

NOTES: (G)

- DRAWING TO BE INTERPRETED IN ACCORDANCE WITH THE CURRENT REVISION OF ASME Y14.5.
  - THIS PART/PRODUCT IS TO BE MANUFACTURED WITH THE LATEST APPLICABLE REGULATIONS OF EC DIRECTIVES FOR THE RESTRICTION OF THE USE OF HAZARDOUS SUBSTANCES IN ELECTRICAL AND ELECTRONIC EQUIPMENT (ROHS), WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE) AND REGISTRATION, EVALUATION, AUTHORIZATION AND RESTRICTION OF CHEMICALS (REACH)
- ▲ LABEL TO INCLUDE:  
PART NUMBER  
"OTTO 21649"  
DATE CODE (YYYY)
- ▲ OUTPUTS ARE FROM THE CENTER TO THE FULL TRAVEL POSITION IN EACH DIRECTION.  
OPTIONS "AA", "BB", "CC", "DD", "EE", "FF" PROVIDE INCREASED VOLTAGE IN +X, +Y; AND DECREASING VOLTAGE IN -X, -Y DIRECTION FROM ONE OUTPUT PER AXIS.  
OPTIONS "GG" AND "HH" PROVIDE INCREASING VOLTAGES IN ALL DIRECTIONS (+X, +Y, -X, -Y) FROM 2 OUTPUTS PER AXIS.  
▲ OPTIONS "BB" AND "EE" PROVIDE REDUNDANT OUTPUT 2 WHICH DUPLICATES OUTPUT 1  
OPTIONS "CC" AND "FF" PROVIDE REDUNDANT OUTPUT 2 WHICH IS INVERSE OF OUTPUT 1  
▲ FULL BOOT VERSION SHOWN AS DEFAULT. SEE PAGE 4 FOR ALTERNATIVE SWITCH/BOOT STYLES.
- ▲ GATED IS RESTRICTED MOVEMENT IN Y AXIS ONLY.  
▲ USE N FOR FULL BOOT, Z-AXIS, & NO PUSHBUTTON OPTIONS.  
▲ 1-9 USED ONLY FOR PUSHBUTTON OPTIONS.  
NOT APPLICABLE IN Z-AXIS.

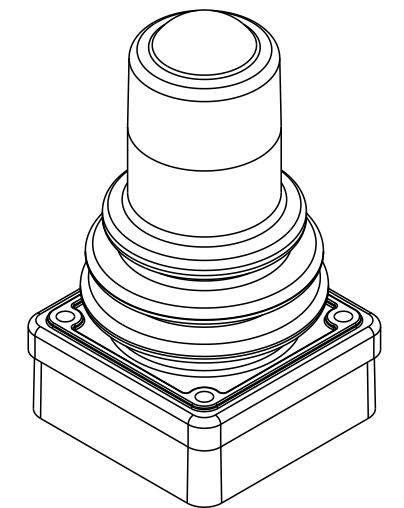
# (G) JHT-



REV	OCN #	DATE	APR
A	059022	20 DEC 10	DCF
B	061838	20 JUN 11	MRM
C	064410	06 JAN 12	MRM
D	064707	31 JAN 12	DCF
E	065360	30 MAR 12	DCF
F	070007	08 APR 13	KLW
G	070711	30 MAY 13	KLW



SUGGESTED PANEL OPENING  
MAX. PANEL THICKNESS OF 0.140



SCALE 4:5



WIRES NOT SHOWN IN ALL VIEWS FOR CLARITY

- MANUFACTURING
- SPC
- SPECIAL REQUIREMENT

UNLESS OTHERWISE SPECIFIED:  
DIMENSIONS ARE IN INCHES.  
TOLERANCES:  
.XX ±.03  
.XXX ±.010  
ANGLES ±2°  
DO NOT SCALE

**OTTO**  
CARPENTERSVILLE, ILLINOIS USA

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DESCRIPTION		JHT, LINEAR HALL EFFECT JOYSTICK	
DRWN. JLW	SIZE C	FSCM NO 21649	DRAWING NO. JHT-
CHKD. MRM			REV. G
APPD. AH			
THIRD ANGLE PROJECTION		Scale 3:2	Sheet 1 OF 4

PRODUCT SPECIFICATIONS				
<b>ELECTRICAL:</b>				
<b>JOYSTICK</b>				
RATED AT V <sub>cc</sub> = 5V @ 20° C LOAD = 1ma (4.7KΩ)	UNITS	MIN	TYP	MAX
SUPPLY VOLTAGE	VDC	4.50	5.00	5.50
OUTPUT VOLTAGE TOLERANCE AT CENTER (SEE APPROPRIATE GRAPH FOR OUTPUT VOLTAGES)	VDC @5V V <sub>cc</sub>	-25	N/A	+25
OUTPUT VOLTAGE TOLERANCE FULL TRAVEL (SEE APPROPRIATE GRAPH FOR OUTPUT VOLTAGES)	VDC @5V V <sub>cc</sub>	-25	N/A	+25
SUPPLY CURRENT PER OUTPUT B=0, V <sub>cc</sub> =5V, I <sub>o</sub> =0	mA	N/A	10	12
OUTPUT IMPEDANCE	kΩ	N/A	1.0	N/A
<b>P9</b>				
<b>SPST-NO-DB</b>				
<b>JOYSTICK Z AXIS RETURN TO CENTER</b>				
RATED AT V <sub>cc</sub> = 5V @ 20° C LOAD = 1ma (4.7KΩ)	UNITS	MIN	TYP	MAX
SUPPLY VOLTAGE	VDC	4.50	5.00	5.50
OUTPUT 1+2 VOLTAGE, +Z, -Z 0° DEFLECTION	VDC @5V V <sub>cc</sub>	2.25	2.50	2.75
OUTPUT 1+2 AT FULL TRAVEL +Z DIRECTION	VDC @5V V <sub>cc</sub>	4.25	4.50	4.55
OUTPUT 1+2 AT FULL TRAVEL -Z DIRECTION	VDC @5V V <sub>cc</sub>	0.45	0.50	0.75
SUPPLY CURRENT (PER SENSOR) B=0, V <sub>cc</sub> =5V, I <sub>o</sub> =0	mA	NA	NA	10
OUTPUT SOURCE CURRENT LIMIT B=-X*, V <sub>o</sub> =0	mA	-1.0	NA	1.0
<b>JOYSTICK Z AXIS FRICTION</b>				
RATED AT V <sub>cc</sub> = 5V @ 20° C LOAD = 1ma (4.7KΩ)	UNITS	MIN	TYP	MAX
SUPPLY VOLTAGE	VDC	4.50	5.00	5.50
OUTPUT 1+2 AT FULL TRAVEL +Z DIRECTION	VDC @5V V <sub>cc</sub>	4.25	4.50	4.55
OUTPUT 1+2 AT FULL TRAVEL -Z DIRECTION	VDC @5V V <sub>cc</sub>	0.45	0.50	0.75
SUPPLY CURRENT (PER SENSOR) B=0, V <sub>cc</sub> =5V, I <sub>o</sub> =0	mA	NA	NA	10
OUTPUT SOURCE CURRENT LIMIT B=-X*, V <sub>o</sub> =0	mA	-1.0	NA	1.0
<b>JOYSTICK Z AXIS 3 DETENT</b>				
RATED AT V <sub>cc</sub> = 5V @ 20° C LOAD = 1ma (4.7KΩ)	UNITS	MIN	TYP	MAX
SUPPLY VOLTAGE	VDC	4.50	5.00	5.50
OUTPUT 1+2 VOLTAGE, +Z, -Z 0° DEFLECTION	VDC @5V V <sub>cc</sub>	2.25	2.50	2.75
OUTPUT 1+2 AT FULL TRAVEL +Z DIRECTION	VDC @5V V <sub>cc</sub>	4.25	4.50	4.55
OUTPUT 1+2 AT FULL TRAVEL -Z DIRECTION	VDC @5V V <sub>cc</sub>	0.45	0.50	0.75
SUPPLY CURRENT (PER SENSOR) B=0, V <sub>cc</sub> =5V, I <sub>o</sub> =0	mA	NA	NA	10
OUTPUT SOURCE CURRENT LIMIT B=-X*, V <sub>o</sub> =0	mA	-1.0	NA	1.0
<b>MECHANICAL:</b>				
<b>JOYSTICK</b>				
MECHANICAL LIFE ALL DIRECTIONS		5,000,000 CYCLES		
TRAVEL ANGLE	DEGREES	18	20	22
OVER TRAVEL ANGLE	DEGREES	0.5	1.0	1.5
MAX ALLOWABLE RADIAL FORCE (STYLES 11, 12, & 21) @ GRP	LBS	N/A	N/A	50
MAX ALLOWABLE RADIAL FORCE (ALL OTHER STYLES) @ GRP	LBS	N/A	N/A	15
<b>P9</b>				
MECHANICAL LIFE		1,000,000 CYCLES		
OPERATING FORCE @ 20° C	OZ	8	12	16
<b>KEYPAD</b>				
MECHANICAL LIFE		1,000,000 CYCLES		
OPERATIONAL FORCE	OZ	2	4	6
<b>Z AXIS</b>				
MECHANICAL LIFE ALL DIRECTIONS		1,000,000 CYCLES		
TRAVEL ANGLE (TOTAL)	DEGREES	56	60	64
OPERATIONAL TORQUE WITH DETENT	IN-OZ	10	20	30
OPERATIONAL TORQUE WITH FRICTION HOLD	IN-OZ	1	4	7
OPERATIONAL TORQUE RETURN TO CENTER	IN-OZ	8	16	24
MAXIMUM ALLOWABLE ROTATIONAL TORQUE	IN-LBS	N/A	N/A	15
<b>ENVIRONMENTAL:</b>				
OPERATING TEMPERATURE	°C	-40	20	85
<b>KEYPAD</b>				
ELECTRONICS SEAL INTEGRITY	WATERTIGHT TO IP65			
<b>JOYSTICK</b>				
ELECTRONICS SEAL INTEGRITY	WATERTIGHT TO IP68S, 1 METER			
EMI/RFI WITHSTAND	PER SAE J1113 CONTACT FACTORY FOR DETAILS			
<b>MATERIAL:</b>				
HOUSING	THERMOPLASTIC, BLACK			
BELLOWS	SILICONE, BLACK			
HARDWARE	NOT PROVIDED			



**GENERAL SCHEMATIC**  
(WIRE BUNDLE 1)

ALL OUTPUTS ARE NOT PRESENT IN ALL CONFIGURATIONS



**PUSHBUTTON SCHEMATIC**  
(WIRE BUNDLE 2)

ALL WIRES ARE NOT PRESENT IN ALL CONFIGURATIONS



**Z AXIS SCHEMATIC**  
(WIRE BUNDLE 2)

ALL WIRES ARE NOT PRESENT IN ALL CONFIGURATIONS



**KEYPAD SCHEMATIC**  
(WIRE BUNDLE 2)

ALL WIRES ARE NOT PRESENT IN ALL CONFIGURATIONS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ARE AS LISTED. MUST BE FREE FROM BURRS AND SHARP EDGES	TOLERANCES	.XX ±.03	THIS DOCUMENT IS THE CONFIDENTIAL PROPERTY OF OTTO ENGINEERING, INC. IT IS NOT TO BE USED IN ANY WAY DETRIMENTAL TO THE INTERESTS OF OTTO ENGINEERING, INC..	DRWN. JLW	SIZE	FSCM NO	DRAWING NO.	REV.
	.XXX ±.010	CHKD. MRM		C	21649	JHT-_____	G	
	ANGLES ±2°	APPD. AH		THIRD ANGLE PROJECTION	Scale 1:1	Sheet 2 OF 4		

### OPTION AA

### OPTION BB

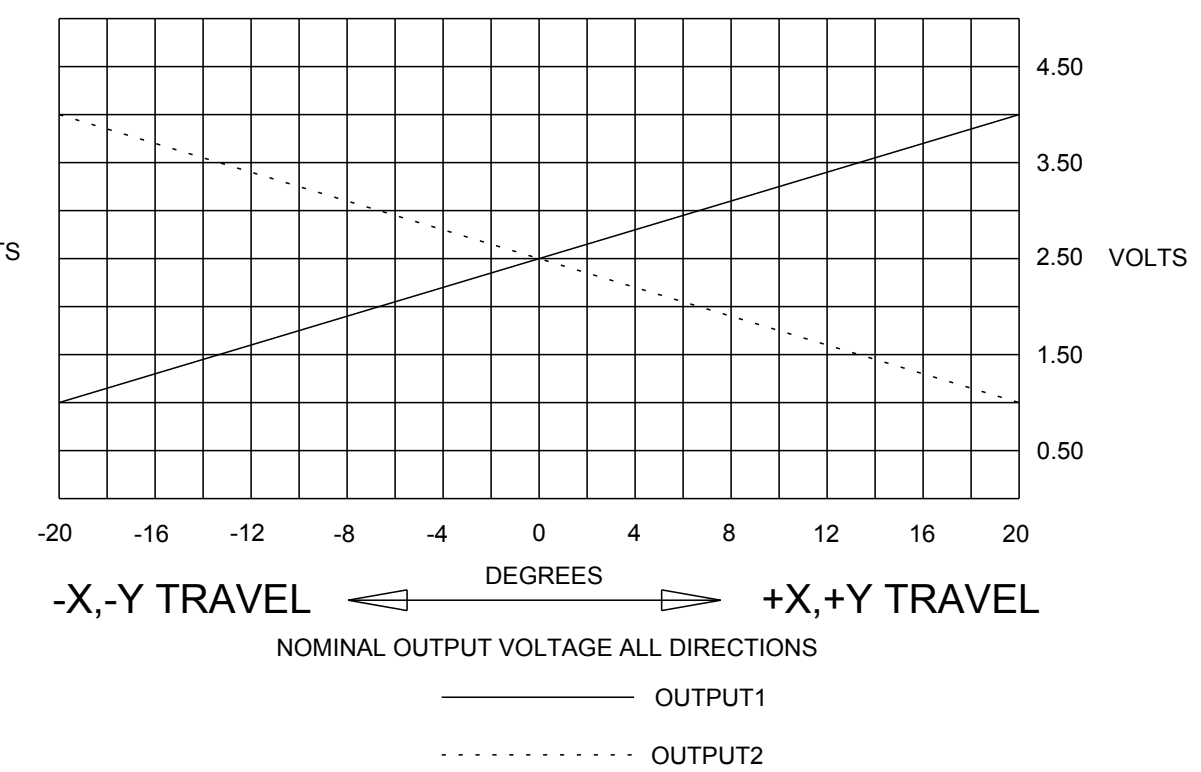
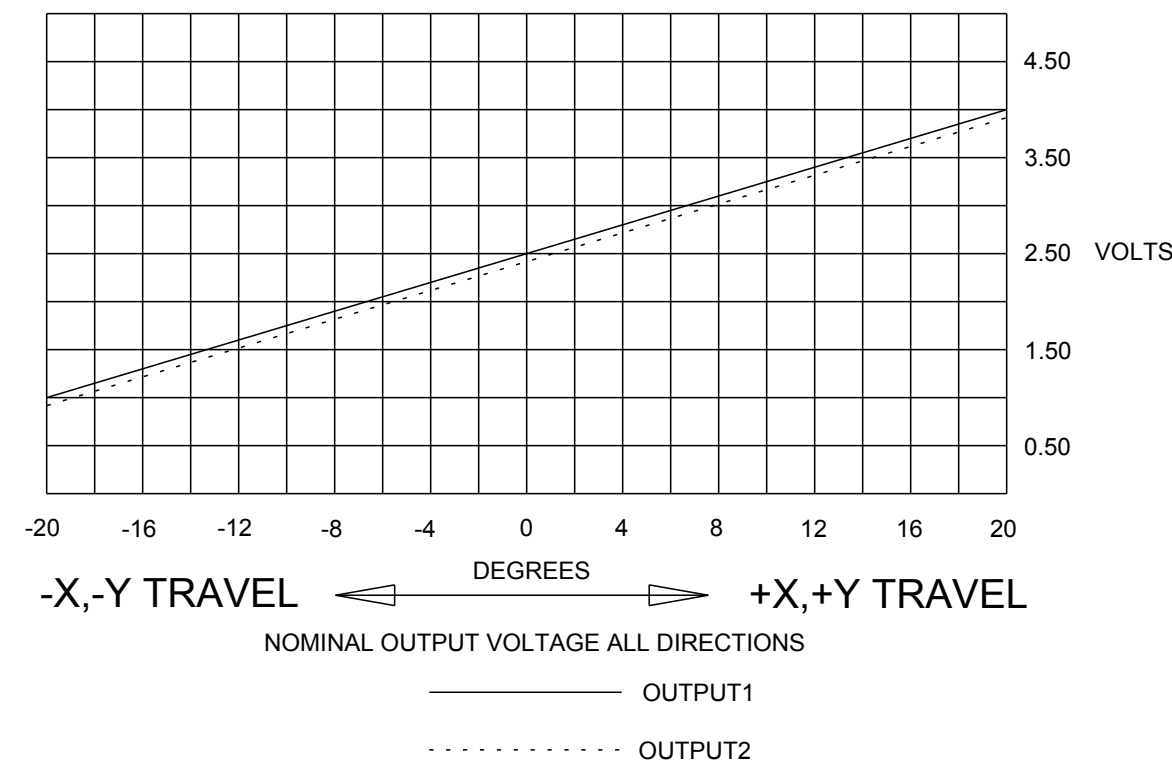
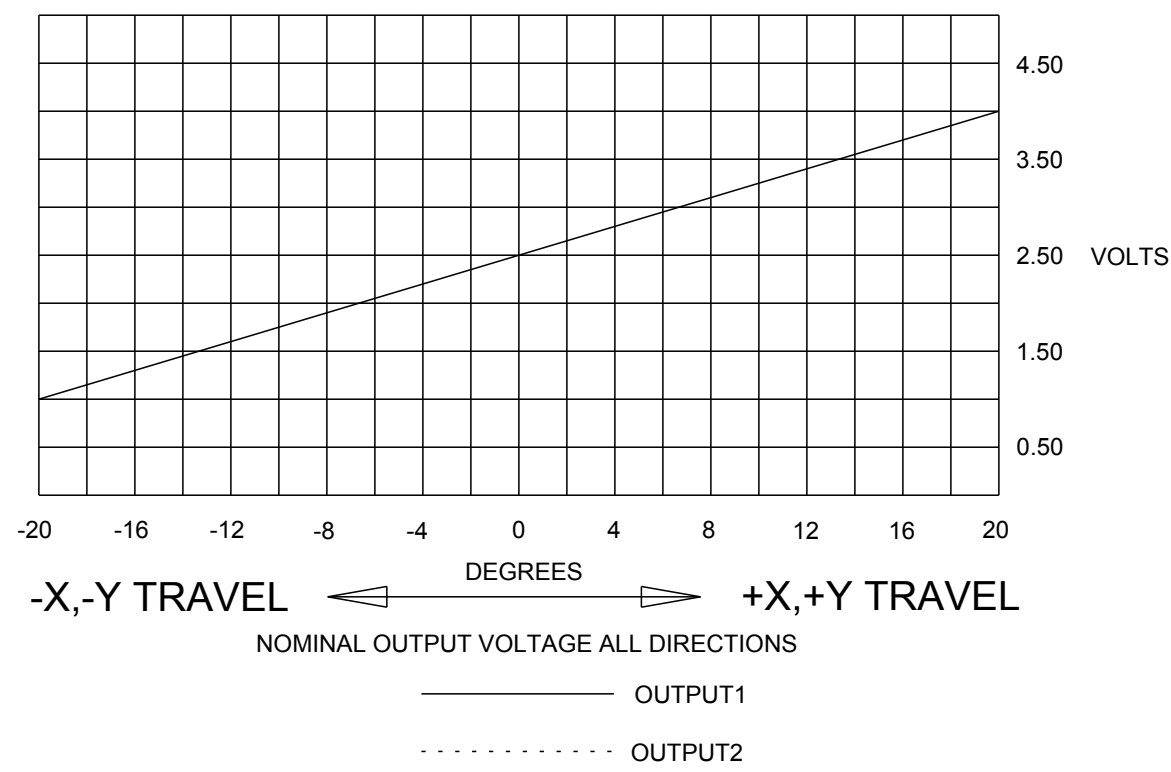
### OPTION CC



### OPTION DD

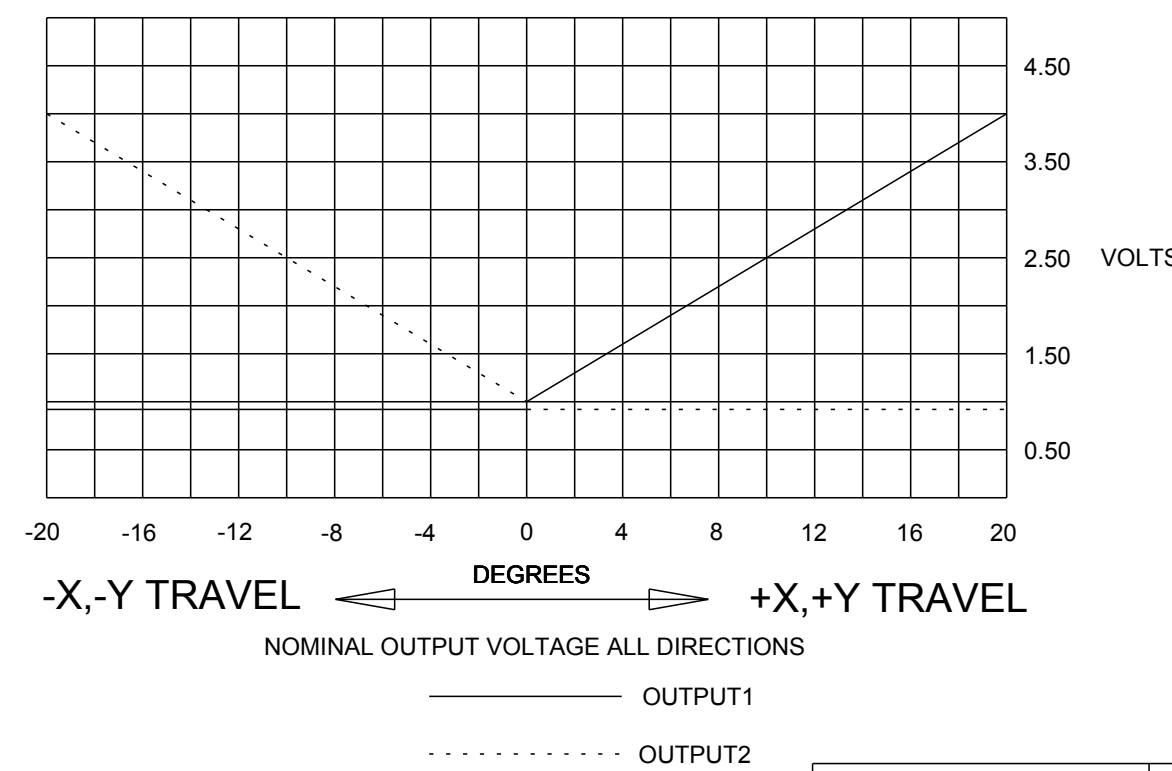
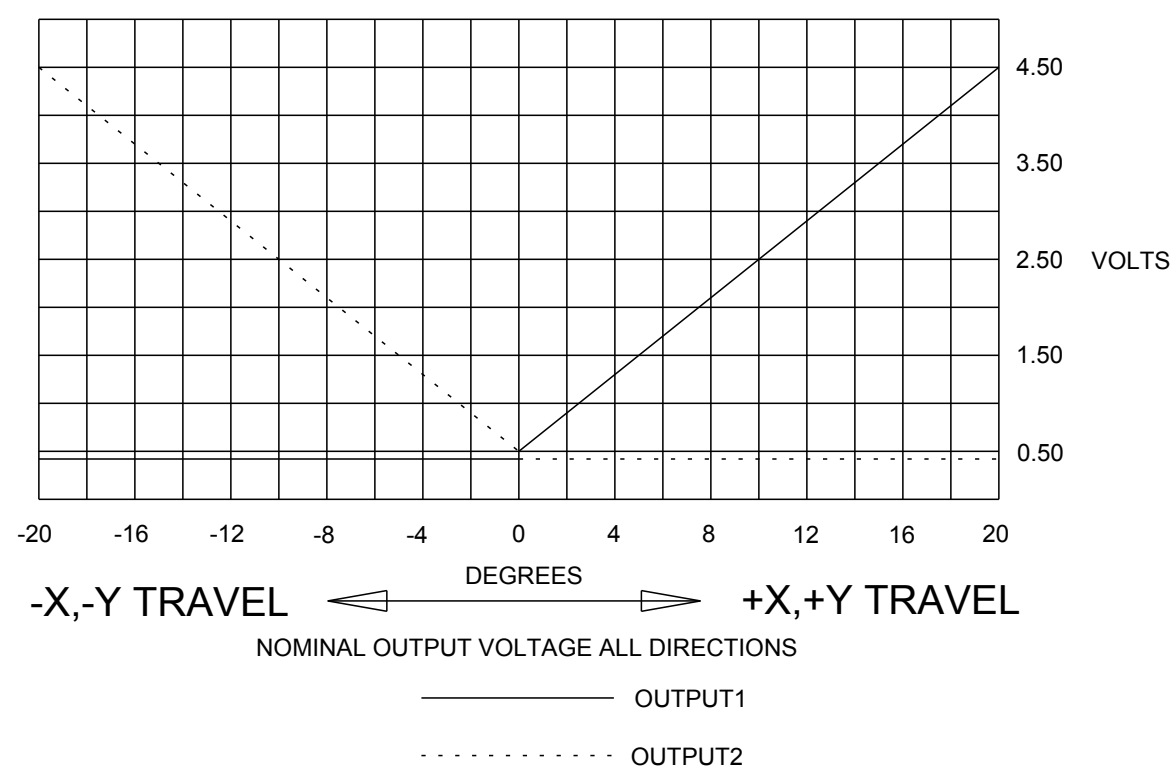
### OPTION EE

### OPTION FF



### OPTION GG

### OPTION HH



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AND SHARP EDGES

TOLERANCES  
.XX ±.03  
.XXX ±.010  
ANGLES ±2°  
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DRWN. JLW  
CHKD. MRM  
APPD. AH  
WT.

SIZE  
**C**

FSCM NO  
**21649**

DRAWING NO.  
**JHT-\_\_\_\_\_**

REV.  
**G**

THIRD ANGLE  
PROJECTION

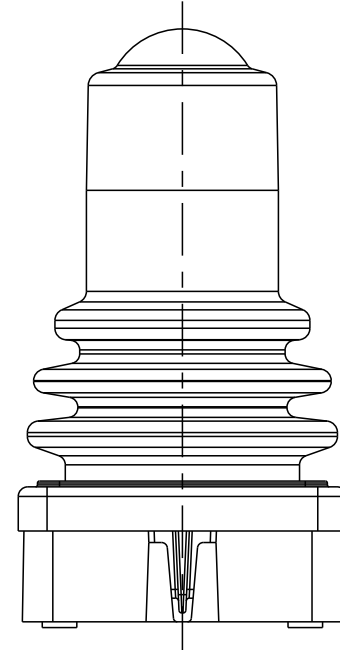
Scale 1:1

Sheet 3 OF 4

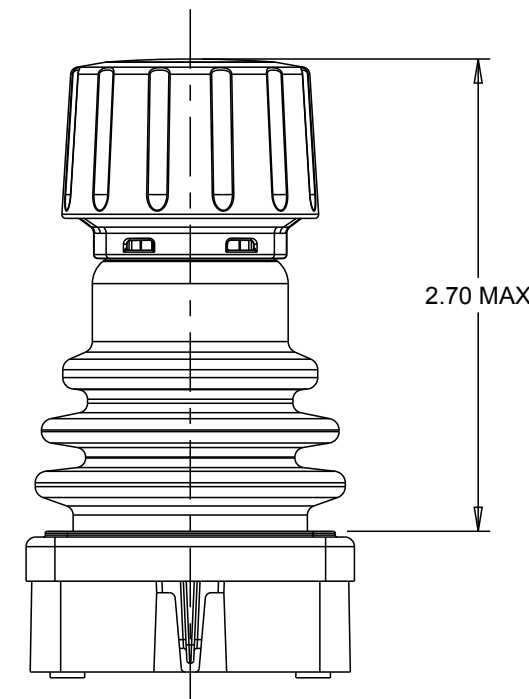


2.45 MAX

HALF BOOT

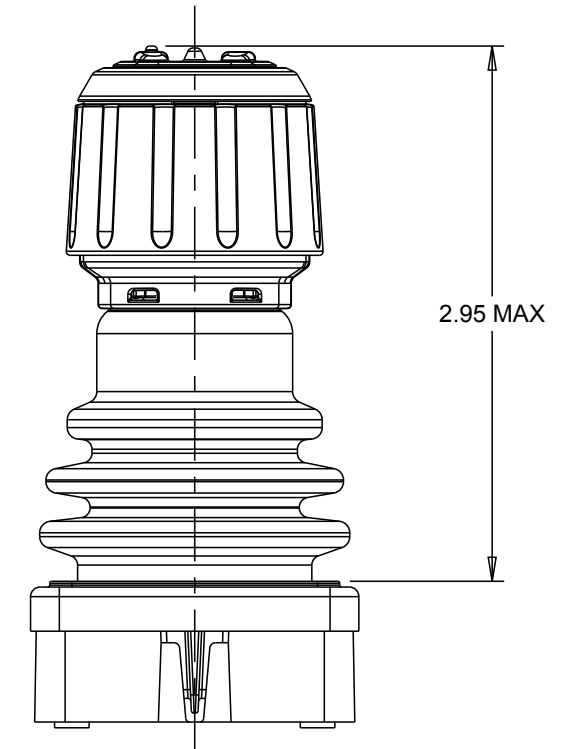


FULL BOOT



2.70 MAX

Z AXIS



2.95 MAX

Z AXIS WITH  
PUSHBUTTONS

SWITCH / STYLE BOOT CONFIGURATION

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.XX ±.03  
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THIRD ANGLE PROJECTION			Scale 1:1	Sheet 4 OF 4