

A Higher Level of Performance



Data Sheet

Gladiator

Gen 3 Microwave Switch Series

Beam Blockage Detection
Circular Polarisation



For more information, please visit >
www.hawkmeasure.com

Overview

Gladiator Gen 3 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 or 4-20mA output the change for automatic indication and process control requirements.

Typical Uses

- Blocked chute detection
- Collision detection
- Stacker / Reclaimer protection
- Shiploader protection
- 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, collision detection for protection, 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 transmission
- Backwards compatible with all Gladiator Microwave generations
- LCD push button setup / diagnostics on remote amplifier
- Simple sensitivity adjustment and calibration on Integral system
- Ranges up to 1200 meters (3937 ft)
- Simple '1-minute' setup application pre-sets
- Remote sensor or Integral 'all in one' types
- Relay outputs: Integral (1 + failsafe) Remote (2)
- Remote test function
- Adjustable ON and OFF delays (0-20 sec)
- Remote 3G HAWKlink connection option
- Remote amplifier to sensor separation up to 500 meters (1640 ft)
- Bright visual status indication on sensors
- Independent housing alignment after mounting sensor.

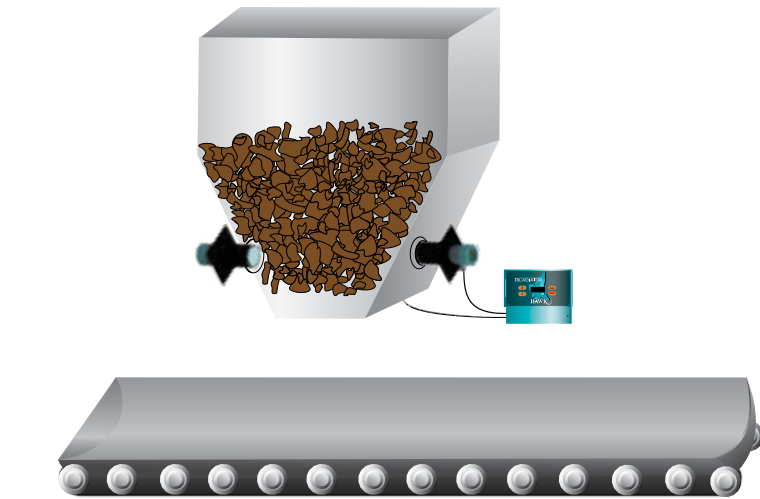
Typical Applications

Gladiator Gen 3 Microwave Switch Series



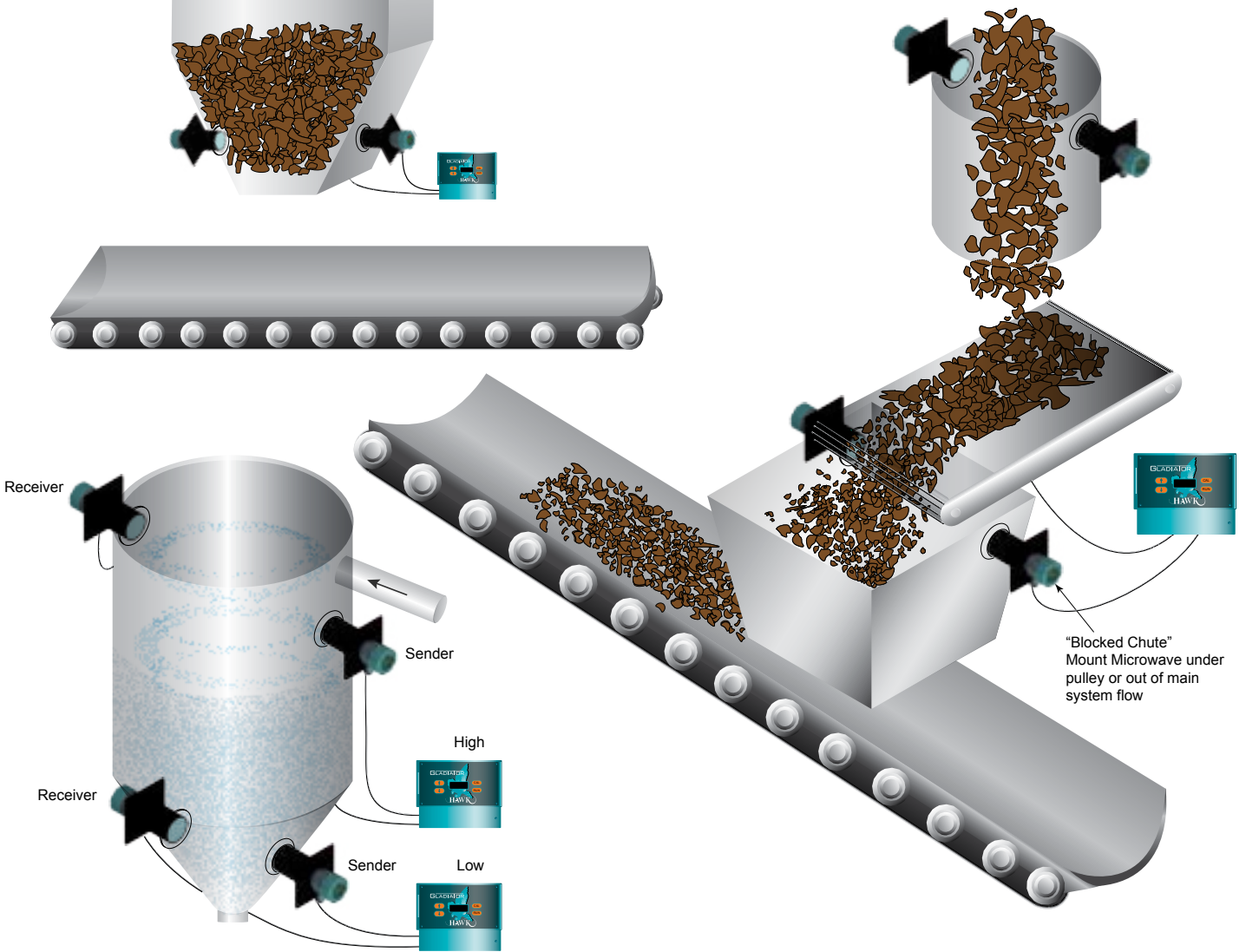
Conveyor Protection

Presence / Absence of material



Bulk Material Handling

High / Low blocked chute detection

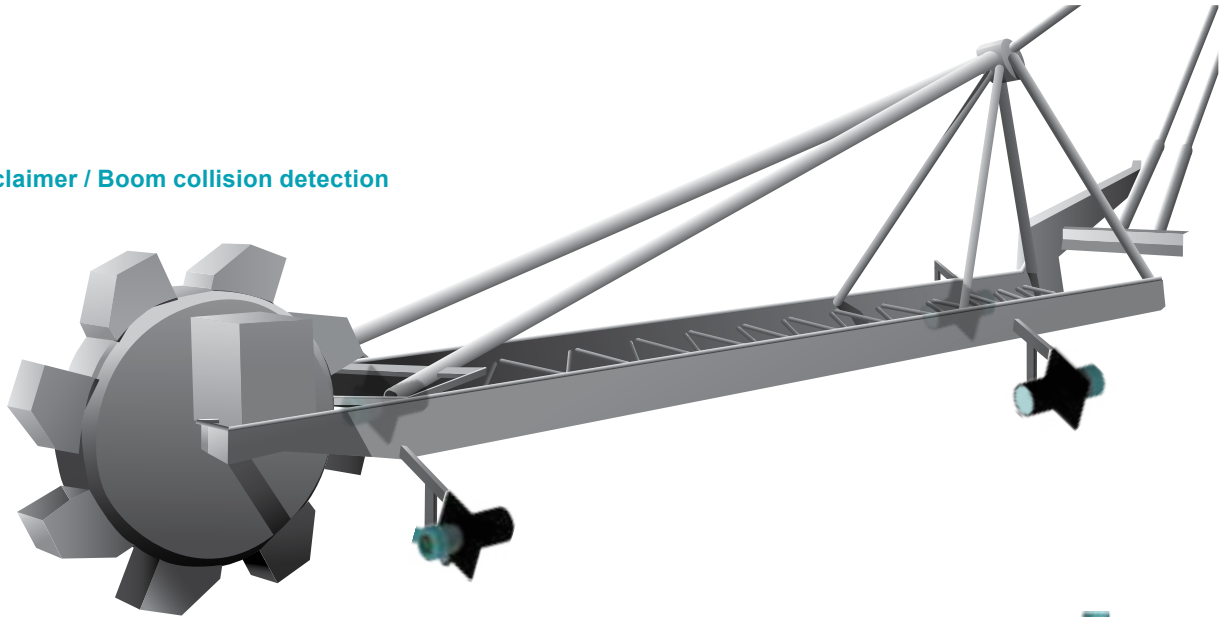


Typical Applications

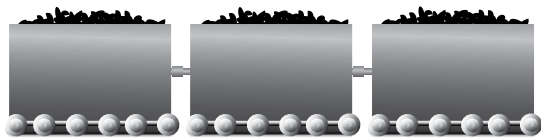
Gladiator Gen 3 Microwave Switch Series



Stacker / Reclaimer / Boom collision detection



Wagon Detection



Truck Detection



Tip / Overload detection



Tip / Overload detection



Linear v Circular Polarisation

Gladiator Gen 3 Microwave Switch Series



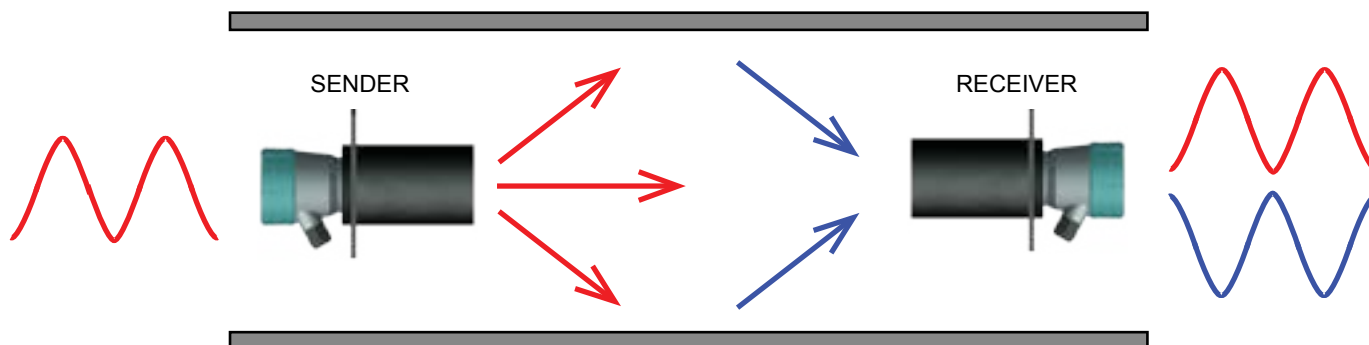
Generation 1 Microwave - Linear Polarisation

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

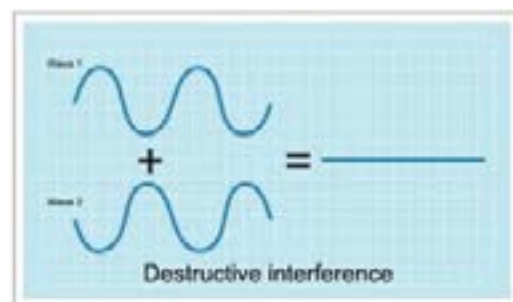
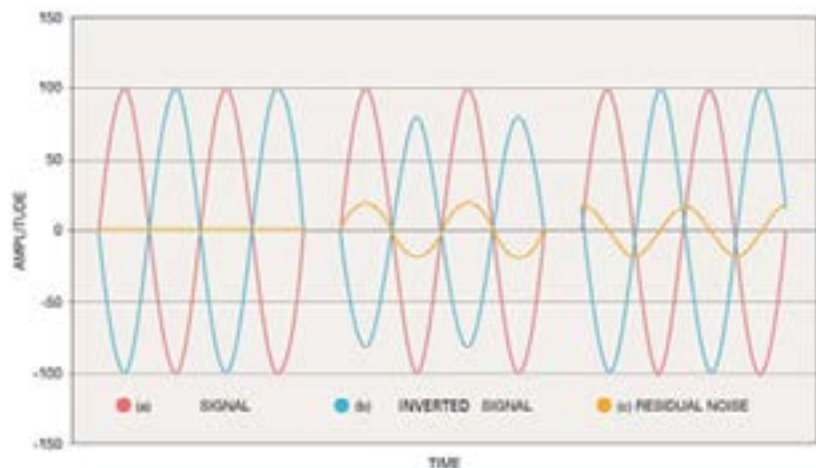
Perfect Condition: Tx Pulse = Rx Pulse



REFLECTIONS FROM CHUTE WALLS OR BOOM
Rx Pulse = Tx Pulse - Reflected Pulse



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.



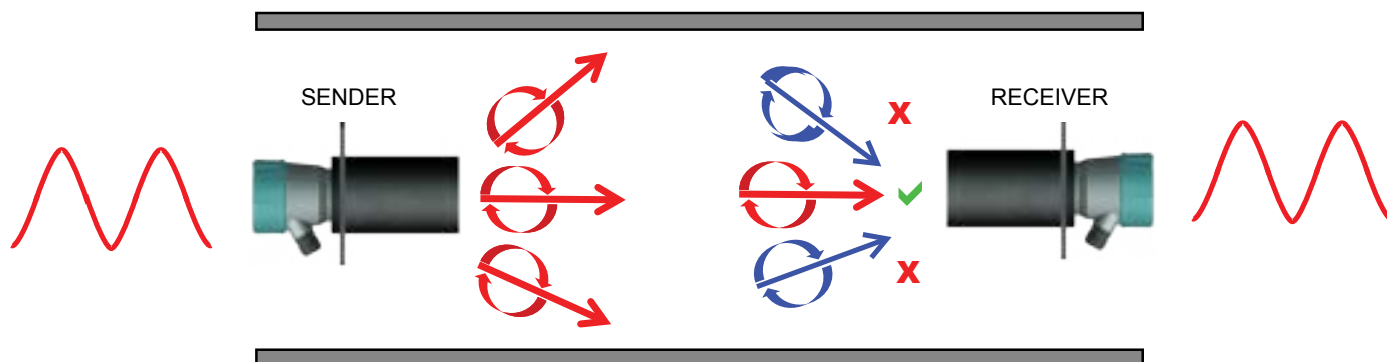
Linear v Circular Polarisation

Gladiator Gen 3 Microwave Switch Series



Generation 3 Gladiator Microwave - Circular Polarisation

- Maximum Receiver Gain: 90,000
- Maximum Distance : 1200m
- Beam Angle: 25° (3 inch horn antenna)



Circular polarization is either right handed or left handed. The HAWK Gen 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 Gen 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.

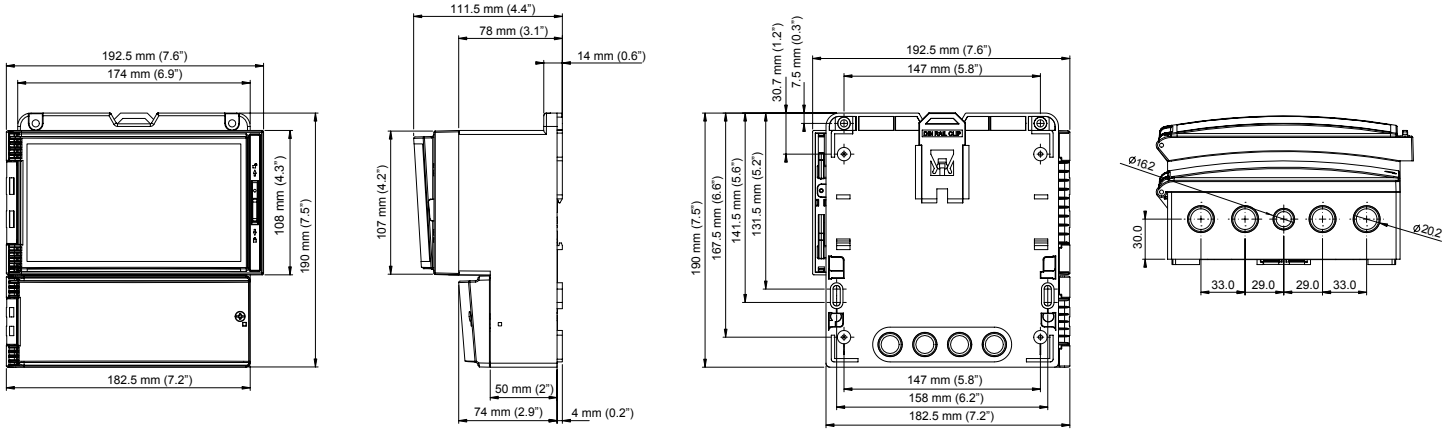
Dimensions

Gladiator Gen 3 Microwave Switch Series

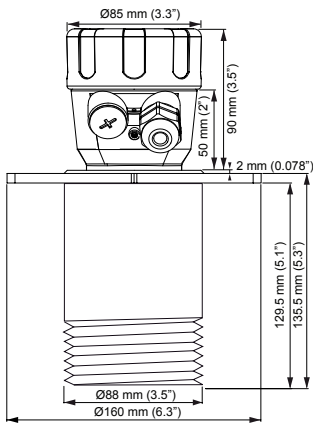


Remote Microwave System

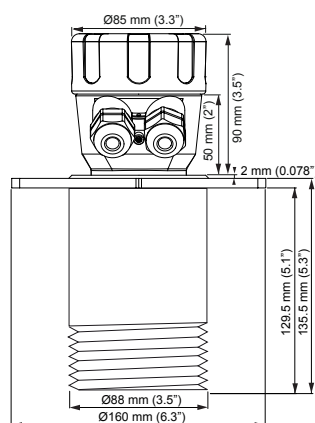
Remote Amplifier



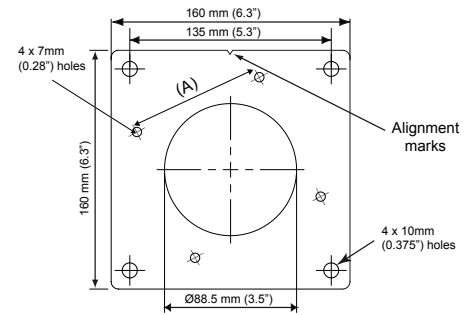
Remote Sender / Receiver



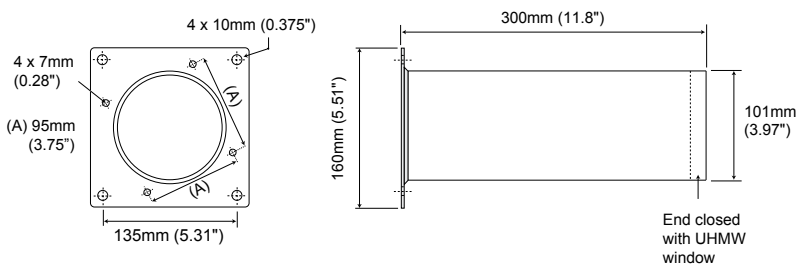
Integral Sender / Receiver



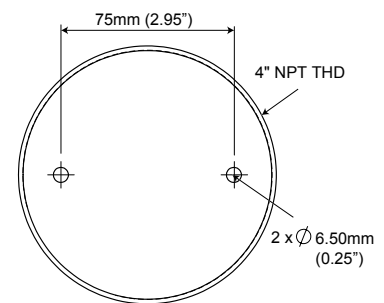
Mounting Bracket



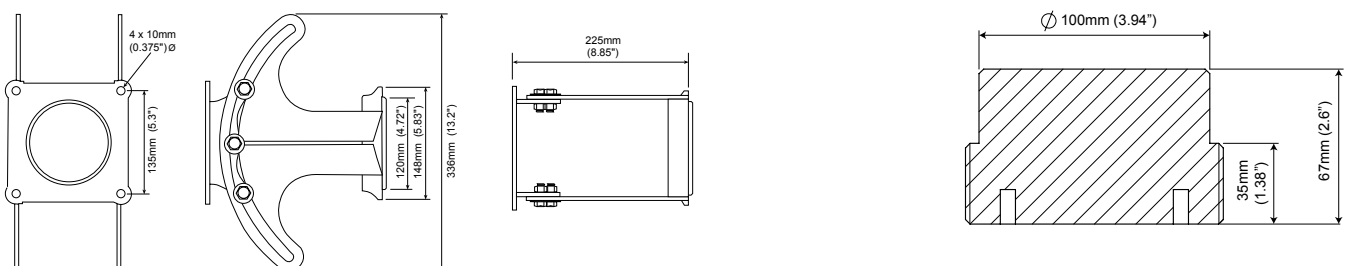
MA15 / MA25 Focaliser Tube (extension pipe)



MA20-P1



MA12 / MA13 Adjustable Mounting Bracket



Dimensions

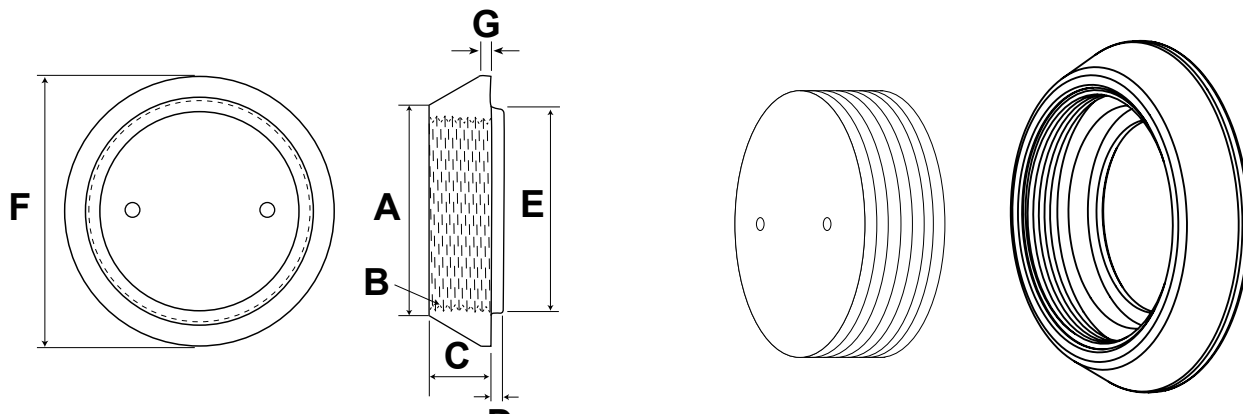
Gladiator Gen 3 Microwave Switch Series



Weldments and Windows (UHMW / PTFE)

Weldment with UHMW / PTFE Windows

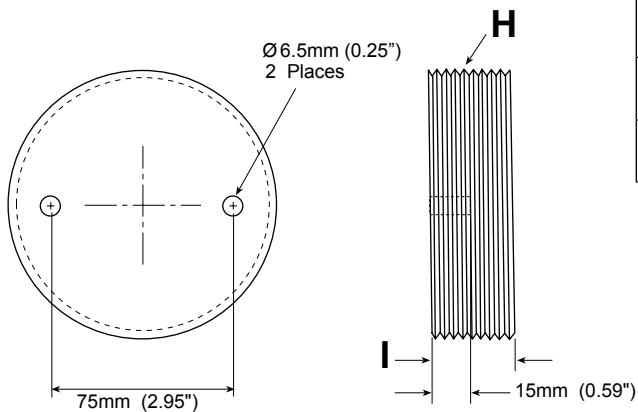
Weldment is welded to the vessel. Window threads into Weldment



Size	A	B	C	D	E	F	G
3"	100 (3.94")	3" NPT	22 (0.87")	5 (0.2")	92.5 (3.64")	118 (4.65")	4 (0.16")
4"	125 (4.92")	4" NPT	24.4 (0.96")	5 (0.2")	120 (4.72")	148 (5.83")	4 (0.16")
6"	190.4 (7.5")	6" NPT	40 (3.94")	5 (0.2")	175 (6.89")	223 (8.78")	11.2 (0.44")

Weldment / Window Parts			
Part Number	Size	Window	Weldment
MA0	3"		✓
MA3	3"	✓	✓
MA4	4"	✓	✓
MA5	6"	✓	✓
MA6	3"	✓	✓
MA7	4"	✓	✓
MA8	6"	✓	✓
MA18	4"		✓
MA19	3"		✓
MA20	4"	✓	
MA21	3"	✓	
MA22	4"		✓

UHMW / PTFE Window



Size	H	I
3"	3" NPT	28.7 (1.13")
4"	4" NPT	35 (1.38")
6"	6" NPT	40 (1.57")

Dimensions

Gladiator Gen 3 Microwave Switch Series

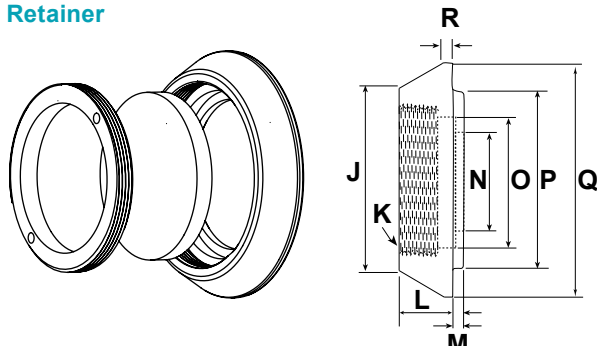


Weldments and Windows (Ceramic)

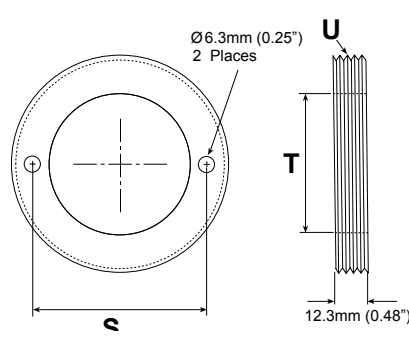
Weldment with Ceramic Windows

Weldment is welded to the vessel. Window is locked into Weldment with Locking Retainer

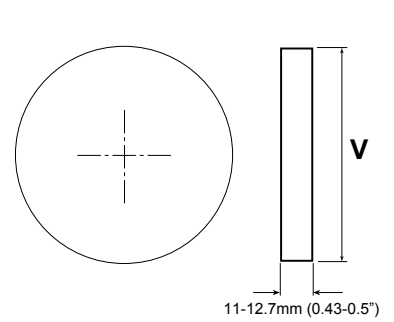
Locking Window Weldment Retainer



Locking Retainer



Ceramic Window



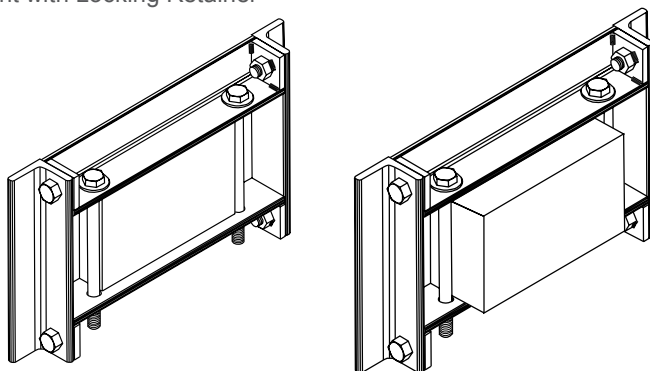
Size	J	K	L	M	N	O	P	Q	R	S	T	U	V
3"	100 (3.94")	3" NPT	22 (0.87")	5 (0.2")	65 (2.56")	75 (2.95")	92.5 (3.64")	118 (4.65")	4 (0.16")	75 (2.95")	65 (2.56")	3" NPT	74.5 (2.93")
4"	125 (4.92")	4" NPT	24.4 (0.96")	5 (0.2")	90 (3.54")	101 (3.98")	120 (4.72")	148 (5.83")	4 (0.16")	100 (3.94")	90 (3.54")	4" NPT	100.5 (3.96")

Weldment / Window Parts			
Part Number	Size	Window	Weldment
MA16	3"	✓	✓
MA17	4"	✓	✓

Weldments and Windows (Ceramic Tile & Firebrick Assemblies)

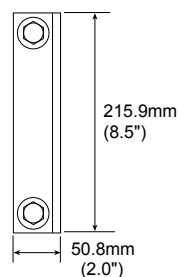
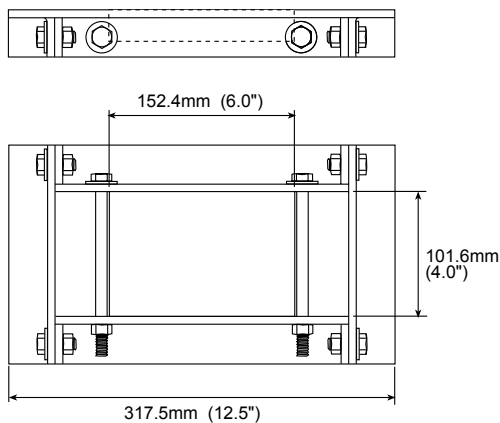
Weldment with Ceramic Windows

Weldment is welded to the vessel. Window is locked into Weldment with Locking Retainer

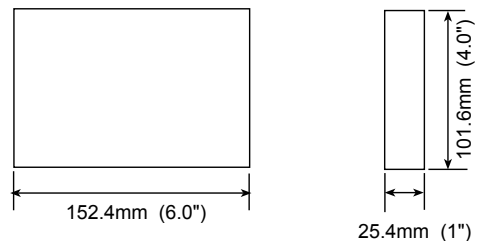


Weldment / Window Parts			
Part Number	Size	Window	Weldment
MA9	Special	✓	✓
MA10	Special	✓	✓
MA16	3"	✓	✓
MA17	4"	✓	✓

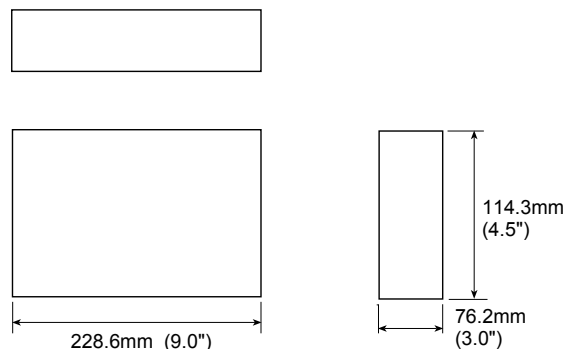
Mounting Assemblies



Ceramic Tile



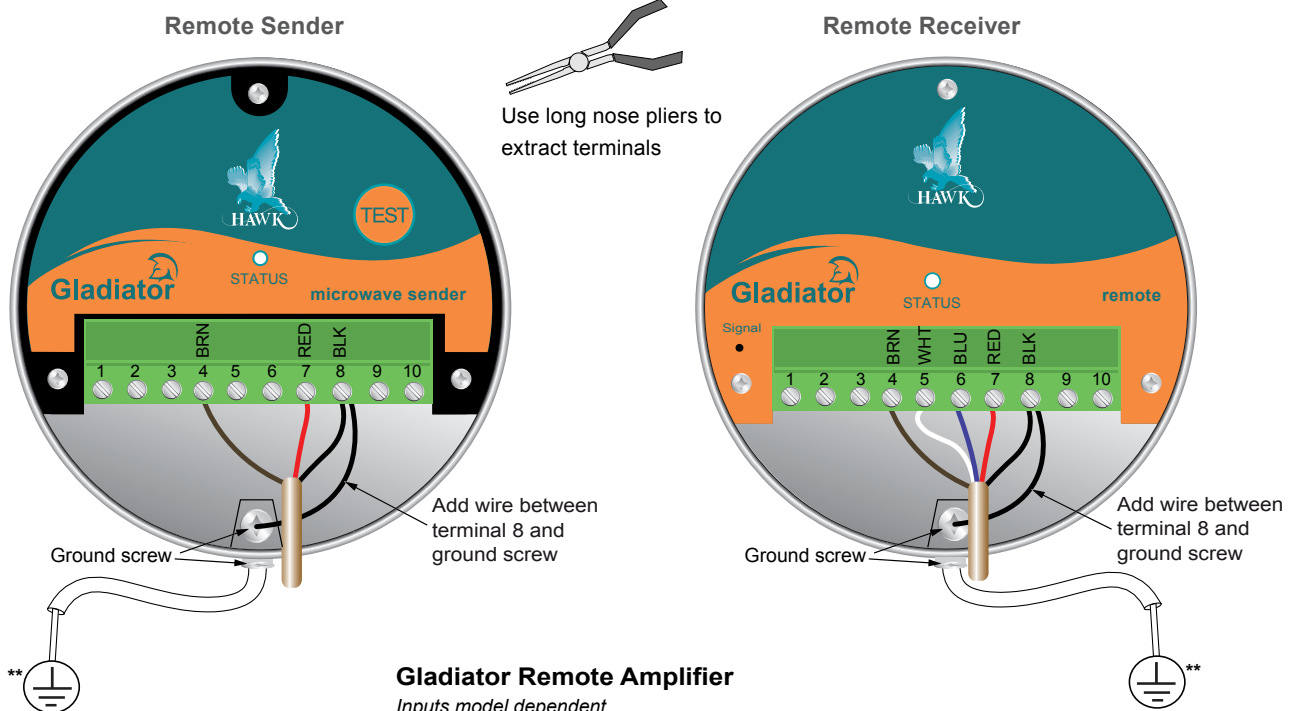
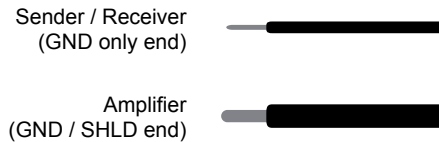
Firebrick





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.



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"/>
			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"/>
<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"/>
I_s	+	-	RED	BLACK	BLUE	WHITE	BROWN	B	A	-	+	⊕	N	⏏
4-20mA			SENSOR			COMMS			DC-In			AC-In		

Remote Receiver

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

Remote Receiver

Status LED

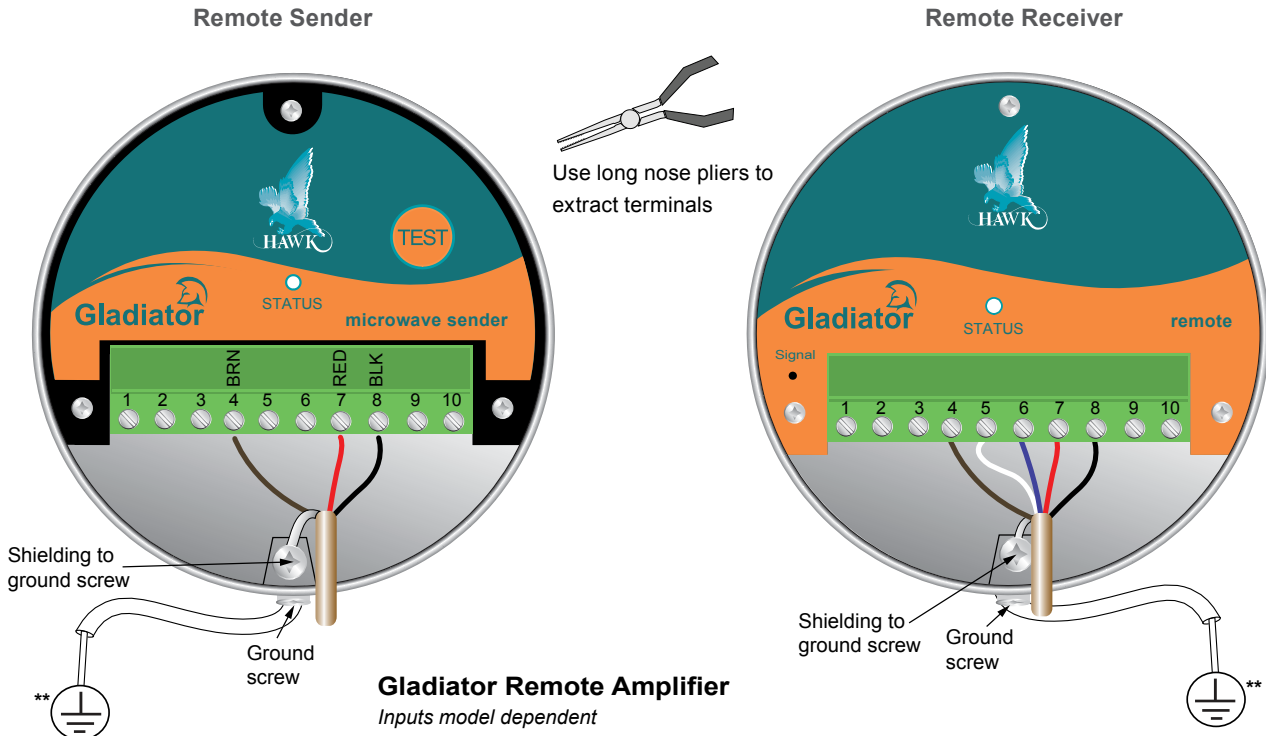
- Green when powered
- High illumination = strong signal
- Low illumination = weak signal

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



Remote System Connection - Customer Supplied Cable



Gladiator Remote Amplifier

Inputs model dependent

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

Remote Receiver

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

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

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

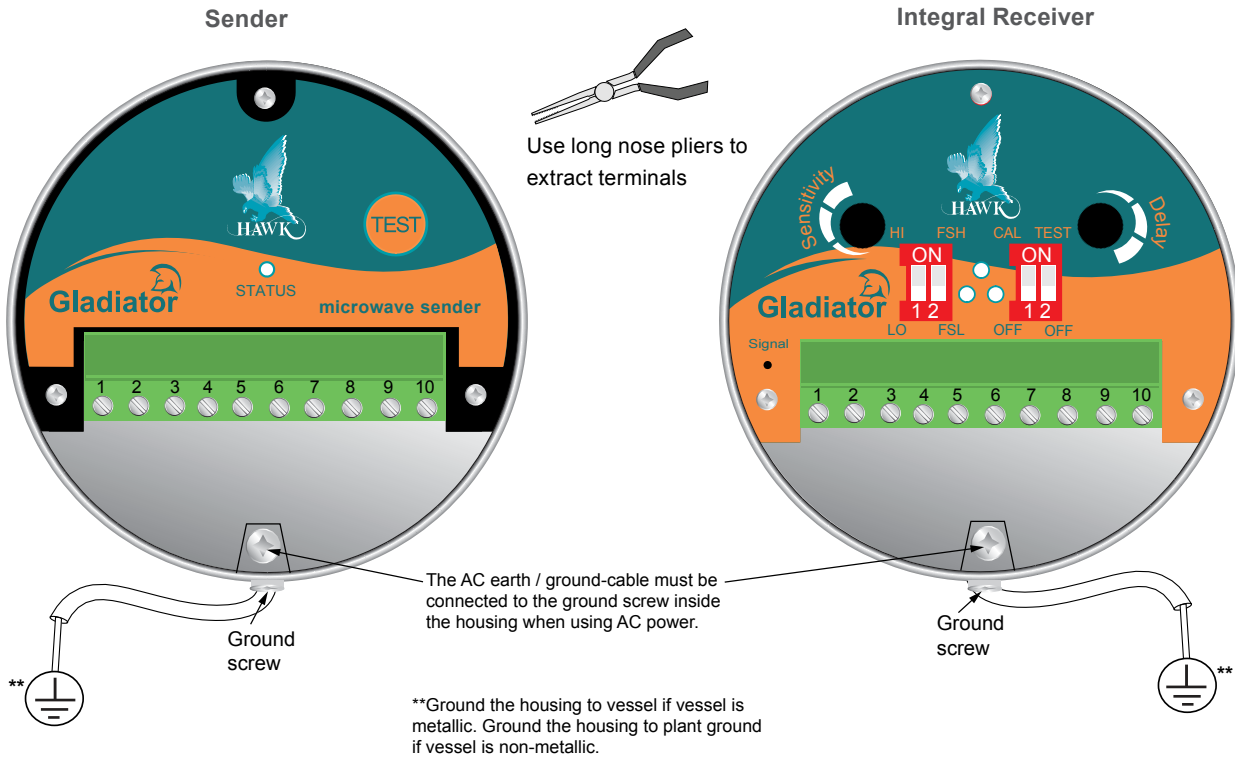
Alternate cable type between Amplifier and Sensors

- 6 or 8 conductor (5 used) shielded twisted pair instrument cable.
- Conductor size dependent on cable length.
- BELDEN 3120A, DEKORON or equivalent.
- Max: BELDEN 3120A = 500m (1640 ft). 3 pairs, 1 conductor not used.

Alternate Cable Colour Equivalents			
Pairs	HAWK	Belden 3120A	Dekoron
Pair 1	Red Black	Red Black	White 1 Black 1
Pair 2	White Blue	Yellow Green	White 2 Black 2
Pair 3	Brown ---	Brown White (not used)	White 3 Black 3 (not used)
Pair 4	not used	not used	not used



Integral System Connection



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

Integral Receiver

Status LED

- Green LED: Indicates received signal strength
- High illumination = strong signal
- Low illumination = weak signal
- Red LED: Indicates Relay status
- Blue LED: Flashes during calibration. Stays illuminated if calibration fails

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

SENDER TERMINAL LAYOUT

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

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
				RS 485		12-30VDC		80-260VAC	

Note:

AC power terminals may only be used when universal AC power supply option has been selected - see part numbers - AC terminals have no function in products without universal AC power option.

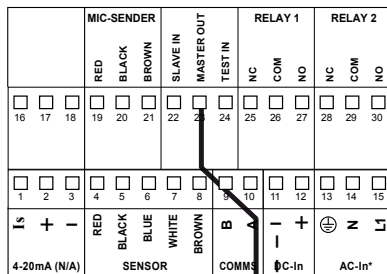


Cross-Talk Prevention / Sequencer Wiring

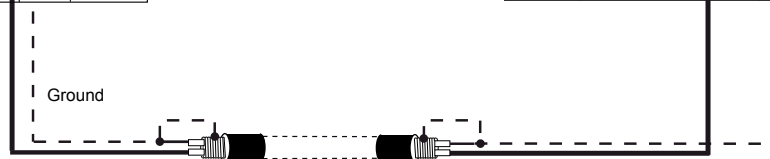
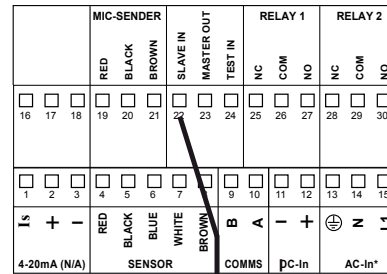
- Up to four remote Microwave systems can be set up for anti-crosstalk.
- For two systems, one can be set to operating mode 'Master' and the other to operating mode 'Slave'
- For up to four systems, a dedicated Sequencing control unit must be used with the four systems set to operating mode 'Slave'
- See user manual for further information.

Master / Slave Wiring

GLADIATOR MICROWAVE REMOTE AMPLIFIER - MASTER

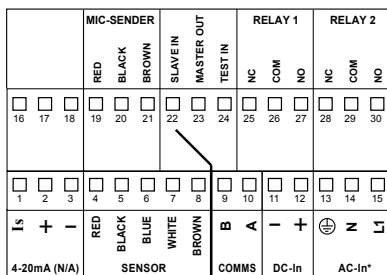


GLADIATOR MICROWAVE REMOTE AMPLIFIER - SLAVE

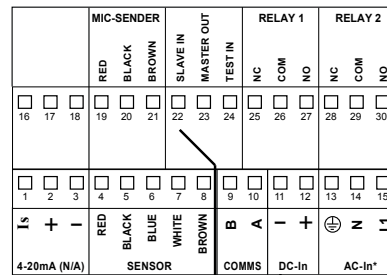


Sequencer / Slave Wiring

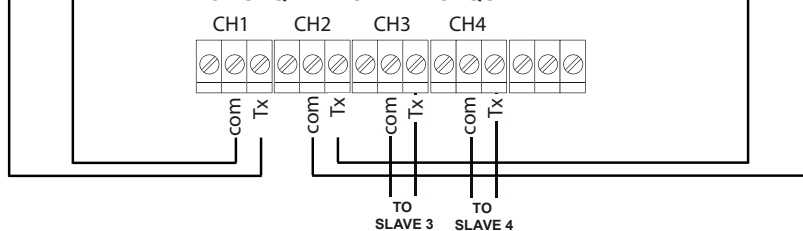
GLADIATOR MICROWAVE REMOTE AMPLIFIER - SLAVE



GLADIATOR MICROWAVE REMOTE AMPLIFIER - SLAVE



GMSEQ MICROWAVE SEQUENCER



Part Numbering

Gladiator Gen 3 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 30-48VDC and 48-90VAC

U 12-30VDC and 90-260VAC

Output Options

S 2 Relays (relay 1 primary switch, relay 2 secondary switch OR Failsafe / Cleaner / Maintenance alarm)

X Option 'S' plus 4-20mA output

Approval

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

GSA S U S

Remote Sender / Receiver

GMSB Gladiator Microwave Sender

GMRR Gladiator Microwave Remote Receiver

Frequency

1 10.525 GHz

Transducer Facing Material Selection

0 UHMW Polyethylene

1 PTFE Teflon

Transducer Housing Material

1 Aluminium / Mild Steel

2 316L Stainless Steel

Output Option

X Not Required - Outputs generated from GSA amplifier

Approval Standard

X Not Required

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

GMSB 1 0 1 X X

Connection Cable

CA-GMR Pre-cut cable for remote sender or receiver

10 10m cable

20 20m cable

30 30m cable

50 50m cable

100 100m cable

Lengths above 100m available via special order

CA-GMR 10

Part Numbering

Gladiator Gen 3 Microwave Switch Series



Integral Version

GMS Gladiator Microwave Sender
GMSR Gladiator Microwave Smart (Integral) Receiver

Power Supply

B 12-30 VDC
U 12-30VDC and 90-260VAC

Frequency

1 10.525 GHz

Transducer Facing Material Selection

0 UHMW Polyethylene
1 PTFE Teflon

Transducer Housing Material

1 Aluminium / Mild Steel
2 Full stainless steel

Output Option

X Not Required for Sender units
S Switch, 1 output relay with Modbus for Receiver units

Approval Standard

X Not Required
A22 ATEX Grp II Cat 3 GD T85°C IP67 Tamb -40°C to 70°C

GMSR B 1 0 1 S X

MA Mounting Accessory

Type

0 3" Weldment, each
3 3" UHMW Window & Weldment each
4 4" UHMW Window & Weldment each
5 6" UHMW Window & Weldment each
6 3" PTFE Window & Weldment each
7 4" PTFE Window & Weldment each
8 6" PTFE Window & Weldment each
9 9' x 4,5" fire brick assembly each
10 6" x 4" ceramic brick assembly each
11 Shock/vibration insulation mounts pack of 4
12 Adjustable mounting bracket (UHMW window) each
13 Adjustable mounting bracket (PTFE window) each
15 Flanged Focaliser tube (extension pipe) (mild steel)
16 3" Ceramic Window & Weldment each
17 4" Ceramic Window & 4" Weldment each
18 4" Microwave Weldment only each
19 3" Stainless steel Weldment only for UHMW each
20 4" UHMW Window only each
21 3" UHMW Window only each
22 4" Stainless steel Weldment only for UHMW each
25 Flanged Focaliser tube (extension pipe) (316L)
20-P1 4" UHMW Window with 40mm insertion depth (fits 4" Weldment)

MA 4

GMSEQ Gladiator Microwave Sequencer

Power Supply

B 12-30VDC
C 30-48VDC and 48-90VAC
U 12-30VDC and 90-260VAC

GMSEQ U

HAWKLink Modem

Model

HL HAWKLink

Type

R Remote stand alone system

Power Supply

B 12-30VDC
U 12-30VDC and 90-260VAC

Network Type

G3 3G

Simcard

S3 Australian Simcard expires after 3 month
S12 Australian Simcard expires after 12 month
X Not Required
(customer supplied data enabled simcard)

HL R U G3 S3

HAWKlink-USB HAWKlink USB PC connector for GosHawkII

Specifications

Gladiator Gen 3 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.

Power Consumption

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

Communications

- GosHawk, Modbus
- Multidrop mode can address 1-250 units over 4 wires.
- 4-20mA

Relay Output: (1) SMART (2) Remote

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

Operating Temperature

- Remote electronics -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 mounting with refractory 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 transmission polarity
- Frequency: 10.525GHz
- Power: +20dBm / 100mW
- Sensitivity -95dBm
- Beam width 25°.

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

- Maximum range under ideal conditions: 1200m (3937 ft)
 - Minimum range under ideal conditions: 10cm (4 inches).
- Note: Minimum ranges are dependent on application conductivity.*

Sender / Receiver to Amplifier Separation

- Up to 500m (1640ft) using specified extension cable.

Alternate cable type between Amplifier and Sensors

- 6 or 8 conductor (5 used) shielded twisted pair instrument cable
- Conductor size dependent on cable length
- BELDEN 3120A, DEKORON or equivalent
- Max: BELDEN 3120A = 500m (1640 ft). 3 pairs, 1 conductor not used
- Max: DEKORON IED183AA004 = 350m (1150 ft). 4 pairs, 3 conductors not used.

Maximum Operating Pressure

- 2 BAR

Display (Remote version only)

- 2 line x 12 character alphanumeric LCD
- Backlight standard.

Memory - Remote

- Non-Volatile (No backup battery required)
- >10 years data retention.

Enclosure Sealing

- Integral Sensors IP67
- Remote Electronics IP65 (Nema 4x)
- Remote Sensors IP67.

Cable Entries

- Remote Sensors: 1 x M20 Gland / 3/4" NPTF threaded adaptor
- Remote Amplifier: 4 x 20mm (0.8"), 1 x 16mm (0.6") knock outs
- Integral Units: 2 x M20 Glands / 3/4" NPTF threaded adaptors.

Mounting

- 3.5" male NPT thread or four 10mm (0.4") holes in flange
- MA12 / MA13 adjustable mounting bracket

Environment Seal

- 3", 4" and 6" weldments for standard mounting on vessel wall with PTFE and UHMW windows
- Flange for mounting separate from vessel wall - isolation shock mounts are available
- Ceramic window assemblies
- Firebrick window assemblies available on custom basis
- Waveguides - custom assemblies available for high temperature and limited access applications.

Weight

- GSA 1kg
- GMS 5kg
- GMR 5kg

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

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