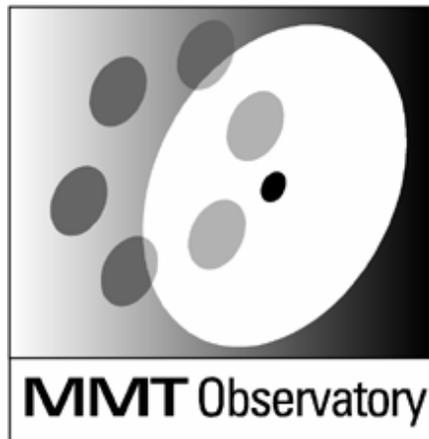


# MMTO Internal Technical Memorandum #03-4



Smithsonian Institution &  
The University of Arizona®

Science Instrument Interface Control Document for the MMT

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D. Blanco and G. Schmidt – May 21, 2003

## Scope

This document contains requirements for interface of science instruments to the converted MMT. The specifications define the interface for normal operations. Any changes to these requirements or special provisions for individual instruments may be submitted to the MMTO Director who may, at his discretion, make special allowances if they would not affect the performance of the telescope. Changes that would impact the performance or operations of the facility or otherwise incur costs to the observatory will be subject to review and approval by the MMTO Council.

## Introduction

All instruments interface to the telescope at the Cassegrain focus. Three foci are currently supported: f/5, f/9, and f/15. Converting between foci is done by changing secondary mirrors. We expect to gradually phase out the f/9 focus and may either decommission and/or convert existing f/9 instrumentation to function at one of the other foci.

In general, instruments will be mounted to a bolt circle on the instrument rotator flange. f/9 instruments may either use this flange or may elect to use the f/9 top box (guider) that provides a mounting flange with several bolt circles common to other telescopes. f/15 instruments should mount directly to the f/15 top box.

Cables to the instrument are routed through a loose tether to allow for instrument rotation. A general instrument patch panel with a tether strain relief is provided. This panel provides general interface cables and utilities such as power, communications, coolants, and waste heat scavenge.

Installation onto the telescope is done at zenith pointing and may make use of an instrument lift to raise the instrument into position.

Storage space within the facility is extremely limited. Temporary storage of small instruments can be accommodated; however, at this time large instruments must provide their own long-term storage. This constraint may be alleviated in part during 2004 when instrument storage space is expected to become available in the Common Building.

## Location of foci (measured with respect to instrument rotator mounting flange)

Bare f/5 (f/5.16)	15.07 inches
Image f/5 (f/5.36)	13.61 inches
Spec f/5 (f/5.29)	12.92 inches
f/9	12.25 inches
f/15	32.25 inches

## Description of the foci

Details of the foci are provided in the document entitled “Optical Specifications for the MMT Conversion,” by Fabricant, McLeod, and West (Ver. 7 is the current revision). We summarize the basic characteristics here:

Focus	Scale (mm/arcsec)	Focal surface radius of curvature (mm)	0.5 arcsec rms field diameter (arcmin)	1.0 arcsec rms field diameter (arcmin)	Unvignetted field diameter (arcmin)
Bare f/5	0.162	2163	5	9	>60
Image f/5	0.169	Flat	39	44	>30
Spec f/5	0.167	3404	60	67	>60
f/9	0.284	1273	13	23	12
f/15	0.463	849	20	29	6

## Instrument handling

Instruments arriving at the observatory are received at the MMT loading dock on the first floor of the facility. The entrance doors to the loading dock provide an opening 90” wide by 78” tall. Once inside, the instrument must be transferred from the first floor to the observing chamber on the second floor. Two means are provided: an elevator suitable for smaller instruments, and a hatch that opens vertically into the observing chamber. All instruments must be provided with wheels or carts to allow transfer across the facility flooring. We recommend the use of compliant rubber wheels of not less than four inches diameter to accommodate uneven flooring in the facility.

Instruments that will not fit in the elevator must be raised through the chamber hatch using the facility overhead crane. The hatch is a tight 96” x 85”. At least 2” clearance on all sides must be maintained, leaving a maximum instrument footprint of 92” x 81”.

The passages and clearances described here define the maximum instrument envelope that can be handled by normal facility operations.

Instruments must be provided with lifting points for an overhead crane. This is required in order that instruments can be weighed to predict telescope balance.

## Instrument envelope

Maximum volume (including cart)	92” L x 81” W x 78” H
Elevator volume (including cart)	56” L x 40” W x 78” H

Note: Instruments that exceed this volume are beyond the normal operations of the facility.

## Instrument weights

Weight	3,000 lb max
Overhanging moment	148,500 in-lb max
Imbalance about rotator axis	Nominally balanced

## Instrument lift

Instruments can be raised to the Cassegrain focal station with the facility instrument lift located directly below the instrument rotator. When retracted the instrument lift is flush to the chamber floor.

Capacity	6,000 lb
Lift floor space	60" x ??
Vertical stroke	68 1/4"
Curb height	9 3/8"

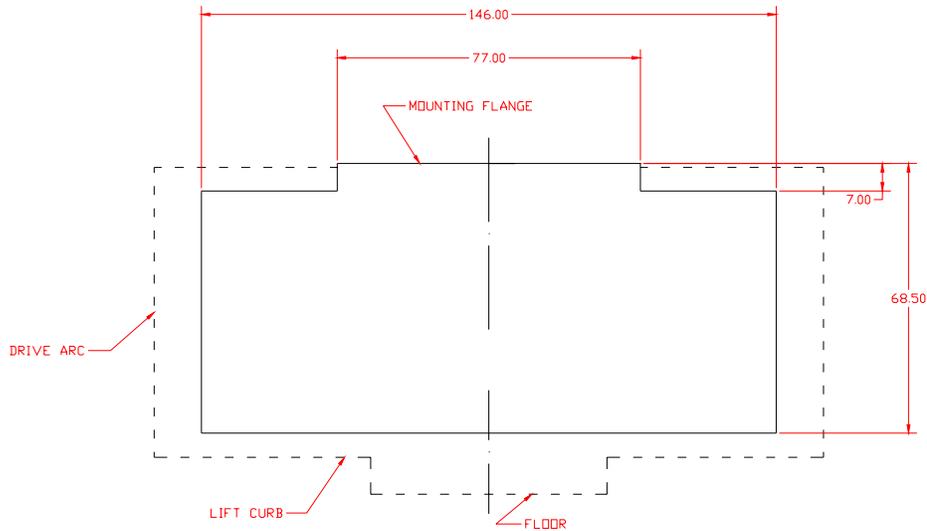
## General Instrument Patch Panel (not yet in service)

The general Instrument Patch Panel will provide a set of standard interface cables from the Cassegrain area to the MMT control room. At this time, the panel is anticipated to provide the following cable runs:

Optical fiber	6 terminated pairs + 6 spare pairs, with ST connectors
Parallel	2 25-conductor ribbon (mass-terminate) cables with female D connectors
Coax	8 RG-58 coaxes with standard BNC connectors
Video	2 RG-59 coaxes with standard BNC connectors
AC Power	110V AC power (quiet)
Ethernet	2 CAT5 ethernet jacks
Signal	2 25-conductor twisted pair cables with D connectors
Coolant	Methanol-water mix at 0 C, ? gpm
Gases & coolant	
Dry filtered N2	10 cfh at 5 psi ?
Coolant (piping only)	2 lines, 0.38" ID ?
Dry air?	
Waste heat scavenge	Connection to mount exhaust plenum

## Instrument swing envelope

Instruments that require field derotation will be restricted to the volume shown below. Two envelopes are shown; the inner envelope allows clearance for safe operation of the telescope, while the outer envelope shows the “hard” edges where collisions would occur. Note that the optical axis lies in the plane of the paper.



## Guiders and wavefront sensors

Instruments can make use of three facility guider/wavefront sensors, one for each focus. The f/9 top box is described in MMT technical memos TM-03-1, TM-85-3, TM-84-8, and references therein.

The f/15 top box was constructed by the UA adaptive optics group (CAAO), who can provide information on its construction.

The f/5 guider and wavefront sensor differs from the other two in that it does not provide a separate mounting flange. Instruments using this facility must be mounted to the instrument rotator flange.

## Instrument rotator

Rotation range	+/- 180° nominal
Rotation rate	-5°/sec to +5°/sec
Ramp rate	-1°/sec <sup>2</sup> to +1°/sec <sup>2</sup>
Accuracy	< 2 arcsec

## **Instrument storage**

There is no storage room available in the facility. Dewars, carts, and other support equipment for small instruments that are currently mounted on the telescope may be temporarily stored at the back (north) of the observing chamber. Large pieces of equipment must be removed from the chamber to permit normal operations.