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Gemini Controls Group Interface Control Document

ICD 12 - Interlock System

Peregrine M. McGehee

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This internal report outlines the requirements and interfaces of the Interlock system used in the Gemini Control System.

1.0 Interlock System Design Requirements

The interlock system monitors the status of a large number of devices and, based on their current status, either enables or disables specific devices in the observatory. The interlock system shall exist as a separate, parallel system to other observatory control systems. This system is intended to operate in a double safe mode — by this we mean that it is not sufficient to only detect the presence of a condition that causes an interlock, it also necessary to sense the absence of this condition.

The current baseline for this system is to use a programmable logic controller (PLC) to monitor interlock signals and to initiate actions based on these interlocks. It is necessary to define a standard interface, if possible, to which systems desiring interlocks can connect. It is intended that, where possible/practical, all interlock systems are self actuating and that only their status is monitored by the PLC system.

The philosophy is that the primary system that is desired to be interlocked performs this function independently of the PLC system. If there are secondary interlocks to be triggered from the primary system then these, in general, operate through the PLC system. This standard interlock interface will follow the design created by the Standard Controller work package.

1.1 Work Package

The Interlock System, along with the control for the Mount Brakes and Hydrostatic Bearings, is the subject of the Interlock, Brake, and Bearing Control System work package. See SDD Chapter 22 for details.

1.2 Hardware Interlock Design Requirements

- completely passive; cannot trigger interlock, can only monitor state
- however ‘state’ can be used in PLC to trigger other interlocks

1.3 Active Interlock Design Requirements

- systems can input interlock requests as +TTL signals to PLC system
- output signals from PLC system (+TTL) are used to trigger active interlocks
- need to monitor state of active interlocks

1.4 Software Interlock Design Requirements

- systems can input interlock requests as software command to interlock system
- outputs from interlock system can be used as interlocks to software systems.
- provision will be made for both of the following modes:
  - we ask software systems to have an input and output TTL signal or front panel and treat like an Active Interlock.
  - we issue a software request for interlocks and monitor software status to determine if we are interlocked.

  The TTL option is recommended for all systems although the software request is allowed for certain exceptions.

1.5 Software Monitor Design Requirements

- want EPICS front panel monitoring ‘Interlock Tree’ status with ability to query ‘WHY’

2.0 Proposed Interlock System Design

2.1 Hardware Architecture

Each point-to-point interlock cable shall contain the following TTL signals:

- Each system outputs the IsSet and $\overline{\text{IsSet}}$ status lines to the Interlock master PLC.
- Each system receives the Set and $\overline{\text{Set}}$ commands from the Interlock master PLC.

All active interlock systems shall set or clear interlocks based on the following logic table:

TABLE 2 - 2 Set Command Logic

Set\$\overline{\text{Set}}$	**0**	**1**
0	Set	Clear
1	Set	Set

All interlock systems shall interpret another interlock system as being set or clear by the following logic table:

TABLE 2 - 3 IsSet Command Logic

IsSet\$\overline{\text{IsSet}}$	**0**	**1**
0	IsSet	IsClear
1	IsSet	IsSet

Note: Can this be done with fiber optics?

FIGURE 2 - 1 Interlock System Architecture

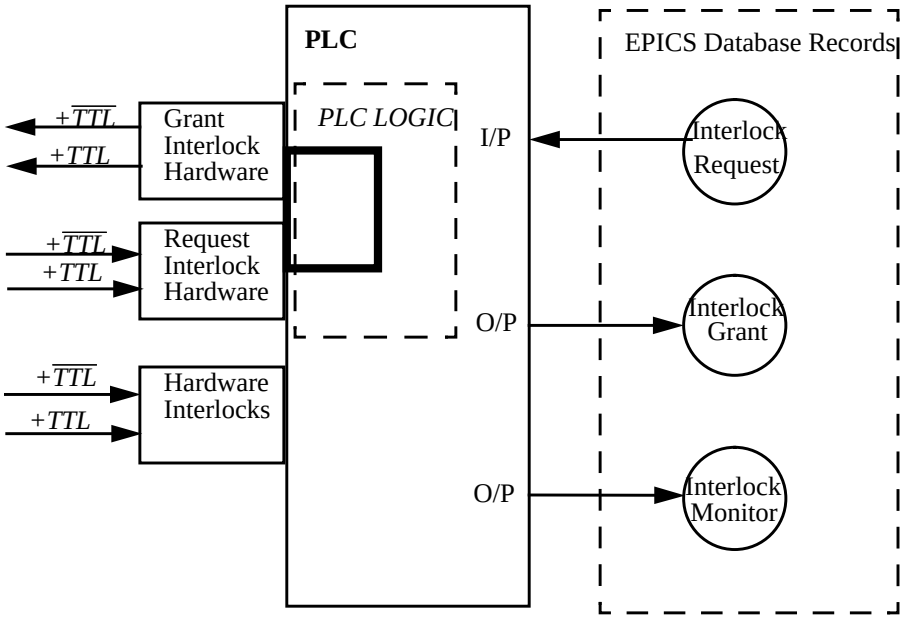
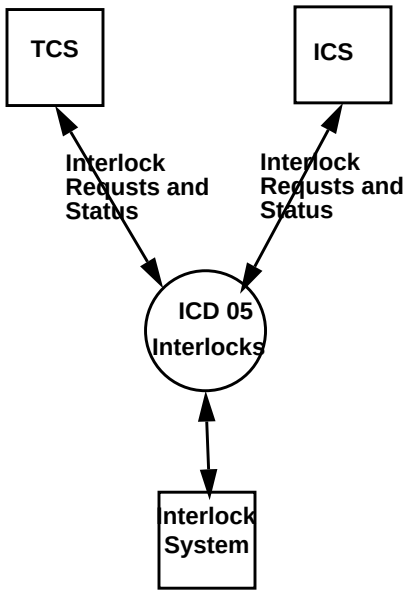


FIGURE 1. Context Diagram



3.0 Interlock Philosophy

The following paragraphs are taken from section 13.3 of the Telescope CDR document [RPT-TE-G0018].

- Safety interlocks shall be provided for the protection of personnel and equipment.

- The primary purpose of the interlocks and safety systems is to prevent injury to personnel working on or around the telescope during operation, maintenance, repair, etc.... of the telescope and it's related components. The secondary purpose is to prevent damage to the telescope, instrumentation, or enclosure that would occur if a subassembly or system (e.g. telescope drive motors) is activated incorrectly or without activating required, interfacing equipment.
- Independent hard wired interlocks shall be provided on all telescope systems where necessary to prevent unsafe situations resulting from single component or subsystem failure.
- Wherever possible, passive systems shall be employed as the primary safety interlock (e.g. hydraulic preload device for drive motors that is pressurized with hydrostatic bearing oil-- drives cannot transmit drive torque if hydrostatic bearings are not fully pressurized.)
- Wherever possible two independent sensors wired in series shall be utilized as safety interlocks. These safety systems shall be designed to provide an electrical 'continuity' before allowing the desired system to activate-- i.e. a fault in either sensor shall disable the corresponding telescope system.
- All safety interlocks shall be monitored and controlled by the Gemini Position and Control System as outlined elsewhere in this document.
- The hazards identified are described, together with a description of the interlocks provided to prevent the hazard from occurring and a description of the hardware.