proposed item and determined that it is equal or superior in all respects to that specified.

    b. Will provide the same warranties for the proposed item as for the item specified.

    c. Has determined that the proposed item is compatible with interfacing items.

    d. Will coordinate the installation of an approved item and make all changes required in other elements of the work because of the substitution.

    e. Waives all claims for additional expenses that may be incurred as a result of the substitution.

3. Construction Materials: The Exhibit Contractor is encouraged to submit for approval products made out of recycled or environmentally responsible material. Every effort will be made by the National Park Service to approve these materials.

F. Coordinate all submittals and review them for legibility, accuracy, completeness, and compliance with contract requirements. Forward submittals that are related to, or affect one another, as a package to facilitate coordinated review. Each transmittal shall contain only data specific to that individual submittal. Delays resulting from the return of submittals without processing, are not the responsibility of the Exhibit Designer. Submittals will be returned without processing if:

1. They have not been reviewed and stamped by the Exhibit Contractor and Owner for coordination of work and for conformance with the Contract Documents prior to submission to the Exhibit Designer.

2. They are not initialed or signed by the authorized person.

3. They are not dated.

4. It becomes evident that they are incomplete or have not been properly reviewed.

G. Submittal Identification:

4. Owner will provide a project identification stamp which shall be applied by the Exhibit Contractor. Identification shall include the park name-package number, project title, contract number, and transmittal number.

5. All sets of shop drawings, manufacturer's catalog sheets, samples, and other documents submitted to the Owner must have the identification information stamped on the submittal.

6. Identification information shall be applied to the bottom right margin on each page. Identification information on samples shall be applied to the most readily visible area on the sample or on tags attached to sample.

H. Submittal Numbering:

7. Number each submittal consecutively.

8. For re-submittals use the original submittal number, plus a letter suffix beginning with A.

9. Additional re-submittals of the same item shall contain the original number with the next consecutive letter.

I. Designer's Review:

10. Submittals will be returned disapproved without technical review if identification information is missing, not filled in, or if placed on the back of the submittal; an incorrect number or format of submittals is provided; the transmittal form is incorrectly filled out; submittals are not coordinated; or submittals do not show evidence of Exhibit Contractor's approval.

11. Any work done or orders for materials or services placed before approval shall be at the Exhibit Contractor's own risk.

12. After reviewing submittals, the Designer will return one copy of form and one copy of applicable (marked up) submittal sheets to the Exhibit Contractor and One Copy to the Owner. Shop drawing review notations will be returned on the reproducible original shop drawing. All other submitted items will be retained. The Exhibit Contractor is responsible for producing additional copies for his/her own use.

13. The returned submittal will be marked in one of three ways as defined below:

a. APPROVED: Acceptable with no corrections.

b. APPROVED WITH NOTATIONS: Minor corrections or clarifications required. All comments are clear and no further review is required. The Exhibit Contractor shall address all review comments when proceeding with the work.

c. DISAPPROVED - RESUBMIT: Rejected as not in accordance with the contract or as requiring major corrections or clarifications. The Designer will identify the reasons for disapproval. The Exhibit Contractor shall revise and resubmit with changes clearly identified.

d. RECEIVED – NO ACTION REQUIRED: Contents of submittal were in appropriate or were sent in error: Not subject to review and record.

e. NOT SUBJECT TO REVIEW: Informational submittal. No copies will be returned. Copy will be kept as record. No review of submittal will be conducted.

1.4 USE OF ELECTRONIC CAD FILES OF PROJECT DRAWINGS

A. Electronic CAD Files of Design Drawings: May only be used to expedite production of Shop Drawings for this Project. Use for other project or purpose not allowed. Contact Exhibit Designer directly for CAD Files.

B. Electronic CAD Files of Design Drawings: Will be distributed only under following conditions:

1. Source information used to generate electronic CAD files was not prepared by Exhibit Designer and Exhibit Designer is not responsible for accuracy of information contained in files.

2. Use of files is solely at receiver's risk. Exhibit Designer does not warrant accuracy of files. Receiving files in electronic form does not relieve receiver of responsibilities for measurements, dimensions and quantities set forth in the Exhibit Contract Documents. In event of ambiguity, discrepancy or conflict between information on electronic media and that in Contract Documents, notify Exhibit Designer of discrepancy and use information in hard copy Drawings and Specifications.

3. CAD Files: Do not necessarily represent latest Contract Documents, existing conditions, and as-built conditions. Receiver: Responsible to determine and comply with these conditions. Receiver: Responsible for incorporating addenda and modifications, Change Orders and Exhibit Designer's Supplemental Instructions.

4. User: Responsible for removing information not normally provided on Shop Drawings and any references to Contract Documents. Shop Drawings submitted with information associated with other trades or with references to Contract Documents will not be reviewed and immediately returned.

5. Files: Vectorworks files transmitted by electronic storage device (CD). There is no guarantee of integrity of data or completeness and form of translation. Receiver shall not hold Exhibit Designer responsible for data or file clean-up required to make files usable, nor for error or malfunction in translation, interpretation or use of this electronic information.

6. Receiver understands that even though Exhibit Designer has computer virus scanning software to detect presence of computer viruses, there is no guarantee that computer viruses are not present in files or in electronic media. Receiver: Not hold Architect nor Exhibit Designer responsible for such viruses or their consequences, and shall hold Architect and Exhibit Designer harmless against costs, losses or damage caused by presence of computer virus in files or media.

END OF SECTION 01330

SECTION 01420 — REFERENCE STANDARDS

PART 1 - GENERAL

PART 1 - GENERAL

1 .1 The following abbreviations, which may be used in the construction specifications, refer to the organizations and specifications of the organizations listed below:

AA	Aluminum Association 900 19th Street, NW, Suite 300 Washington, D.C. 20006-2168
AABC	Associated Air Balance Council 1518 K Street, NW, Suite 503 Washington, D.C. 20005
AAMA	American Architectural Manufacturers Association 1827 Walden Office Square, Suite 104 Schaumberg, Illinois 60173-4268
AAN	see ANLA
AASHTO	American Association of State Highway and Transportation Officials 444 North Capitol Street, NW, Suite 249 Washington, D.C. 20001
ABMA	American Boiler Manufacturers Association 950 N. Glebe Road, Suite 160 Arlington, Virginia 22203-1824
ACI	American Concrete Institute P.O. Box 9094 Farmington Hills, Michigan 48333-9094
ACPA	American Concrete Pipe Association 222 West Las Colinas Boulevard, Suite 641 Irving, Texas 75039-5423
ADC	Air Diffusion Council 11 South LaSalle Street, Suite 1400 Chicago, Illinois 60603
AFPA	American Forest and Paper Association 1111 19th Street, NW, Suite 800 Washington, D.C. 20036
AGA	American Gas Association 1515 Wilson Boulevard Arlington, Virginia 22209
AHA	American Hardboard Association 1210 W. Northwest Highway Palatine, Illinois 60067-1897
AHAM	Association of Home Appliance Manufacturers 20 N. Wacker Drive, Suite 1500 Chicago, Illinois 60606

AI	Asphalt Institute Research Park Drive P.O. Box 14052 Lexington, Kentucky 40512-4052
AISC	American Institute of Steel Construction 1 East Wacker Drive, Suite 3100 Chicago, Illinois 60601-2001
AISI	American Iron and Steel Institute 1101 17th Street, NW Washington, D.C. 20036-4700
AITC	American Institute of Timber Construction 7012 S. Revere Parkway, Suite 140 Englewood, Colorado 80112
ALSC	American Lumber Standards Committee P.O. Box 210 Germantown, Maryland 20875
AMCA	Air Movement and Control Association International, Inc. 30 W. University Drive Arlington Heights, Illinois 60004-1893
ANLA	American Nursery and Landscape Association 1250 I Street, NW, Suite 500 Washington, D.C. 20005
ANSI	American National Standards Institute 11 West 42nd Street, 13th Floor New York, New York 10036
APA	American Plywood Association (See EWA)
APWA	American Public Works Association 106 West 11th Street, Suite 1800 Kansas City, Missouri 64105-1806
ARI	Air-Conditioning and Refrigeration Institute 4301 Fairfax Drive, Suite 425 Arlington, Virginia 22203
ARMA	Asphalt Roofing Manufacturers Association Center Park, 4041 Powder Mill Road, Suite 404 Calverton, Maryland 20705
ASC	Adhesive and Sealant Council 1627 K Street, NW, Suite 1000 Washington, D.C. 20006-1707
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers 1791 Tullie Circle, NE Atlanta, Georgia 30329-2305
ASLA	American Society of Landscape Architects 4401 Connecticut Avenue, NW Fifth Floor Washington, D.C. 20008-2369
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, New York 10017

ASPE	American Society of Plumbing Engineers 3617 Thousand Oaks Boulevard, Suite 210 Westlake, California 91362-3649
ASSE	American Society of Sanitary Engineering 28901 Clemens Road, Suite 100 Westlake, Ohio 44145
ASTM	American Society for Testing and Materials 100 Barr Harbor Drive West Conshohocken, Pennsylvania 19428-2959
AWI	Architectural Woodwork Institute 1952 Isaac Newton Square Reston, Virginia 20190
AWPA	American Wood-Preservers' Association 3246 Fall Creek Highway, Suite 1900 Granbury, Texas 76049-7979
AWPI	American Wood Preservers Institute 1945 Old Gallows Road, Suite 550 Vienna, Virginia 22182
AWS	American Welding Society, Inc. 550 NW LeJeune Road Miami, Florida 33126
AWWA	American Water Works Association 6666 W. Quincy Avenue Denver, Colorado 80235
BHMA	Builders Hardware Manufacturers Association, Inc. 355 Lexington Avenue, 17th Floor New York, New York 10017-6603
BIA	Brick Institute of America 11490 Commerce Park Drive Reston, Virginia 22091-1525
BOCA	Building Officials Code Administrators 4051 W. Flossmoor Road Country Club Hills, Illinois 60478-5795
CBM	Certified Ballast Manufacturers 1422 Euclid Avenue, Suite 402 Cleveland, Ohio 44115-2851
CDA	Copper Development Association, Inc. 260 Madison Avenue, 16th Floor New York, New York 10016-2401
CE	Corps of Engineers 20 Massachusetts Avenue, NW Washington, D.C. 20314
CID	Commercial Item Description See contract clauses
CISPI	Cast Iron Soil Pipe Institute 5959 Shallowford Road, Suite 419 Chattanooga, Tennessee 37421

CLFMI	Chain Link Fence Manufacturers Institute 9891 Broken Land Parkway, Suite 300 Columbia, Maryland 21046
CRA	California Redwood Association 405 Enfrente Drive, Suite 200 Novato, California 94949
CRI	Carpet and Rug Institute 310 S. Holiday Avenue Dalton, Georgia 30722-2048
CRSI	Concrete Reinforcing Steel Institute 933 N. Plum Grove Road Schaumburg, Illinois 60173-4758
CS	Commercial Standard of NBS (U.S. Department of Commerce) Government Printing Office Washington, D.C. 20402
CSSB	Cedar Shingle and Shake Bureau 515 116th Avenue, NE, Suite 275 Bellevue, Washington 98004-5294
DHI	Door and Hardware Institute 14170 Newbrook Drive Chantilly, Virginia 22021-2223
EPA	Environmental Protection Agency 401 M Street, SW Washington, D.C. 20460
EWA	APA- The Engineered Wood Association P.O. Box 11700 Tacoma, Washington 98411-0700
FHA	Federal Housing Administration (U.S. Department of Housing and Urban Development) 451 7th Street, SW Washington, D.C. 20410
FHVA	Fine Hardwood Veneer Association 260 S. First Street, Suite 2 Zionsville, Indiana 46077
FM	Factory Mutual System 1151 Boston-Providence Turnpike P.O. Box 9102 Norwood, Massachusetts 02062-9102
FS	Federal Specifications See contract clauses
GA	Gypsum Association 810 First Street, NE, Suite 510 Washington, D.C. 20002
GANA	Glass Association of North America 3310 SW Harrison Street Topeka, Kansas 66611-2279
HI	Hydronics Institute

	35 Russo Place P.O. Box 218 Berkeley Heights, New Jersey 07922
HMA	Hardwood Manufacturers Association 400 Penn Center Boulevard, Suite 530 Pittsburgh, Pennsylvania 15235-5605
HPMA	Hardwood Plywood Manufacturers Association P.O. Box 2789 Reston, Virginia 22090-2789
IA	Irrigation Association 1911 N. Fort Myer Drive, Suite 1009 Arlington, Virginia 22209-1630
IBC	International Building Code, 2000 Edition
ICBO	International Conference of Building Officials 5360 S. Workman Mill Road Whittier, California 90601
ICEA	Insulated Cable Engineers Association, Inc. P.O. Box 440 South Yarmouth, Massachusetts 02664
IEEE	The Institute of Electrical and Electronics Engineers 345 E. 47th Street New York, New York 10017-2394
IES	Illuminating Engineering Society of North America 120 Wall Street, 17th Floor New York, New York 10005-4001
IGCC	See ITS
ILIA	Indiana Limestone Institute of America, Inc. Stone City Bank Building, Suite 400 Bedford, Indiana 47421
ITS	Internek Testing Services 3393 Route 11 P.O. Box 2040 Cortland, New York 13045-7902
KCMA	Kitchen Cabinet Manufacturers Association 1899 Preston White Drive Reston, Virginia 22091-4326
LIA	Lead Industries Association, Inc. 295 Madison Avenue New York, New York 10017
MBMA	Metal Building Manufacturer's Association c/o Thomas Associates, Inc. 1300 Sumner Avenue Cleveland, Ohio 44115-2851
MFMA	Maple Flooring Manufacturers Association 60 Revere Drive, Suite 500 Northbrook, Illinois 60062
MIA	Marble Institute of America 30 Eden Alley, Suite 201

	Columbus, Ohio 43215
MIMA	Mineral Insulation Manufacturers Association 1420 King Street Alexandria, Virginia 22314
MLSFA	Metal Lath/Steel Framing Association - A Division of NAAMM 8 South Michigan Avenue, Suite 1000 Chicago, Illinois 60603
MS	Military Standardization Documents See contract clauses
MSHA	Mine Safety and Health Administration 4015 Wilson Boulevard, Room 601 Arlington, Virginia 22203
MSS	Manufacturers Standardization Society of the Valve and Fittings Industry 127 Park Street, NE Vienna, Virginia 22180-4602
NAAMM	The National Association of Architectural Metal Manufacturers 8 South Michigan Avenue, Suite 1000 Chicago, Illinois 60603
NACE	National Association of Corrosion Engineers 1440 South Creek Drive P.O. Box 218340 Houston, Texas 77218-8340
NAIMA	North American Insulation Manufacturers Association 44 Canal Center Plaza, Suite 310 Alexandria, Virginia 22314
NAPA	National Asphalt Pavement Association NAPA Building 5100 Forbes Boulevard Lanham, Maryland 20706-4413
NAPCA	National Association of Pipe Coating Applicators 8th Floor, Commercial National Bank Building 333 Texas Street, Suite 800 Shreveport, Louisiana 71101-3673
NBS	National Bureau of Standards (U.S. Department of Commerce)(See NIST)
NCMA	National Concrete Masonry Association 2302 Horse Pen Road Herndon, Virginia 20171-3499
NEC	National Electrical Code (by NFPA)
NECA	National Electrical Contractors Association 3 Bethesda Metro Center, Suite 1100 Bethesda, Maryland 20814
NELM	Northeastern Lumber Manufacturers' Association 272 Tuttle Road P.O. Box 87A Cumberland Center, Maine 04021-0687
NEII	National Elevator Industry, Inc. 185 Bridge Plaza North, Suite 310

Fort Lee, New Jersey 07024

NEMA National Electrical Manufacturers Association
1300 N. 17th Street, Suite 1847
Rosslyn, Virginia 22209

NFPA National Fire Protection Association
1 Batterymarch Park
P.O. Box 9101
Quincy, Massachusetts 02269-9101

NHLA National Hardwood Lumber Association
P.O. Box 34518
Memphis, Tennessee 38184-0518

NHPMA Northern Hardwood and Pine Manufacturers Association, Inc.,
c/o Northern Softwood Lumber Bureau
Box 217
Dear River, Minnesota 56636

NIOSH National Institute for Occupational Safety and Health
NIOSH Building 1, Room 3007
1600 Clifton Road, NE
Atlanta, Georgia 30333

NIST National Institute of Standards and Technology
(US Department of Commerce)
Building 101, #A1134
Route I-270 and Quince Orchard Road
Gaithersburg, Maryland 20899

Send requests for publications to:
Superintendent of Documents
Government Printing Office
Washington, D.C. 20402

NOFMA National Oak Flooring Manufacturers Association
P.O. Box 3009
Memphis, Tennessee 38173-0009

NPA National Particleboard Association
18928 Premiere Court
Gaithersburg, Maryland 20879-1569

NRCA National Roofing Contractors Association
O'Hare International Center
10255 W. Higgins Road, Suite 600
Rosemont, Illinois 60018-5607

NSF NSF International
(Formerly National Sanitation Foundation)
3475 Plymouth Road
P.O. Box 130140
Ann Arbor, Michigan 48113-0140

NTMA The National Terrazzo and Mosaic Association
3166 Des Plaines Avenue, Suite 121
Des Plaines, Illinois 60018

NWWDA National Wood Window and Door Association
1400 East Touhy Avenue, Suite G-54

	Des Plaines, Illinois 60018
OSHA	Occupational Safety and Health Administration U.S. Department of Labor 200 Constitution Avenue, NW Washington, D.C. 20210
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, Illinois 60077-1083
PCI	Precast/Prestressed Concrete Institute 175 W. Jackson Boulevard Chicago, Illinois 60604
PDI	Plumbing and Drainage Institute 45 Briston Drive, Suite 101 South Euston, Massachusetts 02375
PEI	Porcelain Enamel Institute, Inc. 4004 Hillsboro Pike, Suite 224-B Nashville, Tennessee 37215
PI	Perlite Institute, Inc. 88 New Dorp Plaza Staten Island, New York 10306
PS	Product Standard of NBS (U.S. Department of Commerce) Government Printing Office Washington, D.C. 20402
RFCI	Resilient Floor Covering Institute 966 Hungerford Drive, Suite 12-B Rockville, Maryland 20850-1714
RIS	Redwood Inspection Service (Grading Rules) 405 Enfrente Drive, Suite 200 Novato, California 94949
RMMI	Rocky Mountain Masonry Institute 1780 South Bellaire Street, No. 602 Denver, Colorado 80222
SCMA	Southern Cypress Manufacturers Association 400 Penn Center Blvd., Suite 530 Pittsburgh, Pennsylvania 15235
SDI	Steel Deck Institute P.O. Box 25 Fox River Grove, Illinois 60021
SDI	Steel Door Institute 30200 Detroit Road Cleveland, Ohio 44145-1967
SFPA	Southern Forest Products Association P.O. Box 52468 New Orleans, Louisiana 70152
SGCC	See ITS
SIGMA	Sealed Insulating Glass Manufacturers Association 401 N. Michigan Avenue Chicago, Illinois 60611-4267

SJI	Steel Joist Institute 3127 10th Avenue, North Ext. Myrtle Beach, South Carolina 29577-6760
SMACNA	Sheet Metal and Air-Conditioning Contractors' National Association, Inc. 4201 Lafayette Center Drive P.O. Box 221230 Chantilly, Virginia 20151-1209
SPIB	Southern Pine Inspection Bureau (Grading Rules) 4709 Scenic Highway Pensacola, Florida 32504-9094
SSPC	Steel Structures Painting Council 40 24th Street, 6th Floor Pittsburgh, Pennsylvania 15222-4643
SWI	Steel Window Institute c/o Thomas Associates, Inc. 1300 Sumner Avenue Cleveland, Ohio 44115-2851
TCA	Tile Council of America 100 Clemson Research Boulevard Anderson, South Carolina 29625
TIMA	Thermal Insulation Manufacturers Association (See NAIMA)
TPI	Truss Plate Institute 583 D'Onofrio Drive, Suite 200 Madison, Wisconsin 53719
UBC	Uniform Building Code (by ICBO)
UL	Underwriters Laboratories, Inc. 333 Pfingsten Road Northbrook, Illinois 60062
USDA	U.S. Department of Agriculture 14th Street and Independence Avenue, SW Washington, D.C. 20250
WCLB	West Coast Lumber Inspection Bureau (Grading Rules) P.O. Box 23145 Portland, Oregon 97281-3145
WIC	Woodwork Institute of California P.O. Box 980247 West Sacramento, California 95798-0247
WMMPA	Wood Moulding and Millwork Producers Association 507 First Street Woodland, California 95695
WRI	Wire Reinforcement Institute, Inc. 203 Loudoun Street, SW Leesburg, Virginia 20175-2718
WSFI	Wood and Synthetic Flooring Institute (See MFMA)
WWPA	Western Wood Products Association (Grading Rules) Yeon Building 522 SW 5th Avenue

	Portland, Oregon 97204-2122
WWPA	Woven Wire Products Association 2515 Nordica Avenue Chicago, Illinois 60635
WWPI	Western Wood Preservers Institute 7017 NE Highway 99 #108 Vancouver, Washington 98665

END OF SECTION 01420

SECTION 01600 — MATERIALS AND EQUIPMENT

PART 1 – GENERAL

1 .1 RELATED DOCUMENTS

A. Work of this section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents and Owner provided General Conditions.

1 .2 DESCRIPTION

A. The work of this section consists of the general procedures for handling, storing, and protecting material and equipment.

1 .3 TRANSPORTATION AND HANDLING

A. Arrange deliveries of materials in accordance with construction schedules; coordinate to avoid conflict with work and conditions at the site. Deliver materials in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible. Contractor is encouraged to obtain materials in biodegradable or recyclable/reusable packaging that uses the minimum amount of packaging possible.

1 .4 STORAGE AND PROTECTION

A. Store materials in accordance with manufacturer's instructions, with seals and labels accessible for inspection.

B. Interior Storage: Maintain temperature and humidity within the ranges required by manufacturer's instructions.

C. Exterior Storage:

1. Store products subject to damage by the elements in weather tight enclosures.

2. Store fabricated products above the ground, on blocking or skids; prevent soiling or staining. Cover products subject to damage or deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.

D. Protection After Installation: It is important for all finished surfaces to remain protected during construction. Scratches, rubs, nicks and dents will not be acceptable in exposed finished building elements such as log columns, wood panels, concrete topping slabs, gypsum wallboard walls, painted finishes, etc. Provide adequate coverings as necessary to protect installed materials from damage resulting from natural elements, traffic, and subsequent construction. Remove when no longer needed.

END OF SECTION 01600

SECTION 01740 — WARRANTIES

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Work of this section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents and Owner provided General Conditions.

Section 01770 " PROJECT CLOSEOUT"

1.02 SUMMARY

A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturers standard warranties on products and special warranties.

1. Refer to the General Conditions for terms of the Exhibit Contractor's special warranty of workmanship and materials.

2. General closeout requirements are included in Section 01770 "PROJECT CLOSEOUT."

3. Specific requirements for warranties for the Work and products and installations that are specified to be warranted, are included in the individual Sections.

4. Certifications and other commitments and agreements for continuing services to the Owner are specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Exhibit Contractor of the warranty on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Exhibit Contractor.

1.03 WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Exhibit Contract Documents. The Exhibit Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

D. Exhibit Designer’s Recourse: Written warranties made to the Exhibit Designer are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise

available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights or remedies.

1. Rejection of Warranties: The Exhibit Designer reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

    a. The Exhibit Designer reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to counter sign such commitments are willing to do so.

2. Special Warranties:

    a. Shall not deprive the Owner of other rights they may have under other provisions of Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Exhibit Contractor under requirements of Contract Documents.

    b. Commence on Date of Beneficial Occupancy for that space or system, as defined in General Conditions, unless specifically specified otherwise in particular specification section.

1.04 SUBMITTALS:

A. Submit written warranties to the Owner prior to the date certified for Beneficial Occupancy.

1. When a designated portion of the Work is completed and accepted for beneficial occupancy or used by the Owner, submit properly executed warranties to the Exhibit Designer within fifteen days of completion of that designated portion of the Work.

2. When a special warranty is required to be executed by the, or the Exhibit Contractor General Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner for approval prior to final execution.

3. Refer to individual Sections of Division-2 through -16 for specific content requirements, and particular requirements for submittal of special warranties.

B. Form of Submittal: At Final Completion, Exhibit Contractor shall compile two copies of each required warranty properly executed by the Exhibit Contractor, subcontractor, supplier, or manufacturer. Warranty documents shall be organized into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
2. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation.
3. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
4. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES," the Project title or name, and the name of the Exhibit Contractor.

5. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

END OF SECTION 01740

SECTION 01770 – PROJECT CLOSEOUT

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Work of this section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents and Owner provided General Conditions.

Section 01740, “WARRANTIES”

Section 01781, “PROJECT RECORD DOCUMENTATION”

Section 01782, “OPERATION & MAINTENANCE DOCUMENTATION”

Section 01800, “CLEANING”

Section 018200, “DEMONSTRATION AND TRAINING”

1.02 SUMMARY

A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:

1. Inspection procedures.

2. Project record document submittal.

3. Operating and maintenance manual submittal.

4. Submittal of warranties

5. Final cleaning.

B. Closeout requirements for specific construction activities are included in the appropriate Sections in Divisions-2 through -16.

1.03 PARTIAL ACCEPTANCE

A. Partial Owner Acceptance: The Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Final Acceptance, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy, or beneficial occupancy shall not constitute acceptance of the total Work.

1. The Exhibit Designer will prepare a notice of Partial Acceptance for each specific portion of the Work to be occupied before Owner occupancy.

2. Before partial Owner occupancy, exhibit systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will provide, operate, and maintain exhibit systems serving occupied portions of building.

3. On occupancy, Owner will assume responsibility for maintenance and cleaning of exhibits.

1.04 SUBSTANTIAL COMPLETION

A. Substantial Completion is defined as that state when the Exhibit Contractor has complied with the Contract requirements, except for minor deviations, and the project is sufficiently complete and capable of being occupied and used by the Owner for the intended purpose.

B. Preliminary Procedures: Before requesting inspection for Substantial Completion, complete the following:

1. Notification: The Exhibit Contractor shall notify the Owner fourteen (14) days prior to the Exhibit Contractor's intended date for requesting inspection for Substantial Completion.

2. Documentation: Provide supporting documentation for completion as indicated elsewhere in the Contact Documents and a statement showing an accounting of changes to the Contract Sum.

3. Punch List: Submit a list to the Owner of incomplete items, the value of incomplete construction, and reasons Work is not complete.

4. Releases: Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

5. Manuals: Submit operation and exhibit maintenance manuals and exhibit maintenance kit.

6. Security: Make final changeover of permanent locks and transmit keys to the Owner. Advise Owner of changeover in security provisions.

7. Startups: Complete startup testing of all exhibit systems and instructions of the Owner operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mock-ups, construction tools, and similar elements.

8. Commissioning: The successful functional performance tests for Commissioning shall be complete. See Section 01280 – Demonstration and Testing.

9. Training: Conduct Operational Training Sessions as required for museum staff to familiarize with the exhibit systems using the Exhibit Maintenance Manuals as an instructional aid.

C. Inspection Procedures: On receipt of a request for inspection, the Exhibit Designer will either proceed with inspection or advise the Exhibit Contractor of unfulfilled requirements. The Exhibit Designer will notify the Exhibit Contractor of Substantial Completion following the inspection or advise the Exhibit Contractor of construction that must be completed or corrected before Substantial Completion.

1. The Exhibit Designer will repeat the inspection when requested and when assured that the Work is substantially complete.

2. Results of the completed inspection will form the basis of the requirements for Final Acceptance.

1.05 FINAL ACCEPTANCE

A. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

2. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

3. Submit a certified copy of the Exhibit Designer's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the CM.

4. Submit consent of surety to final payment.

5. Submit a final liquidated damages settlement statement.

6. All Commissioning Corrective Action Report (CAR) logs shall be closed.

7. Submit Record Documents and similar record information.

8. Complete final clean-up requirements including touch-up painting of marred surfaces.

B. Re-inspection Procedure: The Exhibit Designer will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Exhibit Designer.

1. Upon completion of re-inspection, the Exhibit Designer will prepare a certificate of final acceptance, or advise the Exhibit Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

2. If necessary, re-inspection will be repeated. Additional re-inspections can be done, if needed, but will require that Exhibit Contractor directly reimburse Exhibit Designer.

1.06 EVIDENCE OF PAYMENTS AND RELEASE OF LIENS

a. Per Owner’s requirements.

1.07 FINAL ADJUSTMENT OF ACCOUNTS

A. Final Statement of Accounting: Submit to Owner and Designer. Show adjustments to Contract Sum:

1. Original Contract Sum.

2. Additions and deductions resulting from:

a. Previous Change Orders.
b. Allowances.
c. Unit Prices.
d. Deductions for uncorrected Work.
e. Deductions for inspection payments.
f. Other adjustments.

3. Total Contract Sum as adjusted.

4. Previous payments.

5. Retainage.

6. Sum remaining due.

B. Owner will prepare final Change Order reflecting approved adjustments to Contract Sum that are not included in Change Orders previously processed.

1.08 FINAL APPLICATION FOR PAYMENT

A. Final Application for Payment: Submit in accordance with procedures and requirements stated in Conditions of the Contract.

PART 2 – PRODUCTS Not Used

PART 3 – EXECUTION

3.01 CLOSEOUT PROCEDURES

A. Operating and Maintenance Instruction: Arrange for each installer of equipment that requires regular maintenance to meet with the museum's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items.

1. Exhibit maintenance manuals.

a) per Section .01782

2. Record documents/ As-builts

3. Exhibit Maintenance Kit
a) Spare parts and materials.
b) keys and tools
c) lubricants
d) fuels
e) cleaning products

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Start-up.

2. Shutdown.

3. Emergency operations.

4. Noise and vibration adjustments.

5. Safety procedures.

6. Economy and efficiency adjustments.

7. Effective energy utilization.

3.02 FINAL CLEANING

A. General: General cleaning during construction is required by the General Conditions and included in other Division 1 Sections.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.

1. Complete the following cleaning operations before requesting inspection for Final Acceptance:

a. Remove labels that are not permanent labels.
b. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
c. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Vacuum all surfaces of the interstitial spaces.
d. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean light fixtures and lamps.
e. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.

C. Pest Control: Engage an experienced exterminator to make a final inspection, and rid the Project of rodents, insects and other pests.

D. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction. Remove temporary construction, if any, and restore site to original condition.

E. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.

END OF SECTION 01770

SECTION 01781 – PROJECT RECORD DOCUMENTS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Work of this section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents and Owner provided General Conditions.

1.02 SUMMARY

A. This section includes administrative and procedural requirements for Project Record Documents. Required Project Record Documents include the following:

1. Marked-up copies of Contract Drawings.

2. Marked-up copies of Shop Drawings.

3. Newly prepared drawings.

4. Marked-up copies of Specifications, addenda, and Change Orders.

5. Marked-up Product Data submittals.

6. Record Samples.

7. Field records for variable and concealed conditions.

8. Record information on Work that is recorded only schematically.

9. Requests for Interpretation

B. Maintenance of Documents and Samples: Store record documents and samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition. Make documents and samples available at all times for the Owner's and Exhibit Designer's inspections.

1.03 RECORD DRAWINGS

A. Markup Procedure: During construction, maintain a set of blue- or black-line white prints of Contract Drawings and Shop Drawings for Project Record Document purposes.

1. Mark these Drawings to show the actual installation where the installation varies from the installation shown originally. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later. Items required to be marked include, but are not limited to, the following:

a. Dimensional changes to the Drawings.
b. Revisions to details shown on the Drawings.
c. Depths of foundations below the first floor.

d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directives.
k. Changes made following the Exhibit Designer's written orders.
l. Details not on original Contract Drawings.

2. Mark record prints of Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings location.

3. Mark record sets with red erasable colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.

4. Mark important additional information that was either shown schematically or omitted from original Drawings.

5. Note alternate numbers, Change Order numbers, and similar identifications.

B. Responsibility for Markup: The individual, installer, subcontractor or other entity who obtained the record data shall prepare the markup on record drawings.

1. Accurately record information in an understandable drawing technique.

2. Record data as soon as possible after obtaining it. Record and check the markup prior to enclosing concealed installations.

3. Prior to Final Acceptance, submit record drawings to the Owner and Exhibit Designer for their records. Organize into sets, and bind and label.

C. Preparation of Record Drawings: Prior to Final Acceptance, review completed marked-up record drawings with the Owner and Exhibit Designer. When authorized, prepare a full set of corrected copies of the Contract Drawings and Shop Drawings.

1. Incorporate changes and additional information previously marked on print sets. Erase, redraw, and add details and notations where applicable. Identify and date each drawing. Include the printed designation "PROJECT RECORD DRAWINGS" in a prominent location on each drawing.

a. Encircle each area of change or additional information with a free-form cloud-shape drawn on the reverse side of the transparency..
b. Identify changes and additional information by printing the Change Order Number or other change reference designation, when applicable, within the cloud-shape encircled area.

2. Refer instances of uncertainty to the Owner for resolution.

3. The Exhibit Fabricator is responsible for printing Record Drawings.

4. Review: Before copying and distributing, submit corrected drawings and the original marked-up Contract Documents to the Owner for review and acceptance of the general scope of changes, additional information recorded and quality of drafting. If acceptable, the Owner will return transparencies and the original marked-up prints to the Exhibit Fabricator for organizing into sets, printing, binding, and final submittal.

D. Copies and Distribution: After completing the preparation of Record Drawings, print 4 copies of each drawing, whether or not changes and additional information were recorded. Organize the copies into manageable sets. Bind each set with durable-paper cover sheets. Include appropriate identification, including titles, dates, and other information on the cover sheets. A digital set should also be provided.

1. Organize and bind original marked-up set of prints that were maintained during the construction period in the same manner.

2. Organize record transparencies into sets matching the print sets. Place these sets in durable tube-type drawing containers with end caps. Mark the end cap of each container with suitable identification.

3. Submit the marked-up record set, transparencies, and the copy sets to the Owner for the Exhibit Designer's records.

E. Newly Prepared Record Drawings: Prepare new drawings instead of following procedures specified for preparing record drawings where new drawings are required when neither the original Contract Drawings nor Shop Drawings are suitable to show the actual installation. New drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.

1. Provide Drawings in a scale that allows for the scope of detailing and notations required to record the actual physical installation and its relationship to other construction.

2. When completed and accepted, integrate newly prepared Drawings with procedures specified for organizing, copying, binding and submitting record drawings.

1.04 RECORD SPECIFICATIONS

A. During the construction period, maintain 4 copies of the Project Specifications, including addenda and other modifications issued, for Project Record Document purposes.

1. Mark the Specifications to indicate the actual installation where the installation varies from that indicated in Specifications. Note related project record drawing information, where applicable. Give particular attention to substitutions, selection of product options, and information on concealed installations that would be difficult to identify or measure and record later.

a. In each Specification section where products, materials or units of equipment are specified or scheduled, mark the copy with the proprietary name and model number of the product furnished.
b. Record the name of the manufacturer, supplier, installer, and other information necessary to provide a record of selections made and to document coordination with record Product Data submittals and maintenance manuals.

2. Upon completion of markup, submit Record Specifications to the Owner for the Exhibit Designer's records.

1.05 RECORD PRODUCT DATA

A. During the construction period, maintain one copy of each Product Data submittal for Project Record Document purposes.

1. Mark Product Data to indicate the actual product installation where the installation varies substantially from that indicated in Product Data submitted. Include significant changes in the product delivered to the site and changes in manufacturer's instructions and recommendations for installation.

2. Give particular attention to information about concealed products and installations that cannot be readily identified and recorded later.

3. Note related Change Orders and markup of record Drawings, where applicable.

4. Upon completion of markup, submit a complete set of record Product Data to the Owner for the Exhibit Designer's records.

5. Where record Product Data is required as part of maintenance manuals, submit marked-up Product Data as an insert in the manual instead of submittal as record Product Data.

1.06 RECORD SAMPLE SUBMITTAL

A. Immediately prior to the date of Final Completion, the Exhibit fabricator shall meet with the Owner at the site to determine which of the Samples maintained during the construction period shall be transmitted to the Exhibit Designer for record purposes.

B. Comply with the Owner 's instructions for packaging, identification marking and delivery to the Architect's sample storage space. Dispose of other samples in a manner specified for disposing of surplus and waste materials.

1.07 MISCELLANEOUS RECORD SUBMITTALS

A. Refer to other Specification sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Prior to Final Acceptance, complete miscellaneous records and place in good order, properly identified and bound or otherwise organized to allow for use and reference.

B. Submit to the Owner for the Exhibit Designer's records.

C. Miscellaneous records include, but are not limited to, the following:

1. Field records on excavations and foundations.

2. Field records on underground construction and similar work.

3. Survey showing locations and elevations of underground lines.

4. Invert elevations of drainage piping.

5. Surveys establishing building lines and levels.
6. Authorized measurements utilizing unit prices or allowances.
7. Records of plant treatment.
8. Ambient and substrate condition tests.
9. Certifications received in lieu of labels on bulk products.
10. Batch mixing and bulk delivery records.
11. Testing and qualification of tradespersons.
12. Documented qualification of installation firms.
13. Load and performance testing.
14. Inspections and certifications by governing authorities.
15. Leakage and water-penetration tests.
16. Fire-resistance and flame-spread test results.
17. Final inspection and correction procedures.

PART 2 –PRODUCTS Not used

PART 3 – EXECUTION Not used

END OF SECTION 01781

SECTION 01782 – OPERATION AND MAINTENANCE DOCUMENTATION

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Work of this section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents and Owner provided General Conditions.

1.02 SUMMARY

A. This section includes administrative and procedural requirements for operation and maintenance manuals and instruction, including the following.

1. Preparing and submitting instruction manuals covering the care, preservation and maintenance of exhibit materials and finishes

2. Preparing and submitting exhibit operation and maintenance manuals for equipment and building operating systems.

3. Instruction of Government operating personnel in the operation and maintenance of exhibit systems and equipment..

B. Additional Requirements: Refer to the individual Specification sections for additional requirements for the care and maintenance of exhibit materials and finishes, and for the operation and maintenance of the various pieces of equipment and operating systems.

C. Related Sections:

Section 01500 "CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS"

Section 01740 "WARRANTIES"

1.03 QUALITY ASSURANCE

A. Exhibit Operation and Maintenance Manual Preparation: In preparation of manuals, use personnel thoroughly trained and experienced in the maintenance of the material or finish involved, or in the operation and maintenance of the equipment or system involved.

1. Where manuals require written instructions, use the personnel skilled in technical writing where necessary for communication of essential data.

2. Where manuals require drawings or diagrams, use draftspersons capable of preparing drawings clearly in an understandable format.

B. Instructions for the museum's personnel: Use instructors thoroughly trained and experienced in the operation and maintenance of the equipment or system involved to instruct museum staff operation and maintenance personnel.

1.04 SUBMITTALS

A. Submittal Schedule: Comply with the following schedule for submitting operation and maintenance manuals:

1. The Owner will return 1 copy of the draft with comments within 15 calendar days after receipt.

2. Make corrections or modifications to comply with the Owner's comments.

3. Submit 4 copies of each approved manual to the Owner within 15 calendar days after receipt of the Owner's comments.

B. Form of Submittal: Prepare operation and maintenance manuals in the form of an instructional manual for use by museum staff and contract operating and maintenance personnel. Organize into suitable sets of manageable size. Where possible, assemble instructions for similar products into a single binder.

1. Binders: For each manual, provide heavy-duty, commercial-quality, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to receive 8-1/2-by-11-inch paper. Provide a clear plastic sleeve on the spine to hold labels describing contents. Provide pockets in the covers to receive folded sheets.

   a. Where 2 or more binders are necessary to accommodate data, correlate data in each binder into related groupings according to the Specifications table of contents. Cross-reference other binders where necessary to provide essential information for proper operation or maintenance of the product.

   b. Identify each binder on front and spine, with the printed title "EXHIBIT OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter covered. Indicate volume number for multiple volume sets of manuals.

2. Dividers: Provide heavy paper dividers with celluloid-covered tabs for each separate section. Mark each tab to indicate contents. Provide a typed description of the product or major parts of equipment included in the section on each divider.

3. Protective Plastic Jackets: Provide protective, transparent, plastic jackets designed to enclose diagnostic software for computerized electronic equipment.

4. Text Material: Where maintenance manuals require written material, use the manufacturer's standard printed materials, where available. If manufacturer's standard printed materials are not available, provide specially prepared data, neatly typewritten, on 8-1/2-by-11-inch , 20-lb/sq. ft. white bond paper.

5. Drawings: Where manuals require drawings or diagrams, provide reinforced, punched binder tabs on drawings and bind in with text.

   a. Where oversize drawings are necessary, fold drawings to the same size as text pages and use as a foldout.
   b. If drawings are too large to be used practically as a foldout, place the drawing, neatly folded, in the front or rear pocket of binder. Insert a typewritten page indicating drawing title, description of contents and reference to the applicable location in the manual.

C. Submittal for Final Manuals: If specifically requested by the Exhibit Contractor and approved by the Owner and Exhibit Designer, written and graphic portions of final manuals may be submitted in a CD ROM electronic format acceptable to the Architect. Manual content and specific information to be included in each type of manual shall comply as specified for bound manuals. Content that is not included in CD ROM electronic format shall be assembled into binders with dividers and other requirements specified for bound manuals. CD ROM disks and binders shall be fully and clearly labeled, with disks and associated binders for each manual boxed or otherwise packaged for accessible storage together.

1.05 EXHIBIT MANUAL CONTENT

A. In each exhibit manual, include information specified in the individual Specification section and the following information where applicable for each major component:

1. General material, finish, system or equipment description.

2. Design factors and assumptions.

3. Copies of applicable Shop Drawings and Product Data.

4. Material, finish, system or equipment identification, including:

   a. Name of manufacturer.
   b. Model number.
   c. Serial number of each component.

5. Equipment operating data:

   a. Operation instructions.
   b. Emergency instructions.
   c. Wiring diagrams.
   d. Inspection and test procedures.

6. Maintenance procedures and schedules.

7. Precautions against improper use and maintenance.

8. Copies of warranties and service contracts.

9. Repair instructions, including listings of spare parts for equipment.

10. Sources of required maintenance materials and related services.

B. Organize each manual into separate sections for each related product or piece of equipment. To the extent applicable, each manual shall contain a title page, table of contents, general information, copies of Product Data, written text, drawings and copies of each warranty and service contract issued.

1. Title Page: Provide a title page in a transparent, plastic envelope as the first sheet of each manual. As a minimum, provide the following information:

   a. Subject matter covered by the manual.

b. Name and address of the Project.
c. Name of Government user agency.
d. Date of submittal.
e. Name, address, and telephone number all contractors who produced work for the exhibit, identifying the portion of the work that they provided.
f. Cross-reference to related products in other operation and maintenance manuals, if applicable.

2. Table of Contents: After title page, include a typewritten table of contents for each volume, arranged systematically according to the Specifications format. Include a list of each product included, identified by product name or other appropriate identifying symbol and indexed to the content of the volume. Where more than one volume is required to accommodate the data, provide a comprehensive table of contents for all volumes in each volume of the set.

3. General Information: Provide a general information section immediately following table of contents, listing each product included in the manual, identified by product name. Under each product, list the name, address, and telephone number of the subcontractor or installer and the maintenance contractor. Clearly delineate the extent of responsibility for each of these entities. Include a local source for replacement parts for equipment.

4. Product Data: General System or equipment description. Where the manuals include manufacturer's standard printed data, include only those sheets that are pertinent to the part or product installed. Mark each sheet to identify each part or product included in the installation. Where the Project includes more than one item contained in the product data, identify each item, using appropriate references from the Contract Documents. Identify data that is applicable to the installation, and delete references to information that is not applicable.

5. Directories: listing names, addresses, and telephone numbers of Exhibit Designer, Engineers, Construction Manager, Exhibit Contractor and Contractor.

6. Written Text: Prepare written test to provide necessary information where manufacturer's standard printed data is not available, and the information is necessary for proper maintenance of materials or finishes, or for proper operation and maintenance of equipment or systems. Prepare written text where it is necessary to provide additional information or to supplement data included elsewhere in the manual. Organize text in a consistent format under separate headings for different procedures. Where necessary, provide a logical sequence of instruction for each operation or maintenance procedure. Mark product data to clearly identify specific products and component parts.

7. Drawings: Provide specially prepared drawings where necessary to supplement manufacturer's printed data to illustrate the relationship of component parts of equipment or systems or to provide control or flow diagrams. Coordinate these drawings with information contained in Project Record Drawings to assure correct illustration of the completed installation. Provide reinforced punched binder tabs on drawings and bind in with text. Oversize Drawings:

   a. Fold drawings to same size as text pages and use as fold-out.
   b. Drawings too large to be used as fold-out, place folded drawing in front or rear pocket of binder. Insert typewritten page indicating drawing title, description of contents, and drawing location at appropriate location in manual.
   c. Copies of applicable shop drawings and product data.

d. Arranged by product, system, or process flow, and subdivided by Specification section. Identify the following as applicable to each drawing:
   1) Significant design criteria.
   2) List of equipment.
   3) System or equipment identification, including:
      - Name of manufacturer.
      - Model number.
      - Serial number of each component.
   4) Parts list for each component.
   5) Operating instructions.
   6) Maintenance instructions and schedules for equipment and systems.
   7) Emergency instructions.
   8) Wiring and piping diagrams.
   9) Inspection and test procedures
   10) Precautions against improper use and maintenance.

C. Warranties, and Service Contracts: Provide a copy of each warranty or service contract in the appropriate manual for the information of the Government's operating personnel. Provide written data outlining procedures to follow in the event of product failure. List circumstances and conditions that would affect the validity of warranty.

D. Where required for full understanding, include a copy of applicable Project Record Drawings. Do not use original Project Record Documents as part of operation and maintenance manuals.

1.06 EXHIBIT MATERIAL AND FINISHES MAINTENANCE MANUALS

A. Submit 3 copies of each materials and finishes manual, in final form, to the Exhibit Designer. Provide one section for architectural products, including applied materials and finishes. Provide a second section for products designed for moisture protection and products exposed to the weather.

B. Architectural Products: Provide manufacturer's data and instructions for the care and maintenance of architectural products, including applied materials and finishes.

1. Manufacturer's Data: Provide complete information on architectural products, including the following, as applicable:

   a. Manufacturer's catalog number.
   b. Size.
   c. Material composition.
   d. Color.
   e. Texture.
   f. Reordering information for custom manufactured products.

2. Care and Maintenance Instructions: Provide care and maintenance information, including manufacturer's recommendations for types of cleaning agents to be used and methods of cleaning. Provide information about cleaning agents and methods that could prove detrimental to the product. Include manufacturer's recommended schedule for cleaning and maintenance..

C. Moisture Protection and Products Exposed to the Weather: Provide complete manufacturer's data with instructions for the inspection, maintenance and repair of products exposed to the weather or designed for moisture-protection purposes

1. Manufacturer's Data: Provide detailed manufacturer's information, including the following, as applicable.

    a. Applicable standards.
    b. Chemical composition.
    c. Installation details.
    d. Inspection procedures.
    e. Maintenance information.
    f. Repair procedures

D. Schedule: Provide complete information in the materials and finishes manual on products specified in the following sections.

1.07 EXHIBIT AV SYSTEMS OPERATION AND MAINTENANCE MANUALS

A. General: Submit 6 copies of each equipment and systems maintenance manual, in final form, to the CM. Provide separate manuals for each unit of equipment, each building operation system, and each electric and electronic system.

B. Equipment and Systems: Provide the following information for each piece of equipment, each building operation system, and each electric or electronic system, where applicable:

1. Description: Provide a complete description of each unit and related component parts, including the following, as applicable:

    a. Equipment or system function.
    b. Operating characteristics.
    c. Limiting conditions.
    d. Performance curves
    e. Engineering data and tests.
    f. Complete nomenclature and number of replacement parts.

2. Manufacturer's Information: For each manufacturer of a component part or piece of equipment, provide the following, as applicable:

    a. Printed operation and maintenance instructions.
    b. Assembly drawings and diagrams required for maintenance.
    c. List of items recommended to be stocked as spare parts.

3. Maintenance Procedures: Provide information detailing essential maintenance procedures, including the following, as applicable:

    a. Routine operations.
    b. Troubleshooting guide.
    c. Disassembly, repair, and reassembly.
    d. Alignment, adjusting, and checking.

4. Operating Procedures: Provide information on equipment and system operation procedures, including the following, as applicable:

    a. Startup procedures.
    b. Equipment or system break-in.

c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Instructions on stopping.
f. Shutdown and emergency instructions.
g. Summer and winter operating instructions.
h. Required sequences for electric or electronic systems.
i. Special operating instructions.

5. Servicing Schedule: Provide a schedule of routine servicing and lubrication requirements, including a list of required lubricants for equipment with moving parts.

6. Controls: Provide a description of the sequence of operation and as-installed control diagrams by the control manufacturer for systems requiring controls.

7. Piping Identification: Provide as-installed, color-coded, piping diagrams, where required for identification.

8. Valve Tags: Provide charts of valve-tag numbers, with the location and function of each valve.

9. Circuit Directories: For electric and electronic systems, provide complete circuit directories of panelboards, including the following, as applicable:

a. Electric service
b. Controls.
c. Communication.

C. Schedule: Provide complete information in the equipment and systems manual on products specified in the following sections.

1.08 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide tools, spare parts, maintenance and extra stock materials in quantities specified in individual Specification sections.

1. Deliver to Project site and place in locations as directed; obtain receipt from subcontractors and suppliers.

B. Submit letter at time of inspection for Substantial Completion listing items and quantities; attach receipts.

1.09 INSTRUCTIONS FOR GOVERNMENT PERSONNEL

A. Prior to the Substantial Completion inspection, instruct the Government's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Provide instruction at mutually agreed times.

B. Use operation and maintenance manuals for each product, piece of equipment or system as the basis of instruction. Review contents in detail to explain all aspects of operation and maintenance.

C. Posted Logs and Instructions: Place operating logs and instructions in see-through vinyl or other weather protective sleeves or framed enclosures, and post for use by Government personnel in locations approved by the Exhibit Designer.

1. Post operating log sheets with spares at or near the applicable equipment.

2. Post flow schematics, wiring diagrams, valve lists, control sequences, start-up and shut-down instructions, and similar information and instructions in the appropriate equipment rooms.

END OF SECTION 01782

SECTION 01800 — CLEANING

PART 1 - GENERAL

1.00 RELATED DOCUMENTS

A. Work of this section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents and Owner provided General Conditions.

1.01 PROGRESS CLEANING

A. Exhibit Contractor shall retain stored items in an orderly arrangement allowing maximum access, not impeding traffic or the progress of other Work, and providing required protection of materials.

B. Exhibit Contractor shall not allow accumulation of scrap, debris, waste material, and other items not required for construction of the Work, and shall maintain the site in a neat and orderly condition at all times.

C. Exhibit Contractor shall provide adequate storage for all items awaiting removal from the job site, observing requirements for fire protection and protection of the ecology. Store volatile waste in covered metal containers and remove from premises daily. Disposal of volatile fluid wastes in storm or sanitary systems or streams or waterways is not permitted.

D. Daily, and more often if necessary, contractor shall inspect the site and pick up all scrap, debris, and waste material.

E. Weekly, and more often if necessary, Exhibit Contractor shall clean the job site and legally dispose of waste materials and rubbish off the Owner's property.

F. Comply with the requirements of the Section 01811 Waste Management.

1.02 MATERIALS

A. Exhibit Contractor shall use only the cleaning materials and equipment that are compatible with the surface being cleaned, as recommended by the manufacturer of the material.

1.03 FINAL CLEANING

A. "Clean," for the purpose of this article, and except as may be specifically provided otherwise, shall be interpreted as meaning the level of cleanliness generally provided by skilled cleaners using commercial quality building maintenance equipment and material.

B. Prior to completion of the work, contractor shall remove form the job site all tools, surplus materials, equipment, scrap, debris, and waste.

C. Site: contractor shall clean all floor surfaces in the vicinity of the work to remove all debris, dust, and dirt.

D. Furniture and furnishings:

1. Just prior to acceptance or occupancy contractor shall visually inspect all exposed surfaces.

2. Exhibit Contractor shall remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from interior and exterior of finished surfaces as follows:

    a. Glass and Plexiglas: clean inside and out, leaving absolutely no streaks, fingerprints, paint droppings, etc.

    b. Painted surfaces: remove marks, stains, fingerprints, and dirt, touch-up as required to match adjacent finish.

    c. Tile: remove dust, dirt, excess grout or adhesive if any.

    d. Casework: contractor shall apply the polish or cleaner recommended by the manufacturer of the material being polished or cleaned as required.

    e Metal: remove all temporary protective covering, clean as required.

E. Exhibit Contractor shall schedule final cleaning as approved by the Owner or Owner's designated representative to enable the Owner to accept a completely clean work.

END OF SECTION 01800

SECTION 01811 — CONSTRUCTION AIR QUALITY MANAGEMENT

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Work of this section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents and Owner provided General Conditions.

1.2 CONSTRUCTION AIR QUALITY MANAGEMENT GOALS FOR THE PROJECT

A. The Owner has established that this Project shall minimize the detrimental impacts on Indoor Air Quality (IAQ) resulting from construction activities. Factors that contaminate indoor air, such as dust entering HVAC systems and ductwork, improper storage of materials on site, and poor housekeeping, shall be minimized.

1.3 SUMMARY

A. This Section includes requirements for the development of a Construction Indoor Air Quality Management Plan.

1. Management Plan (referred to as “the Plan”): Develop the Plan for approval by the Owner, Exhibit Designer and Architect. The Plan shall be implemented throughout the duration of the project construction and before occupancy, and shall be documented as outlined in the Submittal Requirements of this Section. The Plan is included as part of the LEED Building requirements for the project (EQ Credits 3.1 and 3.2).

1.4 RELATED SECTIONS

A. All sections of the Specifications related to interior construction, MEP systems, and items affecting indoor air quality.

B. Volatile Organic Compound (VOC) Limits For Adhesives, Sealants & Architectural Coatings - Section 01811.

C. Painting - Section 09900.

1.5 DEFINITIONS

A. Volatile Organic Compounds (VOCs): Chemical compounds common in and emitted by many building products, including solvents in paints, coatings, adhesives and sealants, wood preservatives; composite wood binder, and foam insulations. Not all VOCs are harmful, but many of those contained within building products contribute to the formation of smog and can irritate (or worse) building occupants by their smell and/or health impact.

B. Materials that Act as “Sinks” for VOC Contamination: Absorptive materials, typically dry and soft (such as textiles, carpeting, acoustical ceiling tiles and gypsum board) that

readily absorb VOC's emitted by "source" materials and release them over a prolonged period of time.

C. Materials that Act as "Sources" for VOC Contamination: Products with high VOC contents that emit VOCs either rapidly during application and curing (typically "wet" products, such as paints, sealants, adhesives, caulks and sealers) or over a prolonged period (typically "dry" products such flooring coverings with plasticizers and engineered wood with formaldehyde).

1.6 REFERENCES

A. "IAQ Guidelines for Occupied Buildings Under Construction," First Edition, November 1995, Chapter 3; The Sheet Metal and Air Conditioner Contractors National Association (SMACNA), (703) 803-2980, www.smacna.org

B. ANSI/ASHRAE 52.2-1999, "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size," www.ashrae.org

1.7 CONSTRUCTION IAQ MANAGEMENT PLAN

A. The Contractor shall prepare and submit a Construction IAQ Management Plan to the Owner for approval. The Construction IAQ Management Plan shall meet the following criteria:

1. Construction activities shall be planned to meet or exceed the minimum requirements of the Sheet Metal and Air Conditioning National Contractors' Association (SMACNA) "IAQ Guidelines for Occupied Buildings under Construction," First Edition, 1995, Chapter 3.

2. Absorptive materials shall be protected from moisture damage when stored on site and after installation.

3. If air handlers are to be used during construction, filtration with a Minimum Efficiency Reporting Value (MERV) of 8 must be at each return air grill, as determined by ASHRAE 52.2-1999.

4. All filtration media shall be replaced immediately prior to occupancy. Filtration media shall have a Minimum Efficiency Reporting Value (MERV) of 13 as determined by ASHRAE 52.2-1999.

5. A "Sequence of Finish Installation Plan" shall be developed, highlighting measures to reduce the absorption of VOCs by materials that act as "sinks."

B. Upon approval of the Plan by the Owner and Architect, it shall be implemented through the duration of the construction process and before occupancy, and documented in accordance with the Submittal Requirements of this Section.

C. Further description of the Construction IAQ Management Plan requirements is as follows:

1. SMACNA Guidelines: Chapter 3 of the referenced "IAQ Guidelines for Occupied Buildings Under Construction," outline IAQ measures in five categories as listed below. The Construction IAQ Management Plan shall be organized in accordance with the SMACNA format, and shall address measures to be implemented in each

of the five categories (including subsections). All subsections shall be listed in the Plan; items that are not applicable for this project should be listed as such.

a. HVAC Protection
   - Return Side
   - Central Filtration
   - Supply Side
   - Duct Cleaning

b. Source Control
   - Product Substitution
   - Modifying Equipment Operation
   - Changing Work Practices
   - Local Exhaust
   - Air Cleaning
   - Cover or Seal

c. Pathway Interruption
   - Depressurize Work Area
   - Pressurize Occupied Space
   - Erect Barriers to Contain Construction Areas
   - Relocate Pollutant Sources
   - Temporarily Seal the Building

d. Housekeeping

e. Scheduling
   - Protect of Materials from Moisture Damage: As part of the "Housekeeping" section of the Construction IAQ Management Plan, measures to prevent installed materials or material stored on-site from moisture damage shall be described. This section should also describe measures to be taken if moisture damage does occur to absorptive materials during the course of construction.
   - Replacement of Filtration Media: Under the "HVAC Protection" section of the Construction IAQ Management Plan, a description of the filtration media in all ventilation equipment shall be provided. The description shall include replacement criteria for filtration media during construction, and confirmation of filtration media replacement for all equipment immediately prior to occupancy.
   - Sequence of Finish Installation for Materials: Where feasible, absorptive materials shall be installed after the installation of materials or finishes which have high short-term emissions of VOCs, formaldehyde, particulates, or other air-borne compounds.

     Absorptive materials include, but are not limited to: carpets; acoustical ceiling panels; fabric wall coverings; insulations (exposed to the airstream); upholstered furnishings; and other woven, fibrous or porous materials. Materials with high short-term emissions include, but are not limited to: adhesives, sealants and glazing compounds (specifically those with petrochemical vehicles or carriers); paints, wood preservatives and finishes; control and/or expansion joint fillers; hard finishes requiring adhesive installation; gypsum board (with associated finish processes and products); and composite or engineered wood products with formaldehyde binders.

     Pre-Occupancy Phase: Schedule a building flush-out by supplying air volume required by LEED Credit EQ3.2

     Develop a separate sequencing plan that identifies feasible opportunities

to meet the above-stated goals for the project. The plan shall be submitted to the Architect and Owner in accordance with the Submittal Requirements of this Section.

1.8 LEED BUILDING SUBMITTALS

A. The Contractor shall submit the following LEED required records and documents:

1. A copy of the Construction IAQ Management Plan and the Sequence Installation Plan, as defined in this Section.

2. Product cut-sheets for all filtration media used during construction and installed immediately prior to occupancy, with MERV values highlighted. Cut sheets shall be submitted with the Contactor's or Subcontractor's 'approved' stamp as confirmation that the products are the products installed on the project.

3. Provide the Architect or Owner's Representative with a minimum of 18 photographs, comprised of at least six photographs taken on three different occasions during construction. The photographs shall document the implementation of the Construction IAQ Management Plan throughout the course of the project construction. Examples include photographs of ductwork sealing and protection, temporary ventilation measures, and conditions of on-site materials storage (to prevent moisture damage). Photographs shall include integral date stamping, and shall be submitted with brief descriptions of the Construction IAQ Management Plan measure documented, or be referenced to project meeting minutes or similar project documents which reference to the Construction IAQ Management Plan measure documented.

PART 2 - PRODUCTS

(Not Applicable)

PART 3 - EXECUTION

3.1 IMPLEMENTATION AND COORDINATION

A. Implement the Construction IAQ Management Plan, and coordinate the Plan with all affected trades. Designate one individual as the Construction IAQ Representative, who will be responsible for communicating the progress of the Plan with the Owner and Architect on a regular basis, and for assembling the required LEED Building documentation. The Contractor shall include provisions in the Construction IAQ Management Plan for addressing conditions in the field that do not adhere to the Plan, including provisions to implement a stop work order, or to rectify non-compliant conditions.

B. Subcontractors shall be responsible for the implementation of specific control measures, as specified in the Construction IAQ Management Plan. Subcontractors shall coordinate their responsibilities through the Construction Manager and their designated Construction IAQ Representative.

END OF SECTION 01811

SECTION 01812 — CONSTRUCTION WASTE MANAGEMENT

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

1.2 RELATED SECTIONS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

B. All sections of the Specifications involving demolition or construction activities.

1.3 SUMMARY

A. This Section includes requirements for Construction Waste Management (CWM), with criteria for recycling and/or salvaging demolition and construction waste generated during the project. A Construction Waste Management Plan shall be developed for approval by the Owner and Architect. The Plan shall be implemented throughout the duration of the project, and shall be documented per the Submittal Requirements of this Section. Construction Waste Management is included as part of the LEED Building requirements for the project.

1.4 PROJECT WASTE MANAGEMENT REQUIREMENTS

A. The Owner has established that this Project shall generate the least amount of waste possible, and that processes that ensure the generation of as little waste as possible due to error, inaccurate planning, breakage, mishandling, contamination, or other factors shall be employed.

B. Of the inevitable waste that is generated, as many of the waste materials as economically feasible shall be returned, reused, salvaged, or recycled. Waste disposal in landfills shall be minimized.

C. Diversion Requirements: The end-of-project recycling rate shall equal, at minimum, **75%** by weight of the total project waste from construction, demolition, and land clearing activities on site. Excavation soil and hazardous waste are excluded from the calculation.

D. Due to the nature and location of the Site, recycling on site may not be possible (to be determined by the Contractor). The Waste Contractor(s) should include off-site opportunities to recycle and reuse removed materials in the Construction Waste Management Plan.

E. As regards these requirements, the Contractor shall develop, for the Owner's review, a Construction Waste Management Plan for this project

1.5 CONSTRUCTION WASTE MANAGEMENT PLAN

A. The Contractor shall prepare and submit a Construction Waste Management Plan (CWM) to the Owner and Architect for approval. The CWM Plan shall outline the provisions to be implemented to recycle and salvage demolition and construction waste generated during the project.

B. Upon approval of the CWM Plan by the Owner and Architect, it shall be implemented throughout the duration of the project, and documented in accordance with the Submittal Requirements of this Section.

C. The CWM Plan shall include, but not be limited to, the following components:

1. *Listing of Targeted Materials*: Develop a list of the waste materials from the Project that will be targeted for reuse, salvage, or recycling. The following materials shall be accounted for (materials that will not be recycled shall be indicated as such):

    a. Cardboard, paper, packaging.
    b. Clean dimensional wood, palette wood.
    c. Beverage containers.
    d. Land clearing debris.
    e. Concrete.
    f. Concrete Masonry Units (CMU).
    g. Asphalt.
    h. Metals from banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
    i. Drywall.
    j. Carpet and pad.
    k. Paint.
    l. Rigid foam.
    m. Glass.
    n. Plastics.

2. *Landfill Information*: Provide the name of the landfill(s) where trash will be disposed of and the applicable landfill tipping fee(s).

3. *Sorting Method*: Provide a description of the proposed means of sorting and transporting the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site for off-site sorting).

4. *Packaging Waste*: Provide an estimate of packaging materials generated, and note whether suppliers will eliminate or take back packaging.

5. *Field Conditions:* Include provisions in the Construction Waste Management Plan for addressing conditions in the field that do not adhere to the CWM Plan, including provisions to implement a stop work order, or to rectify non-compliant conditions.

6. *Recycling Facilities:* Provide the name of the recycling facilities(s) where materials will be sent for recycling, how it will be recycled, and the applicable fee(s).

7. *Additional Information:* Include any additional information deemed relevant to describe the scope and intent of the CWM Plan to the Owner and Architect.

D. Subcontractor Requirements: Construction Waste Management and recycling requirements shall be incorporated into all Subcontractor's contracts.

1.6 SUBMITTAL REQUIREMENTS

A. The Contractor and/or Subcontractors shall submit the following LEED BUILDING certification items:

1. A copy of the Construction Waste Management Plan.

2. Calculations and supporting documentation to demonstrate end-of–project recycling rates which meet the requirements of the Construction Waste Management Plan of this Section.

B. Monthly Reporting: The process for recording and assembling documentation shall be as follows:

1. Record and document the total weight (in tons) of all demolition and construction waste materials sent to the landfill. Monthly Waste Management Reporting Forms shall be used as the basis for determining the total amount of waste land filled for the project. The monthly reporting forms shall specify:

a. The number of Dumpsters or other containers sent to the landfill for that month;
b. The volume (in cubic yards) of each Dumpster or container sent to the landfill for that month;
c. The type of waste contained in each Dumpster or container, and the weight of the waste in each Dumpster or container. If the weight of the waste is not directly measured for each Dumpster or container, the following Solid Waste Conversion Factors shall be used to convert the volume of waste to weight:
1). Solid Weight Conversion Factors:

Mixed Waste	350 lbs/cubic yard
Wood	300 lbs/cubic yard
Cardboard	100 lbs/cubic yard
Gypsum Wallboard	500 lbs/cubic yard
Rubble	1,400 lbs/cubic yard
Steel	1,000 lbs/cubic yard

d. Identification of the Landfill: Provide the name of the landfill that will be accepting the materials. Receipts or other proof of facility reception of materials is required.

2. Record and document the total weight (in tons) of all demolition and construction waste materials recycled or salvaged. Monthly Waste Management Reporting Forms shall be used as the basis for determining the total amount of waste recycled or salvaged for the project. The monthly reporting forms shall specify:

a. The number of Dumpsters or other containers of recycled or salvaged materials for that month;

b. The volume (in cubic yards) of each Dumpster or container of recycled or salvaged materials for that month;
c. The type of recycled or salvaged material contained in each Dumpster or container; and
d. The weight of the recycled or salvaged material in each Dumpster or container. If the weight of the material is not directly measured for each Dumpster or container, the Solid Waste Conversion Factors listed for landfill waste (see above) shall be used, where applicable, to convert the volume of material to weight. For materials not contained in the Solid Waste Conversion Factors above (e.g. glass), propose a conversion factor for review by the Owner and Architect.
e. Provide the name of the receiving facilities/companies that will be purchasing or accepting the recycled or salvaged materials. Receipts or other proof of facility reception of materials is required.
f. For materials separated for recycling off-site, establish a method for tracking the weight of the recycled material. The method shall be included in the CWM Plan for the Owner's and Architect's review and approval.

3. Calculate the end-of-project recycling rate percentage by dividing the recycled and salvaged waste (in tons) by the total waste generated (recycled, salvaged, and land filled waste – also in tons), and multiplying by 100.

PART 2 PRODUCTS

(Not Applicable)

PART 3 EXECUTION

3.1 IMPLEMENTATION

A. The Contractor shall be responsible for coordination and implementation of the overall Construction Waste Management Plan, as well as coordination of the Plan with all affected trades.

B. The Contractor shall designate one individual as the on-site Construction Waste Management Representative, who will be responsible for communicating the progress of the Plan with the Owner and Architect on a regular basis, and for assembling the required LEED documentation.

C. The Contractor shall provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the Project.

D. Separation Facilities: If waste sorting will be done on site, the Contractor shall lay out and label a specific area to facilitate separation of materials for potential recycling, salvage, reuse, and return. Recycling and waste bin areas are to be kept neat and clean and clearly marked in order to avoid contamination of materials.

3.2 MEETINGS

A. Conduct Construction Waste Management meetings. Meetings shall include Subcontractors affected by the CWM Plan. At a minimum, waste management goals and issues shall be discussed at the following meetings:

1. Pre-bid meeting.

2. Pre-construction meeting.

3. Regular job-site meetings.

B. Monthly Waste Management Reporting Forms: Monthly Waste Management Reporting Forms, as required in the Submittal Requirements of this Section, shall be submitted to the Owner and Architect for review throughout the duration of the project.

END OF SECTION 01812

SECTION 01820 — DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Work of this section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents and Owner provided General Conditions.

1.02 SUMMARY

A. This Section includes administrative and procedural requirements for instructing Owner 's operation and maintenance personnel, including the following:

1. Demonstration of operation of all exhibit systems, subsystems, and equipment.

2. Training in operation and maintenance of exhibit systems, subsystems, and equipment.

1.03 SUBMITTALS

A. Instruction Program: Submit 2 copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, instructors' names for each training module, and learning objective and outline for each training module.

1. At completion of training, submit 2 complete training manuals for Owner's use.

B. Qualification Data: For facilitator and instructors, to demonstrate their capabilities and experience include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

E. Demonstration and Training Video: Submit 2 copies at end of each training module.

1.04 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that required for this Project, and whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, experienced in operation and maintenance procedures and training.

C. Pre-instruction Conference: The Exhibit Fabricator, vacillator and instructors shall conduct a conference at the Project site to review methods and procedures related to demonstration and training including, but not limited to, the following:

1. Inspect and discuss locations and other facilities required for instruction.

2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and other facilities.

3. Review required content of instruction.

4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.05 COORDINATION

A. Coordinate instruction schedule with Owner operations. Adjust schedule as required to minimize disrupting Owner operations.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by the Exhibit Designer.

PART 2 - PRODUCTS

2.01 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections, and as follows:

1. All equipment and systems listed in individual specification sections that also require Operations and Maintenance manuals

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
   a. System, subsystem, and equipment descriptions.
   b. Performance and design criteria if Contractor is delegated design responsibility.
   c. Operating standards.
   d. Regulatory requirements.
   e. Equipment function.
   f. Operating characteristics.
   g. Limiting conditions.
   h. Performance curves.

2. Documentation: Review the following items in detail:
   a. Emergency manuals.
   b. Operations manuals.
   c. Maintenance manuals.
   d. Project Record Documents.

e. Identification systems.
f. Warranties and bonds.
g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:
   a. Instructions on meaning of warnings, trouble indications, and error messages.
   b. Instructions on stopping.
   c. Shutdown instructions for each type of emergency.
   d. Operating instructions for conditions outside of normal operating limits.
   e. Sequences for electric or electronic systems.
   f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Control sequences.
   f. Safety procedures.
   g. Instructions on stopping.
   h. Normal shutdown instructions.
   i. Operating procedures for emergencies.
   j. Operating procedures for system, subsystem, or equipment failure.
   k. Seasonal and weekend operating instructions.
   l. Required sequences for electric or electronic systems.
   m. Special operating instructions and procedures.

5. Adjustments: Include the following:
   a. Alignments.
   b. Checking adjustments.
   c. Noise and vibration adjustments.
   d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
   a. Diagnostic instructions.
   b. Test and inspection procedures.

7. Maintenance: Include the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Procedures for routine cleaning
   e. Procedures for preventive maintenance.
   f. Procedures for routine maintenance.
   g. Instruction on use of special tools.

8. Repairs: Include the following:
   a. Diagnosis instructions.
   b. Repair instructions.
   c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   d. Instructions for identifying parts and components.
   e. Review of spare parts needed for operation and maintenance.

PART 3 PART - EXECUTION

3.01 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training. Assemble training modules into a combined training manual.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

3.02 INSTRUCTION

A. Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Exhibit Contractor and the Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with the Contracting Officer's Representative, with at least 7 days' advance notice.

D. Evaluation: At conclusion of each training module, assess and document each participant’s mastery of module by use of an oral, written or demonstration performance-based test.

E. Demonstration and Training Videos: Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. Record on high quality on Digital Video Disc (DVD).

2. At beginning of each training module, record each chart containing learning objective and lesson outline.

F. Cleanup: Collect and remove used and leftover educational materials. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 01820

SECTION 05500 — METAL FABRICATIONS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1. 2 WORK INCLUDED

A. Provide materials, labor, equipment and services necessary to furnish, deliver and install all work of this Section as shown on the drawings, as specified herein and/or as required by job conditions.

B. Work Included. This Section generally includes the following:

1. Metal framing, supports and armatures and custom fabricated hardware as described in the Exhibit Contract Documents

2. Structural design and engineering of the metal framing described in the Exhibit Contract Documents by Exhibit Contractor's Professional Engineer, including municipal filing requirements.

1.3 RELATED SECTIONS

Section 12353 - Exhibit Casework
Section 06100 - Rough Carpentry
Section 06430 Exhibit Woodwork
Section 10500 Etched & Dimensional Graphics

1.4 SUBMITTALS

A. Product Data: Prior to fabrication submit manufacturer's specifications, anchor details and installation instructions for products used in miscellaneous metal fabrications, including paint products and grout.

B. Shop Drawings showing gauge, thickness, size and construction for each member and indicating the method of assembling components, with true profiles, connections to adjoining work, methods of anchoring, and anchorage templates.

1. As a part of the preparation of Shop Drawings, Contractor shall retain a Professional Engineer, licensed in the State of the Museum Project, to review and design the metal framing described in the Exhibit Contract Documents. Exhibit Contractor's Engineer shall supervise the design, review and sign and seal Shop Drawings, visit points of manufacture and construction, and submit structural calculations and drawings to the Building Department as required.

2. The metal structure supporting exhibit systems shall conform to the Building Code, which references the International Building Code 2006 edition. IBC 2006 requires compliance with reference standard ASCE 7-05 with respect to seismic criteria for architectural components.

3. Exhibit Contractor's Structural Engineer shall coordinate the support of metal framing with base building structure as required.

C. Samples:
Three (3) of each finish samples for the copper finishes.
Three (3) of each powder coated metal finish samples.

1.4 QUALITY ASSURANCES

A. Qualifications of Manufacturer: Products used in the work of this Section shall be produced by steel fabricators with no less than (5) years experience and regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Exhibit Designer.

B. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for re-assembly and coordinated installations.

1.5 PRODUCT HANDLING

A. Protect materials from deterioration and damage by moisture, temperature change, contamination, corrosion and other causes.

PART 2 PRODUCTS

2.01 MATERIALS GENERAL

A. Where exposed to view, use only materials, which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.

B. Metal: All steel shall be new and free from defects which might impair strength, durability or appearance to meet the following requirements:

1. Steel Plates, Structural Shapes and Bars: ASTM A36 A572, or A992.

2. Cold-Formed Steel Framing: ASTM C1007.

3. Steel Tubing: Cold formed, ASTM A 500; or hot-rolled, ASTM A501.

4. Structural Steel Sheet: Hot-rolled, ASTM A570; or cold-rolled ASTM A611, Class 1; of grade required for design loading. Gauges: U.S. Standard Gauge.

C. Grout

1. Metallic Non-Shrink Grout: Pre-mixed, factory-packaged, ferrous aggregate grout.

2. Non-Shrink Non-Metallic Grout: Pre-mixed, factory-packaged, non-staining, non-corrosive, non-gaseous grout. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

D. Fasteners

1. Visible Fasteners: Countersunk, flat-head, hex-socket, type bolts or machine screws into tapped holes in supporting steel.

    a. Finish to match surrounding materials.

    b. All visible fasteners are subject to Exhibit Designer's approval.

2. General Fasteners: Provide zinc-coated fasteners where built into exterior walls. Select fasteners for the type, grade and class required.

3. Screws and bolts shall be U.S. Standard.

4. Bolts and Nuts: Regular hexagon head type, ASTM A307, Grade A.

5. Lag Bolts: Square head type.

6. Machine Screws: Cadmium plated steel.

7. Wood Screws: Flat head steel.

8. Plain Washers: Round steel.

9. Toggle Bolts: Tumble-wing type.

10. Lock Washers: Helical spring type carbon steel.

E. Paint

1. Visible Steel: See "Section 09920 Painting" for custom finish specification on steel.

2. Not-Visible Steel: Use manufacturer's or contractor's standard, fast-curing, lead-free, "universal" Primer, selected for to normal atmospheric corrosion, for compatibility with finish paint systems indicated.

3. Priming paint for ferrous metals shall be approved red lead rust inhibitive type complying with PPG Co., Red Lead Primer No. 6-203 or approved equal.

4. Galvanizing Repair Paint: High zinc dust content paint for galvanized steel.

F. Rough Hardware

1. Furnish fabricated bolts, plates, anchors, hangers, dowels and other miscellaneous steel and iron shapes as required and shown on drawings for framing and supporting exhibitry.

2. Fabricate items of sizes, shapes and dimensions required. Furnish steel washers.

G. Miscellaneous Framing and Supports.

1. Fabricate miscellaneous metal framing and supports to sizes, shapes and profiles indicated or, if not indicated, of required dimensions to receive adjacent other work to be retained by framing.

2. Except as otherwise shown, fabricate from structural steel shapes and plates, of welded construction using mitered joints for field connection. Cut, drill and tap units to receive hardware and similar items.

H. Sleeves

1. Fabricate custom mounting sleeves of steel plate and rod for support of museum artifacts graphics and displays as indicated in the Design Drawings.

2.02 FABRICATION

A. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to a radius of approximately 1/32" unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.

B. Perform cutting, fitting and drilling necessary so that work may be properly set in place to permit engaging work to be properly installed. File or grind smooth exposed edges.

C. Furnish screws, bolts and other fastening devices needed for assembling and for attachment to engaging materials so as to avoid unnecessary cutting and drilling.

D. At exposed connections use concealed fasteners wherever possible. Use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Include washers where necessary.

E. Provide for anchorage of type shown, coordinated with supporting structure. Fabricate and space anchoring devices to provide adequate support for intended use.

F. Cut, reinforce, drill and tap miscellaneous metal work to receive finish hardware.

2.03 SHOP PRIMING FERROUS METAL

A. Apply shop primer to surfaces of metal fabrications except those which are galvanized unless otherwise indicated, and in compliance with requirements of SSPC-PA1 "Paint Application Specifications No. 1" for shop painting.

B. Surface Preparation: Prepare ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:

1. Interiors (SSPC Zone 1A): SSPC-SP3 "Power Tool Cleaning".

PART 3 - EXECUTION

3.01 PREPARATION

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. Furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, sleeves, anchor bolts and miscellaneous

items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.02 INSTALLATION

A. General: Metal work shall be well formed to designated shapes and sizes with sharp lines and angles. Shearing and punching shall leave clean, true lines and surfaces.

B. Rebates, lugs and brackets shall be provided to permit assembly in a neat, substantial manner. Fastenings shall be concealed where possible. There shall be no wind in the built-up parts. Joints exposed to the weather shall be formed to exclude water

C. Steel: Permanent connections for steel work shall be riveted where practicable. Rivet and bolt heads shall be countersunk flush with surface.

3.03 CUTTING, DRILLING AND FITTING:

A. Perform cutting, fitting and drilling necessary so that work may be properly set in place to permit engaging work to be properly installed.

B. Furnish screws, bolts and other fastening devices needed for assembling and for attachment to engaging materials so as to avoid unnecessary cutting and drilling. Proper washers shall be included as necessary.

C. Sharp exposed edges shall be filed or ground smooth and round and free from burrs.

3.04 WELDING:

A. Welding shall be done in accordance with the requirements of the American Welding Institute.

B. Welding shall be either oxyacetylene or electric arc process.

C. Use only certified/licensed welders.

D. Wherever possible, welding operations and the tensioning of high strength bolt connections shall be done in shop. If such connections must be done in field, the calculated stresses in the welds or bolts shall be less than 50% of basic allowable values.

E. If required, be responsible for providing a statement by he Exhibit Contractor's licensed structural engineer certifying that this condition exists. Pay expenses incurred by this or by the authorities' requirement for controlled inspections, at no extra cost to Owner. Provide proof of welders' certification on demand.

F. Exposed joints shall be finished smooth, flush and be practically invisible.

3.05 PROTECTION:

A. Protect all protruding pieces for damage during construction.

3.06 ADJUST AND CLEAN

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. For Galvanized Surfaces: Clean field welds, bolted connections and abraded areas and apply zinc-rich galvanizing repair paint to comply with ASTM A780

END OF SECTION 05500

SECTION 06100 — ROUGH CARPENTRY

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1. 2 WORK INCLUDED

A. Provide materials, labor, equipment and services necessary to furnish, deliver and install all work of this Section as shown on the drawings, as specified herein and/or as required by job conditions.

B. Work Included: This Section generally includes the following:

1. Miscellaneous wood framing, backing and supports

1.3 RELATED SECTIONS

Section 05500 - Metal Fabrications
Section 06430 - Exhibit Woodwork

1.4 REFERENCE STANDARDS

A. Lumber Standards: Comply with PS 20 and with applicable rules of the respective grading and inspecting agencies for species and products used.

B. Plywood Product Standards: Comply with PS 1 (ANSI A 199.1) or, for products not manufactured under PS 1 provisions, with applicable APA Performance Standard for type of panel specified.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's specifications and installation instructions for manufactured materials.

B. Wood Treatment Data: Where required by code, treat wood products for permanent installation under this section with fire retardant in accordance with AWPA standards.

1. Include certification by treating plant stating type of preservative and process used, net amount of preservative retained and conformance with applicable standards.
2. Include statement that moisture content of treated materials was reduced to levels indicated prior to shipment to project site.

C. Mock-up:
One (1) 4’ wide section of the SG landscape wood slat walls showing inset cases and graphic panel integration

1.6 QUALITY ASSURANCE

A. Inspection Agencies: Inspection agencies and abbreviations used for reference of lumber grade and species include the following:

1. Southern Pine Inspection Bureau (SPIB)
2. West Coast Lumber Inspection Bureau (WCLIB)
3. Western Wood Products Association (WWPA)

B. Grade Stamps: Use lumber factory-marked with grade stamp of inspection agency to show compliance with grading rule requirements. Stamp must identify grading agency, grade, species, and moisture content at time of surfacing and mill.

1.7 PRODUCT HANDLING

A. Keep materials under cover and dry. Protect against exposure to weather and contact with moist surfaces. Stack lumber and plywood; provide for air circulation within and around stacks.

1.8 COORDINATION

A. Fit rough carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports for attachment of other work.

PART 2 - PRODUCTS

2. 1 LUMBER – GENERAL

A. Lumber Standards: Mill lumber to comply with PS 20 "American Softwood Lumber Standard" and applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

1. Lumber for framing, bridging, blocking, grounds, furring, nailers, etc. shall be construction grade or better.

B. Nominal sizes are indicated, except as shown by detail dimensions. Provide sizes and moisture contents as required by PS 20.

1. Provide dressed lumber, S4S, unless otherwise indicted.
2. Moisture Content: 19 % maximum at time of shipment for sizes 2" or less in nominal thickness.

2. 2 MISCELLANEOUS LUMBER

A. General: Provide wood for support or attachment of other work including bucks, nailers, blocking, furring, grounds and similar members. Provide lumber of sizes indicated and as follows:

1. Moisture Content: 19 % maximum.

2. Grade: Standard Grade light framing size lumber of any species or board size lumber as required. No. 3 Common or Standard grade boards per WCLIB or WWPA rules or No. 3 per SPIB rules.

2. 3 FASTENERS AND ANCHORAGES

A. Provide fasteners of type, size, material and finish as required for condition of use.

B. Where rough carpentry work is exposed to moisture, provide fasteners and anchorages with cadmium plating or a hot-dip zinc coating (ASTM A 153).

2. 4 WOOD TREATMENT BY PRESSURE PROCESS

A. Preservative Treatment: Comply with applicable requirements of AWPA Standards C2 (Lumber) and C9 (Plywood) and of AWPB Standards listed below. Mark each treated item with the AWPB Quality Mark.

1. Where required by code, pressure-treat lumber and plywood with fire-retardant chemicals, "Dricon" by Hickson Corporation or approved equal, applied in accordance with manufacturer's directions.

2. Pressure-treat wood members in contact with masonry or concrete with water-borne preservatives to comply with AWPB LP-2. After treatment, kiln-dry lumber and plywood to a maximum moisture content of 15 %.

3. Complete fabrication of treated items prior to treatment where possible. If cut after treatment, coat cut surfaces with heavy brush coat of chemical used for treatment to comply with AWPA M4.

2. 5 TREATMENT OF ORGANIC MATERIALS

A. All organic materials to be treated to assure that they are pest free. See Casework spec. for Conservation standards for organic materials that will be in contact with artifacts.

PART 3 - EXECUTION

3. 1 INSTALLATION – GENERAL

A. Discard units of material with defects that might impair quality of work and units, which are too small to use.

B. Set carpentry work to required levels and lines with members plumb and true and cut and fitted.

C. Securely attach carpentry work to substrate by anchoring and fastening as required by recognized standards.

D. Countersink nail heads on exposed carpentry work and fill holes.

E. Select fasteners of size that will not penetrate from opposite side of members that will be exposed. Make tight connections between members. Install fasteners without splitting of wood; pre-drill as required.

3. 2 FRAMING INSTALLATION

A. Provide framing members of sizes and install at spacings shown; comply with National Forest Products Association recommendations. Do not splice structural members between supports.

B. Provide necessary furring, accessories, framing and blocking at walls and ceilings as shown on drawings or as required.

3. 3 NAILERS, BLOCKING AND GROUNDS

A. Provide where required for attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

B. Attach to substrates to support applied loading. Countersink bolts and nuts flush with surfaces when necessary.

END OF SECTION 06100

SECTION 06403 — EXHIBIT WOODWORK

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1.2 WORK INCLUDED

1. Exhibit Millwork (WD-01)

1.3 RELATED SECTIONS

Section 06100 - Rough Carpentry
Section 09920 - Painting
Section 12353 - Exhibit Casework

1.4 DEFINITIONS

A. Exhibit Woodwork includes wood panels, furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

1.5 SUBMITTALS

A. General: Submit in accordance with Section 01330 – Submittal Procedures.

B. Product Data: For each type of product indicated, including fasteners, hinges, hardware and accessories, and finishing materials and processes.

C. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements.

D. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Exhibit Fabricator’s verification of all dimensions coordinated with survey drawings of as built conditions.

2. Show details full size.

3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.

4. Show locations and sizes of cutouts and holes for items installed using dimensions taken from measurement of actual hardware.

E. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.

1. Shop-applied opaque paint finishes.

F. Samples for Verification:

1. Provide (3) 8” x 8” samples with shop-applied paint finish.

2. Provide samples of all exposed hardware and accessories, one unit for each type and finish.

G. Material Safety Data Sheets, for all applicable products.

1.6 QUALITY ASSURANCES

A. Installer Qualifications: An experienced installer who has completed exhibit woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Fabricator Qualifications: A firm experienced in producing exhibit woodwork similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Source Limitations: Engage a qualified woodworking firm to assume undivided responsibility for production and installation of exhibit woodwork.

D. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior woodwork, construction, finishes, and other requirements.

1. Provide AWI Quality Certification Program certificate indicating that woodwork complies with requirements of grades specified or proof that the Exhibit Fabricator meets or exceed the AWI requirements.

1.7 PRODUCT HANDLING

A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions can be and are maintained to the level that will prevent defects from forming in the finished work.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Field Measurements: Where woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

2. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being enclosed and indicate measurements on Shop Drawings.

3. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.9 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior Exhibit Designer woodwork can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.

B. Wood Products:

1. Sustainable Forestry Initiative (SFI) certified medium density fiberboard
2. Sustainable Forestry Initiative (SFI) certified hardwood plywood

2.2 HARDWARE AND ACCESSORIES

C. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.

D. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

1. Steel, countersunk, flat head, hex-socket machine screws with finish as per Section 05500 – Metal Fabrications.

E. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

2.3 INSTALLATION MATERIALS

F. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

G. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

H. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

PART 3 PART - EXECUTION

A. PREPARATION:

1. Condition woodwork to average prevailing humidity conditions in installation areas before installation.

2. Before installing exhibit woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

B. INSTALLATION:

1. Quality Standard: Install woodwork to comply with AWI Section 1700.

2. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of 1/8 inch in 96 inches.

3. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.

4. Fire-Retardant-Treated Wood: Handle, store, and install fire-retardant-treated wood to comply with recommendations of chemical treatment manufacturer, including those for adhesives used to install woodwork.

5. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.

6. Complete the finishing work specified in this Section to extent not completed at shop or before installation of woodwork. Fill nail holes with matching filler where exposed. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats were applied in shop.

7. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

8. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

9. Fabricate woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

10. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

11. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements indicated on Shop Drawings before disassembling for shipment.

12. Notify Exhibit Designer seven days in advance of the dates and times woodwork fabrication will be complete.

13. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates measured form actual hardware to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

C. ADJUSTING AND CLEANING

1. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.

2. Clean, lubricate, and adjust hardware.

3. Clean woodwork on exposed and semiexposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06430

SECTION 09771 — FABRICS

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1.2 WORK INCLUDED

A. The Work of this Section includes all labor, materials, equipment and services necessary to complete the fabric wrapped panels and fabrics as shown on the drawings and/or specified herein, including, but not limited to, the following:

1 Casework backer panel fabric

1.3 RELATED SECTIONS

Section 12353 - Exhibit Casework

1.4 SUBMITTALS

A. General: Submit in accordance with Section 01330 SUBMITTALS.

B. Product data for each type of fabric and installation accessories required. Submit written data on physical characteristics, durability, resistance to fading, flame resistance characteristics, and certification of environmentally safe standards.

C. Samples:

1 Provide (3) twelve-inch (12”) square samples for each fabric and color specified.
2 Provide (3) fabric-wrapped or stretched twelve-inch (12") square samples of each type of substrate or frame specified.
3 Provide data on Adhesive Compatibility and Conservation.

D. Maintenance Data:

1 Provide the Exhibit Designer with a manual that shall describe the care, cleaning and maintenance of the installed fabrics.

1.5 TESTING

A. All Products specified under this Section and used inside Exhibit Cases will have to be submitted for testing and need to be approved by the Owner’s Conservator.

1.6 QUALITY ASSURANCES

A. Qualifications of Manufacturer: Products used in the work of this Section shall be produced by manufacturers regularly engaged in manufacture of similar items and with a history of successful production acceptable to the Exhibit Designer.

1.7 DELIVERY, STORAGE AND PRODUCT HANDLING

A. Protect materials from deterioration and damage by moisture, temperature change, contamination, and other causes.

B. Deliver the panels, and accessory items to the areas of the building where installation is scheduled. Coordinate for the proper scheduling of this work. Store materials in areas designated, and carefully protect panels from damage.

PART 2 PRODUCTS

1.8 MATERIALS:

A. (FA-01) – Case deck fabric
Guilford of Maine
5001 Kendrick St. SE, Suite B
Grand Rapids, MI 49512

1.9 FABRICATION:

A. Panel Fabrication Workmanship:

1 Fabric shall be applied in a consistent direction within each Case, and from Case to Case in adjacent exhibits.

2 Fabric shall show no evidence of adhesive bleed-through.

3 Weave of fabric shall remain even and straight across the face of wrapped surfaces, and shall not be stretched, pulled, or distorted.

4 Contractor shall inspect fabrics before incorporating them into the Work. Any piece of fabric which shows any discoloration, pulled threads, or other blemishes which would be visible in the finished Work shall not be used.

5 Panel shall be covered with a single piece of fabric. If fabric needs to be seamed provide drawing indicating seem location prior to fabrication. The fabric shall wrap over all of the edges of build-up panel with a minimum of a 3/4 inch margin.

PART 3 EXECUTION

1.10 EXAMINATION

A. Study the Contract drawings and specifications with regard to the work as shown and required under this section so as to insure its completeness.

B. Examine surfaces and conditions to which this work is to be attached or applied, and notify the Exhibit Designer of any conditions or surfaces which are detrimental to the proper and expeditious installation of the work. Starting on the work, shall imply, acceptance of the surfaces and conditions to perform the work as specified.

C. Verify dimensions taken at the job site, affecting the work. Bring field dimensions, which are at

variance to the attention of the Designer. Obtain decision regarding corrective measures before the start of installation.

D. Cooperate in the coordination and scheduling of the work of this section with the work of other sections so as not to delay job progress.

1.11 INSTALLATION

1 Fabric-covered surfaces shall be handled carefully and maintained absolutely clean and free of dust until final acceptance. Fabric-covered surfaces shall be covered with a protective wrapping until installed in Exhibit Cases. Contractor's installers shall wear disposable white cotton gloves when handling fabric-covered surfaces during installation in Exhibit Cases.

1.12 CLEAN-UP & PROTECTION

A. Upon completion of the work, remove all waste, excess materials, tools and equipment from the job site.

B. Prior to acceptance of the installation, fabrics which are damaged, stained, discolored, torn, ripped or otherwise not acceptable, shall be repaired and/or replaced with new material of same dye-batch.

C. Protect installed panels from damages by other trades. Install and maintain protective materials over panels if necessary.

D. After the installation is completed provide representatives to instruct the Clients maintenance personnel in the care, cleaning and maintenance of the installed panels.

END OF SECTION 09771

SECTION 09920 — PAINTING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1.2 WORK INCLUDED

A. The Work shall include, but is not limited to the following:

1. Prime and finish painting, including touching up of and repairing of abraded, damaged or rusted prime coats.
2. Painting of MDF, wood and metal as indicated on the drawings.
3. Painting of any surface not specifically mentioned to be painted herein or on drawings but for which painting is obviously necessary to complete the work.

1.3 RELATED SECTIONS

Section 05500 Metal Fabrications
Section 06430 Exhibit Woodwork
Section 10000 Silkscreened Graphics

1.4 MATERIALS AND EQUIPMENT NOT TO BE PAINTED

A. Surfaces not to be painted shall be left completely free of droppings and accidentally applied materials. Unless otherwise indicated, the following shall not be painted:

1. Non-ferrous metals
2. Concealed surfaces not exposed to view
3. Items furnished with factory finish
4. Moving mechanical equipment parts
5. Code-required labels

1.5 SUBMITTALS

A. General: Submit in accordance with "Section 01330 Submittals".

B. Materials List: Prior to delivery, submit to the Exhibit Designer a complete list of all materials and applications. This shall in no way be construed as permitting substitution of materials for those specified or accepted for this Work by the Exhibit Designer.

1. Include certificates attesting to compliance with Specifications, verifying compatibility of finish and intermediate coats with prime coats applied under this or other Sections and verifying compatibility of coatings with the substrates to which they will be applied.

C. Samples and Product Literature: Prior to beginning Work, submit samples for review of color, sheen and texture. Provide a listing of materials and application for each coat of each finish sample. Submit three (3) of each of the following to the Exhibit Designer for review.

1. Provide color system of the paint manufacturer from which the Exhibit Designer will select the paint colors;
2. Provide (3) 6" x 6" x 3/4" MDF panels with finished edges for each color of paint and finish by type with finish applied;
3. Provide (3) 6" x 6" of all Powder coated metals with finish applied;

D. Furnish the Exhibit Designer with a schedule indicating completion of the respective coats of paint for the various areas and surfaces.

1.6 QUALITY ASSURANCES

A. Qualification of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces.

B. Source Limitations: Obtain Block Fillers and primers for each coating system from the same manufacturer as the finish coats.

C. LEED Compliance: All paint and coating products must be low VOC content paints.

1.7 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Order materials sufficiently in advance and in adequate quantities to avoid delays of the Project. Paints shall be ready-mixed, unless otherwise directed by the Exhibit Designer.

B. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label with the following information:

1. Name or title of material
2. Product Description
3. Manufacturer's stock number and date of manufacture
4. Manufacturer's name
5. Contents by volume for major pigment and vehicle constituents
6. Thinning instructions
7. Application instructions
8. Color name and number
9. VOC content

C. Storage and Protection.

1. Store only approved materials at the job site in an area used solely for the storage of paint materials and related equipment. Use a dry, well-ventilated space with a temperature range between 60 and 80 degrees F. Store materials not in use in tightly covered containers maintained in clean condition and free of foreign material and residue.

2. Protect paint materials before, during and after application, and ensure the prompt and safe disposal of related waste products.
3. Protect finished work and materials of other trades, and in the event of damage, immediately make all repairs and replacements.

1.8 PROJECT CONDITIONS

A. Examine areas to receive painting, and notify Exhibit Designer of any conditions observed that would be detrimental to the quality of completed work.

B. Apply paints only to surfaces that are clean, dry and free from frost in an atmosphere that is free from dust and airborne material that might become embedded on freshly painted surfaces.

C. Do not apply paint when relative humidity exceeds 85% unless specifically permitted by the manufacturer and approved by the Designer.

D. Commence painting only after lighting fixtures have been installed and are in use, or after temporary lighting providing 50 average foot candles has been provided.

E. Equipment: Provide scaffolding, ladders and other equipment necessary for the proper execution of the work of this section, all conforming to applicable laws, rules and regulations.

F. Protection: Provide and maintain warning signs and coverings and other protection to prevent damage to work of this section and to the work of others.

PART 2 - PRODUCTS

2.1 MATERIALS – GENERAL

A. Paint shall arrive to the job site in factory labeled unopened containers, color-mixed except for tinting of undercoats and possible thinning.

B. Provide prime paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only to recommend limits

C. Paint colors, surface treatment and sheens are indicated on the Contract Drawings. Certain colors may require paint manufacturer to prepare special factory mixes to match colors selected by the Designer.

D. Paint surfaces as specified. However, the Exhibit Designer reserves the right to change finishes within the range of flat, eggshell, semi-gloss or gloss, without additional cost to the Owner.

E. Mixed colors shall match the color selection made by the Exhibit Designer prior to application of the coating.

F. For alkyd paints, provide certification from manufacturer that selected colors will be available for at least 5 years from time of application. Certification shall state that the colors will not differ due to changes in their chemical composition, particularly resultant from quantities and types of solvents used.

G. Unless otherwise noted, specified products are manufactured by Benjamin Moore & Co. Provide products specified or equivalent products manufactured by the following:

1. PPG Industries
2. Sherwin Williams
3. Or approved equal.

H. Pigments: Pure, non-fading and of types to suit paints, substrates and service indicated.

I. Linseed Oil: Raw or boiled, as required, and of approved manufacture as per ASTM D234 and D260, respectively.

J. Turpentine: Pure distilled gum spirits of turpentine, per ASTM D13.

K. Driers, Putty, Spackling Compound, Patching Plaster, etc.: Best quality, of approved manufacturer.

L. Heat Resistant Paint: Where required, use heat resistant paint when applying paint to heating lines and equipment.

M. Galvanizing Cleaner: Porter Prep. No. 99, applied per manufacturer's instructions.

N. Galvanizing Primer: Porter No. 299 Alkyd Zinc Dust Primer applied per manufacturer's instructions.

2.2 PAINT SYSTEMS

A. Plywood (exhibit casework partitions, decks, lifts and panels as indicated)

1. Plywood - Flat Latex finish by Benjamin Moore & Co. (Spray Application in Shop).
   a. Prime Coat: Benjamin Moore (spray application)
   b. Second - Fourth Coats: Benjamin Moore: Moorecraft Super Spec Latex Flat No. 275 (spray application)
   c. Color: to be specified by Exhibit Designer
   d. Sand between coats.
   e. Apply according to manufacturer's recommendations.

B. MDF (medium density fiberboard)

1. MDF - Waterborne Clear Satin Varnish by Benjamin Moore & Co. (Spray Application in Shop).

   a. Prime Coat: Benjamin Moore & Co.'s interior Wood Finishes Quick-Dry Sanding Sealer No. 413. (spray application)
   b. Second - Third Coats, Benjamin Moore's Stays Clear Acrylic Polyurethane No. 423. Satin. (spray application)
   c. Color: clear.
   d. Apply at spreading rate recommended by manufacturer.
   e. Apply according to manufacturer's recommendations.

C. Veneered and COR Panels

1. Veneered and COR panels - Waterborne Clear Satin Varnish by Benjamin Moore & Co. with integral color tinting (Spray Application in Shop).

    a. Prime Coat: Benjamin Moore & Co.'s interior Wood Finishes Quick-Dry Sanding Sealer No. 413. (spray application)
    b. Second - Third Coats, Benjamin Moore's Stays Clear Acrylic Polyurethane No. 423. Satin Finish. (spray application)
    c. Color: clear.
    d. Apply at spreading rate recommended by manufacturer.
    e. Apply according to manufacturer's recommendations.

D. Exposed Ferrous Metal

1. Ornamental Metals – Tinted matte black lacquer to match Base building spec.
    a. Color: to be specified by Exhibit Designer, sample to match Exhibit Designer provided sample
    b. sand between coats.
    c. Apply according to manufacturer's recommendations.

E. Concealed Ferrous Metal

1. Flat Alkyd Finish
    a. Prime Coat: Iron Clad Retardo Rust Inhibitive Primer (163)
    b. Second and Third Coats: Alkyd Dulamel (207)
    c. Color: as specified by Exhibit Designer.
    d. Apply according to manufacturer's recommendations.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where the painting is to be performed and notify the Designer of conditions detrimental to the completion of the work.

B. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean surfaces to be painted before applying paint or treatments. Remove oil and grease with clean cloths and cleaning solvents prior to mechanical cleaning.

B. Program the cleaning and painting so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

C. Mix and prepare painting materials in strict accordance with the manufacturer's directions to produce a mixture of uniform density. Remove film, and strain if necessary.

D. Protect adjacent work and materials by covering, masking or other method.

E. Remove and protect hardware, accessories, plates, lighting fixtures, factory finished work and similar items, or provide in-place protection. Upon completion of each space, carefully replace all removed items.

F. Remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.

G. Metal Surfaces: Fill dents, cracks, hollow places, open joints and other irregularities in metal work to be painted with approved metal filler and sand to a smooth, hard finish, flush with adjoining surface.

1. Weld Fluxes: Remove weld fluxes, splatters and alkali contaminants from metal surfaces in an approved manner and leave surface ready to receive painting.
2. Bare Metal: Thoroughly clean off all foreign matter such as grease, rust, scale and dirt before priming coat is applied. Clean surfaces by flushing with mineral spirits.
3. Shop Primed Metal: Clean off foreign matter as specified for “Bare Metal”. Prime bare, rusted, abraded and marred surfaces with approved primer after proper cleaning of surfaces. Sandpaper all rough surfaces smooth.
4. Galvanized Metal: Wipe down surface as per SSPC Spec. SP-1. Clean with galvanize cleaner, then wash with clear water.

H. Gypsum Board Surfaces: Scrape off all projections and splatters, spackle all holes or depressions, including taped and spackled joints and sand smooth.

I. Wood Surfaces: Clean, sand and touch-up prime coat. Conform to standards of approved Job Mock-Up.

3.3 APPLICATION

A. Application may be by brush or roller or by electrostatic spray where scheduled.

B. Apply paint by spray in accordance with the manufacturer’s directions.

C. All materials shall be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive stipple.

D. Coverage and hide shall be complete. When color, stain, dirt or undercoats show through final coat of paint, the surface shall be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage at no additional cost to the Exhibit Designer.

E. Tint each undercoat a lighter shade where multiple coats are applied. All coats shall be dry to manufacturer’s recommendations before applying succeeding coats.

F. All suction spots or “hot spots” after the application of the first coat shall be touched up before applying subsequent coats.

G. Take care to ensure that all surfaces, including edges, corners, crevices, welds and exposed fasteners, receive a film thickness equivalent to that of flat surfaces.

H. Paint surfaces behind movable equipment and furniture the same as similar exposed surfaces. Paint surfaces behind (out of the sight line) permanently fixed equipment or furniture with prime coat only.

I. Match colors and textures to approved samples and mockups, and remove finish and repaint surfaces that do not comply.

J. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint before final installation of equipment.

K. “Touching-Up” of Factory Finishes: Unless otherwise indicated, materials with a factory finish shall not be painted at the project site. To “touch-up,” use the factory finished material manufacturer’s recommended paint materials to repair abraded, chipped or otherwise defective surfaces.

L. Paint Thickness: Follow the specified minimum dry film (MDF) thickness requirements in the application of two-coat and three-coat work; the MDF for each coat shall not be less than 1.5 mils., or as recommended in paint manufacturer's printed specifications:

1. Three-coat work shall not be less than 5.0 mils total.

2. Two-coat work shall not be less than 3.0 mils total.

3.4 CLEAN UP

A. During the progress of the work, remove from the site all discarded paint materials, rubbish, cans and rags at the end of each work day.

B. Upon completion of painting work, clean glass and other paint spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or damage finished surfaces.

C. At the completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.5 PROTECTION

A. Protect work of other trades, whether to be painted or not, against damage by the painting and finishing work. Leave all such work undamaged. Correct any damages by cleaning, repairing or replacing and repainting, as acceptable to the Exhibit Designer.

B. Provide “Wet Paint” signs as required to protect newly painted finishes. Remove temporary protective wrappings provided by others for protection of their work after completion of painting operations.

END OF SECTION 09920

SECTION 10000 — SILK-SCREENED GRAPHICS

PART 1GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1.2 WORK INCLUDED

A. The Work in this Section shall include, but is not limited to, all labor, materials, equipment, etc. necessary to prepare and screen all the silk screened text and art as shown in drawings and specified herein.

1 Silkscreened graphics on prefabricated exhibit panels and partitions (GT-03)

1.3 RELATED SECTIONS

Section 05500 - Metal Fabrications
Section 06430 - Exhibit Woodwork
Section 09920 - Painting

1.4 SUBMITTALS

A. General: Submit in accordance with Section 01330.

B. Product Data: Prior to fabrication submit manufacturer's specifications and installation instructions for products used in silk-screening process, including paint products.

C. Shop Drawings: Submit shop drawings for approval for all exhibit components that are to receive silk-screened text and or artwork, indicating size, material, and integration of panels into exhibits.

D. Samples:

1 The Exhibit Contractor shall submit samples, to verify quality standards to be met (e.g. small text or thin line clarity, color registration, image quality)

2 Silkscreen artwork for use in fabrication of the samples shall be provided by the Exhibit Designer.

3 The Exhibit Contractor shall submit (3) 12” x 12” graphics based on graphic production files provided by the Exhibit Designer to verify quality standards to be met. Submittals will include;

a. each color specified
b. multiple colors

1.5 QUALITY ASSURANCES

A. Exhibit Contractor qualifications shall be a firm who can submit supporting documentation of having been continuously in the business of installing producing silk-screened graphics of the type and kind specified herein for no less than five (5) years.

1.6 PRODUCT HANDLING

A. Protect materials from deterioration and damage by moisture, temperature change, handling, and other causes.

1.7 DELIVERY, STORAGE AND PRODUCT HANDLING

A. Exhibit Contractor shall protect Silk-Screened Panels against dampness during and after delivery and while installation is underway.

B. Exhibit Contractor shall protect Silk-Screened Panels from surface damage, scratches and abrasion during installation of Exhibits. Exhibit Contractor shall replace all damaged Silk-Screened Panels that cannot be touched up to the satisfaction of the Exhibit Designer. Exhibit Contractor shall replace or retouch damaged work prior to final acceptance by the Exhibit Designer at no additional cost to the Owner.

PART 2- PRODUCTS

2.1 MATERIALS GENERAL

A. INK: Oil base, matte, epoxy enamel or such high quality ink to be compatible with the surface receiving the screen.

B. SCREEN: Synthetic fabric with weave fineness equal to a 120-220 silk mesh, or as required by nature of artwork.

C. PANELS: As indicated on Drawings and on the graphic panel schedule.

D. PAINT: Spray lacquer, satin finish all sides and edges.

2.2 PRODUCTION

A. METHOD: All artwork on screens to be photographically reproduced employing the "indirect" method of stencil preparation, unless otherwise approved by the designer.

B. WORKMANSHIP:

1 Ink application to be continuously even and opaque.
2 Edges of art and type to be razor-sharp with absolutely no evidence of bleeding.
3 There are to be no mesh marks or saw-toothing.
4 Accurate registration required.
5 All minor imperfections are to be touched-up or cleaned-up, leaving the finished work perfect in every respect.
6 All production screen mesh shall be appropriately stretched around rigid frames as per U.S industry standards.

C. ORIGINAL ART:

1 The Exhibit Designer will furnish all camera-ready art work for preparation and silk screening.

2 Mechanical art shall typically be furnished as digital files at full size or percentage thereof. Exhibit Contractor to prepare film positives at full size suitable for stencil preparation. All silk screened art to be output directly from full-scale digital files to1200 dpi Linotronic film or equal. In some cases, over-sized graphics may be output to film negatives at 2400 dpi for enlargement. Art may not be enlarged more than 400% to achieve full size.

3 Instruction boards and/or elevations provided by Exhibit Designer will include production notes, dimensions and reference codes used in drawings and schedules.

4 When the camera-ready art is produced, Exhibit Contractor shall notify designer if there are any problems or discrepancies between the graphic elevations for production and the camera-ready art.

D. SILKSCREENING:

1 Silk-Screening shall be performed on surfaces indicated in the Drawings and the Graphic Panel Schedule.

2 Exhibit Contractor shall allow silkscreen enamels to dry at least 48 hours prior to installation of finished surfaces in exhibit.

3 All positive or negative films for silk screening shall be of proper size and quality.

2.3 COORDINATION / NOTIFICATION

A. Due to the close dimensional tolerances required to successfully execute the work, Exhibit Contractor shall closely coordinate Silk-Screened Panel sizes, locations, and mounting hardware with all adjoining work. If any dimensional discrepancies are found, Exhibit Contractor shall notify designer before proceeding with the work affected.

B. Exhibit Contractor to notify Exhibit Designer if hardware conflicts with Silk-Screened Graphics.

C. Exhibit Contractor shall notify Exhibit Designer if original material is scratched or otherwise damaged in any way which would appear in the produced panel, before proceeding with production of that panel.

2.4 INSPECTION

A. Exhibit Contractor to inspect all panels prior to installation. Panels to be inspected against signed-off galleys to insure the proper use of fonts, that all graphic elements are present; that color applications are correct; and that all spot-colors match approved control samples.

B. Exhibit Designer retains the right to reject any panels after installation that do not meet the requirements above.

C. Exhibit Contractor shall afford the Exhibit Designer and or Exhibit Designer access to facilities for inspecting the graphic work before, during, and after the production stage throughout the course of fabrication. Exhibit Contractor shall give five days notice to the Exhibit Designer and or Exhibit Designer before work is ready for inspection.

D. Exhibit Contractor to alert Exhibit Designer of any conflicts between panel hardware and applied graphics prior to fabrication.

E. Exhibit Contractor shall remove and replace any work found defective after installation at no additional cost to the Owner.

2.5 OWNERSHIP OF GRAPHICS

A. All graphics-related products required shall become the property of the Owner upon completion of the project and shall be transmitted to the Exhibit Designer at no additional cost. This includes, but is not limited to:

1 Artwork
2 Positive and Negative Films
3 Photographic Products
4 Exhibit Contractors Digital Production Files

PART 3 - EXECUTION

3.1 PREPARATION:

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. Coordinate work of this Section with related work of other sections.

3.2 PROTECTION:

A. During shipping and on-site storage, the Exhibit Contractor shall ensure that all Silk-Screened Art will be adequately protected with bubble-wrap and cardboard corner protectors (for individual panels) up to the point of installation. The Exhibit Contractor shall also ensure that all Silk-Screened Art will be handled in such a way that they will be perfect and unmarred when installation is complete.

3.3 INSTALLATION

A. Exhibit Contractor shall remove and replace any work found defective after installation at no additional cost to the Owner.

B. Silk-Screened Panels shall be handled carefully and maintained absolutely clean and free of dust until final acceptance. Silk-Screened Panels shall be covered with a protective wrapping until installed in Exhibits. Exhibit Contractor's installers shall wear disposable white cotton gloves when handling Silk-Screened Panels during installation in Exhibits.

3.4 CLEANING

A. Upon completion of the work and when all danger of damage to graphics and photographs is past, Exhibit Contractor shall inspect and clean all work contained in this section to the satisfaction of the Exhibit Designer and the Owner.

END OF SECTION 10000

SECTION 10200 — DIGITAL OUTPUTS

PART 1 – GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1.2 WORK INCLUDED

A. The Exhibit Contractor shall furnish all labor, materials, equipment, etc., necessary to produce and install all Digital Outputs as detailed in the Drawings and Schedules, and as specified in this document.

1 Digital Print on wall paper (GT-01)
2 Direct to substrate (GT-04)
3 Laminated paper (GT-07)
4 Digital Print on Canvas (GT-09)
5 Direct to substrate on fabric (GT-10)

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's, Exhibit Contractor's and finisher's specifications and installation instructions for each product.

B. Shop Drawings: Prior to fabrication and/or purchase prepare shop drawings of work and submit to and obtain Exhibit Designer's approval thereof. Shop drawings shall be based on drawings, specifications and field measurements essential for proper fitting of Photomurals with other construction or existing Exhibit Designer, and shall present complete information as to illustrate for the Exhibit Contractor the general character of the Photomurals. Actual artwork to produce Digital Photo Prints will be provided by the Exhibit Designer as digital files.

C. Samples:

1 The Exhibit Contractor shall submit samples of each application, based on graphic production files provided by the Exhibit Designer to verify quality standards to be met. Quantity of samples must be submitted according to the requirements set forth in Section 01330 – Submittals.

2 Exhibit Contractor shall submit for approval, completed samples of each photographic print listed below. These shall be submitted as complete assemblies, panel w/ protective UV film as specified in this section.

a. Color photograph with dropped-in caption on contrasting background.

3 In addition, Exhibit Contractor shall submit to the Exhibit Designer test strips at full scale for panels over 4 feet in the shortest dimension, and for any area for which image resolution may not be adequate, or the acceptability of the outcome otherwise uncertain. Area to be tested shall be selected by Exhibit Designer. Exhibit Designer shall provide photo originals.

1.4 PRODUCT HANDLING

A. Exhibit Contractor shall protect Digital Output panels against dampness during and after delivery and while installation is underway.

B. Exhibit Contractor shall protect Digital Output panels from surface damage, scratches and abrasion during installation of exhibits. Exhibit Contractor shall replace damaged work prior to final acceptance by the Exhibit Designer at no additional cost to the Owner.

PART 2- PRODUCTS

2.1

A. Approved Digital Output Products and Methods:

1. Digital Print on fabric/ paper (GT-01)

a. Evergreen Fabric Jet Text
www.dickson-coatings.com
415 Avenue de Savoie, Saint Clair de la Tour 38357 La tour du pin
b. Rollout
www.rollout.ca
301-321 Railway Street, Vancouver BC Canada V6A 1A4
c. Or equal as approved by Exhibit Designer.

2. Direct to Substrate - (GT-04 & GT-10) Flat bed printer with Quadro Array Technology ink -Provide clear coat finish to protect print as required.

a. Durst Rho
www.fusion-imaging.com
601 Boro Street, Kaysville, UT 84037
b. Or equal as approved by Exhibit Designer.

3. Laminated paper for document reproduction flip book (GT-07)

a. archival paper print in clear laminated enclosure
b. Or equal as approved by Exhibit Designer.

4. Digital Print on Canvas to replicate historic oil painting (GT-09)

2.2 FILMS:

A. PROTECTIVE FILM: Seal Print Shield, satin finish, as manufactured by Seal Products Incorporated, Naugatuck, CT 06770

B. ADHESIVE FILM: "Optimount", as manufactured by Seal Products Incorporated, Naugatuck, CT 06770

2.3 PRODUCTION

A. METHOD:

1 Digital files as provided by the Exhibit Designer must not be altered without notification.

2 Digital files that require rasterization in PhotoShop for must be rasterized at 400 dpi. To ensure the best possible resolution for type and images.

3 All photographic art must be prepared as RGB

4 All blends and spot colors must be specified as RGB

B. WORKMANSHIP:

1 All spot colors to match control samples as provided in submittals above.

2 All blends should appear smooth with no evidence of “stepping”.

3 Type and photographs should be as sharp as technically possible.

C. DELIVERABLES:

1 The Exhibit Designer will furnish all digital files, typically at full scale with appropriate crop marks.

2 All placed photographic images provided shall be prepared as RGB files at 400 dpi at final size to ensure the best possible resolution.

3 In some cases, FPO art shall be provided in the production files. In this case, Original Art shall also be provided in the form of transparencies, or reflective art or digital files. Exhibit Contractor will then scan Original art per the specifications above and replace images exactly for final output.

4 Instruction boards and/or elevations provided by Exhibit Designer will include production notes, dimensions and reference codes used in drawings and schedules.

5 Exhibit Contractor shall notify Exhibit Designer if there are any problems or discrepancies between the graphic elevations for production and the digital files provided.

2.4 COORDINATION / NOTIFICATION

A. Due to the close dimensional tolerances required to successfully execute the Work, Exhibit Contractor shall closely coordinate photo panel sizes, locations, and mounting hardware with all adjoining work. If any dimensional discrepancies are found, Exhibit Contractor shall notify Exhibit Designer before proceeding with the Work affected.

B. Exhibit Contractor shall notify Exhibit Designer if original material is scratched or otherwise damaged in any way which would appear in the produced photograph, before proceeding with production of that image.

C. When proofs are pulled, as per requirements under Submittals above, Exhibit Contractor shall notify Exhibit Designer if there are any problems or discrepancies between the Graphic Elevations for Production and the Digital Image output.

2.5 INSPECTION

A. Exhibit Contractor shall afford the Exhibit Designer access to facilities for inspecting the graphic work before, during, and after the production stage throughout the course of fabrication Exhibit Contractor shall give five days notice to the Exhibit Designer before work is ready for inspection.

B. Exhibit Contractor to alert Exhibit Designer of any conflicts between panel hardware and applied graphics prior to fabrication.

2.6 OWNERSHIP OF GRAPHICS

A. All graphics-related products required shall become the property of the Owner upon completion of the project and shall be transmitted to the Exhibit Designer at no additional cost. This includes, but is not limited to:
1 Photographic Products
2 Digital Production Files Exhibit Contractors and Exhibit Designers

PART 3- EXECUTION

3.1 PREPARATION:

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.

B. Coordinate work of this Section with related work of other sections.

3.2 PROTECTION:

A. During shipping and on-site storage, the Exhibit Contractor shall ensure that all Digital Outputs will be adequately protected with bubble-wrap and cardboard corner protectors (for individual panels) up to the point of installation. The Exhibit Contractor shall also ensure that all Digital

Outputs will be handled in such a way that they will be perfect and unmarred when installation is complete.

3.3 LABELING:

A. All Digital Outputs shall be appropriately labeled in a concealed place with the graphic reference number as provided on the mechanicals, photography or art.

3.4 FABRICATION

A. Digital files must not be reduced in resolution from their original size during any print process.

3.5 ORIGINAL PHOTOGRAPHY AND ART

A. The position and size of each photo panel will be specified in the Drawings and Schedules to be provided by the Exhibit Designer. Image crops will be specified on the cropping guides provided by the Exhibit Designer.

B. The Exhibit Designer shall supply all original material in the form of color or black and white transparencies and/or negatives and original artwork. Each of these items to print will be marked with a reference number, as well as reference numbers of the loaning photographer or institution. In all cases, these numbers must be used as reference for production and should remain intact. All acetate sleeves, covers, envelopes, etc. associated with each original must be kept with it and returned to the Exhibit Designer. Specific cropping information will be provided with each original and shall be returned with the original to the Exhibit Designer.

C. IMAGES

1 Images on graphic panels to be provided by Exhibit Contractor as final hi-resolution RGB images unless otherwise indicated by Exhibit Designer.

2 For larger images and murals, images will be provided to the Exhibit Contractor in each graphic layout as low-resolution FPO (for Position Only) files. Exhibit Contractor shall replace FPO images with hi-resolution versions of the same image.

3 Exhibit Contractor should allow for high-resolution scans to be made from Exhibit Designer's original photography and artwork in the quantities indicated on the Graphic Elevations.

4 Digital images will be provided to the Exhibit Contractor in the form of slides, transparencies, prints, negatives, books, and original artwork. Exhibit Contractor shall scan images at the appropriate resolution required for optimum results: at final size, images shall have a resolution of 400 dpi or greater.

5 The Exhibit Designer shall supply all original material for high-resolution scanning. Each of these items to scan will be marked with a reference number, as well as reference numbers of the loaning photographer or institution. In all cases, these numbers must be used as reference for production and should remain intact. All acetate sleeves, covers, envelopes, etc. associated with each original must be kept with it and returned to the Exhibit Designer.

6 Exhibit Contractor shall allow Exhibit Designer's graphic designer forty-eight (48 hours console time at Exhibit Contractor’s production facility to assemble and manipulate large Digital Files in Photoshop as required).

7 Image crops will be indicated by the FPO images in the Digital Files, and on Graphic Elevations provided by Exhibit Designer.

3.6 MOUNTING

A. METHOD: Exhibit Contractor shall drymount Digital Output Inkjet Panels to substrate with Optimount Mounting film or approved equal. Print paper shall be wrapped onto back of the substrate panel at all panel edges, and corners neatly folded. Wrapped panel shall then be covered with UV protective film, also wrapped onto the back of the panel. Where back of panel is visible, apply a finish backing as indicated in the Drawings and Schedules, and as specified in this document.

B. WORKMANSHIP

1 Where the digital outputs require multiple strips of photo paper on same substrate, joint between adjacent strips shall be hairline tight, image perfectly aligned across joint, and color consistent across joint. Exposed edges of paper at joint shall be touched up as required with waterbased marker to match adjacent color values.

2 Where mural is divided into multiple panels, photopaper and protective film shall be wrapped to inside face of panel joints. Image shall be perfectly aligned across joint, and color consistent across joint

3 All materials shall be applied with roller press, and shall be free and clear of dust particles, air pockets and creasing of any kind.

3.7 INSTALLATION

A. Exhibit Contractor shall remove and replace any work found defective after installation at no additional cost to the Owner.

B. Exhibit Designer retains the right to reject any panels after installation that do not meet the requirements above.

C. Exhibit Contractor shall afford the Exhibit Designer's graphic designer access to facilities for inspecting the graphic work before, during, and after the production stage throughout the course of fabrication. Exhibit Contractor shall give one month's notice to the Exhibit Designer before work is ready for inspection.

D. Exhibit Contractor to alert Exhibit Designer of any conflicts between panel hardware and applied graphics prior to fabrication.

3.8 CLEANING

A. Upon completion of the work and when all danger of damage to graphics and photographs is past, Exhibit Contractor shall inspect and clean all work contained in this section to the satisfaction of the Exhibit Designer and Owner.

END OF SECTION 10200

SECTION 10500 — ETCHED AND DIMENSIONAL GRAPHICS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1.2 WORK INCLUDED

A. Work included: The Exhibit Contractor shall furnish all labor, materials, equipment, etc. necessary to prepare and fabricate all the etched and cut metal text and art as shown in drawings, specified herein, or both. The work of this section includes but is not necessarily limited to the following:

1. Laser cut dimensional copper bars & text (GT-02)
2. Etched metallic wall with filled linework & text in Removal Area (GT-05)
3. Laser cut dimensional copper letters inset in scenic trees & terrazzo flooring (GT-06)

B. Related Work specified elsewhere;

Section 05500 — Metal Fabrications

1.3 SUBMITTALS

A. Samples:

1. The Exhibit Contractor shall submit samples of each application, based on graphic production files provided by the Exhibit Designer to verify quality standards to be met. Submittals will include samples;
   a. Gallery Primary panel dimensional copper bars & text - digital files provided by the Exhibit Designer.
   b. Etched metallic wall with filled linework & text in Removal Area: (3) 12” x 12” samples - digital files provided by the Exhibit Designer.
   c. Laser cut dimensional copper letters inset in scenic trees & terrazzo flooring - digital files provided by the Exhibit Designer.

B. Mockup:

1. The Exhibit Contractor shall provide min. 4’ wide x full height etched metallic wall with filled linework & text in Removal Area for a comprehensive mock up of lighting and panel seaming details.

C. Site Survey and Shop Drawings: No work may commence until the site survey and all relevant shop drawings have been reviewed and final “Approval with no exceptions” has been granted by the Exhibit Designer.

PART 2– PRODUCTS

2.0 MATERIALS

A. Acid etched graphics on medium brass with baked enamel linework & text.

B. Approved vendor:
Stoller Metals
http://www.stollermetals.com
22809 86th Ave S
Kent, Washington 98031
United States (206) 903-6188

C. Dimensional Copper bar

2.1 PRODUCTION

A. METHOD: All art and text to be output to 100% film positives. Metal surfaces are treated with photo-resist emulsion. Art to be etched is photographically transferred to treated metal surfaces via UV exposure. Art is etched using a controlled-depth acid attack.

1. Etched depth of type and art as scheduled.
2. Scenic metallic paint finish may be proposed as an alternate to above if sample submittals are approved by Owner and Exhibit Designer.

B. WORKMANSHIP:

1. Edges of art and type to be razor-sharp with absolutely no evidence of bleeding.
2. There are to be no mesh marks or saw-toothing.
3. Accurate registration required.
4. All minor imperfections are to be touched-up or cleaned-up, leaving the finished work perfect in every respect.
5. Etched depths to be consistent.

C. The Exhibit Designer will furnish all artwork for preparation and etching and cutting. All etched art to be output directly from full-scale digital files to1200 dpi Linotronic film or equal. In some cases, over-sized graphics may be output to film negatives at 2400 dpi for enlargement. Art may not be enlarged more than 200% to achieve full size.

D. Instruction boards and/or elevations provided by Designer will include production notes, dimensions and reference codes used in drawings and schedules.

E. When the camera-ready art is produced, Exhibit Contractor shall notify designer if there are any problems or discrepancies between the graphic elevations for production and the camera-ready art.

2.2 INSPECTION

A. Exhibit Contractor to inspect all graphics prior to installation. Graphics to be inspected against signed-off galleys to insure the proper use of fonts, that all graphic elements are present; that color applications are correct; and that all spot-colors match approved control samples.

B. Exhibit Designer retains the right to reject any panels after installation that do not meet the requirements above.

C. Exhibit Contractor shall afford Exhibit Designer access to facilities for inspecting the graphic work before, during, and after the production stage throughout the course of fabrication. Exhibit Contractor shall give five days notice to Contracting Officer before work is ready for inspection.

D. Exhibit Contractor to alert designer of any conflicts between panel hardware and applied graphics prior to fabrication.

E. Exhibit Contractor shall remove and replace any work found defective after installation at no additional cost to the Owner.

2.3 PRODUCT HANDLING

A. Exhibit Contractor shall protect all work against damage during and after delivery and while installation is underway.

B. Exhibit Contractor shall protect all work from surface damage, scratches and abrasion during installation of exhibits. Exhibit Contractor shall replace any damaged work prior to final acceptance by Exhibit Designer at no additional cost to the Owner.

PART 3 – EXECUTION

3.0 INSTALLATION

A. Labeling: All graphics shall be appropriately labeled in a concealed place with the graphic reference number as provided on the provided artwork and shop drawings.

B. Exhibit Contractor shall remove and replace any work found defective after installation at no additional cost to the Owner.

3.1 CLEANING

A. Upon completion of the work and when all danger of damage to graphics is past, Exhibit Contractor shall inspect and clean all work contained in this section to the satisfaction of the Exhibit Designer.

3.2 COORDINATION / NOTIFICATION

A. Exhibit Contractor shall closely coordinate dimensional letter sizes, locations, and mounting hardware with all adjoining work. If any dimensional discrepancies are found, Exhibit Contractor shall notify designer before proceeding with the work affected.

B. Exhibit Contractor to notify designer if hardware conflicts with dimensional graphics.

END OF SECTION 10500

SECTION 10950 –DIORAMAS

PART 1 - GENERAL

1.1 GENERAL

A. Work of this section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents.

1.3 DESCRIPTION OF WORK

A. The Exhibit Contactor shall furnish all labor, materials, equipment, etc., necessary to produce, transport, and install sculptured rock surfaces, scenic groundforms and surface treatments and full scale dioramas as described herein and in the Drawings and Reference Materials. Work shall include specified groundforms, flora, fauna and scenery. Taxidermy provided by Exhibit Contractor as scheduled and installed as specified. Final scenic layout and content will be a result of discussions between the Owner, Exhibit Contractor and Exhibit Designer.

Scenic Treatments include:

1. Origins Tableau Groundform
2. Origins Area Manequin Figures
3. Origins Area Gallery Flooring
4. Removal Area Gallery Flooring

1.3 RELATED SECTIONS

Section 06430 Exhibit Woodwork
Section 09912 Painting
Section 10200 Digital Outputs
Section 16500 Exhibit Lighting

1.4 SUBMITTALS

A. SHOP DRAWINGS & SITE SURVEY: Prior to fabrication, Exhibit Contactor shall prepare measured shop drawings of Work and submit to and obtain Exhibit Designer's approval thereof. Shop drawings shall be scaled drawings (plans, sections, elevations and details) based on Drawings, Specifications, and Reference Materials, and shall present complete information as to fabrication, installation, and proper fitting of the Scenic and Diorama elements within the Exhibit Area indicated, including location and anchorage requirements of any mounting hardware and manequin figures. These drawings must be based on measured field surveys of existing conditions and coordinated with the work of the General Contractor.

B. PHOTOGRAPHS OF PROPOSED Manequin Figures: Prior to fabrication, Exhibit Contactor shall submit photographs of prospective Manequin Figures to obtain the Owner’s approval thereof.

C. SAMPLES AND PRODUCT LITERATURE: Samples of all material types and related products literature are to be submitted to the Exhibit Designer for approval prior to use.

1. Groundform and Flooring samples:

   a. (3) 12 x 12 inch sections of all unique surface treatments

   b. (3) sets of all visible hardware, mounting systems, armatures, etc.

   c. (3) 12 x 12 inch samples of substrates, support systems, etc.

2. Product Manufacturer’s Data: product descriptions, materials including VOC content, warrantees, maintenance instructions, etc.

3. Proposed Pest Control and Desiccation Systems: For all natural materials used.

D. ARTIST'S SKETCHES & MAQUETTES: Prior to fabrication the Exhibit Contactor shall prepare and submit to the Exhibit Designer sketches and/or scale models of the scenic treatments and general character of all scenic elements. Artist's Sketches should indicate form, texture, posture, location, and interaction of all scenic elements.

E. MOCK-UPS: Partial mockups of the Early Origins diorama is a required part of a progress review by the Exhibit Designer and the Owner.

1. Build a partial mockup to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work to demonstrate the following;

a) topography and overall form
b) surface textures and finishes
c) placement of mounts and other materials
d) durability

3. Notify Exhibit Designer one month in advance of dates and times when mockup will be fabricated and ready for review.

4. Coordinate and facilitate an Off-Site Progress Meeting as a quality control review of the mock-up as described in Section 01312 - Project Meetings.

5. Obtain Exhibit Designer's approval of mockup before commencing with final fabrication and installation.

F. PROGRESS PHOTOGRAPHS: The Exhibit Contactor shall submit progress photographs for Exhibit Designer's review and approval before proceeding with the Work. Upon review, The Exhibit Designer and Owner shall have the right to require any modifications necessary in their opinion to achieve biological accuracy.

1. Photographs should be clearly labeled and dated. Images shall be clear and well-lit, with a minimum of background clutter. Dioramas shall be documented in their entirety, with close-ups to show detail.

2. Photographs shall be submitted at the following milestones:

a. After groundforms have been fully sculpted but not finished.
b. After all individual components such as models and groundforms have been built and finished but not yet installed.
c. After all scenery and flora have been placed and installed.

1.5 QUALITY ASSURANCE

A. The Exhibit Contactor shall be a qualified Contactor with at least seven years proven experience in high-quality museum exhibits of similar scale and complexity as this project.

B. Subcontractors shall be recognized and established companies producing the highest quality, first- class construction and installation of their work in their respective fields.

C. Guarantee of Work:

2. Except as otherwise specified, Exhibit Contactor shall guarantee his/her work against defects resulting from the use of inferior materials, equipment, or workmanship for one (1) year from the date of Substantial Completion of the Work, or from full occupancy of the gallery, whichever is earlier.

3. All materials and /or completed fabrications must have a ten year structural service life in the exhibit environments described. Materials must have the capability of resisting any visible damage for a (5) year active service life.

3. If the Exhibit Contactor cannot guarantee a certain material or construction that is shown or is specified, or if he/she cannot furnish guarantees that are required, then Exhibit Contactor shall inform the Owner and the Exhibit Designer to that effect in the submitted materials.

4. If, within any guarantee period, repairs or changes are required in connection with guaranteed work, which, in the opinion of the Owner, is rendered necessary as the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, the Exhibit Contactor shall promptly upon receipt of notice from the Owner, and without expense to the Owner or Exhibit Designer place in satisfactory condition in every particular all of such guaranteed work, correct all defects therein.

PART 2 - PRODUCTS

2.1 PERFORMANCE STANDARDS

A. All materials used should simulate the natural environments of the given scenic treatment. When actual flora is used it must be properly cleaned, desiccated, treated for pest control and sealed.

B. Synthetic materials are to have low VOC levels and allowed time to off - gas prior to arrival on site. All colors are to replicate the natural environment.

C. Materials specified herein are intended to establish the standards of quality required for the Work of this Section. Listing of materials herein does not imply their use nor does it eliminate other materials from consideration.

D. Final selection of a specific material, treatment or technique for each exhibit element must be approved by the Exhibit Designer.

E. Acceptable Scenic and Modeling Studios:

1. Academy Studios
70 Galli Drive
Novato, CA 94949
Tel. 415-883-1031
www.academystudios.com

2. Dixon Studios
912 S Park
Tucson, AZ 85719
Tel. 520-628-4216
www.dixonstudios.com

3. Split Rock Studios
2071 Gateway Boulevard
St. Paul, MN 55112
Tel. 651-631-2211
www.splitrockstudios.com

4. Taylor Studios
1320 Harmon Drive
Rantoul, IL 61866
www.taylorstudios.com

5. Blue Rhino Studios
3277 Sun Drive

Eagan, MN 55121
www.rhinocentral.com

6. Or other as approved by the Designer

2.3 MATERIALS:

A. WOODEN BASE: Fire rated plywood or MDF construction for base and structure of Dioramas to be engineered for supporting the weight of Scenic Work, Dioramas and Taxidermy.

B. SCENIC GROUNDFORMS: All scenic work is to be sculpted to match the Drawings and Reference materials and additional research by the Exhibit Contractor. Final products and finishes used are to be submitted to and approved by Exhibit Designer.

1. Occupancy and Loading:

a. Gallery groundforms must be able to withstand continuous and prolonged occupancy by visitors as this is an activity zone and will be occupied by adults and children and must withstand a live loading of 150 lbs per sq ft.

c. Origins Scenic Tableau in Origns will not be occupied by public but should withshand loading for regular maintenance and cleaning.

2. Approved Materials;

a. Milestone Hybridized Cement
Artisan Finishes Inc.
902 1st Ave South
Seattle, WA 98134
Tel. 206 -340-0830
www.cementics.com/

b. Skimstone
Rudd Company, Inc.
1141 NW 50th St.
Seattle WA 98107
Tel. 206.789-1000
www.skimstone.com

c. Senergy
BASF Wall Systems
3550 St. John's Bluff Road
SouthJacksonville, FL 32224-2614
Tel 904·996·6000
www.senergy.cc

d. Or other as approved by Designer

3. Finishes: Scenic Groundforms are to be durable surfaces with matt (no luster) surfaces. All surfaces should be free of loose materials. Periodic cleaning including removal of dust will be by compressed air. Scenic work shall not have any visible seams or joints between pieces and are to appear continuous with surrounding surfaces.

4. All occupied or touchable scenic treatments and groundforms must be sound attenuated, so as not to sound hollow when walked on or touched.

C. WATER: Water elements are to be cast with clear resin and have no scratches or surface imperfections. There shall be no air bubbles or clouding.

D. FLORA: Flora elements will be either cast from actual approved specimens or sculpted of synthetic materials from a core of twisted wire or polyester rope.

1. All plant specimens and Models are subject to review and approval by the Designer and Owner's botanical curator.

2. Suggested finish materials for plants and trees are;

   a. Polygem Epoxy #4755

   b. Urethane HMP 45.5.

3. All natural materials are to be fully desiccated, treated for pest control and sealed.

F. MOUNTING ASSEMBLIES: All mounting hardware required for mounts, artifacts, specimens are to be supplied and integrated into the Work. No hardware or fasteners are to be visible.

PART 3 - EXECUTION

3.1 TIME OF COMPLETION & FABRICATION SCHEDULE

A. The Exhibit Contactor shall prepare an estimated progress schedule for the Work. The schedule shall be related to the entire Project to the extent required by the Contract Documents. This schedule shall indicate the dates for the starting and completion of the various stages of fabrication and shipping and shall be revised as required by the conditions of the Work, subject to the Owner's approval.

B. Two in-shop meetings shall be planned after approval of materials to review shop drawings, development of scenic elements, reduced scale models and full-scale mock-ups and progress on actual scenic elements. All elements are subject to the Exhibit Designer's review and approval prior to delivery and installation.

3.3 MEASUREMENTS

A. Exhibit Contactor shall be responsible for verifying and guaranteeing all critical measurements, including those provided by Exhibit Designer, Owner, and others. For the purpose of these specifications, critical dimensions shall mean those dimensions which are critical for a proper fit of cast figure to surrounding exhibits and reproductions. All such dimensions shall be shown on the shop drawings.

B. Exhibit Contactor shall be responsible for verifying dimensions that are required for proper coordination with other work, including but not limited to exhibits and Owner provided materials.

3.4 SHOP FABRICATION

A. All exhibits included in the Scope of Work shall be shop fabricated, unless otherwise identified in bid proposal by Exhibit Contactor.

3.5 COORDINATION BETWEEN TRADES

A. Exhibit Contactor shall coordinate work to ensure that the Scenic Work, Dioramas and Mounts will fit properly into the Interior provided by the General Contractor and the work of subcontractors and otherwise fit and are well-integrated with any surfaces they rest on or objects they are touching or holding.

B. Failure of this Exhibit Contactor to make known his/her own needs and to determine the requirements of others shall not be cause for additional compensation to correct interferences, or for extra work which could have been avoided by proper coordination.

3.6 SHIPPING AND HANDLING

A. Exhibit Contactor shall store, handle, and ship all Scenic Work, Dioramas and Models in such a way that they shall be perfect, free of dust and dirt and abrasions, and unmarred when they arrive and are unpacked. Exhibit Contactor shall securely and safely crate all Scenic Work, Dioramas and Models. Crates shall be marked with indications of opening sequence. Crates shall be constructed in such a way as to properly protect the completed figures and any accessories from damage including breakage, scratches and indentations of any sort. Each element of the Work shall be adequately protected with bubble-wrap and foam padding, and supported or braced with framework, as required, up to the point of unpacking.

B. All shipments shall be made with a professional shipping company and shall be fully insured. Owner shall be notified of shipment(s) in advance.

3.7 INSTALLATION

A. Exhibit Contactor shall provide all transportation, lodging, labor, and materials necessary to install the Scenic Work, Dioramas and Models.

B. Exhibit Contactor shall provide all mounting hardware required for complete installation. Exhibit Contactor shall indicate handling points and any vulnerable areas.

3.8 CLEANING

A. The Exhibit Contactor shall restore any damage that occurred during installation.

B. After a minimum period of one week after final installation, and when it has been determined that all airborne dust has settled the Exhibit Contactor shall thoroughly clean all exhibit components so that there are completely free of dust and debris.

C. The Exhibit Designer and the Owner shall review for acceptance.

END OF SECTION 10950

SECTION 10960 — INTERACTIVE EXHIBITS

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section shall be governed by the Contract Documents. Provide materials, labor, equipment and services necessary to furnish, deliver and install all work of this Section as shown on the drawings, as specified herein and/or as required by job conditions.

1.2 WORK INCLUDED

A. Early Government basket making interactive (IN01); Emerging Nationalism Trade interactive (IN.02); We Shall Remain talkback station (IN04); Removal treaty flipbook; Origins audio voice activation

1.3 RELATED SECTIONS

Section 05500 Metal Fabrications
Section 06430 Exhibit Woodwork
Section 10200 Digital Outputs
Section 11130 AV Systems

1.4 QUALITY ASSURANCES

A. The fabricator and the installer shall be one of the same firm who can substantiate that the firm has been continuously engaged in the fabrication and installation of electromechanical interactive work similar to that described herein for not less than seven (7) years.

B. Technical design and prototyping of interactive exhibits is the Exhibit Contractor's responsibility.

1. Exhibit Design Drawings shown are intended to establish the basic dimensions, finishes, location, connections, and profiles of interactive exhibits. The Exhibit Contractor is responsible for the prototyping and testing of the fabrication within these parameters. The drawings are design requirements, unless specifically noted as completely engineered and designed on the drawings.

2. Exhibit design control drawings do not cover some conditions or modifications, which may be required. The Exhibit Contractor, by accepting this Work, acknowledges this and agrees that the Exhibit Designer shall have final acceptance of all matters whether detailed or not for the exhibit design details.

C. All interactive exhibits exposed to direct visitor contact or having visitor interface shall be fabricated to withstand wear and tear of such contact. Exhibit Contractor shall warrantee in writing all interactive exhibits free of defects and able to withstand visitor contact. The period of the warrantee shall be one year. Exhibits failing to function as specified during this period shall be repaired at the Exhibit Contractor’s expense.

D. Contractor shall provide written instructions on the maintenance of all interactive. Owner shall be responsible for providing proper maintenance under the terms of the warrantee.

1.5 SUBMITTALS

A. SAMPLES & PRODUCT LITERATURE: The samples and certificates in the following list are required to be submitted by the Exhibit Contractor to the Exhibit Designer for review. An omission of an item or items does not relieve the Contractor from this responsibility, and for compliance with the Contract Documents of which this is a part.

1. Interactive surfaces

2. Exposed hardware including but not limited to, flip book hinges.

3. Push buttons (Happ or equal), sensors and handsets.

4. Product literature for specialty materials and manufactured hardware, supplies, electrical and mechanical components, and parts.

B. SHOP DRAWINGS

1. Submit shop drawings for review in accordance with the Design Documents.

2. Shop drawings shall indicate by plans, elevations, sections and details of the work of this Section, showing in detail large scale construction, methods of installation and attachment, type, size, spacing and location of welds, bolts or other anchorage devices and shall give all pertinent data as to thickness, dimensions and exposed finishes.

3. Shop drawings shall indicate the work which is furnished by this Section and installed by other trades and the work of other trades which adjoin or butt the work of this Section.

4. As requested by the Exhibit Designer provide additional details, sections and calculations to fully describe the work to be provided.

5. Where items, anchorages, inserts are scheduled to be set into the concrete or built into the work by other Contractors for the installation of exhibits provide setting drawings, templates, instructions and directions for their installation. Coordinate delivery with other work to avoid delay of job progress.

D. PROTOTYPES

1. Prior to final fabrication and installation of all interactives shall be prototyped and tested by the Exhibit Contractor and reviewed by Exhibit Designer and Owner. Build mockups and prototypes to comply with the following requirements, using materials indicated for the completed Work to demonstrate the following;

    a) functionality
    b) accessibility, ergonomics and ease of use
    c) integration of hardware, products and systems
    d) durability

2. Fabrication schedule should be planned so that a minimum four weeks are allowed for prototyping testing and review prior to installation.

3. Notify Exhibit Designer one month in advance of dates and times when prototype will be fabricated and ready for review.

4. Prototypes shall demonstrate the aesthetic effects and functional qualities of materials and systems as well as the defined visitor experience, ergonomics and mechanical functioning of all interactives.

PART 2 - PRODUCTS

2.1 FABRICATION - GENERAL REQUIREMENTS

A. Workmanship and finishes shall be first class in every respect and in accordance with the best practices. Employ skilled workers in the fabrication and erection of this work.

PART 3 - EXECUTION

3.1 TIME OF COMPLETION & FABRICATION SCHEDULE

A. The Exhibit Contactor shall prepare an estimated progress schedule for the Work. The schedule shall be related to the entire Project to the extent required by the Contract Documents. This schedule shall indicate the dates for the starting and completion of the various stages of fabrication and shipping and shall be revised as required by the conditions of the Work, subject to the Exhibit Designer's approval.

3.2 EXAMINATION

A. Two in-shop prototyping reviews shall be planned after approval of materials to review shop drawings. In the first review the Exhibit Designer shall review the progress and provide evaluations of the prototypes and finalize the fabrication of the Work.

B. A second shop review will constitute a verification that all issues have been adequately addressed and revisions implemented to the Satisfaction of the Exhibit Designer prior to delivering and installing the exhibit.

3.3 MEASUREMENTS

A. Exhibit Contactor shall be responsible for verifying and guaranteeing all critical measurements, including those provided by Exhibit Designer, Owner, and others. All such dimensions shall be shown on the shop drawings.

B. Exhibit Contactor shall be responsible for verifying dimensions that are required for proper coordination with other work, including but not limited to exhibits and Owner provided materials.

3.4 SHOP FABRICATION

A. All exhibits included in the Scope of Work shall be shop fabricated, unless otherwise identified in bid proposal by Exhibit Contactor.

3.5 COORDINATION BETWEEN TRADES

A. Exhibit Contactor shall coordinate work to ensure that the Interactive Exhibits will fit properly into the Interior provided by the General Contractor and the work of subcontractors and otherwise fit and are well-integrated with any surfaces they rest on or objects they are touching or holding.

B. Failure of this Exhibit Contactor to make known his/her own needs and to determine the requirements of others shall not be cause for additional compensation to correct interferences, or for extra work which could have been avoided by proper coordination.

PART 4 INSTALLATION

4.1 SHIPPING AND HANDLING

A. Exhibit Contactor shall store, handle, and ship all Interactive Exhibits in such a way that they shall be perfect, free of dust and dirt and abrasions, and unmarred when they arrive and are unpacked. Exhibit Contactor shall securely and safely crate all Interactive Exhibits. Crates shall be marked with indications of opening sequence. Crates shall be constructed in such a way as to properly protect the completed Interactive Exhibits and any accessories from damage including breakage, scratches and indentations of any sort. Each element of the Work shall be adequately protected with bubble-wrap and foam padding, and supported or braced with framework, as required, up to the point of unpacking.

B. All shipments shall be made with a professional shipping company and shall be fully insured. Owner shall be notified of shipment(s) in advance.

4.2 INSTALLATION

A. Exhibit Contactor shall provide all transportation, lodging, labor, and materials necessary to install the Interactive Exhibits.

B. Exhibit Contactor shall provide all mounting hardware required for complete installation. Exhibit Contactor shall indicate handling points and any vulnerable areas.

4.3 DOCUMENTATION & MANUALS

A. Provide documentation binders for all mechanical parts replacements and maintenance procedures for the future upkeep of all interactives as per Section 01782 Operations and Maintenance and Section 01820 Demonstration and Training. The Exhibit Contractor is to conduct a staff training session for all interactives that will require regular maintenance.

4.4 CLEANING AND PROTECTION

A. Protect installed work using adequate and suitable means during and after installation until acceptance.

B. Repair, remove and/or replace surfaces and materials that become marred, scratched, bent or damaged in any way.

C. Clean surfaces of grime and dirt using acceptable and recommended means and methods. Take care not to damage, mar or stain adjacent materials.

END OF SECTION 10960

SECTION 11130 EXHIBIT AUDIO-VISUAL SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Scope of Work

1. Prepare shop drawings and other submittals for review by the exhibit design team prior to construction.

2. Furnish and install audio-visual systems as shown on the project drawings and described in this specification. The drawings and specifications do not describe all work required to fulfill the contract. In addition, provide any additional equipment, materials and labor required to **make complete and working systems** consistent with the intent embodied in the project drawings and specifications.

   a. Provide all necessary connectors, terminals, punch blocks, patch bays, connector panels, and cover plates.

   b. Provide all necessary conduit, surface raceway, boxes, wire and fiber except those items specifically listed as work by others.

   c. Provide all equipment required to meet the performance requirements defined in the AV design documents.

   d. Provide all equipment mounts (and engineering thereof if required by code) for all AV equipment whether listed or not. This includes both manufacture mounts and any custom work required by field conditions.

3. Coordinate installation of AV Systems with the work of the General Contractor as defined in Div 16 and other Sections

4. Coordinate installation of AV System with the work of the exhibit fabricator and media producers.

5. Terminate of all wiring at panels, terminal closets and equipment racks.

6. Test all installed cabling and equipment.

7. Prepare as-built documents.

8. Provide on-site training in the operation and maintenance of the systems for personnel designated by the museum

9. Provide on-site support for opening week events.

10. Provide a one-year warranty covering all systems installed under this specification

B. Related Work by others

1. Division 16: Conduit, raceway and standard electrical boxes shall be provided by General Contractor. All 120 VAC circuits for A/V, teleconferencing, and network devices.

2. CATEGORY cables, fiber optic cables, jacks and patch bays as listed on AV documents to be provided, installed, terminated and tested.

3. All other cable to be provided and installed per AV documents. Termination by AV contractor.

4. All backing required for the attachment of AV equipment to building walls, floors or ceilings.

1.02 REFERENCES

A. Codes

1. Federal, state, Tribal and local codes and requirements.

B. Standards:

1. CSA, UL or other nationally recognized testing laboratory standards.

C. Code compliance is mandatory. Inform the owner if work is shown that appears to conflict with codes.

1.03 SYSTEM DESCRIPTION

A. General: Provide audio-visual systems for sound playback, video projection, computer graphics display, and AV interactive elements

B. The system consists of the following exhibits. Technology descriptions are for reference only. See section 2.04 for specific equipment lists.

2-2_AV.01	*Origins*	*5 spkr,4ch Soundscape*
2-7_AV.02	*Early Government*	*3 spkr,2ch Soundscape*
2-10_AV.04	*Removal*	*6 spkr,6ch Soundscape*
2-13_AV.05	*Fighting & Healing*	*multi touch interactive*
2-14_AV.06	*We Shall Remain*	*Projection presentation*

ADD ALT

2-14_AV.06	*Voices of Today*	*Change to 3 portrait 55" Planar Video Wall*

C. Systems includes KVM switch to monitor all computers in rack room

D. Many exhibits have motion sensors covering area in front of exhibit to trigger the start of the show. Selecting, providing, installing and wiring a motion sensor is in this scope.

E. Many exhibits have hidden docent pushbutton switches to start and stop specific exhibits. Providing, installing and wiring this momentary switch is in this scope.

F. Provide for shipping sample equipment to exhibit fabricators & media producers as required.

1.04 SUBMITTALS

G. Submit the following information as part of the **Bid**:

1. Qualifications:

a. Contractor **must** have completed five major audiovisual installations including audio, video, control and interactive exhibits in a museum environment in the last 6 years. Submit descriptions of installations with similar scope and scale, along with references. At least 2 of these projects must be in excess of $ 200,000.

b. Submit name and experience of project manager and lead programmer.

Lead programmer must be on contractor's permanent staff for a minimum of one year and not a subcontractor

2. Provide exhibit cost breakouts as shown on bid form.

3. Summary of Equipment and Non-Equipment Costs: Tabulate cost summaries separately for systems. Break down non-equipment costs according to the following categories:

a. Equipment

b. Engineering

c. Installation of Contractor Supplied Equipment

d. Show control programming

e. Interactive programming (if any)

f. General and Administrative

g. Taxes

4. Substitutions: Submit bids using the specified equipment. Proposals for substitute equipment will be considered where superior or more cost effective equipment can be substituted without negatively affecting the performance of the integrated systems. Such proposals should be justified and be submitted with technical documentation including manufacturer's specifications.

5. List of Replacement Parts: Supply a list of replacement parts to be provided as part of this contract, subject to the following guidelines:

,

6. Submit brief description of proposed Show Control and Master Audio System

Supplemental Pricing

6. Within 10 working days after bid opening, apparent low bidder shall submit to the Museum supplemental pricing information for all audiovisual items listed in the Section 2.04 Equipment Schedule.

H. Shop Drawings Prior to Fabrication:

1. Submit shop drawings to include the following:

a. Functional block diagrams for the audio, video, room control, and network/telecom systems. Label all inputs and outputs.

b. Rack, frame and backboard elevations for all systems.

c. Audio, video and network patch panels.

d. Detailed riser diagram.

e. Panel details showing all engraving for all systems.

f. Schematics of all custom circuits.

g. Detail any modifications to equipment supplied by manufacturers.

h. Screen images of the audio processor programs showing blocks and all control pages, and a listing of statistics from the compiler showing board, processor and net utilization if applicable.

i. Screen images of the user/staff control system for the Forum. Show all buttons/controls and provide supplemental narrative to explain functionality.

j. Chart or other documentation of exhibit programming functionality.

This should document:

a. How the exhibit operates on the floor

b. How the exhibit is turned on & off

c. Any staff controls for test/debug

d. Projection geometry

Submit coordination drawings to include the following:

k. Installation details for equipment or panels mounted in furniture.

l. Installation details for equipment maintenance and ventilation.

I. Mock-up:

1. No pre-constructions mockups are required

J. Engineering: Contract for the services of an appropriately licensed professional engineer where required to complete the work described in these specifications and the associated drawings.

K. On completion of the Installation:

1. Submit written notification to the Museum Representative of completion of initial tests, and coordinate checkout schedule.

2. Submit as-built drawings, to include:

a. Functional block diagrams for the audio, video, room control, and network/telecom systems. Label all inputs and outputs.

b. Rack, frame and backboard elevations for all systems.

c. Audio, video and network patch panels.

d. Wire lists for all systems, assigning wire numbers for every wire.

e. Schematics of all custom circuits.

f. Detail any modifications to equipment.

3. Submit System Operation and Maintenance Manuals as specified in Section 01730, to include:

a. All manufacturer's manuals.

b. In a narrative section illustrated as necessary, describe the typical procedures to be followed in configuring and operating the systems. This manual should be written for a technically literate reader who is not an expert.

c. A programmer's manual, intended to guide an experienced programmer through the custom software, with appropriate references to manufacturer's manuals.

d. A maintenance manual, describing programmed maintenance procedures with appropriate references to manufacturer's manuals.

e. A troubleshooting guide.

f. A summary in tabular form of the operating settings of all adjustable components.

L. Field Cooperation: Cooperate at all times with all trades doing work on site to minimize lost time, work stoppages and interference.

1.04 DELIVERY, STORAGE AND HANDLING

A. Store all material until it can safely be installed on site. Coordinate delivery times, storage and protection of the equipment at the site, and acceptance with authorized representatives of the Museum.

1.05 WARRANTY

A. Provide a 1 year warranty on the installed systems. Warranty period shall begin on acceptance of the system by the Museum.

B. Warranty shall cover labor and materials required to keep systems functioning as they were at the time of acceptance. Consumables such as projector lamps are not covered by the warranty. Damage or loss due to improper operation of the equipment, fire, flood, earthquake or theft shall not be covered by the warranty.

C. During the warranty period, inspect the system annually and restore all equipment to original performance.

Part-2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be new and shall meet or exceed the latest published specifications of the manufacturer in all respects.

B. Supply the latest model of each piece of specified equipment available at the time of bidding. In the event that models are superseded between bidding and ordering of equipment, notify the Museum and provide the latest model with equal or superior specifications if the cost does not exceed that of the equipment as bid. If the cost of the newer piece exceeds the bid amount the Museum may elect to purchase the newer piece as a change order at additional cost.

2.02 SOFTWARE

A. Show control software will be the responsibility of the contractor. Show control software will operate exhibits as described in media briefs. In addition software will provide for:

- Scheduled system on/off following museum operation hours
- Manual override of schedule for events
- Global volume controls
- System status reporting
- Any Code mandated fire shutdown.

B. Media software will be the responsibility of Media Producer.

C. Contractor will be responsible for setting up any computers supplied by contractor so they will auto boot with no login to the operating system and connect to network

2.03 CUSTOM FABRICATION

A. Unless otherwise specified, custom plates shall be 1/8" brushed aluminum with beveled edges. Labels shall be engraved and paint filled. Anodized finish and infill colors to be approved by Museum Representative.

B. Adopt either EIA 568-A or –B wiring standard for Cat-5 cable to coordinate with data/telecom contractor.

C. Avoid use of mini-din connectors for S-video on custom plates. Use dual 75 ohm BNC on plate and adapters at equipment.

D. Equipment mounted in racks shall be labeled

E. Seismic safety: Attach all permanently installed equipment to the building to minimize risks to personnel and the equipment in the event of earthquake. Brace all hanging equipment appropriately. Obtain the services of an appropriately licensed engineer for design of attachments and mounts where required by codes or prudent practice.

F. All custom fabricated circuits employing integrated circuits and/or discrete components will be built using custom printed circuit boards. Wire wrap or soldered construction on prototyping boards is not acceptable. Exception: Pads and other simple networks that can be built into connector bodies or barrels.

2.04 EQUIPMENT SCHEDULE

2-2_AV.01	**Origins**	*5 spkr, 4 ch soundscape*		
	8 ch audio player	0.5	Alcorn	8trax
	8 ch Amplifier	0.5	QSC	CX168

Ceiling Speakers	5	Tannoy	CMS 503DC BM	
Wall speakers	0	Tannoy	iW 6DW-WH	
backcan/ring	5	Tannoy	A/R	
Buttons & mounting plate	1	TBD		
Jumpers & hookup cables	1	A/R		

2-7_AV.02 **Early Government** *3 spkr 2ch, soundscape*

8 ch audio player	0.5	Alcorn	8trax	
8 ch Amplifier	0.5	QSC	CX168	
Ceiling Speakers	3	Tannoy	CMS 503DC BM	
backcan/ring	3	Tannoy	A/R	
Motion Sensors	2	Museum Tech	BB-200	
Jumpers & hookup cables	1	A/R		

2-10_AV.04 **Removal** *6 spkr 6 ch soundscape*

8 ch audio player	1	Alcorn	8trax	
8 ch Amplifier	0.75	QSC	CX168	
Ceiling Speakers	6	Tannoy	503DCBM	
backcan/ring	6	Tannoy	A/R	
Motion Sensors	2	Museum Tech	BB-200	
Jumpers & hookup cables	1	A/R		

2-13_AV.05 **Fighting & Healing** *Mutli touch interactive.*

55" Touch Monitor	1	3M	C5567PW	
mount	1	Coordinate with Fabricator		
Monitor Extender	1	Extron	DPT HDMI Tx/RX	
USB Extender	1	Extron	USB T/R	
Sound Bar Speaker	1	Innovox	FP-H2	(cut to monitor width)
2 ch Amplifier	1	QSC	302	
CPU	1	HP Z240 SFF W10P 16G 128G SSD		
Jumpers & hookup cables	1	A/R		

2-14_AV.06 **We Shall Remain** *projection theater*

90" Monitor	1	NEC	E905	
Mount	1	Coordinate with Fabricator		
Video Player	1	Brightsign HD-1023		
Memory Card for above	1	A/R		
Sound Bar Speaker	1	Innovox	FP-H2	(cut to monitor width)
Subwoofer	1	Innovox	MicroSub 6iw BLK	
8 ch Amplifier	0.25	QSC	CX168	
Subwoofer Amplifier	1	QSC	CX302	
Laptop Input Plate	1	Extron	MAPP	
Mounting Frame for above	1	Extron	MAPP	
Jumpers & hookup cables	1	A/R		

Common Rack Room Equipment

Racks & Accessories	1	Mid Atlantic	VMRK-54
Sides & Top Panels	1	Mid Atlantic	for above
Power Distribution	1	Mid Atlantic	A/R
Utility CPU	1	HP	Z240 SFF
DSP	1	BiAmp	Tessira Server IO
DSP input cards	4	BiAmp	SCI-4
DSP output cards	5	BiAmp	SCO-4
KVM switch	1	NTI	UniMux 8
Monitor/KBD	1	TBD	TBD
16 port Network Switch	1	Net Gear	TBD
Show Control on/off	1	Crestron	AV3
Crestron touch screen	1	Crestron	TSW-1050
Rack UPS	1	Mid Atlantic	UPS-2200

PART 3 - EXECUTION

3.01 EXAMINATION

A. Prior to commencing installation, verify all critical dimensions and conditions under which work is to be installed. Notify Museum Representative in writing of any dimensional discrepancies or other conditions detrimental to the proper installation or performance of work. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Insure that no devices (including cameras, monitors, projectors, microphones and loudspeakers) are prevented from achieving their intended function by interfering fixtures, architectural elements, or other audiovisual equipment. Notify Museum Representative in writing of any such problems, and do not proceed with installation until unsatisfactory conditions have been corrected.

C. Contractor is responsible for assuring that no CAT5/6 cable runs provided by the Contractor exceed 90m. Notify Museum Representative in writing of any runs that will exceed this distance.

D. Carefully verify all required projection and camera lens focal lengths to achieve desired image sizes and projector locations. Notify Museum Representative in writing if no manufacturers lens will fit the requirements. *Note this means no lens, not just the standard lens that comes with the projector. Contractor is expected to provide appropriate lens.*

3.02 INSTALLATION

A. General

1. All cables, regardless of length, will be marked with permanent, non-handwritten number or letter cable markers within six inches of both ends. There shall be no unmarked cables at any place in the system. Marking codes used on cables shall correspond to codes shown on drawings and/or run sheets.

2. All cables shall be installed splice free from backboard, rack or frame to final destination.

3. Each of the cable groups identified in the project drawings are to be run in separate conduit, bundled separately where run in trays, and grouped within racks except where specifically noted.

4. Wherever possible, maintain 3" separation between cable groups. Maintain larger separations where necessary to avoid interference.

5. All cable shall carry at least the NEC CM rating. Use plenum cable everywhere in project other than within racks or in runs completely within conduit.

6. Provide sufficient ventilation within racks to insure that all equipment operates within manufacturer's recommendations.

7. All boxes and equipment shall be mounted plumb and square.

B. Audio

1. Maintain phasing throughout the audio system.

2. Use crimp type lugs where stranded wire is connected to barrier strips and binding posts.

3. Each rack shall contain a grounding bus bonded to the rack frame and connected to the audiovisual power distribution panel with a #6 or larger conductor. The rack shall show an impedance of at least 100 Kohm to ground when this conductor is lifted.

4. AC outlets within racks shall have ground wires, which shall be connected to the rack ground bus.

5. Connect audio cable shields at one end or both ends to produce best system noise performance. Mic lines and tie lines shall have shields connected at both ends.

C. Video

1. All coaxial cable connections shall be made with crimp type BNC connectors. Provide adapters from BNC to UHF, S-Video or RCA connectors where required.

2. All video receptacles shall be insulated from the panels in which they are installed.

3. Terminate all unused outputs with the appropriate impedance.

4. Video signals may not be looped through connections unless explicitly specified.

5. The lengths of the cables used to carry S-video and component video signals shall be matched to within 1".

6. Projectors and cameras shall be installed so that images do not move or vibrate perceptibly under normal operating conditions.

3.03 FIELD QUALITY CONTROL

A. In all cases, provide written documentation of tests including date, test equipment used, test equipment configuration and results.

B. Initial Tests and Measurements:

1. Verify the operation of all system equipment.

2. Verify pinout and pairing of all wiring. Certify all category cables and fiber with appropriate test equipment

3. Verify DCE/DTE (pin 2/3) requirements of all serial cables. Test to verify voltage on both pins. Wire cable as x-over (null modem) if required.

C. Audio-Visual Systems:

1. Verify that audio systems are free from perceptible hum and buzz.

2. Conduct measurements and adjust audio systems to meet performance standards.

3. Measure impedance of all loudspeaker circuits at 1 kHz and verify that transformer tapping is appropriate.

4. Test that all coaxial cables are free from shorts and isolated from ground.

5. Verify that video systems do not exhibit interference effects from AC power circuits (video hum).

6. Align all video projectors and adjust color balance on projectors and monitors.

3.04 MUSEUM TRAINING

A. Provide 24 hours of training to persons designated by the Museum in the operation of the systems in 6 non-contiguous 4-hour sessions. Allow at least one session for non-technical users

3.05 FINAL ADJUSTING AND ACCEPTANCE TESTS

A. Inventory all equipment on site and compare to equipment lists in contract documents.

B. Demonstrate operation of all systems and equipment.

C. Review initial testing measurements. Repair system and repeat measurements as required by the Museum Representative. Provide the following test equipment for use in making adjustments and acceptance testing by the Museum Representative:

1. HD Video Test Generator both HD.

2. 1/3 octave real time analyzer, calibrated SPL meter, and RMS voltmeter capable of reading in dBu.

3. Audio tone generator and pink noise generator.

4. Audio impedance meter operating at 1 kHz.

5. Audio analyzer capable of measuring frequency response: MLSSA 9.0, TEF 20 or SIA SMAART.

6. Cat 6 tester capable of verifying system performance, not just connectivity.

7. Color calibrator (Calman or equal) to color balance monitors

D. Provide personnel expert in the operation and programming of all installed equipment for up to 40 straight time hours and 10 overtime hours to assist owner and consultant for adjustment and acceptance testing.

E. Tests may be suspended at the option of the Museum Representative if the systems fail to operate or if defective equipment requires repair or replacement. Tests will be resumed when the problems have been corrected by the Contractor.

3.06 CLEANUP AND REPAIR

A. The job site should be left clean and any damage caused to premises by installers will be repaired at no cost to Museum.

3.07 PROTECTION OF WORK

A. It is the responsibility of the contractor to protect finished and unfinished work against damage or loss until the date of final acceptance. Contractor shall take measures to prevent damage by dust and other byproducts of construction. Repair damaged work at no cost to the Museum.

B. Museums are full of artifacts and other irreplaceable objects. While most of your work will take place prior to the installation of artifacts there will be some overlap. It is imperative that you take extra care to avoid risks to these objects. If you are unsure ask the museum staff for assistance.

Many of these items have deep cultural value and no jokes or disrespectful comments will be tolerated.

END OF SECTION

EQUIPMENT FOR

AV.01 Origins

AV.02 Early Government

AV.04 Removal

These exhibits all use the same equipment

Install Speakers

CMS 503DC BM

5" Full Range Ceiling Loudspeaker with Dual Concentric Driver for Installation Applications (Blind Mount)

- Full range ceiling loudspeaker for installation applications
- 60 Watts continuous, 240 Watts peak power
- Next generation 5" Dual Concentric driver featuring Omnimagnet technology
- Torus Ogive waveguide for improved high frequency response and directivity
- Blind Mount version supplied with acoustically enhanced zinc plated steel back can
- Integrated single unit construction for ease of installation
- UL 1480 certified for general signalling systems
- UL 2043 certified for air-handling spaces
- Multiple transformer taps for 70 V and 100 V line systems or 16 Ohm direct input
- Low insertion loss 30 W line transformer with easily accessible tapping switch
- Optimised for LAB GRUPPEN low impedance LUCIA amplifiers with up to 8 CMS series loudspeakers per channel
- Semi matt white finish fits unobtrusively in any environment
- Powder coated UV resistant perforated steel mesh grille with dust protection
- Removable magnetic grille for custom painting

The CMS 503DC BM is a full bandwidth 240-Watt high sensitivity loudspeaker that utilises our third generation Ceiling Monitor System technology (CMS 3.0). Thanks to an all-new proprietary 5" Dual Concentric point-source driver with Omnimagnet technology on a Torus Ogive Waveguide, the UL certified CMS 503DC BM delivers wide and consistent broadband directivity with enhanced intelligibility – plus highly accurate and linear response.

Optimised for Installation

Specifically designed with a self-aligning 3 way clamp system for fast, simple and cost effective installation, CMS 503DC BM features an acoustically enhanced zinc plated steel back can with removable locking screw terminal connector and loop-thru functionality. A low-insertion loss 30 W transformer with convenient front panel tap switching, paintable powder coated steel mesh grille with dust protection, two tile support rails and one C-ring are all included. An Arco style grille, which conceals the entire unit for aesthetic purposes, and plaster (mud) ring are available separately.

TANNOY

CMS 503DC BM

5" Full Range Ceiling Loudspeaker with Dual Concentric Driver for Installation Applications (Blind Mount)

- Optional ARCO designer grilles available for minimal architectural impact
- Self-aligning 3 way clamp mounting system
- Mounting C-ring and ceiling tile rails included
- 5-Year Warranty Program*
- Designed and engineered in the U.K.

LAB GRUPPEN Ready

The CMS 503DC BM is finished in semi matt white and optimised for use with LAB GRUPPEN LUCIA amplifiers, which accommodate up to 8 CMS Series loudspeakers per channel.

You Are Covered

We always strive to provide the best possible Customer Experience. Our products are made in our own MUSIC Group factory using state-of-the-art automation, enhanced production workflows and quality assurance labs with the most sophisticated test equipment available in the world.

As a result, we have one of the lowest product failure rates in the industry, and we confidently back it up with a generous 5-Year Warranty program.

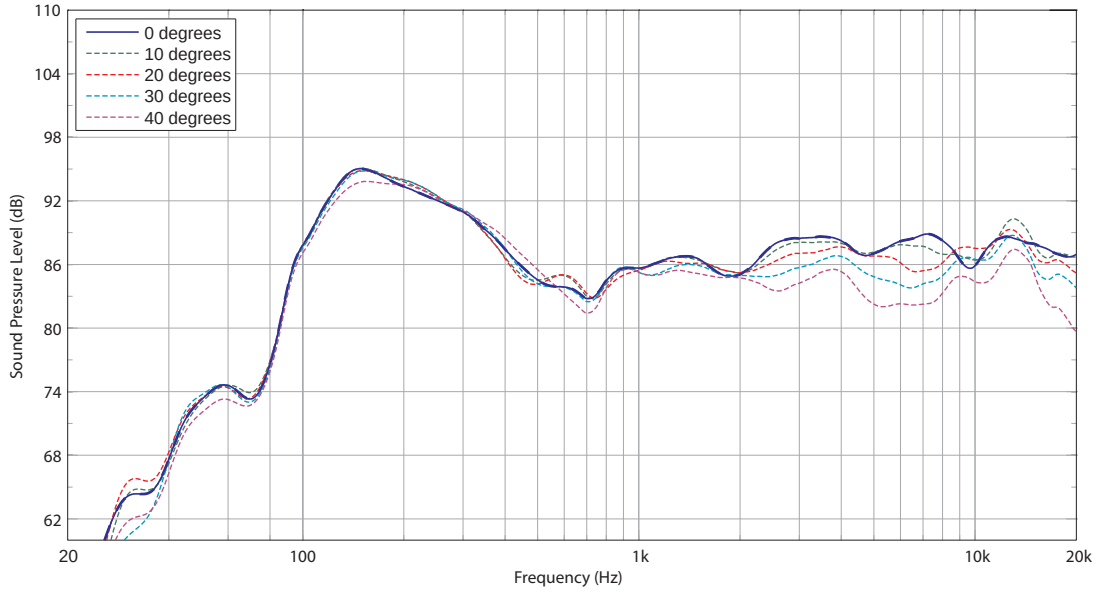
*Warranty details can be found at music-group.com.

TANNOY

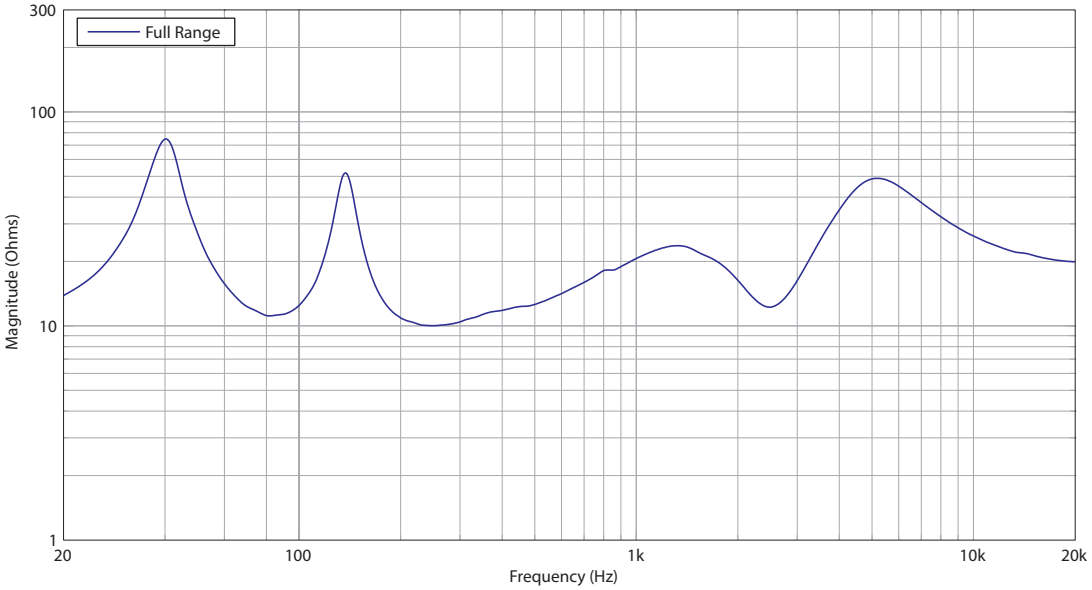
CMS 503DC BM

5" Full Range Ceiling Loudspeaker with
Dual Concentric Driver for
Installation Applications (Blind Mount)

Frequency Response Sensitivity 1 W / 1 m



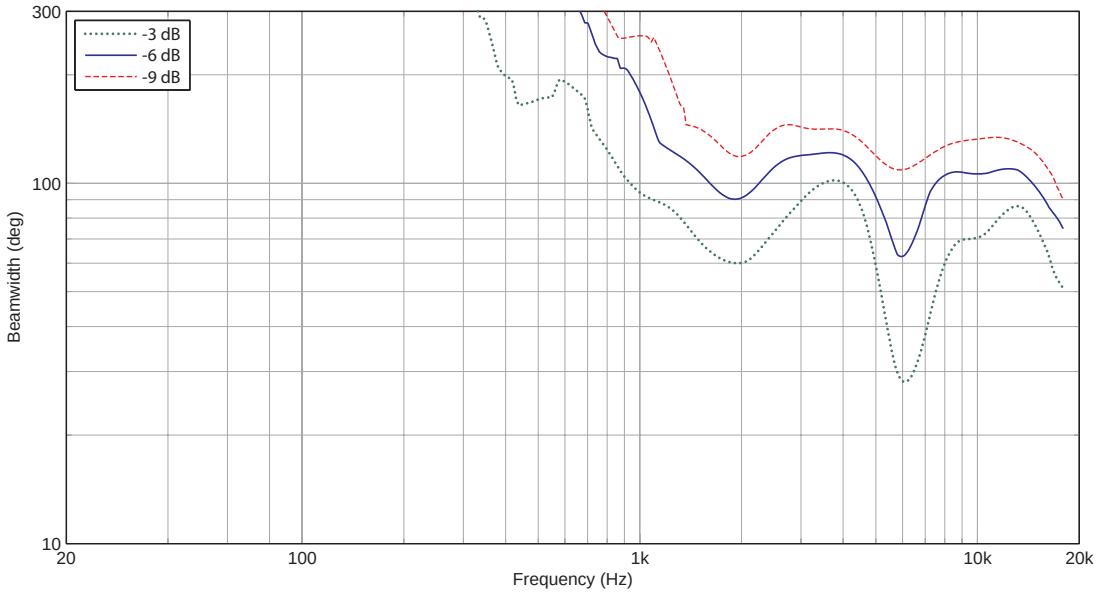
Impedance



CMS 503DC BM

5" Full Range Ceiling Loudspeaker with
Dual Concentric Driver for
Installation Applications (Blind Mount)

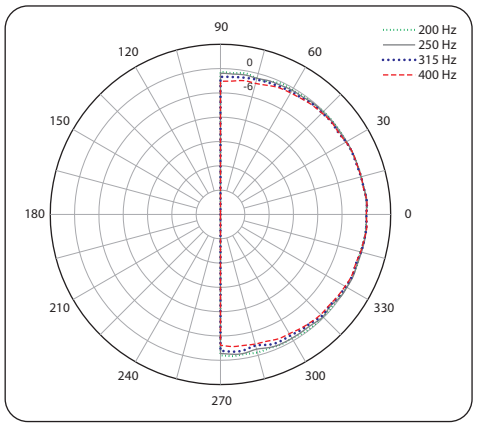
Horizontal Beamwidth

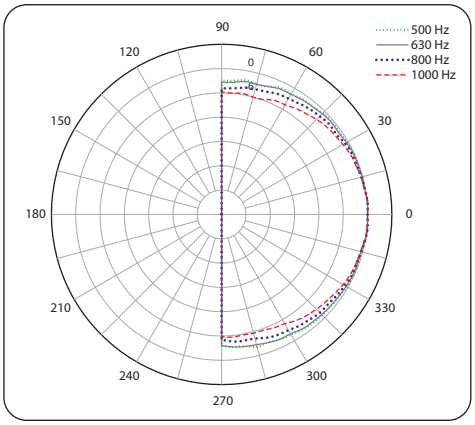


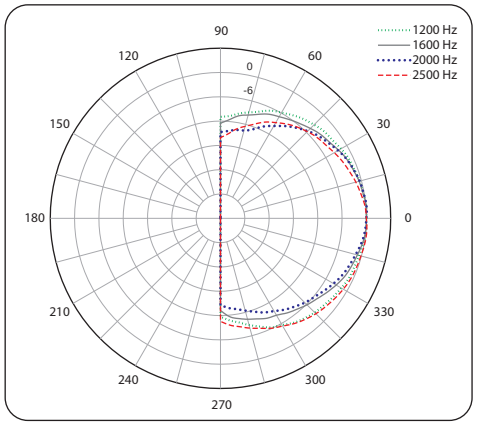
CMS 503DC BM

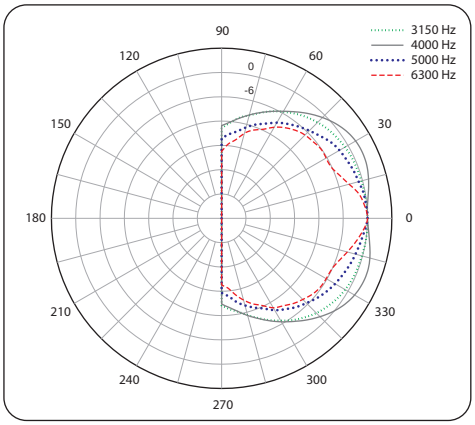
5" Full Range Ceiling Loudspeaker with
Dual Concentric Driver for
Installation Applications (Blind Mount)

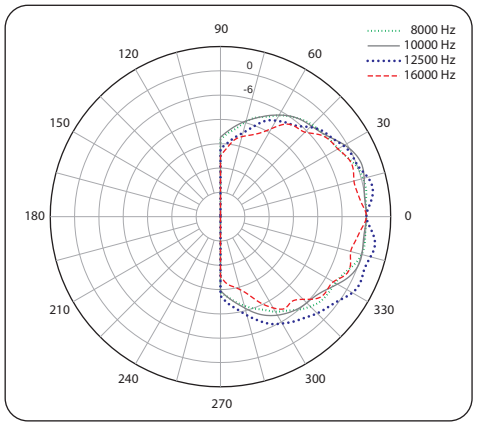
Polar Plots







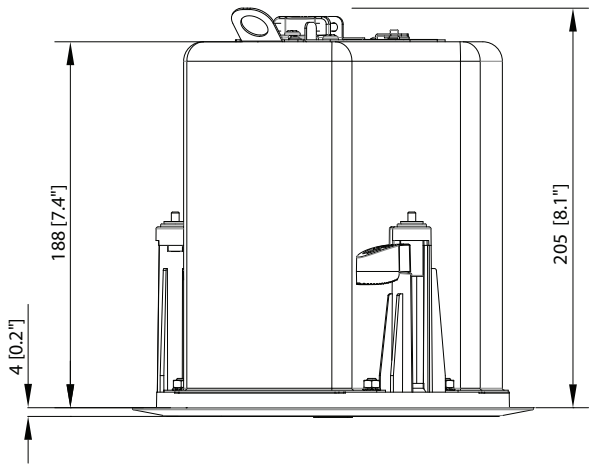


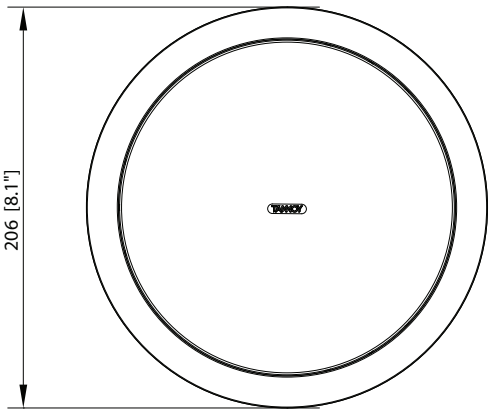


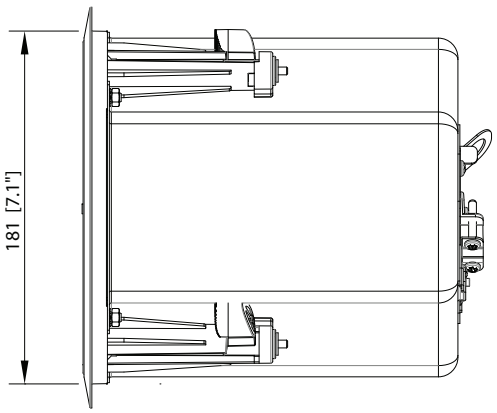
CMS 503DC BM

5" Full Range Ceiling Loudspeaker with
Dual Concentric Driver for
Installation Applications (Blind Mount)

Dimensions







CMS 503DC BM

5" Full Range Ceiling Loudspeaker with
Dual Concentric Driver for
Installation Applications (Blind Mount)

Technical Specifications

Performance

Frequency response (-3 dB) [1]	85 Hz - 50 kHz BM Backcan
Frequency range (-10 dB) [1]	74 Hz - 54 kHz BM Backcan
Frequency range (-10 dB) [1]	70 Hz - 54 kHz PI Backcan
System sensitivity (1 W @ 1 m) [2]	89 dB (1 W = 4 V for 16 Ohms)
Nominal coverage angle	90 degrees conical
Power handling [3]	
Average	60 W
Programme	120 W
Peak	240 W
Recommended amplifier power	120 W @ 16 Ohms
Nominal impedance (Lo, Z)	16 Ohms
Rated maximum SPL	
Average	107 dB
Peak	113 dB
Transformer taps (via front rotary switch)	
70 V	30 W (165 Ω) / 15 W (330 Ω) / 7.5 W (660 Ω) / 3.75 W (1320 Ω) / OFF & low impedance operation
100 V	30 W (330 Ω) / 15 W (660 Ω) / 7.5 W (1320 Ω) / OFF & low impedance operation

Transducers

Dual concentric point source driver	1 x 130 mm (5.0") Dual Concentric driver, using Omnimagnet technology
Low frequency	35 mm (1.38") voice coil, treated multi fiber paper pulp cone
High frequency	20 mm (0.79") PEI dome

Physical

Enclosure	
Backcan	Zinc plated steel
Baffle	Reflex loaded UL 94V-0 rated ABS
Grille	Steel, with weather resistant coating
Safety features	Safety ring located at rear of enclosure for load bearing safety bond
Clamping design	Security toggle clamp Min / Max clamping range 9.5 mm (0.37") / 60 mm (2.36") Recommended clamp torque: 1.5 Nm
Backcan options	
Blind mount (BM)	Complete with fixed backcan
Pre install (PI)	Separate backcan for pre-installation
Cable entry options	Cable clamp & squeeze connector for conduit up to 22 mm
Conduit knockouts on PI Backcan	3 Sets of horizontal positions 19 / 22 / 28 mm (0.75" / 0.87" / 1.10")
Connectors	Removable locking connector with screw terminals with "loop through" facility
Compliance	UL-1480, UL-2043, CE

TANNOY

CMS 503DC BM

5" Full Range Ceiling Loudspeaker with
Dual Concentric Driver for
Installation Applications (Blind Mount)

Physical

Dimensions	
Bezel diameter	205.9 mm (8.11")
Front of ceiling to rear of backcan	—
BM model: Front of ceiling to rear of backcan	188.0 mm (7.40")
BM model: Front of ceiling to top of safety loop	205.3 mm (8.08")
PI model: Front of ceiling surface to rear of speaker unit	133.3 mm (5.25")
PI model: Front of accessory backcan bezel to top of safety loop	153.5 mm (6.04")
Hole cutout diameter (all models)	190 mm (7.48")
Net weight (ea)	
CMS 503DC BM	4.3 kg (9.47 lbs)
CMS 503DC PI	3.2 kg (7.05 lbs)
PI Backcan	1.9 kg (4.18 lbs)
Included accessories	C-Ring, tile-bridge kit, paint mask, cut-out template, grille
Optional accessories	Plaster (mud) ring, Arco grille
Packed quantity	2

Notes
(1) Average over stated bandwidth. Measured in an IEC baffle in an Anechoic Chamber
(2) Unweighted pink noise input, measured at 1 metre on axis
(3) Long term power handling capacity as defined in EIA - 426B test

A full range of measurements, performance data, CLF and Ease Data for CMS 503DC/CMS 503DC LP can be downloaded from www.tannoypro.com.

TANNOY

CMS 503DC BM

5" Full Range Ceiling Loudspeaker with
Dual Concentric Driver for
Installation Applications (Blind Mount)

TANNOY

CMS 503DC BM

5" Full Range Ceiling Loudspeaker with
Dual Concentric Driver for
Installation Applications (Blind Mount)

TANNOY

Install Speakers

CMS 503DC BM

5" Full Range Ceiling Loudspeaker with
Dual Concentric Driver for
Installation Applications (Blind Mount)

TANNOY

Install Speakers

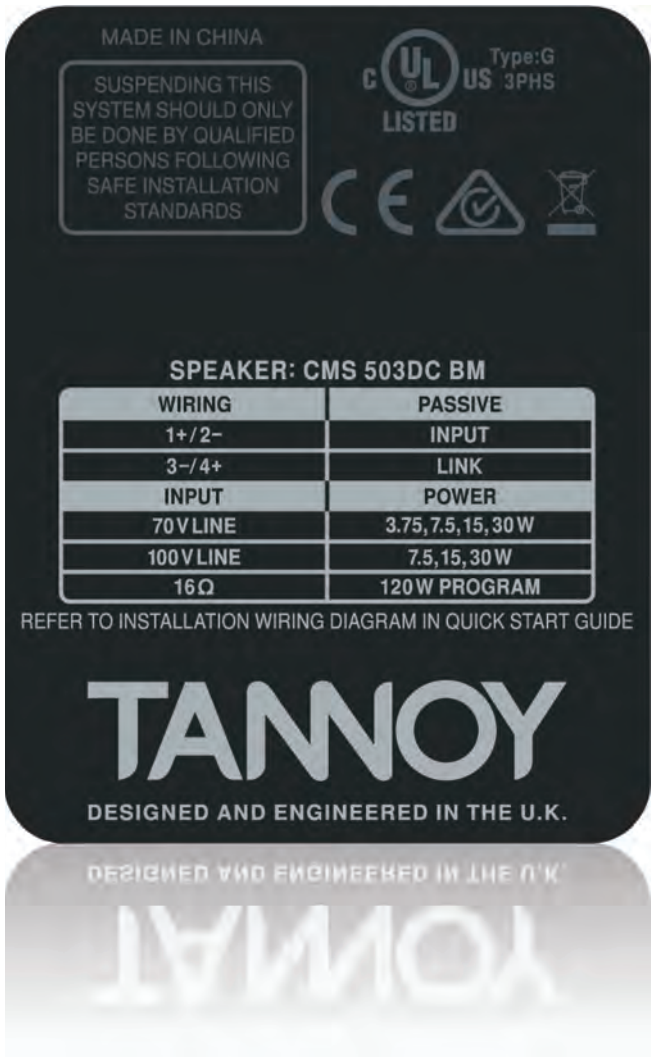
CMS 503DC BM

5" Full Range Ceiling Loudspeaker with
Dual Concentric Driver for
Installation Applications (Blind Mount)

Install Speakers

CMS 503DC BM

5" Full Range Ceiling Loudspeaker with
Dual Concentric Driver for
Installation Applications (Blind Mount)



5 Year Warranty

For service, support or more information contact the TANNOY location nearest you:

Europe
MUSIC Group Services UK
Tel: +44 1562 547 100
Email: CARE@music-group.com

USA/Canada
MUSIC Group Services NV Inc.
Tel: +1 702 963 1300
Email: CARE@music-group.com

Japan
MUSIC Group Services JP K.K.
Tel: +81 3 5833 9121
Email: CARE@music-group.com

TANNOY

ALL NEW! Now with Ethernet

8TraXX™

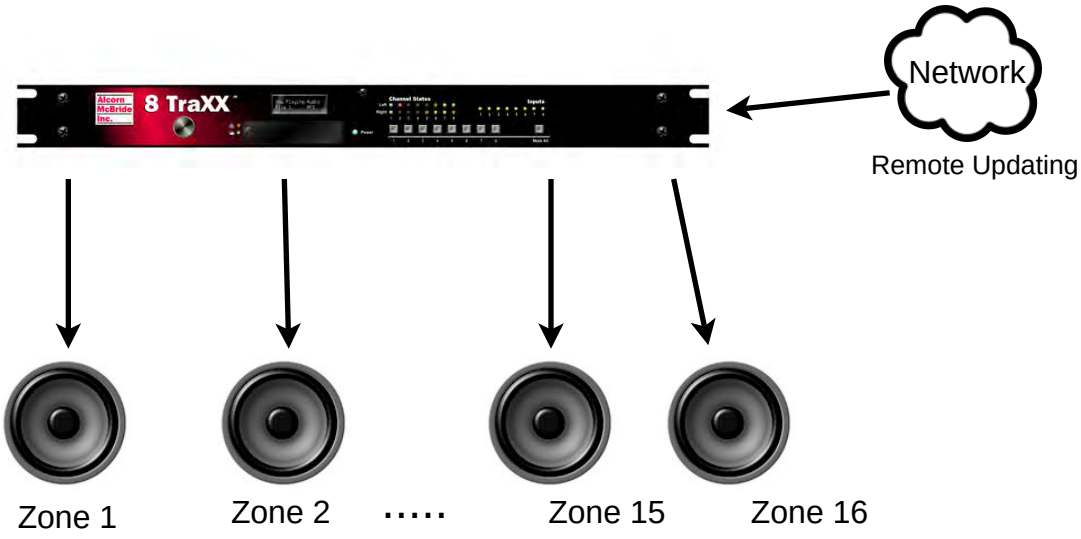
16 Channel Audio Repeater

8TraXX lets you play eight independent stereo tracks from a single, economical rack-mount unit. It's perfect for dark rides, museums, and interactive displays.

- ☑ Ethernet for remote updating
- ☑ 16 Channels of Audio from One CompactFlash
- ☑ Display LCD

Each track is individually triggered by its own discrete input – contact closure or voltage – allowing direct connection to proximity sensors or switches. All tracks can be controlled via RS-232, MIDI, or Ethernet.

8TraXX stores clips in MP3 format on CompactFlash for a rugged, reliable, maintenance-free solution to your playback needs. Access time is nearly instantaneous! All eight tracks are completely independent, and offer superb audio quality. With remote updating via Ethernet, the 8TraXX offers a flexible and reliable solution for all of your multi-channel playback needs.



Applications

- Retail
- Theme Parks
- Museums
- Cruise Ships
- Restaurants
- Theater

Alcorn McBride Inc.
3300 S. Hiawassee Rd.
Building 105
Orlando, FL 32835
Tel (407) 296-5800
Fax (407) 296-5801
info@alcorn.com
www.alcorn.com

8TraXX™

16 Channel Audio Repeater

Specifications

Audio

Channels:	8 Stereo Unbalanced RCA
Format:	MP3
Sample Rate:	Up to 48KHz
Playback Time:	Over 100 Hours (varies by CompactFlash size)
Media:	CompactFlash

Control

Serial:	DB-9M RS-232, 9600 baud, N, 8, 1
Ethernet:	10/100 Base-T, UDP Control, FTP File Transfer, NTP
Parallel Inputs:	(8) Programmable, Contact Closure or Voltage (Start/Stop, Still, Mute, Loop)
MIDI:	5 Pin DIN

Front Panel

Pushbuttons:	8 Direct Cue Trigger Pushbuttons Plus Mute
Knob:	Rotary Encoder with Push to Select
Indicators:	Channel Status LED's for Each Track, Power LED (16) Input Status LED's
Display:	16x2 character LCD Display
CF Socket:	Front Access, Security Cover Plate

Physical

Power:	Captive Barrel, 100 to 250 VAC, 50/60 Hz, 20 Watts Maximum Class 2 Supply Provided
Size:	19" W x 1.75" H x 7" D (48.3 cm W x 4.5 cm H x 17.8 cm D)
Weight:	4 lbs. (1.8 Kg)
Environment:	0°C (32°F) to 38°C (100°F) 0-90% Relative Humidity
Compliance:	CE, UL, CSA, WEEE, RoHS

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CX 8-channel
Professional Power Amplifiers

CX168 | CX108V

Designed for permanently installed sound systems where rackspace is at a premium, QSC's CX108V and CX168 provide unprecedented levels of channel density for multi-channel amplifiers. The CX108V and CX168 provide 100 watts per channel at 70 volts and 90 watts per channel at 8 ohms respectively. With both models, each pair of channels may be bridged to configure these amplifiers as 4, 5, 6 or 7 channel units. Like the entire CX Series, the 8 channel models feature DataPorts for remote amplifier management or signal processing, incorporate QSC's legendary PowerLight™ technology, and deliver our unmatched reputation for quality and reliability.

QSC's PowerLight technology takes your audio to an entirely new level. Delivering tighter bass and clean, transparent highs, PowerLight also cuts waste heat, boosts reliability, and eliminates unwanted noise and hum. PowerLight is a revolutionary switching power supply technology that provides ample current to the audio power circuitry by charging the supply rails over 200,000 times per second through an ultra-low noise impedance circuit. Unlike amplifiers that use conventional supplies, the audio signal is never starved prematurely and remains crisp and clean.

CX 8-channel Amplifiers

	Watts per channel		
Model	70V*	8Ω	4Ω**
CX168	–	8 x 90	8 x 130
CX108V	8 x 100	–	–

20 Hz – 20 kHz, 0.05%THD
** 20 Hz – 20 kHz, 0.2%THD*
***20 Hz – 20 kHz, 0.1%THD*

Features

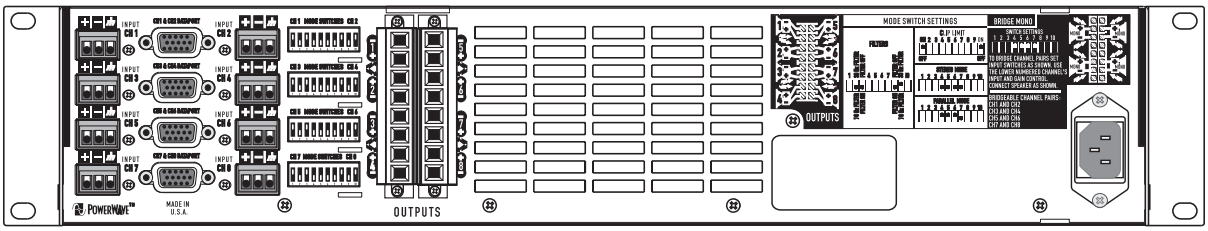
- 100 watts per channel at 70 volts (CX108V)
- 90 watts per channel at 8 ohms and 130 watts per channel at 4 ohms (CX168)
- Compact size — only two rack spaces and 14" deep for reduced rack space
- Channel pairs bridgeable for maximum flexibility
- Exclusive PowerLight switch-mode power supply technology for high performance and compact size
- Active inrush limiting eliminates AC inrush current, removing the need for expensive power sequencers
- Four HD15 DataPorts (one per channel pair) for QSControl computer control or QSC's signal processing accessories
- Custom integrated gain control security cover for tamper proof installations
- 1 dB recessed detented gain controls for fast and accurate settings
- Detachable Euro-style input and output connectors
- DIP switch control for clip limiters, high-pass filters, bridge-mono and parallel operation
- Selectable high-pass filters protect speakers and prevent speaker transformer saturation with minimal effect on program material (50 Hz or 75 Hz; CX108V) (33 Hz or 70 Hz; CX168)
- Comprehensive front panel indicators including signal, clip, bridge mono and parallel-input LEDs
- Fully protected — including DC, infrasonic and ultrasonic, thermal overload and short circuit protection
- High-performance Class AB+B complementary bipolar output circuitry
- Lightweight — only 21 pounds (9.5 kg) for easier racking and shipping
- 3-year warranty plus optional 3-year extended service contract

CX 8-Channel

Specifications

		CX168		CX108V
Stereo Mode (all channels driven)		Continuous average output power per channel		
8Ω / 20 Hz – 20 kHz / 0.05% THD		90 W		–
4Ω / 20 Hz – 20 kHz / 0.1% THD		130 W		–
Midband Ratings		All channels driven	Single channel	
8Ω / 1 kHz / 0.1% THD		100 W	120 W	–
4Ω / 1 kHz / 0.1% THD		140 W	180 W	–
70V / 20 Hz – 20 kHz / 0.2% THD		–		100 W
Bridge-Mono Mode		Bridge-mono mode operation		
16Ω / 20 Hz – 20 kHz / 0.1% THD		180 W		–
8Ω / 20 Hz – 20 kHz / 0.1% THD		260 W		
140V / 20 Hz – 20 kHz / 0.2% THD		–		200 W
Signal to Noise (20 Hz – 20 kHz)		-107 dB		-100 dB
Input Sensitivity		1.35 Vrms at 8Ω		1.26 Vrms at 70V
Voltage Gain		20x (26 dB)		56x (35 dB)
Input Clipping		6 Vrms (+18 dBu)		6 Vrms (+18 dBu)
Output Circuitry		Class AB+B		Class AB+B
Frequency Response		20 Hz – 20 kHz, + 0.2 dB | 8 Hz – 50 kHz, +0/-3 dB		20 Hz – 20 kHz, + 0.4 dB | 8 Hz – 70 kHz, +0/-3 dB
Damping Factor		> 200 (5 kHz and below)		> 500 (5 kHz and below)
Input Impedance		6k ohms unbalanced, 22k ohms balanced		6k ohms unbalanced, 22k ohms balanced
Distortion (SMPTE-IM)		< 0.02%		
Distortion (typical)				
20 Hz – 20 kHz: 10 dB below rated power		< 0.1% THD		
1.0 kHz and below: full rated power		< 0.03% THD		
Cooling		Variable-speed fan / rear-to-front air flow through tunnel heat sink		
Connectors		Input: 3-pin Euro-style detachable terminal blocks (one per channel) DataPort: HD-15 connector (Ch. 1+2, 3+4, 5+6, 7+8) Output: two 8-pin Euro-style detachable terminal blocks		
Controls		Front: AC switch, Ch. 1, 2, 3, 4, 5, 6, 7 & 8 gain knobs Rear: DIP switches for Ch. 1 - 8, clip limiter on/off, LF filter on/off, LF filter freq select 33 or 70 Hz for CX168 LF filter freq select 50 or 75 Hz for CX108V, inputs parallel or stereo; bridge mode		
Indicators		Power-On: Green LED / Parallel inputs: Orange LED (1 per channel pair) / Signal -35 dB: Green LED (1 per channel) Bridged: Yellow LED (1 per channel pair) / Clip: Red LED (1 per channel)		
Amplifier Protection		Full short circuit, open circuit, thermal, ultrasonic, and RF protection. Stable into reactive or mismatched loads		
Load Protection		On/off muting, individual channel DC fault blocking		
Dimensions (HWD)		3.5" (8.9 cm) 2 RU x 19" (48.3 cm) rack mounting x 14" (35.6 cm) from front mounting rails		
Weight - Net / Shipping		21 lb (9.5 kg) / 27 lb (12.3 kg)		
Power Requirements		100, 120, 230 VAC, 50 – 60 Hz (configured at factory)		
120V Current Consumption*	Idle	0.6 A		0.6A
1/8 power pink noise (typical of program material at maximum unclipped power)	8Ω	6.2 A		–
	4Ω	9.2 A		–
	70V	–		6.3 A
1/3 power pink noise (typical of program material with severe clipping)	8Ω	9.2 A		–
	4Ω	14.2 A		–
	70V	–		9.4 A

** Multiply currents by 0.5 for 230V units*



Specifications subject to change without notice.

1675 MacArthur Boulevard • Costa Mesa, CA 92626 • Ph: 800/854-4079 or 714/957-7100 • Fax: 714/754-6174

qscaudio.com

DATA SHEET
TESIRA® SERVER
DIGITAL AUDIO NETWORK SERVER

The Tesira® SERVER is a digital network server for use with the Tesira digital audio networking platform. It is factory configured with one DSP card yet capable of handling up to seven additional DSP cards. It is also factory configured with one AVB-1 Audio Video Bridging digital audio networking card. A second card slot can be populated with an additional AVB card, an SCM-1 CobraNet® network card, or a DAN-1 Dante™ network card. In cases where local I/O is advantageous, a Tesira standard I/O card may be installed. An integral network card provides network connection for configuration and control of the Tesira network. The modular DSP features Biamp SpeechSense™ technology, which enhances speech processing by more accurately distinguishing between human speech and noise. The DSP also provides extensive audio processing, including but not limited to: signal routing and mixing, equalization, filtering, dynamics, and delay as well as control, monitoring and diagnostic tools; all configured through the Tesira designer software. Two Tesira SERVERs can also be designed as a redundant pair (if they carry identical processing and I/O card configurations). The secondary SERVER stays 'live' with the primary, updating runtime parameters. If the primary SERVER should need maintenance, the secondary takes over with no loss of continuity or downtime.

BENEFITS

- Highly scalable processing that can grow over time with the needs of the end customer
- Flexibility for any I/O device to harness the processing available in the server
- Enables I/O devices to be located at end points
- Offers flexibility for control network to run on separate (existing) Ethernet network

FEATURES

- Supports up to 8 DSP cards
- Up to 420 x 420 channels of digital I/O over AVB
- Supports optional 64 x 64 Dante audio networking
- Supports optional 32 x 32 CobraNet audio networking
- System configuration and control via Ethernet or serial connection
- Front panel OLED display for device and system information
- Processing algorithm: SpeechSense
- Supports redundancy for continuous uptime
- Signal processing via intuitive software allows configuration and control for: signal routing and mixing, equalization, filtering, dynamics, delay and much more
- Extensive input, output and logic expansion devices supported as part of the Tesira digital audio networking platform
- Rack mountable (3RU)
- CE marked, UL listed and RoHS compliant
- Covered by Biamp Systems' 5-year warranty

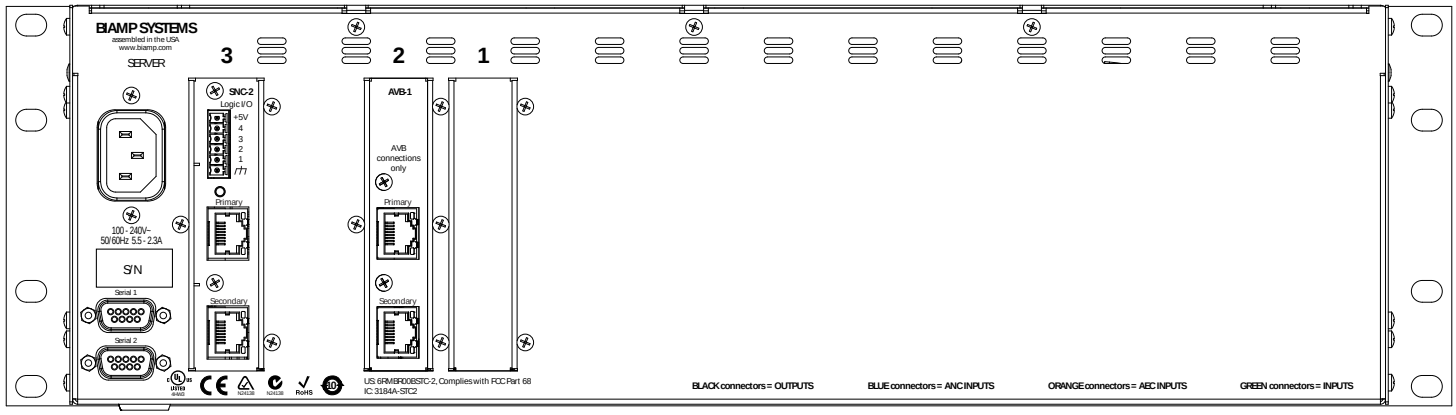
ARCHITECTS & ENGINEERS SPECIFICATION

The digital audio network server shall be designed exclusively for use with Tesira® systems. The server shall support AVB digital audio and control networking by means of a factory configured 420 x 420 modular card. The server shall also support an additional 420 x 420 channel AVB networking card, one 32 x 32 channel CobraNet® networking card, one 64 x 64 channel Dante™ networking card, or one standard analog I/O card. The server shall be factory configured with one DSP card and shall be capable of supporting a total of eight cards. The server shall provide dual Ethernet ports for configuration and control connection. The server shall support redundancy if both the primary secondary units are identically configured. The server shall provide front panel LED identification of server power, status, alarm, and activity as well as system-wide alarm. The server shall provide front panel OLED display for server and system information. The server shall be rack mountable (3RU) and feature software-configurable signal processing, including but not limited to: signal routing and mixing, equalization, filtering, dynamics, and delay, as well as control, monitoring, and diagnostic tools. The server shall be CE marked, UL listed and shall be compliant with the RoHS directive. Warranty shall be 5 years. The digital audio network server shall be Tesira SERVER.

TESIRA SERVER SPECIFICATIONS (AUDIO SPECIFICATIONS GIVEN REFLECT USE OF SIC-4 AND SOC-4)

Frequency Response (20Hz~20kHz @ +4dBu):	+0/-0.25dB
THD+N (20Hz~20kHz):	
@ 0dB Gain, +4dBu In:	< 0.006%
@ 54dB Gain, -50dBu In:	< 0.040%
EIN (20Hz~20kHz, 66dB Gain, 150Ω):	< -125dBu
Dynamic Range (20Hz~20kHz, 0dB):	> 108dB
Tail Length:	up to 300ms
Convergence:	up to 100dB/sec
Input Impedance (balanced):	8kΩ
Maximum Input:	+24dBu
Input Gain Range (6dB Steps):	0 - 66dB
Output Impedance (balanced):	200Ω
Maximum Output:	+24dBu
Power Consumption (100~240VAC 50/60Hz):	< 150W
Phantom Power:	+48 VDC (7mA/input)
Cross Talk (channel to channel @ 1kHz):	
@ 0dB Gain, +4dBu In:	< -85dB
@ 54dB Gain, -50dBu In:	< -75dB
Overall Dimensions:	
Height:	5.25 inches (133 mm)
Width:	19.0 inches (483 mm)
Depth:	17.0 inches (432 mm)
Weight:	18 lbs (8.2 kg)
Sampling Rate:	48kHz
A/D Converters:	24-bit
Compliance:	FCC Part 15B (USA) FCC Part 68 (USA) Industry Canada CS-03 (Canada) CE marked (Europe) UL and C-UL listed (USA & Canada) RCM (Australia) EAC (Eurasian Customs Union) RoHS Directive (Europe)

TESIRA SERVER BACK PANEL



Museum Technology Source, Inc.

BB-200
Microwave Motion Sensor

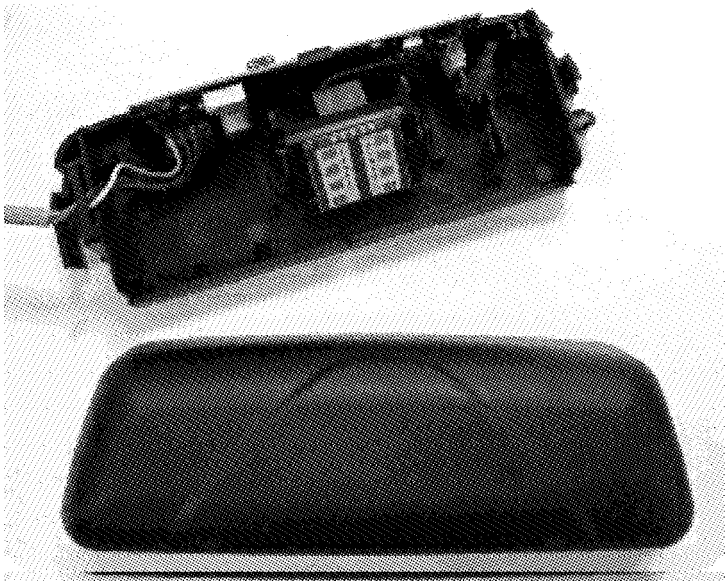
Senses People Up to 16 Feet Away

Adjustable Range

FCC Approved

Reliable Microwave Technology

May Be Concealed Behind Exhibit



BB-200 Motion Sensor Top: Cover Removed

Based on the Doppler Principle, the BB-200 provides a compact and reliable method of detecting when a visitor approaches an exhibit. Unlike passive infra-red detectors used in burglar alarms and driveway lights, the low power radar beam may be aimed to cover a specific area. Also, the range, or sensitivity, is easily adjusted over a range of approximately 3 to 16 feet. In this way, the exhibit is started only when a person is within the appropriate range.

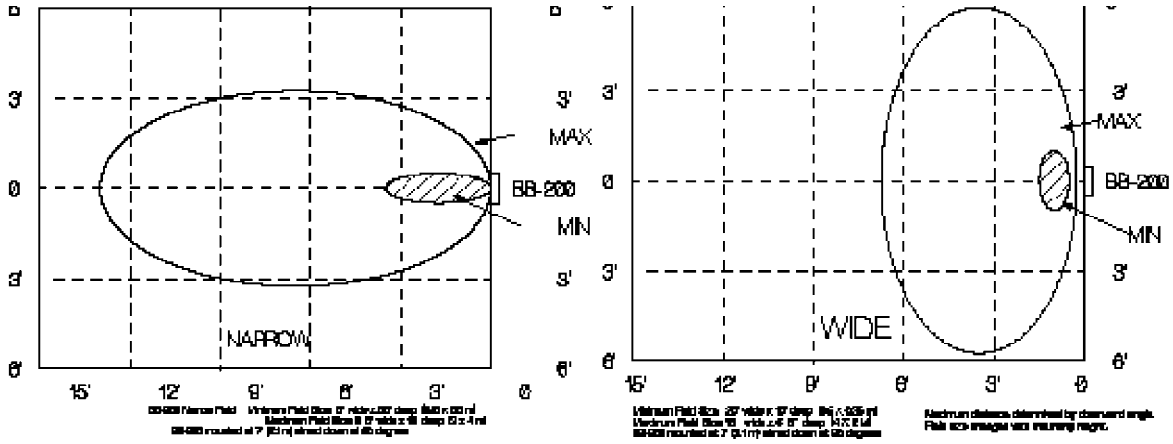
The BB-200 operates from any power source capable of providing 12 to 24 volts AC or DC at 100 milliamps. Any of the Museum Technology products employing the RJ-11 modular plug system is able to directly supply the required power.

In general, the BB-200 should be mounted above, and aimed at, the area to be covered. A light visible on the BB-200 assists in aiming and adjustment. It is suggested that the BB-200 be powered up, and temporarily mounted in the proposed location to ensure proper operation prior to permanent mounting.

The BB-200 may be mounted behind common non-metallic building materials such as plywood, MDF, and drywall. This might result in a slight reduction in maximum range. Again, the BB-200 should be temporarily installed and tested prior to final mounting.

323 Andover Street Wilmington, MA 01887
phone 800-729-6873 / 978-657-3898
www.museumtech.com | contact@museumtech.com

BB-200 Microwave Motion Sensor



DIMENSIONS ARE APPROXIMATE AND TO BE USED AS A GENERAL GUIDE ONLY
BB-200 BEAM PATTERNS

Technical Specifications

Operating Principle: Microwave Doppler Radar

Frequency: K-Band, 24.125 GHz

Range: Approximately 3 to 16 feet; Adjustable by mounting angle and sensitivity control. Wide or narrow beam determined by orientation of antenna

Output: SPST solid state (silent) relay provides for normally normally open operation. Contacts rated 1 amp at 24 VDC

Power: 12 to 24 volts DC or 10 to 24 volts AC
100 mA relay OFF, 120 mA relay ON

Environmental: -4 to 140 Degree F (-20 to +60 C)

Indicator: Green LEDlights while motion sensed

Size: 6.8" wide x 2.4" high x 1.9" deep (172 x 60 x 48 mm); 5 Oz (140 g)

Mounting: Screw holes for mounting to flat surface

Weight: 9 ounces (240 grams)

Adjustments: Range adjustable 3 to 16 feet (1 to 5 meters)
Microwave Horn pivots -20 to +20 degrees; -5 to 90 degrees from horizontal

Approval: FCC

Warranty: Two years parts and labor

323 Andover Street Wilmington, MA 01887
phone 800-729-6873 / 978-657-3898
www.museumtech.com | contact@museumtech.com

EQUIPMENT FOR

AV.05 Fighting & Healing

3M™ Multi-Touch Display C5567PW

Large Format Display with Truly Uncompromised Touch

The interactive 55-inch **3M™ Multi-Touch Display C55677PW** features 3M's high-performance projected capacitive (3M PCT) multi-touch technology and sophisticated bezel-free display design to offer users a truly uncompromised touch experience. The C5567PW chassis display delivers 60 simultaneous touches over 1,200 square inches of interactive surface area, at an ultra-fast 10 ms response time, to enable designers to create multi-user experiences that are more natural, intuitive and responsive when compared to infrared- and optical-based systems. Versatile enough for interactive digital signage, interactive tables and kiosk solutions, the C5567PW provides system architects with a high-performance, easy-to-integrate commercial display for innovative multi-touch solutions.

Precision Large-format Multi-Touch

In addition to delivering 60 simultaneous touches at a 10 ms response time, the 3M touch electronics have an advanced built-in palm rejection algorithm to ensure that unintended contact with the screen is ignored and does not interfere with the user's intended action. The design of the projected capacitive sensor has more than 18,600 touch sensing points in close proximity, making it precise and extremely accurate across the entire touchscreen. The durable 4mm tempered glass touch surface provides an antiglare first surface to ensure excellent image clarity in environments with bright ambient light. Its anti-stiction properties provide excellent finger glide capability, allowing users' fingers to effortlessly glide across the display for easy gesture functions. This fast, accurate and easy to use multi-touch screen enables customers to create, deliver and experience innovative and engaging multi-user applications.

Industrial Grade Designed for Multi-Touch Interaction

The C5567PW display has been designed from the ground up to meet the unique requirements of a large format multi-touch display. The all steel construction and durable glass surface is designed to stand up to unattended public installations. Unlike televisions or digital signs, an interactive multi-touch display draws users in close proximity to the LCD. To maintain sharp image quality at close distances the C5567PW display features a full 1080p HD LCD, wide viewing angles and fine pixel pitch of .21 x .63mm. An advanced thermal management system with replaceable 3M air filters ensures the touch surface is maintained at a comfortable temperature for the user, even in a horizontal table implementation, and promotes "always on" performance of critical electronic components. The glass-to-the-edge bezel-free design mirrors the design trends popular on modern consumer devices and makes it an elegant addition to any commercial or professional environment.

Every element of the C5567PW is designed to enable integrators to configure the display in almost any orientation while meeting the demanding needs of public environments. The LED backlight system allows integrators to implement in landscape, portrait or horizontal orientations without concern of non-uniformity that CCFL systems can exhibit. At just 2.9" deep the C5567PW can be a sleek wall mounted interactive digital sign or a slim interactive table or kiosk.

Recommended Multi-Touch Applications

- Interactive Digital Signage
- Transportation
- Wayfinding
- Command and Control
- Training and Simulation
- Tele-presence
- Retail Product Selectors
- Ticketing/Vending
- Point of Information
- Pro Audio/Visual
- Geospatial
- Broadcast

Feature	Benefit
3M PCT Multi-Touch Technology	• 60 finger multi-touch input enables intuitive on-screen collaboration • Fast <10 millisecond touch response creates a natural, intuitive and responsive interface • Advanced palm rejection algorithms help prevent unintended touches that commonly occur in table applications • Anti-stiction surface enhances the user experience for simple and advanced gestures
Sophisticated and Durable Design	• Flat front surface design built in for elegant modern aesthetics • Slim 2.9" thickness provides sleek low profile appearance while enabling easy integration on wall, table or ensclosure • All metal construction provides rugged frame for public use environments • Advanced thermal management system designed to keep display cool to the touch in tabletop and enclosure installations • Active cooling system with replaceable 3M air filters ensures a cool touching surface regardless of orientation and all but eliminates dust from entering the display
Premium Display for Multi-Touch Applications	• Anti-glare coating to maintain image quality under harsh ambient lighting • Full HD resolution (1920x1080) with a fine pixel pitch to maintain sharp image quality while performing up-close interactions • Ultra-Wide viewing angle presents a brilliant image at most angles • LED Backlights present a long lasting, bright, uniform image regardless of integrated orientation • Support for remote display controls through RS-323 ports • Supports many leading active pens and conductive styli

3M™ Multi-Touch Display C5567PW Specifications

Functional Specifications

Display Details

LCD Technology	AMVA3
Display Colors	1.07 billion
Pixel Pitch	0.21 x 0.63mm
Brightness with touch sensor (max.) (1)	700 cd/m2 (nit) typical 610 cd/m2 (nit) typical
Contrast Ratio (2)	4000:1 typical
Viewing Angle	Horizontal/Vertical: 178 degrees typical
Video Response Time (3)	6.5 ms typical
Refresh Rate	60Hz
Control Type	OSD
Native Resolution	1920 x 1080

(1) Brightness measured on a display with 3M™ Projected Capacitive sensor.
(2) Measured at a contrast ratio of 10.
(3) Gray to Gray.

Touch Details

Number of Touch Points	60 points with palm rejection
Touch Point Speed (4)	<10 ms
Input Type	Finger, think glove, many leading active pens and conductive styli
Touch Communication	USB
Operating System Support	Windows 8 / 7 / Vista / XP, Linux, Mac

(4) Up to 20 touches.

Connections

Power | USB (touch) | OSD | In Out RS-232 | DP | HDMI | DVI | VGA | Out In Audio

Physical Specifications

Product Details

Operating Environment	0 to +40 degrees C, relative humidity, non-condensing 85%
Storage Environment	-10 to +60 degrees C
Video Input	DVI, VGA, HDMI, DP (HDCP)
Audio	Speaker: 5W + 5W @ 8Ω Headphone: 20mW + 20mW @ 32Ω
Cover Glass	4mm Heat Tempered
VESA Pattern	400mm x 400mm
Power Supply	Internal 110/220 VAC Power Supply
Power Consumption	150 watt (maximum)
RoHS Compliant	Yes
Agency Approvals	FCC-B, CE, cTUVus (IEC 60950), C-TICK
Warranty	1 year

Dimensions and Weight

Display Area (WxH) (viewing area)	1209.6 x 680.4mm 47.6 x 26.8 inches
Display Dimensions (outer)	1280 x 750 x 73.5mm 50.4 x 29.5 x 2.9 inches
Packaging (WxHxD)	1472 x 896 x 256mm 57.9 x 35.3 x 10.1 inches
Display weight	39kg / 85.98 lbs
Packaging/Display weight	46kg / 101.5 lbs

Accessories

Included in the Box	Video Cables: VGA, HDMI, DisplayPort, DVI, USB, S232 Cable, US Power Cable, Audio Cable, Touch CD, Quick Start Guide
Sold Separately	Wired OSD Controller (98-1100-0330-2)
Replacement Air Filters	3M Replacement Filters (98-1100-0230-4)

Ordering Information

Part Number	98-1100-0531-5

3M Touch Systems
Subsidiary of 3M Company
501 Griffin Brook Park Drive
Methuen, MA 01844 U.S.A.

1-888-659-1080

www.3M.com/touch

RoHS Directive compliant: RoHS 2011/65/EU means that the product or part does not contain any of the substances in excess of the maximum concentration values ("MCVs") in EU RoHS Directive 2011/65/EU, unless the substance is in an application that is exempt under EU RoHS. The MCVs are by weight in homogeneous materials. This information represents 3M's knowledge and belief, which may be based in whole or in part on information provided by third party suppliers to 3M. (3/13)

IMPORTANT NOTICE TO PURCHASER: Specifications are subject to change without notice. These 3M Touch Systems' Products and software are warranted to meet their published specifications from the date of shipment and one year from the time of purchase. 3M Touch Systems makes no additional warranties, express or implied, including but not limited to any implied warranties of merchantability or fitness for a particular purpose. User is responsible for determining whether the 3M Touch Systems Products and software are fit for User's particular purpose and suitable for its method of production, including intellectual property liability for User's application. If the Product, software or software media is proven not to have met 3M Touch Systems' warranty, then 3M Touch Systems' sole obligation and User's and Purchaser's exclusive remedy will be, at 3M Touch Systems' option, to repair or replace that Product quantity or software media or to refund its purchase price. 3M Touch Systems has no obligation under 3M Touch Systems' warranty for any Product, software or software media that has been modified or damaged through misuse, accident, neglect, or subsequent manufacturing operations or assemblies by anyone other than 3M Touch Systems. 3M Touch Systems shall not be liable in any action against it in any way related to the Products or software for any loss or damages, whether non-specified direct, indirect, special, incidental or consequential (including downtime, loss of profits or goodwill) regardless of the legal theory asserted. (7/02)

Configure your HP Z240 Small Form Factor Workstation - Customizable

RECOMMENDED CONFIGURATIONS

Base configuration | Everyday business | Performance | Compare options

Operating system

The most important software on your PC. Choose the right OS for you to maximize your productivity.

Windows 10 Pro 64 - HP recommends Windows 10 Pro.	Included in price
Windows 10 Home 64	-$43.00
Windows 7 Professional 64 (available through downgrade rights from Windows 10 Pro)	+$58.00
Linux-ready	-$177.00

Processor

A faster processor supports your computer's performance with more efficient operation.

Intel® Pentium® G4560 Processor (3.5 GHz, 3 MB cache, 2133 MHz, 2 core) + Intel® HD Graphics 610	-$475.00
Intel® Core™ i3-6100 Processor (3.7 GHz, 3 MB cache, 2133 MHz, 2 core) + Intel® HD Graphics 530	-$350.00
Intel® Core™ i3-7100 Processor (3.9 GHz, 3 MB cache, 2400 MHz, 2 core) + Intel® HD Graphics 630	-$350.00
Intel® Core™ i5-6500 Processor (3.2 GHz, up to 3.6 GHz w/Turbo Boost, 6 MB cache, 2133 MHz, 4 core) + Intel® HD Graphics 530	-$210.00
Intel® Core™ i5-7500 Processor (3.4 GHz, up to 3.8 GHz w/Turbo Boost, 6 MB cache, 2400 MHz, 4 core) + Intel HD Graphics 630	-$210.00
Intel® Xeon® E3-1205 v6 Processor (3 GHz, 8 MB cache, 2400 MHz, 4 core, 65W) + Intel® HD Graphics P630	-$195.00
Intel® Xeon® E3-1225 v5 Processor (3.3 GHz, up to 3.7 GHz w/Turbo Boost, 8 MB cache, 4 core, 80W) + Intel® HD Graphics P530	-$175.00
Intel® Xeon® E3-1225 v6 Processor (3.3 GHz, up to 3.7 GHz w/Turbo Boost, 8 MB cache, 4 core, 80W) + Intel® HD Graphics P630	-$175.00
Intel® Core™ i5-6600 Processor (3.3 GHz, up to 3.9 GHz w/Turbo Boost, 6 MB cache, 2133 MHz, 4 core) + Intel® HD Graphics 530	-$160.00
Intel® Core™ i5-7600 Processor (3.5 GHz, up to 4.1 GHz w/Turbo Boost, 6 MB cache, 2400 MHz, 4 core) + Intel® HD Graphics 630	-$160.00
Intel® Xeon® E3-1230 v5 Processor (3.4 GHz, up to 3.8 GHz w/Turbo Boost, 8 MB cache, 4 core, 80W)	-$135.00
	-$135.00

Intel® Xeon® E3-1230 v6 Processor (3.5 GHz, up to 3.9 GHz w/Turbo Boost, 8 MB cache, 4 core, 80W)	
Intel® Xeon® E3-1240 v5 Processor (3.5 GHz, up to 3.9 GHz w/Turbo Boost, 8 MB cache, 4 core, 80W)	-$75.00
Intel® Xeon® E3-1240 v6 Processor (3.7 GHz, up to 4.1 GHz w/Turbo Boost, 8 MB cache, 4 core, 80W)	-$75.00
Intel® Xeon® E3-1245 v5 Processor (3.5 GHz, up to 3.9 GHz w/Turbo Boost, 8 MB cache, 4 core, 80W) + Intel® HD Graphics P530	-$25.00
Intel® Xeon® E3-1245 v6 Processor (3.7 GHz, up to 4.1 GHz w/Turbo Boost, 8 MB cache, 4 core, 80W) + Intel® HD Graphics P630	-$25.00
Intel® Core™ i7-6700 Processor (3.4 GHz, up to 4 GHz w/Turbo Boost, 8 MB cache, 2133 MHz, 4 core) + Intel® HD Graphics 530	+$0.00
Intel® Core™ i7-7700 Processor (3.6 GHz, up to 4.2 GHz w/Turbo Boost, 8 MB cache, 2400 MHz, 4 core) + Intel® HD Graphics 630	Included in price
Intel® Xeon® E3-1270 v5 Processor (3.6 GHz, up to 4 GHz w/Turbo Boost, 8 MB cache, 4 core, 80W)	+$50.00
Intel® Xeon® E3-1270 v6 Processor (3.8 GHz, up to 4.2 GHz w/Turbo Boost, 8 MB cache, 4 core, 80W)	+$50.00

ENERGY STAR

ENERGY STAR Qualified Configuration	Included in price

Chassis

The computer housing that holds, protects and organizes the components within your computer. Some configurations are limited to specific chassis types.

HP Z240 SFF 240W 92 percent efficient Chassis	Included in price

Memory

Do more, faster with added memory.

4 GB (1x4 GB) DDR4-2400 Unbuffered Memory	-$275.00
8 GB (1x8 GB) DDR4-2400 Unbuffered Memory	-$185.00
8 GB (2x4 GB) DDR4-2400 Unbuffered Memory	-$185.00
16 GB (2x8 GB) DDR4-2400 Unbuffered Memory	Included in price
32 GB (2x16 GB) DDR4-2400 Unbuffered Memory	+$370.00
32 GB (4x8 GB) DDR4-2400 Unbuffered Memory	+$370.00
64 GB (4x16 GB) DDR4-2400 Unbuffered Memory	+$1110.00

Internal OS load storage options

Operating System Load to SATA	+$0.00
Operating System Load to PCIe	Included in price

Tip: The operating system load to PCIe selected requires a selection in the internal PCIe storage category.

Internal PCIe storage

None	-$170.00

128 GB HP Z Turbo Drive G2 PCIe Solid-State Drive (SSD)	Included in price
256 GB HP Z Turbo Drive G2 TLC PCIe SSD	+$49.00
256 GB HP Z Turbo Drive G2 PCIe Solid-State Drive (SSD)	+$109.00
256 GB HP Z Turbo Drive G2 Self Encrypting (SED) PCIe Solid-State Drive (SSD)	+$119.00
512 GB HP Z Turbo Drive G2 G2 TLC PCIe SSD	+$249.00
512 GB HP Z Turbo Drive G2 PCIe Solid-State Drive (SSD)	+$329.00
512 GB HP Z Turbo Drive G2 Self Encrypting (SED) PCIe Solid-State Drive (SSD)	+$339.00
1 TB HP Z Turbo Drive G2 G2 TLC PCIe SSD	+$509.00
1 TB HP Z Turbo Drive G2 PCIe Solid-State Drive (SSD)	+$609.00

Secondary internal PCIe storage

None	Included in price
256 GB HP Z Turbo Drive G2 G2 TLC 2nd PCIe SSD	+$239.00
256 GB HP Z Turbo Drive G2 2nd PCIe Solid-State Drive (SSD)	+$279.00
512 GB HP Z Turbo Drive G2 G2 TLC 2nd PCIe SSD	+$439.00
512 GB HP Z Turbo Drive G2 2nd PCIe Solid-State Drive (SSD)	+$519.00
1 TB HP Z Turbo Drive G2 G2 TLC 2nd PCIe SSD	+$699.00

1 TB HP Z Turbo Drive G2 2nd PCIe Solid-State Drive (SSD)	+$799.00

Internal storage

Get the storage you need for all of your files, applications, data, photos, videos, music, and more.

None	-$259.00
500GB 7200 RPM SATA 1st Hard Drive	-$159.00
500GB 7200 RPM SATA SFF 1st Opal 2 Self Encrypting (SED) Hard Drive	-$134.00
1TB 7200 RPM SATA 1st Hard Drive	-$129.00
2TB 7200 RPM SATA 1st Hard Drive	-$49.00
256GB SATA 1st Solid-State Drive (SSD)	Included in price
1TB 7200 RPM Enterprise SATA 1st HDD	+$31.00
3TB 7200 RPM SATA 1st Hard Drive	+$31.00
HP Enterprise Class 240GB SATA 1st Solid-State Drive (SSD)	+$170.00
512GB SATA 1st Solid-State Drive (SSD)	+$211.00
4TB 7200 RPM Enterprise SATA 1st Hard Drive	+$231.00
512GB SATA Self-Encrypting (SED) 1st Solid-State Drive (SSD)	+$220.00
HP Enterprise Class 480GB SATA 1st Solid-State Drive (SSD)	+$390.00
1TB SATA 1st Solid-State Drive (SSD)	+$540.00

2 TB SATA SSD	+$890.00

2nd internal storage

Get even more space for files, applications, data, and back-ups.

None	Included in price
500GB 7200 RPM SATA 2nd Hard Drive	+$100.00
1TB 7200 RPM SATA 2nd Hard Drive	+$130.00
2TB 7200 RPM SATA 2nd Hard Drive	+$210.00
256GB SATA 2nd Solid-State Drive (SSD)	+$259.00
1TB 7200 RPM Enterprise SATA 2nd HDD	+$290.00
3TB 7200 RPM SATA 2nd Hard Drive	+$290.00
HP Enterprise Class 240GB SATA 2nd Solid-State Drive (SSD)	+$429.00
512GB SATA 2nd Solid-State Drive (SSD)	+$470.00
4TB 7200 RPM Enterprise SATA 2nd Hard Drive	+$490.00
HP Enterprise Class 480GB SATA 2nd Solid-State Drive (SSD)	+$649.00
1TB SATA 2nd Solid-State Drive (SSD)	+$799.00
2 TB SATA 2nd SSD	+$1149.00

Graphics card

Improve image clarity, motion in videos and color brilliance.

Intel® HD Graphics 630 (7th Generation Intel® Core™ i3/i5/i7 CPUs)	-$374.00
NVIDIA NVS 310 1GB 2xDP 1st No cables included Graphics - PCIe	-$266.00
NVIDIA NVS 315 1GB DMS59 1st DMS59-2xDVI cable Graphics - PCIe	-$266.00
NVIDIA Quadro K420 2GB DL-DVI(I)+DP 1st No cables included Graphics - PCIe	-$246.00
AMD FirePro W2100 2GB 2xDP 1st No cables included Graphics - PCIe	-$245.00
NVIDIA® QUADRO® P400 (2 GB GDDR5, 3 x Mini DisplayPort 1.4; 2 mDP-DP Cables included) Graphics	-$236.00
NVIDIA Quadro K620 2GB DL-DVI(I)+DP 1st No cables included Graphics - PCIe	-$196.00
NVIDIA® QUADRO® P600 (2 GB GDDR5, 4 x Mini DisplayPort 1.4; 2 mDP-DP Cables included) Graphics	-$196.00
AMD FirePro W4300 4GB 4xmDP 1st w/4 mDP-DP cables Graphics	-$75.00
Radeon™ Pro WX 4100 (4 GB GDDR5, 4 x Mini-DisplayPort Outputs - Ready for DisplayPort 1.4 HDR) Graphics	-$60.00
NVIDIA Quadro K1200 4GB 4xmDP 1st w/4 mDP-DP cables Graphics	+$0.00
NVIDIA® QUADRO® P1000 (4 GB GDDR5, 4 x Mini DisplayPort 1.4; 4 mDP-DP Cables included) Graphics	Included in price
NVIDIA NVS 510 2GB 4x mDP 1st w/4 mDP-DP cables Graphics - PCIe	+$64.00

2nd graphics card

None	Included in price
NVIDIA NVS 310 1GB 2xDP 2nd No cables included Graphics - PCIe	+$109.00
NVIDIA NVS 315 1GB DMS59 2nd DMS59-2xDVI cable Graphics - PCIe	+$109.00

Media reader

Direct access to memory and flash cards through your PC - no cords required.

None	Included in price
HP SD Card Reader	+$25.00

Optical drive

Backup files, play music and movies and burn your own CDs and DVDs.

No included Optical Disc Drive	Included in price
9.5mm Slim DVD-ROM 1st Optical Disc Drive	+$28.00
9.5mm Slim DVD-Writer Optical Disc Drive	+$33.00
9.5mm Slim SuperMulti DVDRW 1st Optical Disc Drive	+$33.00
9.5mm Slim Blu-ray Writer 1st Optical Disc Drive	+$148.00

Keyboard

Get the most out of interacting with your computer with an upgraded keyboard and mouse.

HP No Keyboard	-$9.00

HP PS/2 Business Slim Keyboard	+$0.00
HP USB Business Slim Keyboard	Included in price
HP USB CCID Smartcard Keyboard	+$30.00
HP USB Premium Keyboard	+$40.00

Mouse

Get the most out of interacting with your computer with an upgraded keyboard and mouse.

No Included Mouse	-$9.00
HP PS/2 Mouse	-$5.00
HP USB Optical Mouse	Included in price
HP USB Premium Mouse	+$0.00
HP USB Hardened Mouse	+$2.00
HP USB 1000dpi Laser Mouse	+$20.00
3Dconnexion CADMouse	+$150.00

Stand

Organize your workspace and optimize your setup for ergonomic comfort.

HP SFF Chassis Tower Stand	+$5.00

Cable option kits

HP Serial Port Adapter Kit	+$10.00

Graphics connectors

None	Included in price
No Graphics Adapter Cable	+$1.00
HP DisplayPort To DVI-D Adapter	+$10.00
HP Mini DisplayPort to DisplayPort Adapter (Single)	+$10.00
HP DisplayPort To DVI-D Adapter (2-Pack)	+$19.00
HP Mini DisplayPort to DisplayPort Adapters (2-Pack)	+$19.00
HP DisplayPort To DVI-D Adapter	+$10.00
HP DisplayPort To VGA Adapter	+$21.00
HP DisplayPort To DVI-D Adapter (4-Pack)	+$36.00
HP DisplayPort To DVI-D Adapter (2-Pack)	+$19.00
HP Mini DisplayPort to DisplayPort Adapters (4-Pack)	+$36.00
HP DisplayPort To DVI-D Adapter (6-Pack)	+$54.00
HP DisplayPort to Dual Link DVI Adapter	+$129.00

Internal storage options

None	Included in price
RAID 0 Striped Array Configuration	+$10.00
RAID 1 Mirrored Array Configuration	+$10.00

Label

FDA Class 1 Medical Device Registration	+$1.00
HP FEMP and ErP Qualifying S5 Low Power Mode Enabled Configuration	+$1.00

LAN

Intel® Ethernet I210-T1 PCIe Network Interface Card - PCIe	+$40.00
Intel® Ethernet I350-T2 2-Port 1Gb Network Interface Card	+$150.00

Security

Keep your hardware safe and secure.

Convert TPM to 2.0	+$1.00
Convert to TPM 2.0 FIPS 140-2	+$1.00
HP Solenoid Lock and Hood (SFF) Sensor	+$15.00

Accessories

Get the most from your new system with high-quality, tested and approved accessories.

HP Thunderbolt-2 PCIe 1-port I/O Card	+$175.00
HP Z240 SFF Dust Filter	+$9.00

Warranty

Warranty options are available for parts/labor/onsite response.

HP 1/1/1 SFF Warranty	-$40.00
HP 3/3/3 SFF Warranty	Included in price

China CCC Compliance

China Regulatory CCC Compliance Mark	+$1.00

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Contact us now

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Returns & Exchanges (/us/en/ContentView?eSpotName=ReturnsandExchanges&catalogId=10051&langId=-1&storeId=10151)

+ Disclaimer

United States

DTP HDMI 4K 330

LONG DISTANCE HDMI TWISTED PAIR EXTENDER

DTP SYSTEMS 4K UHD

- Transmits HDMI plus control and analog audio up to 330 feet (100 meters) over a shielded CATx cable
- Supports computer and video resolutions up to 4K, including 1080p/60 Deep Color
- Extron XTP DTP 24 shielded twisted pair cable is strongly recommended for optimal performance
- Bidirectional RS-232 and IR pass-through for AV device control
- Accepts additional analog stereo audio signals
- Supported HDMI specification features include data rates up to 10.2 Gbps, Deep Color up to 12-bit, 3D, HD lossless audio formats, and CEC pass-through
- HDCP-compliant
- Supports EDID and HDCP transmission
- Remote power capability
- UL 2043 plenum rated receiver
- Compatible with all DTP™ 330 Series models and DTP 330-enabled products
- 1" (2.5 cm) high, quarter rack width metal enclosures
- Highly reliable, energy-efficient external universal power supply included with Tx models

DTP HDMI 4K 330 Tx

DTP HDMI 4K 330 Rx

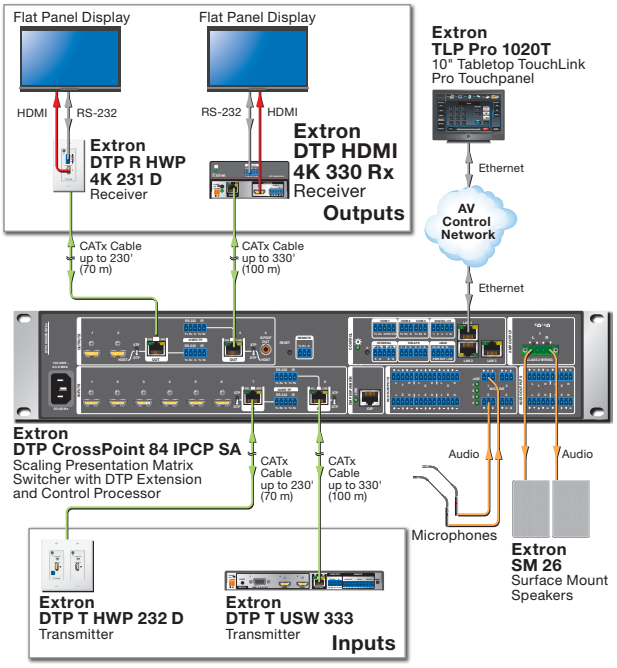
The Extron DTP HDMI 4K 330 extender sends HDMI, analog audio, and bidirectional control signals up to 330 feet (100 meters) over a shielded CATx cable. The HDCP-compliant extender set features a compact enclosure that enables discreet installation in a wide variety of applications.

DESCRIPTION

The Extron **DTP HDMI 4K 330** is a long distance transmitter and receiver set for sending HDMI, audio, and bidirectional RS-232 and IR signals up to 330 feet (100 meters) over a shielded CATx cable to Extron DTP™ 330-enabled products. It provides an effective means for extending HDMI with embedded multi-channel audio from HDMI-equipped devices. The DTP HDMI 4K 330 accepts analog stereo audio signals for simultaneous transmission over the same shielded twisted pair cable. It supports video signals at resolutions up to 4K, including 1080p/60 Deep Color. The DTP HDMI 4K 330 enables the reliable, long distance transmission of HDMI signals, supporting Deep Color up to 12-bit, CEC pass-through, and embedded HD lossless audio formats. DDC communication of EDID and HDCP is continuously maintained between a source and display, ensuring direct compatibility and optimal signal transmission between devices.

For installation flexibility, the DTP HDMI 4K 330 transmitter or receiver can be remotely powered over the shielded twisted pair cable by a DTP 330-enabled product. The twisted pair extender also supports simultaneous transmission of bidirectional RS-232 and IR signals from a control system for AV device control. The DTP HDMI 4K 330 can be integrated with an Extron DTP CrossPoint® 84 Presentation Matrix Switcher, or other DTP 330-enabled products to support sources, plus displays and other output devices at remote locations.

APPLICATION DIAGRAM



SPECIFICATIONS

TRUE 4K SPECIFICATION

Max 4K Capabilities		
Resolution and Refresh Rate	**Chroma Sampling**	**Max Bit Depth per Color**
4096 x 2160 at 30 Hz 3840 x 2160 at 30 Hz	4:4:4	8 bit
4096 x 2160 at 60 Hz 3840 x 2160 at 60 Hz	4:2:0	

Frame rate[1]	24, 25, 30, 50, or 60 fps
Chroma sampling[1]	4:4:4, 4:2:2, or 4:2:0
Color bit depth[1]	8 bits per color
Signal type	HDMI 1.4, HDCP 2.2
Max. video data rate	10.2 Gbps (3.4 Gbps per color)

NOTE: [1]Subject to the maximum data rate limit. Use our calculator (http://www.extron.com/product/videotools.aspx) to determine video parameters supported by this data rate.

VIDEO INPUT — TRANSMITTER

Connectors	1 female HDMI type A

INTERCONNECTION BETWEEN TRANSMITTER AND RECEIVER

Signal transmission distance	
1080p @ 60 Hz	Up to 330' (100 m) using shielded twisted pair (STP) cable or XTP DTP 24 STP cable
2560x1600 @ 60 Hz	Up to 330' (100 m) using shielded twisted pair (STP) cable or XTP DTP 24 STP cable
4K/UHD @ 30Hz and 60 Hz	Up to 330' (100 m) using shielded twisted pair (STP) cable or XTP DTP 24 STP cable
Cable requirements	Solid conductor, 24 AWG or better
Cable recommendations	400 MHz bandwidth, STP (shielded twisted pair)

NOTE: Extron XTP DTP 24 shielded twisted pair cable is strongly recommended for optimal performance.

VIDEO OUTPUT — RECEIVER

Connectors	1 female HDMI type A

AUDIO INPUT

Number/signal type	1 PC level stereo, unbalanced

NOTE: Analog audio is not embedded onto the digital video signal. Embedded digital audio is not de-embedded from the digital video signal.

AUDIO OUTPUT

Number/signal type	1 stereo (2 channel), balanced/unbalanced

GENERAL

Power supply	External Input: 100-240 VAC, 50-60 Hz Output: 12 VDC, 1 A, 12 watts

Model	Version Description	Part number
DTP HDMI 4K 330 Tx	HDMI Tx - 330 feet (100 m)	60-1331-12
DTP HDMI 4K 330 Rx	HDMI Rx - 330 feet (100 m)	60-1331-13

Decorator Style Models

Model	Version Description	Part number
DTP HDMI 4K 330 D Tx	Decorator-Style Tx, Black - 330 feet (100 m)	60-1464-12
DTP HDMI 4K 330 D Tx	Decorator-Style Tx, White - 330 feet (100 m)	60-1464-13
DTP HDMI 4K 330 D Rx	Decorator-Style Rx, Black - 330 feet (100 m)	60-1464-22
DTP HDMI 4K 330 D Rx	Decorator-Style Rx, White - 330 feet (100 m)	60-1464-23

For complete specifications, please go to www.extron.com
Specifications are subject to change without notice.

04-2017
68-2416-01
REV. A3
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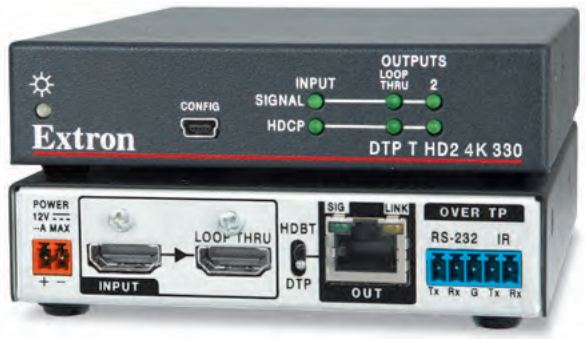
DTP T HD2 4K 330

LONG DISTANCE DTP TRANSMITTER FOR HDMI WITH INPUT LOOP-THROUGH

DTP SYSTEMS 4K UHD



- **Transmits HDMI plus control up to 330 feet (100 meters) over a shielded CATx cable**
- **Supports computer and video resolutions up to 4K, including 1080p/60 Deep Color**
- **Buffered HDMI input loop-through**
- **Extron XTP DTP 24 shielded twisted pair cable is strongly recommended for optimal performance**
- **DTP® output is compatible with HDBaseT-enabled devices**
- **Bidirectional RS-232 and IR pass-through for AV device control**
- **Remote power capability**
- **Supported HDMI specification features include data rates up to 10.2 Gbps, Deep Color up to 12-bit, 3D, and HD lossless audio formats**
- **Key Minder®**
- **EDID Minder®**
- **Compatible with all DTP 330 Series receivers and DTP 330-enabled products**
- **Rack-mountable 1" (2.5 cm) high, quarter rack width metal enclosure**
- **Highly reliable, energy-efficient external universal power supply included**

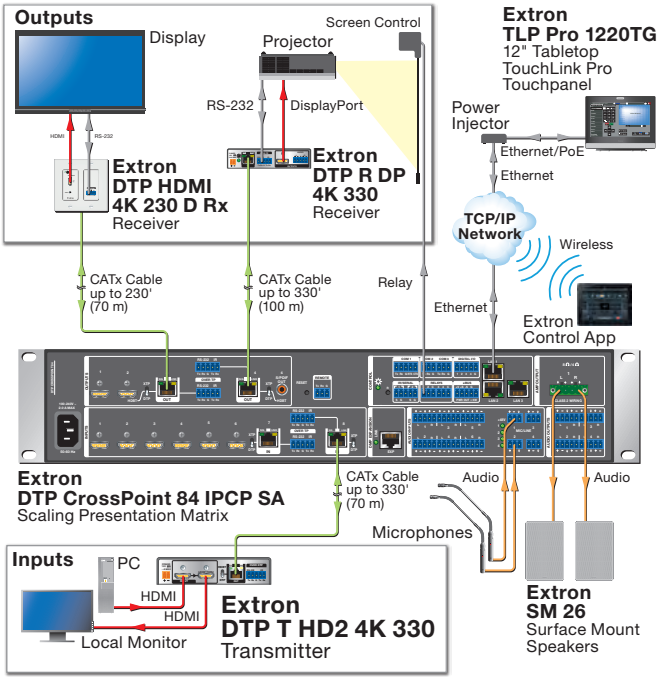
The Extron DTP T HD2 4K 330 transmitter sends HDMI with embedded audio, plus bidirectional control signals up to 330 feet (100 meters) over a shielded CATx cable to Extron DTP® 330-enabled products. The HDCP-compliant transmitter includes several integrator-friendly features that streamline installation. Its compact enclosure enables discreet installation in a wide variety of applications.

DESCRIPTION

The Extron **DTP T HD2 4K 330** is a long distance transmitter for sending HDMI with embedded audio, and bidirectional RS-232 and IR signals up to 330 feet (100 meters) over a shielded CATx cable to Extron DTP 330-enabled products. It provides one HDMI input with loop-through to support local monitoring of digital video, and one DTP output. The DTP T HD2 4K 330 supports video signals at resolutions up to 4K, including 1080p/60 Deep Color. It offers many integrator-friendly features such as EDID Minder, Key Minder, bidirectional RS-232 and IR pass-through for remote AV device control, and compatibility with HDBaseT-enabled devices. The compact enclosure size and remote power capability make the DTP T HD2 4K 330 ideal for discreet placement in lecterns, beneath tables, or wherever needed to meet application requirements.

To enhance and simplify integration, the DTP T HD2 4K 330 includes automatic input cable equalization and automatic color bit depth management. It also offers an HDBaseT output mode for sending digital video and embedded audio, plus bidirectional control signals to any HDBaseT-enabled display. The DTP T HD2 4K 330 can be integrated with an Extron DTP CrossPoint® Presentation Matrix Switcher, or other DTP 330-enabled products to support sources at remote locations.

APPLICATION DIAGRAM



SPECIFICATIONS

TRUE 4K SPECIFICATION

Max. 4K Capabilities		
Resolution and Frame Rate	**Chroma Sampling**	**Max Bit Depth per Color**
4096 x 2160 at 30 Hz 3840 x 2160 at 30 Hz	4:4:4	8 bit
4096 x 2160 at 60 Hz 3840 x 2160 at 60 Hz	4:2:0	

Frame rate[1]	24, 25, 30, 50, or 60 fps
Chroma sampling[1]	4:4:4, 4:2:2, or 4:2:0
Color bit depth[1]	8 bits per color
Signal type	HDMI, HDCP
Max. video data rate	10.2 Gbps (3.4 Gbps per color)

NOTE: [1]Subject to the maximum data rate limit. Use our calculator (http://www.extron.com/product/videotools.aspx) to determine video parameters supported by this data rate.

INTERCONNECTION BETWEEN TRANSMITTER AND RECEIVER

Connector	1 RJ-45 jack
Signal transmission distance	
1080p @ 60 Hz	Up to 330' (100 m) using shielded twisted pair (STP) cable or XTP DTP 24 cable
2560x1600 @ 60 Hz	Up to 330' (100 m) using STP cable or XTP DTP 24 cable
4K/UHD @ 30Hz and 60 Hz	Up to 330' (100 m) using STP cable or XTP DTP 24 cable
Cable requirements	Solid conductor, 24 AWG or better
Cable recommendations	400 MHz bandwidth, STP (shielded twisted pair)

NOTE: Extron XTP DTP 24 shielded twisted pair cable is strongly recommended for optimal performance.

NOTE: Output mode signaling:

DTP: HDMI with embedded audio, analog audio, RS-232 and IR, and remote power

HDBaseT: HDMI with embedded audio plus RS-232 and IR

CONTROL/REMOTE

USB control port	1 front panel female mini USB B
Program control	Extron Simple Instruction Set (SIS™), Extron Product Configuration Software (PCS)

COMMUNICATIONS — EXTERNAL DEVICE (RS-232/IR OVER TP)

Serial control port	RS-232 via (1) 3.5 mm, 5-pole captive screw connector (connector is shared with IR control ports)
IR pass-through control port	(1) 3.5 mm, 5-pole captive screw connector (connector is shared with RS-232 control port) TTL level (0 to 5 V) modulated infrared control from 30 kHz up to 60 kHz

GENERAL

Power supply	External Input: 100-240 VAC, 50-60 Hz Output: 12 VDC, 1 A, 12 watts
Enclosure dimensions	1.0" H x 4.3" W x 6.0" D (1" high, 1/4 rack wide) 2.5 cm H x 10.9 cm W x 15.2 cm D (depth excludes connectors)
Regulatory compliance	
Safety	CE, c-UL, UL
EMI/EMC	CE**, C-tick, FCC Class A**, ICES, VCCI

Model	Version Description	Part number
DTP T HD2 4K 330	HDMI Tx - 330 feet (100 m)	60-1491-52

For complete specifications, please go to www.extron.com
Specifications are subject to change without notice.

10-2015
68-2813-01
REV. A1
Letter - English - NP

USB Extender Plus Series

TWISTED PAIR EXTENDER FOR USB PERIPHERALS

Extend and switch USB peripherals between multiple locations

- Extends USB peripherals up to 1,980 feet (600 meters) through a Gigabit Ethernet network
- Extends USB peripherals up to 330 feet (100 meters) point-to-point over one CATx cable
- Supports USB 2.0/1.0 devices with data rates up to 480 Mbps
- Choice of rack-mountable and architectural form factors
- USB switching controller lets you easily create USB switching systems

Extron Electronics
INTERFACING, SWITCHING AND CONTROL

Introduction

The USB Extender Plus Series extends and switches USB signals from peripheral devices to a host computer up to 1,980 feet (600 meters) through a Gigabit Ethernet network or up to 330 feet (100 meters) point-to-point over one CATx cable. It supports USB 2.0/1.0 devices with data rates up to 480 Mbps and it is compatible with USB 3.0 devices that can operate at USB 2.0 data rates. The transmitter includes USB peripheral emulation to enable booting a host computer that is not connected to a keyboard or mouse. To simplify device integration, the receiver features a built-in, active four-port hub. The controller provides simple setup and control for creating a distributed USB matrix switching system over a Gigabit Ethernet network. Available in various form factors, the USB Extender Plus Series supports USB peripherals such as keyboards, mice, mass storage devices, and webcams in pro AV environments.

The USB Extender Plus Series is capable of transmitting USB signals long distances over a CATx twisted pair infrastructure. For distances up to 330 feet (100 meters), installation of the USB Extender Plus enables direct connection of USB peripherals to the remote host computer without needing additional IP network drops, equipment, software, or drivers.

Where longer distances are required or when pairing one transmitter to multiple receivers, the USB Extender Plus Series transmitter and receiver can be connected to a Gigabit Ethernet switch located up to 330 feet (100 meters) away to extend the total distance to 660 feet (200 meters). The signal can be extended through a network of up to five Gigabit Ethernet switches, for a total transmission distance of 1,980 feet (600 meters).

Transmitters and receivers are available in three form factors that can be mixed and matched for optimum integration flexibility. The compact, 1-inch quarter rack width metal enclosure is designed for desktop, under desk, lectern, or rack mounting. The USB Extender Plus AAP model provides convenient and elegant architectural USB connectivity. The USB Extender Plus D is a decorator-style wallplate that fits into a single-gang wall box.

The USB Plus Matrix Controller provides a simple management interface to create USB switching systems using up to 64 USB Extender Plus Series transmitters and receivers. Any AV control processor can easily control USB switching using SIS commands sent via Ethernet or RS-232. The system can be configured quickly and easily using Extron's Product Configuration Software - PCS.

FEATURES

Extends USB peripherals up to 1,980 feet (600 meters) through a Gigabit Ethernet network

Extends USB peripherals over one CATx cable point-to-point up to 330 feet (100 meters)

Supports USB 2.0/1.0 devices with data rates up to 480 Mbps. Compatible with USB 3.0 devices that can operate at USB 2.0 data rates

Enables bulk, control, interrupt, and isochronous transfers as defined by the USB specification.

Receiver features an integrated four-port hub with 5 Volts, 500 mA available on each port

Allows simultaneous connection to multiple peripheral devices such as the Extron Annotator 300, mass storage devices, keyboards, mice, or other HID – Human Interface Devices.

One transmitter can connect to four receivers

Using a Gigabit Ethernet switch, one transmitter can support up to four receivers via an IP network.

Peripheral emulation

Offers increased system reliability by emulating a connection between the host and an HID-compliant keyboard and mouse.

Real-time status LED indicators for troubleshooting and monitoring

Provides visual confirmation of port activity between an active host and each connected peripheral device.

Choice of rack-mountable and architectural form factors

Available in a compact, 1-inch rack-mountable metal enclosure, an AAP - Architectural Adapter Plate, and a single-gang decorator-style wallplate for easy integration into a variety of environments.

USB switching controller lets you easily create USB switching systems

One controller can manage a switcher configuration of up to 64 USB Extender Plus Series transmitters and receivers. Enables the use of serial or IP commands for integration into a control system.

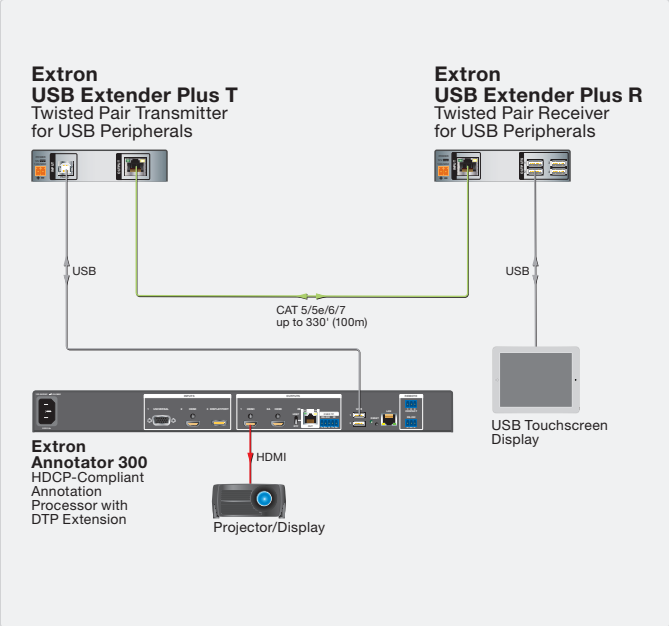
Device class filtering on select models restricts the range of device types to HID and smart card readers - USB Extender Plus HID

Device class filtering prevents unauthorized downloading or uploading of content via the USB port in secure environments. The USB Extender Plus HID is configured at the factory, such that device class filtering cannot be removed or altered in the field.

Highly reliable, energy-efficient external universal power supply included, replacement part #70-775-01

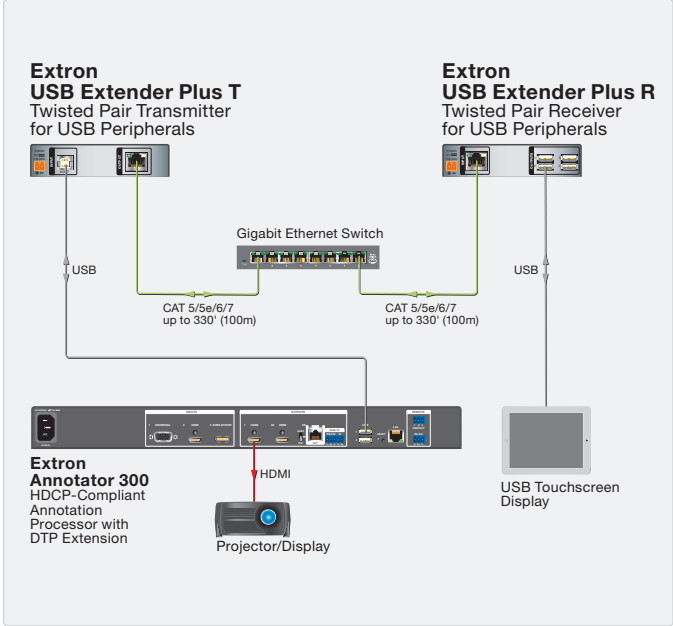
Provides worldwide power compatibility, with high demonstrated reliability and low power consumption for reduced operating costs.

Applications



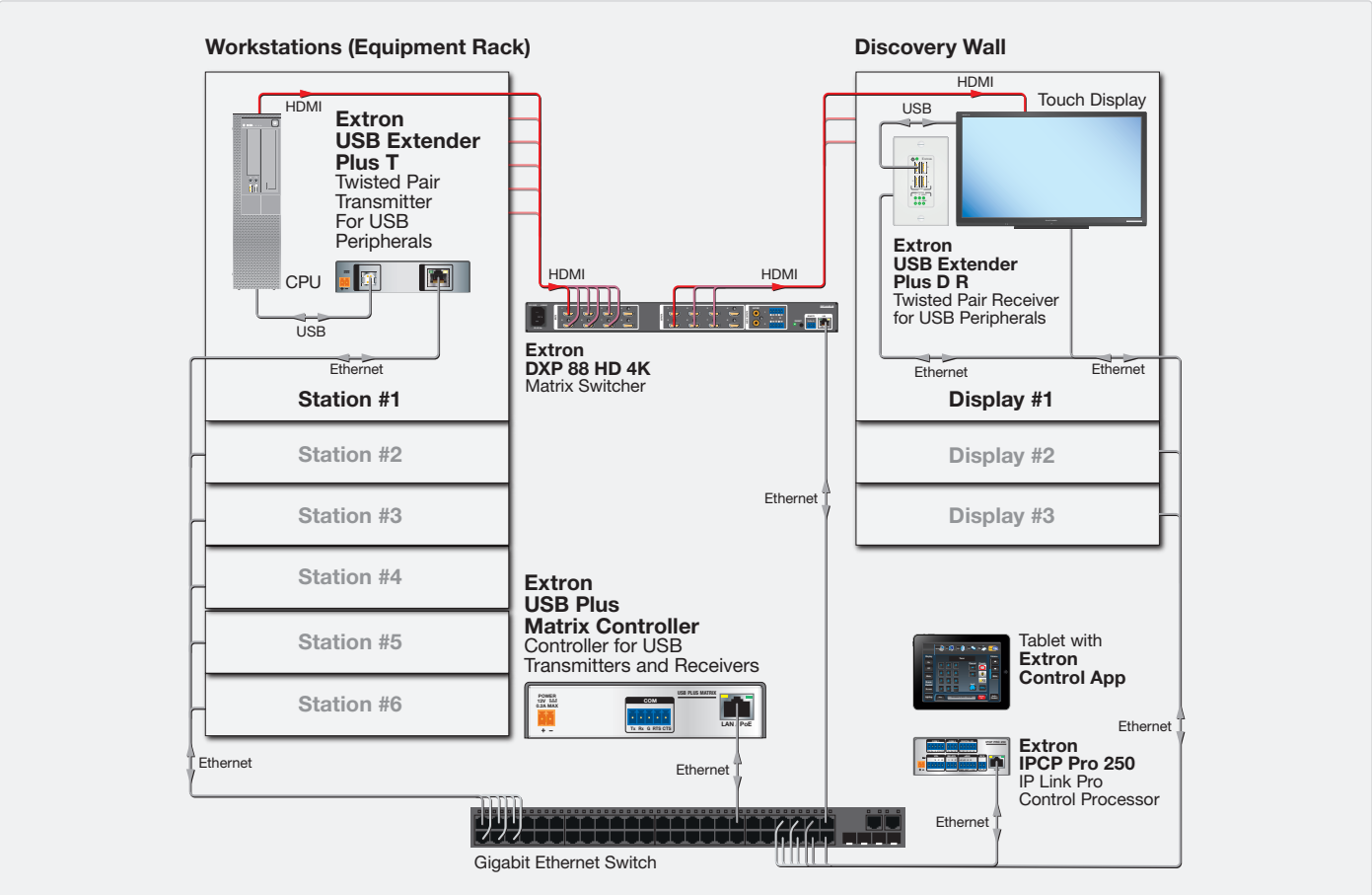
POINT-TO-POINT

A single CATx cable connects any transmitter and receiver up to 330 feet (100 meters) apart.



NETWORKED

CATx cables connect any transmitter and receiver via a Gigabit Ethernet Network, of up to five switches, up to 1,980 feet (600 meters) apart.



SWITCHED

CATx cables connect multiple transmitters and receivers via a Gigabit Ethernet Network, of up to five switches, up to 1,980 feet (600 meters) apart, with connections between the transmitters and receivers dynamically controlled by the USB Plus Matrix Controller.

Specifications

Form factors can be mixed and matched between transmitters and receivers for mounting in all types of furniture and locations.

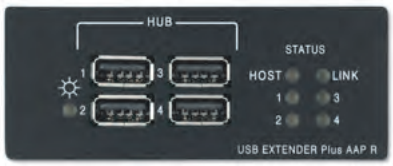
Rack-Mount

USB Extender Plus T

USB Extender Plus R

Architectural Adapter Plates

USB Extender Plus AAP T - Front



USB Extender Plus AAP R - Front

Decorator-Style Wall Plates

USB Extender Plus D T - Front

USB Extender Plus D R - Front

USB EXTENDER PLUS T/R SERIES	
USB host support	xHCI (USB 3.0), EHCI (USB 2.0), OHCI/UHCI (USB 1.1)
USB data rates	Low speed (1.5 Mbps), full speed (12 Mbps), high speed (480 Mbps)
USB host — Tx units	
Number/signal type	1 USB
USB hub — Rx units	
Number/signal type	(1) 4-port USB hub
Interconnection between transmitter and receiver	
Connectors	1 female RJ-45 per unit
Signal transmission distance	
Point to point	Up to 330' (100 m)
Over the network	Up to 1980' (600 m)**
NOTE: **Over the network distance is through connection of up to five network switches.	
Power supply	External Input: 100-240 VAC, 50-60 Hz Output: 12 VDC, 1 A
Enclosure type	Metal
GENERAL	
Regulatory compliance	
Safety	CE, c-UL, KCC, UL
EMI/EMC	CE, C-tick, FCC Class A, ICES, VCCI Class A
Environmental	Complies with the appropriate requirements of RoHS, WEEE
USB PLUS MATRIX CONTROLLER	
Ethernet control	
Network interface controllers (NICs)	1
Serial control	
Quantity/type	1 bidirectional RS-232
GENERAL	
Power supply	External Input: 100-240 VAC, 50-60 Hz Output: 12 VDC, 1 A, 12 watts
Power consumption	
Device and power supply	2.0 watts, 100-240 VAC, 50-60 Hz
Mounting	
Rack mount	Yes, with optional 1U rack shelf or back of the rack mounting kit
Furniture mount	Yes, with optional bracket kit
Enclosure type	Metal
Warranty	3 years parts and labor
NOTE: All nominal levels are at ±10%.	

Model	Version Description	Part number
USB Extender Plus T	Transmitter	60-1471-12
USB Extender Plus R	Receiver	60-1471-13
USB Extender Plus D T	Transmitter - Decorator-Style Version - White	60-1473-13
USB Extender Plus D R	Receiver - Decorator-Style Version - White	60-1473-23
USB Extender Plus AAP T	Transmitter - AAP Version - Black	60-1472-12
USB Extender Plus AAP R	Receiver - AAP Version - Black	60-1472-22
USB Extender Plus AAP R	Receiver - AAP Version - White	60-1472-23
USB Extender Plus T HID	HID Transmitter	60-1539-12
USB Extender Plus R HID	HID Receiver	60-1539-13
USB Plus Matrix Controller	Controller	42-267-01

For complete specifications, please go to www.extron.com
Specifications are subject to change without notice.

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www.extron.com

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EQUIPMENT FOR

AV.06 We Shall Remain

Empowered by Innovation NEC

NEC Large E Series

Commercial-Grade

- LED backlighting delivers both environmental and economic benefits
- Temperature sensors and fans protect the panel from damage
- High definition, and contrast ratio deliver superior visual quality
- Internal 10W speakers and built-in handles enable a simplified installation

Connected

- Comprehensive input panel connects to latest peripherals
- Full bi-directional RS-232 control and ethernet control allow individual and group-addressable control, including email diagnostics
- Compatibility with NEC control software PD Comms Tool and NaViSet Administrator 2
- Custom input detect feature to prioritize active inputs
- Expanded terminal interface including 2 HDMI, DisplayPort, DVI and VGA options

Adaptable

- Flexible connectivity with built-in OPS expansion slot for maximum versatility
- Extensive control and diagnostic communication provide the highest level of remote management
- IR and Button Lock options for protecting against unnecessary setting changes

FULL HD 1080p

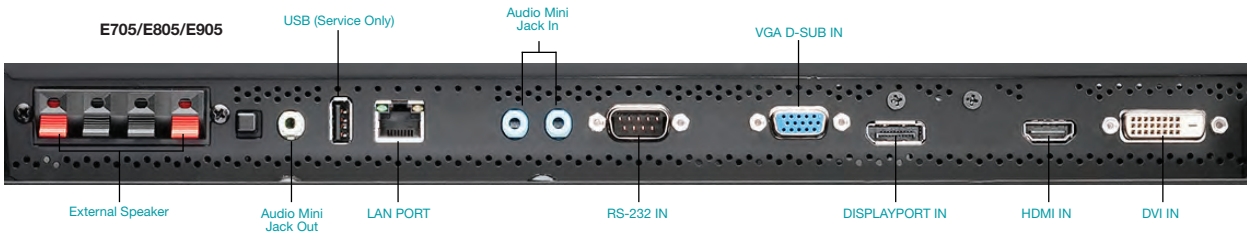
LED Backlit LCD

www.necdisplay.com

Specifications for E705/E805/E905

MODEL	E705	E805	E905
LCD MODULE			
Panel Technology	UV²A	UV²A	UV²A
Viewable Image Size	70"	80"	90"
Native Resolution	1920 x 1080		
Brightness (Typical/Max)	360/450 cd/m²	280/350 cd/m²	280/350 cd/m²
Contrast Ratio (Typical)	4000:1	5000:1	5000:1
Viewing Angle	176° Vert. / 176 Hor.(88U/88D/88L/88R) @CR>10	176° Vert. / 176 Hor.(88U/88D/88L/88R) @CR>10	176° Vert. / 176 Hor.(88U/88D/88L/88R) @CR>10
Aspect Ratio	16:9		
Active Screen Area (W x H)	60.6 x 34.1in. / 1538.9 x 865.6mm	69.7 x 39.2 in. / 1771.2 x 996.3mm	78.5 x 44.1 in. / 1923.0 x 1121.0mm
Displayable Colors	More than 16.7 million	More than 1.07 billion	More than 1.07 billion
CONNECTIVITY			
Input Terminals			
Digital	Displayport, HDMI x2, DVI		
Analog	VGA 15-pin D-sub		
Audio	Audio Mini-Jack x2		
External Control	Ethernet (RJ45), RS-232C		
Other	USB (Service Port Only)		
Output Terminals			
Audio	Audio Mini-Jack, External Speaker Jack x2		
Digital Tuner	SB-03TM included in OPS slot for -AVT models		
Speakers	Integrated (10W x 2)		
POWER CONSUMPTION			
On (Typical)	150W	235W	270W
Power Saving Mode	<2.5W		
PHYSICAL SPECIFICATIONS			
Bezel Width (L/R, T/B)	0.9/0.9, 0.9/0.9 in. / 23.0/23.0, 23.0/23.0 mm	1.2/1.2, 1.2/1.2 in. / 29.7/29.7, 29.7/29.7mm	1.2/1.2, 1.2/1.2 in. / 29.7/29.7, 29.7/29.7mm
Net Dimensions (without stand; WxHxD)	62.5 x 36.2 x 3.4 in. / 1587.0 x 919.6 x 86.9 mm	72.3 x 41.8 x 3.4 in. / 1836.2 x 1061.3 x 86.9mm	81.0 x 46.7 x 4.9 in. / 2058.4 x 1186.4 x 123.2 mm
Net Weight (without stand)	103.4lbs / 47.0 kg	135.3lbs / 61.5 kg	178.6lbs / 81.0kg
VESA Hole Configuration	400 x 400mm (4-hole)		
ENVIRONMENTAL CONDITIONS			
Operating Temperature	32°-104°F / 0°-40°C		
Operating Humidity	20 - 80%		
Operating Altitude	9843 ft. / 3000m		
LIMITED WARRANTY	3 years parts and labor, including backlight*		
ADDITIONAL FEATURES	Integrated temperature sensors, thermodynamic cooling fans, Ethernet Control and Communication, RS-232C Control and Communication, AMX Beacon Compatible, Crestron Connected Compatible, Carbon Footprint Meter, Full 24/7 Scheduler Function, PIP/POP/Side by Side settings, Input Labeling, Built-In Speakers, OPS-Compliant Slot, Custom Input Detect Modes, NaViSet Administrator 2 Compatible, NEC PD Comms Tool Compatible, IR Lock Settings, Button Lock , Fixed/Variable Audio Out		
SHIPS WITH	Power Cord, 1.8m DVI-D Cable, Wireless Remote Control, Batteries, CD-ROM, Setup Manual		
OPTIONAL ACCESSORIES			
Single Board Computers	All NEC OPS-based computers		
Other	SB-03TM (Digital Tuner included in -AVT models), ST-801 (stand), SP-TF1 (thin rear or side-mounted speakers, 15W x 2), SB-01HC (OPS HD-SDI Card), SB-04HC (OPS 3G-SDI Card), ARM based Digital Media Player (OPS-DRD), Large Wall Mount (WMK-6598),OPS HDBaseT Receiver (SB-07BC)		

* Warranty restrictions apply. Contact your representative for details.



NEC Display Solutions
500 Park Boulevard, Suite 1100
Itasca, IL 60143
866-NEC-MORE

BrightSign®

BRIGHTSIGN HD

AN UPDATED CLASSIC.
MAINSTREAM PERFORMANCE.

BrightSign HD models are ideal for mainstream Full HD and HTML5 applications that require high reliability and ease of use. All models offer H.265 decoding, HTML5 rendering with mainstream performance, and Gigabit Ethernet. Robust interactive controls, live content features, BrightWall™ and Mosaic Mode make this set of players a perfect fit for a wide range of applications.

BrightSign HD223

Standard I/O Player

Enjoy flawless Full HD single video decoding, mainstream HTML5 performance and simultaneous playback from local, networked and streaming sources. Includes the standard I/O package of Gigabit Ethernet, GPIO, and analog/digital audio.

Price: $350

BrightSign HD1023

Expanded I/O Player

All the features of the HD223 plus additional interactive options via USB 2.0 (type A), and serial ports to fully engage your audience.

Price: $450

Features

- H.265
- 1080p60 single decode
- Mainstream HTML5
- IP Streaming
- BrightBeacon™
- BrightWall™
- AutoWall™
- Zones
- BrightPlates™
- Interactive
- Live Feeds
- Geo-Fencing
- Tagging
- BrightSign App
- Sign Preview
- Remote Snapshot
- B-Deploy
- IP Streaming Server
- Digital Audio
- Mosaic Mode

BrightSign®

SPECIFICATIONS

MODEL	HD223	HD1023
VIDEO ENGINE DECODER		
Single 1080p60 video decoding	X	X
MEDIA FORMATS		
Video Codecs: H.265, H.264(MPEG-4, Part 10), MPEG-2, MPEG-1	X	X
Video Containers: .ts, .mpg, .vob, .mov, .mp4, .m2ts, .wmv	X	X
Images: BMP, JPEG, PNG	X	X
Audio: MP2, MP3, AAC, and WAV (AC3 is passed through)	X	X
HTML5	X (Mainstream)	
DISPLAY RESOLUTIONS		
1920x1080x24/25/29.92/30/50/59.94/60p, 1920x1080x50/59.94/60i, 1600x1200x60p, 1440x1050x60/75p, 1440x900x60/75p, 1360x768x60p, 1280x1024x60/75p, 1280x960x60p, 1280x800x60p/75p, 1280x768x60p, 1280x720x50/59.94/60p, 1024x768x60p, 800x600x60/75p, 720x576x50p/50i, 720x480x59.94/60p/60i, 640x480x60p	X	X
HARDWARE INTERFACES		
External micro SD Slot (SDHC and SDXC); SDHC storage up to 32GB SDXC storage up to 2TB	X	X
USB High Speed Host Port (also supports content updates)		X (Type A)
Phoenix GPIO Port (12-pin bi-directional)	X	X
3.5mm RS-232 Serial Port		X
3.5mm Audio Out (analog -or- SPDIF digital, non-simultaneous)	X	X
HDMI 1.4a Out	X	X
Ethernet	X (Gigabit)	
M.2 (E) Keyed Wi-Fi/Bluetooth Connector	X	X
Wi-Fi External Antenna Connector (optional)	X	X
Status LEDs	Power, Error, Busy, Update	
Reset and Service Buttons	X	X
Real Time Clock	X	X
FEATURES		
H.265 Decoding: smaller file sizes and lower bitrates than H.264	X	X
HTML5: hardware-accelerated engine that plays modular HTML assets flawlessly alongside high-bandwidth video	X (Mainstream)	
BrightBeacon™: 2-way Bluetooth/Beacon communication between mobile devices & signage (requires: wireless/ Bluetooth module)	X	X
BrightWall™: synchronized playback across multiple displays	X	X
AutoWall™: embraces the power of HTML5 to create unique multimedia video walls	X	X

MODEL	HD223	HD1023
Zones: playback multiple content types on a single screen	X	X
Mosaic Mode: simultaneously play a multitude of smaller resolution videos that add up to the maximum video resolution of the player	X	X
IP Streaming: play streaming media	X	X
IP Streaming Server: serve IP streams from local storage	X	X
Interactivity: connect virtually any type of interactive device to a multitude of interactive ports	X (GPIO, UDP)	X (GPIO, USB, serial, UDP)
Live Feeds: Live Data, Live Text, MRSS, Twitter, Flickr, etc.	X	X
Tagging: BrightSign Network users can assign media and player tags for highly targeted content distribution	X	X
BrightSign App: update signs with an iOS device	X	X
Geo-Fencing: trigger playback based on location (requires USB dongle)		X
Sign Preview: preview presentation playback in BrightAuthor	X	X
Remote Snapshot: remotely view a snapshot image of the display's playback	X	X
BrightPlates™: easy template-based sign creation service	X	X
Networking: update, manage and schedule your signage	X	X
B-deploy: A setup feature to deploy many players at once	X	X
Extended Thermal: supports ambient temperatures between 0° & 70° C at 90% max relative humidity, non-condensing	X	X
SOFTWARE		
Free BrightAuthor Software	X	X
BrightSign Networking Options	X	X
ACCESSORIES		
USB Button Pads		X
Wireless/Bluetooth Module	X	X
MicroSD Class 10 Cards (various capacities)	X	X
MISCELLANEOUS		
Dimensions (W x H x D)	*159.9 x 22 x 144.2mm or 6.3 x 0.87 x 5.7 in*	
Weight	12 oz	
Power	12V / 1.5A (18 Watts)	
Multi-Country Power & Regulatory Approvals	X	X
Built-in Wall Mounting Brackets	X	X
1 year warranty, parts and labor	X	X

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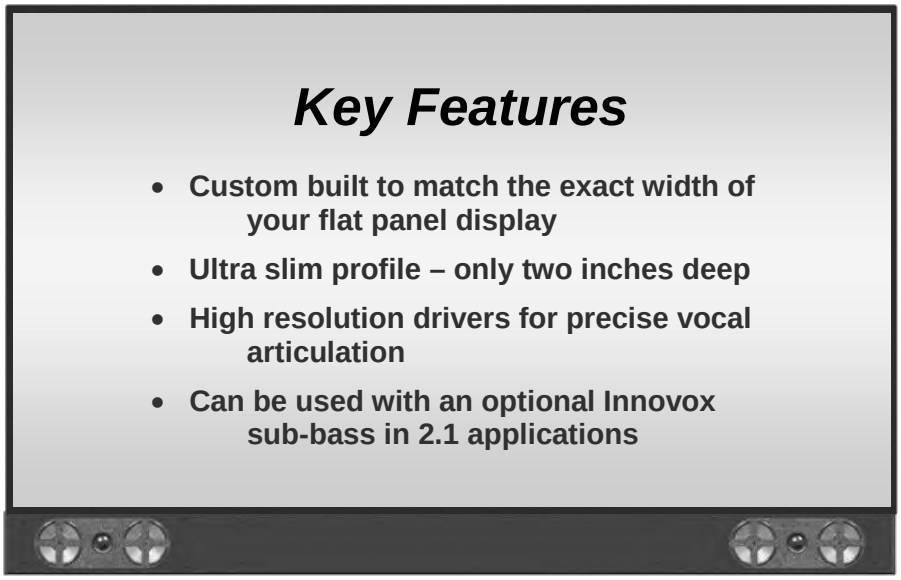
AMERICAN LOUDSPEAKER INNOVATION

FLEX SELECT Series –

FS-H2

Key Features

- **Custom built to match the exact width of your flat panel display**
- **Ultra slim profile – only two inches deep**
- **High resolution drivers for precise vocal articulation**
- **Can be used with an optional Innovox sub-bass in 2.1 applications**



(shown without grille)

DESCRIPTION

The ***Flex Select*** Model **FS-H2** is an ultra slim two-channel horizontal loudspeaker designed to mate with flat panel video displays. It has been developed for applications where the budget allows the use of separate amplifiers external to video displays. Carefully selected drivers are employed with sophisticated filter networks to take full advantage of the reserve power available with separate amplifiers to optimize performance and SPL in a slim profile. Nominal coverage angle is 100° H x 120° V. Configuration per channel includes two 3.5” long-excursion LF drivers and one .75" textile dome HF driver.

NOMINAL DATA

Frequency Response	120 – 20,000 Hz, ± 3 dB
Sensitivity	90 dB @ 2.83 volts / 1M
Impedance	8 Ω
Power Handling	90 W long term (AES-2) (per channel)
Maximum Output	103 dB long term; 109 dB peak
Nominal Coverage Angles	100° H x 120° V
Dimensions	height: 4.13 “ width: (custom: 34.0 – 96.0“) depth: 2.06 ”
Net Weight	12-15 lbs (depending on length)
Shipping Weight	15-17 lbs (depending on length)

DESCRIPTIVE DATA

System Configuration	2-channel 2-way full-range for music / speech
Components & Loading (per channel)	(2) 3.5 ” long-throw woofers; (1) 0.75“ tweeter
Recommended High-Pass Filter	On-board 1st order @ 120 Hz; no outboard HP needed
Enclosure Type	Low profile sealed enclosure
Enclosure Material	Extruded ABS plastic with steel baffle insert
Finish	Black is standard; (custom colors available)
Connectors	Phoenix
Grille	Integral fabric wrap

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PROUDLY MADE IN THE U.S.A.

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AMERICAN LOUDSPEAKER INNOVATION

Micro-Sub Series –

Micro-Sub 6 iw

DESCRIPTION

The **Micro-Sub 6 iw** is a high definition subwoofer designed for permanent in-wall installation. It uses a 6" low frequency driver in a very compact sealed enclosure which fits within a standard 2 x 4 stud space.

Working in conjunction with external DSP processing, it achieves maximum bass output from a minimum enclosure size. DSP options include an Innovox proprietary powered system processor, or DSP configurations from our free library for Biamp, BSS and Symetrix processors.

The **Micro-Sub 6 iw** complements the Innovox *Slim Line Series* of shallow profile surface-mount loudspeakers and the *Flex-Video Series* of display-mounted loudspeakers. It is also used as a low-bass component in extended range distributed audio systems

(shown without grille)

KEY FEATURES:

- fits in standard 2 x 4 wall space
- excellent transient response
- 45 Hz low frequency extension
- minimal 4.1-inch depth

APPLICATIONS:

- theme venues and restaurants
- boardrooms
- video presentation / program audio
- retail spaces

NOMINAL DATA

Frequency Response	45 – 350 Hz ± 3 dB
Impedance	8 Ω
Power Handling (AES-2)	175 W long term program
Maximum Output	102 dB long term; 108 dB peak
Dimensions	height: 10.33" / 262 mm width: 14.43" / 367 mm depth w/ grille: 4.12" / 105 mm depth, no grille: 3.92" / 100mm
Net Weight	10 lbs / 22.0 kg
Shipping Weight	12 lbs / 26.4.1 kg

DESCRIPTIVE DATA

System Configuration	Dedicated low frequency
Components & Loading	(1) 6 " LF driver, sealed
Recommended High-Pass Filter	4th order Butterworth @ 40 Hz
Cabinet Type	Rectangular with flange for wall-mount
Enclosure Material	Hardwood multi-ply plywood
Finish	Black or White (custom colors available)
Connectors	Dual binding head screws
Suspension Hardware	(2) wall-mount brackets
Grille	Powder-coated perforated steel standard

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MADE IN THE U.S.A.

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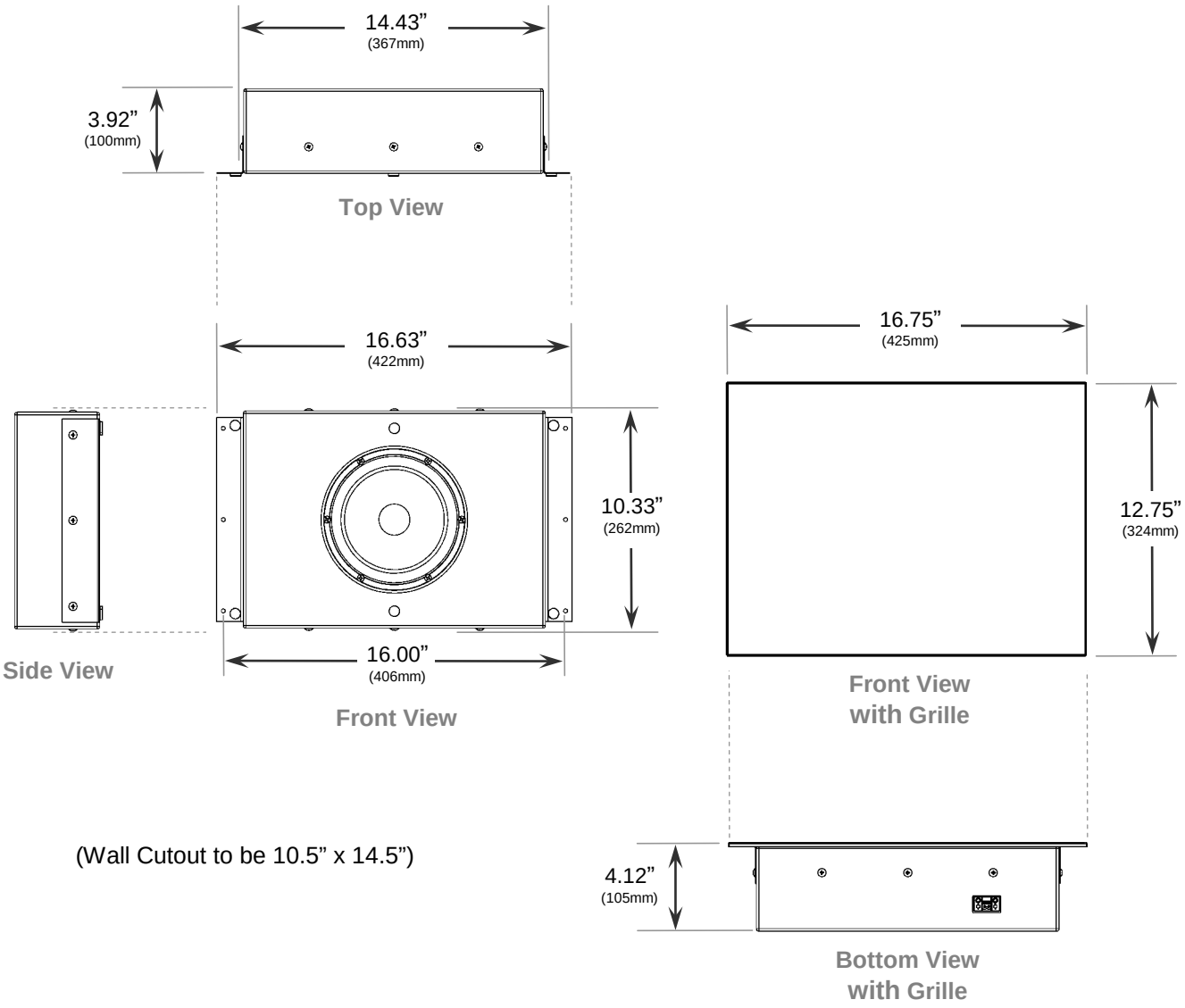
AMERICAN LOUDSPEAKER INNOVATION

Micro-Sub Series –

Micro-Sub 6 iw

DIMENSIONAL DRAWINGS



(Wall Cutout to be 10.5” x 14.5”)

296 North Pascal Street
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MADE IN THE U.S.A.

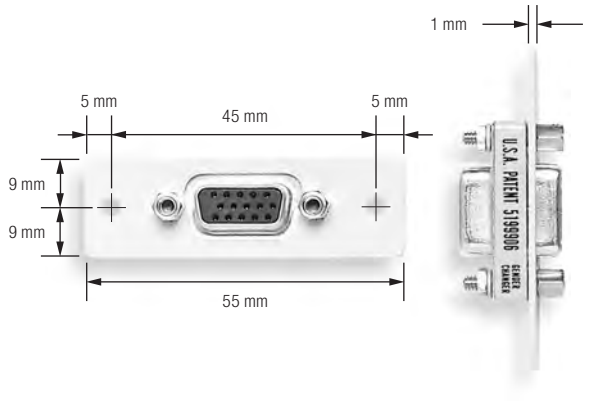
MAAP - Mini Architectural Adapter Plates

AV, Data, Power, and Control Connectivity for Wall Mount, Furniture Mount, and Floor Mount Applications

DESCRIPTION

Extron **Mini Architectural Adapter Plates** are optional mounting plates designed to work with our installation interfaces, installation distribution amplifiers, wallplates, floor plates, rack plates, and other products that feature MAAP openings. Over 100 different MAAPs are available featuring popular video, audio, phone, data, computer, and control connectors. There are also MAAPs available with silkscreen labels of the most common pass-through connections and blank MAAPs to fill empty slots.

Custom engraving is available for an additional charge. See http://www.extron.com/engraving or contact your Extron Customer Support Representative.



Video MAAPs

One HDMI Female to One HDMI Female on 10" Pigtail

Type: Quick Connect
Size: Single Space

COLOR	PART #
Black	70-617-12
White	70-617-13
RAL9010 White	70-617-15

One HDMI Female to Female Barrel

Type: Barrel
Size: Single Space

COLOR	PART #
Black	70-617-02

One DisplayPort Female to One DisplayPort Female on 10" Pigtail

Type: Quick Connect
Size: Single Space

COLOR	PART #
Black	70-676-12
White	70-676-13
RAL9010 White	70-676-15

Video MAAPs

One DVI-I Female to One DVI-I Female on 10" Pigtail, One 3.5 mm Stereo Mini Jack to Solder Tabs

Type: Quick Connect & Installation
Size: Triple Space

COLOR	PART #
Black	70-717-02
White	70-717-03
RAL9010 White	70-717-05

One BNC Female to Female Barrel

Shown with engraving

Type: Barrel/Adapter
Size: Single Space
Optional Silkscreen: "VIDEO"

COLOR	PART #
Black	70-286-11
Black with Silkscreen	70-286-12
White	70-286-21
White with Silkscreen	70-286-22
RAL9010 White	70-286-51
RAL9010 White with Silkscreen	70-286-52

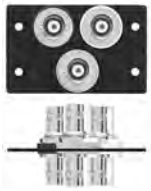
Two BNC Female to Female Barrels

Type: Barrel/Adapter
Size: Single Space

COLOR	PART #
Black	70-286-13
White	70-286-23

Video MAAPs

Three BNC Female to Female Barrels



Type: Barrel/Adapter
Size: Double Space

COLOR	PART #
Black	70-440-11
White	70-440-21
RAL9010 White	70-440-51

One S-Video Female to Female Barrel

Type: Barrel/Adapter
Size: Single Space

COLOR	PART #
Black	70-287-12
White	70-287-22

One S-Video Female to Two BNC Female on 4" Pigtails

Type: Quick Connect
Size: Single Space

COLOR	PART #
Black	70-287-14
White	70-287-24
RAL9010 White	70-287-54

One S-Video Female to Captive Screw Terminal

Type: Quick Connect
Size: Double Space

COLOR	PART #
Black	70-287-13
White	70-287-23

Two S-Video Female to Female Barrels

Type: Barrel/Adapter
Size: Single Space

COLOR	PART #
Black	70-287-15
White	70-287-25
RAL9010 White	70-287-55

Video MAAPs

One RCA Female to Female Barrel

Type: Barrel/Adapter
Size: Single Space

COLOR	PART #
Black	70-289-11
White	70-289-21

One RCA Female to BNC Female Adapter

Type: Barrel/Adapter
Size: Single Space

COLOR	PART #
Black	70-290-11
White	70-290-21
RAL9010 White	70-290-51

One F-Connector Female to Female Barrel

Type: Barrel/Adapter
Size: Single Space

COLOR	PART #
Black	70-291-11
White	70-291-21

Two F-Connector Female to Female Barrels

Type: Barrel/Adapter
Size: Single Space

COLOR	PART #
Black	70-291-12
White	70-291-22
RAL9010 White	70-291-52

Audio/Video MAAPs

One HDMI Female to One HDMI Female on 10" Pigtail

Type: Quick Connect
Size: Single Space

COLOR	PART #
Black	70-617-12
White	70-617-13
RAL9010 White	70-617-15

One HDMI Female to Female Barrel

Type: Barrel
Size: Single Space

COLOR	PART #
Black	70-617-02

One DVI-I Female to One DVI-I Female on 10" Pigtail, One 3.5 mm Stereo Mini Jack to Solder Tabs

Type: Quick Connect & Installation
Size: Triple Space

COLOR	PART #
Black	70-717-02
White	70-717-03
RAL9010 White	70-717-05

One BNC Female to Female Barrel, One 3.5 mm Stereo Mini Jack to Solder Tabs

Type: Barrel & Installation
Size: Single Space

COLOR	PART #
Black	70-301-11

One BNC Female to Female Barrel, Two RCA Female to BNC Female Adapters

Type: Barrel/Adapter
Size: Double Space

COLOR	PART #
Black	70-439-12
White	70-439-22
RAL9010 White	70-439-52

Audio/Video MAAPs

One RCA Female to Female Barrel, One 3.5 mm Stereo Mini Jack to Solder Tabs

Type: Barrel & Installation
Size: Single Space

COLOR	PART #
Black	70-437-11
White	70-437-21
RAL9010 White	70-437-51

One RCA Female to Solder Cups - Video, Yellow; One 3.5 mm Stereo Mini Jack to Solder Tabs

Type: Installation
Size: Single Space

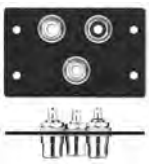
COLOR	PART #
Black	70-303-11
White	70-303-21
RAL9010 White	70-303-51

Two RCA Female to Solder Cups - Audio, Red / White; One RCA Female to Solder Cup - Video, Yellow

Type: Installation
Size: Single Space

COLOR	PART #
Black	70-300-11
White	70-300-21
RAL9010 White	70-300-51

Two RCA Female to Solder Cups - Audio, Red / White; One RCA Female to Solder Cup - Video, Yellow



Type: Installation
Size: Double Space

COLOR	PART #
Black	70-300-12
White	70-300-22

Three RCA Female to Female Barrels White / Red / Yellow

Shown with silkscreen

Type: Barrel/Adapter
Size: Double Space
Optional Silkscreen: "LEFT", "RIGHT", "VIDEO"

COLOR	PART #
Black	70-289-13
White	70-289-23
RAL9010 White	70-289-53
Black with Silkscreen	70-289-14
White with Silkscreen	70-289-24
RAL9010 White with Silkscreen	70-289-54

Audio/Video MAAPs

One RCA Female to BNC Female Adapter, Two RCA Female to Female Barrels

Type: Barrel/Adapter
Size: Double Space

COLOR	PART #
Black	70-442-12
White	70-442-22
RAL9010 White	70-442-52

Two RCA Female to Captive Screw - Audio, Red / White; One RCA Female to Female Barrel - Video, Yellow

Shown with silkscreen

Type: Quick Connect
Size: Double Space
Optional Silkscreen: "LEFT", "RIGHT", "VIDEO"

COLOR	PART #
Black	70-300-13
RAL9010 White	70-300-53
Black with Silkscreen	70-300-14
White with Silkscreen	70-300-24

One S-Video Female to Female Barrel, One 3.5 mm Stereo Mini Jack to Solder Tabs

Type: Barrel & Installation
Size: Single Space

COLOR	PART #
White	70-438-21

One S-Video Female to Female Barrel, Two RCA Female to BNC Female Adapters

Type: Barrel/Adapter
Size: Double Space

COLOR	PART #
Black	70-443-12
White	70-443-22
RAL9010 White	70-443-52

One S-Video Female to Female Barrel, Two RCA Female to Female Barrels

Type: Barrel/Adapter
Size: Double Space

COLOR	PART #
Black	70-444-12
White	70-444-22
RAL9010 White	70-444-52

Audio/Video MAAPs

One S-Video Female to Female Barrel, Three RCA Female to BNC Female Adapters

Type: Barrel/Adapter
Size: Double Space

COLOR	PART #
Black	70-445-12
White	70-445-22
RAL9010 White	70-445-52

One S-Video Female to Female Barrel, One RCA Female to BNC Female Adapter, Two RCA Female to Female Barrels

Shown with silkscreen

Type: Barrel/Adapter
Size: Double Space
Optional Silkscreen: "S-VIDEO", "VIDEO", "AUDIO", "L", "R"

COLOR	PART #
Black	70-553-11
White	70-553-21
RAL9010 White	70-553-51
Black with Silkscreen	70-553-12
White with Silkscreen	70-553-22
RAL9010 White with Silkscreen	70-553-52

AV Super Module: Two RCA Female to Solder Cups - Audio, Red / White; One RCA Female to Solder Cups - Video, Yellow; One S-Video Female to Bare Wires

Type: Installation
Size: Double Space

COLOR	PART #
Black	70-299-11
White	70-299-21
RAL9010 White	70-299-51

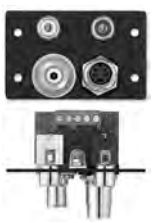
AV Super Module: Two RCA Female to Female Barrels - Audio, Red / White; One RCA Female to Female Barrel - Video, Yellow; One S-Video Female to Female Barrel

Shown with silkscreen

Type: Barrel/Adapter
Size: Double Space
Optional Silkscreen: "S-VIDEO", "VIDEO", "LEFT", "RIGHT"

COLOR	PART #
Black	70-299-12
White	70-299-22
Black with Silkscreen	70-299-13
White with Silkscreen	70-299-23

AV Super Module: Two RCA Female to Captive Screw - Audio, Red / White; One RCA Female to Female Barrel - Video, Yellow; One S-Video Female to Female Barrel



Type: Quick Connect
Size: Double Space

COLOR	PART #
Black	70-299-14
White	70-299-24
RAL9010 White	70-299-54

Audio/Video MAAPs

One 15-pin HD Female to Captive Screw, One 3.5 mm Stereo Mini Jack to Captive Screw; Three RCA Female to Captive Screw

Type: Quick Connect
Size: Triple Space

COLOR	PART #
Black	70-794-02
White	70-794-03
RAL9010 White	70-794-05

Audio MAAPs

One HDMI Female to Female Barrel

Type: Barrel
Size: Single Space

COLOR	PART #
Black	70-617-02

One HDMI Female to One HDMI Female on 10" Pigtail

Type: Quick Connect
Size: Single Space

COLOR	PART #
Black	70-617-12
White	70-617-13
RAL9010 White	70-617-15

One XLR 3-pin Male to Solder Cups - Switchcraft

Type: Installation
Size: Double Space

COLOR	PART #
Black	70-296-14
White	70-296-24
RAL9010 White	70-296-54

One XLR 3-pin Female to Solder Cups - Switchcraft

Type: Installation
Size: Double Space

COLOR	PART #
Black	70-296-13
White	70-296-23

One XLR 3-pin Female to Solder Cups - Neutrik

Type: Installation
Size: Double Space
Optional Silkscreen: "MICROPHONE"

COLOR	PART #
Black	70-296-11
White	70-296-21
RAL9010 White	70-296-51
Black with Silkscreen	70-296-12
White with Silkscreen	70-296-22
RAL9010 White with Silkscreen	70-296-52

Shown with silkscreen

Audio MAAPs

One XLR 3-pin Male to Solder Cups - Neutrik

Type: Installation
Size: Double Space

COLOR	PART #
Black	70-448-12
White	70-448-22
RAL9010 White	70-448-52

One Mini XLR 3-pin Male to Solder Cups - Switchcraft

Type: Installation
Size: Single Space

COLOR	PART #
Black	70-297-11
RAL9010 White	70-297-51

One Mini XLR 3-pin Male to Captive Screw - Switchcraft

Type: Quick Connect
Size: Single Space

COLOR	PART #
Black	70-297-12
White	70-297-22
RAL9010 White	70-297-52

Two Mini XLR 3-pin Male to Solder Cups - Switchcraft

Type: Installation
Size: Single Space

COLOR	PART #
Black	70-297-13

Two RCA Female to Solder Cups - Red / White

Shown with silkscreen

Type: Installation
Size: Single Space
Optional Silkscreen: "LEFT", "RIGHT"

COLOR	PART #
Black	70-292-11
White	70-292-21
Black with Silkscreen	70-292-12
White with Silkscreen	70-292-22

Audio MAAPs

Two RCA Female to Female Barrels - Red / White

Type: Barrel/Adapter
Size: Single Space

COLOR	PART #
Black	70-289-12
White	70-289-22
RAL9010 White	70-289-52

Two RCA Female to Captive Screw Terminal - Red / White

Type: Quick Connect
Size: Single Space

COLOR	PART #
Black	70-292-14
White	70-292-24
RAL9010 White	70-292-54

One 1/4" Female Stereo Phone to Solder Tabs

Type: Installation
Size: Single Space

COLOR	PART #
Black	70-295-11
White	70-295-21

One 1/4" Female Stereo Phone to Captive Screw Terminal

Type: Quick Connect
Size: Single Space

COLOR	PART #
Black	70-295-12

Two 1/4" Female Stereo Phone to Solder Tabs

Type: Installation
Size: Single Space

COLOR	PART #
Black	70-295-13
White	70-295-23

Audio MAAPs

One 3.5 mm Stereo Mini Jack to Solder Tabs

Shown with silkscreen

Type: Installation
Size: Single Space
Optional Silkscreen: "AUDIO"

COLOR	PART #
Black	70-293-11
White	70-293-21
RAL9010 White	70-293-51
Black with Silkscreen	70-293-12
White with Silkscreen	70-293-22
RAL9010 White with Silkscreen	70-293-52

One 3.5 mm Stereo Mini Jack to Captive Screw Terminal

Type: Quick Connect
Size: Single Space

COLOR	PART #
Black	70-293-13
White	70-293-23

Two 3.5 mm Stereo Mini Jack to Solder Tabs

Type: Installation
Size: Single Space

COLOR	PART #
Black	70-293-14
White	70-293-24
RAL9010 White	70-293-54

Two 3.5 mm Stereo Mini Jack to Captive Screw Terminal

Type: Quick Connect
Size: Single Space

COLOR	PART #
Black	70-293-15
White	70-293-25

One Neutrik Speakon Male to Solder Tabs - 4 Pole

Type: Installation
Size: Double Space

COLOR	PART #
Black	70-298-11
White	70-298-21

Control/Computer MAAPs

One USB A Female to One USB A Female on 10" Pigtail

Type: Quick Connect
Size: Single Space

COLOR	PART #
Black	70-455-12
White	70-455-13
RAL9010 White	70-455-15

One USB B Female to One USB A Female on 10" Pigtail

Type: Quick Connect
Size: Single Space

COLOR	PART #
Black	70-459-12
White	70-459-13
RAL9010 White	70-459-15

One DisplayPort Female to One DisplayPort Female on 10" Pigtail

Type: Quick Connect
Size: Single Space

COLOR	PART #
Black	70-676-12
White	70-676-13
RAL9010 White	70-676-15

One DVI-I Female to One DVI-I Female on 10" Pigtail, One 3.5 mm Stereo Mini Jack to Solder Tabs

Type: Quick Connect & Installation
Size: Triple Space

COLOR	PART #
Black	70-717-02
White	70-717-03
RAL9010 White	70-717-05

One 15-pin HD Female to Female Gender Changer

Shown with silkscreen

Type: Barrel/Adapter
Size: Single Space
Optional Silkscreen: "COMPUTER VIDEO"

COLOR	PART #
Black	70-309-11
White	70-309-21
RAL9010 White	70-309-51
Black	70-310-12
White	70-310-22
RAL9010 White	70-310-52

Control/Computer MAAPs

One 15-pin HD Male to Male Gender Changer

Type: Barrel/Adapter
Size: Single Space

COLOR	PART #
Black	70-309-13
White	70-309-23
RAL9010 White	70-309-53

One 15-pin HD Female to Five BNC on 4" Pigtails

Type: Quick Connect
Size: Single Space

COLOR	PART #
Black	70-309-14
White	70-309-24
RAL9010 White	70-309-54

One 15-pin HD Female to Female Gender Changer, One 3.5 mm Stereo Mini Jack to Solder Cups

Shown with silkscreen

Type: Barrel & Installation
Size: Double Space
Optional Silkscreen "COMPUTER VIDEO"

COLOR	PART #
Black	70-433-12
Black with Silkscreen	70-433-13
White	70-433-22
White with Silkscreen	70-433-23
RAL9010 White	70-433-52
RAL9010 White with Silkscreen	70-433-53

One 15-pin HD Female to Captive Screw, One 3.5 mm Stereo Mini Jack to Captive Screw

Shown with silkscreen

Type: Quick Connect
Size: Triple Space
Silkscreen: "COMPUTER", "AUDIO"

COLOR	PART #
Black	70-808-02
White	70-808-03
RAL9010 White	70-808-05

One 9-pin D Female to Female Gender Changer

Type: Barrel/Adapter
Size: Single Space

COLOR	PART #
Black	70-310-11
White	70-310-21
RAL9010 White	70-310-51

Control/Computer MAAPs

One 9-pin D Male to Male Gender Changer

Type: Barrel/Adapter
Size: Single Space

COLOR	PART #
Black	70-310-12
White	70-310-22
RAL9010 White	70-310-52

One 9-pin D Female to Female Gender Changer, One 3.5 mm Stereo Mini Jack to Solder Cups

Type: Barrel & Installation
Size: Double Space

COLOR	PART #
Black	70-434-11
White	70-434-21
RAL9010 White	70-434-51

One USB A Female to One USB B Female on 10" Pigtail

Type: Quick Connect
Size: Single Space

COLOR	PART #
Black	70-383-12
White	70-383-13
RAL9010 White	70-383-15

Two 6-pin Mini DIN Female to Female Barrels - Keyboard / Mouse

Type: Barrel/Adapter
Size: Single Space

COLOR	PART #
Black	70-311-14

One USB A Female to USB B Female Adapter

Type: Barrel/Adapter
Size: Single Space

COLOR	PART #
Black	70-383-11
White	70-383-21

Control/Computer MAAPs

One 6-pin Mini DIN Female to Female Barrel - Keyboard / Mouse

Type: Barrel/Adapter
Size: Single Space

COLOR	PART #
Black	70-311-12
White	70-311-22
RAL9010 White	70-311-52

One USB A Female to Female Barrel

Type: Barrel/Adapter
Size: Single Space

COLOR	PART #
Black	70-455-11

One USB B Female to USB A Female Adapter

Type: Barrel/Adapter
Size: Single Space

COLOR	PART #
Black	70-459-11
White	70-459-21
RAL9010 White	70-459-51

One USB Connector to Captive Screw

Type: Quick Connect
Size: Single Space

COLOR	PART #
Black	70-312-11
White	70-312-21
RAL9010 White	70-312-51

One XLR 4-pin Female to Solder Cups - Neutrik

Type: Installation
Size: Double Space

COLOR	PART #
Black	70-305-11
White	70-305-21
RAL9010 White	70-305-51

Control/Computer MAAPs

One XLR 4-pin Female to Solder Cups - Switchcraft

Type: Installation
Size: Double Space

COLOR	PART #
Black	70-305-12
White	70-305-22
RAL9010 White	70-305-52

One XLR 5-pin Female to Solder Cups - Neutrik

Type: Installation
Size: Double Space

COLOR	PART #
Black	70-305-13
White	70-305-23

One XLR 6-pin Female to Solder Cups - Neutrik

Type: Installation
Size: Double Space

COLOR	PART #
Black	70-305-14
White	70-305-24
RAL9010 White	70-305-54

One Mini XLR 4-pin Male to Solder Cups - Switchcraft

Type: Installation
Size: Single Space

COLOR	PART #
Black	70-307-11
White	70-307-21
RAL9010 White	70-307-51

One Mini XLR 6-pin Male to Solder Cups - Switchcraft

Type: Installation
Size: Single Space

COLOR	PART #
Black	70-307-13

Control/Computer MAAPs

One 5-pin Captive Screw Terminal to Solder Tabs

Type: Installation
Size: Single Space

COLOR	PART #
Black	70-308-11
White	70-308-21
RAL9010 White	70-308-51

MMX 32 MAAP

Remote Control for MMX 32 VGA Series Matrix Switchers
Type: Installation
Size: Single Space

COLOR	PART #
Black	70-277-12
White	70-277-22

One Switch: Latching, Single Pole, Single Throw, 10A / 125 VAC, 6A / 250 VAC Max Voltage

Type: Installation
Size: Single Space

COLOR	PART #
Black	70-304-11
White	70-304-21

One Switch with Integral LED: Latching, Single Pole, Single Throw, 5A / 125 VAC, 3A / 250 VAC Max Voltage

Type: Installation
Size: Single Space

COLOR	PART #
Black	70-304-12

One Switch: Latching, Single Pole, Double Throw, 15A / 125 VAC, 10A / 250 VAC, 10A / 28 VDC Max Voltage

Type: Installation
Size: Single Space

COLOR	PART #
Black	70-304-13

Data/Phone MAAPs

One Fiber ST Female to Female Barrel

Type: Barrel/Adapter
Size: Double Space

COLOR	PART #
Black	70-467-11
White	70-467-21
RAL9010 White	70-467-51

One Fiber MTRJ Female to Female Barrel

Type: Barrel/Adapter
Size: Double Space

COLOR	PART #
White	70-469-21
RAL9010 White	70-469-51

One Fiber Duplex LC Female to Female Barrel

Type: Barrel/Adapter
Size: Double Space

COLOR	PART #
Black	70-470-11

One RJ-11 Female to Punch Down - Phone

Type: Installation
Size: Single Space

COLOR	PART #
Black	70-313-11
White	70-313-21
RAL9010 White	70-313-51

One RJ-11 Female to Punch Down - Phone

Type: Installation
Size: Double Space

COLOR	PART #
Black	70-313-13
White	70-313-23

Data/Phone MAAPs

One RJ-11 Female to Female Barrel - Phone

Type: Barrel/Adapter
Size: Single Space

COLOR	PART #
Black	70-313-12
White	70-313-22
RAL9010 White	70-313-52

One RJ-45 Female to Punch Down - CAT 5

Shown with silkscreen

Type: Installation
Size: Single Space
Optional Silkscreen: "NETWORK"

COLOR	PART #
Black	70-314-11
Black with Silkscreen	70-314-12
White	70-314-21
White with Silkscreen	70-314-22
RAL9010 White	70-314-51
RAL9010 White with Silkscreen	70-314-52

One RJ-45 Female to Punch Down - CAT 6

Type: Installation
Size: Double Space

COLOR	PART #
Black	70-314-15
White	70-314-25
RAL9010 White	70-314-55

One RJ-45 Female to Female Barrel - CAT 5e

Shown with silkscreen

Type: Barrel/Adapter
Size: Single Space
Optional Silkscreen: "NETWORK"

COLOR	PART #
Black	70-314-13
Black with Silkscreen	70-314-14
White	70-314-23
White with Silkscreen	70-314-24
RAL9010 White	70-314-53

One RJ-45 Female to Female Barrel - CAT 5e

Type: Barrel/Adapter
Size: Double Space

COLOR	PART #
Black	70-314-16
White	70-314-26

Data/Phone MAAPs

One RJ-45 Female to Punch Down for CAT 6 - Leviton

Type: Installation
Size: Single Space

COLOR	PART #
Black	70-314-17
White	70-314-27
RAL9010 White	70-314-57

One RJ-45 Female to Punch Down for CAT 6 - Leviton

Type: Installation
Size: Double Space

COLOR	PART #
Black	70-314-18
White	70-314-28
RAL9010 White	70-314-58

One RJ-45 Female to Punch Down - CAT 5e Neutrik EtherCon

Type: Installation
Size: Double Space

COLOR	PART #
Black	70-314-19
White	70-314-29

Cable Pass-Through and Blank Plates

Blank Plate - Single

Size: Single Space

COLOR	PART #
Black	70-315-11
White	70-315-21
RAL9010 White	70-315-51

Blank Plate - Double

Size: Double Space

COLOR	PART #
Black	70-315-12
White	70-315-22
RAL9010 White	70-315-52

Blank Plate - Triple

Size: Triple Space

COLOR	PART #
Black	70-315-13
White	70-315-23
RAL9010 White	70-315-53

Blank Plate - Quad

Size: Quad Space

COLOR	PART #
Black	70-315-14
White	70-315-24

One Grommet - 1" ID

Type: Captive Cable
Size: Quad Space

COLOR	PART #
Black	70-316-11
White	70-316-21

Cable Pass-Through and Blank Plates

Captive Cable Kit with One Large Cable Hole

Type: Captive Cable
Size: Double Space

COLOR	PART #
Black	70-317-11
White	70-317-21

Captive Cable Kit with Two Small Cable Holes

Type: Captive Cable
Size: Double Space

COLOR	PART #
Black	70-317-12

Captive Cable Kit with One Large Cable Hole and Two Small Cable Holes

Type: Captive Cable
Size: Triple Space

COLOR	PART #
Black	70-317-13

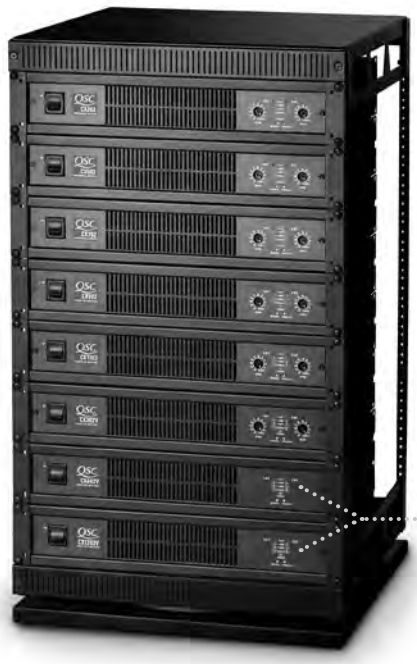
Single Space Cable Pass-Through

Type: Pass-Through
Size: Single Space

COLOR	PART #
Black	70-637-02
White	70-637-03
RAL9010 White	70-637-05

CX 2-channel
Professional Power Amplifiers

CX302 | CX502 | CX702 | CX902 | CX1102 | CX302V | CX602V | CX1202V



All models include an integrated security cover for tamper-proof installations

The CX Series is designed to meet the specialized needs of sound contractors. Eight 2-channel models have been designed from the ground up, combining the exclusive QSC PowerLight™ technology with specific features to meet the requirements of fixed installations.

With high-output power, versatile loading options, high thermal capacity and unmatched reliability, the CX Series is the perfect solution to any permanently installed sound system.

CX 2-channel Amplifiers

		Watts per channel		
Model	70 V*	8Ω**	4Ω**	2Ω†
CX302	–	200	325	600
CX502	–	300	500	800
CX702	–	425	700	1200
CX902	440	550	900	1500
CX1102	1000	700	1100	1700
CX302V	250	–	–	–
CX602V	440	550	–	–
CX1202V	1000	700	1100	–

**1 kHz, 0.05% THD*
***20 Hz – 20 kHz, 0.05% THD*
†1 kHz, 1% THD

Features

- 8 models to meet your exact power requirements
- Exclusive PowerLight switch-mode power supply technology for high performance and compact size
- Custom integrated security cover for tamper proof installations
- Variable speed fan for low noise
- 1 dB detented gain controls for fast and accurate gain settings
- Active inrush limiting eliminates AC inrush current, removing the need for expensive power sequencers
- XLR and detachable Euro-style input connectors
- HD15 DataPort connector for QSControl computer control or signal processing accessories
- Dip switch control for clip limiters, high-pass filters, bridge-mono and parallel operation
- Selectable high-pass filters protect speakers and prevent speaker transformer saturation with minimal effect on program material (33 Hz or 75 Hz on non-V models, 50 Hz or 75 Hz on V models)
- Comprehensive front panel indicators including signal, clip, protect and QSC's exclusive bridge-mono and parallel input LEDs
- Barrier strip output connector
- Comprehensive protection circuitry including DC, infrasonic, thermal overload and short circuit protection
- Class H complementary bipolar output circuitry for high efficiency (CX702, CX902, CX1102 & CX1202V)
- Optional external transformer accessory pack for isolated 70 and 100 volt outputs (converts CX302 to 400 watts per channel isolated output)
- Compact size – all models only 2 RU and 14" deep for reduced rack cost and floor space
- Lightweight – all models only 21 pounds (9.5 kg) for easier racking and shipping
- 3-year warranty plus optional 3-year extended service contract

CX 2-Channel

Specifications

		CX302	CX502	CX702	CX902	CX1102	CX302V	CX602V	CX1202V
Stereo Mode (both channels driven)				Continuous average output power per channel					
8Ω / 20 Hz – 20 kHz / 0.05% THD		200 W	300 W	425 W	550 W	700 W	–	550 W	700 W
4Ω / 20 Hz – 20 kHz / 0.05% THD		325 W	500 W	700 W	900 W	1100 W	–	–	1100 W
2Ω / 1 kHZ / 1% THD		600 W	800 W	1200 W	1500 W	1700 W	–	–	-
70V / 20 Hz – 20 kHz / 0.05% THD		–	–	–	400 W	800 W	200 W	400 W	800 W
70V / 1 kHz / 0.05% THD		–	–	–	440 W	1000 W	250 W	440 W	1000 W
70V / 1 kHz / 1% THD		–	–	–	600 W	1200 W	300 W	600 W	1200 W
Bridge-Mono Mode				Bridge-mono mode operation					
16Ω / 20 Hz – 20 kHz / 0.1% THD		400 W	600 W	850 W	1100 W	1400 W	–	1100 W	1400 W
8Ω / 20 Hz – 20 kHz / 0.1% THD		700 W	1100 W	1500 W	2000 W	2200 W	–	–	2200 W
4Ω / 1 kHz / 1% THD		1200 W	1600 W	2400 W	3000 W	3400 W	–	–	–
140V / 20 Hz – 20 kHz / 0.1% THD		–	–	–	800 W	1600 W	400 W	800 W	1600 W
140V / 1 kHz / 0.05% THD		–	–	–	880 W	2000 W	500 W	880 W	2000 W
140V / 1 kHz / 1% THD		–	–	–	1200 W	2400 W	600 W	1200 W	2400 W
Signal to Noise (20 Hz – 20 kHz)		> -107 dB	> -107 dB	> -106 dB	> -106 dB	> -106 dB	> -106 dB	> -106 dB	> -106 dB
Input Sensitivity at 8Ω		1.26 Vrms	1.23 Vrms	1.16 Vrms	1.17 Vrms	1.35 Vrms	1.26 Vrms	1.26 Vrms	1.26 Vrms
Gain at 8Ω		30 dB	32 dB	34 dB	35 dB	35 dB	35 dB	35 dB	35 dB
Output Circuitry		Class AB+B	Class AB+B	2-tier Class H	2-tier Class H	2-tier Class H	Class AB+B	Class AB+B	2-tier Class H
Distortion (SMPTE-IM)		< 0.02%							
Distortion (typical)									
20 Hz – 20 kHz: 10 dB below rated power		< 0.01% THD							
1.0 kHz and below: full rated power		< 0.01% THD							
Frequency Response		20 Hz - 20 kHz, ± 0.2 dB							
Damping Factor		> 500							
Input Impedance		6k ohms unbalanced, 12k ohms balanced							
Input Clipping		10 Vrms (+22 dBu)							
Cooling		Variable-speed fan, rear-to-front air flow							
Connectors		Input: 3-pin XLR & 3-pin detachable terminal blocks (1 each per channel) Output: Safety shrouded barrier strip							
Amplifier Protection		Full short circuit, open circuit, thermal, ultrasonic, RF protection. Stable into reactive or mismatched loads							
Load Protection		On/off muting, DC-fault power supply shutdown							
Dimensions (HWD)		3.5" (8.9 cm) 2 RU x 19" (48.3 cm) rack mounting x 14" (35.6 cm) from front mounting rails							
Weight - Net / Shipping		21 lb (9.5 kg) / 27 lb (12.3 kg)							
120V Current Consumption	Idle	0.8 A	0.9 A	0.9 A	0.9 A	0.9 A	0.8 A	0.9 A	0.9 A
1/8 power pink noise (typical of program material at maximum unclipped power)	8Ω	3.8 A	5.6 A	5.0 A	6.0 A	7.6 A	–	–	–
	4Ω	6.0 A	9.0 A	7.9 A	9.5 A	11.6 A	–	–	–
	2Ω	9.6 A	14.0 A	11.8 A	14.0 A	16.6 A	–	–	–
	70V	–	–	–	–	–	5.7 A	8.7 A	12.0 A
1/3 power pink noise (typical of program material with severe clipping)	8Ω	5.4 A	8.0 A	8.4 A	11.0 A	13.1 A	–	–	–
	4Ω	8.9 A	13.3 A	13.5 A	17.0 A	20.0 A	–	–	–
	2Ω	14.3 A	21.0 A	22.0 A	27.0 A	–	–	–	–
	70V	–	–	–	–	–	8.0 A	13.0 A	19.0 A

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qscaudio.com

CX 8-channel
Professional Power Amplifiers

CX168 | CX108V

Designed for permanently installed sound systems where rackspace is at a premium, QSC's CX108V and CX168 provide unprecedented levels of channel density for multi-channel amplifiers. The CX108V and CX168 provide 100 watts per channel at 70 volts and 90 watts per channel at 8 ohms respectively. With both models, each pair of channels may be bridged to configure these amplifiers as 4, 5, 6 or 7 channel units. Like the entire CX Series, the 8 channel models feature DataPorts for remote amplifier management or signal processing, incorporate QSC's legendary PowerLight™ technology, and deliver our unmatched reputation for quality and reliability.

QSC's PowerLight technology takes your audio to an entirely new level. Delivering tighter bass and clean, transparent highs, PowerLight also cuts waste heat, boosts reliability, and eliminates unwanted noise and hum. PowerLight is a revolutionary switching power supply technology that provides ample current to the audio power circuitry by charging the supply rails over 200,000 times per second through an ultra-low noise impedance circuit. Unlike amplifiers that use conventional supplies, the audio signal is never starved prematurely and remains crisp and clean.

CX 8-channel Amplifiers

	Watts per channel		
Model	70V*	8Ω	4Ω**
CX168	–	8 x 90	8 x 130
CX108V	8 x 100	–	–

20 Hz – 20 kHz, 0.05%THD
** 20 Hz – 20 kHz, 0.2%THD*
***20 Hz – 20 kHz, 0.1%THD*

Features

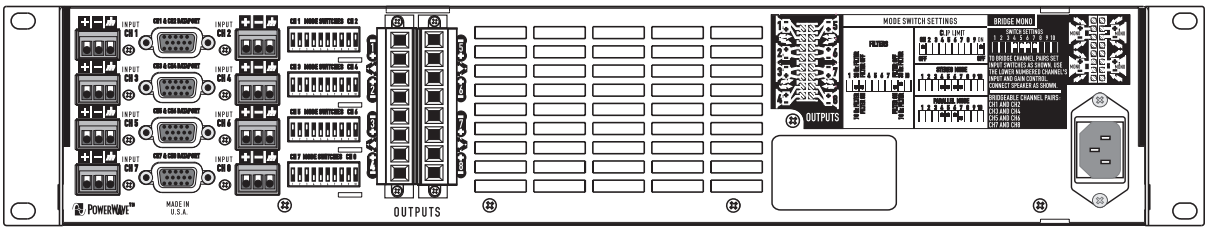
- 100 watts per channel at 70 volts (CX108V)
- 90 watts per channel at 8 ohms and 130 watts per channel at 4 ohms (CX168)
- Compact size — only two rack spaces and 14" deep for reduced rack space
- Channel pairs bridgeable for maximum flexibility
- Exclusive PowerLight switch-mode power supply technology for high performance and compact size
- Active inrush limiting eliminates AC inrush current, removing the need for expensive power sequencers
- Four HD15 DataPorts (one per channel pair) for QSControl computer control or QSC's signal processing accessories
- Custom integrated gain control security cover for tamper proof installations
- 1 dB recessed detented gain controls for fast and accurate settings
- Detachable Euro-style input and output connectors
- DIP switch control for clip limiters, high-pass filters, bridge-mono and parallel operation
- Selectable high-pass filters protect speakers and prevent speaker transformer saturation with minimal effect on program material (50 Hz or 75 Hz; CX108V) (33 Hz or 70 Hz; CX168)
- Comprehensive front panel indicators including signal, clip, bridge mono and parallel-input LEDs
- Fully protected — including DC, infrasonic and ultrasonic, thermal overload and short circuit protection
- High-performance Class AB+B complementary bipolar output circuitry
- Lightweight — only 21 pounds (9.5 kg) for easier racking and shipping
- 3-year warranty plus optional 3-year extended service contract

CX 8-Channel

Specifications

		CX168		CX108V
Stereo Mode (all channels driven)		Continuous average output power per channel		
8Ω / 20 Hz – 20 kHz / 0.05% THD		90 W		–
4Ω / 20 Hz – 20 kHz / 0.1% THD		130 W		–
Midband Ratings		All channels driven	Single channel	
8Ω / 1 kHz / 0.1% THD		100 W	120 W	–
4Ω / 1 kHz / 0.1% THD		140 W	180 W	–
70V / 20 Hz – 20 kHz / 0.2% THD		–		100 W
Bridge-Mono Mode		Bridge-mono mode operation		
16Ω / 20 Hz – 20 kHz / 0.1% THD		180 W		–
8Ω / 20 Hz – 20 kHz / 0.1% THD		260 W		
140V / 20 Hz – 20 kHz / 0.2% THD		–		200 W
Signal to Noise (20 Hz – 20 kHz)		-107 dB		-100 dB
Input Sensitivity		1.35 Vrms at 8Ω		1.26 Vrms at 70V
Voltage Gain		20x (26 dB)		56x (35 dB)
Input Clipping		6 Vrms (+18 dBu)		6 Vrms (+18 dBu)
Output Circuitry		Class AB+B		Class AB+B
Frequency Response		20 Hz – 20 kHz, + 0.2 dB | 8 Hz – 50 kHz, +0/-3 dB		20 Hz – 20 kHz, + 0.4 dB | 8 Hz – 70 kHz, +0/-3 dB
Damping Factor		> 200 (5 kHz and below)		> 500 (5 kHz and below)
Input Impedance		6k ohms unbalanced, 22k ohms balanced		6k ohms unbalanced, 22k ohms balanced
Distortion (SMPTE-IM)		< 0.02%		
Distortion (typical)				
20 Hz – 20 kHz: 10 dB below rated power		< 0.1% THD		
1.0 kHz and below: full rated power		< 0.03% THD		
Cooling		Variable-speed fan / rear-to-front air flow through tunnel heat sink		
Connectors		Input: 3-pin Euro-style detachable terminal blocks (one per channel) DataPort: HD-15 connector (Ch. 1+2, 3+4, 5+6, 7+8) Output: two 8-pin Euro-style detachable terminal blocks		
Controls		Front: AC switch, Ch. 1, 2, 3, 4, 5, 6, 7 & 8 gain knobs Rear: DIP switches for Ch. 1 - 8, clip limiter on/off, LF filter on/off, LF filter freq select 33 or 70 Hz for CX168 LF filter freq select 50 or 75 Hz for CX108V, inputs parallel or stereo; bridge mode		
Indicators		Power-On: Green LED / Parallel inputs: Orange LED (1 per channel pair) / Signal -35 dB: Green LED (1 per channel) Bridged: Yellow LED (1 per channel pair) / Clip: Red LED (1 per channel)		
Amplifier Protection		Full short circuit, open circuit, thermal, ultrasonic, and RF protection. Stable into reactive or mismatched loads		
Load Protection		On/off muting, individual channel DC fault blocking		
Dimensions (HWD)		3.5" (8.9 cm) 2 RU x 19" (48.3 cm) rack mounting x 14" (35.6 cm) from front mounting rails		
Weight - Net / Shipping		21 lb (9.5 kg) / 27 lb (12.3 kg)		
Power Requirements		100, 120, 230 VAC, 50 – 60 Hz (configured at factory)		
120V Current Consumption*	Idle	0.6 A		0.6A
1/8 power pink noise (typical of program material at maximum unclipped power)	8Ω	6.2 A		–
	4Ω	9.2 A		–
	70V	–		6.3 A
1/3 power pink noise (typical of program material with severe clipping)	8Ω	9.2 A		–
	4Ω	14.2 A		–
	70V	–		9.4 A

** Multiply currents by 0.5 for 230V units*



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EQUIPMENT FOR

Misc. Control

AV3

3 SERIES

3-Series Control System®

- *Enterprise-class control system*
- *3-Series® Control Engine — substantially faster and more powerful than other control systems*
- *Exclusive modular programming architecture*
- *Onboard 1GB RAM & 4GB Flash memory*
- *Expandable storage up to 1TB*
- *Rear panel memory card slot*
- *High-speed USB 2.0 host port*
- *Industry-standard Ethernet and Cresnet® wired communications*
- *Control Subnet — provides a dedicated local network for Crestron® devices*
- *XPanel with Smart Graphics™ computer and web based control*
- *iPhone®, iPad®, and Android™ control app support*
- *Crestron Fusion® Cloud Enterprise Management Service support*
- *SNMP remote management support*
- *Two RS-232/422/485 COM ports with hardware and software handshaking*
- *Four RS-232 COM ports with software handshaking only*
- *Eight IR/serial, eight relay, and eight Versiport I/O ports*
- *Three built-in 3-Series control card expansion slots (optional)[3]*
- *Programmable event scheduling with astronomical time clock*
- *Native BACnet™/IP support[2]*
- *IEC 61000-4-5 Installation Class 4 surge immunity on COM, Versiport, and network connections[4]*
- *Installer setup via Crestron Toolbox™ software or web browser*
- *C#, symbol based, and drag-and-drop programming environments*
- *Full Unicode (multi-language) support*
- *Increased network throughput and security*
- *Secure access through full user/group management or Active Directory integration*
- *Hardware level security using 802.1X authentication*
- *TLS, SSL, SSH, and SFTP network security protocols*
- *FIPS 140-2 compliant encryption*
- *IIS v.6.0 Web Server*
- *IPv6 ready*
- *Front panel USB computer console port*
- *2-space rack-mountable*

The Crestron® AV3 is an enterprise-class control system with an enhanced feature set including built-in control card expansion slots and a dedicated Control Subnet port. Featuring the 3-Series® control engine, the AV3 forms the core of any modern networked home or commercial building, managing and integrating all the disparate technologies throughout your facility to make life easier, greener, more productive, and more enjoyable.

3-Series® Control Systems

Today's commercial buildings and custom homes comprise more technology than ever before, and all these systems need to be networked, managed, and controlled in fundamentally new ways. The IP based 3-Series platform is engineered from the ground up to deliver a network-grade server appliance capable of faithfully handling everything from boardroom AV and home theater control to total building management.

3-Series embodies a distinctively robust, dynamic, and secure platform to elevate your system designs to higher levels of performance and reliability. Compared to other control systems, Crestron 3-Series provides a pronounced increase in processing power and speed with more memory, rock solid networking and IP control, and a unique modular programming architecture.

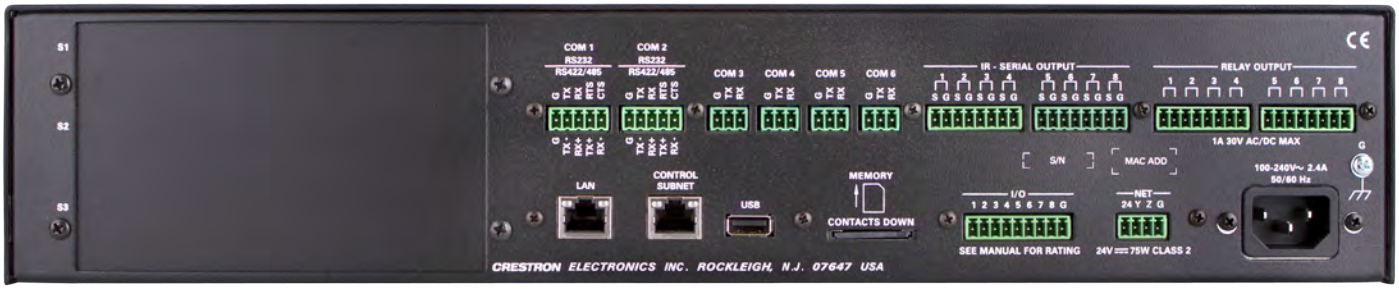
Modular Programming Architecture

Designed for enhanced scalability, the AV3 affords high-speed, real-time multi-tasking to seamlessly run multiple programs simultaneously. This exclusive modular programming architecture lets programmers independently develop and run device-specific programs for AV, lighting, shades, HVAC, security, etc., allowing for the optimization of each program, and allowing changes to be made to one program without affecting the whole. Even as your system grows, processing resources can easily be shifted from one 3-Series processor to another without rewriting any code. The end benefit is dramatically simplified upgradability with minimal downtime, whether implementing changes on site or remotely via the network.

Robust Ethernet & IP Control

IP technology is the heart of 3-Series, so it should be no surprise that its networking abilities are second to none. Gigabit Ethernet connectivity enables integration with IP-controllable devices and allows the AV3 to be part of a larger managed control network. Whether residing on a sensitive corporate LAN, a home network, or accessing the Internet through a cable modem, the AV3 provides secure, reliable interconnectivity with IP-enabled touch screens, computers, mobile devices, video displays, media servers, security systems, lighting, HVAC, and other equipment — whether on premises or across the globe.

AV3 3-Series Control System®



AV3 – Rear View

Dedicated Control Subnet

The Crestron Control Subnet is a Gigabit Ethernet network dedicated to Crestron devices. Via the AV3's Control Subnet port, an installer may simply connect a single touch screen or wireless gateway, or add a Crestron PoE switch (CEN-SW-POE-5 or CEN-SWPOE-16) [1] to handle multiple touch screens, gateways, AV components, and other devices. Auto-configuration of the entire subnet is performed by the AV3, discovering each device and assigning IP addresses without any extra effort from the installer.

A separate LAN port on the AV3 provides a single-point connection to the customer's LAN, requiring just one IP address for the complete control system. The LAN port allows full interconnectivity between devices on the local subnet with other devices, systems, servers, and WAN/Internet connections outside the local subnet. For sensitive applications that require absolute security, the entire Control Subnet can be completely isolated from the customer's LAN using Isolation Mode.

Control Apps & XPanel

Years ago, Crestron pioneered the world's first IP-based control system unleashing vast new possibilities for controlling, monitoring, and managing integrated systems over a LAN, WAN, and the Internet. Today, Crestron offers more ways than ever to control your world the way you want. Using a computer, smartphone, or tablet device, Crestron lets you control anything in your home or workplace from anywhere in the world.

Native to every 3-Series control system, Crestron XPanel technology transforms any laptop or desktop computer into a virtual Crestron touch screen. Crestron control apps deliver the Crestron touch screen experience to iPhone®, iPad®, and Android™ devices, letting you safely monitor and control your entire residence or commercial facility using the one device that goes with you everywhere.

Crestron Fusion® Cloud

Crestron Fusion Cloud provides an integrated platform for creating truly smart buildings that save energy, enhance worker productivity, and prolong the life-span of valuable equipment. As part of a complete managed network in a corporate enterprise, college campus, convention center, or any other facility, the AV3 works integrally with Crestron Fusion Cloud to enable remote scheduling, monitoring, and control of rooms and technology from a central help desk. It also enables organizations to reduce energy consumption by tracking real-time usage and automating control of lighting, shades, and HVAC.

SNMP Support

Built-in SNMP support enables integration with third-party IT management software, allowing network administrators to manage and control Crestron systems on the network in an IT-friendly format.

Cresnet®

Cresnet provides a dependable network wiring solution for Crestron keypads, lighting controls, shade motors, thermostats, occupancy sensors, and other devices that don't require the higher speed of Ethernet. The Cresnet bus offers easy wiring and configuration, carrying bidirectional communication and 24VDC power to each device over a simple 4-conductor cable. To assist with troubleshooting, the AV3 includes our patent-pending Network Analyzer which continuously monitors the integrity of the Cresnet network for wiring faults, marginal performance, and other errors.

Onboard Control Ports

In addition to Ethernet, the AV3 includes six bidirectional COM ports and eight IR ports to interface directly with all of your centralized AV sources, video displays, and other devices. Eight programmable relay ports are included for controlling projection screens, lifts, power controllers, and other contact-closure actuated equipment. Eight "Versiport" I/O ports enable the integration of power sensors, motion detectors, door switches, alarms, or anything else that provides a dry contact closure, low-voltage logic, or 0-10 Volt DC signal.

Optional Control Card Expansion Slots

Additional control ports can be added to the AV3 using 3-Series Control Cards and the CAGE3 Control Card Expansion Cage.[1] The CAGE3 accessory installs in the AV3, providing three control card expansion slots on the AV3's rear panel. Adding the CAGE3 option affords great expansion capability without requiring any additional rack space.

BACnet™/IP

Native support for the BACnet/IP communication protocol provides a direct interface to third-party building management systems over Ethernet, simplifying integration with HVAC, security, fire & life safety, voice & data, lighting, shades, and other systems. Using BACnet/IP, each system runs independently with the ability to communicate together on one platform for a truly smart building.[2]

AV3 3-Series Control System®

SPECIFICATIONS

Control Engine

Crestron 3-Series; real-time, preemptive multi-threaded/multitasking kernel; Transaction-Safe Extended FAT file system; supports up to 10 simultaneously running programs

Memory

SDRAM: 1 GB
Flash: 4 GB
Memory Card: Supports SD and SDHC cards up to 32 GB
External Storage: Supports USB mass storage devices up to 1 TB

Communications

Ethernet: 10/100/1000 Mbps, auto-switching, auto-negotiating, auto-discovery, full/half duplex, industry-standard TCP/IP stack, UDP/IP, CIP, DHCP, SSL, TLS, SSH, SFTP (SSH File Transfer Protocol), FIPS 140-2 compliant encryption, IEEE 802.1X, SNMP, BACnet/IP [2], IPv4 or IPv6, Active Directory authentication, IIS v.6.0 Web Server, SMTP e-mail client
Control Subnet: 10/100/1000 Mbps Ethernet, auto-switching, auto-negotiating, auto-discovery, full/half duplex, DHCP server, DNS Server, port forwarding, Isolation Mode
Cresnet: Cresnet master mode
USB: Supports USB mass storage class devices via rear panel USB 2.0 host port, supports computer console via front panel USB 2.0 device port
RS-232/422/485: For 2-way device control and monitoring, all ports support RS-232 up to 115.2k baud with software handshaking, two ports also support hardware handshaking, RS-422, and RS-485
IR/Serial: Supports 1-way device control via infrared up to 1.2 MHz or serial TTL/RS-232 (0-5 Volts) up to 115.2k baud

Connectors & Card Slots

S1 – S3: (3) 3-Series control card expansion slots (optional)[3]

COM 1 – 2: (2) 5-pin 3.5 mm detachable terminal blocks;
Bidirectional RS-232/422/485 ports [4];
Up to 115.2k baud; hardware and software handshaking support

COM 3 – 6: (4) 3-pin 3.5 mm detachable terminal blocks;
Bidirectional RS-232 ports [4];
Up to 115.2k baud; software handshaking support

IR - SERIAL OUTPUT 1 – 8: (2) 8-pin 3.5 mm detachable terminal blocks;
Comprises (8) IR/Serial output ports;
IR output up to 1.2 MHz;
1-way serial TTL/RS-232 (0-5 Volts) up to 115.2k baud

RELAY OUTPUT 1 – 8: (2) 8-pin 3.5 mm detachable terminal blocks;
Comprises (8) normally open, isolated relays;
Rated 1 Amp, 30 Volts AC/DC;
MOV arc suppression across contacts

LAN: (1) 8-pin RJ45 jack;
10Base-T/100Base-TX/1000Base-T Ethernet port [4];
Connects to the customer's LAN

CONTROL SUBNET: (1) 8-pin RJ45 jack;
10Base-T/100Base-TX/1000Base-T Ethernet port [4];
Provides a dedicated local network for Crestron devices

USB: (1) USB Type A female;
USB 2.0 port for storage devices

MEMORY: (1) SD memory card slot;
Accepts one SD or SDHC card up to 32 GB for memory expansion

I/O 1 – 8: (1) 9-pin 3.5 mm detachable terminal block;
Comprises (8) "Versiport" digital input/output or analog input ports (referenced to GND)[4];
Digital Input: Rated for 0-24 Volts DC, input impedance 20k Ohms, logic threshold >3.125V low/0 and <1.875V high/1;
Digital Output: 250 mA sink from maximum 24 Volts DC, catch diodes for use with "real world" loads;
Analog Input: Rated for 0-10 Volts DC, protected to 24 Volts DC maximum, input impedance 21k Ohms with pull-up resistor disabled;
Programmable 5 Volts, 2k Ohms pull-up resistor per pin

NET: (1) 4-pin 3.5 mm detachable terminal block;
Cresnet master port, outputs power to Cresnet devices [4];
See "Power" section for additional specifications

100-240V~2.4A 50/60Hz: (1) IEC 60320 C14 main power inlet;
Mates with removable power cord, included

G: (1) 6-32 screw;
Chassis ground lug

COMPUTER (front): (1) USB Type B female;
USB 2.0 computer console port (6 ft cable included);
For setup only

Controls & Indicators

PWR: (1) Green LED, indicates operating power supplied from AC line
NET: (1) Amber LED, indicates communication with the Cresnet system
MSG: (1) Red LED, indicates control system has generated an error message
HW-R: (1) Recessed pushbutton for hardware reset
SW-R: (1) Recessed pushbutton for software reset
CNPS FAULT: (1) Red LED and (1) pushbutton, LED indicates an excessive Cresnet load detected at the NET port, pushbutton resets the fault indication
SLOT 1 – 3: (3) Green LEDs, indicate control cards are inserted in the corresponding slots [3]
LAN (rear): (2) Bi-color green/amber LEDs, left LED indicates Ethernet link status and connection speed, right LED indicates Ethernet activity
CONTROL SUBNET (rear): (2) Bi-color green/amber LEDs, left LED indicates Ethernet link status and connection speed, right LED indicates Ethernet activity

Power

Main Power: 2.4 Amps @ 100-240 Volts AC, 50/60 Hz
Available Cresnet Power: 75 Watts (3.125 Amps @ 24 Volts DC)

AV3 3-Series Control System®

Environmental

Temperature: 41° to 113° F (5° to 45° C)
Humidity: 10% to 90% RH (non-condensing)
Heat Dissipation: 45 BTU/hr with no Cresnet devices, no control cards;
71 BTU/hr with full Cresnet load, no control cards;

See individual control card spec sheets for additional specifications

Enclosure

Chassis: Metal, black finish, vented top and sides
Faceplate: Extruded metal, black finish, polycarbonate label overlay
Mounting: Freestanding or 2 RU 19-inch rack-mountable (adhesive feet and rack ears included)

Dimensions

Height: 3.47 in (89 mm) without feet
Width: 17.28 in (439 mm);
19.00 in (483 mm) with rack ears
Depth: 10.06 in (256 mm)

Weight

4.0 lb (1.9 kg)

MODELS & ACCESSORIES

Available Models

AV3: 3-Series Control System®

Available Accessories

CAGE3: Control Card Expansion Cage for AV3
C3COM-3: 3-Series® Control Card - 3 COM Ports
C3IO-16: 3-Series® Control Card - 16 Versiport I/O Ports
C3IR-8: 3-Series® Control Card - 8 IR Ports
C3RY-8: 3-Series® Control Card - 8 Relay Ports
C3RY-16: 3-Series® Control Card - 16 Relay Ports
PWE-4803RU: PoE Injector
CEN-SW-POE-5: 5-Port PoE Switch
CEN-SWPOE-16: 16-Port Managed PoE Switch
C2N-HBLOCK: Multi-type Cresnet Distribution Block
CNTBLOCK: Cresnet Distribution Block
CNSP-XX: Custom Serial Interface Cable
IRP2: IR Emitter Probe w/Terminal Block Connector
Crestron® App: Control App for Apple® iOS® & Android™
XPanel: Crestron Control® for Computers
myCrestron: Dynamic DNS Service for Crestron Systems
Crestron Fusion®: Enterprise Management Platform
3-Series® BACnet™/IP Support: 3-Series Native BACnet/IP Interface License
CSP-LIR-USB: IR Learner

Notes:

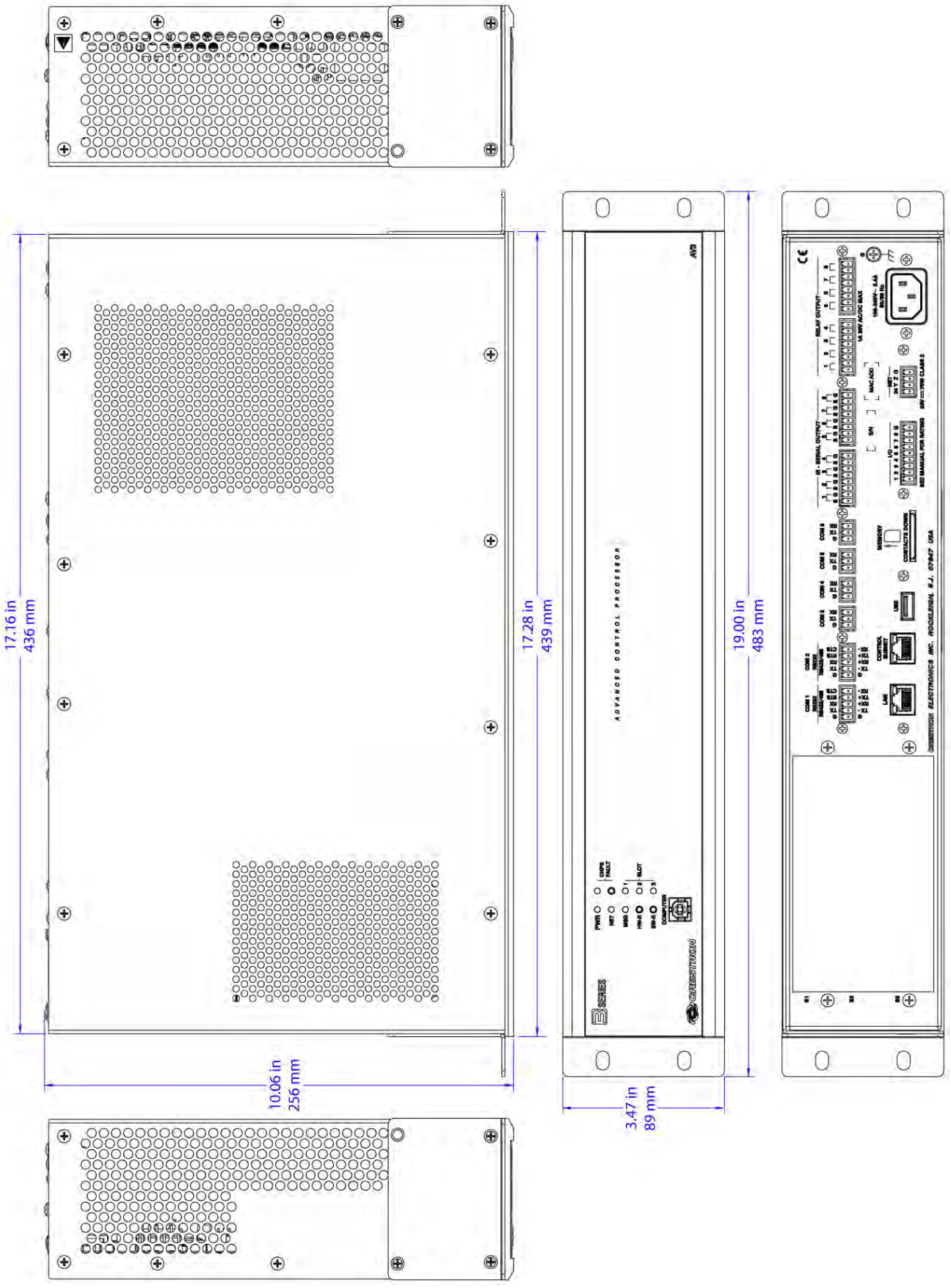
1. Item(s) sold separately.
2. License required. The AV3 supports a maximum of 2000 BACnet objects when dedicated for BACnet use only. Actual capabilities are contingent upon the overall program size and complexity.
3. Requires CAGE3 Control Card Expansion Cage accessory.
4. The following connections comply with IEC 61000-4-5 Installation Class 4 surge immunity levels: COM 1 - 6, I/O 1 - 8, NET, LAN, and CONTROL SUBNET.

This product may be purchased from an authorized Crestron dealer. To find a dealer, please contact the Crestron sales representative for your area. A list of sales representatives is available online at www.crestron.com/salesreps or by calling 800-237-2041.

The specific patents that cover Crestron products are listed online at: patents.crestron.com.

Certain Crestron products contain open source software. For specific information, please visit www.crestron.com/opensource.

AV3 3-Series Control System®



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www.crestron.com

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TSW-1050

10.1” Touch Screen

- *Ultra clean, modern appearance*
- *Thin profile and compact footprint*
- *Affordable and easy to install*
- *10.1” widescreen active-matrix color display*
- *1280 x 800 WXGA display resolution*
- *Capacitive touch screen technology*
- *Smart Graphics™ support [1]*
- *High-performance H.264 streaming video*
- *Rava® SIP intercom and phone technology*
- *Customizable audio feedback*
- *Built-in microphone and speakers*
- *5 soft-touch capacitive buttons*
- *Single-wire Ethernet connectivity*
- *PoE network powered*
- *Supports US or European electrical wall box mounting*
- *Can be mounted directly to drywall or paneling over a cutout*
- *Compatible with TSW-UMB Universal Mounting Bracket [2]*
- *Compatible with TSW-RMB Retrofit Mounting Brackets [2]*
- *Pre-construction and masonry mounting options available [2]*
- *Available tabletop and swivel mount options [2]*
- *Available in smooth black or white finish*

Advanced Touch Screen Control

A Crestron® touch screen offers an ideal user-interface for controlling all the technology in your home, boardroom, classroom, courtroom, or command center. Touch screens do away with piles of remote controls, cluttered wall switches, and cryptic computer screens, simplifying and enhancing the way you use technology. For controlling audio, video, lighting, shades, HVAC, security, and other systems, Crestron touch screens are fully-customizable with easy-to-use controls and icons, true feedback and real-time status display, live streaming video, and advanced navigation of digital media servers, tuners, and other devices.

With its clean, contemporary design highlighted by edge-to-edge glass and stunning HD color graphics, the Crestron TSW-1050 touch screen makes an elegant statement on any wall, tabletop, or lectern. Perfectly at home in the most contemporary residence or modern office building, its high-tech good looks underline its power for simplifying everyday tasks and functions throughout any facility.

The TSW-1050 delivers the ultimate touch screen experience in an unobtrusive, space-saving design featuring a brilliant, high-definition 10.1 inch capacitive touch screen display and 5 soft-touch buttons. PoE connectivity and a range of mounting options make installation a breeze for both new and retrofit applications. Additional features include high-performance H.264 video, audio feedback, Rava® SIP Intercom, and advanced Smart Graphics™.

Smart Graphics™[1]

Crestron touch screens use Smart Graphics to deliver the ultimate user experience *and* the ultimate value by enabling the creation of dynamically rich user interfaces with incredible efficiency and unparalleled functionality. Using Smart Graphics, programmers can swiftly integrate fluid gesture-driven controls, animated feedback, rich metadata, embedded apps and widgets, and full-motion video for a deeply engaging and ultra-intuitive touch screen experience.

Crestron Smart Graphics offers these enhancements and more:

- Cool-looking graphical buttons, sliders, knobs, and gauges that are intuitive and fun to use
- Kinetic effects to enhance the feeling of realism, with lists and toolbars that scroll with momentum at the flick of a fingertip
- Drag-and-drop objects that snap into place, offering an easy way to switch sources
- Dashboard widgets to personalize the touch screen with clocks, weather, news, and other information
- Customizable themes allowing a completely different look and feel for every user, event, or season
- Fully-developed SmartObjects™ that enable sophisticated control over complex devices with minimal programming

Soft-Touch Buttons

The TSW-1050 includes five soft-touch capacitive buttons for quick access to commonly used functions. The buttons are pre-labeled with icons for “Power”, “Home”, “Lights”, “Up”, and “Down” functions. Each button is programmable via the control system for custom functionality.

TSW-1050 10.1” Touch Screen

TSW-1050-W-S – Shown in White

TSW-1050-B-S with TSW-1050-TTK TableTop Mounting Kit

Streaming Video

High-performance streaming video capability makes it possible to view security cameras and other video sources right on the touch screen. Native support for H.264 and MJPEG formats allows the TSW-1050 to display live streaming video from an IP camera, a streaming server (Crestron CEN-NVS200 or similar[2]), or a DigitalMedia™ switcher. Video is delivered to the touch screen over Ethernet, eliminating the need for any extra video wiring.

Rava® SIP Intercom

Rava SIP Intercom Technology enables hands-free VoIP communication with other Rava-enabled touch screens and door stations. Rava works over Ethernet, supporting 2-way intercom, video intercom[3], and paging without any special wiring. VoIP phone capability is also possible through integration with an SIP-compatible IP phone system or SIP server, allowing hands-free telephone functionality complete with speed-dialing, caller ID, custom ringers, and other enhancements. Built-in echo cancellation affords full-duplex performance for clear, seamless voice communication using the TSW-1050’s integrated microphone and speakers.

Audio Feedback

Customized audio files can be loaded to add another dimension to the touch screen graphics using personalized sounds, button feedback, and voice prompts.

Single-Wire Connectivity

A simple Ethernet LAN connection is all that is required to wire the TSW-1050, containing all control, video, intercom, and power signals within a single wire.

Power over Ethernet

Using PoE technology, the TSW-1050 gets its operating power right through the LAN wiring. PoE (Power over Ethernet) eliminates the need for a local power supply or any dedicated power wiring. A PoE Injector (PWE-4803RU[2]) simply connects in line with the LAN cable at a convenient location. Crestron PoE switches (CEN-SW-POE-5 or CEN-SWPOE-16, or CEN-SWPOE-24[2]) may also be used to provide a total networking solution with built-in PoE.

Simple, Versatile Mounting

Using the bracket provided, the TSW-1050 installs easily over a 2-gang or 3-gang electrical box, or a 2-gang European electrical box. It can also be attached directly to drywall and other surfaces over the front of a 2-3/8” H x 3-3/8” W (60mm H x 86mm W) cutout. When installed, it protrudes just 1/2 inch from the mounting surface and is magnetically adhered to its mounting bracket, eliminating any visible screws for an ultra clean appearance.

Crestron also offers the TSW-UMB Universal Mounting Bracket[2], which provides a post-construction wall mounting solution that can accommodate a variety of current and future Crestron devices including the TSW-1050. The TSW-UMB makes it easy to change devices at any time without having to cut or patch the wall, or order any additional mounting hardware. For a pre-construction mounting solution, the TSW-UMB can be used along with a TSW-UMB-PMK Pre-Construction Mounting Kit[2]. Masonry and concrete applications can be accommodated using the TSW-UMB along with a TSW-550-BBI back box[2].

Replacing an older Crestron touch screen with a new TSW-1050 can be made simple using a TSW-RMB Retrofit Mounting Bracket. A variety of adapter brackets are available to enable easy installation of the TSW-1050 right over the existing back box, mounting kit, or cut-out.

Tabletop Option

Using the optional Tabletop Kit (TSW-1050-TTK[2]), the TSW-1050 becomes a stylish, freestanding touch screen that fits perfectly on a table, desk, or countertop. It can even be permanently attached to the surface using the optional Swivel Mount Kit (TSW-550/750/1050-SMK[2]).

SPECIFICATIONS

Touch Screen Display

Display Type: TFT Active matrix color LCD
Size: 10.1 inch (257 mm) diagonal
Aspect Ratio: 16:10 WXGA

TSW-1050 10.1” Touch Screen

Resolution: 1280 x 800 pixels
Brightness: 400 nits (cd/m²)
Contrast: 800:1
Color Depth: 24-bit, 16.7M colors
Illumination: Edgelit LED
Viewing Angle: ±80° horizontal, ±80° vertical
Touch Screen: Projected Capacitive

Buttons

Hard Keys: (5) Projected capacitive pushbuttons, programmable, pre-labeled with icons for “Power”, “Home”, “Lights”, “Up”, and “Down”
Reset: (1) Miniature pushbutton on rear panel for hardware reset

Memory

LPDDR2 RAM: 1 GB
Flash: 4 GB
Maximum Project Size: 512 MB

Graphics Engine

Supports Smart Graphics™ [1]

Communications

Ethernet: 10/100 Mbps, auto-switching, auto-negotiating, auto-discovery, full/half duplex, DHCP, IEEE 802.3af and 802.3at Type 1 compliant

Video

Streaming Formats: H.264 (MPEG-4 part 10 AVC), MJPEG

Audio

Features: Built-in microphone and speakers, Rava® SIP Intercom
Audio Feedback Formats: MP3

Connectors

LAN PoE: (1) 8-wire RJ45 with 2 LED indicators; 10Base-T/100Base-TX Ethernet port, Power over Ethernet compliant; Green and yellow LEDs indicate Ethernet port status

Power Requirements

Power over Ethernet: IEEE 802.3at Type 1 (802.3af compatible) Class 3 (12.95W) PoE Powered Device

Environmental

Temperature: 32° to 112°F (0° to 45°C)
Humidity: 10% to 90% RH (non-condensing)
Heat Dissipation: 44 BTU/hr

Enclosure

Construction: Plastic, smooth black or white finish
Mounting: Surface mount over a 2 or 3-gang electrical box, 2-Gang European (DIN 49073) electrical box, or 2-3/8” H x 3-3/8” W (60mm H x 86mm W) cutout; additional wall mount and tabletop options available separately

Dimensions

Height: 6.46 in (164 mm)
Width: 10.12 in (257 mm)
Depth: 2.03 in (52 mm)

Weight

23.9 oz (675 g)

MODELS & ACCESSORIES

Available Models

TSW-1050-B-S: 10.1” Touch Screen, Black Smooth
TSW-1050-W-S: 10.1” Touch Screen, White Smooth

Available Accessories

TSW-1050-TTK: Tabletop Kit for TSW-1050 [specify color]
TSW-550/750/1050-SMK: Swivel Mount Kit for TSW-1050-TTK
TSW-UMB: Universal Mounting Bracket
TSW-UMB-PMK: Pre-Construction Mounting Kit for TSW-UMB
TSW-550-BBI: Wall Mount Back Box for TSW-UMB – International Version
TSW-RMB: Retrofit Mounting Brackets
PWE-4803RU: PoE Injector
CEN-SW-POE-5: 5-Port PoE Switch
CEN-SWPOE-16: 16-Port Managed PoE Switch
CEN-NVS200: Network Video Streamer
SW-VMK-WIN: TouchPoint® Virtual Mouse & Keyboard Software for Windows®

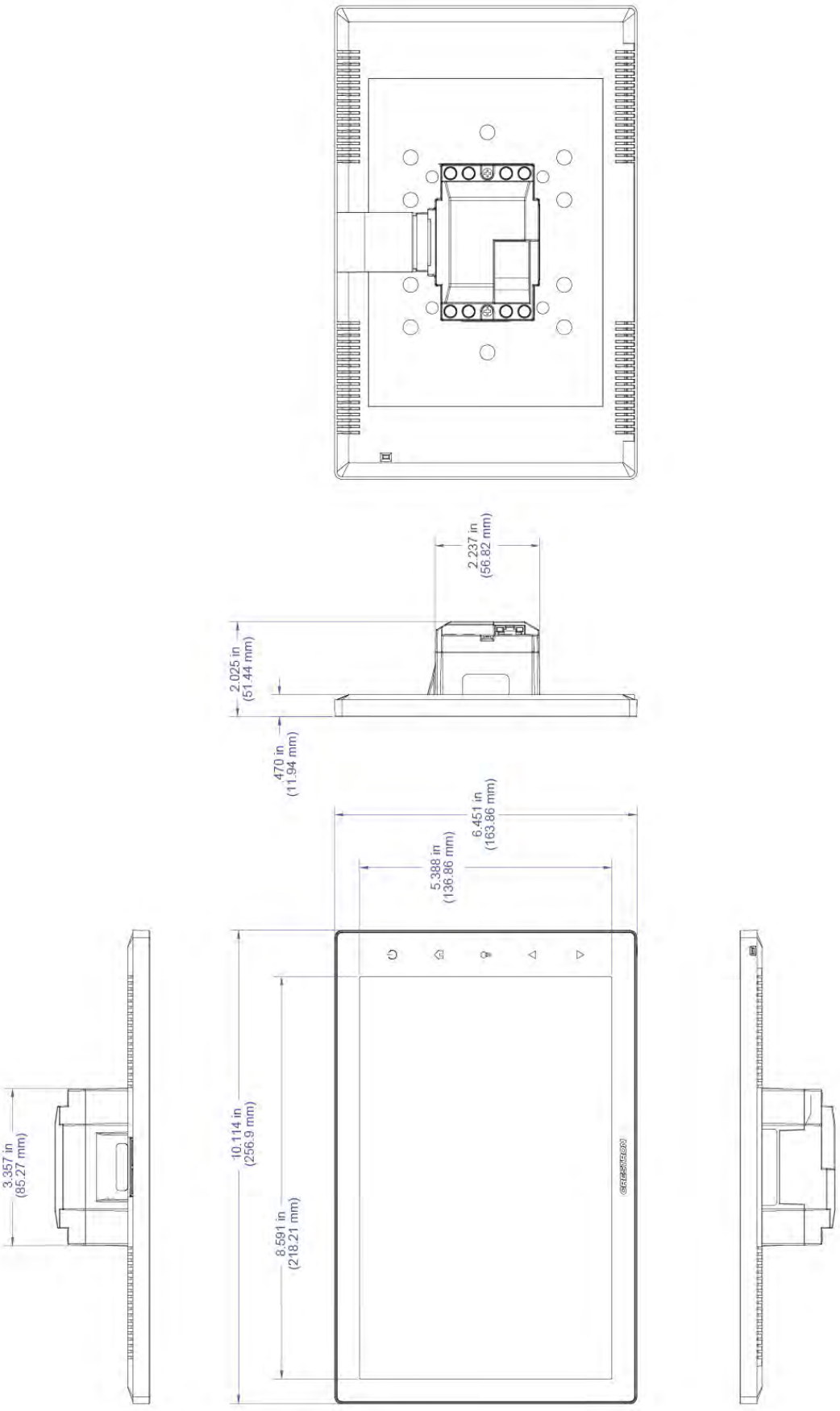
Notes:

1. Supports Smart Graphics only. Not compatible with “traditional” UI projects.
2. Item(s) sold separately.
3. H.264 compatible IP camera required.

This product may be purchased from an authorized Crestron dealer. To find a dealer, please contact the Crestron sales representative for your area. A list of sales representatives is available online at www.crestron.com/salesreps or by calling 800-237-2041.

The specific patents that cover Crestron products are listed online at: patents.crestron.com.

TSW-1050 10.1” Touch Screen



Crestron Electronics, Inc. 15 Volvo Drive | Rockleigh, NJ 07647
Tel: 800.237.2041 / 201.767.3400 | Fax: 201.767.1903
www.crestron.com

Specifications subject to change without notice. Revised 11/03/14

UPS Series

uninterruptible power supply

uninterruptible power supply with energy saver design that is optimized to address the needs of A/V systems

features:

- Pure Sine Wave technology with Automatic Voltage Regulation to improve the quality of power provided to the A/V system
- Surge suppression utilizes a clean line-to-neutral design that does not pass noise contamination to ground
- Models with bank control available
- Individual outlet control available
- Internet enabled models available, which include:
  - Real time UPS monitoring via the Web
  - Remote management and configuration of UPS via Web Browser or NMS (Network Management System)
  - Auto-shutdown to protect servers/workstations from data loss due to power failure
  - Schedule shutdown/start-up/reboot of the UPS
  - Event logging to trace UPS operational history
  - Data logging for analyzing power conditions
  - Event notification via email and SNMP traps
  - Supports TCP/IP, SNMP/HTTP, NTP, DNS, SMTP protocol
  - MIB (Management Information Base) provided
  - Quick installation and user friendly interface
  - User upgradeable firmware via FTP
  - Security management provided
- Control system integration via RS-232 and USB and analog I/O
- Load shedding allows extended run time for system-critical components by disconnecting power to less-critical components
- Line Interactive Technology
- Power Manager software allows extensive configuration and event notification capabilities
- Energy Saver design reduces power consumption by up to 75% when compared with traditional UPS designs
- 9' SignalSAFE™ power cord minimizes stray magnetic fields
- UL Listed in the US and Canada

UPS-1000R

UPS-EBPR

UPS Series
basic dimensions

specifications:

Rackmount Uninterruptible Power Supply (UPS) shall be Middle Atlantic Products model # UPS- __ R__ (refer to chart). UPS shall be line interactive with AVR. Unit shall measure 19.00" W x 3.50" H x 19.00" D and occupy 2 rackspaces. UPS shall have a rear mounting range of 19" to 32" and not require more than one person to mount. Unit shall operate on 120 VAC/60Hz current. Unit shall have a nominal output of 120V. Unit shall have a capacity of __ VA and __ W (refer to chart). Unit shall have (8) NEMA 5- __ receptacles on the rear of the unit (refer to chart). Unit shall have a priority outlet bank consisting of 4 outlets dedicated to ensure maximum run time of critical components. Unit shall have a non-critical outlet bank consisting of 4 outlets dedicated to load shedding, or individual outlet control, depending on model. Unit shall be IP enabled, depending on model, or when used with option IP Expansion card, model# UPS-IPCARD. Rackmount UPS shall include a 9' __ (refer to chart) SignalSAFE™ power cord with NEMA __ (refer to chart) plug. UPS shall have surge suppression that utilizes a clean line-to-neutral design that does not pass noise contamination to ground. Rackmount UPS shall have a hot swappable battery that allows for a __ minute run time at half load and a __ (refer to chart) minute run time at full load. Rear of unit shall have inputs that allow for the installation of up to 10 additional hot swappable batteries. Rackmount UPS shall be RoHS EU Directive 2002/95/EC compliant. Rackmount UPS shall utilize Middle Atlantic Power Manager™ software. Rackmount UPS shall be warrantied to be free from defects in materials and workmanship under normal use and conditions for a period of 3 years; battery shall be warrantied for a period of 2 years. Rackmount UPS shall be UL listed in US and Canada.

UPS-1000 Series					
Utility Voltage (AC)	≤ 80	81-105	106-133	133-147	>147
Fans Engaged	front & rear	rear only	none	rear only	front & rear
dBA above Ambient	22dBA	11dBA	0	11dBA	22dBA

UPS-2200 Series					
Utility Voltage (AC)	≤ 80	81-105	106-133	133-147	>147
Fans Engaged	Front & Rear	Rear only	None	Rear Only	Front & Rear
dBA above Ambient	27dBA	14dBA	0	14dBA	27dBA

UPS-IPCARD
Web based control shall be enabled on non-internet enabled Middle Atlantic Products UPS by UPS-IPCARD, which shall be installed into the Expansion Port on the rear of the UPS. This shall be compatible with UPS firmware v1.65 or greater, and provide full functionality when used on models with firmware v1.75 or greater.

UPS-RLCARD
Remote shutdown of the UPS shall be enabled on non-internet enabled Middle Atlantic Products UPS by UPS-RLCARD, which shall be installed into the Expansion Port on the rear panel of the UPS. This shall be compatible with UPS firmware v1.65 or greater. A user supplied remote push button and external +12VDC source shall be connected to the DB-9 connector on the UPS-RLCARD to activate the remote shutdown feature.

Expansion Battery
Rackmount expansion battery pack shall be Middle Atlantic Products model# UPS-EBPR. Expansion battery pack shall be suitable for use with both UPS-1000R and UPS-2200R. UPS-EBPR shall measure 19.00" W x 3.50" H x 19.29" D and occupy 2 rackspaces. UPS-EBPR shall require 22.66" useable depth. With __ hot swappable batteries connected to the unit, there is a __ minute run time at half load and a __ minute run time at full load (refer to chart). Rackmount expansion battery pack shall be warrantied for a period of 2 years.

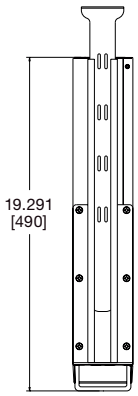
Replacement Battery
Replacement Battery Pack for the UPS shall be Middle Atlantic Products model # UPS-RBP. Replacement battery pack shall be suitable for use with both UPS-1000R__ and UPS-2200R__. Replacement battery shall be warrantied to be free from defects in materials and workmanship under normal use and conditions for a period of 2 years.

UPS Series
basic dimensions

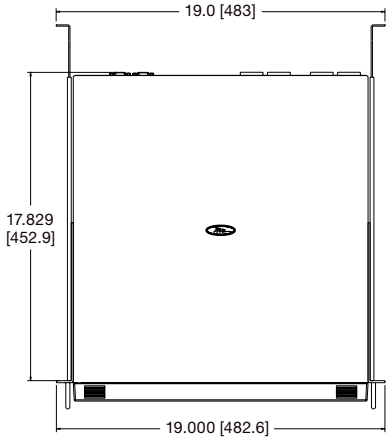
all dimensions in inches unless otherwise noted [all dimensions in brackets are in millimeters]

UPS-2200/1000 Series

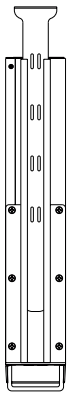
side view



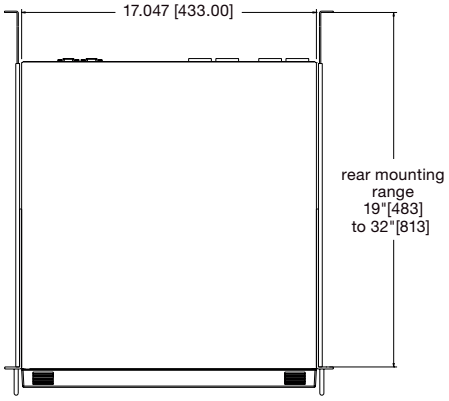
top view



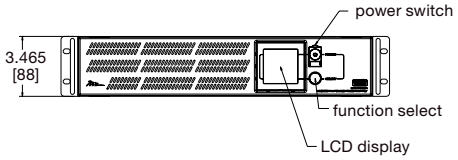
side view



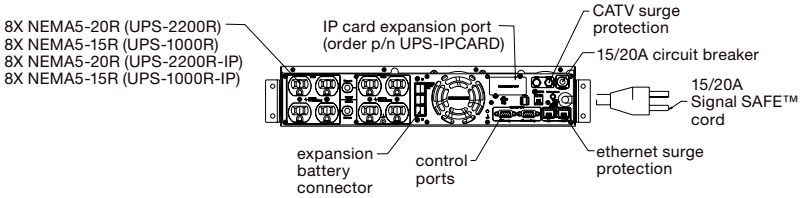
bottom view



front view

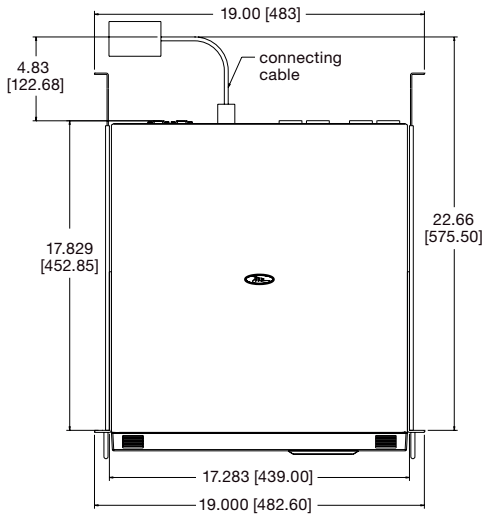


rear view

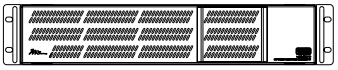


UPS-EBPR Series

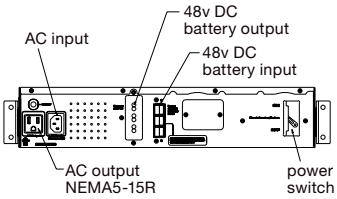
top view



front view



rear view



Model#	Capacity	Outlet Control	Internet enabled
UPS-1000R	1000VA	critical / non-critical bank	w/ optional UPS-IPCARD
UPS-1000R-IP	1000VA	critical / non-critical bank	yes
UPS-1000R-8	1000VA	individual outlet	w/ optional UPS-IPCARD
UPS-1000R-8IP	1000VA	individual outlet	yes
UPS-2200R	2150VA	critical / non-critical bank	w/ optional UPS-IPCARD
UPS-2200R-IP	2150VA	critical / non-critical bank	yes
UPS-2200R-8	2150VA	individual outlet	w/ optional UPS-IPCARD
UPS-2200R-8IP	2150VA	individual outlet	yes

UPS Series
basic dimensions

all dimensions in inches unless otherwise noted [all dimensions in brackets are in millimeters]

		UPS-1000R Series		UPS-2200R Series	
Input	Nominal Input Voltage	120 V		120 V	
	Input Voltage Range	80VAC – 145VAC		80VAC – 145VAC	
	Input Frequency	60 Hz +/- 3 Hz (auto sensing)		60 Hz +/- 3 Hz (auto sensing)	
	Input Protection Type	Resettable thermal fuse		Resettable thermal fuse	
	Cord Length / Cord Type / Plug Type	9 ft. / 14/3 / NEMA 5-15P		9 ft. / 12/3 / NEMA 5-20P	
Output	Green Mode Consumption	Less than 9W at full battery capacity		Less than 9W at full battery capacity	
	Nominal Output Voltage	120 V		120 V	
	Capacity (VA)	1000VA		2150VA	
	Capacity (Watts)	750W		1650W	
	Waveform	Pure Sine Wave		Pure Sine Wave	
	On Line Output Frequency	57 - 63 Hz for 60 Hz nominal		57 - 63 Hz for 60 Hz nominal	
	On Battery Output Frequency	60 Hz +/- .1 Hz		60 Hz +/- .1 Hz	
	Transfer Time (Typical)	4 ms typical line to battery / battery to line		4 ms typical line to battery / battery to line	
	Overload Protection (on line mode)	100%≤ Load< 110% warning, 120 sec shutdown 110%≤ Load< 125% warning, 40 sec shutdown 125%≤ Load warning, 10 sec shutdown		100%≤ Load< 110% warning, 120 sec shutdown 110%≤ Load< 125% warning, 40 sec shutdown 125%≤ Load warning, 10 sec shutdown	
	Overload Protection (on battery mode)	100%≤ Load< 110% warning, 30 sec shutdown 110%≤ Load< 125% warning, 10 sec shutdown 125%≤ Load warning, 3 sec shutdown		100%≤ Load< 110% warning, 30 sec shutdown 110%≤ Load< 125% warning, 10 sec shutdown 125%≤ Load warning, 3 sec shutdown	
Total Harmonic Distortion (THD) *typical 120V power with 2%-4% THD	Total System Load	0%	20%	60%	100%
	Utility Mains* THD	2.0%	2.0%	2.0%	2.0%
	Battery Backup THD	1.9%	1.3%	1.5%	5.2%
Surge Protection & Filtering	Lightning / Surge Protection	L-N=>381 J (127J x 3) Clamp voltage 270V (Max energy 10 / 1000 µs)		L-N=>381 J (127J x 3) Clamp voltage 270V (Max energy 10 / 1000 µs)	
	RJ11 / RJ45 Protection	Sidactorx1 Clamp Voltage 275V Fuse (.75A / 250V) x 2		Sidactorx1 Clamp Voltage 275V Fuse (.75A / 250V) x 2	
Physical	Output Receptacles	(8) NEMA 5-15R		(8) NEMA 5-20R	
	Dimensions (in.)	19.00" [423] W x 3.50" [89] H x 19.29" [490] D		19.00" [423] W x 3.50" [89] H x 19.29" [490] D	
	Weight (lb.)	68 lbs.		77 lbs.	
Battery	Rating	12V / 9.0 AH x 4		12V / 9.0 AH x 4	
	Auto Charger	1A		1A	
	Hot Swappable External Battery	Yes		Yes	
	Run Time at Half Load	26 minutes		13 minutes	
	Run Time at Full Load	13 minutes		6.4 minutes	
Warning Diagnostics	Control Panel	LCD Display Indicators, Power On		LCD Display Indicators, Power On	
	Audible Alarms	On Battery, Low Battery		On Battery, Low Battery	
Environmental	Operating Temperature	32°F to 104°F (0°C to 40°C)		32°F to 104°F (0°C to 40°C)	
	Operating Relative Humidity	0 to 95% Non-Condensing		0 to 95% Non-Condensing	

UPS Series
basic dimensions

all dimensions in inches unless otherwise noted [all dimensions in brackets are in millimeters]

		UPS-1000R Series	UPS-2200R Series
Communication	Software	Middle Atlantic Power Manager™	Middle Atlantic Power Manager™
Management	Self-Test	Manual Self-Test via front panel	Manual Self-Test via front panel
	Auto-Charger/ Auto-Restart	yes	yes
	COM Interface	Primary: - RS232 Communication + Control - Analog Status Notification + Control Secondary: - Analog status notification only	Primary: - RS232 Communication + Control - Analog Status Notification + Control Secondary: - Analog status notification only
	Built-in USB Interface	yes	yes

Estimated Run Times UPS-1000R Series								
Load (VA)	120	240	360	480	600	720	840	960
Load (W)*	84	168	252	336	420	504	588	672
Load (A)	1	2	3	4	5	6	7	8
# of expansion batteries	Estimated Run Time (Minutes)							
UPS only	102	51	34	26	20	17	15	13
1	561	283	190	143	114	94	80	69
2	1020	515	345	260	207	171	145	125
3	1479	747	501	377	300	249	211	181
4	1938	979	657	494	394	326	276	238
5	2397	1211	813	611	487	403	341	294
6	2856	1443	968	728	580	480	407	350
7	3315	1676	1124	845	674	557	472	406
8	3774	1908	1280	962	767	635	537	463
9	4233	2140	1435	1079	860	712	603	519
10	4692	2372	1591	1196	954	789	668	575

*Assuming a Power Factor of .7

Estimated Run Times UPS-2200R Series																
Load (VA)	120	240	360	480	600	720	840	960	1080	1200	1320	1440	1560	1680	1800	1920
Load (W)*	90	180	270	360	450	540	630	720	810	900	990	1080	1170	1260	1350	1440
Load (A)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
# of expansion batteries	Estimated Run Time (Minutes)															
UPS only	102	51	34	26	20	17	15	13	11	10	9	9	8	7	7	6
1	561	283	190	143	114	94	80	69	60	53	47	42	37	33	29	26
2	1020	515	345	260	207	171	145	125	109	96	84	75	66	58	51	45
3	1479	747	501	377	300	249	211	181	158	139	122	108	95	84	74	64
4	1938	979	657	494	394	326	276	238	207	181	160	141	124	109	96	84
5	2397	1211	813	611	487	403	341	294	256	224	197	174	153	135	118	103
6	2856	1443	968	728	580	480	407	350	305	267	235	207	182	161	141	122
7	3315	1676	1124	845	674	557	472	406	353	310	272	240	212	186	163	142
8	3774	1908	1280	962	767	635	537	463	402	352	310	273	241	212	185	161
9	4233	2140	1435	1079	860	712	603	519	451	395	348	306	270	237	208	181
10	4692	2372	1591	1196	954	789	668	575	500	438	385	339	299	263	230	200

*Assuming a Power Factor of .75

High Density DVI USB KVM Switch: 4-, 8-, 16-, 24- and 32-Port
UNIMUX™

Control up to 32 single link DVI USB computers with one USB keyboard, USB mouse & DVI monitor

- The High Density Switch saves rack space
  - 4-, 8- and 16-port switches are 1RU in height.
  - 24- and 32-port switches are 2RU in height.
  - Rackmount kit included.
- Incorporates NTI's patented true autoboot USB switching; all attached USB PCs, SUNs and MACs can be booted simultaneously.
- Supports video resolutions up to 1920x1200.
- Supports digital DVI for crisp and clear video quality on flat panel display.
- Control the switch through the front panel interface, keyboard commands or RS232.
- Compliant with USB 2.0 (low/full speed) standards.
- High quality, rugged steel construction with durable powder coat finish.
- USB SUN start-up keys are supported.
- Supports MAC soft (keyboard) power-on.
- Cabling runs are simplified with NTI's high density KVM switch cables.
- Available with optional stereo audio.

UNIMUX-DVI-16HD (Front & Back)

The UNIMUX™ High Density DVI USB KVM switch allows you to control up to 32 single link DVI USB computers with one DVI-D monitor, USB keyboard and USB mouse.

Specifications

Hosts

- Female HDMI-A connectors.
- Supports USB-enabled computers (PC, SUN, and MAC) with DVI video.
- Multiplatform support: Windows 2000/XP/Vista/7, Windows Server 2000/2003/2008, Solaris, Linux, FreeBSD and MAC OS 9/10.

Monitor

- Supports crisp and clear video resolution up to 1920x1200.
- One female DVI-I connector.
- Single link DVI-D signal.
- DDC2B compatible.

Devices

- Two female USB Type A connectors.
- Provides support for full-speed (12 Mbps) or low-speed (1.5 Mbps) USB keyboard and mouse.
- Compatible with most USB keyboards and mice, including USB IntelliMouse®.
- Keyboard and mouse are hot-pluggable.
- Supports SUN and MAC extra keys.

Audio Option

- 3.5mm stereo audio jacks for inputs and output.
- Maximum input/output levels: 4Vp-p (line level).
- Input impedance: 10k Ohms.
- Output impedance: 32 Ohms.
- Signal-to-Noise Ratio (SNR): 87 dBA
- Frequency Response: 20 Hz to 20 kHz, ±0.5 dB.
- Total Harmonic Distortion + Noise: 0.02% at 1kHz.
- Requires powered speakers or headphones.
- CD quality audio output.

Power

- 110 or 220 VAC at 50 or 60 Hz via IEC connector.
- Power consumption: 10W

MTBF

- UNIMUX-DVI-4HD: 262,851 hrs
- UNIMUX-DVI-8HD: 217,508 hrs
- UNIMUX-DVI-16HD: 160,996 hrs

Dimensions

- 4-, 8-, 16-port switches WxDxH:
  - 15.2x6x1.75 in (386x152x45 mm) (without supplied rackmount kit)
  - 19x6x1.75 in (483x152x45 mm) (with supplied rackmount kit)
- 24- and 32-port switches WxDxH:
  - 15.3x6x3.5 in (389x152x89 mm) (without supplied rackmount kit)
  - 19x6x3.5 in (483x152x89 mm) (with supplied rackmount kit)

Cables

- Interface cables between your computers and the switch are required for proper operation. (Cables not included) Use USB-DHEXT-xx-MM to connect the computers to the switch.

Environmental

- Operating temperature: 32°F to 100°F (0°C to 38°C).
- Storage temperature: -22°F to 140°F (-30°C to 60°C).
- Operating and Storage Relative Humidity: 17 to 90% non-condensing RH.

Regulatory Approval

- CE, RoHS
- TAA compliant

Warranty

- Two years

Compatible NTI Products

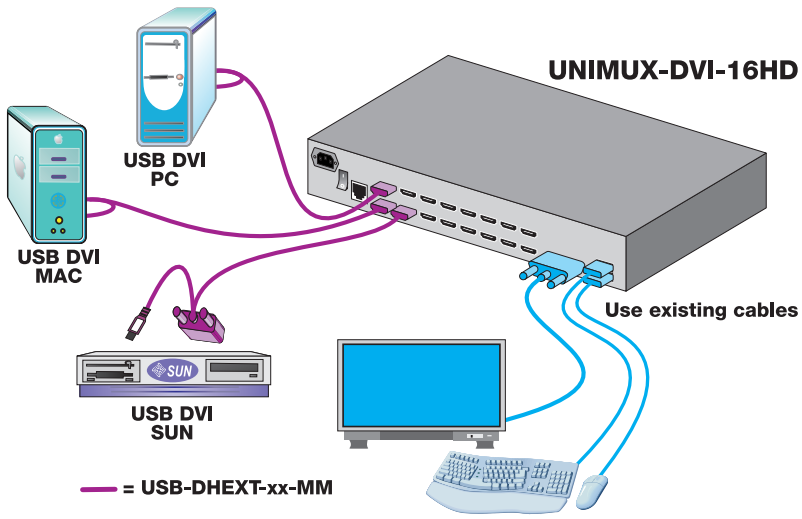
- Combine NTI's extenders, switches, and cables for complex applications.
  - DVI-D to HDMI Single Link Interface Cable (DVI-HD-xx-MM).
  - HDMI USB KVM Extender over HDBase-T (ST-C6USBH-HDBT).

NETWORK TECHNOLOGIES INCORPORATED
1.800.RGB.TECH (800.742.8324) Toll Free: US & Canada
330.562.7070 International calls
330.562.1999 Worldwide fax
sales@ntigo.com
www.networktechinc.com

High Density DVI USB KVM Switch: 4-, 8-, 16-, 24- and 32-Port
UNIMUX™

Control up to 32 single link DVI USB computers with one USB keyboard, USB mouse & DVI monitor

Configuration and Cable Illustration



Control Methods

Front Panel Interface

- LEDs indicate currently selected port and mode of operation.
- Hold in any button for more than five seconds to go into **Scan, Broadcast** or **Command Mode**.
  - In **Normal Operating Mode**, the user can directly operate the selected computer with transparent presence of the NTI switch.
  - **Scan Mode** automatically and sequentially displays the video from each powered on computer for 2-255 seconds.
  - **Broadcast Mode** allows the user's keystrokes to be sent to both powered on computers. (Broadcast Mode is not available for MACs.)
  - **Command Mode** allows the user to give instructions to the switch through his/her keyboard. Keystrokes are not passed to the computer.

Keyboard

- **Scan**, **Broadcast** or **Command Modes** are available from the keyboard using hot keys.
- Use the keyboard to command the switch box to select ports or configure the **Scan** delay.
- Type <Ctrl>+<`> (or <Compose>+<`>) to go into Command Mode.
- Press <Esc> to leave **Command Mode** and return to **Normal** or **Scan Mode**.

RS232 Control

- Female RJ45 connector.
- Baud rate 2400, 9600, 19200, or 38400.
- Use DIP switches to set the baud rate and address up to 16 units, all of which can be daisy chained and controlled by one serial port.
- 5-foot (1.5-meter) CAT5e patch cable, RJ45F-DB9F and RJ45F-DB25F adapters included.
- **Commands**
  - RS - causes switch to reset so that IN1 connects to OUT1, IN2 connects to OUT2.
  - CS - causes one INx/OUTx connection to occur.
  - CA - causes all inputs to connect to specified output.
  - RO - reads what input is connected to specified output.
  - RU - reads size of matrix, reports number of inputs and number of outputs on specified switch.

High Density USB DVI KVM Switches

NTI Part #	# of CPUs (x)	Desktop Size WxDxH without supplied rackmount kit	Rack Size WxDxH with supplied rackmount kit
UNIMUX-DVI-4HD	4	15.2x6x1.75 in (386x152x45 mm)	19x6x1.75 in (483x152x45 mm)
UNIMUX-DVI-8HD	8	15.2x6x1.75 in (386x152x45 mm)	19x6x1.75 in (483x152x45 mm)
UNIMUX-DVI-16HD	16	15.2x6x1.75 in (386x152x45 mm)	19x6x1.75 in (483x152x45 mm)
UNIMUX-DVI-24HD	24	15.3x6x3.5 in (389x152x89 mm)	19x6x3.5 in (483x152x89 mm)
UNIMUX-DVI-32HD	32	15.3x6x3.5 in (389x152x89 mm)	19x6x3.5 in (483x152x89 mm)

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330.562.7070 International calls
330.562.1999 Worldwide fax
sales@ntigo.com
www.networktechinc.com

VMRK SERIES RACK, VMRK-54

VMRK-54 |

FEATURES & BENEFITS

This taller version of our broadcast standard 22” wide rack has extra height for taller spaces – delivering a full 54 rackspaces in the same floor space as a standard rack. Built-in horizontal lacing bars enable quick tie-and-slide lacing of video cable bundles. Specify a VMRK to maximize capacity, and where seismic certification and open or removable sides are required or preferred.

RoHS

PEP ecoPASSPORT® PRODUCT ENVIRONMENTAL PROFILE

- Fully welded construction for strength
- 54 spaces of racking height
- Racks gang together when fully loaded
- Multiple lacing points and slotted rail brackets for cable management flexibility
- Standard front and rear adjustable 10-32 threaded “L-Rail” with numbered spaces
- Includes standard solid locking rear door

SPECIFICATIONS

GENERAL INFO

Gangable: Yes
Finish: Black
UL Standards Tested: UL1678

LISTING AGENCIES/THIRD PARTY CERTIFICATIONS

ASCE: 7-10
RoHS: Yes
Greenguard: Yes
UL Listing No: E173107

DIMENSIONS

Usable Depth: 29.29
Usable Height: 94.5
Capacity Weight (US): 10000
Depth (US): 31.4
Height (US): 100.64
Width (US): 22
Rack Units: 54

TECHNICAL INFORMATION

Rackrail Type: 10-32
Seismic Load Capacity: 640
Static Load Capacity: 10000
UL Load Capacity: 2500
Material: Steel
Mounting: Horizontal
Seismic Rating: Yes

SECTION 12353 - EXHIBIT CASEWORK

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this section shall be governed by the Contract Documents. Provide materials, labor, equipment, and services necessary to furnish, deliver, and install all work of this section as shown on the drawings, as specified herein, and/or as required by job conditions.

B. The Work of this Section includes all labor, materials, equipment and services necessary to complete the exhibition Caseworks as shown on the drawings and/or specified herein:

1. Structural engineering of the exhibit Casework metal frame, supported glazing, object support systems, and graphic panel supports by Exhibit Contractor's Professional Engineer, including Building Department filing and testing and acceptance review as per local code requirements.

C. RELATED SECTIONS

Section 05500 Metal Fabrication
Section 06430 Exhibit Woodwork
Section 09920 Painting
Section 10200 Digital Output
Section 16500 Exhibit Lighting

1.4 QUALITY ASSURANCES

A. The fabricator and the installer shall be one of the same firm who can substantiate that the firm has been continuously engaged in the fabrication and installation of Exhibit Casework similar to that described herein for not less than seven (7) years.

B. Technical design, engineering and prototyping of Exhibit Casework is the Exhibit Contractor's responsibility.

1. The Design Documents are intended to provide performance and aesthetic and functional specifications for the design, fabrication and installation of the Exhibit Casework. This Exhibit Contractor is responsible for the engineering and design of the components and materials as well as fabrication, installation, and performance of the fabrications.

2. Exhibit Design Drawings shown are intended to establish the basic dimensions, finishes, motion, location, connections, and profiles of the Exhibit Caseworks. The Exhibit Contractor is responsible for the design and engineering of the fabrication within these parameters. The drawings are design requirements, unless specifically noted as completely engineered and designed on the drawings.

3. Exhibit design control drawings do not cover some conditions or modifications, which may be required. The Exhibit Contractor, by accepting this Work, acknowledges this and agrees that the Exhibit Designer shall have final acceptance of all matters whether detailed or not for the exhibit design details.

C. Casework Engineer qualifications: Professional engineers experienced in providing engineering

services of the kind required that have resulted in the successful installation of Exhibit Caseworks as similar as possible in material, design and extent to that indicated for this Project.

D. All work shall comply with all building and applicable life safety codes and is subject to the Owner's code consultant's review.

E. All Exhibit Caseworks shall be engineered to withstand normal wear and tear of routine installation and operation. Exhibit Contractor shall warrantee in writing all Exhibit Caseworks are free of defects. The period of the warrantee shall be one year. Exhibit Caseworks failing to function as specified during this period shall be repaired at the Exhibit Contractor's expense.

F. Exhibit Contractor shall provide written instructions on the maintenance of all Exhibit Caseworks – See Section 01782 Operations Demonstration and Training. Owner shall be responsible for providing proper maintenance under the terms of the warrantee.

1.3 SUBMITTALS

A. SAMPLES & PRODUCT LITERATURE

1. Product Literature: For all manufactured parts and hardware, submit catalog cuts, literature, color charts, and data sheets along with other required submittals.

2. Fire Rating: Submit fire retardant test data for partitions and panel cores.

3. Samples: Prior to purchasing bulk materials, and in advance of fabrication, the Exhibit Contractor shall submit the following samples to the Exhibit Designer for approval:

a. Two (2) pieces each of all fasteners, hinges, spring washers, threaded inserts, locks, levelers, gaskets, etc. which will be incorporated into the finished Casework.

b. Two (2) one-foot-square (12" x 12") sample of glass with finished edges and seals.

c. Two (2) each (12" long) section of Steel Framing Section including typical weld and with specified finish.

d. Three (3) one-foot-square (12" x 12") sample of base and partition panel with specified finish.

e. Two (2) each of all object support brackets and graphic panel support brackets with specified finish.

4. Conservation: Prior to purchase and fabrication, all construction and finish materials must be approved by the Owner.

B. SHOP DRAWINGS

1. For each typical Exhibit Casework and each unique Exhibit Casework, submit shop drawings to the Exhibit Designer for review in accordance with the requirements of the Contract Documents.

2. For each typical Exhibit Casework and each unique Exhibit Casework, provide large scale

plans elevations, sections and details clearly showing the materials, thicknesses, dimensions and method of attachment to each other and to the encountered conditions. Fastening devices whether concealed or exposed shall be noted as to size, type and spacing. Clearly indicate scale.

a. Note and describe the various materials and finishes including but not limited to structural materials, fire retardants, adhesives, paints, caulks, gasket material, graphic panels, shelves and decorative elements. Provide manufacturer name, address and complete product information including product name, color, and identifying number. Note how materials will be fastened to one another.

b. Lighting details and layouts are to be provided to Exhibit Designer and the Exhibit Designer's Lighting Consultant for review and approval prior to fabrication.

b. Joints which occur in the finished work shall be clearly identified and shall be subject to the Exhibit Designer's review and approval.

c. Submit complete schedule of Casework hardware, noting numbers, types, manufactures and finish.

d. Provide isometric drawings showing access into the Casework structure for all required maintenance including access into the display chamber and the lighting power chamber. Clearly indicate access for graphic panels in each Casework as well as for the re-lamping of each fixture.

3. Provide final drawings that incorporate any required revisions. Fabrication to be based on the Exhibit Designer's approval of final Shop Drawings.

4. Provide two copies of as-built package that includes as-built drawings and specifications for final construction and finish materials.

5. Indicate in all drawings those items which will be Not In Contract.

6. As a part of the preparation of Shop Drawings, Contractor shall retain a Professional Engineer, licensed in the State of the Museum, to review and design the exhibit Casework metal frames, supported glazing, object support systems, and graphic panel supports all as described in the Contract Documents.

a. Structural Metal Framing drawings are to be submitted to Exhibit Designer and Exhibit Designer's Consulting Structural Engineer for review and approval prior to fabrication.

b. Contractor's Engineer shall supervise the design, review and sign and seal Shop Drawings, visit points of manufacture and construction, and submit all calculations and drawings to the Building Department as required. The Exhibit Contractor's Engineer shall arrange and supervise all required testing needed for Building Department.

c. Casework systems shall conform to local and international Building Codes and be in compliance with reference standard ASCE 7-05 with respect to seismic criteria for architectural components.

d. The Exhibit Casework Steel Framing Systems are to accommodate the weight of artifacts and exhibit displays in addition to its own self weight and the weight of

supported glazing and lighting systems. The Casework glazing is to accommodate the seismic deflections of its supporting frame and continue to be supported and retained by its frame during a code specified seismic event.

C. PROTOTYPES

1. Fabricate Casework assembly showing access, finish, hardware including object support system with mock objects, assembly and integration of all graphic panel types with all components for display area, as well and lighting for each case type.

2. In order to test the Casework performance and review all design details, the prototype must be built to the dimensions of the Casework-type in the exhibit; if such a prototype is approved, it may be incorporated into the final exhibit as long as it is indistinguishable from the remaining production run of Exhibit Caseworks.

3. Contractor shall not proceed with fabrication of the component in question until the prototype is accepted based on its overall quality, function and appearance by the Owner and Exhibit Designer. Casework must pass performance testing to assure;

   a) proper functioning of Casework hardware including doors
   b) integration of object support system and Owner provided mounts
   c) removable graphic panels
   d) functionality of lightingf

4. Contractor shall devise a timetable for fabrication and submittal of prototype so that a submittal and review process of reasonable duration shall have no adverse effect on project schedule. A four-month schedule from submittal of preliminary drawings to review of Casework prototypes is recommended.

5. Qualification data for firms and persons specified in "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Exhibit Designers and Owners, and other information specified.

1.4 DELIVERY, STORAGE AND HANDLING

A. Conditioning: Installer shall advise Exhibit Contractor of temperature and humidity requirements for Casework installation areas. Do not install work until required temperature and relative humidity have been stabilized and will be maintained in installation areas. Fabrication and installation schedule must allow four weeks between the application of the last paint, sealant, or adhesive and the installation of any artifact or item.

B. Fully protect each item from the weather and from extremes in temperature and relative humidity while in transit from point of origin or fabrication to the job site. When delivered immediately place under cover and adequately protect from damage. Keep clean, and store and handle in such a manner as to avoid injury. Casework must be clean and free of all insects and mold.

B. Deliver items from the point of origin with the original, approved manufacturers packing and wrapping. Removing of wrapping and packing materials shall occur in the final room or space only.

C. Remove delivered materials which do not conform to the reviewed samples or are damaged, marred or otherwise not suitable for installation from the job site and replace with acceptable

materials.

D. Finished items shall be delivered to the job site ready for installation. Storage of finished items at the job site awaiting installation will not be permitted.

E. Only limited repair of damaged materials can occur on site. Repair work especially that requiring painting, sanding, sawing or other dust or volatile producing work must be approved and may be restricted to a work area outside of the exhibit space.

1.5 WARRANTY

A. Exhibit Contractor guarantees and warrants the completed work and components for one year from acceptance for any defects in materials or workmanship. Contractor shall promptly correct, at its expense, any portion of the work not meeting industry standards or local building code requirements, or which fails or proves defective in whole or in part during the warranty period.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All construction and finish materials must be approved by the Exhibit Designer and Owner for Conservation.

B. Metal: All exposed metal finishes for Casework shall be typical per Section 09920 Painting.

C. Glazing: All glazing to be low-iron laminated safety glass with ultraviolet radiation filtering laminate. Glass thickness to be reviewed by engineer to assure that glass will not bend or bow. Edges to be precision ground and polished.

D. Plywood used within Caseworks for exhibit partitions to be 3/4” Appleply free from urea-formaldehyde based adhesives and cold treated for pest control. All plywood products are to be certified by Forest Stewardship Council.

1. Approved Manufacturers;

a. States Industries
Eugene OR
Tel. 800-626-1981
www.statesind.com

b. Or equal as approved by Exhibit Designer.

E. Epoxy Sealant: All wood used within Casework environments shall be sealed before covering with paint or fabric with two (2) coats of a paintable sealant such as Sancure by Lubrizol or approved equal applied per Manufacturer's specifications.

F. Paint: Casework interiors shall only be painted with Conservation-approved paint. No oil-based paints nor any other substances emitting formaldehyde, volatile acids, or other corrosive volatile organic compounds shall be used inside Casework environments. See Section 09920 Painting

G. Caulking: Select a neutral cure silicone caulk that does not emit acetic acid during cure. DowCorning neutral curing RTV silicone or equal, installed per Manufacturer's specifications.

H. Gaskets: Select an inert extruded silicon seal bonded to glass edges with neutral curing silicon adhesive as tested and approved by Smithsonian Institution, installed per Manufacturer's specifications. Door hinges and access panels must allow clearance for the gasket dimension. The density of the gasket is important, as is its location, continuity, and dimensions. When possible seat foam gaskets into a channel or through that measures 60% of the gasket's depth. To prevent air leakage, it is critical that access doors and removable panels meet the following criteria:

1. Attach with enough fasteners in order to compress the gasket material
2. Do not bow or deform under the pressure of the fasteners
3. Seat evenly against a uniform gasket surface
4. Fit with continuous gasket with no gap between sections
5. Do not bind against the gasket along the hinged side.

I. Glue: Any adhesive used inside the Casework either in construction or application of finishes including graphic panels and photomurals must be approved by the Exhibit Designer and the Owner's Conservator.

1. Approved Materials;
    a. Fabric: Adhere using mechanical fastening methods, 3M#465 acrylic adhesive transfer tape, or approved equivalent.
    b. Instabond C by Quality Mounting and Laminating Systems, Inc. is pre-approved as an interior Casework adhesive. This can be used for prints, graphics or text panels.

J. Concealed fastening clips in conjunction with Casework interiors shall be extruded aluminum interlocking type and not less than 2 inches wide x .125 inches thick.

K. Finish Hardware (visible)

1. 1/4" diam, countersunk, flat-head, allen-socket type bolts or machine screws. Finish to match adjacent finishes.

L. Rough Hardware (concealed from view)

1. Nails shall be common steel wire, untreated for interlock work as per FS FF-N-1 05. Finishing type at countersunk face locations for concealment.

2. Bolts shall be standard mild steel, Hex head bolts with square nuts and malleable iron and steel plate washers conforming to the following:

    a. Bolts FS FF-B-575 and 584
    b. Nuts ASTM A-563
    c. Expansion shields FS FF-B-561
    d. Toggle bolts FS FF-B-588
    e. Lag screws and bolts ANSI B18.2.1

3. Wood screws as per ANSI B18.6.1.

4. All concealed wood must be coated with two applications of a Owner's Conservator approved coating.

2.4 CONSERVATION REQUIREMENTS

A. CONSTRUCTION:

2. Physical stability: provide structural stability to withstand shock and vibration (from visitor movement, HVAC system, and other equipment) and to comply with all local seismic requirements.

3. All Exhibit Caseworks should protect their content from fire exposure for at least 30 minutes and the force from overhead sprinklers and fire department hoses.

4. All Exhibit Caseworks shall be constructed to allow only inert or acid-free materials to come in contact with historic textiles, documents, specimens and other sensitive organic materials and artifacts.

5. All Exhibit Casework elements to be allowed a minimum of 2 weeks off-gas time prior to scheduled object install.

6. Provide easy access to objects in display chamber for rotation of objects.

7. Provide easy access to lighting equipment for maintenance.

B. TEMPERATURE AND HUMIDITY CONTROL

1. The building's HVAC system for exhibit areas is designed to maintain a temperature of 70 Degrees Fahrenheit +/- 2 degree variation over 24 hours and a Relative Humidity of 50% +/- 5% variation (for both summer & winter). The system has the ability to be reset to 68 Degrees Fahrenheit +/- 40% Relative Humidity with the same tolerances for winter set back. Exhibit Caseworks is to ventilate and maintain a target relative humidity with no more than a total of 1% variation in relative humidity per hour and a rise in temperature of no more than 1°F per hour even when the Casework is lit or any equipment is operational.

2. Contractor to provide one (1) "Arten Thermo/Hygrometer" or approved equal per Exhibit Casework to measure and monitor relative humidity.

3. Low voltage lighting power supply chamber at Casework deck must be physically accessible from within the display chamber. Heat from any equipment including lamps must not rise the Casework temperature more than 2°F. Mechanical fans or other system may be required to dissipate heat.

C. SECURITY

1. Casework closure system to include manual key lock for individual doors at the door location. Provide Owner with (1) master key for all Exhibit Caseworks and (3) duplicates.

2. Use shatterproof laminated glazing, or safety laminate on tempered glass.

3. Use tamper -resistant hardware for all concealed Casework screws and entry hardware.

4. Conceal all entry hardware.

PART 3 PART - EXECUTION

3.1 EXAMINATION

A. Study the Contract drawings and specifications with regard to the work as shown and required under this Section so as to insure its completeness.

B. Examine surfaces and conditions to which this work is to be attached or applied and notify the Exhibit if conditions exist which are detrimental to the proper and expeditious installation of the work. Starting on the work shall imply acceptance of the surfaces and conditions to perform the work as specified.

C. Verify dimensions taken at the job site those affecting the work. Bring field dimensions which are at variance to the attention of the Exhibit. Obtain decision regarding corrective measures before the start of installation.

D. Cooperate in the coordination and scheduling of the work of this Section with the work of other Sections so as not to delay job progress.

E. Consult with Exhibit Designer on Casework design, materials selection and testing, and Casework performance testing.

3.2 INSTALLATION

F. Perform installation using skilled workers who are familiar with this type of work. The manufacturer shall provide the services of a direct manufacturers representative in the field to assure that the work is being performed in a manner recommended.

G. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims in a manner that will prevent any future warping, cracking, settling or other distortion. Install to a tolerance of 1/8" in 8'-0" for plumb and level (including shelves); and with 1/16" maximum offset in flush adjoining surface, 1/8" maximum offsets in revealed adjoining surfaces.

H. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

I. Accurately locate each item at its designated location and anchored in place in a secure and plumb manner, using the methods and means noted on the reviewed submittals.

J. The climatological conditions at the job site shall be equal to the conditions under which the work was fabricated. Do not store or install the work when the temperature and humidity are above or below accepted limits, as determined by the manufacturer and/or the Exhibit Designer.

    1. Defects which occur as a result of the above shall be repaired and/or replaced, as determined by the Exhibit Designer, and at no additional cost.

K. Installation: Carefully unpack each item near its point of installation. Loose parts and accessory items shall be set within the Exhibit Casework at their designated locations.

    1. Install without distortion so that doors and panels will fit openings properly and be securely aligned. Adjust hardware to center doors and drawers in openings and provide unencumbered operation. Complete the installation of hardware and accessory items as indicated.

2. As each item is set the leveling devices shall be adjusted so that its top is plumb and level, and tested so it does not sway, rock or shake.

3. Prior to acceptance, operating hardware shall be checked and adjusted. Hardware shall operate smoothly for use intended. In the closed position the space between the moving portion and the fixed shall be uniform, even and plumb, and flush with the abutting surface. Doors in their open position should allow Casework access of no less than 60% of the doors width.

4. Provide a closeout package including as-built drawings, tools and keys for Casework entry, manual for AV controlled door access, extra material, touch up kit with paint, fabric and other finish materials.

3.3 PROTECTION AND CLEANING

A. Protect installed Casework work at all times, by adequate and suitable means, during and after installation and until accepted. The site must be dust free and clear of other trades prior to and during Casework installation. Once Caseworks are installed the area should be secured and Permission to Work permits should be issued to prevent damage to Caseworks by following trades.

B. Surfaces which become damaged, marred, scratched, abraded or are not sound and are defective functionally or visually shall be repaired and/or removed and replaced, as determined at no additional cost.

C. Clean all surfaces of grime, dust and general construction dirt. Touch-up shop-applied finishes to restore damaged or soiled areas.

D. Clean hardware, lubricate and make final adjustments for proper operation.

END OF SECTION 12353

SECTION 16500 – EXHIBIT LIGHTING

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this section, as shown or specified, shall be in accordance with the requirements of Division 1 Specifications and the Exhibit Contract Documents and Owner provided General Conditions.

B. Provide labor, materials, and equipment for the installation of indoor exhibit lighting fixtures, lighting equipment, and lamps as shown on the drawings and specified here.

C. Refer to drawings for dimensions and details. Check and verify dimensions and details on drawings before proceeding with the work. Report any discrepancies at once to the Exhibit Designer. Should it appear that the work intended is not sufficiently detailed or explained on the drawings or in the specifications, apply to the Exhibit Designer for further drawings or explanations, as may be necessary. Conform to these explanations in the work. If any question arises about the true meaning of the drawings or specifications, refer the matter to the Exhibit Designer whose decision is final and conclusive. In no case submit a bid, or proceed on any work with uncertainty. The intention of this specification and the accompanying or applicable drawings is to provide a job complete in every respect. Contractor is responsible for this result.

1.2 SCOPE

A. Included in the work of this Section are labor, materials and appurtenances required to complete the work of this Section, as specified herein, as required by job conditions, or as indicated on drawings, including but not limited to general requirements for lighting fixtures including coordination, definitions, quality assurances, submittals, mockup, samples and general responsibility for a complete job.

B. Scope and responsibility for the procurement and installation of exhibit lighting elements are indicated on the Light Fixture Schedule. Responsibilities are divided into three procurement groups and two installation groups.

Procurement Groups:

1. Fit Out: Lighting fixtures are to be purchased and coordinated by the General Contractor

2. Fit Out/Alt By Owner: Lighting fixtures are to be priced by the GC as an alternate with final purchasing direction to be decided by the owner.

3. Exhibit: Items are to be purchased and coordinated by the XC.

Install Groups:

1. Fit Out: Lighting fixtures are to be installed by the General Contractor and their representatives.

2. Exhibit: Items are to be installed by the XC and their representatives.

1.3 DEFINITIONS

A. In this specification, the term “Exhibit Designer” includes the Exhibit Designer, Owner's representative and/or the Lighting Consultant, together or individually, as they shall decide. The term “fixtures” refers to exhibit lighting fixtures and luminaires.

1.4 RELATED DOCUMENTS

A. Applicable requirements of the Contract Documents and of Division I General Requirements of the Specifications apply to the work of this Section.

1.5 COORDINATION

A. Clearly indicate the Work to be performed by other trades contractors, and the materials that are adjacent to or abutting the Work of this Section. Coordinate as required.

B. Fixture locations as indicated on the electrical drawings are generalized and approximate. Carefully verify locations with Exhibit Designer's plans, reflected ceiling plans and other reference data prior to installation. Check for adequacy of headroom and non-interference with other equipment, such as ducts, pipes or openings. Bring conflicts to the Exhibit Designer's attention before proceeding with the work.

C. Give ample notice of special openings required for placing equipment in the building, in order to avoid cutting of completed work.

D. Furnish the materials and labor for Work included under this Section in ample time, and in sufficient quantities so that all of the Work may be installed in proper sequence to avoid unnecessary cutting of the floors and walls.

E. Co-ordinate and schedule the Work of this Section with the Work of other Sections, Utility Companies and the Telephone Company so that there shall be no delay in the proper installation and completion of any part of each respective Work. Construction Work shall proceed in its natural sequence without unnecessary delay caused by the Work of this Section.

F. Schedule the Work to prevent Work of this Section being damaged by other construction operations. Remove and replace Work so damaged at no cost to Owner.

G. Where Work of this Section is to be flush or concealed, install it to assure that it does not project beyond the finished lines of floors, ceilings or walls.

H. Although the location of equipment included in the Work of this Section may be shown on the Contract Drawings in a certain place, actual construction may disclose that the location for the Work does not make its position easily and quickly accessible. In such cases, call the Exhibit Designer's attention to this situation before installing this Work, and comply with his installation instructions.

I. Verify mounting conditions for all fixtures, and furnish appropriate mounting details upon request. Such mounting details shall be approved by Exhibit Designer.

1.6 QUALITY ASSURANCES

A. Acceptable manufacturers are listed in the fixture descriptions. Acceptable manufacturers shall be prepared to provide, upon request, proof of satisfactory production of equal or similar fixtures for a period of at least five years prior to bidding.

B. Statement of Application

1. The Contractor, by commencing the Work of this Section, assumes overall responsibility, as a part of the warranty of the Work, to assure that assemblies, components and parts shown or required by the Work of this Section comply with the Contract Documents.

2. Required Warranty

   a. For a period of one year after Owner's initial acceptance and establishment of the beginning date of the warranty period, and at no additional cost, the Contractor shall promptly provide and install replacements for fixtures or components (except for lamps) which, in the opinion of the Owner, are defective in materials or workmanship under normal operating conditions. If approved to do so by the Owner, the Contractor may repair installed equipment at the job site to Owner's satisfaction, provided that the Contractor repairs any damage to adjacent Work. For any time during the warranty period that fixtures are not fully functional due to defects in materials or workmanship, the Contractor shall provide or pay for and install and remove suitable and adequate temporary lighting fixtures. The Contractor also warrants replacement fixtures or components to be free of defects in workmanship or materials for a period of one year following replacement, and shall replace any defective replacements during their warranty period.

   b. The Contractor shall not be held responsible for acts of vandalism or for abnormal or accidental abuse of the fixtures or their components occurring during the warranty period, nor shall the Contractor be held responsible for deleterious effects caused by maintenance procedures performed without the concurrence of Contractor.

C. Substitutions

1. Fixtures included under this Section are specified by approved manufacturer and type. Furnish equipment as specified, unless substitutions are mutually agreed upon, as follows.

2. During the construction period, no substitutions shall be considered unless compelling reasons are given, such as inability to meet delivery schedule. This reason shall not be acceptable if delay is caused by Contractor's failure to order fixture in accordance with the schedule presented under “SUBMITTALS” below. In such cases, it is Contractor's responsibility to provide fixtures as specified without delay to the project and without additional cost to Owner.

3. Substitutions shall be named, samples, catalogue cuts and complete photometric reports submitted, and cost savings documented. Each substitution requested shall be submitted in the form of an alternate, separate proposal, accompanied by complete descriptive and technical data, indicating addition or deduction from the base bid. Submit a written request for proposed fixtures to be substituted to Exhibit Designer at least two weeks prior to the bid period. Substitutions proposed less than two weeks prior to the bid submittal date, and/or not including proper documentation, shall not be considered. The Owner shall accept or reject proposed substitutions.

4. The Exhibit Designer may request samples of fixtures proposed as substitutions by the Contractor. Samples shall be submitted in accordance with Section 1.08. Submit complete and operable sample fixtures for any proposed substitution as indicated in 1.06.C. above. Substitution samples provided to the Exhibit Designer less than one week prior to the bid submittal date, and/or not including proper documentation, shall not be considered.

5. Where proposed substitutions alter the function or appearance, or change space requirements or mounting details indicated in the Contract Documents, the Contractor shall detail such changes in the proposal and include costs for revised design and construction for trades involved.

6. In the case of "package" substitutions exceeding 10% of the fixture types included in this Specification, the Contractor shall reimburse the Exhibit Designer and consultants for the cost of evaluating proposed substitutions, whether or not such substitutions are accepted.

D. Equipment Compatibility: For each group of similar fixture types provide fixtures and components fabricated by one manufacturer, to simplify maintenance and replacement of equipment.

E. Regulatory Agencies

1. Provide fixtures constructed, wired and installed in compliance with the current edition of applicable city, state and national codes. Provide fixtures conforming to Underwriters Laboratories Standards, and to provisions of applicable codes which exceed those standards. In addition, provide fixtures which conform to additional regulations necessary to obtain approval for use of specified fixtures in locations shown. Use only electrical components listed by Underwriters Laboratories.

2. Particular attention is called to Article 410 (Lighting Fixtures) of the National Electric Code. Provide only fixtures that meet these requirements, as interpreted by local agencies. As manufacturers' catalogue numbers may not include thermal protection devices, it is Contractor's responsibility to co-ordinate the fixture provided with the ceiling construction in accordance with local code enforcement practice.

F. Recognized Standards

1. Underwriters Laboratories (UL)
2. National Electrical Code (NEC)
3. Certified Ballast Manufacturers Association (CBM)
4. Illuminating Engineering Society (IES)
5. American Society for Testing and Materials (ASTM)
6. American National Standards Institute (ANSI)

1.7 SUBMITTALS

A. Shop drawings, samples, test data and certificates shall be submitted for approval in accordance with the requirements of the Contract Documents. Fixtures or other materials shall not be shipped, stored or installed into the work unless prior approval has been received, based upon the submittal of shop drawings, samples, catalogue cuts, test data, certificates or other material submitted for approval. Make modifications to fixtures in accordance with Exhibit Designer's comments concerning submittals, as a part of the work of this Section.

B. Submittal Schedule

1. Within 90 calendar days after award of General Contract, a List of Intended Manufacturers and estimated fabrication lead times shall be submitted to Exhibit Designer. Lead times sha ll be measured in weeks, beginning from the manufacturer's receipt of approved shop drawings and release, and ending at shipment. Exhibit Designer shall approve or disappr ove each manufacturer.

2. Within 30 days after Contractor's receipt of Exhibit Designer's response to the List of Intended Manufacturers, copies of purchase orders and manufacturers' acknowledgments for all fixtures specified, conforming to Exhibit Designer's responses, shall be forwarded to Exhibit Designer. The purchase orders and the manufacture acknowledgments need not lis t prices, but shall contain a warranted fabrication lead time, in weeks, as defined above. These fabrication times shall be adequate for the timely completion of the job.

3. Within 30 days after date of manufacturer's acknowledgment of order, Contractor shall forward to Exhibit Designer complete shop drawings, and/or catalogue cuts for all specified fixtures.

4. Within 15 days after Contractor's receipt of disapproved shop drawings, revised shop drawings shall be resubmitted to Exhibit Designer.

5. Within 15 days after receipt of “approved” or “approved as noted” shop drawings, Contractor shall forward to Exhibit Designer a warranted shipment date for each specified fixture, as well as forwarding samples, texts, or any outstanding data required for approval.

6. The Contractor shall call to the attention of the Exhibit Designer any submittals that have not been returned to him in a timely manner and that might affect the appropriate delivery of fixtures.

C. Shop Drawings

1. Submit shop drawings for each type of fixture, except where specified fixtures are standard, unmodified, off-the-shelf units, fully described by catalogue cuts. If allowed by Exhibit Designer, such catalogue cuts may be substituted for shop drawings. Submit shop drawings in the form of one (1) reproducible and four (4) prints, or catalogue sheets in nine (9) copies

2. Indicate on shop drawings, materials, finishes, metal gauges, overall and detail dimensions, sizes, electrical and mechanical connections, fasteners, welds, joints, end conditions, provisions for the work of others, and similar information. Include pertinent mounting details including hung ceiling construction. Indicate complete details of the fixture, including manufacturer's catalogue numbers for sockets, ballasts, light shields, switches and type of wiring, and targeting and locking devices for adjustable fixtures. Indicate type and extent of approved inert insulating materials to prevent electrolytic corrosion at junctions of dissimilar metals shall be supplemented by additional drawings if information or descriptions listed above are not included in the sheets.

D. Submit independent laboratory photometric data in the directed number of copies and in format as directed by the Exhibit Designer. Photometric data shall be submitted for standard, off-the-shelf units, at the time the manufacturer's cuts are submitted. Photometric testing and reporting shall conform to IES procedures.

E. Manufacturer's catalogue sheets shall indicate input and load electrical characteristics, ambient temperature rating, noise level rating, mounting methods and UL listing for use with required lamp.

F. Fluorescent fixture manufacturer shall submit, when requested to do so, (with fixture shop drawing or Catalogue Sheet) thermal test data for the fixture to prove that nuisance tripping of the Class P ballast shall not occur when fixture is operating under the following conditions:

1. Voltage not exceeding 5% above nominal line voltage.
2. Room ambient of 77 degrees Fahrenheit (25 degrees Celsius).
3. Maximum ceiling cavity ambient temperature for recessed installation not exceeding 113 degrees Fahrenheit (45 degrees Celsius).

1.8 SAMPLES

A. When samples are specifically called for in the Fixture Descriptions in this Section, submit (1) sample unless otherwise indicated. If fixture samples are requested, supply a completely operable fixture with a plug for standard 120 Volt service. Otherwise provide component parts as specifically requested.

B. In addition to the above, after shop drawings, data and any other required submissions have been approved, submit to Exhibit Designer a sample of one of the following components.

1. Finish samples of any custom color or finish requested by Exhibit Designer.

C. Where a sample is submitted or requested, do not fabricate that fixture type until the sample is approved. Submit and resubmit a sample as specified in the Fixture Descriptions, as required, until samples are approved.

D. Tag samples with the name of the project, referenced specification, paragraph or drawing number, the fixture type number and any other identifying data. Ship the sample to the address specified by Exhibit Designer. After review, the sample shall be shipped to the Exhibit Designer at the project site for use as a comparison standard. All transportation charges for samples shall be paid by the Contractor. Make fixtures supplied under the work of this Section identical with approved samples. Do not install any sample fixtures in the project.

1.9 MOCK-UP

A. As a part of the work of this Section and at no additional cost to Owner, temporarily install, connect and adjust a reasonable number of fixtures of for mock-up listed below to verify specified requirements. Place the mock-up fixtures where and when directed by Exhibit Designer. Removal and storage of mock-up fixtures, when approved, shall be accomplished by the Contractor.

B. Contractor shall coordinate with General Contractor to provide fixtures not part of Exhibit Lighting scope but required for mock up. Contractor shall provide a minimum of six (6) sample track heads for each of the exhibit spaces to assist exhibit designers in coordinating exhibit elements.

C. Mock-up review (including lighting samples) required for the following areas:

   a. TBC

1.10 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Lighting fixtures and their component elements shall be delivered to the job site factory-assembled and wired to the greatest extent practical, in strict accordance with the approved shop drawings, samples, certificates and catalogue cuts, and shall be handled in a careful manner to avoid damage.

B. Exposed finishes shall be protected during manufacture, transport, storage and handling. Delivered materials shall be identical to the approved samples. Materials that become damaged shall be repaired and/or replaced as directed.

C. Fixtures shall be stored under cover, above the ground, in clean, dry areas, and shall be tagged and/or marked as to type and location.

D. Delivered fixtures shall include wiring, sockets, ballasts, shielding, channels, lenses and other parts and appurtenances necessary for fixture installation of each fixture type.

PART 2 PRODUCTS

2.1 GENERAL

A. Provide materials, equipment, appurtenances and workmanship for the work of this Section conforming to the highest commercial standards, as specified and indicated on the drawings. Make fixture parts and components not specifically identified or indicated on the drawings, of materials most appropriate to their use or function, and resistant to corrosion and to thermal and mechanical stresses encountered in the normal application and function of the fixtures.

B. Provide fixtures that are constructed to be suitable for and compatible with the surface materials and construction in which they will be installed.

2.2 MARKING OF FIXTURES

A. Plainly mark fixtures equipped with ballasts for operation of rapid start lamps “Use Rapid Start Lamps Only”. Similarly, mark other fixtures according to proper lamp type. Clearly mark ballasts that have multi-level outputs as such, and indicate proper terminals for the various outputs. Provide markings that are clear and that are located to be readily visible to service personnel, but invisible from normal viewing angles when lamps are in place.
B. All labels to be placed on interior or not visual surfaces or removed.

2.3 MATERIALS AND FABRICATION

A. Unless otherwise noted, use only completely concealed hardware. Weld exposed metal at joints, fill with weld material, grind smooth, and make free from light leaks by the inherent design of the fixture body and frame. Bond gaskets, when used, to the fixture metal. Gasket incandescent fixtures with overlapping trim. Weld ballast support studs, socket saddle studs and reflector support studs to fixture body. Self-threading screws are not approved. Make flexible leads enter fixtures at sides, unless otherwise noted. Ventilate ballast compartments and fixtures using bottom relamping, unless otherwise noted.

B. Fixture components shall be constructed of minimum 20 gauge sheet steel unless otherwise specified.

C. Construct fixtures with the minimum number of joints. Make unexposed joints by approved method such as welding, brazing, screwing or bolting. Soldered joints are not acceptable. Do not use self-tapping methods or rivets for fastening parts which shall be removed to gain access to electrical components requiring service or replacement, or for fastening any electrical components or their supports.

D. Provide metallic cast or extruded parts of fixtures that are close grained, sound, and free from imperfections or discoloration. Provide cast or extruded parts that are rigid, true to pattern, and of ample weight and thickness. Provide cast or extruded parts that are properly fitted, filed, ground, buffed and chased to provide finished surfaces and joints free of imperfections. Make thickness on cast parts not less than 1/8 inch.

E. Provide housings for discharge lamps (fluorescent, HID) fixtures that make electrical components easily accessible and replaceable, without removing the fixture body from its mounting.

2.4 FINISHES

A. Apply fixture finishes after fabrication in a manner that assures a durable wear-resistant surfacing. Prior to finishing, hot clean the surfaces by accepted chemical means, and treat them with corrosion inhibiting (phosphating) treatment to assure positive paint-adhesion. Give exposed metal surfaces (brass, bronze, aluminum and others) and finished castings except chromium-plated or stainless steel parts an even coat of high grade methacrylate lacquer, or transparent epoxy. Anodize exposed aluminum surfaces for corrosion resistance. Make sheet steel fixture housing, and iron and steel parts which have not received phosphating treatment, or which are to be utilized in exterior applications corrosion resistant by zinc or cadmium plating or hot-dip zinc galvanizing after completion of all forming, welding, or drilling operations. Provide minimum thickness of protective coatings:

1. Hot galvanized zinc coating .0005 inch

2. Cadmium plating.00015 inch

B. Electroplate parts operated under temperatures injurious to hot-dipped galvanizing.

C. Cadmium plate screws, bolts, nuts and other fastening or latching hardware.

D. Except where otherwise indicated provide fixtures with a final synthetic, high-temperature baked enamel coating of color and finish as specified or directed. Unless otherwise specified, provide white baked enamel reflective surfaces, with a minimum reflectance of 86%. Unless otherwise specified, provide matte black non-reflective surfaces. Prior to painting give all parts proper etched surface preparation to assure paint adherence and durability. See paragraphs above.

2.5 FIXTURE WIRING

A. Provide wiring between fluorescent lamp holders and associated operating and starting equipment of similar or heavier gauge than the leads furnished with the approved types of ballasts and having equal or better insulating and heat resisting characteristics. Provide internal wiring of fixtures containing a minimum number of splices. Make splices with approved mechanical insulated steel spring type connectors, suitable for the temperature and voltage conditions to which the splices are to be subjected.

B. Make connections of wires to terminals of lamp holders and other accessories in a neat and workmanlike manner and which are electrically and mechanically secure, with no loose strands protruding. Provide a number of wires extending to or from the terminals of a lamp holder or other accessory that does not exceed the number which the accessory is designed to accommodate.

C. Provide wiring channels and wireways free from projections and rough or sharp edges throughout. At points or edges over which conductors shall pass and may be subject to injury or wear, round bush to make a smooth contact surface with the conductors.

D. Install insulated bushings at points of entrances and exit of flexible wiring.

2.6 BALLASTS

A. Provide ballasts for fluorescent lamps that are suitable for the electrical characteristics of the supply circuits to which they are to be connected, and which are suitable for operating the specified lamps. Provide ballasts which, unless specifically indicated to the contrary, have the following characteristics:

1. Electronic rapid start
2. power factor $\geq$ .90
3. ballast factor $\geq$ .90
4. total harmonic distortion $\leq$ 10%
5. lamp current crest factor $\leq$ 1.7
6. UL Class P
7. Sound Rating A.
8. Multi-lamp rapid start ballasts shall be of the series sequence type.

B. Provide ballasts conforming to UL, and ANSI specifications and displaying labels or symbols of approval by the UL, and of certification by the CBM. Design, fabricate and assemble component parts of ballasts in accordance with the latest requirements of the NEC. Mark ballasts “Class P” indicating approved integral ballast protection. This ballast protection is provided by a built-in self-resetting thermally actuated device that will remove the ballast from line when excessive ballast temperature is reached. See 1.07.F regarding nuisance tripping test data.

C. Rigidly mount ballasts, unless specifically indicated to the contrary, to the inside of the top of the fixture housing, with ballast surfaces and housing in complete contact for efficient conduction of ballast heat. Permanently affix ballast mounting screws to the fixture housing. Provide only fixtures whose design, fabrication, and assembly prevent overheating or cycling of lamps and ballasts under any condition of use.

D. Provide identical ballasts within each fixture type.

E. Provide ballasts having the lowest sound-rating available for the lamps specified and clearly showing their respective sound ratings. Replace ballasts found by Exhibit Designer or Engineer to be unduly noisy, without charge, prior to acceptance of the job. Inform Exhibit Designer in writing if ballasts with a sound rating other than A are to be provided.

F. Approved Ballast Manufacturers

1. Magnetic:
   Advance
   General Electric
   Universal

2. Electronic:
   Advance
   Aromat
   Universal
   Osram Sylvania

G. Ballasts shall have a 5-year warranty from date of acceptance of the completed installation.

2.7 Lamp holders

A. Provide fluorescent fixture sockets that are white, of heat resistant plastic and rated at 660W. Fluorescent lamp sockets operating with an open circuit voltage in excess of 300 volts shall be of the safety type which open the supply circuit when the lamp is removed from the sockets.

B. Rigidly and securely attach lamp holding sockets to the fixture enclosure or husk.

C. Where pull-chains are included, provide an insulating joint.

D. Provide sockets suitable for specified lamps, and set to position the lamps in optically correct spacing and relationship to lenses, reflectors, filters, and baffles.

2.8 LAMPS

A. Provide electric lamps as required, during construction, including lamps for fixtures furnished by others.

B. Provide a complete set of new lamps, as specified in Fixture Descriptions below, in each fixture, at the completion of the Work, leaving fixtures and lighting equipment completely lamped and/or in normal operating condition.

C. The following lamp manufacturers are approved:

1. General Electric
2. Philips
3. Osram Sylvania

2.9 LED (LIGHT EMITTING DIODE)

A. The Contractor shall furnish the complete LED-based lighting system as described in Contract Document.

B. LED fixture shall be UL listed. Power/data supply shall be UL listed for Class 1 or Class 2 wiring and with housing that meets a minimum IP20 rating for dry location installation.

C. The LED module and all of its components must not be subject to mechanical stress. Assembly must not damage or destroy the conducting paths on the circiut board.

D. The LED fixture shall be operated at constant and carefully regulated current levels. LEDs shall not be overdriven beyond their specified nominal voltage and current.

E. LED fixture shall be thermally protected using thermal management techniques and housing shall be designed to transfer heat from the LED board to the outside environment.

F. Operating temperature not to exceed range set by Manufacturer to avoid premature failure and to obtain expected life. LED occupied space to be conditioned if necessary.

G. All LED fixtures and power/data supplies shall be provided by a single manufacturer to ensure compatibility.

H. All LEDs used in the LED fixture shall be high brightness and proven quality from the same manufacturer, the same bin and shipped at the same time. Manufacturer of LED systems shall utilize an advanced production LED binning process to maintain color consistency.

I. Manufacturer shall provide installation guides and system power and control wiring

J. All drivers and LED used in LED fixtures designated as dimming shall provide dimming to 5%

K. LED fixtures to have a minimum Color Rending Index (CRI) not less then 90 unless otherwise approved by Exhibit Lighting Designers.

2.10 LENSES

A. Where plastic lenses are indicated, provide lenses of virgin methyl methacrylate, unless otherwise indicated.

B. Make lenses, louvers, or other light diffusing elements contained in frames removable, but positively held within the frames so that hinging or other motion of the frame will not cause the diffusing element to drop out.

2.11 FIXTURE DESCRIPTIONS

A. Provide fixtures which conform to the above standards and criteria, as indicated on the drawings, and as indicated below. Contractor to verify ceiling conditions for all fixture types.

B. Catalogue or series numbers, when shown, are intended to provide assistance in establishing general type or category of lighting fixtures. These are not part of specification nor are they to be used to order fixtures. Contractor shall provide a fixture that meets the complete fixture description.

C. Allowances, when given, cover the cost to the Electrical Contractor, in U.S. dollars, of the lighting fixture only. Allowances do not include lamps, taxes, delivery, handling, installation or Contractor's overhead or profit.

D. Standard fixture catalogue cuts included with this specification section are for general information only, and are not a part of the specification.

E. Custom fixture design drawings and/or modification drawings for standard fixtures provided with the specification are an integral part of the specification and are to be used in conjunction with the fixture descriptions as the full specification for the affected fixture types.

F. Bring any discrepancies between drawing and specifications to the attention of the Exhibit Designer before submitting bids.

G. Provide “attic stock” of replacement lenses and diffusers. Quantity shall be equivalent to either 5% of fixture type count or (2), whichever is greater. Attic stock is to be suitably boxed and marked and turned over to the owner as directed.

PART 3 EXECUTION

3.1 GENERAL

A. Install fixtures complete with lamps, as indicated, and with equipment, materials, parts, attachments, devices, hardware, hangers, cables, supports, channels, frames and brackets necessary to make a safe, complete, and fully operative installation.

B. Verify and provide fixtures that are appropriate for the mounting conditions of the project.

C. Reject and do not install blemished damaged or unsatisfactory fixtures. Replace imperfect or unsatisfactory fixtures, if installed, as directed by Exhibit Designer or Lighting Consultant.

D. Set fixtures, when installed, to be true, and free of light leaks, warps, dents, or other irregularities.

E. Provide finish for exposed parts as specified so indicated, provide a finish as directed by Exhibit Designer.

F. Mount fixtures at heights and locations indicated on the Contract Drawings, or as required by Exhibit Designer.

G. Upon completion of the installation, the lighting fixtures and lighting equipment shall be in first class operating order and free from defects in condition and finish. At time of final inspection, all fixtures and equipment shall be clean, fully lamped, and be complete with required lenses or diffusers, reflectors, side panels, louvers, or other components necessary for the function of the fixtures. Any reflectors, lenses, diffusers, side panels or other parts damaged prior to the final inspection shall be replaced by Contractor prior to inspection.

3.2 ACCESSIBILITY

A. Install equipment such as junction and pull boxes, fixture housings, transformers, ballasts, switches and controls, and other apparatus that shall be reached from time to time for operation and maintenance, to be easily accessible and appropriate for mounting and ceiling conditions.

3.3 SUPPORTS

A. Provide necessary hardware supports for fixtures that are adequate and safe to support the weight of the fixtures.

B. Provide visible hanging devices that are finished to match the fixture finish, unless indicated otherwise.

C. Provide attachment devices including brackets, cast metal shapes with the requisite rigidity and strength to maintain continuous alignment of installed fixtures.

D. Provide supporting members that are surface passivated, and which are primed or paint-dipped to resist corrosion.

E. Provide fastening devices of a positive locking type, which do not require special tools to apply or remove them. Do not use tie wires in place of fastening devices.

F. Contractor is responsible for the necessary suspension system; Contractor shall ascertain the structural reliability of supports provided under other Sections of the specification.

G. Provide surface mounted fixtures with required mounting devices and accessories. Uniformly maintain the fixture heights shown on the Contract Drawings or established in the field. The allowable tolerances in individual fixture mounting shall not exceed 1/4 inch and may not vary more than 1/2 inch from mounting height shown on the drawings. Install fixtures in continuous runs absolutely level, and in line with each other. Hanging devices shall comply with code requirements.

H. Provide at least two supports for individually mounted fluorescent fixtures.

3.4 FOCUSING

A. All adjustable lighting fixtures shall be aimed, focused, and locked by the Contractor under supervision of Exhibit Designer Lighting Designer or Museum Staff.

B The Contractor is responsible to make provisions as required to have sufficient time allowed, manpower and equipment available for focusing. The Contractor shall ensure focusing to be carried out efficiently without delay and to satisfactory of Exhibit Designer, and Museum Staff.

C Ladders, tools, and other necessary equipment required for focusing are the responsibility of the Contractor.

D. Focusing of exhibition lighting shall occur after the completion of exhibit installation and the lighting system is confirmed operational. At the time of exhibition lighting focusing, the Contractor shall assure all fixtures, lamps, and accessories (including optical lens and shields) specified are available.

E. Where possible, fixtures shall be focused during normal working hours. However, where daylight interferes, focusing shall be performed after dark.

3.5 CLEANING

A. Upon completion of the fixture installation and at the time of final inspection, fixtures shall be clean, and free from marks, dust, spotting or other defects. Replace any broken or defective parts prior to final inspection. Replace or make good all defects revealed by final inspection.

Appendix 1 – Exhibit Lighting Fixture Schedule and Exhibition Lighting Fixture Cut Sheets

END OF SECTION

Cherokee National Capitol Museum 2/19/18
LIGHTING FIXTURES ESTIMATES

GENERAL CONTRACTOR LIGHTING SCOPE

Track Lighting and Fixtures

Track

QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
390	Feet	TRK1	Surface 2 Circuit Track	WHT	Lightolier	Advent Track 61xMCE (FEEDS, JOINERS, HARDWARE TBD)
220	Feet	TRK2	Recessed 2 Circuit Track	WHT	Lightolier	Advent Track 61xMCE and 7516 Lytespan Recessed Housing (FEEDS, JOINERS, HARDWARE TBD)

Track Fixtures

QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
200	Each	TH2	LED Track Fixture, 1000 Lumen 90 CRI, 3000K Narrow Flood	WHT	Lightolier	OmniSpot LC-10-930-W-TE LLM-RNF

Track Head Accessories for TH-2

QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
200	Each	-	TH2 ACCESSORY HOLDER	WHT	Lightolier	LC10AHWHT
100	Each	-	Reflectors	-	Lightolier	LLM-xx (Beam Spread TBD)
200	Each	-	Lighting Accessories (Spread Lenses)	-	Lightolier	LC10-xx
100	Each	-	Light Control ND Filters	-	TBD	TBD

2nd Floor Ceiling Cove Lighting

QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
30	Each	LC1	LED Cover Light	NA	i2	CAS-1031K-08W-B

Ambient Lighting

QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
TBD		LSR1	Recessed Slot LED	WHT	LEDALITE PHILIPS	39C0-L-C-G-L-S-3-LENGHT TBD-7-VOLTAGE-E
TBD		LSR1 EM	Recessed Slot LED Emergency Lighting	WHT	LEDALITE PHILIPS	39C0-L-C-G-L-S-3-LENGHT TBD-7-VOLTAGE-E EM

L1 Welcome Desk

QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
12	Feet	CL1	Monorail Track with LED Wash	SLV	Feelux	MNR-RAIL, Spot MRS1-3000K-24V-X-XX, Wash MNP1-3000K-24V-X-XX
1	Each		24V Power Supplies	NA	Feelux	Size TBD

EXHIBIT FABRICATOR LIGHTING SCOPE

Early Government

QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
2	*Each*	*TBD*	*10 Foot Bridge Track and Track Heads*	*TBD*	*TBD*	*TBD*

QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
6	*Each*	*FX2*	*Projector Track Fixture with Leaf Temple*	*TBD*	*WAC*	*L-LED009-30-WT with 2 COLOR CUSTOM LEAF GLASS TEMPLATES*

Removal Lighting

QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
92	Feet	WL1	Linear LED Wall Wash	NA	Ecosense	L50-I-XX (LENGTH)-06-22-80-MULT-ASYM LV- ASYM LOUVER MNT-L-LFAB CC-L-WIREBOX
6	Each	FX1	Effects Projector (Lens ad Effects Glass and Colors TBD)	BLK	ROSCO	2970000RGBW1 2970000000XX LENS EFFECT GLASS TBD
4	Feet	TRK1BLK	Surface 2 Circuit Track Mounted to Strut	BLK	Lightolier	Advent Track 612MBKCE
4	Each	TH2 BLK	LED Track Fixture, 1000 Lumen 90 CRI, 3000K Narrow Flood	BLK	Lightolier	OmniSpot LC-10-930-BK-TE LLM-RS WITH LC10AHBK
68	Feet		Pendent Mounted Back-to-Back Stacked Strut Channel Fixture Mounting	BLK	TBD	Back-to-Back Stacked Strut Channel (Black) on Ridged Pendents (Length TBD)

Case 3.1

QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
16	Feet	CL2 *CASE FRONT*	Monorail Track with LED Fixtures	SLV	Feelux	MNR-RAIL(LENGTHS TBD) MNR1-3000K-24V AND MRS3-3000K-24VSLV)-XX(BEAM)
16	Feet	CL22 *CASE REAR*	Linear Wall Wash	SLV	Feelux	HDP6-30K-24V-X (LENGTHS TBD) HBV-ANGLE BRACKETS
2	Each	na	24V Power Supplies (Total Wattage TBD)	NA	Feelux	Size TBD

Case 3.2

QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
8	Feet	CL2 *CASE FRONT*	Monorail Track with LED Fixtures	SLV	Feelux	MNR-RAIL(LENGTHS TBD) MNR1-3000K-24V AND MRS3-3000K-24VSLV)-XX(BEAM)
8	Feet	CL22 *CASE REAR*	Linear Wall Wash	SLV	Feelux	HDP6-30K-24V-X (LENGTHS TBD) HBV-ANGLE BRACKETS
2	Each		24V Power Supplies	NA	Feelux	Size TBD

Case 3.3

QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
16	Feet	CL2 *CASE FRONT*	Monorail Track with LED Fixtures	SLV	Feelux	MNR-RAIL(LENGTHS TBD) MNR1-3000K-24V AND MRS3-3000K-24VSLV)-XX(BEAM)
16	Feet	CL22 *CASE REAR*	Linear Wall Wash	SLV	Feelux	HDP6-30K-24V-X (LENGTHS TBD) HBV-ANGLE BRACKETS
2	Each		24V Power Supplies	NA	Feelux	Size TBD

Case 3.4

QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
20	Feet	CL2 *CASE FRONT*	Monorail Track with LED Fixtures	SLV	Feelux	MNR-RAIL(LENGTHS TBD) MNR1-3000K-24V AND MRS3-3000K-24VSLV)-XX(BEAM)
20	Feet	CL22 *CASE REAR*	Linear Wall Wash	SLV	Feelux	HDP6-30K-24V-X (LENGTHS TBD) HBV-ANGLE BRACKETS
2	Each		24V Power Supplies	NA	Feelux	Size TBD

Case 3.5

QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
28	Feet	CL2 *CASE FRONT*	Monorail Track with LED Fixtures	SLV	Feelux	MNR-RAIL(LENGTHS TBD) MNR1-3000K-24V AND MRS3-3000K-24VSLV)-XX(BEAM)
28	Feet	CL22 *CASE REAR*	Linear Wall Wash	SLV	Feelux	HDP6-30K-24V-X (LENGTHS TBD) HBV-ANGLE BRACKETS
2	Each		24V Power Supplies	NA	Feelux	Size TBD

Case 3.6

QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
20	Feet	CL2 *CASE FRONT*	Monorail Track with LED Fixtures	SLV	Feelux	MNR-RAIL(LENGTHS TBD) MNR1-3000K-24V AND MRS3-3000K-24VSLV)-XX(BEAM)
20	Feet	CL22 *CASE REAR*	Linear Wall Wash	SLV	Feelux	HDP6-30K-24V-X (LENGTHS TBD) HBV-ANGLE BRACKETS
2	Each		24V Power Supplies	NA	Feelux	Size TBD

Case 4.1

QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
2.5	Feet	CL1	Monorail Track with LED Wash	SLV	Feelux	MNR-RAIL (LENGTHS TBD), Spot MRS1-3000K-24V-X-XX, Wash MNP1-3000K-24V-X-XX
1	Each		24V Power Supplies	NA	Feelux	Size TBD

Case 4.2

QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
2.5	Feet	CL1	Monorail Track with LED Wash	SLV	Feelux	MNR-RAIL, Spot MRS1-3000K-24V-X-XX, Wash MNP1-3000K-24V-X-XX
1	Each		24V Power Supplies	NA	Feelux	Size TBD

Case 4.3

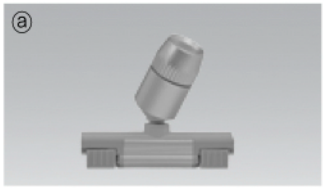
QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
1.5	Feet	CL1	Monorail Track with LED Wash	SLV	Feelux	MNR-RAIL, Spot MRS1-3000K-24V-X-XX, Wash MNP1-3000K-24V-X-XX
1	Each		24V Power Supplies	NA	Feelux	Size TBD

Case 4.4

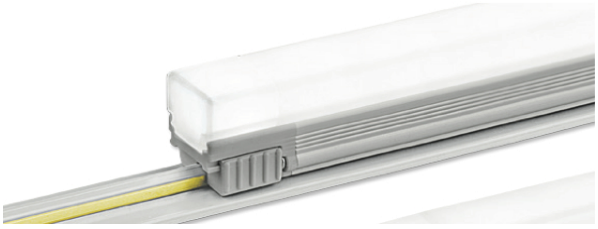
QTY	UNIT	TYPE	DESCRIPTION	CLR	MFG	MODEL
1.5	Feet	CL1	Monorail Track with LED Wash	SLV	Feelux	MNR-RAIL, Spot MRS1-3000K-24V-X-XX, Wash MNP1-3000K-24V-X-XX
1	Each		24V Power Supplies	NA	Feelux	Size TBD

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE CL1	
DATE: 2-16-18			

MRS1 SPOTS



ⓐ MonoRail Spot		
Beam angle	Silver	Black
15°	MRS1 40K-24V-SV-15	MRS1 40K-24V-BK-15
30°	MRS1 40K-24V-SV-30	MRS1 40K-24V-BK-30



MNP1 WASH

MNR-RAIL POWER SUPPLY TRACK

ORDER#: MNR-RAIL(LENGTHS TBD) MNP1-3000K-24V AND MRS1-3000K-24V-SLV-XX(BEAM)

NOTES:
APPLICATION:
INTERNAL SMALL CASE LIGHTING
- POWER RAIL POWER TRACK (LENGTH TBD)
- MONORAIL PRO-SPOT-FREE WASH (MNR1)
- MONORAIL-SPOT SPOT LIGHTS (MRS1)
- EACH CASE TO HAVE LOCAL DIMMING
- POWER FEEDS, DRIVERS & MOUNTING TBD

MANUFACTURER: FEELUX

MOUNTING: TBD

COLOR: SILVER

LAMP/WATTAGE: LED 3000K 85CRI

TECHNICAL ARTISTRY
145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

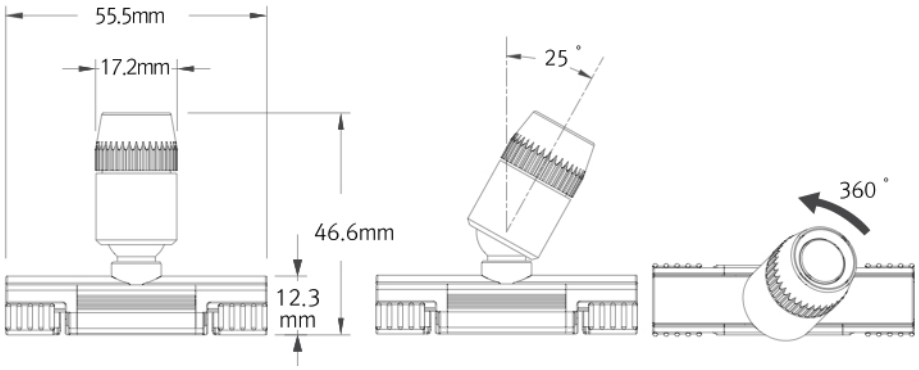
STATUS: SUBMITTED 1-30-18

APPROVED BY:

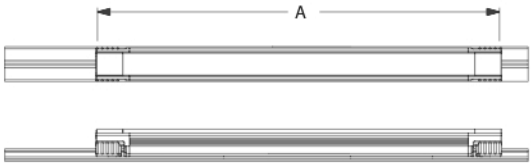
TYPE: CL1

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE CL1	
DATE: 2-16-18			

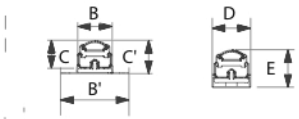
* Fixture



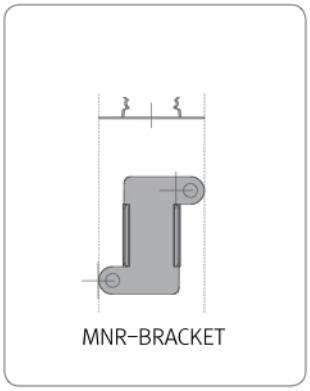
Fixture w/o connector

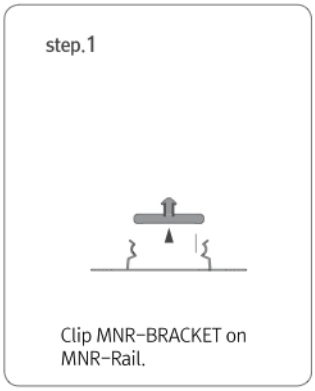


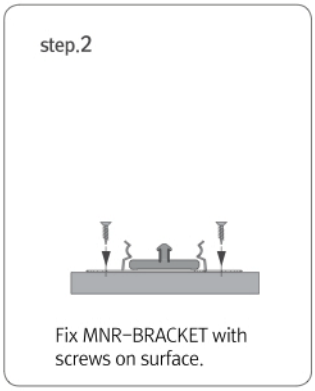
Dimensions with bracket and rail

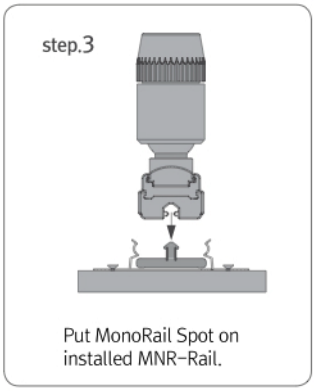


Model Number	Voltage Input (V)	Power Input (W)	A inches (mm)	A' inches (mm)	B inches (mm)	B' inches (mm)	C inches (mm)	C' inches (mm)	D inches (mm)	E inches (mm)
MNP1-(color)K-24V	DC 24	1.3	3.74" (95)	4.76" (121)	.6" (15.3)	1.2 (30.6)	.48 (12.3)	.58 (14.9)	.65 (16.6)	.6875 (17.5)









ORDER#: MNR-RAIL(LENGTHS TBD) MNP1-3000K-24V AND MRS1-3000K-24V-SLV-XX(BEAM)

NOTES:
APPLICATION:
INTERNAL SMALL CASE LIGHTING
- POWER RAIL POWER TRACK (LENGTH TBD)
- MONORAIL PRO-SPOT-FREE WASH (MNR1)
- MONORAIL-SPOT SPOT LIGHTS (MRS1)
- EACH CASE TO HAVE LOCAL DIMMING
- POWER FEEDS, DRIVERS & MOUNTING TBD

MANUFACTURER: FEELUX

MOUNTING: TBD

COLOR: SILVER

LAMP/WATTAGE: LED 3000K 85CRI

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145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

STATUS: SUBMITTED 1-30-18

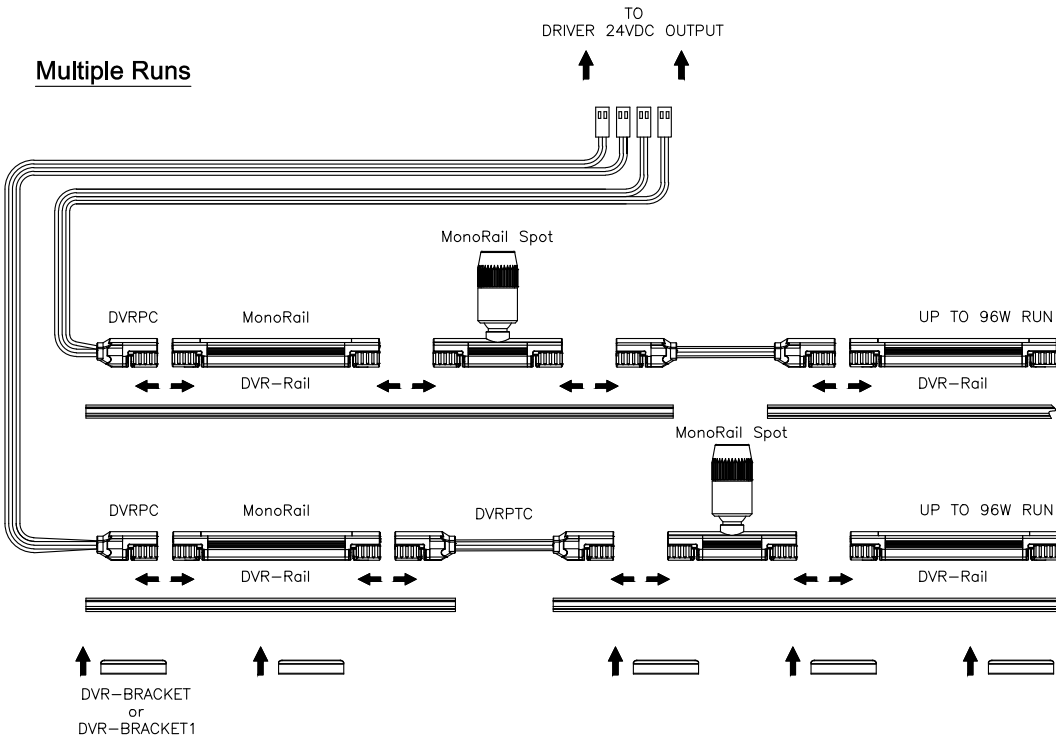
APPROVED BY:

TYPE: CL1

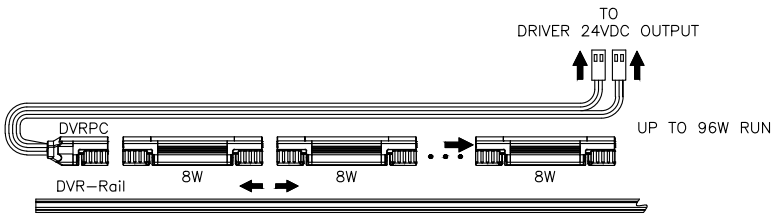
PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE CL1	
DATE: 2-16-18			

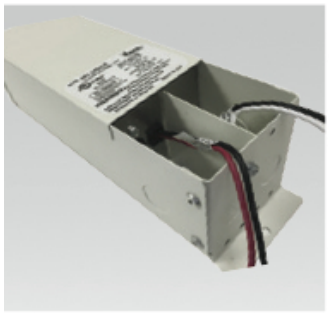
Mono-Rail can run up to 96 Watts in one run.

Multiple Runs



Continuous Runs





Justin Drivers

____ 481-24DCR
____ 483-24DCR-277
____ 961-24DCR
____ 963-24DCR-277
____ C2240-24DCR
____ C2240-24DCR-277

CAUTION:
TOTAL CONNECTED FIXTURES WATTAGE NOT TO EXCEED DRIVER WATTAGE!

ORDER#: MNR-RAIL(LENGTHS TBD) MNP1-3000K-24V AND MRS1-3000K-24V-SLV-XX(BEAM)

NOTES: APPLICATION:
INTERNAL SMALL CASE LIGHTING
- POWER RAIL POWER TRACK (LENGTH TBD)
- MONORAIL PRO-SPOT-FREE WASH (MNR1)
- MONORAIL-SPOT SPOT LIGHTS (MRS1)
- EACH CASE TO HAVE LOCAL DIMMING
- POWER FEEDS, DRIVERS & MOUNTING TBD

MANUFACTURER: FEELUX

MOUNTING: TBD

COLOR: SILVER

LAMP/WATTAGE: LED 3000K 85CRI

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STATUS: SUBMITTED 1-30-18

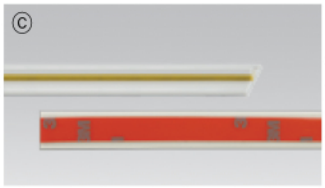
APPROVED BY:

TYPE: CL1

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE CL1	
DATE: 2-16-18			

ⓑ Power supply track : MNR-Rail (20m)

Power supply track in Roll without adhesive
Color : White, Gray, Black



ⓒ Power supply track : MNR-Rail (1.2m)

Power supply track with adhesive tape
Color : White, Gray, Black

ⓓ Adhesive tape

Adhesive tape for MNR-Rail (16.5m)

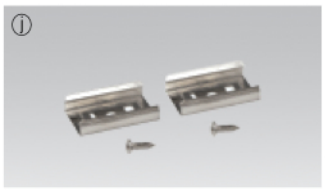
ⓔ Power supply cable to the MNR-Rail : MNRPC (2500mm)

120W in one row (w/ terminal block)
180W in one row (w/o terminal block)

ⓕ Connecting cable between MNR-Rail

MNRPTC	MNRPTC1	MNRPTC2	MNRPTC4	MNRPTC6
150mm(6inch)	300mm(1feet)	600mm(1feet)	1200mm(4feet)	1800mm(6feet)

ⓘ MonoRail bracket : MNR-BRACKET (standard)



ⓙ MonoRail bracket : MNR-BRACKET1 (optional)

ORDER#: MNR-RAIL(LENGTHS TBD) MNP1-3000K-24V AND MRS1-3000K-24V-SLV-XX(BEAM)

NOTES:
APPLICATION:
INTERNAL SMALL CASE LIGHTING
- POWER RAIL POWER TRACK (LENGTH TBD)
- MONORAIL PRO-SPOT-FREE WASH (MNR1)
- MONORAIL-SPOT SPOT LIGHTS (MRS1)
- EACH CASE TO HAVE LOCAL DIMMING
- POWER FEEDS, DRIVERS & MOUNTING TBD

MANUFACTURER: FEELUX

MOUNTING: TBD

COLOR: SILVER

LAMP/WATTAGE: LED 3000K 85CRI

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STATUS: SUBMITTED 1-30-18

APPROVED BY:

TYPE: CL1

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE CL2	
DATE: 2-16-18			

CASE FRONTS

MRS3 SPOTS

ⓐ MonoRail Spot HO

Beam angle	Silver	Black
25°	MRS3 40K-24V-SV-25	MRS3 40K-24V-BK-25
45°	MRS3 40K-24V-SV-45	MRS3 40K-24V-BK-45
60°	MRS3 40K-24V-SV-60	MRS3 40K-24V-BK-60

MNR1 WASH

MNR-RAIL POWER SUPPLY TRACK

CASE REARS

ORDER#: FRONT SIDE MNR-RAIL(LENGTHS TBD) MNR1-3000K-24V AND MRS3-3000K-24VSLV)-XX(BEAM)
BACK SIDE HDP6-30K-24V-X (LENGTHS TBD) HBV-ANGLE BRACKETS

NOTES: APPLICATION: INTERNAL TALL CASE LIGHTING
- FRONT CASE MNR-RAIL TRACK (LENGTH TBD)
  SPOT LIGHTS & MONORAIL WASH MNR1 QUAN. TBD
- REAR CASE LINEAR LED WASH HDP-6 LENTS TBD
- EACH CASE TO HAVE LOCAL DIMMING
- POWER FEEDS, DRIVERS & MOUNTING TBD

MANUFACTURER: FEELUX

MOUNTING: TBD

COLOR: SILVER

LAMP/WATTAGE: LED 3000K 85CRI

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STATUS: SUBMITTED 1-1-18

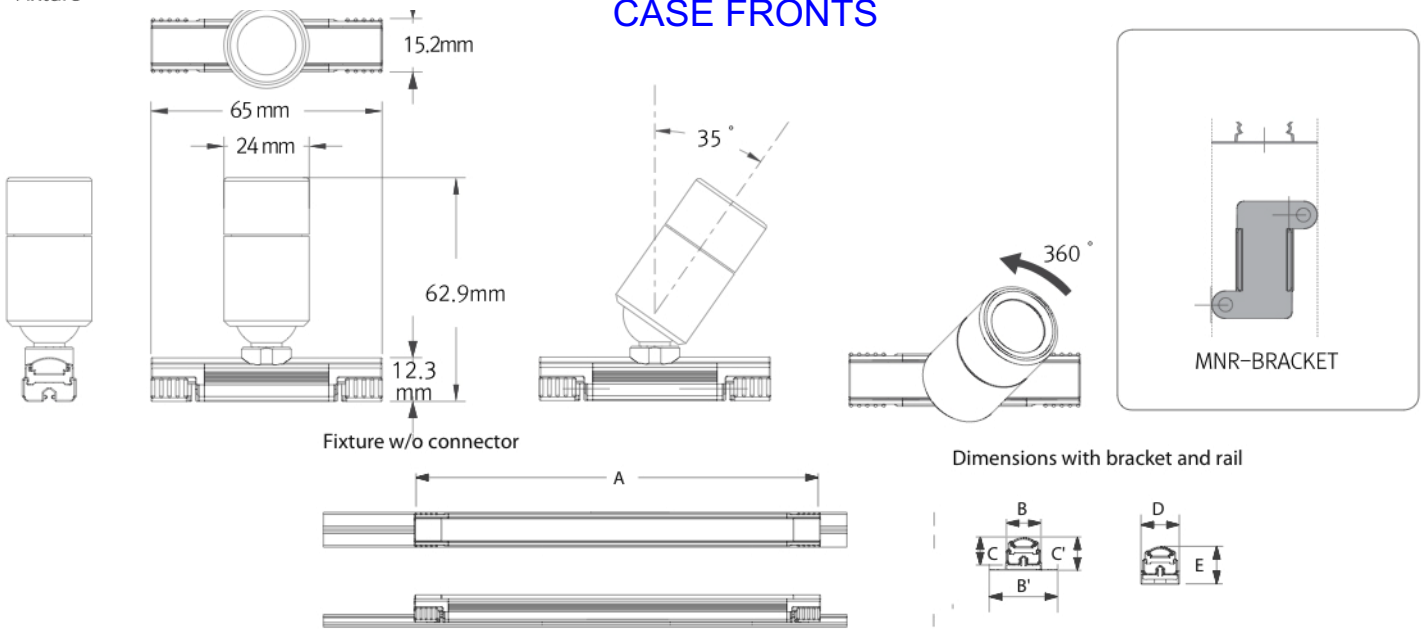
APPROVED BY:

TYPE: CL2

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE CL2	
DATE: 2-16-18			

* Fixture

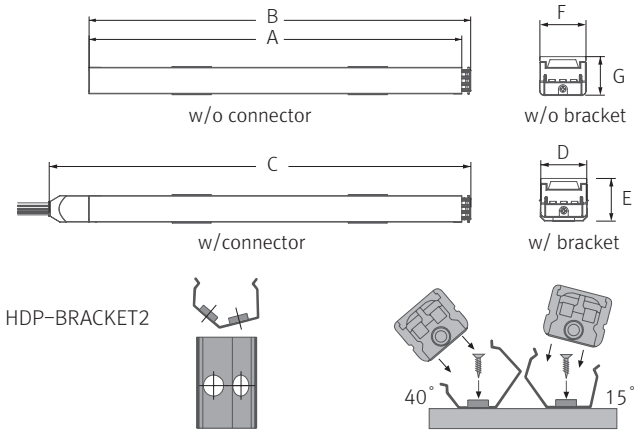
CASE FRONTS



Model Number	Voltage Input (V)	Power Input (W)	A inches (mm)	A' inches (mm)	B inches (mm)	B' inches (mm)	C inches (mm)	C' inches (mm)	D inches (mm)	E inches (mm)
MNR1-(color)K-24V	DC 24	1.3	3.74" (95)	4.76" (121)	.6" (15.3)	1.2 (30.6)	.48 (12.3)	.58 (14.9)	.65 (16.6)	.5625 (14.3)

* Fixture

CASE REARS



Model Name	Power Input (V)	Lamp Power (W)	A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)
HDP3 40K-24V	DC 24	3	140.4	145.5	168.4	16	14	15	12.7
HDP6 40K-24V	DC 24	6	280.5	285.6	308.5	16	14	15	12.7
HDP12 40K-24V	DC 24	12	560	565.1	588	16	14	15	12.7
HDP18 40K-24V	DC 24	18	839	844.1	867	16	14	15	12.7
HDP24 40K-24V	DC 24	24	1118.1	1123.2	1146.1	16	14	15	12.7

ORDER#: FRONT SIDE MNR-RAIL(LENGTHS TBD) MNR1-3000K-24V AND MRS3-3000K-24VSLV)-XX(BEAM)
BACK SIDE HDP6-30K-24V-X (LENGTHS TBD) HBV-ANGLE BRACKETS

NOTES: APPLICATION: INTERNAL TALL CASE LIGHTING
- FRONT CASE MNR-RAIL TRACK (LENGTH TBD)
  SPOT LIGHTS & MONORAIL WASH MNR1 QUAN. TBD
- REAR CASE LINEAR LED WASH HDP-6 LENTS TBD
- EACH CASE TO HAVE LOCAL DIMMING
- POWER FEEDS, DRIVERS & MOUNTING TBD

MANUFACTURER: FEELUX

MOUNTING: TBD

COLOR: SILVER

LAMP/WATTAGE: LED 3000K 85CRI

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STATUS: SUBMITTED 1-1-18

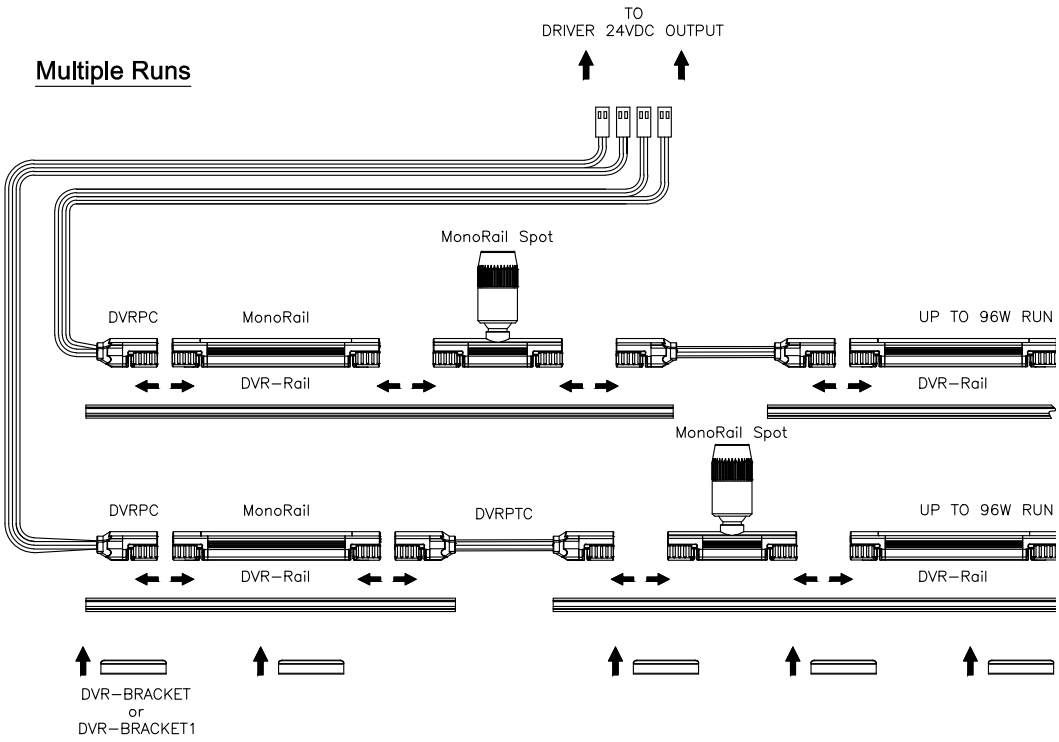
APPROVED BY:

TYPE: CL2

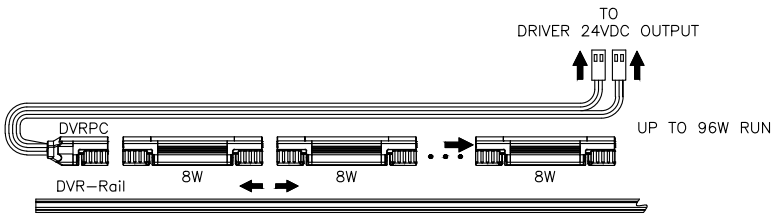
PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE CL2	
DATE: 2-16-18			

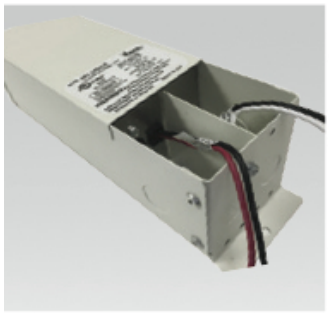
Mono-Rail can run up to 96 Watts in one run.

Multiple Runs



Continuous Runs





Justin Drivers

____ 481-24DCR
____ 483-24DCR-277
____ 961-24DCR
____ 963-24DCR-277
____ C2240-24DCR
____ C2240-24DCR-277

CAUTION:
TOTAL CONNECTED FIXTURES WATTAGE NOT TO EXCEED DRIVER WATTAGE!

ORDER#: FRONT SIDE MNR-RAIL(LENGTHS TBD) MNR1-3000K-24V AND MRS3-3000K-24VSLV)-XX(BEAM)
BACK SIDE HDP6-30K-24V-X (LENGTHS TBD) HBV-ANGLE BRACKETS

NOTES: APPLICATION: INTERNAL TALL CASE LIGHTING
- FRONT CASE MNR-RAIL TRACK (LENGTH TBD)
  SPOT LIGHTS & MONORAIL WASH MNR1 QUAN. TBD
- REAR CASE LINEAR LED WASH HDP-6 LENTS TBD
- EACH CASE TO HAVE LOCAL DIMMING
- POWER FEEDS, DRIVERS & MOUNTING TBD

MANUFACTURER: FEELUX
MOUNTING: TBD
COLOR: SILVER
LAMP/WATTAGE: LED 3000K 85CRI

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STATUS: SUBMITTED 1-1-18	APPROVED BY:	TYPE: CL2

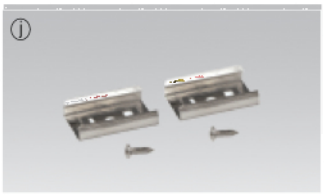
PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE CL2	
DATE: 2-16-18			

ⓑ Power supply track : MNR-Rail (20m)

Power supply track in Roll without adhesive
Color : White, Gray, Black

ⓘ MonoRail bracket : MNR-BRACKET (standard)

Power supply track with adhesive tape
Color : White, Gray, Black

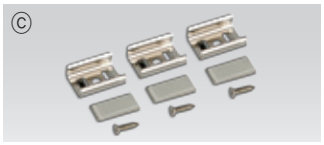


ⓙ MonoRail bracket : MNR-BRACKET1 (optional)

Adhesive tape for MNR-Rail (16.5m)

ⓑ Power cable : HDPPC

Power cable (Between FLX Stix HDP & 6-way distributor)



ⓒ Mounting bracket : HDP-BRACKET 1

Included in fixture

ⓓ Angle bracket (15˚ & 40˚) : HDP-BRACKET 2

ⓔ Sidefeed for seamless extension (3W) : HDP3 40K-24V-S

The dimension is the same as HDP3 40K-24V
Powered only through cable, no power supply on the input connector

ⓕ End cap : HDP-CAP

Included in fixture

ORDER#: FRONT SIDE MNR-RAIL(LENGTHS TBD) MNR1-3000K-24V AND MRS3-3000K-24VSLV)-XX(BEAM)
BACK SIDE HDP6-30K-24V-X (LENGTHS TBD) HBV-ANGLE BRACKETS

NOTES: APPLICATION: INTERNAL TALL CASE LIGHTING
- FRONT CASE MNR-RAIL TRACK (LENGTH TBD)
  SPOT LIGHTS & MONORAIL WASH MNR1 QUAN. TBD
- REAR CASE LINEAR LED WASH HDP-6 LENTS TBD
- EACH CASE TO HAVE LOCAL DIMMING
- POWER FEEDS, DRIVERS & MOUNTING TBD

MANUFACTURER: FEELUX

MOUNTING: TBD

COLOR: SILVER

LAMP/WATTAGE: LED 3000K 85CRI

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STATUS: SUBMITTED 1-1-18

APPROVED BY:

TYPE: CL2

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE FX1	
DATE: 2-16-18			

X-Effects® LED Projector

ROSCO

SPECIFICATIONS

Input Voltage:	100-240VAC
Power Consumption:	65 Watts at maximum output
Output:	5500K: 3,500 lumens
	RGBW: 1,500 lumens
LED Array:	5500K or RGBW (White LED = 5500K)
Lumen Maintenance:	50,000 hours at 45C (LM-79-08)
Power Connection:	6-ft (2m) insulated with female UTL connector (user end unterminated)
Data:	DMX512 In/Out via UTL Connector on luminaire
	X-Effects LED 5500K – 5 Control Channels
	X-Effects LED RGBW – 8 Control Channels
	RDM compatible
Operating Temp.:	-13° to 113° F (-20° to 45° C)
Environment:	IP65 rated
Housing:	Powder Coated Aluminum
Approvals:	ETL / UL Standards #1573 and # 8750
	cETL / CSA C22.2 #166
	CE
Dimensions:	10.25"Wx 7.4"Lx 9"H
	(26cm x 18.6cm x 22.9cm)
Weight:	9 lbs (4.1 kg)

X-Effects LED Projector	
Item Code	**Description**
297000055001	X-Effects LED Projector, 5500K, Black
297000055002	X-Effects LED Projector, 5500K, White
297000055003	X-Effects LED Projector, 5500K, Silver
2970000RGBW1	X-Effects LED Projector, RGBW, Black
2970000RGBW2	X-Effects LED Projector, RGBW, White
2970000RGBW3	X-Effects LED Projector, RGBW, Silver

WWW.ROSCO.COM

ORDER#: 2970000RGBW1 2970000000XX LENS TBD

NOTES:
APPLICATION: EFFECTS LIGHTING
- PENDANT HUNG ON STRUT
- LENS TBD
- EFFECT GLASS AND COLOR TBD
- ANCILLARY HARDWARE TBD

MANUFACTURER: ROSCO

MOUNTING: PENDENT

COLOR: BLACK

LAMP/WATTAGE: LED 60 WATT

TECHNICAL ARTISTRY
145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

STATUS: SUBMITTED 2-8-18

APPROVED BY:

TYPE: FX1

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE FX1	
DATE: 2-16-18			

X-Effects® LED Projector

ROSCO

X-Effects LED Accessories	
Item Code	**Description**
297000000019	X-Effects LED Projector 19° Lens - Black
297000000030	X-Effects LED Projector 30° Lens - Black
297000000050	X-Effects LED Projector 50° Lens - Black
297000000070	X-Effects LED Projector 70° Lens - Black
29700000S19	X-Effects LED Projector 19° Lens - Silver
29700000S30	X-Effects LED Projector 30° Lens - Silver
29700000S50	X-Effects LED Projector 50° Lens - Silver
29700000S70	X-Effects LED Projector 70° Lens - Silver
296000010012	Safety Cable, 3' (1m)
296000005001	Rosco Pole Mount Accessory - Black
296000005002	Rosco Pole Mount Accessory - White
296000005003	Stainless Steel Strap Kit for Rosco Pole Mount
296000005004	Rosco Wall Mount Accessory - Black
296000005005	Rosco Wall Mount Accessory - White
	Static Filter Part Numbers
297000000085	X-Effects LED Amber Fire Effect FIlter
297000000090	X-Effects LED Green Aurora Effect Filter
297000000095	X-Effects LED Cyan Water Effect Filter
120P***YYYY***SXFX	X-Effects LED Permacolor Dichroic Glass Filter ***YYYY*** = four digit color number
	Static Gobo Part Numbers
250***XXXXX***SXFX	X-Effects LED Static Standard Steel Gobo ***XXXXX***= five digit standard gobo number
255***XXXXX***SXFX	X-Effects LED Static Image Glass Gobo ***XXXXX*** = five digit gobo number
255***XXXXX***SXFX	X-Effects LED Static ColorWave Gobo ***XXXXX*** = five digit gobo number
2507210ISXFX	X-Effects LED Static Custom Steel Gobo
260CUSBWSXFX	X-Effects LED Static Custom B&W Glass Gobo
260CUS1CSXFX	X-Effects LED Static Custom One-Color Glass Gobo
260CUS2CSXFX	X-Effects LED Static Custom Two-Color Glass Gobo
260CUSMCSXFX	X-Effects LED Static Custom Multi-Color Glass Gobo
	(Continued)

WWW.ROSCO.COM

ORDER#: 2970000RGBW1 2970000000XX LENS TBD

NOTES:
APPLICATION: EFFECTS LIGHTING
- PENDANT HUNG ON STRUT
- LENS TBD
- EFFECT GLASS AND COLOR TBD
- ANCILLARY HARDWARE TBD

MANUFACTURER: ROSCO

MOUNTING: PENDENT

COLOR: BLACK

LAMP/WATTAGE: LED 60 WATT

TECHNICAL ARTISTRY
145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

STATUS: SUBMITTED 2-8-18

APPROVED BY:

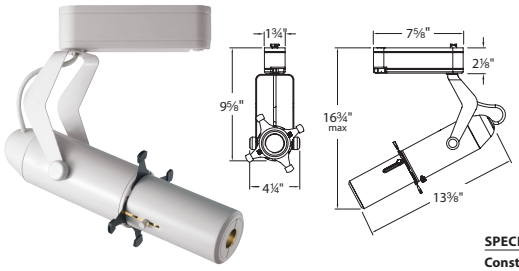
TYPE: FX1

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE FX-2	
DATE: 2-16-18			

FRAMING PROJECTOR – model: LED009

LEDme® Track Luminaire

WAC LIGHTING
Responsible Lighting®



PRODUCT DESCRIPTION

Using state of the art multi-chip LED technology, the Framing Projector uses two lenses for precise focus adjustment to highlight artwork and wall décor or project images, signs and corporate logos.

FEATURES

- Can be used to project images, signs, and corporate logos
- Uses two lenses to allow precise focus adjustment
- Precise beam adjustment from 24° to 40°
- Accepts "D" size Glass and Metal Gobos
- 355° horizontal rotation and 90° vertical aiming
- ANSI Compliant Warm/Neutral LED Bins for a finer color consistency
- Accepts 1 addtional lens
- 60,000 hour potential LED life
- 5 year WAC Lighting product warranty

TBD

SPECIFICATIONS

Construction: Die-cast aluminum track head with polycarbonate driver case and track adapter. Two focusing lenses and metal shims contained in framing snoot.

Finish: Abrasion resistant paint finish.
Available in Black (BK) and White (WT).

Driver: Input voltage: 120VAC 50/60Hz - Power: 22.5W

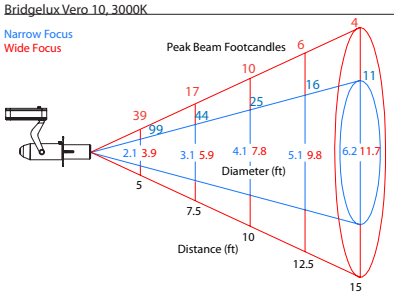
Lamp: Bridgelux LED Vero10 LED

Dimming: Not Dimmable

Standards: ETL & cETL Listed

APPLICATION PERFORMANCE

Bridgelux Vero 10, 3000K



ORDER NUMBER

System	Model #	Power	Color Temp	CRI	Lumens	Finish
L L Track H H Track J J/J2 Track	LED009	22.5W	927 2700K 27 2700K 930 3000K 30 3000K 35 3500K 40 4000K	90 85 90 85 85 85	305 365 315 380 395 400	BK Black WT White

System	Model #	Color	Finish
L	LED009	30	WT

Example: **L-LED009-40-WT**

FINISHES

BK WT

ACCESSORIES

Color Lens	LENS-16	AMB Amber BLU Blue GRN Green RED Red YEL Yellow

-LEAF TEMPLATE CUSTOM 2 COLOR GLASS BY OTHERS TBD

WAC Lighting
www.waclighting.com
Phone (800) 526.2588 • Fax (800) 526.2585

Headquarters/Eastern Distribution Center
44 Harbor Park Drive • Port Washington, NY 11050
Phone (516) 515.5000 • Fax (516) 515.5050

Western Distribution Center
1750 Archibald Avenue • Ontario, CA 91760
Phone (800) 526.2588 • Fax (800) 526.2585

ORDER#: L-LED009-30-WT CUSTOM LEAF TEMPLATE TBD

NOTES:
APPLICATION: EFFECT TRACK FIXTURES
- CUSTOM GLASS TEMPLATES TBD

MANUFACTURER: WAC

MOUNTING: TRACK

COLOR: WHITE

LAMP/WATTAGE: LED 23 WATTS 3000K

TECHNICAL ARTISTRY
145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

STATUS: SUBMITTED 2-16-18

APPROVED BY:

TYPE: FX2

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE LC1	
DATE: 2-16-18			

1.6" High x 3.2" Wide
Available in 1', 3' and 4' Lengths

i2Cove
Asymmetrical LED Light Fixture

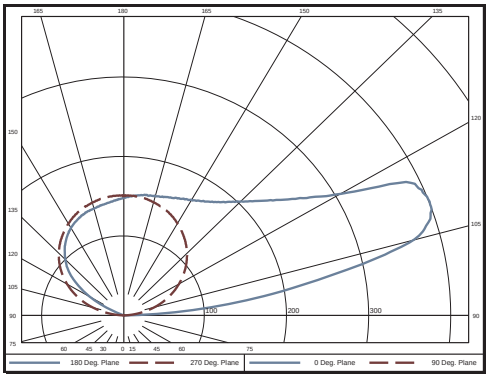
i2Systems ADVANCED LED LIGHTING

Ideal for Cove Applications

Provides shadow-free lighting for indirect interior cove installations. Slim design profile is perfect for applications where space is at a premium.

FEATURES	**Quick & Easy Installation**	Factory installed armored cables allow easy installation into existing electrical systems. 1', 3' and 4' modules are available.
	Flexible Mounting Options	Luminaires can be installed in a variety of configurations: linearly, around corners, or in curved installations.
	Reliability	Individually serialized units provide photometric traceability.
	Tight Color Consistency	High quality LEDs and strict binning controls insure color consistency and long-lasting performance.
	Simple Power Connection	Easily connects to the building's power source (100 - 277 VAC, 50 / 60 Hz) via an 18" entry cable.
PERFORMANCE	**LED Color**	2700 K, 3000 K, 3500 K *(Other CCT available. Consult factory.)*
	LED CRI	80 Minimum; 82 Typical *(90+ available. Consult factory.)*
	LED Color Consistency	2-Step MacAdam Ellipse
	Efficacy	96.5 lm / Watt
ELECTRICAL SPECIFICATIONS	**Input Power**	8 Watts / Ft Typical *(Fully factory programmable, 5 - 12 W per foot.)*
	Input Voltage	120 - 277 VAC, 50 / 60 Hz
	Max. Fixture Run Length	8 Watts: 60 Ft @ 120 VAC 100 Ft @ 208 VAC, 240 VAC, 277 VAC
	Temperature	Startup/Operating: -20°C to +40°C Storage: -30°C to +60°C Relative Humidity: 10 - 90% *(non-condensing)*
	Dimming	10% to 100% Via 0 - 10 VDC

POLAR PLOT **120° Beam Angle** **96.5 lm / W**



3000K LUMEN DATA

System Watts/Ft	Delivered Lumens/Ft	
	82 CRI	92 CRI
5	483	386
6	579	463
7	676	540
8	772	618
9	869	695
10	965	772
11	1062	849
12	1158	926

Output Factors	
CCT	Multiplier
2000K	0.75
2700K	0.96
3000K	1
3500K	1.03
4000K	1.05

i2Systems ADVANCED LED LIGHTING
Integrated Illumination Systems, Inc.
355 Bantam Lake Road
Morris, CT 06763 USA
tel +1.860.567.0708
fax +1.860.567.2501
sales@i2Systems.com

ORDER#: CAS-1030K-08W-B

NOTES:
APPLICATION: COVE LIGHT (HIDDEN)
- DIMMING
- FEEDS, JOINERS, ANCILLARY HARDWARE TBD

MANUFACTURER: I2 LIGHTING

MOUNTING: COVE

COLOR: NA

LAMP/WATTAGE: LED 3000K 90CRI
8 WATTS PER FT

TECHNICAL ARTISTRY
145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

STATUS: SUBMITTED
10-10-17

APPROVED BY:

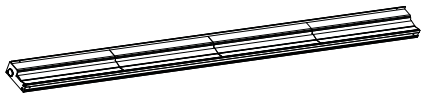
TYPE: LC1

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE LC1	
DATE: 2-16-18			

i2Cove

Asymmetrical LED Light Fixture

i2Systems® ADVANCED LED LIGHTING



PART NUMBER BUILDER

CAS	1	–	30K	–	08W	–	
FIXTURE PREFIX	LENGTH		LED COLOR		POWER		PACKAGING

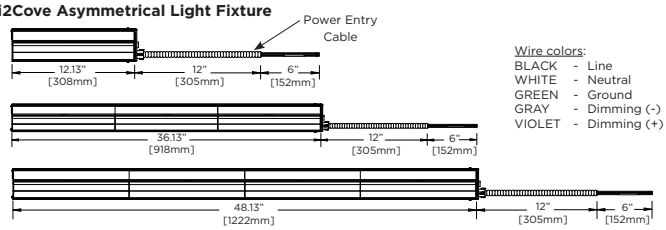
FIXTURE PREFIX	LENGTH	LED COLOR	POWER	PACKAGING
i2Cove Asymmetrical	**1** 1 Ft **3** 3 Ft **4** 4 Ft	**27K** 2700 K **30K** 3000 K **35K** 3500 K	**08W** 8 Watts *(other power options available)*	**S** Single (qty 1) **B** Bulk (1': qty 4, 4': qty 7)

EXAMPLES

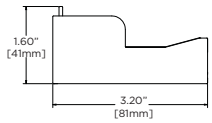
CAS1-27K-08W-B

CAS4-35K-08W-S

i2Cove Asymmetrical Light Fixture



Wire colors:
BLACK - Line
WHITE - Neutral
GREEN - Ground
GRAY - Dimming (-)
VIOLET - Dimming (+)



End View

OPTIONS

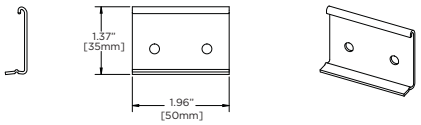
BRACKETS

- ☐ **CAB-1** Flat *(supplied with fixture)*
- ☐ **CAB-2** Adjustable, Rotating *(optional)*

CORNER KIT

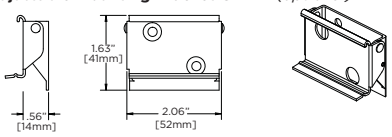
- ☒ **CAK-1** Plug-in Corner Kit *(optional)*

Flat Mounting Bracket CAB-1 *(2 brackets supplied with fixture)*



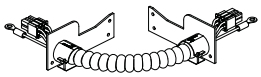
- For surface mounting fixtures
- Secure with mounting screws
- Snap fixture into place

Adjustable Mounting Bracket CAB-2 *(optional)*



- For surface mounting fixtures
- Variable angle positions
- Secure with mounting screws (not included)
- Snap fixture into place

Plug-In Corner Kit CAK-1 *(optional)*



Kit includes:
- Two end plates
- Armored cable assembly

Integrated Illumination Systems, Inc.
355 Bantam Lake Road
Morris, CT 06763 USA

tel +1.860.567.0708
fax +1.860.567.2501
sales@i2Systems.com

ORDER#: CAS-1030K-08W-B

NOTES:

APPLICATION: COVE LIGHT (HIDDEN)
- DIMMING
- FEEDS, JOINERS, ANCILLARY HARDWARE TBD

MANUFACTURER: I2 LIGHTING

MOUNTING: COVE

COLOR: NA

LAMP/WATTAGE: LED 3000K 90CRI 8 WATTS PER FT

TECHNICAL ARTISTRY
145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

STATUS: SUBMITTED 11-13-17	APPROVED BY:	TYPE: LC1

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE LC1	
DATE: 2-16-18			

i2Cove

Asymmetrical LED Light Fixture

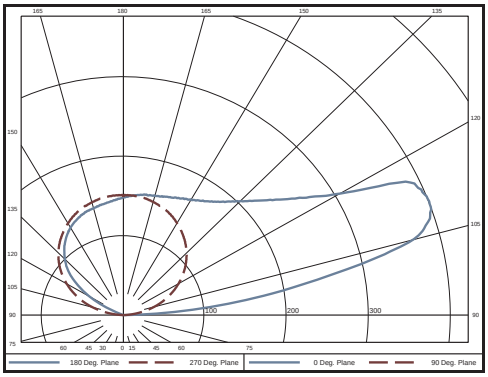
i2Systems ADVANCED LED LIGHTING

PHOTOMETRICS

CAS1-30K-08W 3000K, 1ft, 8W

Integrating Sphere	
Luminous Flux	699 Lumens
Efficacy	96.5 lm/W
CCT	2905 K
CRI (Ra)	82.8
Electrical Data at 120 VAC	
Test Temperature	24.5 °C
Voltage	120.0 VAC
Current	0.06300 A
Power	7.250 W
Power Factor	0.956
Frequency	60 Hz
Current THD	20.0%

i2Cove Asymmetrical Polar Plot



Zonal Lumen Summary

Zone	Lumens	% of Luminaire	Zone	Lumens	% of Luminaire	Zone	Lumens	% of Luminaire
0-5	0	0.0%	60-65	0.01	0.0%	120-125	57.59	8.40%
5-10	0	0.0%	65-70	0.04	0.0%	125-130	54.90	8.0%
10-15	0	0.0%	70-75	0.09	0.0%	130-135	52.08	7.6%
15-20	0	0.0%	75-80	0.17	0.0%	135-140	48.83	7.2%
20-25	0	0.0%	80-85	0.27	0.0%	140-145	45.07	6.6%
25-30	0	0.0%	85-90	0.41	0.1%	145-150	40.72	6.0%
30-35	0	0.0%	90-95	5.68	0.8%	150-155	35.77	5.2%
35-40	0	0.0%	95-100	24.81	3.6%	155-160	30.18	4.4%
40-45	0	0.0%	100-105	46.16	6.8%	160-165	24.01	3.5%
45-50	0	0.0%	105-110	58.37	8.5%	165-170	17.47	2.6%
50-55	0	0.0%	110-115	63.81	9.3%	170-175	10.62	1.6%
55-60	0.00	0.0%	115-120	62.05	9.1%	175-180	3.56	0.5%

CERTIFICATIONS

UL (US & Canada)
FCC
RoHS
Made in the USA

i2Systems ADVANCED LED LIGHTING
Integrated Illumination Systems, Inc.
355 Bantam Lake Road
Morris, CT 06763 USA
tel +1.860.567.0708
fax +1.860.567.2501
sales@i2Systems.com

ORDER#: CAS-1030K-08W-B

NOTES:
APPLICATION: COVE LIGHT (HIDDEN)
- DIMMING
- FEEDS, JOINERS, ANCILLARY HARDWARE TBD

MANUFACTURER: I2 LIGHTING

MOUNTING: COVE

COLOR: NA

LAMP/WATTAGE: LED 3000K 90CRI
8 WATTS PER FT

TECHNICAL ARTISTRY
145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

STATUS: SUBMITTED 10-10-17

APPROVED BY:

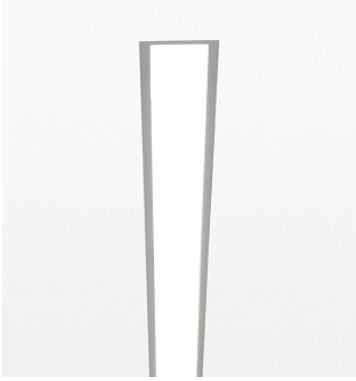
TYPE: LC1

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE LSR1 LENGTH TBD	
DATE: 2-16-18			

Transforming
light into
an element of
design

DIRECT DEFINITION, FLUSH SILK LENS
2200 lm/4ft, Flush Silk
3000K

TRUGROOVE CONTINUOUS
DEFINITION LED



Ordering guide

Product Type	Source	Color Temp *	Lumens *	Optics	Housing	Ceiling / Trim	Run Length	Wiring †	Voltage	Driver
39C0	L	C	G	L	S	3	TBD	7	TBD	E
TruGroove Definition LED	L LED	A 4000K B 3500K C 3000K	E 3000 lm/4ft G 2200 lm/4ft K 1500 lm/4ft	L Flush Silk Lens M Regressed Silk Lens	S Standard C Chicago Plenum	1 T-Grid 3 Drywall Trimless 4 Drywall Trim 5 Armstrong Formations	Total run length in feet and inches	7 1 cct Dimming M 1 cct Dimming + EM Wiring N 1 cct Dimming + EM Batt. Pack 1 1 cct 3 1 cct + EM/NL Wiring 5 1 cct + EM Batt. Pack B 2 cct A/B	1 120V 2 277V 3 347V	E Philips Advance 0-10V *Other drivers available - consult your Philips representative*

* Nominal values within a range. Consult photometry data for exact color temp, lumens & distribution.
† Not all wiring types are available with all configurations. Consult Philips Ledalite for a complete list of available options.

Mounting Hardware

☐ Mount Type
Consult separate mounting spec sheet for mount type options

Integrated Controls Please indicate with check mark.

☐ SpaceWise DT Occupancy & Daylight Sensor (SZ)

ORDER#: 39C0-L-C-G-L-S-3-LENGHT TBD-7-VOLTAGE-E

NOTES:
APPLICATION: RECESSED TRIM-LESS LINEAR SLOT
- EM AS NEEDED LSR1EM
- SINGLE CIRCUIT WITH DIMMING

MANUFACTURER: LEDALITE PHILIPS

MOUNTING: RECESSED

COLOR: WHITE

LAMP/WATTAGE: LED 3000K 2200 LM/4FT

TECHNICAL ARTISTRY
145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

STATUS: SUBMITTED 11-13-17

APPROVED BY:

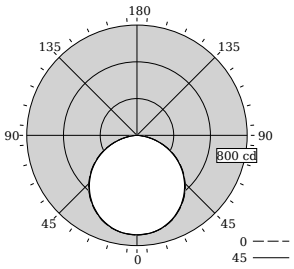
TYPE: LSR1 LENGTH TBD

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE LSR1 LENGTH TBD	
DATE: 2-16-18			

TRUGROOVE CONTINUOUS DEFINITION LED

DIRECT DEFINITION, FLUSH SILK LENS

Photometry



0% Up / 100% Down

Total Output	2100 lm
Efficacy	75.0 lm/W
CCT	3084K
CRI	82
Distribution	0% Up / 100% Down
Spacing Criteria (0/90/180°)	1.27/1.26/NA
Meets RP-1-12 recommendations for VDT-Normal spaces	

Values per 4ft unit

Fixture photometry has been conducted in accordance with IESNA LM-79-08

IES files for this and other photometric options can be downloaded online at www.lightingproducts.philips.com

Candela Distribution

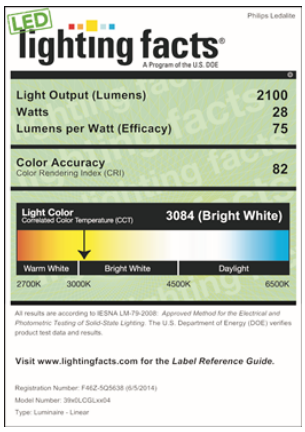
Vertical Angle	Horizontal Angle 0	22.5	45	67.5	90	Zonal Lumens
0	723	723	723	723	723	0
5	720	716	719	721	719	68
15	699	692	698	698	696	196
25	651	646	650	647	647	299
35	583	579	580	579	576	362
45	495	492	493	489	488	379
55	390	389	387	383	383	345
65	271	270	267	264	264	265
75	144	143	141	140	140	150
85	29	29	28	29	28	36
90	0	0	0	0	0	0
95	0	0	0	0	0	0
105	0	0	0	0	0	0
115	0	0	0	0	0	0
125	0	0	0	0	0	0
135	0	0	0	0	0	0
145	0	0	0	0	0	0
155	0	0	0	0	0	0
165	0	0	0	0	0	0
175	0	0	0	0	0	0
180	0	0	0	0	0	0

Coefficients of Utilization (%)

RCR	Ceiling	80				70			50		0
	Wall	70	50	30	10	70	50	30	50	30	10	0
0		119	119	119	119	116	116	116	111	111	111	100
1		109	104	100	96	106	102	98	97	94	91	84
2		99	90	83	78	96	88	82	85	80	75	69
3		90	79	71	64	87	78	70	75	68	63	58
4		82	70	61	54	80	69	60	66	59	53	50
5		76	63	53	47	73	61	53	59	52	46	43
6		70	56	47	41	68	55	47	53	46	40	37
7		65	51	42	36	63	50	42	49	41	35	33
8		60	46	38	32	59	46	38	44	37	32	29
9		56	43	34	29	55	42	34	41	34	28	26
10		53	39	31	26	51	39	31	38	31	26	24

Avg. Luminance (cd/m2)

Vertical Angle	Horizontal Angle 0	45	90
55	7473	7419	7339
65	7052	6943	6870
75	6114	5995	5936
85	3702	3525	3525



Electrical Specifications

Input Voltage	120V	277V
Input Power	28.0W	28.0W
Input Current	0.24A	0.12A
Power Factor	0.983	0.878
Total Harm. Distortion	16.5%	19.3%

Tested values – contact technical support for rated values. Off-state power zero unless certain controls are specified.

With SpaceWise DT, standby power <0.5W (120V) or <0.8W (277V).

ORDER#: 39C0-L-C-G-L-S-3-LENGHT TBD-7-VOLTAGE-E

NOTES:

APPLICATION: RECESSED TRIM-LESS LINEAR SLOT
- EM AS NEEDED LSR1EM
- SINGLE CIRCUIT WITH DIMMING

MANUFACTURER: LEDALITE PHILIPS

MOUNTING: RECESSED

COLOR: WHITE

LAMP/WATTAGE: LED 3000K 2200 LM/4FT

TECHNICAL ARTISTRY
145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

STATUS: SUBMITTED 11-13-17

APPROVED BY:

TYPE: LSR1 LENGTH TBD

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE LSR1 LENGTH TBD	
DATE: 2-16-18			

TRUGROOVE CONTINUOUS DEFINITION LED

Modules & Runs

TruGroove Continuous LED nominal housing lengths

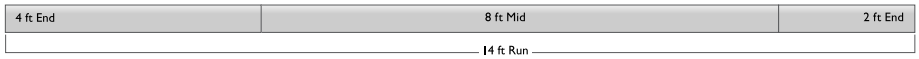
2ft, 3ft, 4ft, 6ft & 8ft units can be combined to build continuous runs starting from 5ft in 1ft steps. Available incremental units allow run lengths from 5ft in steps as small as 1/8in*.

**Note: Asymmetric and E lumen package versions (3000lm/4ft) are only available in 2ft increments.*

Flush lens trimless versions can be installed in either the wall or ceiling.

To ensure full cavity closure and simplify installation, there are both end-run units with one closed end and mid-run, open units.
Refer to module size details below for actual dimensions e.g. trim. T-grid units fit within a standard 2' grid.
To specify corners and patterns, refer to TruGroove Corners data sheets.

Continuous Run Example

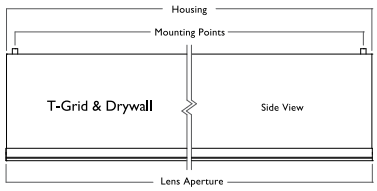


Housing lengths

Trim type	Run & housing	Lens	Mounting points	Overall trim
T-Grid	Length L	L – 1"		L – 0.2"
Drywall Trimless	Length L	L	L – 0.8"	L + 3.3"
Drywall Trim	Length L	L	L – 0.8"	L + 1.5"

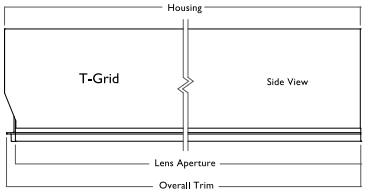
Module Dimensions

Continuous mid-run units

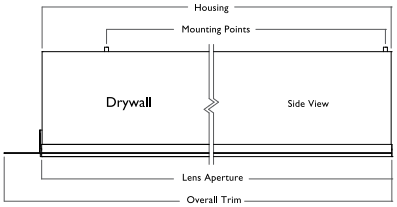


Nominal length	Housing & Lens	Mounting points
2ft	24.0"/610mm	23.2"/590mm
3ft	36.0"/914mm	35.2"/894mm
4ft	48.0"/1219mm	47.2"/1199mm
6ft	72.0"/1829mm	71.2"/1808mm
8ft	96.0"/2438mm	95.2"/2418mm
Increment	Length L	L – 0.8"

Continuous end-run units



Nominal length	Housing	Lens	Trim – T-Grid
2ft	24.0"/610mm	23.5"/597mm	23.9"/606mm
3ft	36.0"/914mm	35.5"/902mm	35.9"/911mm
4ft	48.0"/1219mm	47.5"/1207mm	47.9"/1216mm
6ft	72.0"/1829mm	71.5"/1816mm	71.9"/1826mm
8ft	96.0"/2438mm	95.5"/2426mm	95.9"/2435mm
Increment	Length L	L – 0.5"	L – 0.1"



Nominal length	Housing	Mounting points	Trim – Drywall trimless	Trim – Drywall trim
2ft	24.0"/610mm	23.2"/590mm	25.7"/652mm	24.75"/629mm
3ft	36.0"/914mm	35.2"/894mm	37.7"/957mm	36.75"/933mm
4ft	48.0"/1219mm	47.2"/1199mm	49.7"/1262mm	48.75"/1238mm
6ft	72.0"/1829mm	71.2"/1808mm	73.7"/1872mm	72.75"/1848mm
8ft	96.0"/2438mm	95.2"/2418mm	97.7"/2481mm	96.75"/2457mm
Increment	Length L	L – 0.8"	L + 1.7"	L + 0.75"

ORDER#: 39C0-L-C-G-L-S-3-LENGHT TBD-7-VOLTAGE-E

NOTES:

APPLICATION: RECESSED TRIM-LESS LINEAR SLOT
- EM AS NEEDED LSR1EM
- SINGLE CIRCUIT WITH DIMMING

MANUFACTURER: LEDALITE PHILIPS

MOUNTING: RECESSED

COLOR: WHITE

LAMP/WATTAGE: LED 3000K 2200 LM/4FT

TECHNICAL ARTISTRY
145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

STATUS: SUBMITTED 11-13-17

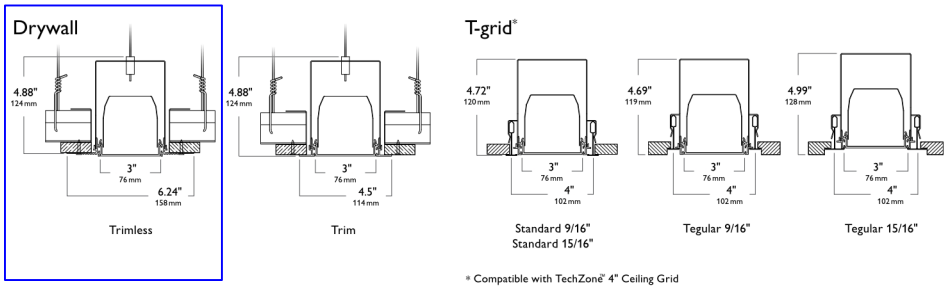
APPROVED BY:

TYPE: LSR1 LENGTH TBD

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE LSR1 LENGTH TBD	
DATE: 2-16-18			

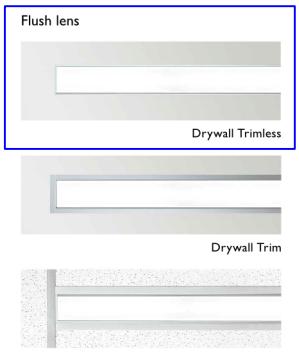
TRUGROOVE CONTINUOUS DEFINITION LED

Options and Details



* Compatible with TechZone® 4" Ceiling Grid

Trim Views



Housing
Die-formed 20 gauge cold-rolled steel. Multiple upper wire entrances available for continuous row mounting of fixtures.

Weight
Maximum 3.5lb/ft.

Optical System
Performance version: White light emitted from the LED sources is internally reflected and laterally redirected by a biconvex lens. Light is then reflected by Miro Silver panels and exits through the optical lens assembly. This assembly contains acrylic extrusion profiles to retain a layer of MesoOptics film, creating both an uninterrupted continuum of light and an optical batwing distribution.

Definition version: Light passes through a diffuse white acrylic lens to deliver a highly uniform luminous continuum.

Standard Driver
Dimming: 0-10V, 5-100% Philips Advance Xitanium Sensor Ready (SR), 5-100% (for SpaceWise). Output is Class 2 rated.

Lumen Maintenance
At an ambient temperature of 25°C in non-insulated contact applications, the LED lumen maintenance expectation for each lumen package is:
K: L_{80} (12k) 71,000 hrs
G: L_{80} (12k) 68,000 hrs
E: L_{80} (12k) 54,000 hrs

Controls
Available with SpaceWise DT occupancy & daylight sensor w/ advanced grouping & dwell time.

* SpaceWise DT commissioning is via a compatible Android phone and Philips Field App. Compatible wireless dimming wall switches are available for dimming. For more information, please refer to www.philips.com/spacewise

Mounting
Mounting brackets on housing sides support T-Grid installation. 1/16" diameter aircraft cable with self-locking, tamper-resistant, miniature cable gripper provides vertical adjustment for drywall. Aircraft cable, crimp and gripper independently tested to meet stringent safety requirements.
Compatible with 4" Armstrong TechZone ceiling grid.

Joints
Self-aligning joining system with hands-free pre-joining wire access.

Electrical
Factory pre-wired to section ends with quick-wire connectors.

Approvals
Certified to UL, CSA and IES standards. Insulation Contact (IC) rated.

Finish
Extruded aluminum trim and die-cast endplates coated with electrostatically applied and thermally cured polyester. White sensors only, powder coat paint finish.

Environment
Rated for dry or damp locations in operating ambient temperatures 0-40°C (32-104°F). Certain luminaire components may be adversely affected by contaminants. Damage caused by sulfur, chlorine, petroleum based solutions or other contaminants are not covered under warranty.

Due to continuing product improvements, Philips Ledalite reserves the right to change the specifications without notice.

Philips Lighting
North America Corporation
200 Franklin Square Drive
Somerset, NJ 08873
Phone: 855-486-2216

ORDER#: 39C0-L-C-G-L-S-3-LENGHT TBD-7-VOLTAGE-E

NOTES:
APPLICATION: RECESSED TRIM-LESS LINEAR SLOT
- EM AS NEEDED LSR1EM
- SINGLE CIRCUIT WITH DIMMING

MANUFACTURER: LEDALITE PHILIPS

MOUNTING: RECESSED

COLOR: WHITE

LAMP/WATTAGE: LED 3000K 2200 LM/4FT

TECHNICAL ARTISTRY
145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

STATUS: SUBMITTED 11-13-17

APPROVED BY:

TYPE: LSR1 LENGTH TBD

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE TH2	
DATE: 2-16-18			

PHILIPS LIGHTOLIER

Track lighting

OmniSpot LED

LC10, 12W/1000lm

OmniSpot LED cylinder is designed to meet the most demanding retail lighting challenges through sleek and discrete aesthetics while providing a high center beam candlepower and efficacy performance. OmniSpot LED cylinder allows for less than 1" of space between the track head and track in the ceiling.

Fixture

example: LC10930WTECW

Series	Adapters	Lumens	CRI/CCT	Finishes	Dimming	Options
LC		10	930	W	TE	
LC OmniSpot LED cylinder	— Lightolier **H** Halo **J** Juno **P** Prospec[1] **GT** Global TEK	**10** 1000lm	**827** 80CRI/2700K **830** 80CRI/3000K **835** 80CRI/3500K **840** 80CRI/4000K **927** 90CRI/2700K **930** 90CRI/3000K	**AL** Aluminum[1] **BK** Matte Black **W** Matte White	**TE** Trailing edge (ELV)	— None (leave blank)
			930 90CRI/3000K	See above finishes	**TE** Trailing edge (ELV)	**CW** CrispWhite

Reflector

example: LLMRNS

Series	Beam spreads (ordered separately)
LLM	TBD
LLM Reflector for 1000lm	**RNS** 12° Narrow Spot **RS** 18° Spot **RNF** 24° Narrow Flood **RF** 36° Flood

Accessories[2]

example: LC10AHWH

Series	Finishes/Types
LC10AH Accessory holder[3] **LC10SN** Snoot	**WH** Matte White **BK** Matte Black **AL** Aluminum
7472 Hex cell (matte black)[4]	
LC10 Diffusion film	**SY** Symmetrical Spread **SF** Soft Focus **LS** Linear Spread **FR** Frosted Etched

1. Prospec adapters are not available with aluminum finish.
2. Aperture ring on the fixture can hold a maximum of 1 film and 1 snoot.
3. Accessory holder can hold a maximum of 1 hex cell, 1 film, and 1 snoot.
4. Hex cell needs to be ordered with an Accessory holder.

Features

1. **LED board:** COB LED.
2. **Integrated housing heat sink:** Impact extrusion aluminum maintains LED junction temperature for min of 50,000 hr lifetime (pending) at 70% lumen maintenance.
3. **Track attachment fitting:** Locking lever for mechanical/electrical connection.
4. **Aperture Ring:** Included with luminaire. Die cast aluminum, powder coated to match other components. Easily threads on and off without use of tools to access reflector and install accessories. Accepts a maximum of 1 film and 1 snoot.
5. **Mounting arm:** Die-cast aluminum.
6. **Movable brass contact:** Brass extends for connection to 2nd circuit (Advent track only).
7. **Pivot mounts:** Allows for 350° horizontal. Vertical rotation of +/- 90° from vertical aim to the floor.
8. **Interchangeable optics:** High efficiency metalized coating providing up to 98% total reflectivity for optimal light quality, beam control and punch. Reflector has lens attached which protects reflector finish and LEDs from contamination. Tool-less installation. Reflector sold separately to allow field replaceability.
10. **Finishes:** Powder coated.

Electrical (electronic power supply)

Input voltage: 120V, 60Hz Input power: 12W
Efficacy: 98lm/W (nominal) @ 3000K
High power factor: >0.9 CRI: 80-85 (typical)

Labels

cULus Listed.
5 year warranty.
ENERGY STAR® certified (except any combinations containing CrispWhite, 80CRI 40K, or accessories).

ORDER#: LC-10-930-W-TE LLM-XXX (REFLECTOR) LC10-XXX ACCESSORIES TBD

NOTES:
APPLICATION: TRACK FIXTURES
- ACCESSORIES TBD
- REFLECTORS TBD

MANUFACTURER: LIGHTOLIER

MOUNTING: TRACK

COLOR: WHITE

LAMP/WATTAGE: LED 1000 LUMENS 3000K 90 CRI 14 WATTS

TECHNICAL ARTISTRY
145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

STATUS: SUBMITTED 11-13-17

APPROVED BY:

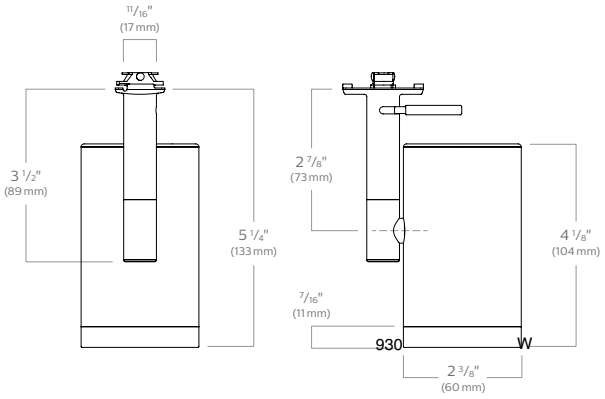
TYPE: TH2

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE TH2	
DATE: 2-16-18			

LC10 OmniSpot LED

Cylinder, 1000 lm (12 W)

Dimensions



Dimming

Trailing edge (ELV) dimming compatible

SR400RPC120	Philips Sunrise (100 - 5%)
SELV-300P	Lutron Skylark (100-7%)
DVELV-300P	Lutron Diva (100-7%)
6615-P	Leviton Decora (100-12%)

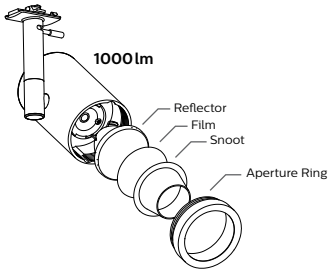
Mounting

Compatible with all Monopoint, Multipoint, recessed track, suspension track, as well as Basic, Advent and Radius track systems. Can be wall mounted vertically or horizontally. Cannot be used with extension wands.

	Beam spread (To 50% CBCP)	CBCP	Rated Life (Hrs.)
LLMRNS Narrow Spot	12°	14,160	50,000
LLMRS Spot	18°	7,103	50,000
LLMRNF Narrow Flood	24°	4,891	50,000
LLMRF Flood	36°	2,680	50,000

TBD

Accessories (ordered separately)



Hex cell louvers
7472 = 2" dia.

Only available in matte black. Must order the accessory holder to hold the hex cell louver.

Snoot
LC10SN = 2" dia.

Diffusion/special films
LC10 = 2" dia.

- **LS** Linear spread film
- **FR** Frosted etched film
- **SF** Soft focus film
- **SY** Symmetrical spread film

ORDER#: LC-10-930-W-TE LLM-XXX (REFLECTOR) LC10-XXX ACCESSORIES TBD

NOTES:
APPLICATION: TRACK FIXTURES
- ACCESSORIES TBD
- REFLECTORS TBD

MANUFACTURER: LIGHTOLIER

MOUNTING: TRACK

COLOR: WHITE

LAMP/WATTAGE: LED 1000 LUMENS 3000K 90 CRI 14 WATTS

TECHNICAL ARTISTRY
145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

STATUS: SUBMITTED 11-13-17

APPROVED BY:

TYPE: TH2

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE TH2	
DATE: 2-16-18			

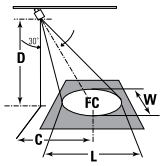
LC10 OmniSpot LED

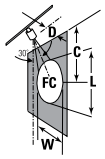
Cylinder, 1000 lm (12 W)

Aiming angles

L and **W** are the outer points where the candle power drops to 50% of the maximum. **FC** are the initial footcandles at the center of the beam. Data shown is for 3000K, use the table on the right for CRI/CCT adjustment factors.

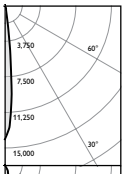
L Beam length
D Distance
W Beam Width
A Aiming Angle
FC Footcandles
C Distance to center beam
CBCP Center Beam Candlepower.





Adjustment factors

CRI	CCT	Multiplier
80	2700K	0.95
	3000K	1.00
	3500K	1.02
	4000K	1.03
90	2700K	0.79
	3000K	0.82
90CW	3000K	0.7



Fixture: LC10830ALTE
Reflector: LLMRNS

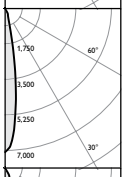
CCT[1]:	3000K
Output lumens:	1083 lms
Input watts[2]:	11.1 W
Efficacy:	97.6 lm/w
CRI:	80 min
CBCP.:	14,160 cd
Beam Angle:	12°
Field Angle:	24°
Report no[3]:	924GFR

Narrow Spot
30° Horizontal Aiming

Distance			Beam	
D	C	F.C.	L	W
6	3.5	255	1.7	1.5
8	4.6	144	2.3	1.9
10	5.8	92	2.8	2.4
12	6.9	64	3.4	2.9

30° Horizontal Aiming

Distance			Beam	
D	C	F.C.	L	W
2	3.5	443	1.7	0.8
3	5.2	197	2.6	1.3
4	6.9	111	3.5	1.7
5	8.7	71	4.3	2.1



Fixture: LC10830ALTE
Reflector: LLMRS

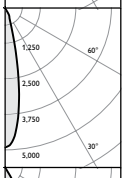
CCT[1]:	3000K
Output lumens:	1068 lms
Input watts[2]:	11.1 W
Efficacy:	96.2 lm/w
CRI:	80 min
CBCP.:	7,103 cd
Beam Angle:	18°
Field Angle:	37°
Report no[3]:	923GFR

Spot
30° Horizontal Aiming

Distance			Beam	
D	C	F.C.	L	W
6	3.5	128	2.6	2.2
8	4.6	72	3.4	2.9
10	5.8	46	4.3	3.7
12	6.9	32	5.1	4.4

30° Horizontal Aiming

Distance			Beam	
D	C	F.C.	L	W
2	3.5	222	2.7	1.3
3	5.2	99	4.1	1.9
4	6.9	55	5.5	2.5
5	8.7	36	6.9	3.2



Fixture: LC10830ALTE
Reflector: LLMRNF

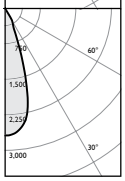
CCT[1]:	3000K
Output lumens:	1057 lms
Input watts[2]:	11.1 W
Efficacy:	95.2 lm/w
CRI:	80 min
CBCP.:	TBD cd
Beam Angle:	24°
Field Angle:	46°
Report no[3]:	922GFR

Narrow Flood
30° Horizontal Aiming

Distance			Beam	
D	C	F.C.	L	W
6	3.5	88	3.3	2.8
8	4.6	50	4.4	3.8
10	5.8	32	5.5	4.7
12	6.9	22	6.6	5.6

30° Horizontal Aiming

Distance			Beam	
D	C	F.C.	L	W
2	3.5	153	3.7	1.6
3	5.2	68	5.6	2.4
4	6.9	38	7.4	3.3
5	8.7	24	9.3	4.1



Fixture: LC10830ALTE
Reflector: LLMRF

CCT[1]:	3000K
Output lumens:	1050 lms
Input watts[2]:	11.1 W
Efficacy:	94.6 lm/w
CRI:	80 min
CBCP.:	2,680 cd
Beam Angle:	36°
Field Angle:	62°
Report no[3]:	921GFR

Flood
30° Horizontal Aiming

Distance			Beam	
D	C	F.C.	L	W
6	3.5	48	5.4	4.5
8	4.6	27	7.2	6.0
10	5.8	17	9.0	7.5
12	6.9	12	10.8	9.0

30° Horizontal Aiming

Distance			Beam	
D	C	F.C.	L	W
2	3.5	84	7.6	2.6
3	5.2	37	11.4	3.9
4	6.9	21	15.2	5.2
5	8.7	13	19.0	6.5

1. Correlated Color Temperature within specs as defined in ANSI_NEMA_ANSLG C78.377-2008: Specifications for the Chromaticity of Solid State Lighting Products.
2. Wattage controlled to within +/- 5%.
3. Tested using absolute photometry as specified in LM79: IESNA Approved Method for the Electrical and Photometric Measurements of Solid-State Lighting Products.

Philips Lighting North America Corporation
200 Franklin Square Drive, Somerset, NJ 08873
Tel. 855-486-2216

Philips Lighting Canada Ltd.
281 Hillmount Rd, Markham, ON, Canada L6C 2S3
Tel. 800-668-9008

ORDER#: LC-10-930-W-TE LLM-XXX (REFLECTOR) LC10-XXX ACCESSORIES TBD

NOTES:
APPLICATION: TRACK FIXTURES
- ACCESSORIES TBD
- REFLECTORS TBD

MANUFACTURER: LIGHTOLIER

MOUNTING: TRACK

COLOR: WHITE

LAMP/WATTAGE: LED 1000 LUMENS 3000K 90 CRI 14 WATTS

TECHNICAL ARTISTRY
145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

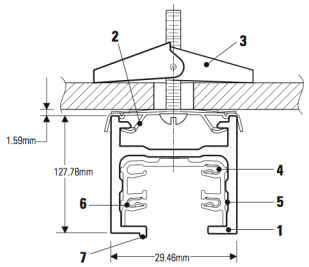
STATUS: SUBMITTED 11-13-17

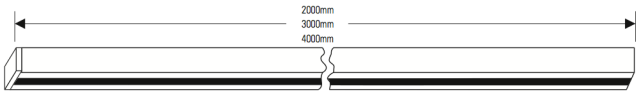
APPROVED BY:

TYPE: TH2

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE TRK1	
DATE: 2-16-18			

LIGHTOLIER Advent Lytespan® 1 and 2 Circuit Track **61XMCE**





Plain Track

Finishes	Plain Track			
	2m Catalog No.	3m Catalog No.	4m Catalog No.	
Aluminum	**612MALCE**	**613MALCE**	**614MALCE**	
Black	**612MBKCE**	**613MBKCE**	**614MBKCE**	
White	**612MWHCE**	**613MWHCE**	**614MWHCE**	

Features
1. **Advent Lytespan Track:** 6063-T5 Aluminum 1.8mm wall thickness.
2. **Track Mounting Clips:** 0.61mm Spring steel, in black or white; furnished with track units.
3. **Toggle Bolt & Screws:** furnished with track units.
4. **Conductor (3):** 16A current carrying capacity.
5. **Insulating Liner:** 1.2mm wall, thermoplastic.
6. **Neutral Conductor:** on bead side of track.
7. **Polarity Bead:** identifies the neutral conductor.
8. **Live End:** molded thermoplastic. Includes contacts for power supply leads.
9. **Dead End Cover:** molded thermoplastic.
10. **Mini Coupler:** connects track units mechanically and electrically.

Mechanical
Track units plug together and lock securely to prevent accidental separation. Track units can be field cut.

Finish
All painted finishes are baked enamel.

Mounting
Track may be surface mounted to ceilings or walls. The track may be stem mounted. The track is not intended to be cable mounted. The track can also be recessed, see Specification Sheet 7515.

Electrical
Two circuits individually controllable, rated 16 amps, at 220 - 240 volts 50 Hz per track circuit (16 amps total for the two circuits), when supplied by a 220/240 volt, 50 Hz, single phase 3-wire branch circuit with a grounded neutral. The track is polarized and continuously grounded throughout. Electrical conductors are concealed in a insulating liner. Lytespan lighting units attach to the track at any point and can be adjusted to operate on either track circuit. Not intended for use with a power cord or a convenience receptacle adapter. Magnetic and electronic transformers require different dimmer controls. Use the proper control device on the track. Caution should be used when operating dimming controls on 3 wire circuiting (the neutral conductor may overload). For additional information on dimming, call 1-800-833-3664. All wiring must be in accordance with National and Local Codes.

Labels
I.B.E.W.,CE

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PHILIPS

ORDER#: 61X (LENGTHS) MWWHCE

NOTES:

APPLICATION:SURFACE TRACK
- 2 CIRCUIT
- FEEDS, JOINERS, ANCILLARY HARDWARE TBD

MANUFACTURER: LIGHTLOIER

MOUNTING: SURFACE

COLOR: WHITE

LAMP/WATTAGE: NA

TECHNICAL ARTISTRY
145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

STATUS: SUBMITTED 11-13-17

APPROVED BY:

TYPE: TRK1

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE TRK1	
DATE: 2-16-18			

LIGHTOLIER® Advent Lytespan® 1 and 2 Circuit Track 61XMCE

Track Mounting and Power Feed Systems

Track Mounting Clips
Furnished with track: 2 clips per 2m track, 3 clips per 3m and 4m track units. Attaches to track at any point. Clip is nylon coated. White clip supplied with white track, and aluminum, black clip with black track. Spaces track from ceiling.

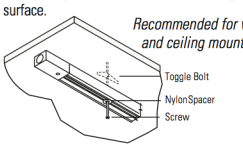
Not recommended for wall mounting.

56451WH Matte White
56451BK Matte Black

Set of 10

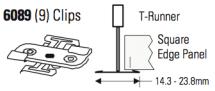
Direct Mounting
Toggle bolts and nylon insulators are furnished with Track, two per 2m track, three per 3m and four per 4m track. Mount through existing holes in track. Top of track sits flush to mounting surface.

Recommended for wall and ceiling mounting.



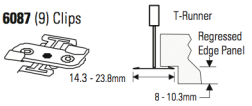
Grid Ceiling Mounting Clips
Square Edge Panels and 14.827mm-23.812mm T-Bars Clip is supplied assembled. Mounts onto T-Bars by rotating clips. Use two per 2m track, three per 3m, and four per 4m track.

6089 (9) Clips



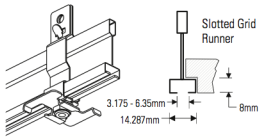
Regressed Edge Panels and 14.287mm-23.812mm T-Bar Clip is supplied assembled. Mounts easily onto T-Bars by rotating clips. Use two per 2m track, three per 3m, and four per 4m track.

6087 (9) Clips



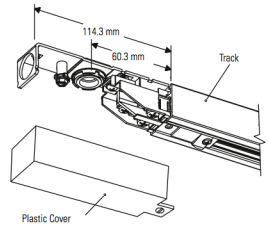
Slotted Grid Ceilings such as Donn Fineline and Chicago Metalic Ultraline 3500 and 3600.Use two per 2m track, three per 3m, and four per 4m track.

6088 (9) Clips



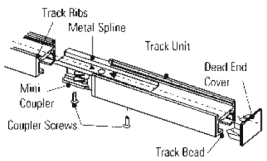
Live End
Energizes Track from the beginning of a run. It is included with Individual Track Units. Use with plain track units.

6148ALCE Matte Aluminum
6148BKCE Matte Black
6148WHCE Matte White



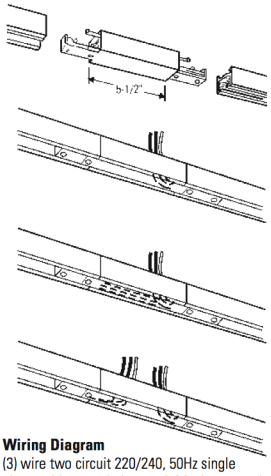
Mini-Coupler
Used to connect two pieces of track together mechanically and electrically. *Power cannot be fed to the Mini-Coupler.*

6149ALCE Matte Aluminum
6149BKCE Matte Black
6149WHCE Matte White

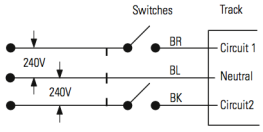


In-Line Connector
Permits power feed between track units in a straight run of track. The In-Line Connector is polarized and pre-wired. KO permits direct feed with electrical connector.

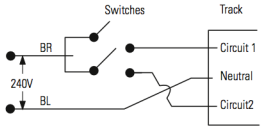
6154ALCE Matte Aluminum
6154BKCE Matte Black
6154WHCE Matte Aluminum



Wiring Diagram
(3) wire two circuit 220/240, 50Hz single phase with grounded neutral. Maximum total track load (circuit 1 + circuit 2) = 16 amps.



220/240 50Hz single branch circuit, 16 amp supply. Maximum load, 16 amps distributed between track circuits.



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ORDER#: 61X (LENGHTS) MWWHCE

NOTES:

APPLICATION:SURFACE TRACK
- 2 CIRCUIT
- FEEDS, JOINERS, ANCILLARY HARDWARE TBD

MANUFACTURER: LIGHTLOIER

MOUNTING: SURFACE

COLOR: WHITE

LAMP/WATTAGE: NA

TECHNICAL ARTISTRY
145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

STATUS: SUBMITTED 11-13-17

APPROVED BY:

TYPE: TRK1

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE TRK1	
DATE: 2-16-18			

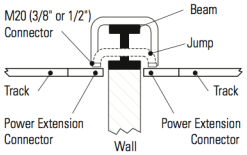
LIGHTOLIER Advent Lytespan® 1 and 2 Circuit Track **61XMCE**

Track Mounting, Power Feed Systems and Mounting Patterns

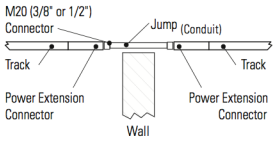
Power Extension Connector
Replaces Dead End Cover at end of track to permit power continuity around structural obstacles to another track section.
Accepts same power feed-in kits as Live End.

6146ALCE Matte Aluminum
6146BKCE Matte Black
6146WHCE Matte White

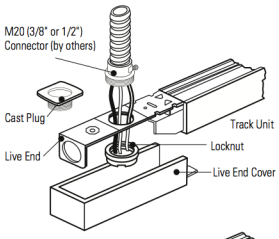
Over Beam or Through Beam

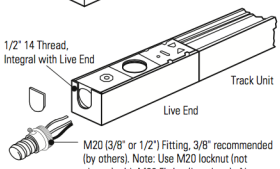


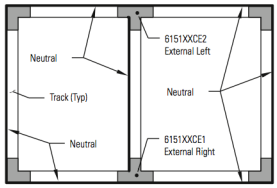
Through Wall or Column



Direct Feed into Connectors
The Live End, "L", "T", "X", In-Line & Variable Angle Connectors will accept an M20 (3/8" or 1/2") electrical fitting. Does not require a separate power feed kit.







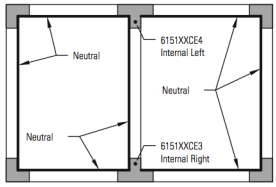
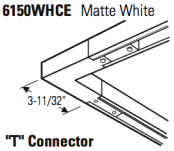


Fig. 1 View from Floor

"L" Connector
The "L" connector is polarized and pre-wired. It may be rotated for right angle or left angle turn. KO permits direct feed with electrical connector.

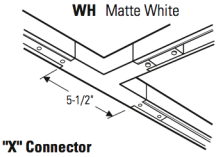
6150ALCE Matte Aluminum
6150BKCE Matte Black
6150WHCE Matte White



"T" Connector
The "T" connector is polarized and pre-wired. Used to make "T" pattern with track. (See fig. 1) 12 ga. copper jumper wires supplied to make all necessary connections. KO permits direct feed with electrical connector.

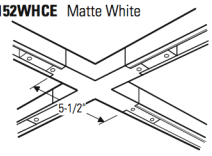
6151CE1** External Right AL
6151CE2** External Left AL
6151CE3** Internal Right AL
6151CE4** Internal Left AL

Finishes: **AL Matte Aluminum
BK Matte Black
WH Matte White



"X" Connector
The "X" connector is not pre-wired or polarized. Used to make "X" pattern with track. 12ga. copper jumper wires supplied to make all necessary connections. KO permits direct feed with electrical connector.

6152ALCE Matte Aluminum
6152BKCE Matte Black
6152WHCE Matte White



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PHILIPS

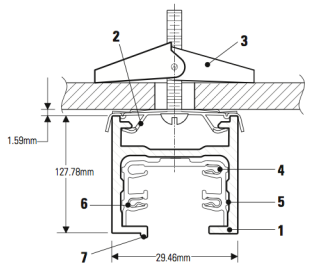
ORDER#: 61X (LENGTHS) MWWHCE

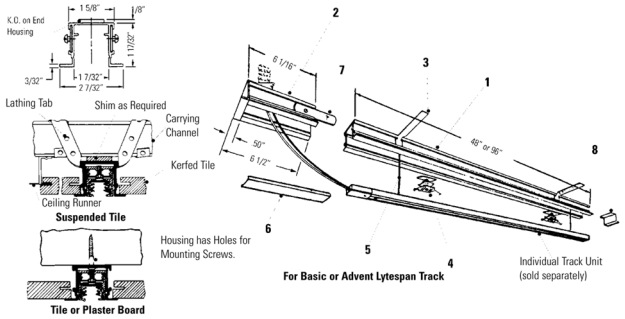
NOTES:	MANUFACTURER: LIGHTLOIER	
APPLICATION:SURFACE TRACK - 2 CIRCUIT - FEEDS, JOINERS, ANCILLARY HARDWARE TBD	MOUNTING: SURFACE	COLOR: WHITE
	LAMP/WATTAGE: NA	

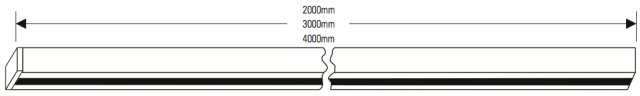
TECHNICAL ARTISTRY 145 Avenue of the Americas New York, New York 10013 212-989-6889 • 212-647-0256 fax	STATUS: SUBMITTED 11-13-17	APPROVED BY:	TYPE: TRK1

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE TRK2	
DATE: 2-16-18			

LIGHTOLIER® Advent Lytespan® 1 and 2 Circuit Track 61XMCE







Plain Track

Finishes	Plain Track		
	2m Catalog No.	3m Catalog No.	4m Catalog No.
Aluminum	**612MALCE**	**613MALCE**	**614MALCE**
Black	**612MBKCE**	**613MBKCE**	**614MBKCE**
White	**612MWHCE**	**613MWHCE**	**614MWHCE**

Features

1. **Advent Lytespan Track:** 6063-T5 Aluminum 1.8mm wall thickness.
2. **Track Mounting Clips:** 0.61mm Spring steel, in black or white; furnished with track units.
3. **Toggle Bolt & Screws:** furnished with track units.
4. **Conductor (3):** 16A current carrying capacity.
5. **Insulating Liner:** 1.2mm wall, thermoplastic.
6. **Neutral Conductor:** on bead side of track.
7. **Polarity Bead:** identifies the neutral conductor.
8. **Live End:** molded thermoplastic. Includes contacts for power supply leads.
9. **Dead End Cover:** molded thermoplastic.
10. **Mini Coupler:** connects track units mechanically and electrically.

Mechanical

Track units plug together and lock securely to prevent accidental separation. Track units can be field cut.

Finish

All painted finishes are baked enamel.

Mounting

Track may be surface mounted to ceilings or walls. The track may be stem mounted. The track is not intended to be cable mounted. The track can also be recessed, see Specification Sheet 7515.

Electrical

Two circuits individually controllable, rated 16 amps, at 220 - 240 volts 50 Hz per track circuit (16 amps total for the two circuits), when supplied by a 220/240 volt, 50 Hz, single phase 3-wire branch circuit with a grounded neutral. The track is polarized and continuously grounded throughout. Electrical conductors are concealed in a insulating liner. Lytespan lighting units attach to the track at any point and can be adjusted to operate on either track circuit. Not intended for use with a power cord or a convenience receptacle adapter. Magnetic and electronic transformers require different dimmer controls. Use the proper control device on the track. Caution should be used when operating dimming controls on 3 wire circuiting (the neutral conductor may overload). For additional information on dimming, call 1-800-833-3664. All wiring must be in accordance with National and Local Codes.

Labels

I.B.E.W.,CE

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Lightolier is a Philips group brand

PHILIPS

ORDER#: 61X (LENGTHS) MWWHCE 7515 RECESSED HOUSING

NOTES:	MANUFACTURER: LIGHTLOIER	
APPLICATION: RECESSED TRACK - 2 CIRCUIT - FEEDS, JOINERS, ANCILLARY HARDWARE TBD	MOUNTING: RECESSED	COLOR: WHITE
	LAMP/WATTAGE: NA	

TECHNICAL ARTISTRY 145 Avenue of the Americas New York, New York 10013 212-989-6889 • 212-647-0256 fax	STATUS: SUBMITTED 11-13-17	APPROVED BY:	TYPE: TRK2

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE TRK2	
DATE: 2-16-18			

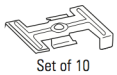
LIGHTOLIER® Advent Lytespan® 1 and 2 Circuit Track 61XMCE

Track Mounting and Power Feed Systems

Track Mounting Clips
Furnished with track: 2 clips per 2m track, 3 clips per 3m and 4m track units. Attaches to track at any point. Clip is nylon coated. White clip supplied with white track, and aluminum, black clip with black track. Spaces track from ceiling.

Not recommended for wall mounting.

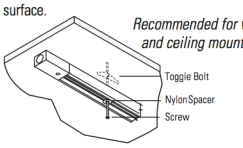
56451WH Matte White
56451BK Matte Black



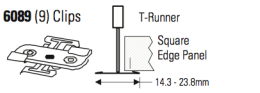
Set of 10

Direct Mounting
Toggle bolts and nylon insulators are furnished with Track, two per 2m track, three per 3m and four per 4m track. Mount through existing holes in track. Top of track sits flush to mounting surface.

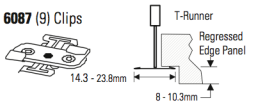
Recommended for wall and ceiling mounting.



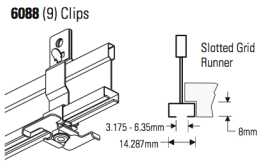
Grid Ceiling Mounting Clips
Square Edge Panels and 14.827mm-23.812mm T-Bars Clip is supplied assembled. Mounts onto T-Bars by rotating clips. Use two per 2m track, three per 3m, and four per 4m track.



Regressed Edge Panels and 14.287mm-23.812mm T-Bar Clip is supplied assembled. Mounts easily onto T-Bars by rotating clips. Use two per 2m track, three per 3m, and four per 4m track.

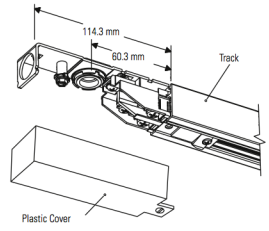


Slotted Grid Ceilings such as Donn Fineline and Chicago Metalic Ultraline 3500 and 3600.Use two per 2m track, three per 3m, and four per 4m track.



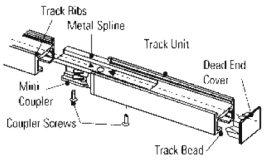
Live End
Energizes Track from the beginning of a run. It is included with Individual Track Units. Use with plain track units.

6148ALCE Matte Aluminum
6148BKCE Matte Black
6148WHCE Matte White



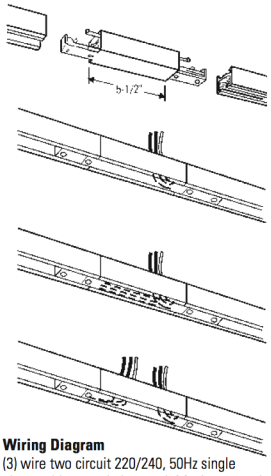
Mini-Coupler
Used to connect two pieces of track together mechanically and electrically. *Power cannot be fed to the Mini-Coupler.*

6149ALCE Matte Aluminum
6149BKCE Matte Black
6149WHCE Matte White

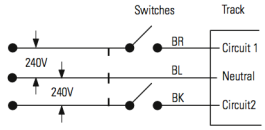


In-Line Connector
Permits power feed between track units in a straight run of track. The In-Line Connector is polarized and pre-wired. KO permits direct feed with electrical connector.

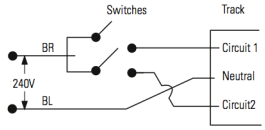
6154ALCE Matte Aluminum
6154BKCE Matte Black
6154WHCE Matte Aluminum



Wiring Diagram
(3) wire two circuit 220/240, 50Hz single phase with grounded neutral. Maximum total track load (circuit 1 + circuit 2) = 16 amps.



220/240 50Hz single branch circuit, 16 amp supply. Maximum load, 16 amps distributed between track circuits.



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Lightolier is a Philips group brand

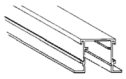
PHILIPS

ORDER#: 61X (LENGTHS) MWWHCE 7515 RECESSED HOUSING

NOTES:	MANUFACTURER: LIGHTLOIER	
APPLICATION: RECESSED TRACK - 2 CIRCUIT - FEEDS, JOINERS, ANCILLARY HARDWARE TBD	MOUNTING: RECESSED	COLOR: WHITE
	LAMP/WATTAGE: NA	

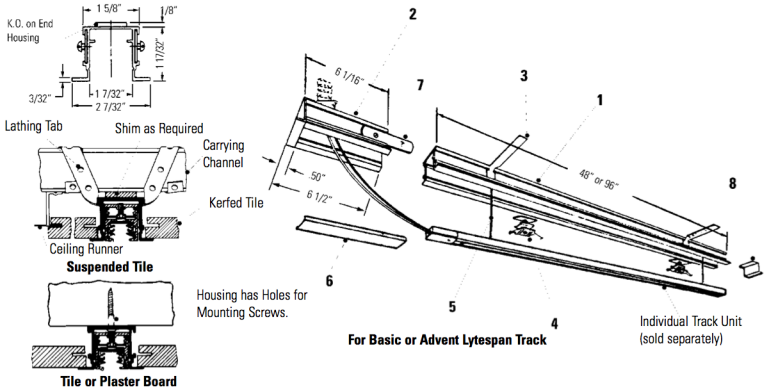
TECHNICAL ARTISTRY 145 Avenue of the Americas New York, New York 10013 212-989-6889 • 212-647-0256 fax	STATUS: SUBMITTED 11-13-17	APPROVED BY:	TYPE: TRK2

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE TRK2	
DATE: 2-16-18			



Lytespan® Track Lighting System 7515

Recessed Housing

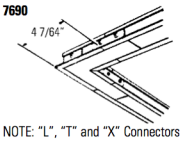


Patterns with Recessed Track

"L", "T", and "X" Housing/Splice Boxes are used to form patterns with recessed track. 7/8" dia. K.O.'s are provided on top for attaching circuit wiring for power feed. Auxiliary Electrical Connectors are required with "L", "T" and "X" Housing/Splice Boxes for power feed or power continuity through these Housing/Splice Boxes. Extra End Caps are provided with Housing/Splice Boxes.

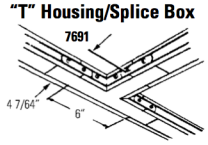
"L" Housing/Splice Box

7690



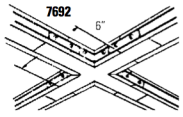
"T" Housing/Splice Box

7691



"X" Housing/Splice Box

7692



Auxiliary Electrical Connector Kits

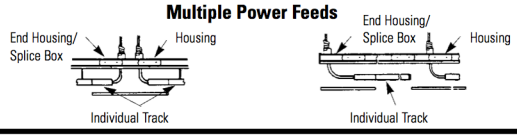
6464WH (Basic)
6467WH (Advent)
Set of 2 for "L" Housing/Splice Box

6462WH (Basic)
6465WH (Advent)
Set of 4 for "T" or "X" Housing/Splice Box

NOTE: "L", "T" and "X" Connectors (See Specification Sheet 6000) are not used with recessed track.

Catalog No.	Description
7515	4' Housing
7516	8' Housing
7517	End Housing/Splice Box

Multiple Power Feeds



Features

1. **Housing:** extruded aluminum .062" wall, matte white. Will resist alkali in concrete for 48 hours while setting.
2. **End Housing/Splice Box:** extruded aluminum. 062" wall, matte white (2)7/8" dia. K.O.'s provided for multiple feeds.
3. **Lathing Tab:** 20 ga. plated steel. Slides to desired position.
4. **Mounting Clip:** secures track to housing (includes allen wrench).
5. **Hanger Chain**
6. **Splice Box Cover:** 26 ga. steel, matte white. Snaps in without tools.
7. **Spline**
8. **End Cap:** (2) Supplied with End Housing/Splice Box.

Mechanical

Housings and Splice Boxes are locked securely together with metal Splines and Screw Fasteners.

Mounting

Lathing Tabs and holes in Recessed Housings are provided for mounting in a variety of ceilings. Recessed Housings may be installed in concrete.

Finish

Baked Enamel Paint, Matte White.

Labels

UL; I.B.E.W.

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LIGHTOLIER®

ORDER#: 61X (LENGTHS) MWWHCE 7515 RECESSED HOUSING

NOTES:

APPLICATION: RECESSED TRACK
- 2 CIRCUIT
- FEEDS, JOINERS, ANCILLARY HARDWARE TBD

MANUFACTURER: LIGHTLOIER

MOUNTING: RECESSED

COLOR: WHITE

LAMP/WATTAGE: NA

TECHNICAL ARTISTRY
145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

STATUS: SUBMITTED 11-13-17	APPROVED BY:	TYPE: TRK2

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE WL1	
DATE: 2-16-18			

ECOSENSE® TROV®

OVERVIEW • SPECIFICATIONS • ORDERING

INTERIOR + EXTERIOR | **L50 ASYM**

THE L50 INCLUDES PATENTED OPTICAL DESIGN THAT DELIVERS THE WIDEST RANGE OF BEAM ANGLE OPTIONS FOR PRECISE COVE, WALL GRAZING, WALL WASHING OR LINE OF LIGHT APPLICATIONS. EXCLUSIVE FLIP TO FLAT™ HINGE DESIGN PROVIDES FLEXIBILITY WHEN MANAGING SMALL COVE DETAILS. TROV OFFERS SMOOTH, FLICKER FREE DIMMING DOWN TO 0%.

FEATURES :

- DIM TO 0%, ELV REVERSE PHASE
- 24 BEAM ANGLES
- MULTI-VOLT
- FLIP TO FLAT™
- 6 CCT OPTIONS
- 80+ AND 90+ CRI OPTIONS
- IP54 INTERIOR AND IP66 EXTERIOR OPTIONS

MODEL/ SIZE	INTERIOR/ EXTERIOR	LENGTH	POWER	CCT		CRI	VOLTAGE	OPTICS	
L50	I	12 & 48	06	22		80	MULT	ASYM	
L50	I E	12" 48"	02 04 06 08 10 12	**WHITE CCT** 22 27 30 35 40 50	**MONO COLOR** GR**** BL AM RD***	80 90* Blank For Color	MULT (120-277V)	**GRAZING** 9 x 9 9 x 17 9 x 29 9 x 59 15 x 15 15 x 23 15 x 35 15 x 65 **COVE** 120** Asym **LINE OF LIGHT** LOL	**WASHING** 25 x 25 25 x 33 25 x 45 25 x 75 39 x 9 55 x 25 40 x40 40 x 48 40 x 60 40 x 90 45 x 15 70 x 40 70 x 70

EXAMPLE: L50-I-48-10-27-90-MULT-15x65 *90 CRI not available in 2200K or 5000K **120 is only available with Exterior option. See L35 spec sheet for interior cove options. ***Red is not available in 12W or 10W. ****Green is not available in 12W.

PERFORMANCE	WATTS	OPTIC	LUMEN OUTPUT	EFFICACY
	2W	ASYM	110 lm/LF (361 lm/m)	55 lm/W
	4W	ASYM	302 lm/LF (1037 lm/m)	76 lm/W
	6W	ASYM	482 lm/LF (1614 lm/m)	80 lm/W
	8W	ASYM	675 lm/LF (2224 lm/m)	84 lm/W
	10W	ASYM	785 lm/LF (2644 lm/m)	79 lm/W
	12W	ASYM	923 lm/LF (2752 lm/m)	77 lm/W

ALL LUMEN DATA IS FROM 4000K 80CRI FIXTURES. PLEASE SEE PHOTOMETRY SPEC SHEET FOR ADDITIONAL LUMEN DATA.

COLOR RENDERING INDEX	80+, 90+
COLOR CONSISTENCY	2-STEP MACADAM ELLIPSE

LUMEN DEPRECIATION / RATED LIFE	WATTS	L70 @ 25C	L70 @ 50C	L90 @ 25C	L90 @ 50C
	2W-12W	>150,000	>70,000	>50,000	>25,000

* CALCULATIONS FOR LED FIXTURES ARE BASED ON MEASUREMENTS THAT COMPLY WITH IES LM-80 TESTING PROCEDURES AND IES TM-21 CALCULATOR

ELECTRICAL

POWER CONSUMPTION

2W*/LF (6.6W/M) ; 4W/LF (13.2W/M) ; 6W/LF (19.8W/M) ; 8W/LF (26.4W/M) ; 10W/LF (33W/M) ; 12W/FL (39.6W/M)
* 3W/LF (9.9W/M) at 220V -277V

MAX FIXTURE RUN LENGTH

	2W/LF		4W/LF		6W/LF		8W/LF		10W/LF		12W/LF	
Volts	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'	Max Run all 1'	Max Run all 4'
120	214	214	186	186	152	152	114	114	91	91	76	76
220	374	392	340	340	277	277	209	209	95	167	95	139
277	374	494	374	428	349	349	263	263	95	190	95	175

POWER FACTOR	4W, 6W, 8W, 10W, 12W >0.9, 2W<0.9
OPERATING VOLTAGE	MULTIVOLT: 110-277VAC, 50/60 Hz
DRIVER	INTEGRAL TO FIXTURE; DE-RATED POWER AND SYNCHRONOUS START-UP AT FULL BRIGHTNESS
STARTUP TEMPERATURE	-40°F TO 122°F (-40°C TO 50°C)
OPERATING TEMPERATURE	-40°F TO 122°F (-40°C TO 50°C)
STORAGE TEMPERATURE	-40°F TO 176°F (-40°C TO 80°C)

ECOSENSE LIGHTING INC.
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855.6.ECOSEN

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20171120

ORDER#: L50-I-XX (LENGTH)-06-22-80-MULT-ASYM LV- ASYM LOUVER MNT-L-LFAB CC-L-WIREBOX

NOTES:
APPLICATION: WASH WASH
- MOUTED TO PENDANT STRUT
- TO HAVE ASYMMETRIC LOUVERS
- ELV DIMMING
- FEEDS, JOINERS, ANCILLARY HARDWARE TBD

MANUFACTURER: ECOSENSE

MOUNTING: *STRUT*

COLOR: NA

LAMP/WATTAGE: LED 80 CRI 6W PER FOOT

TECHNICAL ARTISTRY
145 Avenue of the Americas New York, New York 10013
212-989-6889 • 212-647-0256 fax

STATUS: SUBMITTED 2-8-18

APPROVED BY:

TYPE: WL1

PHASE: FD	Cherokee National Capitol Museum Tahlequah, Oklahoma	TYPE WL1	
DATE: 2-16-18			

ECOSENSE® TROV®

OVERVIEW • SPECIFICATIONS • ORDERING — INTERIOR + EXTERIOR | **L50 ASYM**

DATE	PROJECT	FIRM	TYPE

CONTROL	**DIMMING**	110-277VAC, ELV TYPE 0.07%-100%, REVERSE PHASE, TRAILING EDGE
PHYSICAL	**DIMENSIONS**	W 1.6" x H 2" x L 12"/48" ; (41.6mm x 50.5mm x 304.7mm/1201mm)
	HOUSING /LENS	EXTRUDED ALUMINUM; UV STABILIZED POLYCARBONATE; STAINLESS STEEL FASTENERS; PLASTIC ENDCAPS RUBBER OVERMOLD FOR CABLE ASSEMBLY
	WEIGHT	1.52LBS / 0.69KG (1FT) ; 4.95LBS / 2.25KG (4FT)
	CONNECTORS	INTEGRAL MALE/ FEMALE CONNECTORS
	ENVIRONMENT	INDOOR • ETL CERTIFIED FOR DRY/DAMP LOCATIONS IP54 OUTDOOR • ETL CERTIFIED FOR WET LOCATIONS IP66 IMPACT RATED TO IK10
	BEAM ANGLE	GRAZING, WASHING, COVE, ASYMMETRIC, LINE OF LIGHT
	MOUNTING OPTIONS	INTEGRAL MOUNTING AND ADJUSTABLE AIMING FROM 0°-180° IN 15° INCREMENTS
FIXTURE RATING & CERTIFICATIONS	**CE, ETL CERTIFIED** **RoHS COMPLIANT** **ENERGY STAR COMPLIANT** **DLC COMPLIANT** **RCM CERTIFIED**	
LIMITED WARRANTY	**5 YEARS**	

WIRING OPTIONS (MVOLT): 110-277VAC

Power Cable Assembly, TROV, Leader/Jumper, 10 foot **CBL-3P-L-UNV-10***
Power Cable Assembly, TROV, Leader/Jumper, 50 foot **CBL-3P-L-UNV-50***
Power Cable Assembly, TROV, Jumper, 5 foot **CBL-3P-L-UNV-05****
Power Cable Assembly, TROV, Jumper, 1 foot **CBL-3P-L-UNV-01****
Power Cable Assembly, TROV, Male and Female terminator caps **CBL-3P-L-UNV-CAPS**

*Two (2) terminators are included with the 10' and 50' power cable. One Leader need per circuit/fixture run. Cables are not plenum rated.
** If using the 5' or 1' power cable assembly as a leader to power a run one set of CBL-3P-L-UNV-CAPS will also be need per cable.

0-10V CONTROL OPTIONS

100-120VAC / 277VAC Linear Dimming Control Module 0-10V - Plenum Rated **LDCM-PL-120-277-010V-GR**

All products come standard with ELV dimming capabilities. 0-10V Control options required for operation at 0-10V.

OPTIONAL ACCESSORIES

Mounting

Mounting Track and Clips Set, 48 Inch Track, 8 Clips ..... **MNT-L-TRKCLIP-48** .....48" track and clips set will work with one 48" fixture or four 12" fixtures.
Mounting Track and Clips Set, 12 Inch Track, 2 Clips..... **MNT-L-TRKCLIP-12** .....12" track will not work with 48" fixtures.
Mounting Track Clip, TROV, Set of 2..... **MNT-L-CLIP** .....Clips needed = 12" fixtures need 1 set of 2 and 48" fixture needs 2 sets of 2.
90 Degree L bracket, TROV, Set of 2..... **MNT-L-LBKT** .....L-Brackets needed = 12" fixtures need 1 set of 2 and 48" fixture needs 1 set of 2.
Angle Locking Clip, TROV, Pack of 10..... **MNT-L-ANGLOCK** .....Angle Locks needed = 12" fixtures need 1 and 48" fixtures need 2. (Included with fixtures)
Mounting, Fine Adjustment Bracket, TROV ..... **MNT-L-FAB** .....Fine Adjustment Brackets needed = 12" fixtures need 1 and 48" fixtures need 2.
*Fine Adjustment Bracket is highly recommended for Grazing Optics.
Mounting, Fine Adjustment L-Bracket, TROV ..... **MNT-L-LFAB** .....Fine Adjustment L-Brackets needed = 12" fixtures need 1 and 48" fixtures need 2.
*Fine Adjustment L-Bracket is recommended for Asymetric Optics when aiming is needed.

Wall Mount Arm

Wall Mount Arm, 6 inch, TROV **WMA-L-CA-06**
Wall Mount Arm, 12 inch, TROV..... **WMA-L-CA-12**
Wall Mount Arm, 18 inch, TROV..... **WMA-L-CA-18**
Wall Mount Arm, 24 inch, TROV..... **WMA-L-CA-24**
Wall Mount Arm End Plate Set, TROV, Includes Left and Right..... **WMA-L-END**
Wall Mount Arm Joiner Plate, TROV ..... **WMA-L-JNR**

Wall Mount Arms needed = For individual fixture installations two arms and one end set will be needed per fixture. For continuous run installation one endset will be needed per run. Each end set contains one left and one right end plate. One joining set wll be needed per joint. One arm per fixture will be need plus one extra arm to complete the run. For example: A 10ft run made with two 4ft and two 1ft fixtures will contain; 1 x WMA-L-END, 3 x WMA-L-JNR, and 5 x WMA-L-CA-12. Leader cables are not included with wall mount arms, end sets, or joiners sets.

Masking Plates

Masking Plate, 3 inch high, 12 inch, L50 & L35 ..... **MP-L50-3H-12**
Masking Plate, 3 inch high, 48 inch, L50 & L35 ..... **MP-L50-3H-48**

Masking Plates needed = One 12" lens is needed per 12" fixture and one 48" lens is needed per 48" fixture.

Landscape Stake

Landscape Stake, 6 inch, TROV, Set of 2 ..... **LS-L-STK-06**
Landscape Stake, 12 inch, TROV, Set of 2 ..... **LS-L-STK-12**
Landscape Stake, 18 inch, TROV, Set of 2 ..... **LS-L-STK-18**

Landscape Stakes needed = 12" and 48" fixtures both need one set of 2.

Wire Box

Conduit Connection, Wire Box, TROV, Interior Only, L50 .....**CC-L-WIREBOX**

Wire box can be used instead of a leader cable to start a run. 1/2" conduit fitting can attach directly to the box on one end and the fixture to the other.

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LOS ANGELES, CA 90012

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855.6.ECOSEN

ORDER#: L50-I-XX (LENGTH)-06-22-80-MULT-ASYM LV- ASYM LOUVER MNT-L-LFAB CC-L-WIREBOX

NOTES:
APPLICATION: WASH WASH
- MOUTED TO PENDANT STRUT
- TO HAVE ASYMMETRIC LOUVERS
- ELV DIMMING
- FEEDS, JOINERS, ANCILLARY HARDWARE TBD

MANUFACTURER: ECOSENSE

MOUNTING: *STRUT*

COLOR: NA

LAMP/WATTAGE: LED 80 CRI 6W PER FOOT

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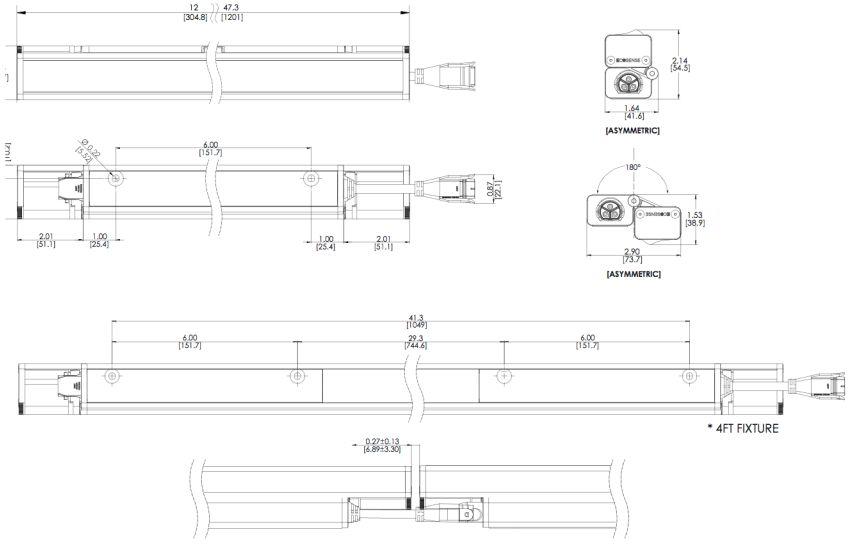
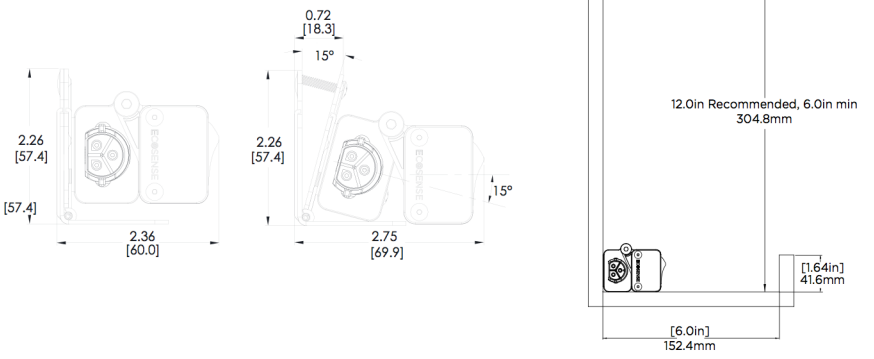
OVERVIEW • SPECIFICATIONS • ORDERING

INTERIOR + EXTERIOR | **L50 ASYM**

DATE	PROJECT	FIRM	TYPE



Fine Adjustable L-Bracket:



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ORDER#: L50-I-XX (LENGTH)-06-22-80-MULT-ASYM LV- ASYM LOUVER MNT-L-LFAB CC-L-WIREBOX

NOTES:
APPLICATION: WASH WASH
- MOUTED TO PENDANT STRUT
- TO HAVE ASYMMETRIC LOUVERS
- ELV DIMMING
- FEEDS, JOINERS, ANCILLARY HARDWARE TBD

MANUFACTURER: ECOSENSE

MOUNTING: *STRUT*

COLOR: NA

LAMP/WATTAGE: LED 80 CRI 6W PER FOOT

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