

A Higher Level of Performance



Data Sheet

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# G1

## Microwave Switch Series

Beam Blockage Detection  
**Circular Polarisation**



For more information, please visit >  
[www.hawkmeasurement.com](http://www.hawkmeasurement.com)

# Overview

## G1 Microwave Switch Series



### Principle of Operation

A high power circular polarized Microwave pulse is emitted from the Sending unit to the Receiving unit in a transmission chain of approximately 100 pulses per second. If the path between the Sender and Receiver is blocked by any object or material which absorbs or reflects microwave energy the Receiving unit will no longer detect the complete transmission chain and indicate via Relay for automatic indication and process control requirements.

### Typical Uses

- Blocked chute detection
- Nucleonic switch replacement
- High level alarm / Low level alarm
- Truck / machine detection.

### Function

The Gladiator Microwave Switch can be used for blockage detection, barrier detection, machine detection and point level measurement, and detection of objects or material between two points.

### Primary Areas of Application

- Asphalt
- Brewing
- Cement
- Chemical
- Dairy
- Edible oil
- Fertilizer
- Food & Beverage
- Glass
- Mining & Metals
- Oil & Gas
- Packaging
- Paint
- Paper
- Pharmaceutical
- Plastics
- Power Generation
- Refining
- Semiconductor
- Sugar
- Textile
- Water & Wastewater.

### Features

- State of the art circular polarisation
- Simple sensitivity adjustment and calibration
- Hazardous Dust Approved - IECEx & cETLus
- Theoretical range up to 300m (984ft)
- Simple '1-minute' setup application presets
- Multiple Output & Communications Options
- Remote test function
- Adjustable ON and OFF delays (0-20 sec)
- Remote 4G Hawklink connection option
- Bright visual status indication on sensors
- Independent housing alignment after mounting sensor.

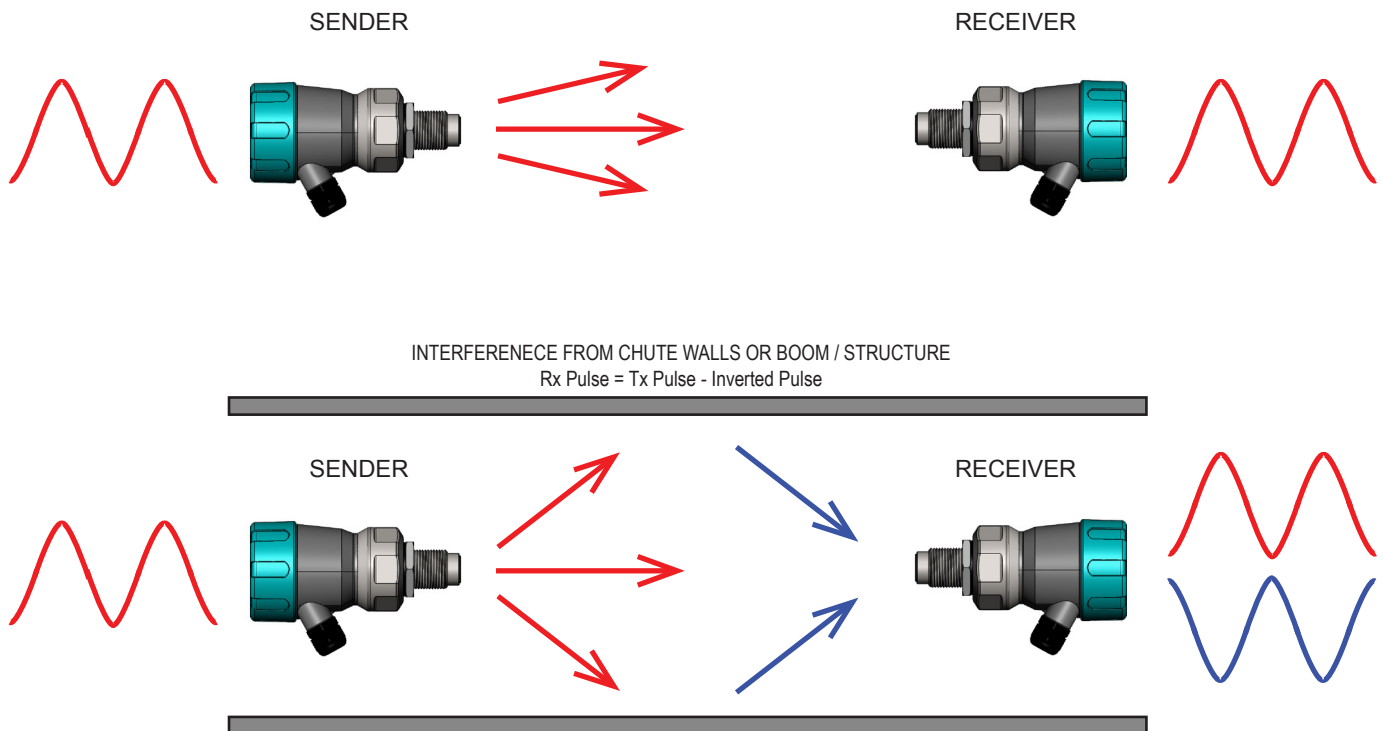
# Linear vs Circular Polarisation

G1 Microwave Switch Series

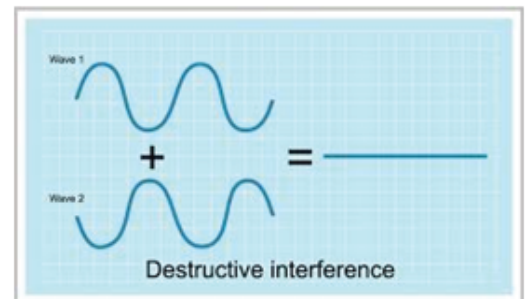
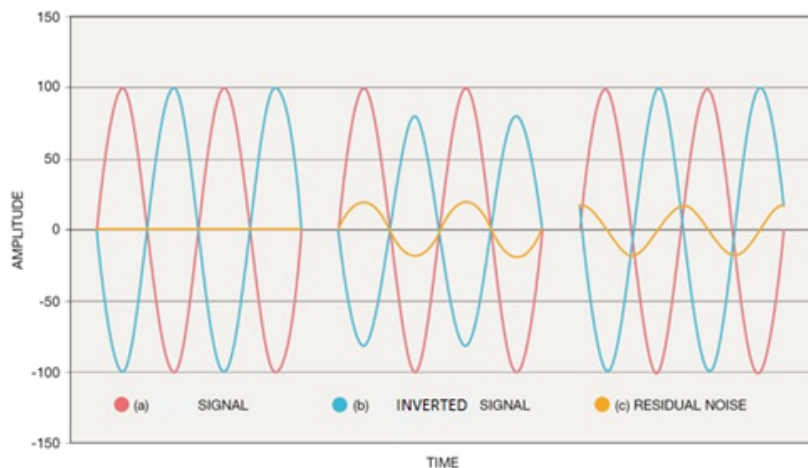


## Previous Gladiator Microwave - Linear Polarisation

- Maximum Receiver Gain: 5000
- Maximum Distance : 100m
- Beam Angle: 40°



When a microwave transmitted signal comes in contact with an object, it will reflect. The amount of reflection and phase change depends on the objects dielectric constant. A linear receiver is not able to differentiate between the direct and the reflected signals; hence it will receive both and sum of the result is likely to be a smaller signal or worst-case no signal at all.



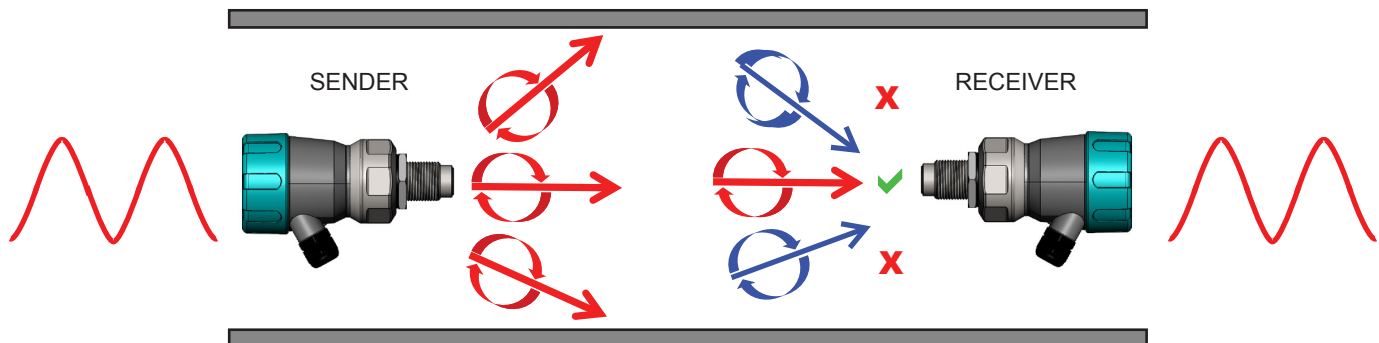
# Linear vs Circular Polarisation

## G1 Microwave Switch Series



### G1 Microwave - Circular Polarisation

- Maximum Receiver Gain: 90,000
- Maximum Distance : 300m
- Beam Angle: 50°



Circular polarization is either right handed or left handed. The HAWK Generation 3 system is right hand circular polarized. When a Circular polarized microwave transmitted signal comes in contact with an object it will reflect a left hand circular polarized transmitted signal, will then change to right hand circular polarized signal on the next reflection and vice versa with every reflection. If it is a single or odd number of reflections it will be a left hand polarized signal and if it is a two or even number of reflection then it will be a right hand polarized signal. The amount of reflection and phase change depends on the objects dielectric constant.

A HAWK Generation 3 receiver is designed to only receive a right hand circular polarized signal which means single or odd number of reflections (left hand circular polarized signals) will be ignored by the microwave receiver.

The only time a circular polarized system can be affected is when two or even numbers of reflection occur where the time delay or phase shift will start to cancel part of the signal. Due to multiple reflections, the amount of energy is smaller compared to the direct signal. Hence a circular polarized system will receive more signal than a linear polarized system, reducing the possibility of false trips.

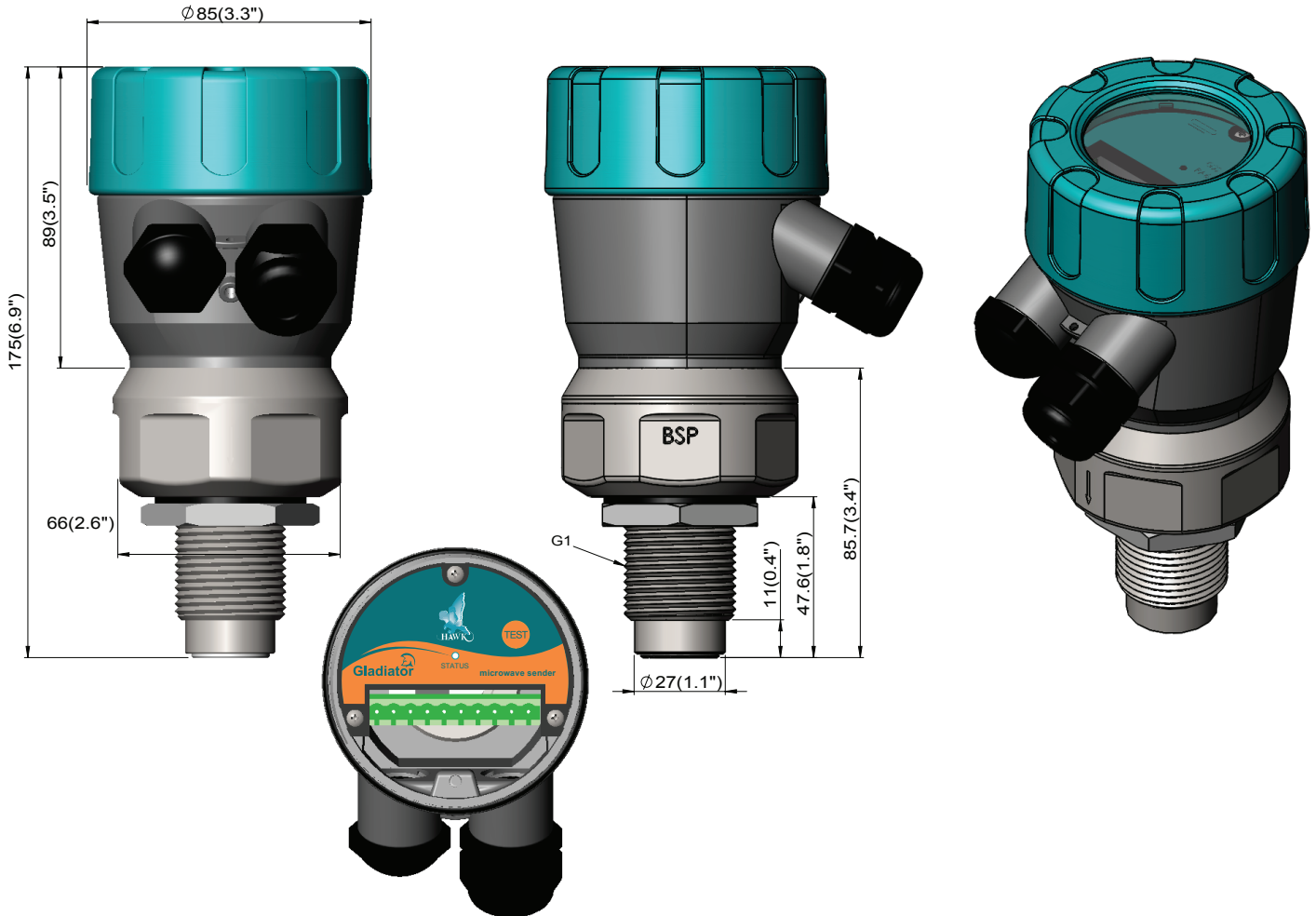
# Dimensions

## G1 Microwave Switch Series

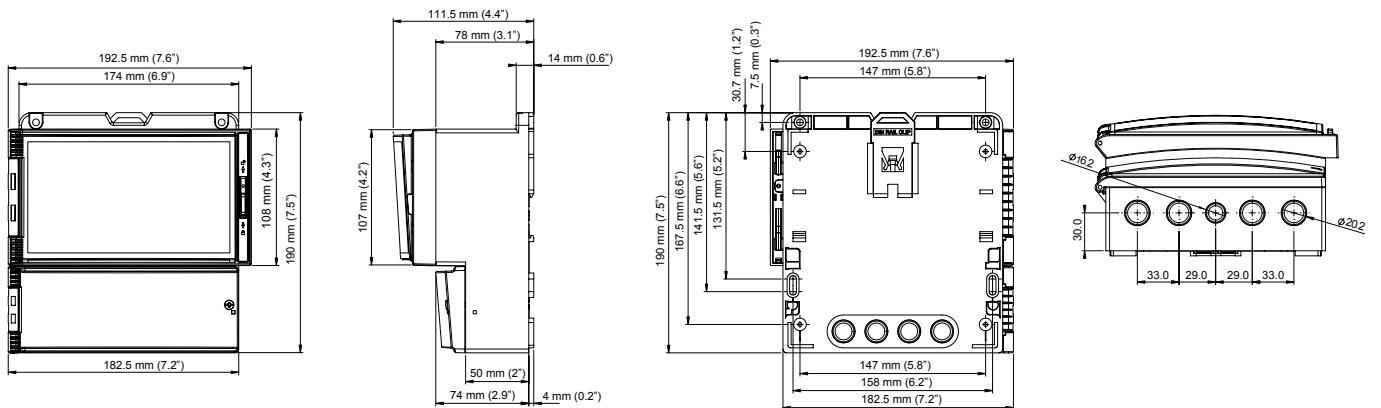


### Sender / Receiver

1" BSP or 1" NPT thread types available



### Remote Amplifier





### Weldment / Couplings with Windows

The weldment / couplings are designed to be welded into an appropriately sized hole in the vessel or application wall. A matching UHMW high wear window is then threaded into the weldment / coupling to act as a seal for the application. For Approval Option 2D Installations the Window is secured using a Locking Ring. See MD Series Windows and Weldments for further information.

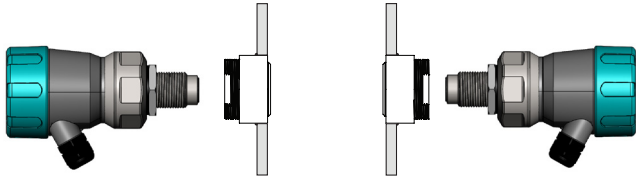
This typical installation isolates the Microwave hardware from coming into contact with any damaging materials and allows simple maintenance or replacement of units without having to unseal the process / application.

The Microwave transmission will pass directly through plastics to measure the material in the process.

#### MA2 - 2" Weldment / coupling with UHMW windows

Isolated from process with Weldment / Coupling and window

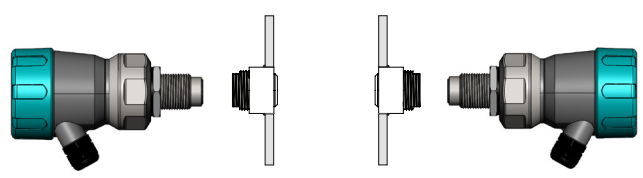
Mount maximum 100mm (4") back from Window.



#### MA1 - 1" Weldment / coupling with UHMW window

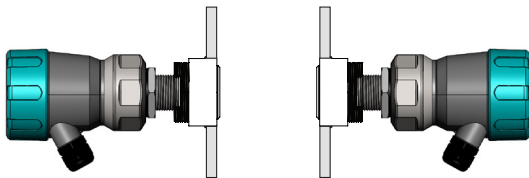
Isolated from process with Weldment / Coupling and window

Mount maximum 100mm (4") back from Window.



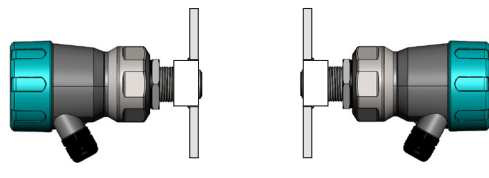
Isolated from process with Weldment / Coupling and window

Mounted to MA2-UW threaded window



Sensing element within process

Mounted to MA1-WC threaded weldment / coupling



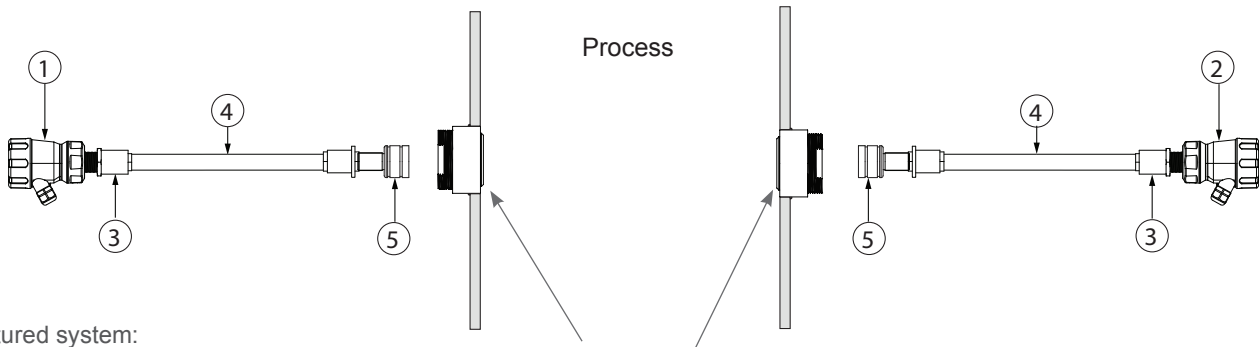


### Waveguides with windowed weldment / coupling process seals

System with Waveguide extensions for remote mounting / signal transmission.

Waveguides can be used for difficult to access areas or to isolate the electronics from high temperature or non-compatible processes.

For more information see the G1 Microwave Waveguide Parts and Assembly Guide

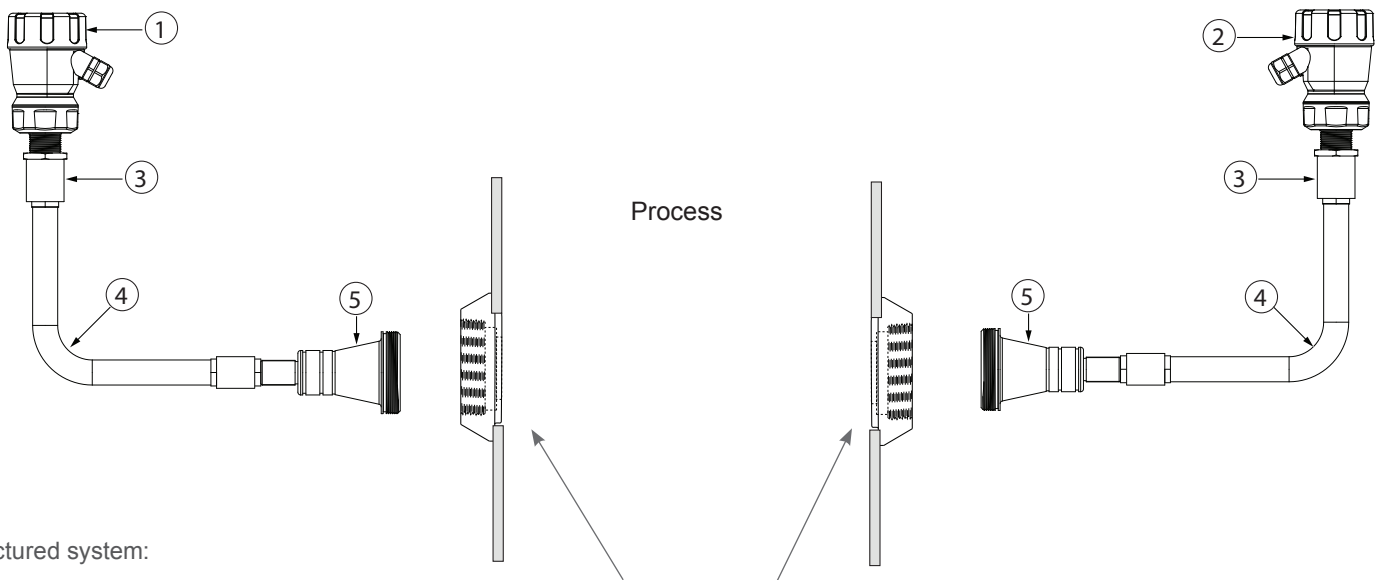


Pictured system:

- (1) G1R with TB (1" BSP) thread
- (2) G1S with TB (1" BSP) thread
- (3) Qty2 of MA-WG01
- (4) Qty2 of MA-WG10-L=xx
- (5) Qty2 of MA-WG03

MA2-WC-SS  
Weldment / coupling  
with UHMW window

Ceramic windows for high temperature applications



Pictured system:

- (1) G1R with TB (1" BSP) thread
- (2) G1S with TB (1" BSP) thread
- (3) Qty2 of MA-WG01
- (4) Qty2 of MA-WG02
- (5) Qty2 of MA-WG04

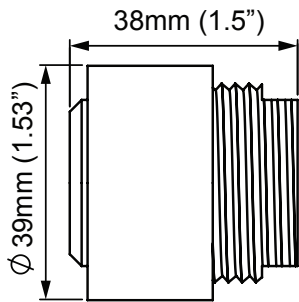
MA16  
3" Weldment with  
ceramic window



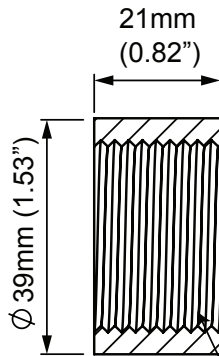
### MA Series Mounting Accessories

Weldment / Couplings with Window for application seal

**MA1**  
(consists of MA1-WC and MA1-UW)

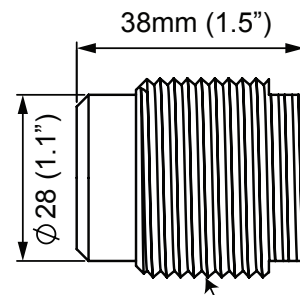


**MA1-WC**  
Weldment / Coupling



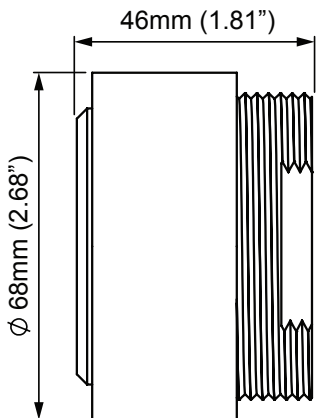
1" BSP  
internal thread

**MA1-UW**  
UHMW Window

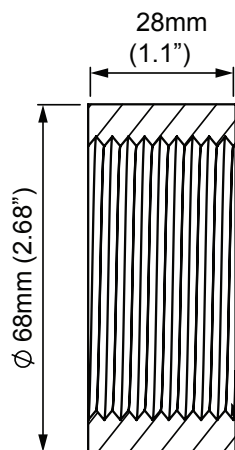


1" BSP  
external thread

**MA2**  
(consists of MA2-WC and MA2-UW)

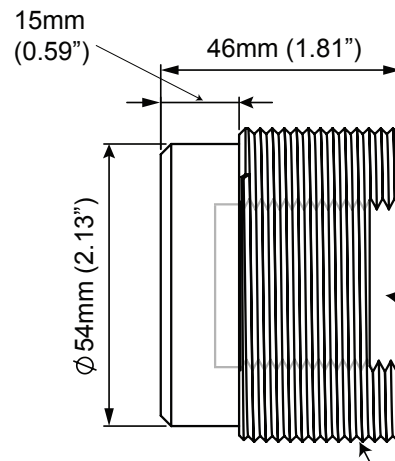


**MA2-WC**  
Weldment / Coupling



2" BSP  
internal thread

**MA2-UW**  
UHMW Window



1" BSP/NPT  
internal thread

2" BSP  
external thread



# Dimensions

## G1 Microwave Switch Series



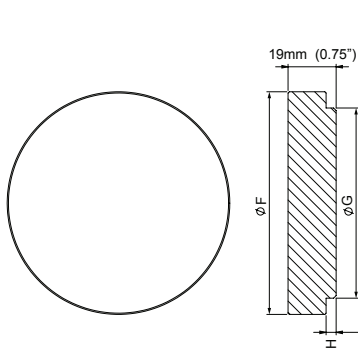
### MD Series Weldments and Windows

#### Weldment with UHMW or PTFE Windows

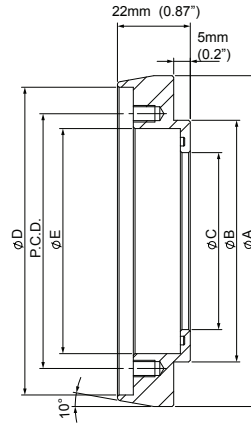
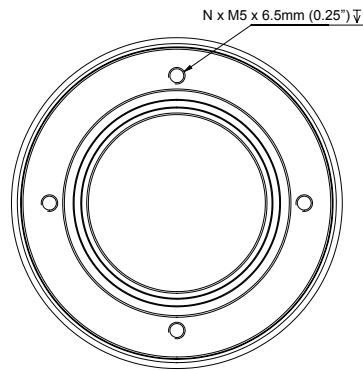
The Weldment is welded to the vessel. The Window locks into the weldment using a locking ring.

For Approval Option 2D & 3C Installations. Consult Safety Instructions for critical details.

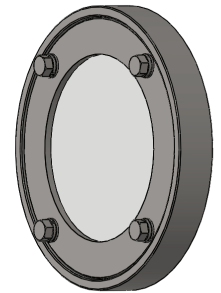
#### UHMW / PTFE Window



#### Weldment



#### Assembled Piece



Part No <sup>1</sup> .	Window Material	A		B		C		D		E		P.C.D		No. Holes
		mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	
MD1-X	UHMW	75	3.0	48	1.9	29	1.1	68	2.7	43	1.7	52	2.0	4
MD2-X	UHMW	100	3.9	73	2.9	54	2.1	93	3.7	68	2.7	77	3.0	4
MD3-X	UHMW	122	4.8	93	3.7	77	3.0	115	4.5	90	3.5	99	3.9	4
MD6-X	PTFE	122	4.8	93	3.7	77	3.0	115	4.5	90	3.5	99	3.9	4

<sup>1</sup>X = Weldment Material Selection

Part No <sup>1</sup> .	Window Material	F		G		H		P.C.D		No. Holes
		mm	in	mm	in	mm	in	mm	in	
MD1-X	UHMW	43	1.7	28	1.1	4	1.6	52	2.0	4
MD2-X	UHMW	68	2.7	53	2.1	4	1.6	77	3.0	4
MD3-X	UHMW	89	3.5	76	3.0	4	1.6	99	3.9	4
MD6-X	PTFE	89	3.5	76	3.0	4	1.6	99	3.9	4

<sup>1</sup>X = Weldment Material Selection

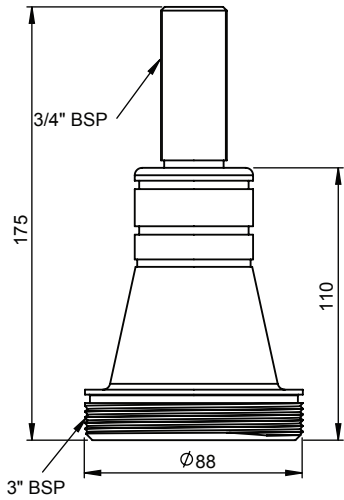
# Dimensions

## G1 Microwave Switch Series

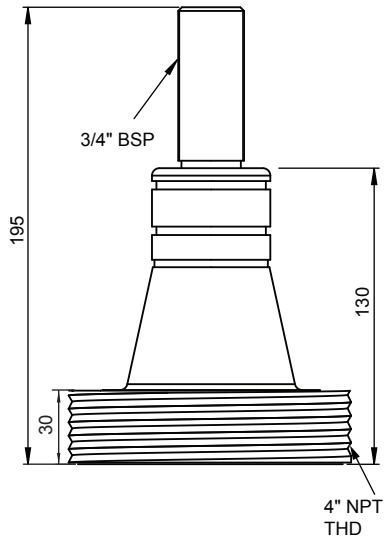


### Waveguides and Waveguide Accessories

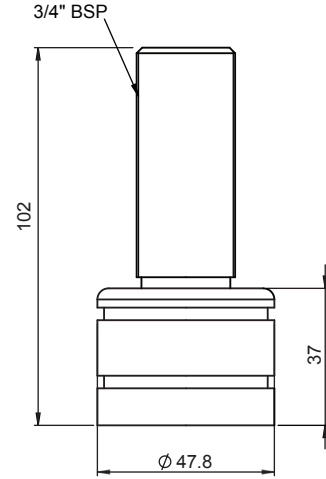
**MA-WG04**



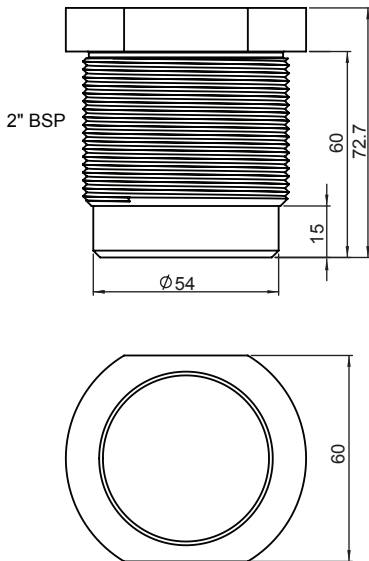
**MA-WG04 with MA-WG14 window**



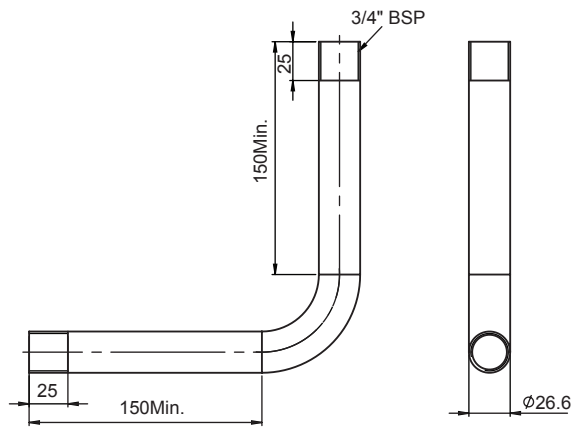
**MA-WG03**



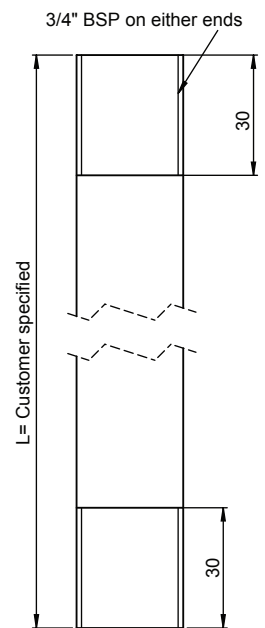
**MA-WG12**



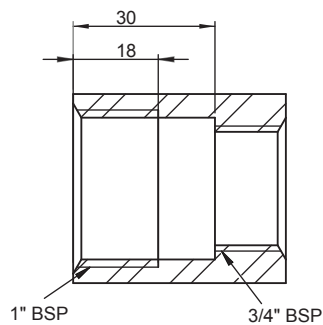
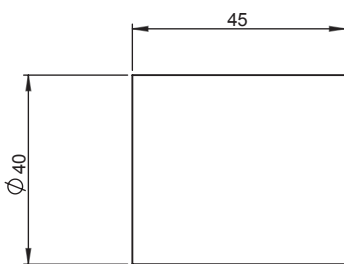
**MA-WG02**



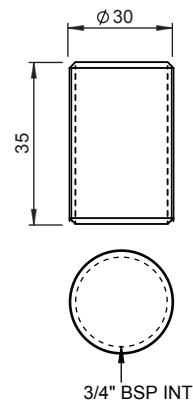
**MA-WG12L=xxx**



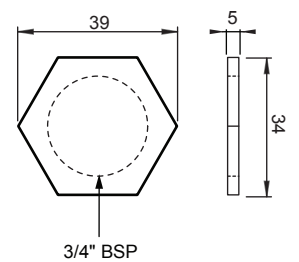
**MA-WG01**



**MA-WG-13**



**MA-WG11**



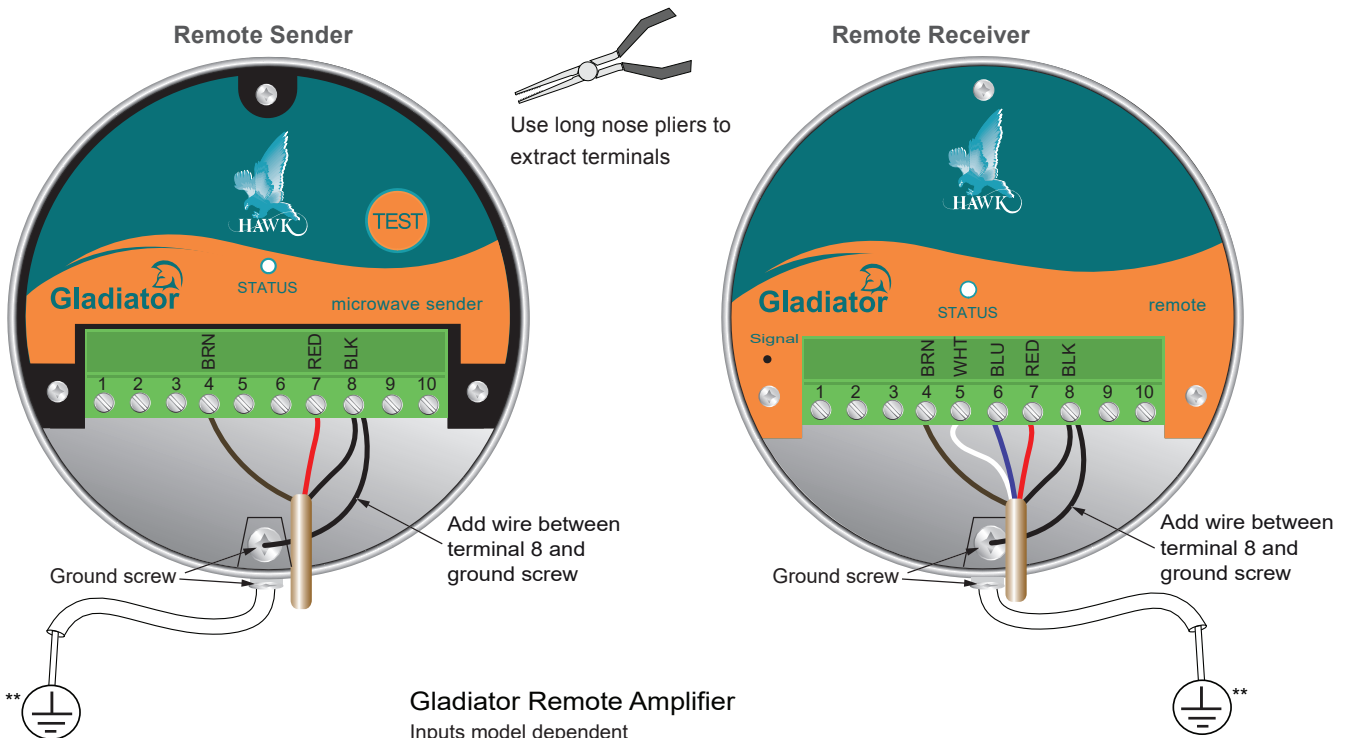


### Remote System Connection - HAWK Supplied Cable

- The black wire of HAWK supplied cable comes with one end GND and the other GND / SHLD together.
- The GND / SHLD end is a larger cable which has been heat shrunk. The GND only end is the same size as the other cables.
- The GND / SHLD end must be connected to the amplifier.

Sender / Receiver (GND only end) 

Amplifier (GND / SHLD end) 



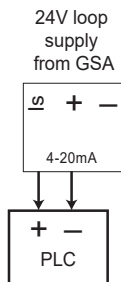
#### Remote Sender

##### Status LED

- Green when powered
- Blinks while working correctly
- Solid while not transmitting

##### TEST Button

- Press and hold to test level relay action



#### Gladiator Remote Amplifier

Inputs model dependent

			MIC-SENDER			RELAY 1			RELAY 2					
			RED	BLACK	BROWN	SLAVE IN	MASTER OUT	TEST IN	NC	COM	NO	NC	COM	NO
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
			Sender											
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
			RED	BLACK	BLUE	WHITE	BROWN	B	A	-	+	⊕	⊖	⊥
			SENSOR			COMMS			DC-In			AC-In		

Remote Receiver

24V loop supply from PLC

#### Remote Receiver

##### Status LED

- Green when powered
- High illumination = strong signal
- Low illumination = weak signal

##### Signal Contact

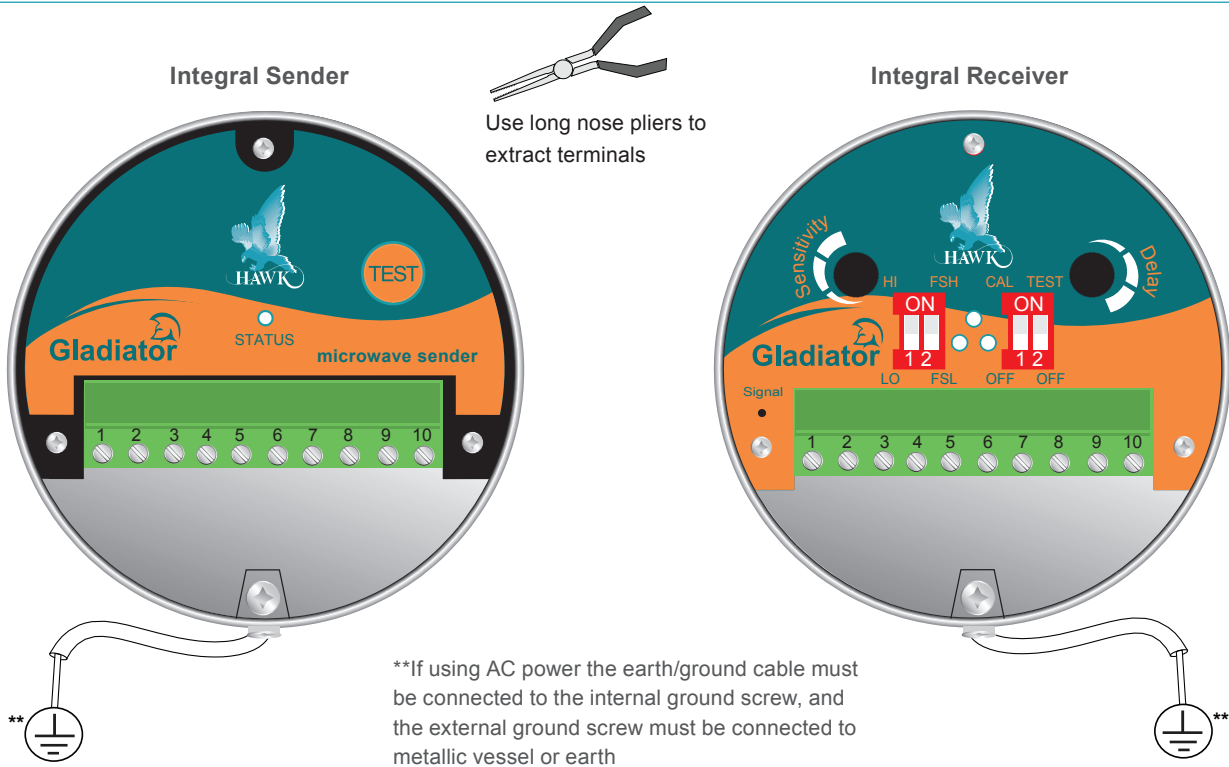
- Signal can be read with voltmeter across Signal contact point and earth screw (or other ground reference)
- 2.4-2.5V is full signal. 0V is no signal

\*AC-In is replaced by 36-60VDC with Power Input Option 'C'.

\*\*Ground the housing to vessel if vessel is metallic. Ground the housing to plant ground if vessel is non-metallic.



### Integral System Connection



#### SENDER TERMINAL LAYOUT

						DC-IN		AC-IN	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
						+	-	N	L1
						12-30VDC		80-260VAC	

Terminals 1, 2, 3, 4, 5, 6 not used

#### RECEIVER TERMINAL LAYOUT

RELAY				COMMS		DC-IN		AC-IN	
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
NC	COM	NO	Test	A	B	+	-	N	L1
				Modbus D0 D1		12-30VDC		80-260VAC	

#### Sender

##### Status LED

Green when powered  
Blinks while working correctly  
Solid while not transmitting

##### TEST button

Press and hold to test level relay action

#### Receiver

##### Status LED

Green when powered  
High illumination = strong signal  
Low illumination = weak signal

##### Signal Contact

Signal can be read with voltmeter across Signal contact point and earth screw (or other ground reference)

2.4-2.5V is full signal. 0V is no signal

# Part Numbers

## G1 Microwave Switch Series



### Remote Version

#### Remote Amplifier

**GSA** Gladiator Amplifier (compatible with all Gladiator products), Modbus

##### Housing

S Polycarbonate

##### Power Supply

B 12-30 VDC

C 36-60VDC

U 12-30VDC and 90-260VAC

##### Output Options

S 2 x SPDT Relays

R 2 x SPDT Relays with Modbus Over Wi-Fi

X 2 x SPDT Relays with 4-20mA output

B 2 x SPDT Relays with Modbus Over Bluetooth

E 2 x SPDT Relays with Modbus Over Ethernet

##### Approval

A22 ATEX Grp II Cat 3 GD T85°C IP67 Tamb -40°C to 70°C

**GSA S U S**

#### Remote Sender / Receiver

##### Model

**G1S** Gladiator 1" Microwave Sender

**G1T** Gladiator 1" Microwave Remote Receiver

##### Electronics Housing

S Powder Coated Aluminium

C 316L Stainless Steel

##### Power Supply

B Not Required (Model G1S only)

X Not Required (Model G1T only)

##### Mounting Thread

TB 1" BSP

TN 1" NPT

##### Approvals

X Not Required

A22 ATEX Grp II Cat 3 GD T85°C IP67 Tamb -40°C to 70°C

2D IECEx ta tb IIIC T\* Da Db Tamb = -30 to +80C

**G1S C B TB X**

*\*Consult Safety Instructions, Temperature Code information for temperature and other ratings*

# Part Numbering

## G1 Microwave Switch Series



### Integral Version

#### Model

- G1S** Gladiator 1" Microwave Sender
- G1R** Gladiator 1" Microwave Integral Receiver, 1 Relay with Failsafe
- G1Q** Gladiator 1" Microwave Integral Receiver with anti-crosstalk Sequenced software, 1 Relay with Failsafe. Requires GMSEQ Sequencer

#### Electronics Housing (Sensor element is 316L with Teflon face)

- S Powder Coated Aluminium
- C 316L Stainless Steel

#### Power Supply

- B 12-30VDC
- U 12-30VDC and 80-260VAC

#### Mounting Thread

- TB 1" BSP
- TN 1" NPT

#### Approvals

- X Not Required
- A22 ATEX Grp II Cat 3 GD T85°C IP67 Tamb -40°C to 70°C
- 2D IECEx ta tb IIIC T\* Da Db Tamb = -30 to +80C
- 3C cETLus (power supply option 'B only', model option G1S, G1R only)  
Ex ta/tb IIIC T\* Da/Db  
Zone 20/21, AEx ta/tb IIIC T\* Da/Db  
Sensor Face: Class II, III Div. 1, Groups EFG, T\*  
Sensor Body: Class II, III Div. 2, Groups EFG, T\*

**G1S C B TB X**

*\*Consult Safety Instructions, Temperature Code information for temperature and other ratings*

### Microwave Sequencer

**GMSEQ** Gladiator Microwave Sequencer

#### Power Supply

- B 12-30VDC
- C 36-60VDC
- U 12-30VDC and 90-260VAC

**GMSEQ U**

### MA Series Mounting Accessories

#### MA

- 1 1" UHMW Window & mild steel weldment/coupling each
- 1-SS 1" UHMW Window & 316L stainless steel weldment/coupling each
- 1-UW 1" UHMW Window each
- 1-WC 1" mild steel weldment/coupling each
- 1-WC-SS 1" 316L stainless steel weldment/coupling each
- 2 2" UHMW Window & mild steel weldment/coupling each
- 2-SS 2" UHMW Window & 316L stainless steel weldment/coupling each
- 2-UW 2" UHMW Window each
- 2-WC 2" mild steel weldment/coupling each
- 2-WC-SS 2" 316L stainless steel weldment/coupling each

**MA 2**

*Additional mounting accessory variants and materials including high temperature ceramics are available.*

*See Gladiator Gen 3 Microwave datasheet available at [www.hawkmeasurement.com](http://www.hawkmeasurement.com)*

### Waveguides & Waveguide accessories

#### MA-WG

- 01 316L Threaded connector for Sender / Receiver
- 02 316L 90deg bend pipe (150mm + 150mm). Includes qty 2 of MA-WG11
- 03 316L 1-1/2" Wave guide horn. Includes qty 1 of MA-WG13
- 04 316L 3" Wave guide horn assembly. Includes qty 1 of MA-WG13
- 10-L=1 316L Straight pipe extension <sup>1</sup>L= length in mm. Includes qty 2 of MA-WG11
- 11 316L Locking nut
- 12 2" BSP teflon plug with socket to match MA-WG03 horn
- 13 316L Pipe to pipe connector coupling
- 14 4" Teflon window to match MA-WG04 Horn. Fits into MA18 weldment.

**MA-WG 01**



### MD Series Mounting Accessories - Kit

For Approval Option 2D & 3C Installations. Consult Safety Instructions for critical details.

#### MD Mounting Accessories Kit

##### Window Facing Material

- 1 1" UHMW Window (-30°C to +75°C)
- 2 2" UHMW Window (-30°C to +75°C)
- 3 3" UHMW Window (-30°C to +75°C)
- 6 3" PTFE Window (-30°C to +200°C)

##### Weldment Material

- A SS304
- S SS316
- M Mild Steel

**MD 3 - A**

### MD Series Mounting Accessories - Parts

For Approval Option 2D & 3C Installations. Consult Safety Instructions for critical details.

#### BASE Weldment Only

##### Weldment Size

- MD1 Matches MD1
- MD2 Matches MD2
- MD3 Matches MD3 & MD6

##### Material

- A SS304
- S SS316
- M Mild Steel

**BASE - MD2 - A**

#### WIN Window only

##### Window Facing Material

- MD1 UHMW for MD1 (-30°C to +75°C)
- MD2 UHMW for MD2 (-30°C to +75°C)
- MD3 UHMW for MD3 (-30°C to +75°C)
- MD6 PTFE for MD6 (-30°C to +200°C)

**WIN - MD2**

#### LRING Locking Ring Only

##### Ring Size

- MD1 Matches MD1
- MD2 Matches MD2
- MD3 Matches MD3 & MD6

##### Material

- A SS304
- S SS316
- M Mild Steel

**LRING - MD2 - A**

MD Series Part Combinations				
Full Kit <sup>1</sup>	Size	Window	Weldment <sup>1</sup>	Locking Ring <sup>1</sup>
MD1-X	1"	WIN-MD1	BASE-MD1-X	LRING-MD1-X
MD2-X	2"	WIN-MD2	BASE-MD2-X	LRING-MD2-X
MD3-X	3"	WIN-MD3	BASE-MD3-X	LRING-MD3-X
MD6-X	3"	WIN-MD6	BASE-MD3-X	LRING-MD3-X

<sup>1</sup>X = Material Selection

# Specifications

## G1 Microwave Switch Series



### Operating Voltage

- Integral 12-30VDC / Remote 12-30VDC (residual ripple no greater than 100mV)
- Integral 80-260VAC / Remote 90-260VAC 50 / 60Hz
- Remote 36-60VDC

### Power Consumption

- <0.8W @ 24VDC
- <5VA @ 240VAC
- <6W @ 48VDC
- <3VA @ 115VAC

### Communications

- GosHawk, Modbus
- Modbus over Ethernet TCP/IP
- 4-20mA
- Bluetooth (v5.2), Up to 30m (98ft) range with direct line of sight with Android & iOS App

### Relay Output

- Remote: 2 x SPDT Form 'C' contacts, rated 5A at 240VAC resistive
- Integral: 1 x SPDT Form 'C' contacts, rated 5A at 240VAC resistive
- Remote fail-safe test facility for one relay.

### Operating Temperature (Electronics)

- Remote Amplifier -40°C (-40°F) to 80°C (176°F)
  - Integral Units -30°C (-20°F) to 65°C (150°F)\*
  - Remote Sensors -30°C (-20°F) to 65°C (150°F)\*.
- \*For higher temperature applications, remote waveguide mounting with appropriate windows is necessary.*

### Maximum Temperature (Mounting Accessories)

- 316L parts: 800°C
- Mild steel parts: 500°C
- Ceramic parts (alumina ceramic 95%) -50 to 800°C
- Teflon parts: 250°C
- UHMW parts: 80°C
- MD Weldment O-ring seals: NBR (Nitrile) 90°C (194°F). O-ring can be replaced with appropriate material for application.

### Power Density

- Rated from emitter to receiver at approximately 20μW/cm<sup>2</sup>
- Complies with FCC Title Rules Part 15 (Beam Blockage)
- Caution sign posting not required.

### Transmitted Signal

- Circular polarisation polarity
- Sensitivity -88dBm
- Frequency: 10.525GHz
- Beam width 50°
- Power: +14dBm / 25mW.

### Fail-Safe

- Selectable - presence or absence of material
- High level fail-safe: relay is activated when material is present
- Low level fail-safe: relay is activated when no material is present.

### Range

- Theoretical Maximum range: 300m (984ft)
  - Recommended Range (Chutes) 15m
  - Recommended Range (Object detection) 50m
  - Minimum range under ideal conditions: 10cm (4 inches).
- Note: Minimum ranges are dependent on application conductivity.*

### Maximum Operating Pressure

- 10 BAR (145psig).

### Enclosure Sealing

- G1S/G1T/G1R: IP66/67
- GSA: IP65 / NEMA 4X

### Wetted Materials

- Sensing element housing: 316L stainless steel
- Sensing element face: Teflon.

### Cable Entries

- Integral Units: 2 x M20 Glands / 3/4" NPTF threaded adaptors.

### Mounting

- 1" NPT
- 1" BSP

### Remote Test Input

- Press to test (used to check for malfunction of unit from remote position, PLC, SCADA etc).

### Weight

- G1R/G1S/G1T 1kg
- GSA 1kg.

### Approval

- IECEx Certificate No. IECEx TSA 16.0005X  
Zone 20/21, Zone 21  
Ex ta tb IIIC T\* Da Db Tamb = -30 to +80C
- cETLus Certificate No. ETL24CA105410316X  
Ex ta/tb IIIC T\* Da/Db  
Zone 20/21, AEx ta/tb IIIC T\* Da/Db  
Sensor Face: Class II, III Div. 1, Groups EFG, T\*  
Sensor Body: Class II, III Div. 2, Groups EFG, T\*

*\*Consult Safety Instructions, Temperature Code information for temperature and other ratings*



## Contact Info

G1 Microwave Switch Series



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Additional product warranty and application guarantees upon request.

Technical data subject to change without notice.

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