

Mauna Kea Infrared NICI JBox Specification

Rev 0.4

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PRELIMINARY

ABSTRACT: This document provides an overview and detailed technical specifications for the NICI instrument's JBox. The JBox is a junction box that serves as an interconnect between the 55-pin Motor Control Cable and cryostat mechanisms' individual control cables. This document is intended for engineers and technicians working with NICI's Mechanism Control Subsystem.

Revision History

Revision	Author	Summary of revisions	Date
0.4	Mike Thompson	Cleaned up implementation details, updated to as-implemented.	10/27/04
0.31	Mike Thompson	Fixed version number in header and title page.	8/24/04
0.3	Mike Thompson	Minor changes. Updated issues list, appendix H. This version had an incorrect version number in the header and title page, 0.2, while the filename indicated ver 0.3.	4/26/04
0.2	Mike Thompson	Comments/conclusions per 4/12/04 tele-conference with Peter Onaka and Greg Ching. Changed mechanism cables connectors from PT02E-12-8P to PT02E-12-10P. Added max possible dimensions of Elma box. Actual selection still TBD, Greg.	4/19/04
0.1	Mike Thompson	Initial Revision. This is a first draft and contains questions and issues to resolve and is meant for review with Peter, Greg, and Doug.	4/5/04

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1 JBox Overview

1.1 Purpose

This document specifies the JBox of the NICI instrument. It provides a high level overview of the JBox. It also provides technical information on the components within the JBox and internal and external cabling.

This document is intended for engineers and technicians working with NICI's Mechanism Control Subsystem.

1.2 High Level Description

The JBox has two major functions. One is to act as a junction box to fan-out power, control, and communication signals from the 55-pin Motor Control Cable to the 7 NICI IC mechanisms. The IC mechanisms are listed in the following table.

Mechanism	Type of Drive
Pupil Mask Wheel	Discrete position wheel
Beam Splitter/Dichroic Wheel	Discrete position wheel
Red (CH1) Filter Wheel	Discrete position wheel
Blue (CH2) Filter Wheel	Discrete position wheel
Pupil Imager Wheel	Discrete position wheel
Focal Plane Mask Wheel	Continuous rotary drive
Spider Mask Rotator	Continuous rotary drive

The JBox also functions to house the Hall Effect Sensor Preamplifier Board (HEPB). The HEPB monitors the Hall Effect sensors mounted on the cryogenic mechanisms which are used in conjunction with embedded magnets to provide high resolution, non-contact position measurement. The HEPB provides indications to software and to the motors when the mechanisms are in a detent position.

2 Related Documents

This document is part of the NICI Service & Calibration Manual. Other related documents are:

- NICI Mechanism Utility Box Specification
- SDN3004 Mechanism Control Subsystem Electronics Specification
- System Wiring Spreadsheet: Mechanisms - UBox - JBox

3 Functional and Performance Requirements

The JBox is a component of the Mechanism Control subsystem. The JBox does not have explicit functional or performance requirements specified in the FPRD. Any related functional or performance requirements are defined in SDN3004 Mechanism Control.

4 Technical Specifications

This section provides a quick overview of the technical features and components of the JBox. For additional details see Section 5 Functional Description.

- **Hall Effect Circuitry**
 - 8 channel instrumentation amplifier
 - Gain = 100
 - Positive and negative threshold comparators on each amplified channel
 - LED indication for each comparator
 - Individual potentiometer adjustment for each channel
 - 10mA excitation current for 4 wire sensor interface
- **Mechanism Utility Cable and Hall Effect Utility Cable**
 - Glenair part numbers: ABC55495-5 and ABC55495-6
 - Connectors: PT06A-22-55S, 55 socket straight plug with strain relief.
 - (This part number alone does not imply strain relief. "SR" may be appended to the P/N to indicate this.)
 - Receptacles: PT02A-22-55P, 55 pin box mount receptacle.
- **Cryostat Mechanism Cables**
 - Interfaces with Animatics SmartMotor SM3410D Sub-D7 connectors.
 - Connectors:
 - PT02E-12-10P cable receptacles mate to PT06E-12-10S Mechanism Cable plugs.
 - Animatics Sub-D7 plugs and receptacles for motor connection.

5 Functional Description

The JBox is basically a junction box. It provides an interface between the 55-pin Mechanism Utility Cable and the cryostat mechanisms for power, RS-232 communication, and mechanism detent detection. It also houses the Hall Effect Sensor Preamplifier Board. The Hall Effect Board monitors the Hall Effect Sensors mounted on the mechanisms and provides an indication of mechanisms in their detent (DET) position. Motors for the AO mechanisms are driven from the JBox in the IC Rack.

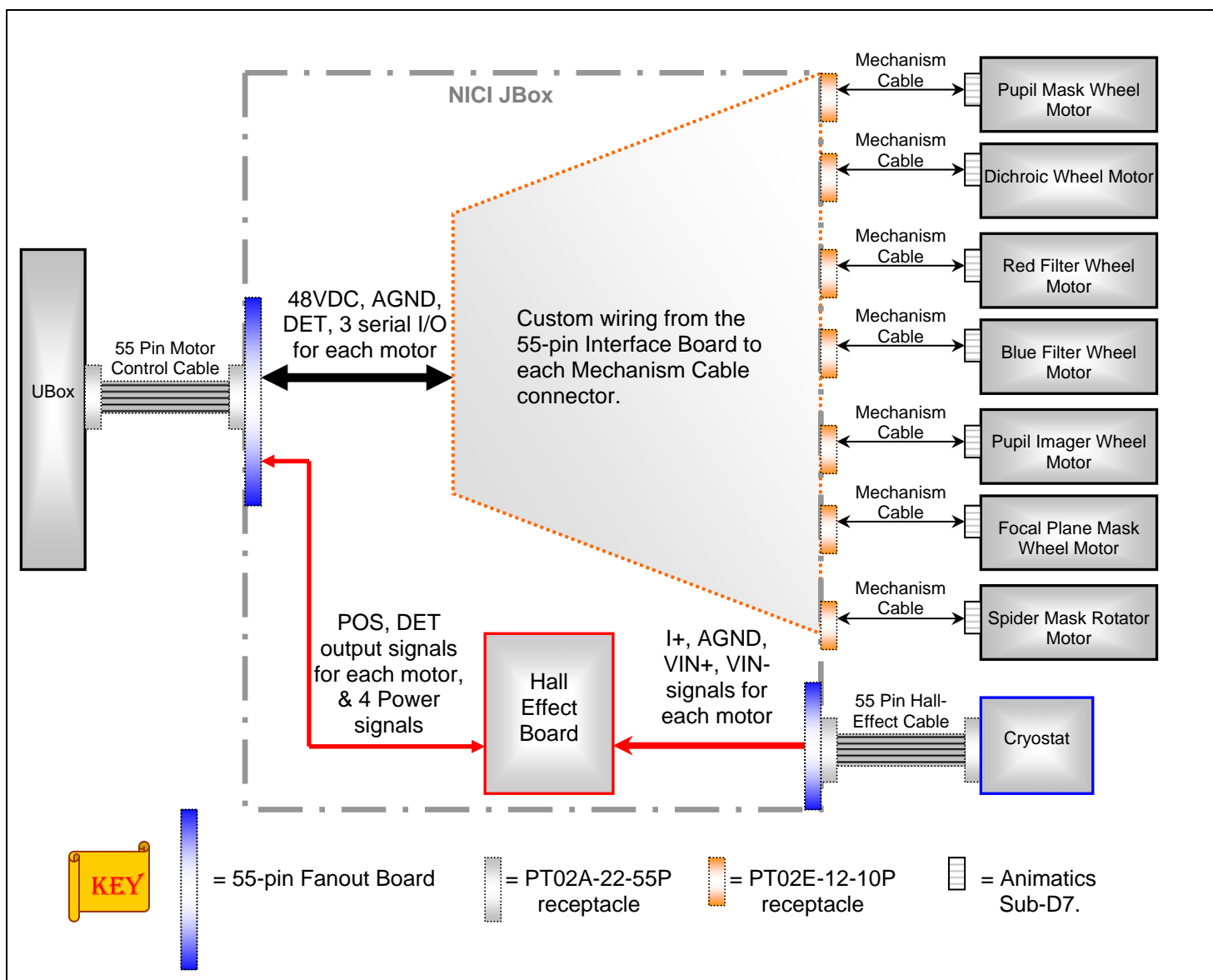


Figure 1 Block Diagram of JBox Components and Interfaces

6 Connections and Cabling

This section defines the internal connections and external connectors for NICI's JBox. Details on the Utility Cables can be found in SDN3004 Mechanism Control and in the Mechanism Spreadsheets. Pinouts and implementation specific information on the JBox can be found in the Mechanism Spreadsheets.

6.1 Cabling Overview

This section provides an overview of the technical/mechanical details of cables with connections to the JBox. The table below provides details on each type of cable used in the Utility Box.

Cable Name	Manuf./Part/Length	Conductors	Signal Type	Connectors
Motor Control	Glenair ABC55495-5, Standard Utility Cable, Straight Through, Shielded, Neoprene Jacket, 92" length.	55 x 22 AWG multi-strand	Low level/noise, 48 VDC	PT06A-22-55S molded connectors w/ strain relief.
Hall Effect	Glenair ABC55495-6, Standard Utility Cable, Straight Through, Shielded, Neoprene Jacket, 64" length	55 x 22 AWG multi-strand	Low level/noise, +/- 15 VDC	PT06A-22-55S molded connectors w/ strain relief.
Cryo Mechanism	Custom built from Animatics cable, CBLPWRCOM.	7	Various, see cable spec.	Animatics Sub-D7, PT06E-12-10S.

6.2 Cryostat Mechanism Cables and Connection Descriptions

This section specifies the Mechanism Cables. The Mechanism Cables route power, control, RS-232 communication, and detent indication (Hall Effect) signals between the JBOX and the 7 IC mechanisms.

Each Mechanism Cable carries the 6 communication/control and power signals listed below through a shielded cable. The cables' JBox plugs are locking cylindrical connectors. The connector to the mechanisms is the Animatics Sub-D7, which carries a serial connection and PWR/GND. Most of the conductors are multi-strand 22 AWG. This cable could be constructed from an off-shelf Animatics pig-tailed cable, CBLPWRCOM. The CBLPWRCOM I/O is listed in Figure 3. The following table specifies the Mechanism Cable Pinout.

PT02E-10-6S Pin	Signal Name	Conductor	Mechanism Pin	Mechanism Signal Name
A	DET	22 AWG	Sub-D7(1)	I/O G
C	TXD	22 AWG	Sub-D7(3)	RS-232 Transmit
D	RXD	22 AWG	Sub-D7(4)	RS-232 Receive
E	GND	22 AWG	Sub-D7(5)	RS-232 Ground
G	48VDC	22 AWG	Sub-D7(A1)	Power (+24 to 48V DC)
F	GND	22 AWG	Sub-D7(A2)	Power Ground
-	-	-	Sub-D7(2)	+5V out
B	Shield	-	-	Shield

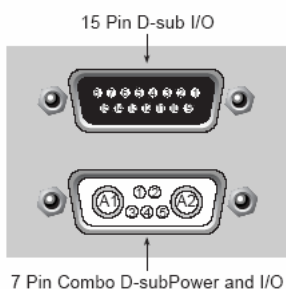
Figure 2 Mechanism Cables Pinout

This motor pinout is from the Animatics document "Smartmotors™ Technical Notes," 08.pdf, undated.

Double D-sub Connectors

More robust construction, provides better resistance to harsh environments, and at no additional cost. Recommended for new designs.

Standard for SmartMotors 23 and 34 Series.



7 Pin Combo D-Sub Power and I/O:

A1 +20V to +48V DC
A2 Power Ground
1 Sync or I/O G
2 +5V Out
3 RS-232 Transmit
4 RS-232 Receive
5 RS-232 Ground

15 Pin D-Sub I/O:

1 I/O A
2 I/O B
3 I/O C
4 I/O D
5 I/O E
6 I/O F
7 I/O G
8 Encoder A Out
9 Encoder B Out
10 SM RS-232 Transmit
11 SM RS-232 Receive
12 +5V Out
13 Ground
14 Power Ground
15 Power

Figure 3 Animatics Motor Pinout

6.3 Hall Effect Sensor Preamplifier Board I/O

Each mechanism implements a Hall Effect Sensor. From the board's point of view each sensor has 4 I/O signals, I+, I-, V+, and V- as illustrated.

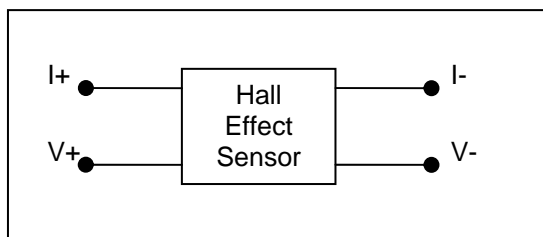


Figure 4 Hall Effect Sensor Diagram

6.3.1 Sensor Interface I/O

The 55-pin Hall Effect Utility Cable carries these 4 signals for each of the 7 IC Mechanism Hall Effect sensors. The Hall Effect Sensor Preamplifier Board has 8 channels of Hall Effect Sensor I/O. The following table indicates which board channels are associated with which mechanisms' Hall Effect Sensors. It also specifies the I/O from the Hall Effect Board to the 55-pin interface board for the Hall Effect Utility Cable. Note that channel 8 is a spare channel.

H.E. Board I/O signal	H.E. Board Pin #	Connects to Hall Effect Sensor on:	Signal Name	55-Pin Interface Board Pin #
CH1_I+	P1-C2	Pupil Mask Wheel	PUPILMASK_I+	JH2-1
AGND (I-)	P1-A2	Pupil Mask Wheel	PUPILMASK_AGND	JH2-2
CH1_VIN+	P1-C3	Pupil Mask Wheel	PUPILMASK_V+	JH2-3
CH1_VIN-	P1-A3	Pupil Mask Wheel	PUPILMASK_V-	JH2-4
CH2_I+	P1-C4	Beam Splitter/Dichroic Wheel	DICHROIC_I+	JH2-5
AGND (I-)	P1-A4	Beam Splitter/Dichroic Wheel	DICHROIC_AGND	JH2-6
CH2_VIN+	P1-C5	Beam Splitter/Dichroic Wheel	DICHROIC_V+	JH2-7
CH2_VIN-	P1-A5	Beam Splitter/Dichroic Wheel	DICHROIC_V-	JH2-8
CH3_I+	P1-C6	Red (CH1) Filter Wheel	REDFLTR_I+	JH2-9
AGND (I-)	P1-A6	Red (CH1) Filter Wheel	REDFLTR_AGND	JH2-10
CH3_VIN+	P1-C7	Red (CH1) Filter Wheel	REDFLTR_V+	JH2-11
CH3_VIN-	P1-A7	Red (CH1) Filter Wheel	REDFLTR_V-	JH2-12
CH4_I+	P1-C8	Blue (Ch2) Filter Wheel	BLUEFLTR_I+	JH2-13
AGND (I-)	P1-A8	Blue (Ch2) Filter Wheel	BLUEFLTR_AGND	JH2-14
CH4_VIN+	P1-C9	Blue (Ch2) Filter Wheel	BLUEFLTR_V+	JH2-15
CH4_VIN-	P1-A9	Blue (Ch2) Filter Wheel	BLUEFLTR_V-	JH2-16
CH5_I+	P1-C10	Pupil Imager Wheel	PUPILIMG_I+	JH2-17
AGND (I-)	P1-A10	Pupil Imager Wheel	PUPILIMG_AGND	JH2-18
CH5_VIN+	P1-C11	Pupil Imager Wheel	PUPILIMG_V+	JH2-19
CH5_VIN-	P1-A11	Pupil Imager Wheel	PUPILIMG_V-	JH2-20
CH6_I+	P1-C12	Focal Plane Mask Wheel	FPMASK_I+	JH2-21
AGND (I-)	P1-A12	Focal Plane Mask Wheel	FPMASK_AGND	JH2-22
CH6_VIN+	P1-C13	Focal Plane Mask Wheel	FPMASK_V+	JH2-23
CH6_VIN-	P1-A13	Focal Plane Mask Wheel	FPMASK_V-	JH2-24
CH7_I+	P1-C14	Spider Mask Rotator	SPIDERMASK_I+	JH1-1
AGND (I-)	P1-A14	Spider Mask Rotator	SPIDERMASK_AGND	JH1-2
CH7_VIN+	P1-C15	Spider Mask Rotator	SPIDERMASK_V+	JH1-3
CH7_VIN-	P1-A15	Spider Mask Rotator	SPIDERMASK_V-	JH1-4
CH8_I+	P1-C16	Spare	-	-
AGND (I-)	P1-A16	Spare	-	-
CH8_VIN+	P1-C17	Spare	-	-
CH8_VIN-	P1-A17	Spare	-	-

Figure 5 Hall Effect Sensor Interface and Pinout

6.3.2 Detent Detection Interface

The Hall Effect Board has a set of I/O signals that indicate detent (DET) detection for each of the 8 channels. NICI implements the detent detection on the CMP+ output signals of the Hall Effect Board. Each channel's DET signal is routed to both the mechanism in question and back to IC software via the Motor Control Cable. The 55-pin interface board listed in the table indicates the pinout for the signals to the Motor Control Cable.

H.E. Board I/O signal	H.E. Board Pin #	Connects to Hall Effect Sensor on:	Signal Name	55-Pin Interface Board Pin #
CH1_CMP+	P1-C18	Pupil Mask Wheel Motor & Motor Control Cable	PUPILMASK_I+	JH1-19
CH2_CMP+	P1-C20	Dichroic Wheel Motor & Motor Control Cable	PUPILMASK_AGND	JH1-20
CH3_CMP+	P1-C22	Red Filter Wheel Motor & Motor Control Cable	DICHROIC_AGND	JH1-21
CH4_CMP+	P1-C24	Blue Filter Wheel & Motor Control Cable	DICHROIC_AGND	JH1-22
CH5_CMP+	P1-C26	Pupil Imager Wheel Motor & Motor Control Cable	PUPILMASK_V+	JH1-23
CH6_CMP+	P1-C28	Focal Plane Mask Wheel Motor & Motor Control Cable	PUPILMASK_V-	JH1-24
CH7_CMP+	P1-C30	Spider Mask Rotator Motor & Motor Control Cable	DICHROIC_I+	JH1-25
CH8_CMP+	P1-C32	No connect. Spare.	-	No Connect.

6.3.3 Position Interface

The Hall Effect Board outputs an amplified Hall Effect Position signal, POS, for each of the sensor channels. They are routed through the Motor Control Cable to Instrument Control.

H.E. Board I/O signal	H.E. Board Pin #	Connects to Hall Effect Sensor on:	Signal Name	55-Pin Interface Board Pin #
CH1_CMP+	P1-C18	Pupil Mask Wheel Motor & Motor Control Cable	PUPILMASK_I+	JH2-1
CH2_CMP+	P1-C20	Dichroic Wheel Motor & Motor Control Cable	PUPILMASK_AGND	JH2-2
CH3_CMP+	P1-C22	Red Filter Wheel Motor & Motor Control Cable	DICHROIC_AGND	JH2-6
CH4_CMP+	P1-C24	Blue Filter Wheel & Motor Control Cable	DICHROIC_AGND	JH2-6
CH5_CMP+	P1-C26	Pupil Imager Wheel Motor & Motor Control Cable	PUPILMASK_V+	JH2-3
CH6_CMP+	P1-C28	Focal Plane Mask Wheel Motor & Motor Control Cable	PUPILMASK_V-	JH2-4
CH7_CMP+	P1-C30	Spider Mask Rotator Motor & Motor Control Cable	DICHROIC_I+	JH2-5
CH8_CMP+	P1-C32	No connect. Spare.	-	No Connect.

7 Mechanical Specifications

- Dimensions of JBox
 - Elma Type 33.
 - Maximum poss. dimensions
 - 257.5 mm W x 240 mm D x 125 mm H
 - (10.14" W x 9.45" D x 4.92" H)
- Weight of all components and box.
 - each Sixnet component is about 8 lbs (mail from frank markowski 10/24)
 - 3.83"H x 4.75"W x 4.25"D

8 Grounding

Refer to the NICI Electronics System Document for grounding information...

9 Acronyms and Definitions

DET	Detent, a signal generated by the Hall Effect Sensor Preamplifier Board.
GND	Electrical ground
IC	Instrument Control, NICI's Instrument Control rack, Rack1.
JBOX	Junction Box, a utility box primarily for interfacing with NICI's mechanisms.
MKIR	Mauna Kea Infrared
SM	Animatics SmartMotor
UBox	The Mechanism Utility Box.