TMT ICD: APS to M1CS (DRAFT)

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1 Introduction

1.1 Background

This is the Alignment and Phasing System (TMT.TEL.CONT.ACS) to the Primary Mirror Control System (TMT.TEL.CONT.M1CS) Interface Control Document.

The Alignment and Phasing System (APS) is responsible for measuring the segment alignments in piston, tip and tils, measuring the segment wavefront errors, and measuring the M2 alignment.

The Primary Mirror Control System (M1CS) is responsible for the real-time control of the segmented Thirty Meter Telescope (TMT) primary mirror (M1). M1CS maintains the shape of the primary mirror in the presence of disturbances in the operating environment. The major components of M1CS are:

Sensors: The edge sensors are used to measure the relative positions of each of the 492 segments of TMT. The sensors are mounted on the back side of the segments, with two sensor halves on each inter-segment edge: 2772 pairs, total. The sensors, coupled with electronic readouts, measure on one output the sum of the relative segment height difference and dihedral angle, and on the other output the gap between the segments.

Actuators: The actuators are used to position each of the 492 segments in piston, tip, and tilt: 1476 actuators, total. The actuators are mounted between the fixed and moving frames of the Primary Segment Assemblies (PSAs) on the telescope. The actuators incorporate a local sensor and a high-rate servo to meet their requirements.

Segment Controller & Cabling (SCC): The SCC provides distributed electronics, networking, and power to all of the segment actuators and edge sensors, as well as providing the interface to the Global Loop Controller (GLC). Most of the SCC hardware is attached to the telescope. In the reference implementation, there are 84 node boxes, each of which consolidates the controls and networking for up to 6 segments. The SCC also controls the forces applied by the 21 warping harnesses (part of the PSA) on each segment as determined by APS, and provides segment temperature sensors.

Global Loop Controller (GLC): The GLC implements the M1CS control algorithms; provides overall system control, calibration, configuration, diagnostics, and other executive functions; and provides an engineering interface. In addition the GLC is responsible for providing the software interface described in this document.

The intended audience for this document is:

- The M1CS development team
- The ACS development team.

This document in a living document and will be updated as the design of the ACS and M1CS evolves.

1.2 Scope

This document is limited to the communication interface. It describes the information that passes between the ACS and the M1CS.

It describes the telemetry data that ACS and M1CS exchange with each other as well as the commands that the ACS uses to align the M1CS system.

1.3 Document Outline

Section 2 provides the list of telemetry items that pass between the ACS and the M1CS subsystem.

Section 3 provides the details of the communication interface for all the telemetry items listed in section 2.

1.4 Applicable Documents

- **AD1** - APS Design Requirements Document (TBD)
- **AD2** – M1CS Design Requirements Document (TMT.CTR.DRD.08.005.REL17)

- **AD3** – GLC Design Requirements Document (TMT.CTR.DRD.10.005.DRF)

1.5 Reference Documents

- **RD1** – TMT Software Design Description (Vol1), Functional Architecture, (TMT.SFT.TEC.12.014).
- **RD2** – TMT Software Design Description (Vol2), Technical Architecture, (TMT.SFT.TEC.12.016).

1.6 Abbreviations, Definitions and Nomenclature

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3 Interface Specifications

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3.4 Access and Handling Interfaces

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