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- LIGO -  
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<b>Detector Configuration Control Procedures</b>
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## 1 PURPOSE

The purpose of this document is to provide the guidelines, procedures and responsibilities for maintaining configuration control of Detector hardware and software installed at the two LIGO sites.

## 2 SCOPE

The scope of this document is limited to configuration control of Detector hardware and software as it is installed at the LIGO Livingston and Hanford sites. This includes the hardware and software itself and its supporting documentation. The procedures defined within this document are to include both permanent installations and temporary changes to Detector systems.

## 3 OVERVIEW

As Detector equipment is installed at the sites, configuration control must be maintained. This will be particularly important, as the installation, test, commissioning and operating staffs at the sites change from week to week as people arrive from other places to perform these various tasks. It is imperative, particularly under these circumstances, that the sites have the latest drawing and documentation packages for their installation, including any site specific changes to original designs. Also, since these changes take place at the sites and, at best, there is a delay in relaying information back to the design institution, it is proposed that the sites therefore maintain the documentation libraries.

It is the goal of this document to provide guidelines such that configuration control can be maintained, which includes:

1. All necessary documentation is available at the sites for Detector systems and components.
2. As the Detector System evolves and changes are made, the changes are documented and traceable.
3. “Temporary” changes and installations are traced through the system, as well as permanent changes.
4. As various Detector produced components evolve through changes, they will diverge from the initial design. The configuration control process must ensure that documentation exists for every instance of an installed component type.

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## 4 DEFINITIONS

Various terms are used in subsequent subsections in describing the configuration control procedures. The key terms are defined here for clarification.

### 4.1. Documents and File System

#### 4.1.1. Title I File System

This is the title given for the site equivalent of the LIGO Document Control Center (DCC). This system contains all original electronic documentation for the site, as well as paper copy originals. This is intended as the definitive source of correct documentation.

In addition, the Title I file shall contain all configuration control documentation, as outlined in section 4.2. Configuration Control Forms and Records.

#### 4.1.2. Controlled Document

A controlled document is defined here as an original which is maintained within the LIGO DCC and site Title I file system and is never removed or released, as an original, from those file systems. At the sites, this can have several forms:

1. Initial release, electronic and hardcopy, of a document.
2. Released revisions, electronic and hardcopy, of a document.
3. Hardcopy of documents which have been released for work as official documents at the sites and returned with approved markups and changes(See markup procedures in section 6).

#### 4.1.3. Official Document

An official document is defined here as a copy of a controlled document specifically marked and released by the Detector site librarian. At any given time, only one official copy of a specific document is released from the Title I file. These are the only copies which may contain official markups and must be returned to the Title I file system upon completion of work. When an official document has been marked with approved changes and returned to the Title I files, it becomes a controlled document.

#### 4.1.4. Unofficial Document

At any time, copies of documentation can be requested from the Title I file system or DCC. These are all unofficial copies. These copies cannot be used to make changes or other markups for return to the Title I file system.

#### 4.1.5. Control Room Copy

It is intended that a complete, up to date set of documentation be maintained in the site control rooms. These are to be copies of the latest revisions of documentation.

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## 4.2. Configuration Control Forms and Records

Configuration control at the sites will require various forms and record keeping. These are defined as follows.

### 4.2.1. Document Change Notice (DCN)

The DCN is to be the LIGO standard DCN. This form shall be completed and approved with every document change at the sites.

### 4.2.2. Engineering Change Request (ECR)

All requests for engineering changes, either permanent or temporary, must be documented with an ECR form. An example form is attached in Appendix A.

### 4.2.3. Engineering Maintenance Request (EMR)

All initial installation, testing, maintenance requests and maintenance performed at the sites shall be documented using an EMR. An example EMR is attached in Appendix A.

### 4.2.4. Document / Software Release Request (DSRR)

When official copies of documentation or software is to be modified, it must be checked out from the site librarian. This form is used to request release of this documentation and/or software.

## 4.3. Personnel

In the remainder of this document, various staff is designated to perform the functions of configuration control. This section defines these staff references.

### 4.3.1. Site Librarian

The site librarian is defined that member or members of the site staff designated by the site manager to maintain the Detector documentation for that site. It is suggested that the designated Detector system point of contact be the site librarian for that particular system. This would avoid overburdening a single staff member, plus the point of contact has a vested interest in maintaining up to date documentation for his or her system. A CDS point of contact should be assigned as the librarian for Detector software.

Responsibilities of the site librarian(s) include:

1. Ensuring that all applicable documentation has been transferred to the site prior to installation of equipment.
2. Maintaining a Title I file system, both electronic and paper copies, for that site.
3. Signing out official documents to site staff to perform installation, test or maintenance and ensuring that such drawings are returned with proper documentation, as outlined in the procedures section of this document.
4. Control of site detector software.

### **4.3.2. Crew Chief**

A crew chief is defined for purposes of this document as that person or persons designated by the site manager as the approving authority for Detector work. This includes:

1. Authorizing installation, test, commissioning and maintenance activities.
2. Authorizing the check out of controlled documentation from the site librarian.
3. Approval of completed work and resubmission of documentation to the site librarian.

### **4.3.3. Site Staff**

Site staff is defined as those persons who actually perform the installation, test, commissioning and maintenance of Detector equipment at the sites. This term includes all staff visiting the sites as well as those who are resident to the site.

### **4.3.4. System Designer**

The system designer is defined as that group or individual responsible for the initial designs and documentation of the delivered Detector system, subsystem or component. This also refers to that LIGO staff which is responsible for any permanent upgrades to a particular Detector subsystem or component.

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## 5 SITE DOCUMENT LIBRARY

### 5.1. Organization

The site Detector documentation library shall include:

1. An electronic copy and/or link to electronic copies in LIGO DCC for all latest electronic revisions to Detector documentation.
2. A paper copy of the latest electronic revision.
3. A paper copy of each hand marked up drawing (official document), with appropriate revision numbers (see following section).
4. A copy of all DCN, ECR, EMR and DSRR forms.
5. All test data for installed Detector systems.

### 5.2. Revisions and Releases

#### 5.2.1. Initial Release

Prior to delivery to the sites, the system designers shall follow the standard LIGO procedures for obtaining document numbers and turning in documentation to the LIGO DCC, including an approved DCN.

The initial release shall have a letter designator in the revision field of the document number, such as D990133-A-C, where A is the revision and C designates this as a Detector drawing.

#### 5.2.2. Site Revisions

Once a document has been changed at the sites, these revisions must be designated and tracked, using the procedures outlined in Section 6. Revision identifiers are dependent on whether the drawing is a system drawing or a component drawing. A system drawing is defined here as one which provides system layout, cabling and other system interconnect information. A component drawing is defined as one which defines an individual Detector designed board or chassis incorporated within a system or multiple systems.

##### 5.2.2.1 System Drawings

After a system drawing has been modified by manual markups, a number is added after the revision letter e.g. D980133-A1-C. Every time a drawing is checked out and returned with markups, the number following the letter is incremented. When changes are accrued and then the original release electronically updated, it is reissued with the next letter designator.

As an example, a Data Acquisition System (DAQS) drawing, designated D990133-A-C, is initially sent to a site. The installation staff checks out an official copy of this drawing and marks appropriate changes that were made during the installation process, and this now becomes D990133-A1-C, and only exists in paper form. Later, perhaps some signal channel assignments are changed, drawing D990133-A1-C is marked up with the latest changes, and is returned as D990133-A2-C, again as a paper copy.



The system designer is at some point informed of changes and incorporates all of the markups into the electronic version. This is then reissued as D990133-B-C. This drawing shall note all revisions which have been incorporated into this new release.

### 5.2.2.2 Component or Board Level Drawings

Board level drawings offer configuration control problems beyond the level of system drawings. An installed system and its system documentation are unique to each other and should always be in synchronization. A circuit board, while originating from a set of documentation which is initially intended to cover all boards of that type, may, over time with various modifications, become a unique entity which no longer matches the generic documentation. Also, two sets of prints may describe the board, one set from which the board is initially manufactured, and a second set which describes the field changes to that board. Therefore the revision designator is slightly different than the system drawings.

In the case of a Detector board or chassis, the letter revision designator indicates which revision of documentation the board itself was manufactured from. The number designator after the letter denotes the field modification revision applied to the board. In fact, on each such board produced by Detector, there is a revision letter stamped on the board, along with an erasable field to enter the field revision number.

As an example in this case, say a DAQ module is designed and fabricated from a drawing set numbered D990344-A-C. The boards produced will have a board rev A marked on them and a blank field change area. These boards go to a site, and one is modified for the PSL in a particular manner. The official drawing is marked with the changes and this drawing becomes D990344-A1-C and the field change area on the board itself is marked with a 1. Another board of the same generic type is now specially modified for another application. An official copy of the original drawing is again marked up with the changes and becomes D990344-A2-C, and the board marked with field change 2. As can be seen, rev A1 and A2 may differ greatly, therefore both revs must be controlled documents such that drawings always exist for particular instances of boards.

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## 6 SITE CONFIGURATION CONTROL PROCEDURES

This section covers the procedures to be followed at the sites to maintain Detector configuration control. It is intended as a general procedure, with the specific mechanics of implementation to be determined by the individual sites. The following subsections describe procedures for:

- Initial Installation
- System Changes
- System Maintenance

### 6.1. System Installation

#### 6.1.1. Submittal of Documentation

Prior to site installation, all applicable drawings and other documentation shall be submitted to the LIGO DCC, along with the LIGO Document Change Notice (DCN). A hardcopy of this documentation shall also be forwarded to the site librarian.

#### 6.1.2. Site Filing of Documentation

Upon receipt of this documentation, the site librarian shall:

1. Make two copies of the originals.
2. Mark the originals as Title I copies and enter into the Title I file system.
3. Mark one of the copies as “Control Room Copy”, and enter it into the control room files.
4. Mark one copy as “Official Copy”, and place in the Title I file system. This will be the copy which may be checked out in the future for changes and markups.

#### 6.1.3. Detector Software Installation

When software is delivered to a site, the software and its documentation is to be delivered to the designated site librarian. The documentation will be handled by the site librarian in the same manner as that outlined for hardware documentation. In addition, the software will be installed in a controlled area (software librarians directory or sld), accessible only by the site librarian and designated alternate(s). All executable code will also be copied to a release area, from which the various Detector computers will load the object code. Both the sld and release areas are to be owned by the librarian, with read only access by others.

### 6.2. System Changes

When changes are to be made to a Detector system, the following engineering change procedures shall be followed. This includes both temporary and permanent changes.

#### 6.2.1. Submittal of Engineering Change Request

When a change is required to a Detector system, either permanent or temporary, an Engineering Change Request (ECR) is to be submitted. This standard form is attached in Appendix A.

An ECR must be approved prior to performing the change. The only case where an ECR may be submitted after the work is performed is if, during installation, errors are found in the installation drawing package. In this case, the installation is performed and an ECR submitted to have the drawings reflect as built.

If an ECR only affects a single site, the site manager, or his appointee, may approve an ECR. If the change involves multiple sites, the Detector manager, or his appointee, must approve the ECR. If the estimated cost of the ECR exceeds the LIGO change threshold, a LIGO Change Request must be submitted and approved prior to approving the ECR.

### **6.2.2. Work Permit**

Prior to work on any system or component at a LIGO site, be it for installation, test, or maintenance, either temporary or permanent, the staff involved must get approval from the site crew chief. No work is to be performed on Detector systems without such approval. This approval is obtained by submitting the standard site Work Permit form for approval by the site crew chief. For performing Detector system changes, this Work Permit is to be accompanied by an approved ECR. The crew chief also has the responsibility of ensuring that system designers and the other site are kept aware of work involving changes to Detector systems.

### **6.2.3. Checkout of documentation**

On approval to do work, latest copies of documentation shall be available from the Detector site librarian. If the work involves changes to Detector components, the Detector site librarian shall issue an official copy after receiving a completed DSRR. This copy shall be produced from the current Title I documentation and be marked as an official copy. There shall be only one such official copy released at any one time.

As an example, someone has the approval to perform work on the site DAQS network. The latest drawing in the library is a marked up drawing designated D990133-A1-C. The librarian now makes a copy of D990133-A1-C and stamps this as an official copy. Attached with this is a blank DCN.

Note that in not all cases is the latest revision the appropriate revision for the work being performed. As an example, the latest revision for a particular electronics module type is D990134-A3-C, but the actual board being worked on has only revision A1 installed. The document numbered D990134-A1-C is the one which should be issued in this event.

### **6.2.4. Checkout of Software**

If changes are required to software, the staff performing the work requests checkout of source code from the site librarian, again by submitting a DSRR. The site librarian will then copy the latest release of software to a designated work area. Only one such copy is to exist at any given time. When work has been completed and software tested and approved, the site librarian shall move the revised software into the sld and release areas. The site librarian shall also perform such backups as necessary to ensure there is a copy of the latest software at all times.

### 6.2.5. Performance of Work

As a Detector system or component is changed, appropriate markups shall be made to the official copy of the documentation previously checked out from the Detector site librarian. All changes shall be marked in red for ease of identification. Text descriptions of changes shall also be noted on the attached DCN form.

In addition, if any tests are run on the system or component, any supporting documentation, such as completed test procedures or data plots, these shall be maintained for return with the checked out document package.

If an electronic module is modified, the appropriate revision number (as obtained from the site librarian) must be marked in the revision number area on the printed circuit board.

If software is modified, it shall be given the next sub release number designation. All changes made shall be noted in the header section of the software.

### 6.2.6. Task Completion

Upon completion of work, the marked up documentation, DCN and supporting documentation shall be returned to the crew chief for final approval of changes made. In no case shall the crew chief approve any markups to unofficial copies of documentation. If the work involved changes to software, the site software librarian shall be notified to return the new source and object code back into the sld and release areas.

Prior to approving the completion of work, the crew chief should verify, or designate someone to verify, that the work was properly completed. This verification should include:

1. Changes have been completed, as described in the ECR, and the new installation is operational.
2. Detailed or, at minimum, spot checks that document changes in fact are accurate when compared with the installed system.
3. All cables which may have been installed have correct cable labels attached. All cables which do not have proper labelling are subject to immediate removal.
4. Any installation work performed is in keeping with general guidelines for grounding and shielding.
5. Visual inspection of work area. The intent here is to check that the work area has been cleaned up, cabling is properly dressed, chassis and other components are properly secured, and, in general, the work performed has a "professional" appearance.

### 6.2.7. Document Filing

Once approved by the crew chief, the documentation is to be returned to the Detector site librarian. This documentation is then filed in the Title I file for that Detector system or component.

If the official drawings have been revised with markups, the librarian shall verify that all changes have been noted in the attached DCN. The DCN and affected documents are then given the appropriate next revision designation, and filed with the Title I documentation set as controlled documents. The librarian also updates the DSRR by which this documentation was requested to indicate that the official copies have been returned.

### **6.2.8. Return of Software**

If the changes required modifications to software, the site librarian is notified that work has been completed. The librarian shall then move the applicable software back from the work area and into the sld and release areas. The librarian shall also ensure changes are documented and the responsible system designer is notified of the changes.

### **6.2.9. Electronic Updates**

When marked up documents are returned to the site librarian, a copy of the DCN shall be transmitted to the responsible system designer. Since the system designer typically does not reside at the sites, it is important that he/she be kept up to date on field revisions, particularly as it may affect new designs and/or revisions being worked elsewhere. The system designer shall then coordinate with the site librarian when revisions are incorporated into electronic documentation and available for transfer back to the sites.

## **6.3. System Maintenance**

As faults are encountered in the Detector systems, either hardware or software, they are to be reported via an Engineering Maintenance Request (EMR). A sample form is attached in Appendix A. All EMR are to be submitted to the site crew chief for disposition. All originals shall be contained in an EMR binder in the control room such that a maintenance history can be maintained.

If, to accomplish the repairs requested in the EMR, changes need to be made to a Detector system, the change process of the preceding section shall be followed.

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## **APPENDIX 1      FORMS**

This appendix contains the forms described for configuration control. These are:

- Engineering Change Request (ECR)
- Engineering Maintenance Request (EMR)
- Document / Software Release Request (DSRR)

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# Engineering Change Request (ECR)

ECR NO.	Type:
Sheet	of
Req. By:	
Date	

Description of Change (Include applicable drawing numbers & titles):

---

Reason for Change:

---

- Priority:
- |   |   |
|---|---|
| <input type="checkbox"/> 1) Safety issue or prevents Ligo operation                       | <input type="checkbox"/> 4) Inconvenience/annoyance |
| <input type="checkbox"/> 2) Affects essential capability, no work-around available        | <input type="checkbox"/> 5) Other (Minor)           |
| <input type="checkbox"/> 3) Affects essential capability, temporary work-around available |   |

## ECR Analysis: (Include Cost and Schedule Impact)

---

Done By: \_\_\_\_\_ Date: \_\_\_\_\_  
Est. Cost:: \_\_\_\_\_ Estimated Time to Implement: \_\_\_\_\_  
Description: \_\_\_\_\_

Approved: \_\_\_\_\_  
Assigned To: \_\_\_\_\_



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## Engineering Maintenance Request (EMR)

EMR NO.

Sheet of

System:

Subsystem:

Req. By:

Date

Category: Initial/periodic test  hardware fault  software fault  other

### Description of Problem:

Priority:  1) Safety issue or prevents Ligo operation  4) Inconvenience/annoyance  
 2) Affects essential capability, no work-around available  5) Other (Minor)  
 3) Affects essential capability, temporary work-around available

### Description of Maintenance Performed:

Work performed by: \_\_\_\_\_ Date: \_\_\_\_\_

Description of Work Performed (Attach any test data):

Time Taken: \_\_\_\_\_ Maintenance tested and signed off by: \_\_\_\_\_ Date: \_\_\_\_\_





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## Documentation / Software Release Request (DSRR)

DSRR NO.

Sheet 1 of 1

System:

Subsystem:

Req. By:

Date

### Documentation Requested:

Doc. Number

Title

---

### Software Requested:

Source Code File

Description

---

Released By: \_\_\_\_\_ Date: \_\_\_\_\_

---

Return Received By: \_\_\_\_\_ Date: \_\_\_\_\_

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Comments: