



IMACS: Inamori-Magellan Areal Camera and Spectrograph

Pre-ship Review

28 May 2003

Description of Motion Control System
Electronics

Introduction

✱ Design philosophy.

- ✱ Initial design by Dave Carr inherited Magellan control system design experience.
- ✱ Off-the-shelf components.
- ✱ External placement of electronic racks.
- ✱ Thermal energy removal.

✱ Design elements.

- ✱ Eleven custom designed and built electronics chassis.
- ✱ Easy access and maintainability.

Topics of Discussion

- ✱ Mechanical considerations.
- ✱ A basic DOS motion control system.
- ✱ Communications protocols.
- ✱ Hard-stop logic.
- ✱ Data acquisition system.
- ✱ Thermal considerations.

Motion Control System

Mechanical Considerations

- ✱ Two 19" bolted-together 6-foot tall racks.
- ✱ Thirteen custom built chassis's on ball-bearing pull-out rack slides.
- ✱ Thirty-five foot bundle of cables between electronics racks and instrument, routed through flexible IGUS cable chain.

Motion Control System

Mechanical Considerations

- ✱ Heavy-duty keyed mil-spec twist and lock connectors – durable and idiot proof.
- ✱ Individual wires labeled throughout instrument to ease and speed troubleshooting.

A Basic Motion Control Electronics System

- ✱ Off-the-shelf components.
- ✱ Linear power supplies used to eliminate noise generated by switching power supplies.
- ✱ Single-point ground philosophy used throughout instrument to prevent ground loops.

A Basic Motion Control Electronics System

- ✱ Motion and I/O controlled by DOS single-board-computer running on 15-slot ISA back-plane.
- ✱ Industry standard ISA control cards.
- ✱ Same components as used in the design of Magellan I and II telescopes.

DOS Computer

Controls:

- ✱ Sixteen 5-phase stepper motors via four 4-channel ISA indexer cards.
- ✱ Four linear motors (shutter).
- ✱ Three DC motors (LO5).
- ✱ Two Piezo transducers (flexure).

DOS Computer Controls:

- ✱ Fifteen Renishaw encoders.
- ✱ 272 digital I/O lines.
- ✱ Calibration lamps.
- ✱ One AC motor (hatch).

Communications Protocols

- ✱ TC/IP Ethernet between racks and GUI high-level computer uses TC/IP to serial converter.
- ✱ RS-232 serial interfaces.
 - ✱ Data acquisition unit.
 - ✱ DOS computer.
- ✱ RS-422 differential interfaces.
 - ✱ Vacuum gauges.
 - ✱ Physik Instrumente PZT controller.

Hard-stop Logic

- ✱ Shuts down affected sub-system, independent of computer control.
- ✱ Requires user intervention before resumption of normal activity.

Data Acquisition System

- ✱ Agilent multi-channel data acquisition system.
- ✱ Monitors:
 - ✱ Twenty temperatures, using four-wire RTD sensors.
 - ✱ Three pressure measurements.
 - ✱ Nine voltages.
 - ✱ Extra channels available.

Thermal Considerations

- ✱ Two racks consume approximately 500 watts.
- ✱ Liquid-cooled heat exchanger used to remove heat and to equalize temperature of racks to ambient dome temperature.

What This Means

- ✿ A strong, robust, easily maintainable system.
- ✿ Readily available components.
- ✿ Same spares and shared experience with Magellan I and II telescope control systems.