NEWFIRM

SYSTEM DESIGN NOTE

Title: NFM-AD-02-1106 Telescope Services Interface Requirements					
Prepared by	**Date**	**Approved by**	**Date**	**Rev.**	**Rev Date**
Ron Probst	4/28/04				
Related documents:					

1. Introduction

This SDN states requirements for service interfaces between the NEWFIRM instrument and various utilities it requires that are on board the telescope, e.g. power, Ethernet, fiber optics, high pressure helium gas for cryocoolers, etc. Components that are to be provided by the NEWFIRM Project and incorporated into these interfaces are also identified. In some instances details of an interface, e.g. manufacturer and precise type of a connector, are already determined and are stated here as requirements.

Section 2 summarizes requirements, describes the notional concept, lists relevant drawings, and provides contact information for key persons. Section 3 provides detailed information for individual components that shall be used. Figures referred to in the text follow in Section 4.

2. Services interface requirements

This SDN gives requirements for the interface between NEWFIRM and the 4-m telescopes for all utilities required to operate NEWFIRM plus components to be provided by the project that must be incorporated into this interface. A notional concept is described but is subject to change as the subassemblies are studied in more detail. Since neither the concept nor the preliminary design for the physical layout is fully worked out and frozen, this is not a description of a finished design.

The guider, being both functionally and physically distinct from the instrument, is not included. The guider has a separate interface with its own dedicated cables, connectors, etc.

The NOAO Tucson contact person for NEWFIRM design details is John Andrew, jandrew@noao.edu, 520-318-8112. The interface person between NOAO Tucson and NOAO La Serena, through whom all communications between these sites should flow, is Ruben Dominguez, rdominguez@noao.edu, 520-318-8275. On the telescope side of the interface, contact for KPNO is Dr. John Glaspey, jglaspey@noao.edu, 520-318-8701; contact for CTIO is Dr. Tim Abbott, tabbott@noao.edu, 011-56-51-205216. NEWFIRM Project Scientist and Systems Engineer is Dr. Ron Probst, rprobst@noao.edu, 520-318-8268. Given the state of design of the instrument-telescope interface at the time of writing, open communication as the design is completed is very important to the success of this subsystem.

2.1 Reference drawings

Since neither the concept nor the preliminary design for the physical layout is fully worked out and frozen, there are no assembly drawings for reference. Drawing numbers are to be assigned by John Andrew to be consistent with the drawing tree.

Detail drawings are:

- Helium heater assembly, from GNIRS Project, Drawing 89-NOAO-4200-0155

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2.2 Requirements summary

The on-telescope utilities to be connected to the instrument, and discussed here, separate into two groups as follows:

1. Gases. This includes high pressure helium for the cold heads, and dry nitrogen at modest pressure for the environmental cover N2 gas manifold. The interface shall include
    a. Supply and return high pressure helium gas lines
    b. A helium gas heater
    c. A charcoal adsorber
    d. A manifold splitting out supply and return helium gas to three cold heads
    e. A high pressure relief valve on the manifold
    f. A dry N2 gas supply with filter and flow meter
    g. A Differential Pressure Switch (DPS) to control coldheads
    h. An enclosure with inlet port, outlet port, and fan for removal of heat by airflow

2. Power and signals. This includes AC power and control/signal lines for the instrument control electronics and the MONSOON array controller. The interface shall include
    a. 110VAC unfiltered (“dirty”) power
    b. 110VAC filtered (“clean”) power
    c. 10/100 base T Ethernet connection for the instrument controller
    d. Two optical fiber pairs (four fibers) for the array controller

The concept is for two separate interface panels to be mounted on the NEWFIRM truss at appropriate locations. Each panel will be dedicated to one of these interface groups. For Group 2, the various lines and cables will be gathered into an umbilical cable wrapup that connects to a mating panel mounted on the telescope cage structure. This telescope panel gathers up the existing on-telescope cables, etc. to a single location for this umbilical connection. The subassembly to be produced for NEWFIRM inc ludes both the on-instrument and on-telescope panels.

For Group 1, the on-telescope connections are to the existing high pressure helium gas supply and return line connections, which are mounted side by side on a cage panel; and to the N2 gas line, which shall be routed around the cage to coincide with the helium line connections. These connections may be located differently on the two telescopes. Standing inside the cage facing the door, the connections are low in the cage and to the right of the door on the Mayall telescope. The on-instrument interface panel shall be located such that a pair of helium gas lines of moderate length can reach either on-telescope location without obstructing entrance to the cage.

Figures 1 and 2 in Section 4 show the required components and a schematic layout.

Routing of umbilical cord wrap-ups shall be determined in consultation with the telescope operations group at each site. Helium gas lines are fairly inflexible and tend to dictate their own routing. They shall be tied off to the truss and/or cage as necessary to fix them in place. The object is to preserve unobstructed space around the instrument for maintenance, and connections to it that are robust against disconnection or damage by people moving about in the cage.

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3. Component details

3.1 Gas services interface. This group includes components of substantial physical size and weight. The interface panel shall be mounted on the telescope truss in a location that permits ease of access to its high pressure helium line connections, and connection to either on-telescope helium gas line location as noted above.

3.1.1 Supply and return high pressure helium gas lines connected to the existing telescope lines. These shall be stainless steel jacketed flex lines of Aeroquip size 8 (supply) and size 12 (return). Connecting fittings shall be Aeroquip size 8 (supply) and Aeroquip size 12 (return) on each end.

3.1.2 Helium gas heater assembly. This shall conform to drawing 89-NOAO-4200-0155 with the exception that Aeroquip helium gas connections shall be size 8 on inlet and outlet. The Watlow heater at the heart of this assembly is described at www.anafaze.com/products/heaters/ht_circ.cfm. Note the need for internal electrical modifications that derate the heater, and for a custom gas coupling assembly for use in a helium system.

3.1.3 Charcoal adsorber. This shall be a Leybold 010 004-T adsorber unit procured from CoolPair Plus. Helium gas line connections shall be Aeroquip size 8 at inlet and outlet. Units removed from compressors tend to have oil contamination and shall not be used. Further information may be obtained from Paul Schmitt, pschmitt@noao.edu, 520-318-8134.

3.1.4 Helium gas manifold. This manifold is a custom designed unit. The design shall be developed from a preliminary design provided by John Andrew and based on experience with previous instruments. It is expected that the final design shall stay close to this baseline. Inlet and outlet lines and fittings to/from the telescope shall be as specified in 3.1.1. Fittings for the line pairs to/from cold heads shall be Aeroquip size 8 (supply) and Aeroquip size 12 (return). Line pairs to and from each cold head shall be stainless steel jacketed flex lines of Aeroquip size 8 (supply) and size 12 (return). Connecting fittings shall be Aeroquip size 8 (supply) and Aeroquip size 12 (return) on the manifold ends. Fitting sizes on the cold head ends shall be specified to match the purchased cold heads at the time the flex lines are purchased.

3.1.5 High pressure relief valve. This shall be incorporated into the manifold (3.1.4) on the inlet side. The following components are required and may be obtained from Arizona Valve and Fitting: Nupro Relief Valve P/N SS-4R3A, Spring Kit P/N 177-R3A-K1-B. The valve shall be assembled and set to 400 psi.

3.1.6 N2 gas supply with filter and flow meter. The simple arrangements currently in use on both 4-m telescopes are adequate and shall be copied at this interface panel.

3.1.7 Differential Pressure Switch (DPS). This switch shall use Aeroquip fittings that are connected to the high and low pressure sides of the helium system. A switch is triggered when the high-low pressure difference is > 150 psi. The switch enables the power to the coldheads when it is triggered.

3.1.8 Enclosure for heat removal. Heat generated at this interface shall be contained within a surrounding enclosure, and removed by taking in ambient air from the cage and exhausting it to a remote location. The outlet shall use a round duct 4 inches in outside diameter and 1 inch long to permit connection of flexible tubing. (Tubing is to be provided by the telescope operations group.) There shall be an exhaust fan at the outlet. The inlet port geometry shall provide similar surface

area but is not otherwise specified. The enclosure is not required to be airtight, and may consist of multiple nonstructural pieces that are fastened in place after helium gas line connections are made, in order to provide maximum access to these connections. The gas heater is expected to be the largest heat source (~700 W) so a good flow path around this component is necessary.

3.2 Power and signals interface. This panel is much smaller and lighter than the gas services interface. Since no significant heat is generated here, there is no requirement for an enclosure or heat removal. The instrument panel shall be mounted on the truss between the instrument control and MONSOON electronics boxes in a location that provides for convenient connections with minimum cable length to both boxes. The matching telescope panel shall be mounted in the cage as convenient after consultation with the telescope operations groups.

3.2.1 110 VAC mains (“dirty”) power. Mains power is used to drive motors and other electrically noisy apparatus. In this instance, it is provided to the instrument control electronics for the filter wheel motors. Each panel shall have a single panel-mount twistlock connector for mains power. The connector shall be hard wired to a power cable running to the instrument controller (instrument panel) or to telescope mains power (telescope panel). The umbilical between panels shall use a female connector on the instrument panel end. The panel mount connectors shall be black in color, in conformance with existing practice at the telescopes for mains power outlets.

3.2.2 110 VAC isolated (“clean”) power. Isolated power is used in connection with electronics that provide control and signal connections to detectors and other components sensitive to electrical noise. In this instance, it is provided to the MONSOON array control electronics. Each panel shall have a single panel-mount twistlock connector for isolated power. The connector shall be hard wired to a power cable running to the MONSOON controller (instrument panel) or to telescope isolated power (telescope panel). The umbilical between panels shall use a female connector on the instrument panel end. The panel mount connectors shall be orange in color, in conformance with existing practice at the telescopes for isolated power outlets.

3.2.3 10/100 Base T Ethernet connection. Each panel shall have a pair of RJ-45 Ethernet connections, wired together. An Ethernet cable shall connect to the instrument panel and to an RJ-45 connection at the instrument controller box. Similarly, an Ethernet cable from the telescope side shall connect to the telescope panel. An Ethernet cable shall connect the two panels and be incorporated into the umbilical wrapup.

3.2.4 Optical fiber pairs for array control. The MONSOON Project shall supply two fiber pairs connected to the MONSOON controller and of sufficient length to run from it, through the instrument panel and umbilical wrapup, to connectors at the telescope panel. The interface at the on-instrument panel shall be an aperture sufficient to pass these fibers, with protection against rubbing damage and removable strain relief. The telescope panel shall provide connectors to the instrument and to the existing telescope fibers. Connector type and fiber size shall conform to that presently provided on the telescope.

3.3 Interface panel mount to instrument. The interface panels shall mount to the NEWFIRM truss in a manner that allows them to be readily removed as complete subassemblies when NEWFIRM is on the telescope. The present concept is for bolting to brackets that are welded to the truss assembly. Size, location, and manner of connecting these panels shall be coordinated with John Andrew as the design develops.

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4. Figures

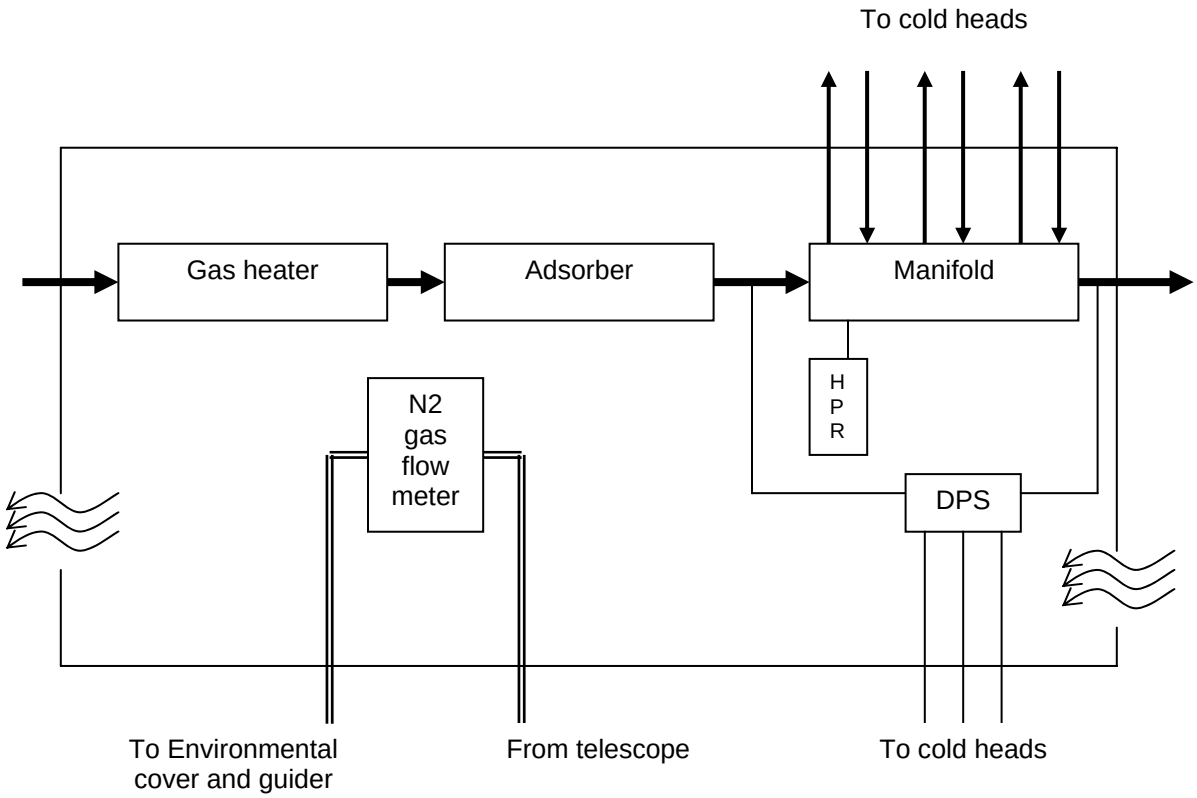

Figure 4.1. Helium lines interface. High pressure helium gas enters from the left and exits to the right. The manifold has three sets of supply and return lines to individual cold heads. It also incorporates a high pressure relief valve (HPR), and a differential pressure switch (DPS) that turns off AC power to the cold heads if the difference high – low falls below 150 psi. The interface panel is enclosed and cooled by forced air. A flow meter regulates N2 gas fed to the Environmental Cover Assembly.

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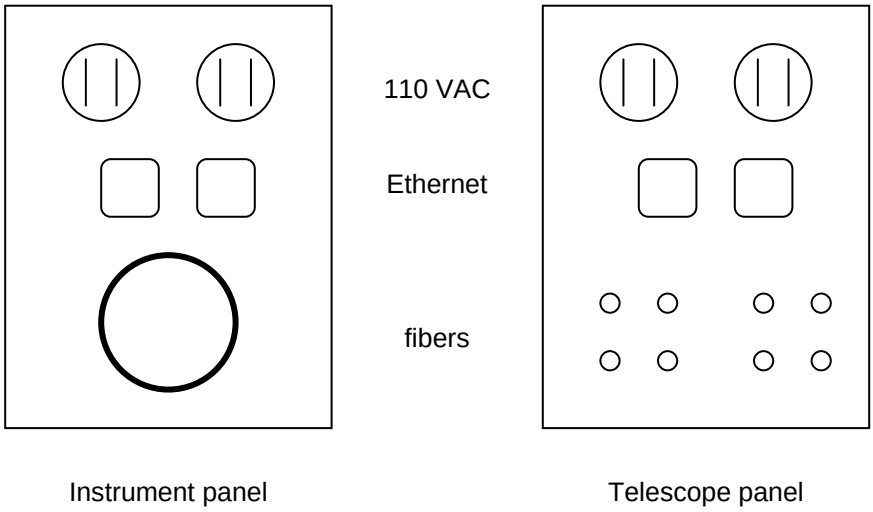

Figure 4.2. Power and signal interface. Each panel has connections for two 110VAC regulated (“clean”) power lines. Each panel has two RJ45 Ethernet connections, jumpered together. The instrument panel has a hole through which two pairs of optical fibers pass. On the telescope panel these terminate at connectors, jumpered to a second set for connection of the on-telescope fibers.