This document covers the technical content for acceptance review of a subset of the Advanced LIGO (aLIGO) installation. See document [M1300468](https://dcc.ligo.org/LIGO-M1300468) for an overview of the aLIGO acceptance process. Acceptance by Systems Engineering is to be indicated in the metadata for this document in the LIGO Document Control Center (DCC).

# Installation Instance/Subset Definition

*Insert a brief description of the subset of the aLIGO equipment which is covered under this installation acceptance document. Complete the entries in the following table. If elements of the table are not applicable, enter “not applicable”.*

This installation covers the DAQ system at LLO.

|  |  |
| --- | --- |
| **Interferometer** [*L1 or H1*]: | **L1** |
| **Building**(s)/**Room**(s): [*e.g. corner/LVEA*] | **LVEA, CER, End-X, End-Y** |
| **Electronics Rack Designation**(s): | L1-ISC-C1, L1-ISC-C2, L1-ISC-C3, L1-ISC-C4, L1-SEI-C1, L1-ISC-R1, L1-ISC-R2, L1-ISC-R4. |

# Procedures

If there are any caveats or explanatory notes regarding the procedure documentation cited in the table below, then add these notes to the table entries.

|  |  |
| --- | --- |
| **System Documentation:**  *[enter linked DCC document #(s); found under* [*E1200023*](https://dcc.ligo.org/LIGO-E1200023)*]* | [E1200645](https://dcc.ligo.org/LIGO-E1200645) is the top level DAQ system document.  [E1400085](https://dcc.ligo.org/LIGO-E1400085) is the top level document for aLIGO DAQ Installation. |
| **As-Built/Installed Procedure(s) and Documents**  either:   1. Enter hyperlinked DCC number for revised or red-lined baseline install procedure, and/or 2. Enter hyperlinked DCC number for separate document with installation notes on deviations, changes in procedure, changes in tooling, etc., and/or 3. Enter a list of hyperlinked electronic log entries detailing the experience in applying the baseline installation procedure | The following documents are relevant:  [T1100260](https://dcc.ligo.org/LIGO-T1100260): LLO CDS VLANs and Computer Names  [D1102217](https://dcc.ligo.org/LIGO-D1102217): LLO CDS Network Diagram  [D1400014](https://dcc.ligo.org/LIGO-D1400014): aLIGO L1 Front-End IO Chassis As-Built Drawings.  [E1400089](https://dcc.ligo.org/LIGO-E1400089): LLO aLIGO DAQ Racks |

# Drawings

*Enter hyperlinked DCC document number(s) for each drawing in the table below. If elements of the table are not applicable, enter “not applicable”. All chamber-level, assembly drawings can be found listed at* [*E1200562*](https://dcc.ligo.org/LIGO-E1200562) *and found linked under* [*D0901491*](https://dcc.ligo.org/LIGO-D0901491)*.*

|  |  |
| --- | --- |
| Applicable Top-Level Drawing(s): | [D1400014](https://dcc.ligo.org/LIGO-D1400014): aLIGO L1 Front-End IO Chassis As-Built Drawings. See also “Related Files”. |
| Electronics Rack Drawing(s): | All drawings for the racks can be found by navigating through [G1001032](https://dcc.ligo.org/LIGO-G1001032). |

# Serial Number Records

*Serial numbers are used to track a subset of the parts, particularly active elements (see* [*M1000051*](https://dcc.ligo.org/LIGO-M1000051)*) and electronics (with S-numbered documents; see* [*T0900520*](https://dcc.ligo.org/T0900520)*). Enter the hyperlinked DCC document number(s), and name(s) for the highest level assembly(ies) covered by this installation acceptance document in the table below. Also enter the hyperlink to the ICS entry for the instance of this assembly in the Inventory Control System (ICS). If elements of the table are not applicable, enter “not applicable”. If elements of the table are not available/missing, then enter “not available”.*

|  |  |  |
| --- | --- | --- |
| Assembly DCC D-Number | Assembly Name | ICS entry. |
| [E1400089](https://dcc.ligo.org/LIGO-E1400089) | LLO aLIGO DAQ Racks | Serial Numbers for DAQ installs are listed in “Related Documents”. |
| [E1200331](https://dcc.ligo.org/LIGO-E1200331) | LLO Rack S numbers | Serial Numbers for all racks, and for components installed in said racks, can be found through this document. |
| [E1400091](https://dcc.ligo.org/LIGO-E1400091) | LLO aLIGO Timing Racks | Bookmark to racks where aLIGO timing equipment is installed at LLO |

# Testing

*All post-installation, stand-alone, in situ, checkout/testing (phases 2 and 3 per* [*M1000211*](https://dcc.ligo.org/LIGO-M1000211)*) must be completed, be successful and be documented:*

* *phase 2: pre-installed, post-storage, test results for the assembly (testable item)*
* *phase 3: stand-alone, in situ test results for the assembly (testable item)*

*Note that integrated testing (phase 4 testing per* [*M1000211*](https://dcc.ligo.org/LIGO-M1000211)*) is covered under the system acceptance review, not this installation acceptance review. In the table below, enter hyperlinked DCC document number(s) for all of the relevant testing for the major subassemblies/subsystems covered within this installation instance/subset. If elements of the table are not applicable, enter “not applicable”. If elements of the table are not available/missing, then enter “not available”.*

|  |  |  |
| --- | --- | --- |
| Subsystem | Testable Item | DCC document numbers |
| DAQ | Extensive testing was done for most if not all installed electronics. | These test results need to be collated into either a DCC document tree or an SVN repository or both.  Software validation tests should also be linked. |

# Installation Completeness

*If/as applicable, provide a hyperlink reference to a list of remaining tasks to be completed before the installation is finished (i.e. a ‘punch’ list).*

|  |  |
| --- | --- |
| Installation tasks remaining to be completed: | None – installation has been completed |

# Installation/Integration Issues and ECRs

*If/as applicable, provide a hyperlinked list of integration issues and Engineering Change Requests (ECRs) encountered during installation and which are relevant to the installation subset/instance covered by this acceptance document. See* [*M1300323*](https://dcc.ligo.org/LIGO-M1300323) *for a description of the Integration Issue and ECR Tracker.*

*The format of the url for the bug tracker is as follows e.g.*

***\****[***https://services.ligo-wa.caltech.edu/integrationissues/show\_bug.cgi?id=****826*](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=826)

N.B.: Many of the issues/actions noted below relate to subsystem racks (not specifically DAQ racks). They are included here in case they were/are missed in the other separate installation instance reviews.

|  |  |
| --- | --- |
| Tracker # *[hyperlinked]* | Title/description |
|  |  |
| [#7](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=7) closed | AI chassis outputs mislabel on front panel |
| [#17](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=17) | PSL/ISC racks very close |
| [#26](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=26) closed | LLO End Station Rack layout missing ISC rack |
| [#28](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=28) closed | End Station EtherCAT Chassis Modification for TCS |
| [#29](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=29) closed | EtherCAT chassis End 2 changed |
| [#33](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=33) | Lack of drawings for timing diagnostics/cesium clock replacement |
| [#34](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=34) closed | ECR: Add PEM, timing chassis to end-station TCS Remote racks |
| [#35](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=35) closed | ECR: Add Beckhoff, Dolphin equipment to end-station DAQ racks |
| [#36](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=36) closed | D1200136 Rear Panel D-number is wrong |
| [#37](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=37) closed | D1200136 24V Connector is non-standard |
| [#38](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=38) closed | D1200136 has no ON/OFF switch and does not do its own power regulation |
| [#39](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=39) closed | Ring Heater Chassis: Part Numbers are wrong, Documentation is not correct |
| [#40](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=40) closed | Need housing, power, network for rotation stage Beckhoff modules |
| [#41](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=41) | Add PSL environmental sensors, EtherCat chassis to L1 |
| [#42](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=42) | ECR: Install SSD RAID in DAQ for raw minute trend files |
| [#43](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=43) closed | ECR: Add second DAQ adapter to data concentrator |
| [#50](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=50) closed | Communication error in the Dolphin -> Tripped the 3 BSCs |
| [#58](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=58) closed | Retrieval of second trend data in control-room too slow |
| [#59](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=59) closed | need ethernet cable to HEPI pumps |
| [#60](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=60) closed | DC Power Monitoring System |
| [#65](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=65) | Migrate TCS corner-station readout to OAF chassis |
| [#78](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=78) closed | SUS Electronics Missing/Incomplete/Out-of-date Drawings |
| [#85](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=85) | procedure(s), safe-guards and cautions for safe/proper use and diagnosis of equipment |
| [#91](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=91) closed | ECR - Adding Coil Driver Monitor Signals to Frames |
| [#92](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=92) closed | ports misidentified on End 2 EtherCAT chassis |
| [#96](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=96) closed | ALS COMM/DIFF signals missing |
| [#97](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=97) | Add direct wire connection between RT and EtherCAT systems |
| [#139](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=139) closed | H1 PSL tripped due to Beckhoff remote client 'glitching' |
| [#142](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=142) | PEM monitoring channels need to be set up |
| [#143](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=143) | EtherCAT channels freeze |
| [#216](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=216) closed | QPD OMC\_A/B electronics chain missing |
| [#217](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=217) closed | BSC ISI coil driver over-temp warning periodically going off |
| [#332](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=332) | RF phase shifts when cables moved |
| [#375](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=375) closed | Migrate the ISI Checker Script functions to the frontend code |
| [#385](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=385) closed | create science frame channels for the SEI models |
| [#441](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=441) closed | Cable plan for 5-way coax cables |
| [#463](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=463) | AA Filter Chassis Power Regulator Board Has Potential Short Circuit on -15V Rail |
| [#445](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=445) closed | ECR: Update the SAFE level for the BSC and HEPI model watchdog |
| [#465](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=465) closed | Need for additional amplification on the 135MHz signal chain |
| [#469](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=469) | ECR: New naming scheme for OMC channels |
| [#482](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=482) | ECR: ODC changes in SUS, SEI, HPI and PSL |
| [#483](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=483) | ECR: ODC Master Implementation |
| [#484](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=484) | ECR: Adding h1psl0 to the Dolphin network |
| [#487](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=487) closed | Remove ISI IPC links which come from SUS offload |
| [#489](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=489) closed | Duplicate cable number in end station wiring diagram |
| [#490](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=490) closed | ECR for DAQ frame file name change |
| [#491](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=491) closed | ECR - PSL channels in the science frame |
| [#500](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=500) closed | ECR: HEPI MEDM Update |
| [#530](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=530) closed | update to the HEPI master model and related MEDM screens |
| [#552](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=552) closed | Change the Data rate for the Watchdog State channel in the science frame (duplicate of #650). |
| [#556](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=556) | TCS End Station EtherCAT chassis design modifications |
| [#557](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=557) | Lack of Baffle Photo-diode Readback |
| [#562](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=562) closed | Readbacks for arm cavity baffle photodiodes (Duplicate of #557) |
| [#569](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=569) | Modulator uses DB15 for RF connector |
| [#598](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=598) | SMA connectors on demod chassis |
| [#599](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=599) | EPICS gateways |
| [#600](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=600) | medm screen editing |
| [#644](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=644) | checking electronics modules without visible over-current protection |
| [#657](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=657) | upgrade IOP software watchdogs to use targeted dackill |
| [#658](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=658) closed | mislabeled outputs on D1100680 |
| [#662](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=662) | Use of GE FANUC RFM cards on end-station SEI, SUS front-ends |
| [#664](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=664) | 5V regulator failing on Timing Comparators |
| [#665](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=665) closed | LSC model running too long for RFM to end-stations |
| [#668](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=668) | DC Switch Breaker Box Install in Pier Pod and TCS ISS Power cords. |
| [#672](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=672) closed | Enable Guardian to exceed limit on EPICS enumerated strings |
| [#705](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=705) | Adding frequency readbacks for some RF modulation signals |
| [#713](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=713) | AA/AI placement in End Station Remote rack |
| [#714](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=714) | Move the 79.2MHz doubler to ISC-R4 |
| [#716](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=716) | Add a relay switch for ALS laser noise eater |
| [#720](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=720) | Modification of SUS User Watchdog to Reduce False Alarm Rate |
| [#721](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=721) | Replace the custom cartesian-bias-ramping code with cdsFiltCtrl2 parts |
| [#722](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=722) | Adding Independent ASC IPC Paths for Dither Alignment to Most SUS |
| [#746](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=746) | ECR: store suspension mis/alignment values separately in EPICS database |
| [#760](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=760) | CDS Real-time System Parameter Configuration Control |
| [#762](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=762) | Increase drive range for the ETM UIM actuators |
| [#764](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=764) | Second trend readback is slow |
| [#779](https://services.ligo-wa.caltech.edu/integrationissues/show_bug.cgi?id=779) | HAM 2&3 and ITMX, BS & ITMY (ISI and HEPI) local models slightly differ from documentation (ADC/DAC numbering) |