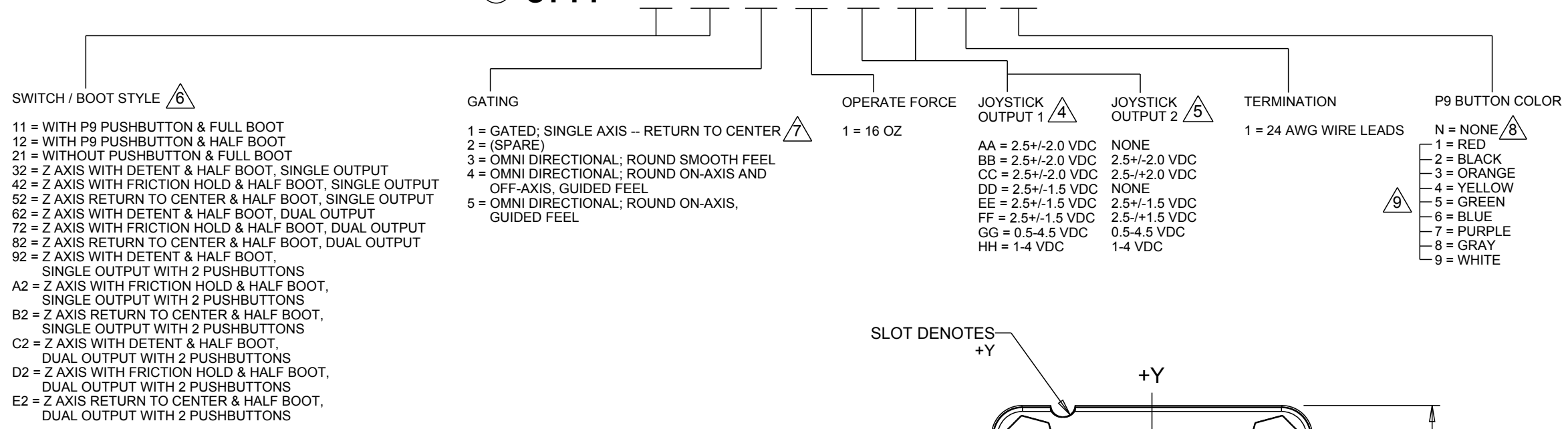


NOTES: (G)

- 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.

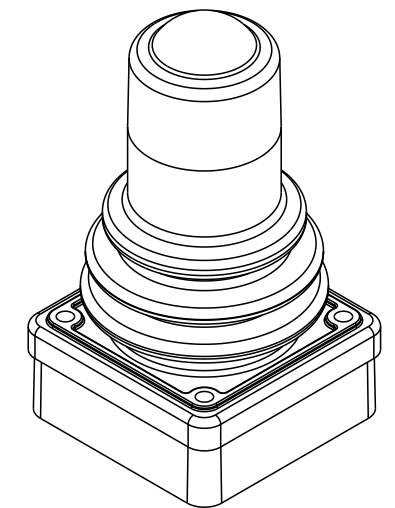
(G) JHT-



| 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 | | | Scale 3:2 |
| THIRD ANGLE PROJECTION | | Sheet 1 OF 4 | |

| PRODUCT SPECIFICATIONS | | | | |
|--|--|------------------|------|------|
| ELECTRICAL: | | | | |
| JOYSTICK | | | | |
| RATED AT V _{cc} = 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 _{cc} | -25 | N/A | +25 |
| OUTPUT VOLTAGE TOLERANCE FULL TRAVEL (SEE APPROPRIATE GRAPH FOR OUTPUT VOLTAGES) | VDC @5V V _{cc} | -25 | N/A | +25 |
| SUPPLY CURRENT PER OUTPUT B=0, V _{cc} =5V, I _o =0 | mA | N/A | 10 | 12 |
| OUTPUT IMPEDANCE | kΩ | N/A | 1.0 | N/A |
| P9 | | | | |
| SPST-NO-DB | | | | |
| JOYSTICK Z AXIS RETURN TO CENTER | | | | |
| RATED AT V _{cc} = 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 _{cc} | 2.25 | 2.50 | 2.75 |
| OUTPUT 1+2 AT FULL TRAVEL +Z DIRECTION | VDC @5V V _{cc} | 4.25 | 4.50 | 4.55 |
| OUTPUT 1+2 AT FULL TRAVEL -Z DIRECTION | VDC @5V V _{cc} | 0.45 | 0.50 | 0.75 |
| SUPPLY CURRENT (PER SENSOR) B=0, V _{cc} =5V, I _o =0 | mA | NA | NA | 10 |
| OUTPUT SOURCE CURRENT LIMIT B=-X*, V _o =0 | mA | -1.0 | NA | 1.0 |
| JOYSTICK Z AXIS FRICTION | | | | |
| RATED AT V _{cc} = 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 _{cc} | 4.25 | 4.50 | 4.55 |
| OUTPUT 1+2 AT FULL TRAVEL -Z DIRECTION | VDC @5V V _{cc} | 0.45 | 0.50 | 0.75 |
| SUPPLY CURRENT (PER SENSOR) B=0, V _{cc} =5V, I _o =0 | mA | NA | NA | 10 |
| OUTPUT SOURCE CURRENT LIMIT B=-X*, V _o =0 | mA | -1.0 | NA | 1.0 |
| JOYSTICK Z AXIS 3 DETENT | | | | |
| RATED AT V _{cc} = 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 _{cc} | 2.25 | 2.50 | 2.75 |
| OUTPUT 1+2 AT FULL TRAVEL +Z DIRECTION | VDC @5V V _{cc} | 4.25 | 4.50 | 4.55 |
| OUTPUT 1+2 AT FULL TRAVEL -Z DIRECTION | VDC @5V V _{cc} | 0.45 | 0.50 | 0.75 |
| SUPPLY CURRENT (PER SENSOR) B=0, V _{cc} =5V, I _o =0 | mA | NA | NA | 10 |
| OUTPUT SOURCE CURRENT LIMIT B=-X*, V _o =0 | mA | -1.0 | NA | 1.0 |
| MECHANICAL: | | | | |
| JOYSTICK | | | | |
| 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 |
| P9 | | | | |
| MECHANICAL LIFE | | 1,000,000 CYCLES | | |
| OPERATING FORCE @ 20° C | OZ | 8 | 12 | 16 |
| KEYPAD | | | | |
| MECHANICAL LIFE | | 1,000,000 CYCLES | | |
| OPERATIONAL FORCE | OZ | 2 | 4 | 6 |
| Z AXIS | | | | |
| 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 |
| ENVIRONMENTAL: | | | | |
| OPERATING TEMPERATURE | °C | -40 | 20 | 85 |
| KEYPAD | | | | |
| ELECTRONICS SEAL INTEGRITY | WATERTIGHT TO IP65 | | | |
| JOYSTICK | | | | |
| ELECTRONICS SEAL INTEGRITY | WATERTIGHT TO IP68S, 1 METER | | | |
| EMI/RFI WITHSTAND | PER SAE J1113 CONTACT FACTORY FOR DETAILS | | | |
| MATERIAL: | | | | |
| 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

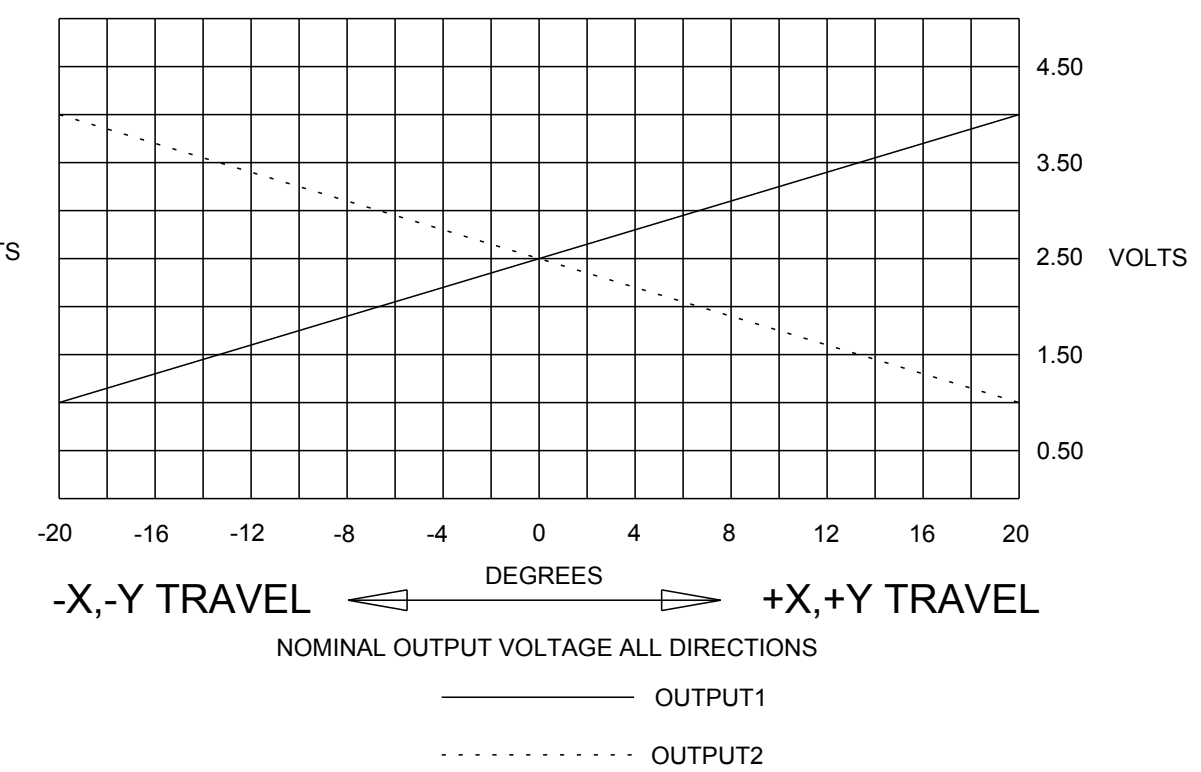
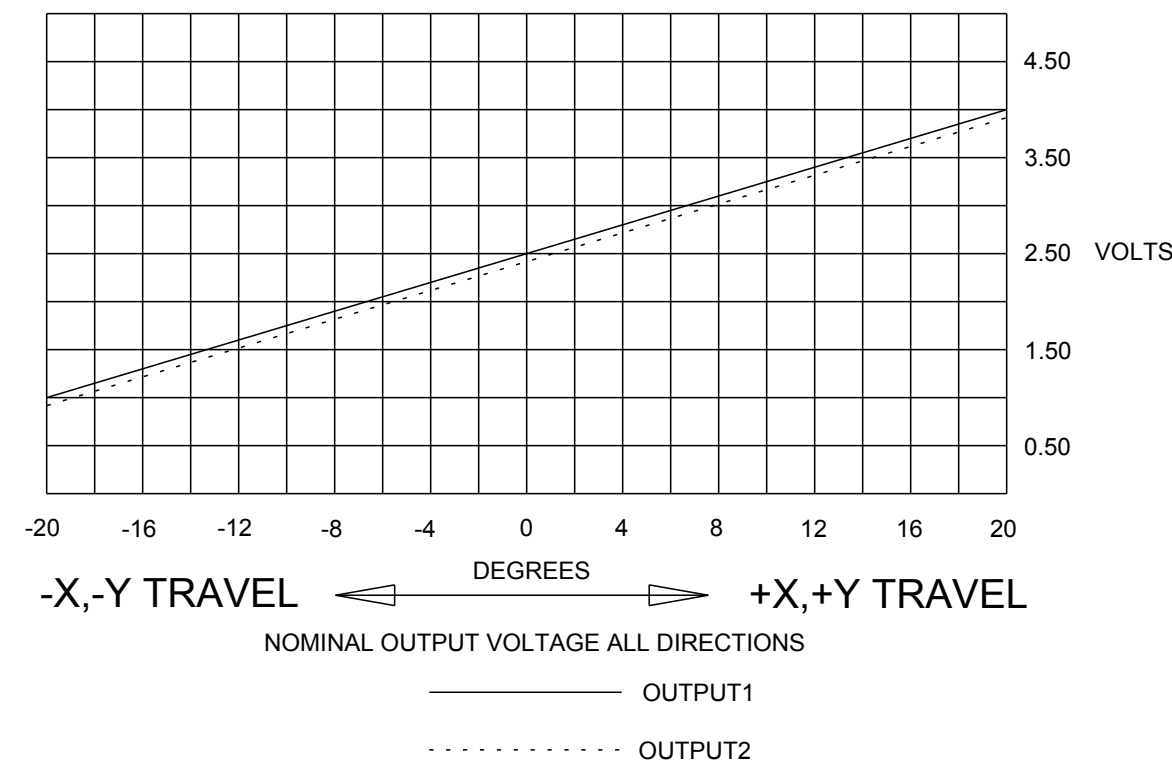
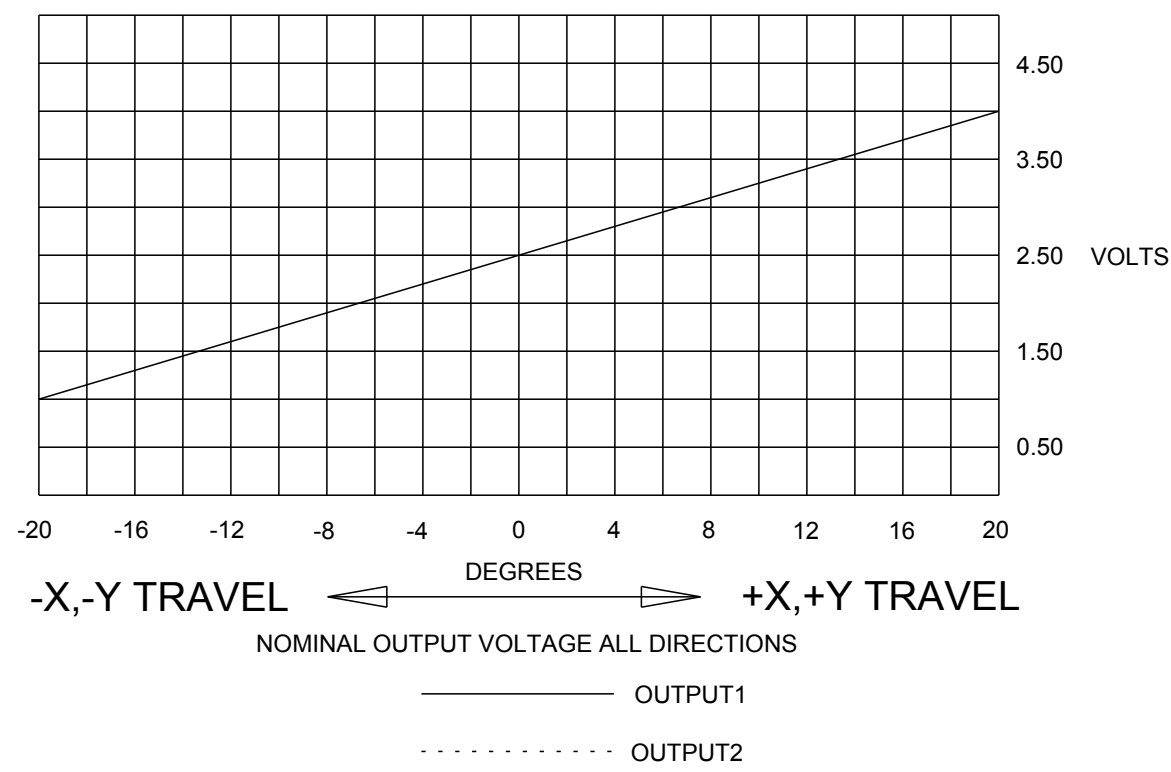
OPTION CC



OPTION DD

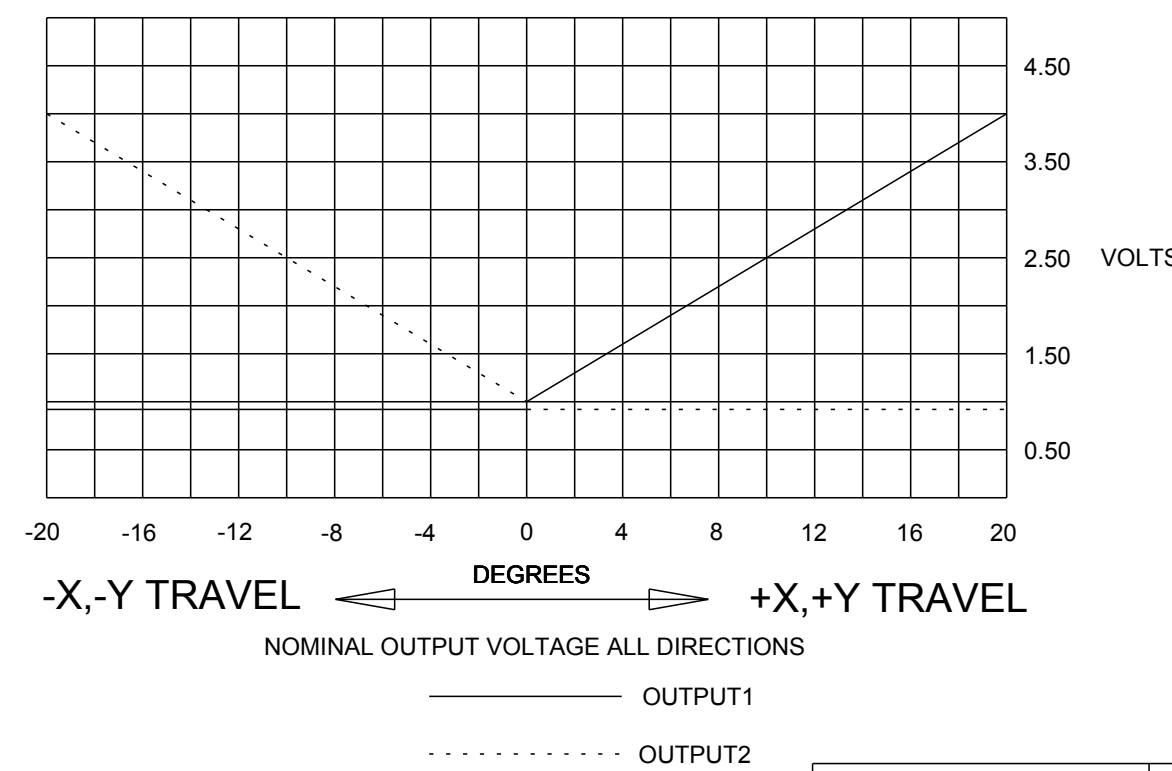
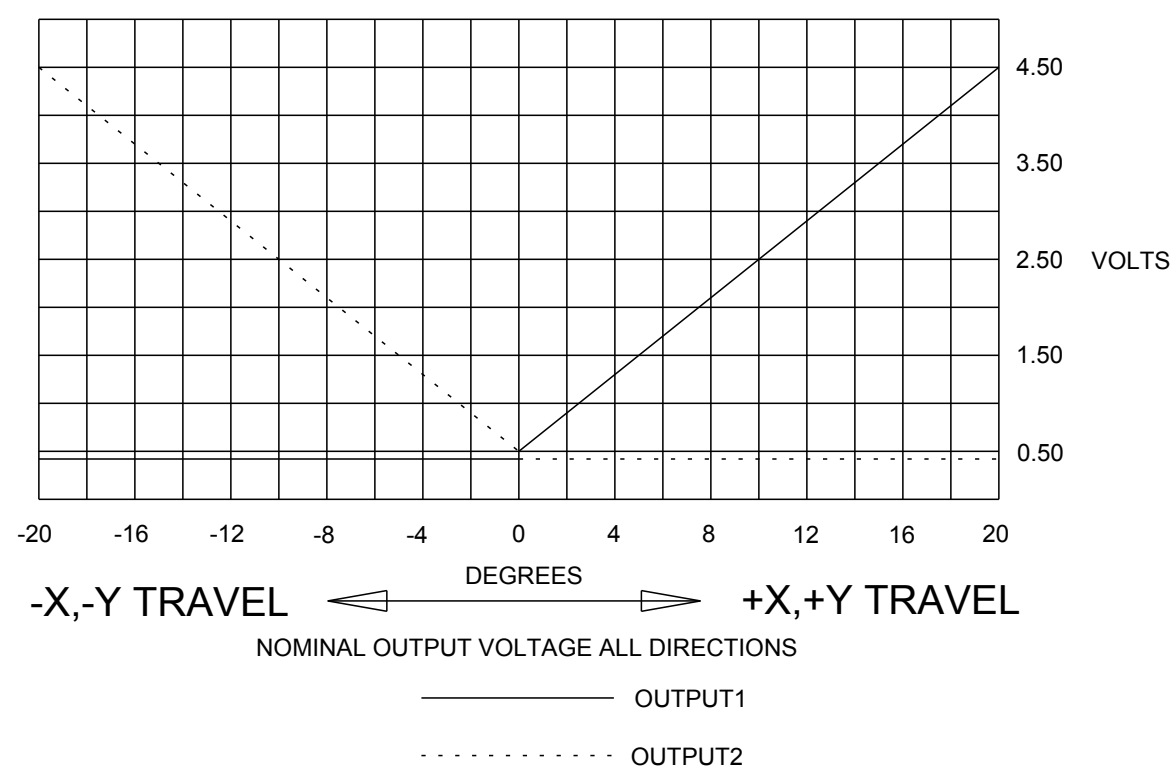
OPTION EE

OPTION FF



OPTION GG

OPTION HH



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DIMENSIONS ARE IN INCHES.
TOLERANCES ARE AS LISTED.
MUST BE FREE FROM BURRS
AND SHARP EDGES

TOLERANCES
.XX ±.03
.XXX ±.010
ANGLES ±2°
DO NOT SCALE DRAWING

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DRWN. JLW
CHKD. MRM
APPD. AH
WT.

SIZE
C

FSCM NO
21649

DRAWING NO.
JHT-_____

REV.
G

THIRD ANGLE
PROJECTION

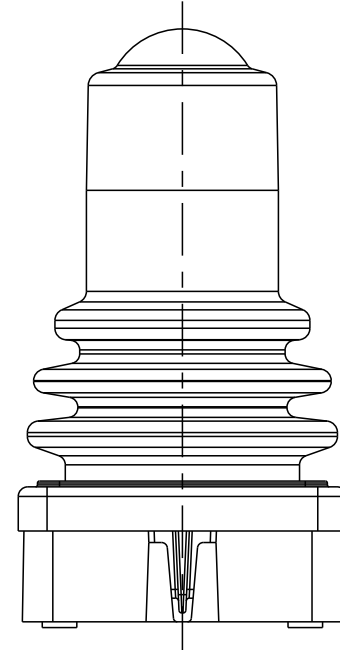
Scale 1:1

Sheet 3 OF 4

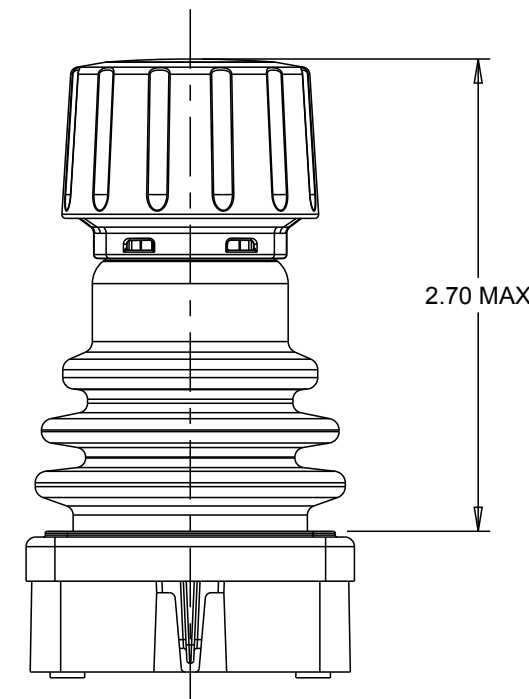


2.45 MAX

HALF BOOT

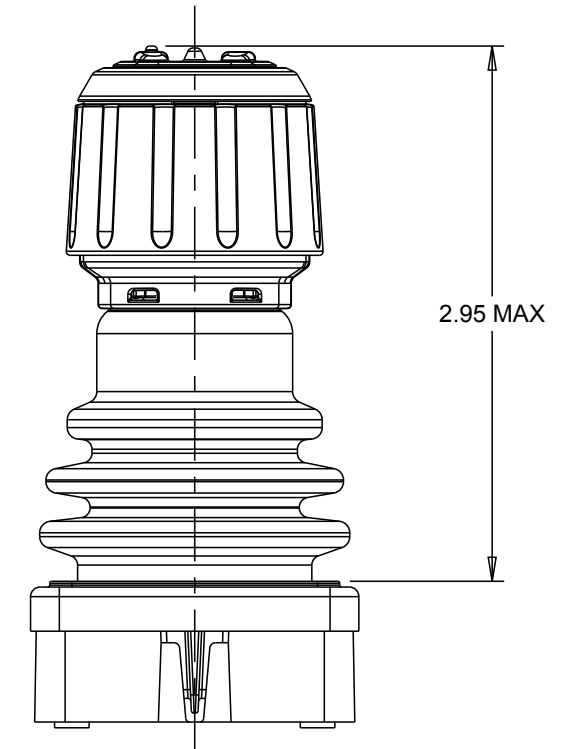


FULL BOOT



2.70 MAX

Z AXIS



2.95 MAX

Z AXIS WITH
PUSHBUTTONS

SWITCH / STYLE BOOT CONFIGURATION

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES.
TOLERANCES ARE AS LISTED.
MUST BE FREE FROM BURRS
AND SHARP EDGES

TOLERANCES
.XX ±.03
.XXX ±.010
ANGLES ±2°
DO NOT SCALE DRAWING

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| | | | | |
|------------------------|--------|---------------|-----------------------|--------------|
| DRWN. JLW | SIZE C | FSCM NO 21649 | DRAWING NO. JHT-_____ | REV. G |
| CHKD. MRM | | | | |
| APPD. AH | | | | |
| THIRD ANGLE PROJECTION | | | Scale 1:1 | Sheet 4 OF 4 |