**WERBEL MICROWAVE LLC**
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## 90° Quadrature Hybrid, 2-4GHz, SMA Female

## WMQH-2-4-S

### Key Features

- Octave band.
- High isolation.
- Excellent return loss.
- Low unbalance.


*Photo is representative.*

The 90-degree hybrid WMQH-2-4-S provides 3dB split with 90 degrees phase shift over the S band, in an aluminum enclosure measuring 1.15 x 0.50 x 0.38 inches with SMA connectors. The device is RoHS compliant but may be built using lead solder for military applications on special order. Return loss 24dB typical, isolation 23dB typical, phase balance 2.7 degrees typical. Werbel Microwave has designed this octave band quadrature hybrid with stripline technology. Parts are assembled and tested in the USA.

| Specifications | Min. | Typ. | Max. | Units |
|---|---|---|---|---|
| Frequency | 2 | -- | 4 | GHz |
| Impedance | -- | 50 | -- | Ohm |
| Phase Difference | -- | 90 | -- | Degrees |
| Total Loss[1] (J1-J3 and J1-J4) | -- | 3.15±0.45 | -- | dB |
| Isolation | 19 | 23 | -- | dB |
| Return Loss (all ports) | 17 | 24 | -- | dB |
| Amplitude Balance | -- | 0.45 | 1.7 | dB |
| Phase Balance (±) | -- | 2.7 | 4.0 | Degrees |
| Input Power (CW)[2] | -- | -- | 50 | Watts |

### Mechanical

| | |
|---|---|
| Connector Interface | SMA-Female |
| Operating Temperature[3] | -40 to +85 °C |
| Storage Temperature | -55 to +100 °C |
| Weight | 0.6 oz (17.9 g) |
| Humidity | 10-90% non-condensing |
| Environment | Indoor Use Only |

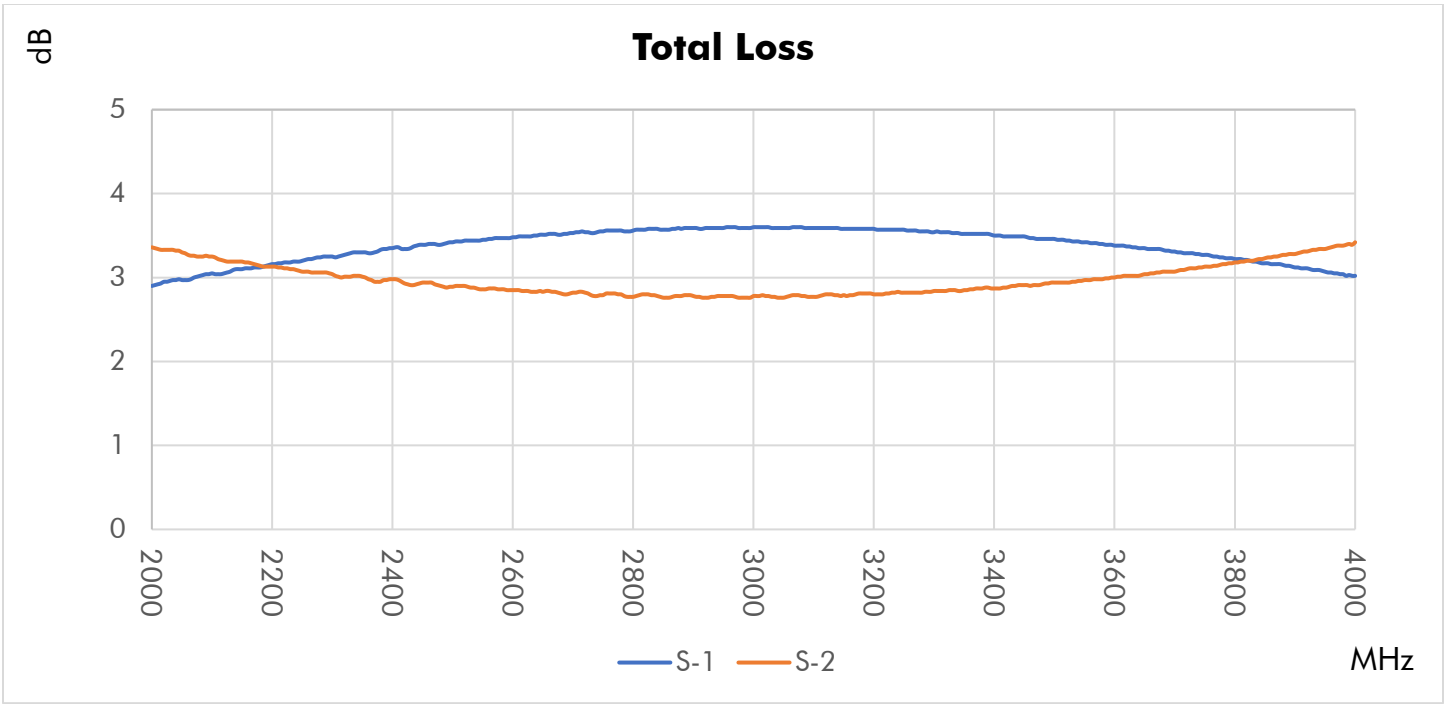
### Materials

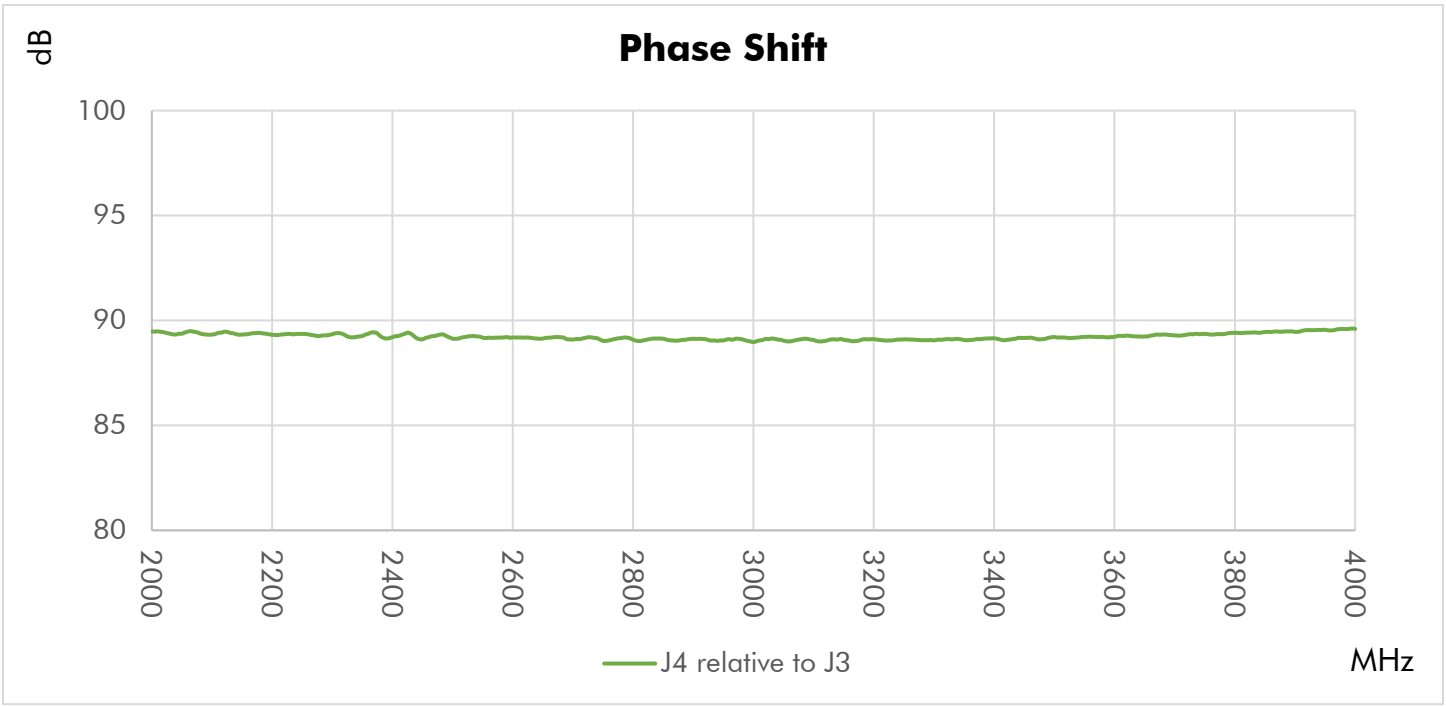
RoHS and REACH Compliant[4]

| | |
|---|---|
| Enclosure | Aluminum |
| Connectors | Stainless Steel |
| Contacts | Be Cu, Gold Plated |
| Insulators | PTFE |
| Finish | Green Paint |

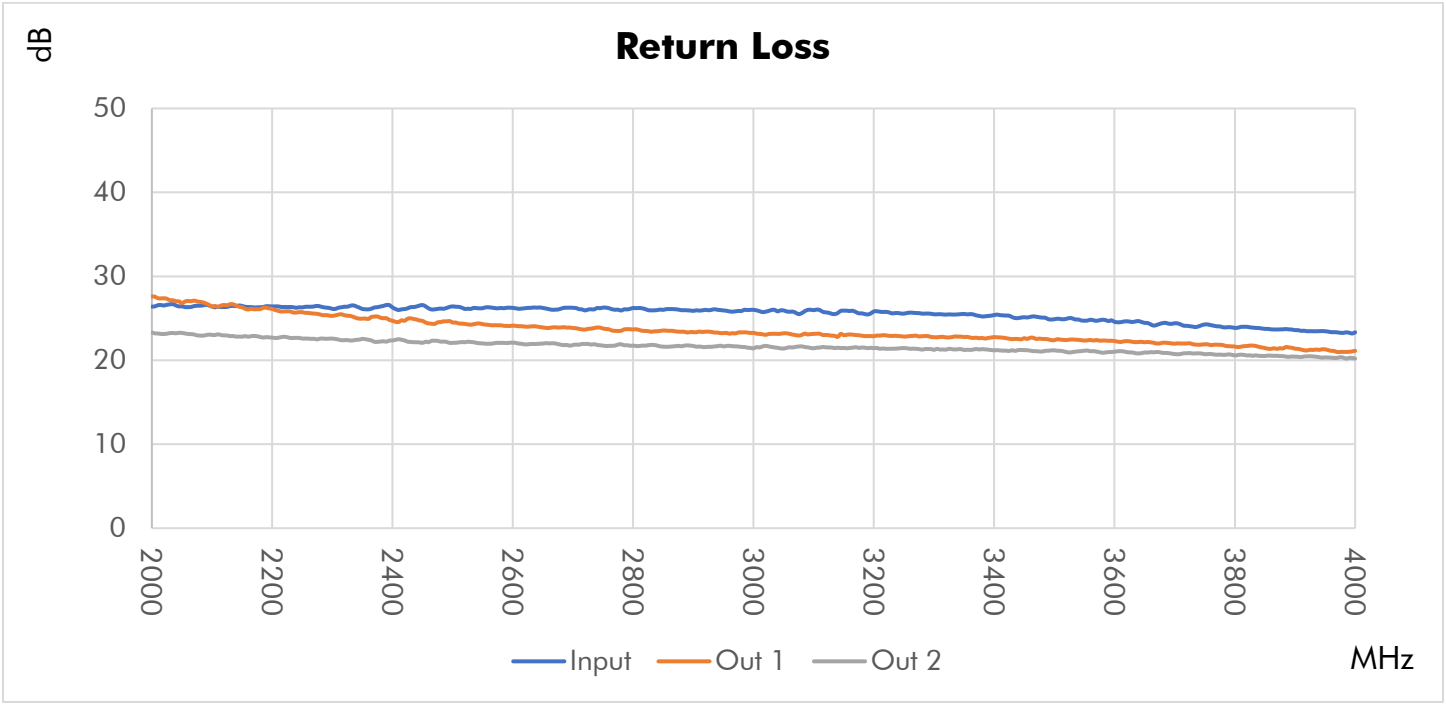
1. Total Loss includes insertion loss and frequency sensitivity.
2. All output ports should be terminated in a 50-ohm load with 1.2:1 max VSWR.
3. Specifications are at +25°C.
4. To the best of our knowledge at the time of publication.

## Typical Performance at +25 °C

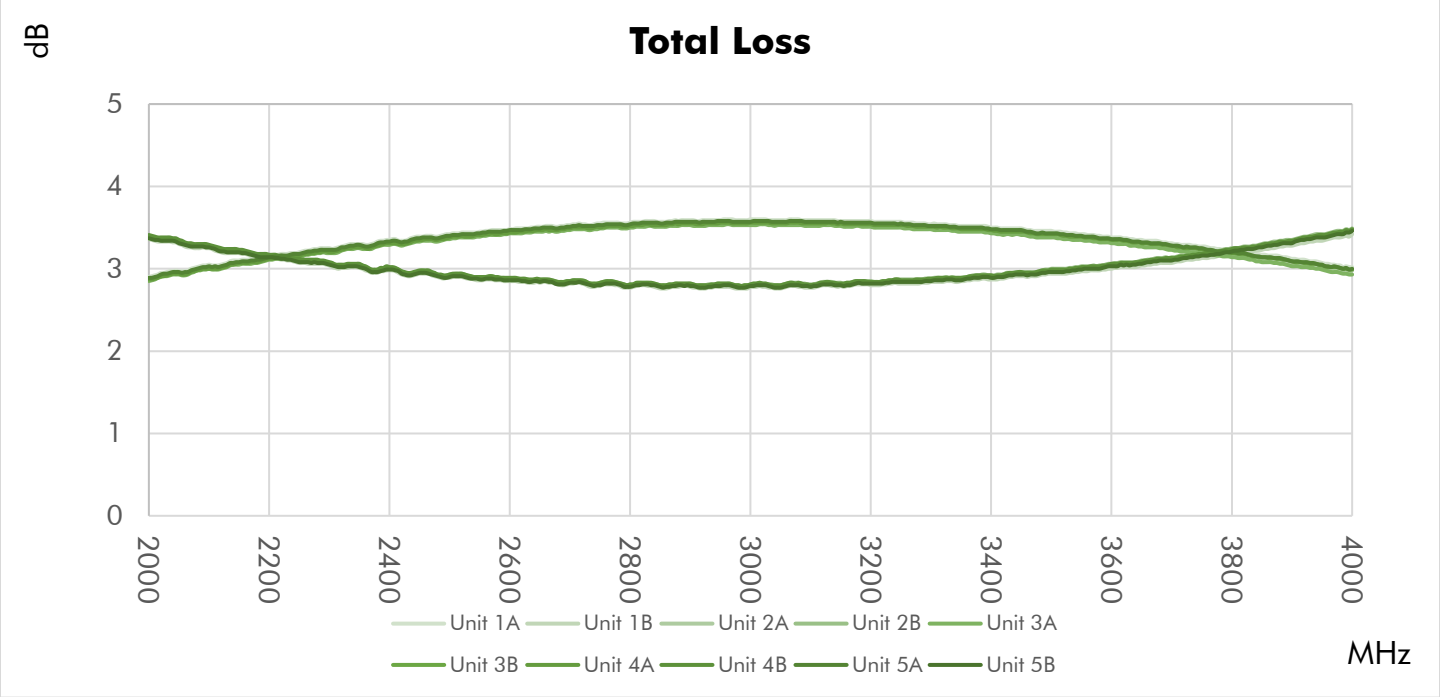


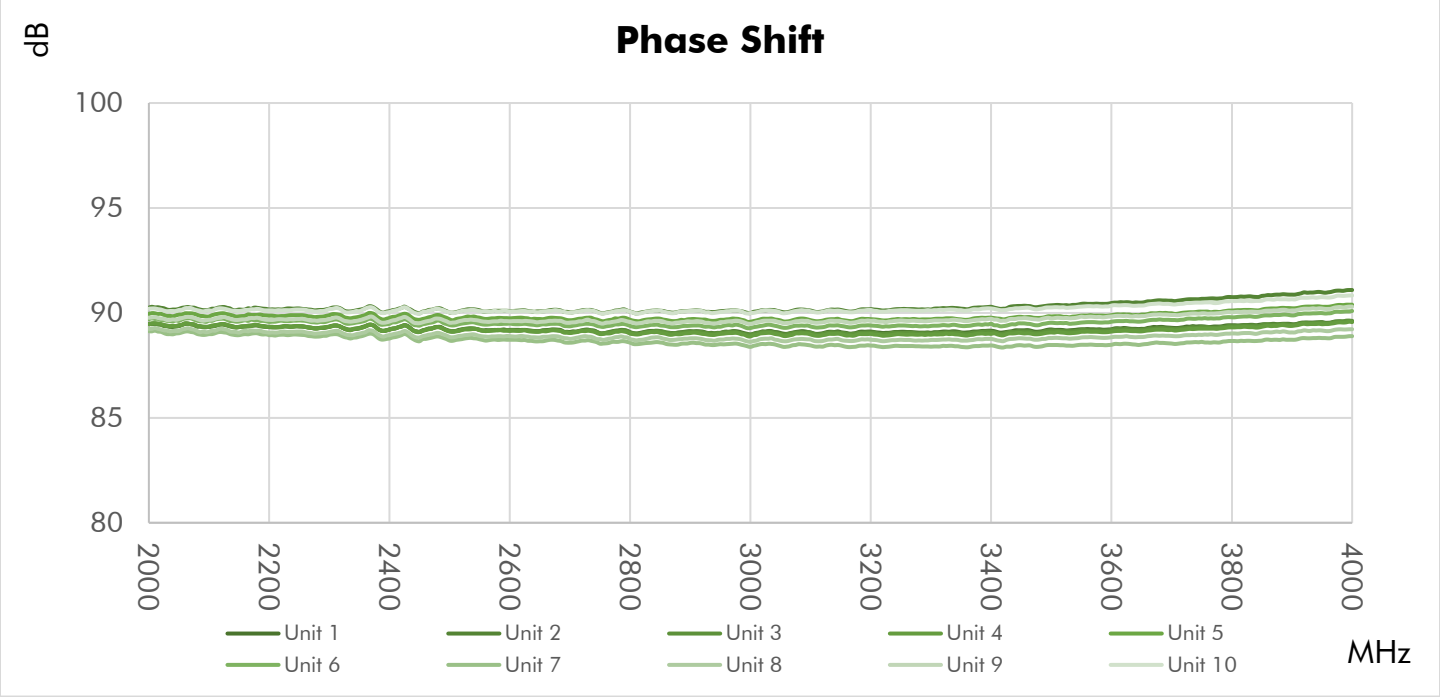




Isolation
dB
50
40
30
20
10
0
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Isolation
MHz


Return Loss
dB
50
40
30
20
10
0
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
Input
Out 1
Out 2
MHz

## Repeatability in Production

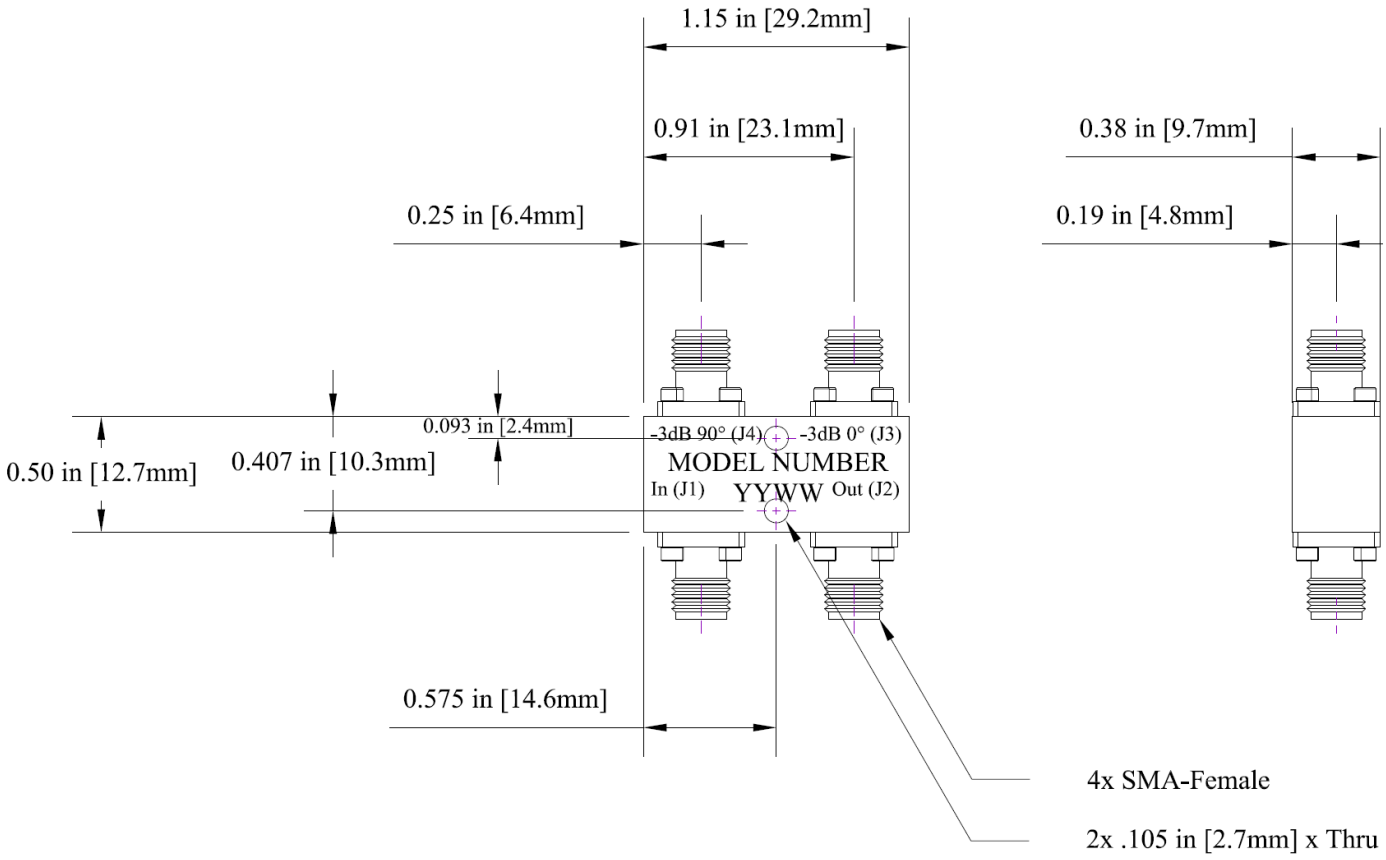


## Typical Performance at +25 °C

| Frequency (MHz) | Insertion Loss (dB) J1-J3 | Coupling (dB) J1-J4 | Amplitude Unbalance (dB) | Phase Unbalance (deg) | Isolation (dB) J1-J2 | Return Loss (dB) J1 |
|---|---|---|---|---|---|---|
| 2000 | 2.8 | 3.3 | 0.5 | 89.6 | 25.4 | 25.3 |
| 2100 | 3.0 | 3.2 | 0.2 | 89.7 | 25.0 | 26.1 |
| 2200 | 3.1 | 3.2 | 0.0 | 89.3 | 24.7 | 25.5 |
| 2300 | 3.2 | 3.0 | 0.2 | 89.6 | 24.3 | 25.1 |
| 2400 | 3.2 | 2.9 | 0.3 | 89.8 | 23.9 | 24.8 |
| 2500 | 3.3 | 2.9 | 0.4 | 89.4 | 23.6 | 24.6 |
| 2600 | 3.4 | 2.9 | 0.5 | 89.6 | 23.4 | 24.7 |
| 2700 | 3.4 | 2.8 | 0.6 | 89.3 | 23.3 | 24.3 |
| 2800 | 3.5 | 2.8 | 0.7 | 89.3 | 23.0 | 23.9 |
| 2900 | 3.5 | 2.8 | 0.7 | 89.1 | 22.7 | 24.1 |
| 3000 | 3.6 | 2.9 | 0.7 | 88.6 | 22.5 | 24.8 |
| 3100 | 3.5 | 2.8 | 0.7 | 89.0 | 22.3 | 22.6 |
| 3200 | 3.5 | 2.9 | 0.6 | 88.3 | 22.2 | 22.0 |
| 3300 | 3.7 | 2.7 | 1.0 | 90.0 | 22.1 | 22.8 |
| 3400 | 3.4 | 3.0 | 0.4 | 88.6 | 22.0 | 22.5 |
| 3500 | 3.4 | 3.0 | 0.4 | 89.6 | 21.8 | 22.3 |
| 3600 | 3.6 | 3.5 | 0.1 | 87.5 | 21.7 | 21.3 |
| 3700 | 3.1 | 3.2 | 0.1 | 87.6 | 21.6 | 24.1 |
| 3800 | 3.2 | 3.1 | 0.2 | 88.3 | 21.4 | 21.3 |
| 3900 | 2.9 | 3.2 | 0.2 | 88.4 | 21.2 | 21.1 |
| 4000 | 2.9 | 3.5 | 0.5 | 91.1 | 21.2 | 20.9 |

## Outline Dimensions




Outline # OL-Q0204
Dimensions are in inches, [mm] shown for convenience.
Tolerances on 2-pl decimals: ±.03. 3-pl decimals: ± .015.

## Port Configuration

| | | OUTPUT | | | |
|---|---|---|---|---|---|
| | | J1 | J2 | J3 | J4 |
| INPUT | J1 | -- | ISO | 0° | +90° |
| | J2 | ISO | -- | +90° | 0° |
| | J3 | 0° | +90° | -- | ISO |
| | J4 | +90° | 0° | ISO | -- |