Data Sheet

G1 Microwave Switch Series

Beam Blockage Detection
Circular Polarisation

For more information, please visit >
www.hawkmeasure.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

<table>
<thead>
<tr>
<th>Asphalt</th>
<th>Packaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brewing</td>
<td>Paint</td>
</tr>
<tr>
<td>Cement</td>
<td>Paper</td>
</tr>
<tr>
<td>Chemical</td>
<td>Pharmaceutical</td>
</tr>
<tr>
<td>Dairy</td>
<td>Plastics</td>
</tr>
<tr>
<td>Edible oil</td>
<td>Power Generation</td>
</tr>
<tr>
<td>Fertilizer</td>
<td>Refining</td>
</tr>
<tr>
<td>Food &amp; Beverage</td>
<td>Semiconductor</td>
</tr>
<tr>
<td>Glass</td>
<td>Sugar</td>
</tr>
<tr>
<td>Mining &amp; Metals</td>
<td>Textile</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>Water &amp; Wastewater.</td>
</tr>
</tbody>
</table>

Features

- State of the art circular polarisation
- Simple sensitivity adjustment and calibration
- IECEx ta tb IIIC T* Da Db
- Theoretical range up to 300m (984ft)
- Simple ‘1-minute’ setup application presets
- Relay outputs: Integral (1 + failsafe)
- Remote test function
- Adjustable ON and OFF delays (0-20 sec)
- Remote 3G Hawklink connection option
- Bright visual status indication on sensors
- Independent housing alignment after mounting sensor.

*Consult Safety Instructions
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 object’s 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.
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.
Microwave System

1" BSP or 1" NPT thread types available
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.

Sensing element within process
Mounted to MA1-WC threaded weldment / coupling
Waveguides

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.


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Mounting Example

System with Waveguide extensions with MA2-WC-SS window and weldment/coupling application seal.

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1Displayed drawing includes qty 5 of MA-WG11 locking nut per side

2Displayed drawing includes qty 3 of MA-WG11 locking nut per side
Dimensions
G1 Microwave Switch Series

MA Series Mounting Accessories

Weldment / Couplings with Window for application seal

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

MA1-WC
Weldment / Coupling

MA1-UW
UHMW Window

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

MA2-WC
Weldment / Coupling

MA2-UW
UHMW Window
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 Installations. Consult Safety Instructions for critical details.

<table>
<thead>
<tr>
<th>Part No</th>
<th>Window Material</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>P.C.D</th>
<th>No. Holes</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD1-X</td>
<td>UHMW</td>
<td>75</td>
<td>3.0</td>
<td>48</td>
<td>1.9</td>
<td>29</td>
<td>1.1</td>
<td>68 2.7</td>
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<tr>
<td>MD2-X</td>
<td>UHMW</td>
<td>100</td>
<td>3.9</td>
<td>73</td>
<td>2.9</td>
<td>54</td>
<td>2.1</td>
<td>93 3.7</td>
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<tr>
<td>MD3-X</td>
<td>UHMW</td>
<td>122</td>
<td>4.8</td>
<td>93</td>
<td>3.7</td>
<td>77</td>
<td>3.0</td>
<td>115 4.5</td>
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<tr>
<td>MD6-X</td>
<td>PTFE</td>
<td>122</td>
<td>4.8</td>
<td>93</td>
<td>3.7</td>
<td>77</td>
<td>3.0</td>
<td>115 4.5</td>
</tr>
</tbody>
</table>

1\text{X} = \text{Weldment Material Selection}

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<table>
<thead>
<tr>
<th>Part No</th>
<th>Window Material</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>P.C.D</th>
<th>No. Holes</th>
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</thead>
<tbody>
<tr>
<td>MD1-X</td>
<td>UHMW</td>
<td>43</td>
<td>1.7</td>
<td>28</td>
<td>1.1</td>
<td>4</td>
</tr>
<tr>
<td>MD2-X</td>
<td>UHMW</td>
<td>68</td>
<td>2.7</td>
<td>53</td>
<td>2.1</td>
<td>4</td>
</tr>
<tr>
<td>MD3-X</td>
<td>UHMW</td>
<td>89</td>
<td>3.5</td>
<td>76</td>
<td>3.0</td>
<td>4</td>
</tr>
<tr>
<td>MD6-X</td>
<td>PTFE</td>
<td>89</td>
<td>3.5</td>
<td>76</td>
<td>3.0</td>
<td>4</td>
</tr>
</tbody>
</table>

1\text{X} = \text{Weldment Material Selection}
Waveguides and Waveguide Accessories

MA-WG04

MA-WG04 with MA-WG14 window

MA-WG03

MA-WG12

MA-WG02

MA-WG12L=xxx

MA-WG-13

MA-WG01

MA-WG11
**Wiring**

**G1 Microwave Switch Series**

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**Sender**

**Status LED**
- Green when powered
- Blinks while working correctly
- Solid while not transmitting

**TEST button**
- Press and hold to test level relay action

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**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

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**If using AC power the earth/ground cable must be connected to the internal ground screw, and the external ground screw must be connected to metallic vessel or earth**

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**SENDER TERMINAL LAYOUT**

<table>
<thead>
<tr>
<th>Terminals</th>
<th>DC-IN</th>
<th>AC-IN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2, 3, 4, 5, 6</td>
<td>7, 8, 9, 10</td>
<td></td>
</tr>
<tr>
<td>12-30VDC</td>
<td>80-260VAC</td>
<td></td>
</tr>
</tbody>
</table>

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

**RECEIVER TERMINAL LAYOUT**

<table>
<thead>
<tr>
<th>Terminals</th>
<th>RELAY</th>
<th>COMMS</th>
<th>DC-IN</th>
<th>AC-IN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, 2, 3, 4, 5, 6</td>
<td>7, 8, 9, 10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RS 485</td>
<td>Modbus</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-30VDC</td>
<td>80-260VAC</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TERMINAL LAYOUT**

1. **DC-IN**: 12-30VDC
2. **AC-IN**: 80-260VAC
3. **RELAY**: NC, COM, NO, Test
4. **COMMS**: RS 485, Modbus

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Use long nose pliers to extract terminals

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**Overview**

**G1 Microwave Switch Series**
**Overview**

**Part Numbers**

**G1 Microwave Switch Series**

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1S</td>
<td>Gladiator 1&quot; Microwave Integral Sender, 1 Relay with Failsafe</td>
</tr>
<tr>
<td>G1R</td>
<td>Gladiator 1&quot; Microwave Integral Receiver, 1 Relay with Failsafe</td>
</tr>
<tr>
<td>G1Q</td>
<td>Gladiator 1&quot; Microwave Integral Receiver with anti-crosstalk Sequenced software, 1 Relay with Failsafe. Requires GMSEQ Sequencer</td>
</tr>
</tbody>
</table>

**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 +80°C

**Microwave Sequencer**

<table>
<thead>
<tr>
<th>GMSEQ</th>
<th>Gladiator Microwave Sequencer</th>
</tr>
</thead>
</table>

**Power Supply**

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

**G1S**

- MA Series Mounting Accessories

<table>
<thead>
<tr>
<th>MA</th>
<th>1</th>
<th>1&quot; UHMW Window &amp; mild steel weldment/coupling each</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-SS</td>
<td>1</td>
<td>UHMW Window &amp; 316L stainless steel weldment/coupling each</td>
</tr>
<tr>
<td>1-UW</td>
<td>1</td>
<td>UHMW Window each</td>
</tr>
<tr>
<td>1-WC</td>
<td>1</td>
<td>mild steel weldment/coupling each</td>
</tr>
<tr>
<td>1-WC-SS</td>
<td>1</td>
<td>316L stainless steel weldment/coupling each</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>UHMW Window &amp; mild steel weldment/coupling each</td>
</tr>
<tr>
<td>2-SS</td>
<td>2</td>
<td>UHMW Window &amp; 316L stainless steel weldment/coupling each</td>
</tr>
<tr>
<td>2-UW</td>
<td>2</td>
<td>UHMW Window each</td>
</tr>
<tr>
<td>2-WC</td>
<td>2</td>
<td>mild steel weldment/coupling each</td>
</tr>
<tr>
<td>2-WC-SS</td>
<td>2</td>
<td>316L stainless steel weldment/coupling each</td>
</tr>
</tbody>
</table>

**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-Le 316L Straight pipe extension ‘Le’ 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.

*Consult Safety Instructions*
MD Series Mounting Accessories - Kit

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

BASE Weldment Only

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)

BASE - MD2 - A

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

<table>
<thead>
<tr>
<th>Full Kit¹</th>
<th>Size</th>
<th>Window</th>
<th>Weldment¹</th>
<th>Locking Ring¹</th>
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</thead>
<tbody>
<tr>
<td>MD1-X</td>
<td>1&quot;</td>
<td>WIN-MD1</td>
<td>BASE-MD1-X</td>
<td>LRING-MD1-X</td>
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<tr>
<td>MD2-X</td>
<td>2&quot;</td>
<td>WIN-MD2</td>
<td>BASE-MD2-X</td>
<td>LRING-MD2-X</td>
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<tr>
<td>MD3-X</td>
<td>3&quot;</td>
<td>WIN-MD3</td>
<td>BASE-MD3-X</td>
<td>LRING-MD3-X</td>
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<tr>
<td>MD6-X</td>
<td>3&quot;</td>
<td>WIN-MD6</td>
<td>BASE-MD3-X</td>
<td>LRING-MD3-X</td>
</tr>
</tbody>
</table>

¹X = Material Selection
Specifications

G1 Microwave Switch Series

**Operating Voltage**
- 12-30VDC (residual ripple no greater than 100mV)
- 80-260VAC.

**Power Consumption**
- <0.8W @ 24VDC
- <3VA @ 115VAC.
- <5VA @ 240VAC

**Communications**
- GosHawk, Modbus
- Multidrop mode can address 1-250 units over 4 wires.

**Relay Output**
- Form ‘C’ (SPDT) contacts, rated 5A at 240VAC resistive
- Remote fail-safe test facility for one relay.

**Operating Temperature**
- Integral Units -30°C (-20°F) to 65°C (150°F)*.
  *For higher temperature applications, remote waveguide mounting with appropriate windows is necessary.

**Power Density**
- Rated from emitter to receiver at approximately 20µW/cm²
- Complies with FCC Title Rules Part 15 (Beam Blockage)
- Caution sign posting not required.

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

**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 (984 ft)
- 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**
- 2 BAR.

**Enclosure Sealing**
- IP66/67

**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" NTP
- 1" BSP

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

**Weight**
- G1R 1kg
- G1S 1kg.

**Approval**
- IECEx Zone 20/21, Zone 21
- Ex ta tb IIIIC T* Da Db Tamb = -30 to +80C
- IP66
  *Consult Safety Instructions

Specifications model dependent

For more information and global representatives: www.hawkmeasure.com

Additional product warranty and application guarantees upon request.
Technical data subject to change without notice.

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