Next Generation Adaptive Optics System

Laser to Safety System Interface

(Draft)

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VersionV1.0

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REVISION HISTORY

Revision	Date	Author (s)	Reason for revision / remarks
1.0	February 11, 2009	JC	Initial release

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1 INTRODUCTION

The laser system(s) shall be procured from an outside contractor for the NGAO project. For personnel and equipment safety, the laser system(s) shall operate with interlocks from the safety system. The safety system will be a Programmable Logic Controller with an electronics interface. Interlocking the laser system shall be done via this electronics interface. The safety system employs environmental sensors and receives commands from the control system to ensure both personnel and equipment is protected. This document specifies this interface between the laser system(s) and the safety system. For simplicity, the interface will be specified for a single laser. If there is more than one laser, each interface will be duplicated.

References

1.1 Referenced Documents

Documents referenced in the requirements are listed in Table 1. Copies of these documents may be obtained from the source listed in the table.

Ref. #	Document #	Revision or Effective Date	Source	Title
1	TBD	Version 1	WMKO	NGAO Safety System Requirement

Table 1: Reference Document.

1.2 Acronyms and Abbreviations

Table 2 defines the acronyms and abbreviations used in this document.

Acronym/Abbreviation	Definition
AO	Adaptive Optics
NGAO	Next Generation Adaptive Optics System
TBD	To Be Determined
TTL	Transistor-Transistor Logic
VDC	Volt Direct Current
WMKO	W.M.K. Observatory

Table 2: Acronyms and Abbreviations.

2 ELECTRONICS FORMAT

For signal integrity, each status or command will have two signals defined as signal high and its complement signal low. Signal high is represented as a "1" and signal low is represented by a "0". All signals will be TTL compatible. The differential state between the signals will determine the status or command. The maximum drain current of a TTL high will be 200mA.

The Safety System will employ compatible devices similar to the Allen Bradley input/output models: 1746-IG and 1746-OG. The appendix provides the signal formats for these modules.

Any indeterminate stats such as both the signal and its complement being high and or low will be an invalid state. When such a state occurs, the receiver of the signal will go into its failed safe state for that signal.

3 SIGNALS BETWEEN SAFETY SYSTEM AND LASER

The following table shows the expected signals and their definition between the laser safety system and the laser system:

#	Item	Direction	Description
1	5VDC Power and Ground	Laser to Safety System	Provides the voltage reference between the two systems.
2	Laser Status	Laser to Safety System	Informs safety system if laser is ON or OFF
3	Laser Fault Status	Laser to Safety System	Informs safety system if laser has faulted
4	Laser Shutter Status	Laser to Safety System	Informs safety system the status of the laser shutter
5	Laser Shutter Status Fault	Laser to Safety System	Informs the safety system the shutter has faulted
6	Laser Shutdown Command	Safety System to Laser	Commands the laser to shutdown
7	Laser Shutter Command	Safety System to Laser	Command the laser shutter to open

Table 3: Interface Signals

3.1 Laser Status

The laser is OFF when the *Laser Status*+ is high and the *Laser Status*- is low. The laser is ON when the *Laser Status*+ is low and the *Laser Status*- is high. All other states are invalid.

3.2 Laser Fault Status

The laser is faulted when the *Laser Fault*+ is high and the *Laser Fault*- is low. The laser not faulted when the *Laser Fault*+ is low and the *Laser Fault*- is high. All other states are invalid and considered faulted.

3.3 Laser Shutter Status

The laser shutter is opened when the *Laser Shutter*+ is high and the *Laser Shutter*- is low. The laser shutter is closed when the *Laser Shutter*+ is low and the *Laser Shutter*- is high. All other states are invalid.

3.4 Laser Shutter Fault Status

The laser shutter is faulted when the *Laser Shutter+* is high and the *Laser Shutter-* is low. The laser shutter is operational when the *Laser Shutter+* is low and the *Laser Shutter-* is high. All other states are invalid and considered faulted.

3.5 Laser Shutdown Command

The laser is commanded to shutdown when the *Laser Shutdown+* is high and the *Laser Shutdown-* is low. The laser is allowed to operate when the *Laser Shutdown+* is low and the *Laser Shutdown-* is high. All other states are invalid and the shutter must shutdown upon these states.

3.6 Laser Shutter Command

The laser is commanded to close its shutter when the *Laser Shutter+* is high and the *Laser Shutter-* is low. The laser is commanded to open its shutter when the *Laser Shutdown+* is low and the *Laser Shutdown-* is high. All other states are invalid and the shutter is to remain closed.

4 MECHANICAL FORMAT

The mechanical interface between the safety system and the laser system will b a MS3120F14-15S or equipment. The pin location is represented in the table below:

#	Item	Description
A	Shield	Overall shield for cable
B	5VDC	5VDC power
C	5VDC common	5VDC power reference
D	Laser Status	Informs safety system if laser is ON
E	Laser Status compliment	Informs safety system if laser is ON (compliment)
F	Laser Fault	Informs safety system the laser faulted
G	Laser Fault compliment	Informs safety system the laser faulted compliment
H	Laser Shutter Status	Informs safety system shutter status
J	Laser Shutter Status compliment	Informs safety system shutter status compliment
K	Laser Shutter Fault Status	Informs safety system shutter fault status
L	Laser Shutter Fault Status compliment	Informs safety system shutter fault status compliment
M	Laser Shutdown	Informs the laser to shutdown
N	Laser Shutdown compliment	Informs the laser to shutdown compliment
P	Laser Shutter Command	Informs the laser to open its shutter
R	Laser Shutter Command	Informs the laser to open its shutter compliment

	compliment	

Table 4: Mechanical Interface and Pin-out

5 APPENDIX: ALLEN BRADLEY MODULES

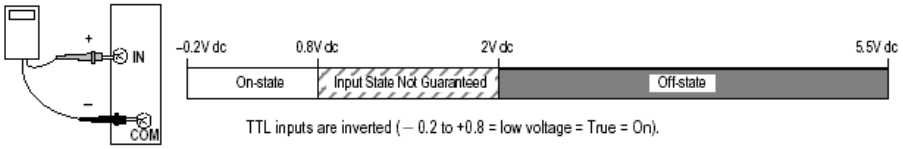
Sourcing TTL Input Module (1746-IG16)

Specification		Catalog Number 1746-IG16 (RTB)
Voltage Category		5V dc TTL source
Operating Voltage		4.5 to 5.5V dc source 50 mV peak-to-peak ripple max.
Number of Inputs		16
Points per Common		16
Backplane Current Draw	5V	0.140A
	24V	0.0A
Signal Delay (max.)		on = 0.25 ms off = 0.50 ms
Off-State Voltage (max.)		2.0V dc ①
Off-State Current (max.)		4.1 mA
Nominal Input Current		3.7 mA at 5V dc

① TTL inputs are inverted (–0.2 to +0.8 = low voltage = True = on). Use a NOT instruction in your program to convert to traditional True = High logic.

RTB = Removable Terminal Block.

On/Off-State Voltage Range



(Measure voltage from common terminal to input terminal.)

TTL inputs are inverted (– 0.2 to +0.8 = low voltage = True = On).

Circuit and Wiring Diagrams

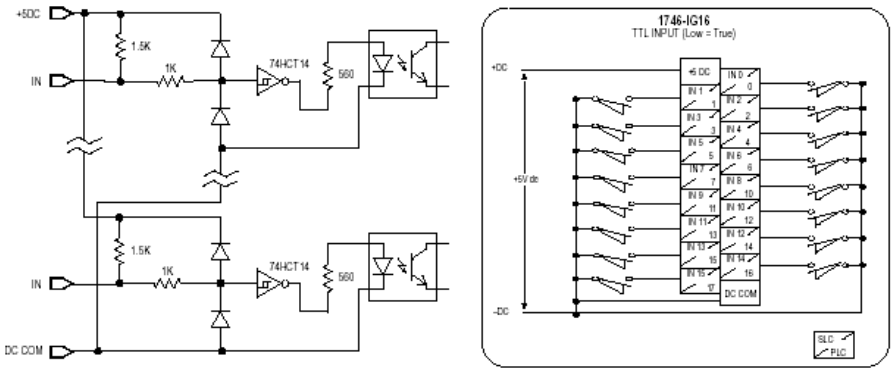


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Figure 1: Allen Bradley 1746-IG16 Input Module

Sinking TTL Output Module (1746-OG16)

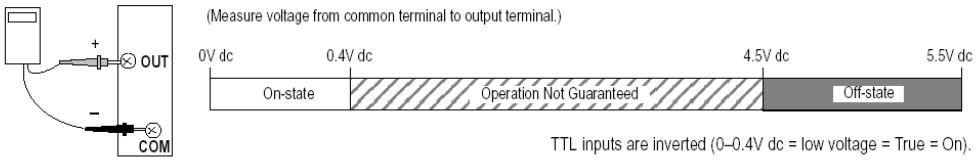
Specification		Catalog Number 1746-OG16 (RTB)
Voltage Category		5V dc TTL ①
Operating Voltage Range		4.5 to 5.5V dc 50 mV peak-to-peak ripple maximum 495 MA maximum at 5V dc
Number of Outputs		16
Points per Common		16
Backplane Current Draw	5V	0.180A
	24V	0.0A
Signal Delay (max.) (Resistive Load)		on = 0.25 ms / off = 0.5 ms
Off-State Leakage (max.)		0.1 mA
Load Current (min.)		0.15 mA
Continuous Current (max.)		24 mA

① TTL outputs are inverted (0–0.4V dc = low voltage = True = On). Use a NOT instruction in your ladder program to convert to traditional True = High logic.

RTB = Removable Terminal Block.

NA = not applicable.

On/Off-State Voltage Range



Circuit and Wiring Diagrams

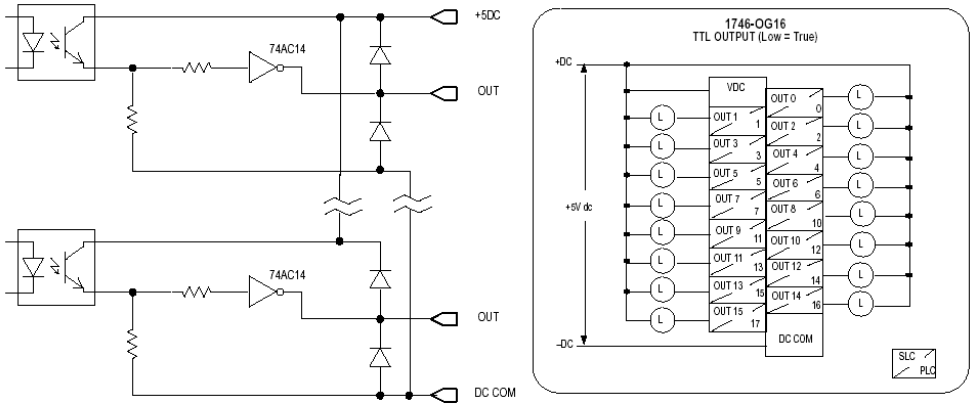


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Figure 2: Allen Bradley 1746-OG16 Module