

**APOLLO G&N Specification**  
PS 2003140 CM  
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PROCUREMENT SPECIFICATION

FOR

PRODUCT CONFIGURATION AND ACCEPTANCE TEST REQUIREMENTS

ROPE DRIVER MODULE (B16-B17)

DRAWING NO. 2003140

Record of Revisions

Date	Revision Letter	TDRR No.	Pages Revised	Approvals	
				MIT	NASA
M 7-1-66	A	30751	1, 1, 2, 0, 12, 13, 17	✓✓ FA	✓✓ FA
M 8/25/66	B	30752	1, 13	✓✓ FA	✓✓ FA
M 12/15/66	C	32345	1, 2, 10, 13	✓✓ FA	✓✓ FA
M 1/5/67	D	3-563	1 & 2	✓✓ FA	✓✓ FA
M 3-9-67	E	3-950	1, 2, 10, 13	✓✓ FA	✓✓ FA
M 3-8-67	F	33140	1, 7	✓✓ FA	✓✓ FA
M 4-17-67	G	33435	1, 10, 13	✓✓ FA	✓✓ FA
M 4-6-67	H	33542	1, 14, 18	✓✓ FA	✓✓ FA

This specification consists of pages 1 to 18 inclusive.

APPROVALS	A. C. METZGER NASA/MSC	E C Hall 6/1/66	M W Murphy 6-1-66	R. Price 5-21-66	P. DeLooff May 4, 1966 R. DeLooff 5/16/66
			MIT/IL		RAY

**1. SCOPE**

This specification establishes the detail requirements for complete identification and acceptance of the Rope Driver Module Part No. 2003140-011 and 2003140-021.

**2. APPLICABLE DOCUMENTS**

The following documents form a part of this specification to the extent specified herein.

**2.1 EFFECTIVE ISSUES.** Unless otherwise specified herein, Military and Government Standards and specifications shall be the issue in effect on the date of request for proposal or invitation to bid.

**SPECIFICATIONS**

**APOLO G&N**

ND 1002214

General Specification for Preservation, Packaging, Packing and Container Marking of APOLLO Guidance and Navigation Major Assemblies, Assemblies, Subassemblies, Parts and Associated Ground Support Equipment.

**DRAWINGS**

**APOLO G&N**

2003140

**ROPE DRIVER MODULE (B16-B17)**

Copies of Specifications, Standards, Drawings, Bulletins and Publications required by suppliers in connection with specific procurement functions should be obtained from the Procuring Activity or as directed by the Contracting Officer.

**2.2 CONFLICTING REQUIREMENTS.** In the event of conflict between the requirements of the contract, this Specification and the documents listed in this section, the following order of precedence shall apply and the contractor shall notify MIT Apollo Management of the conflict as soon as it is determined.

- a. The contract
- b. This Specification
- c. Documents listed in this section

### 3.1.4 (Resistance (Cont'd))

- c. The resistance between the following pin pairs shall be  $200 \pm 4.0$  ohms.

<u>Pins</u>	<u>Pins</u>	<u>Pins</u>
130 to 230	219 to 119	143 to 243
129 to 229	220 to 120	142 to 242
128 to 228	221 to 121	141 to 241

- d. The resistance and polarity for the following pin pairs shall be as follows:

<u>Pin</u>	<u>Pin</u>	
+	-	
138	140	not more than $300 \pm 100$ ohms at $11.5 \pm 4.5$ ma
131	135	not more than $300 \pm 100$ ohms at $11.5 \pm 4.5$ ma
140	138	not less than 10 megohms at 6 volts
135	131	not less than 10 megohms at 6 volts

### 3.1.3 Capacitance. The following values shall apply:

- a. The capacitance between the following pin pairs shall be  $6.8 \pm 1.0$  uf.

<u>Pins</u>	<u>Pins</u>	<u>Pins</u>
165 to 267	154 to 256	239 to 111
267 to 265	256 to 254	240 to 111

- b. The capacitance between the following pin pairs shall be  $20.4 \pm 2.0$  uf.

<u>Pins</u>
202 to 101
203 to 101
204 to 101

- c. The capacitance between pins 103 and 225 shall be 1 uf  $\pm 15\%$ .

### 3.1.5 Inductance. The following values shall apply:

- a. The inductance between the following pin pairs shall be  $8.2 \pm 2.0$  uh.

<u>Pins</u>	<u>Pins</u>
165 to 267	255 to 256
266 to 267	239 to 111
154 to 256	240 to 111

3.1.9. Inhibit Drivers. The input and output signals shall conform to the characteristics specified in table 3-3 and figure 3-2.

Table 3-3

Characteristic	Input at pin A	Output at pin B
Level ( $A_1$ ) high	$2.10 \pm 0.25$ volts	----
Level ( $A_2$ ) low	$0.8 \pm 0.1$ volt	2.0 ma max
Amplitude (A)	-----	$225 \pm 5$ ma*
Rise Time ( $T_r$ )	100 nsec max	$700 \pm 250$ ns
Fall Time ( $T_f$ )	100 nsec max	----
Pulse Width (PW)	3 usec $\pm 5\%$	----
Period (T)	16 usec $\pm 5\%$	----
Time Delay ( $T_d$ )	-----	0.5 usec max
$T_{off}$	-----	1.0 usec max

\* At 25°C.

**3.1.10 Set and Reset Drivers.** The input and output waveforms shall comply with Table 3-4 and Figure 3-2 with the output measured across the output load resistor. The amplitude (A) limits specified herein have been established for an ambient temperature of 25°C.

Table 3-4

Parameters	Input	Output
Level ( $A_2$ ) low	$0.8 \pm 0.1$ volts	$2.0$ ms, max
Level ( $A_1$ ) high	$2.1 \pm 0.25$ volts	-----
Amplitude (A)	-----	$450 \pm 5$ ms *
Rise Time ( $T_r$ )	100 nsec max	$0.60 \pm 0.2$ usec
Fall Time ( $T_f$ )	100 nsec max	-----
Pulse Width (PW)	$4$ usec $\pm 5\%$	-----
Period (T)	$16$ usec $\pm 5\%$	-----
TD	-----	200 nsec max and 50 nsec min.
T OFF	-----	$0.90$ usec max.

\* at 25°C

3.1.11 Clear Driver. The input and output waveforms shall comply with Table 3-5 and Figure 3-2 with the output measured across the output load resistor. The amplitude (A) limit has been established for an ambient temperature of 25°C.

Table 3-5

Parameter	Input	Output
Level ( $A_2$ ) low	$0.6 \pm 0.1$ volt	2.0 ms, max
Level ( $A_1$ ) high	$2.1 \pm 0.25$ volts	-----
Amplitude (A)	-----	$350 \pm 5$ ms*
Rise Time ( $T_r$ )	100 nsec max	$1.9 \pm 0.5$ microsec -0.3 usec.
Fall Time ( $T_f$ )	100 nsec max	-----
Pulse Width (PW)	4 usec $\pm$ 5%	-----
Period (T)	32 usec $\pm$ 5%	-----
TD	-----	0.20 usec max
T OFF	-----	1.75 usec max

\* at 25°C

**3.1.12 Rope Gates.** The input and output pulse characteristics shall comply with Table 3-6 and Figure 3-3. The output pulse shall be measured across output load resistor.

Table 3-6

Parameter	Input	Output
Level ( $A_2$ ) low	1.5 volts max	0.1 volts max
Level ( $A_1$ ) high	0.1 volt below B+ max	1.5 volts below B+ max
Rise Time ( $T_r$ )	0.2 usec max	-----
Fall Time ( $T_f$ )	0.2 usec max	-----
Pulse Width (PW)	8 usec $\pm$ 5%	-----
Period (T)	16 usec $\pm$ 5%	-----
T ON	-----	0.6 usec max
T OFF	-----	1.5 usec max

3.1.13 Marginal Voltage and Temperature Extremes. The module shall perform as described in paragraphs 3.1.8 through 3.1.12 under each of the two combinations (temperature and input voltage) of operating extremes.

3.1.13.1 Low Operating Extreme:

- a. Voltage:  $4.8 \pm 0.1$  vdc and  $12.2 \pm 0.1$  vdc
- b. Temperature:  $-10^{\circ}\text{C}$   $-2.8^{\circ}\text{C}$

Under the low operating extremes the following output (amplitude A) deviations shall apply:

<u>Set and Reset Driver</u>	<u>Clear Driver</u>	<u>Inhibit Driver</u>
Amplitude A = $475 \pm 15$ ma	Amplitude A = $350 \pm 15$ ma	Amplitude A = $220 \pm 10$ ma
Tr $0.6 \pm 0.3$		
$-0.2$		

3.1.13.2 High Operating Extreme

- a. Voltage:  $3.4 \pm 0.1$  vdc and  $16.5 \pm 0.1$  vdc
- b. Temperature:  $70^{\circ}\text{C}$   $-0^{\circ}\text{C}$

Under the high operating extreme the following output (amplitude A) deviations shall apply.

<u>Set and Reset Driver</u>	<u>Clear Driver</u>	<u>Inhibit Driver</u>
Amplitude A = $425 \pm 15$ ma	Amplitude A = $350 \pm 15$ ma	Amplitude A = $225 \pm 10$ ma
Tr $1.3 \pm 0.6$		
$-0.3$ usec.		
T off NMT $1.9$ us		
<u>ROPE GATE:</u> A <sub>1</sub> NMT 1.8V below B+		

NOTE: Input high amplitudes will not be within the room temperature limits.

3.1.13.3 Inhibit and Clear Drivers Outputs Under Low Conditions. With input voltages of  $3.4 \pm 0.1$  vdc and  $16.5 \pm 0.1$  vdc and with an ambient temperature of  $+0^{\circ}\text{C}$   $-10^{\circ}\text{C}$   $-2.8^{\circ}\text{C}$  amplitude A for the inhibit drivers shall be  $255 \pm 10$  ma and for the clear drivers shall be  $370 \pm 15$  ma.

3.1.13.4 Inhibit and Clear Drivers Outputs Under High Conditions. With input voltages of  $4.8 \pm 0.1$  vdc and  $12.2 \pm 0.1$  vdc and in an ambient temperature of  $70^{\circ}\text{C}$  amplitude A for inhibit drivers shall be  $190 \pm 10$  ma and for the clear drivers shall be  $325 \pm 15$  ma.

3.1.14 Vibration. The module shall perform as specified in paragraphs 3.1.8 through 3.1.12 when installed in an operating computer which is being subjected to the vibration requirements specified in the applicable specifications for the computer subsystem. Acceptance criteria for the module shall be compliance of the computer subsystem with its applicable specifications.

**3.2 Product Configuration**

**3.2.1 Drawings.** The configuration of the assembly shall be in accordance with APOLLO G&N Drawing 2003140 and all drawings and engineering data referenced thereon.

**3.2.2 Weight.** Maximum allowable weight of the assembly shall be 0.70 pounds.

**4. QUALITY ASSURANCE PROVISION**

**4.1 GENERAL.** The contractor responsible for the manufacture of the assembly shall be responsible for the accomplishment of each test required herein. A cross reference index of module requirements (section 3) and verification tests for these requirements (section 4) is provided in Table 4-1.

Table 4-1 Cross Reference Index

Requirement (Section 3)	Verification (Section 4)
3.1.1	4.2.2
3.1.2	4.2.3.1
3.1.3	4.2.3.2
3.1.4	4.2.3.3
3.1.5	4.2.3.4
3.1.6	4.2.3.5
3.1.7	4.1.3
3.1.8	4.2.4.2
3.1.9	4.2.4.3
3.1.10	4.2.4.4
3.1.11	4.2.4.5
3.1.12	4.2.4.6
3.1.13	4.3.1
3.1.14	4.3.2
3.2.1	4.2.1
3.2.2	4.2.5

#### 4.2.4 Dynamic Tests

4.2.4.1 Test Conditions. The input pulses shall be applied to the module from a micrologic as specified in figure 4-1. The following conditions shall be maintained throughout dynamic tests unless otherwise specified. The input DC levels shall be adjusted before applying power to the module.

- a. Pins 169, 101, 103, 111, 218, 235, 254, 259, and 265 shall be connected to ground (0 VDC).
- b. Pins 102, 154, 165, 239 and 240 shall be connected to  $14.0 \pm 0.1$  VDC (high B+).
- c. Pins 255 and 266 shall be connected to  $4.0 \pm 0.1$  VDC (low B+).

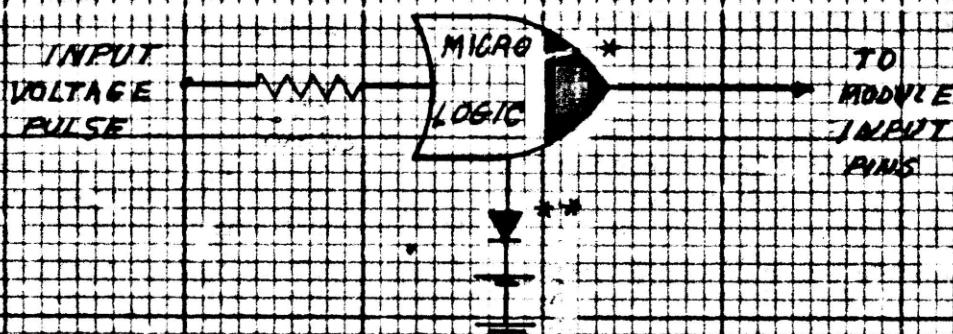
4.2.4.2 Inhibit Gates. Verify that the input and output waveforms complies with paragraph 3.1.8. The input shall be applied to pin 249. The output shall be measured across a 50-ohm,  $\pm 5\%$ , loading resistor connected between pin 244 and 0 VDC. Pins 104, 125, 224 and 212 shall be terminated to not more than 0.9 vdc. Inputs shall be terminated to not more than 0.9 vdc when not being used.

4.2.4.3 Inhibit Drivers. Verify that the input and output waveforms complies with paragraph 3.1.9. See table 4-2 for input and output pin relationships and for pin A and B locations. The following connections shall be made.

- a. Pins 104, 125, 224 and 212 shall be grounded.
- b. Connect pin 260 to a potential of  $1.7 \pm 0.2$  volts below B+ high.
- c. Connect 10- ohm  $\pm 0.1\%$  load resistors between pin B (see table 4-2) and B+ (high).

Table 4-2 Input-Output Pin Relationship

Pin A Input	Pin B Output
269	169
167	268
263	162
160	262
258	157
156	257
251	152
151	250



\*\* MICROLOGIC PART NO. 1006326 OR EQUIVALENT  
\*\* DIODE PART NO. 100675V OR EQUIVALENT

FIGURE 8-1 INPUT MICROLOGIC

4.2.4.4 Set and Reset Drivers. Verify that the input and output waveforms complies with paragraph 3.1.10. The input waveforms shall be applied to pins 125, 212 and 224. The outputs shall be measured across 10-ohm  $\pm$  0.1% load resistor connected between the output pins (108, 123 and 227) and B+ (high). The input pins shall be returned to not more than 0.9 vdc when no input pulse is being applied.

4.2.4.5 Clear Driver. Verify that the input and output pulses complies with paragraph 3.1.11. The input shall be applied to pin 104. The output shall be measured across 10-ohm  $\pm$  0.1% resistors connected from the output pins (206 and 207) and high B+. Inputs shall be terminated to not more than 0.9 vdc when not being tested.

4.2.4.6 Rope Gates. Verify that the input and output pulses complies with paragraph 3.1.12. The input pulses shall be applied to module pins 144, 137 and 213. The output measurements shall be made across the 31 ohms  $\pm$  1% load resistors connected between the output pins (237, 118, 149, 139, 127, 222, 113, 252 and 238) and ground. The input-output pin association is as follows:

149, 238 and 252 and associated with 144

113, 118 and 222 associated with 213

127, 139 and 237 associated with 137

4.2.5 Weight. Weigh the module to the nearest .01 pound. Verify that the weight does not exceed the maximum allowable weight specified in paragraph 3.2.2.

4.3 WORKMANSHIP. The following tests shall be performed under the conditions specified as a verification of good workmanship.

4.3.1 Marginal Voltage and Temperature Extremes. The module shall perform without degradation in performance when subjected to the temperature and voltage combinations specified in paragraph 3.1.13. There shall be an exception to the performance requirements in those instances (in section 3) where a specific ambient temperature of 25°C has been specified as a criteria for achieving the specified results. The module shall be subjected to the tests specified in paragraphs 4.2.4.2 through 4.2.4.6 in the high and low (voltage and temperature) environments. The module shall be exposed to its test temperature for at least 30 minutes prior to test.

4.3.2 Vibration. Install the module in an applicable computer. Subject the computer subsystem to the vibration tests specified in the applicable JDC. Verify that the computer subsystem meets the requirements of the applicable specification.

## 5. PREPARATION FOR DELIVERY

5.1 GENERAL. Preparation for delivery shall be in accordance with SPECIFICATION ND 1002214.

6. NOTES. None.