

A Higher Level of Performance



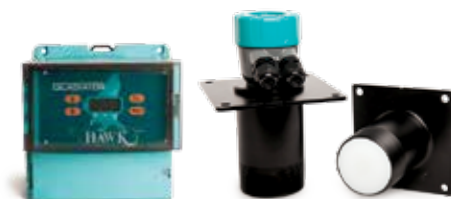
Data Sheet

Gladiator

Gen 3 Doppler Microwave Switch Series

Product Flow Detection

Circular Polarisation



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

Overview

Gladiator Doppler Microwave Series



Principle of Operation

The HAWK Gladiator Doppler Microwave flow switch is used in process applications requiring highly reliable non-contact, non-intrusive product flow detection and movement. The system operates by sending out bursts of microwave energy toward the target product being monitored. The target product will reflect some of the microwave energy back to the system where it is processed to determine if the product is flowing or moving. The system uses the Doppler principle to determine if the product is moving by monitoring small changes in the reflected signal frequency.

When product flow is detected or stops the user set delay period begins and then the relay output is switched for alarm or control purposes. The system also has adjustable Sensitivity to compensate for product dielectrics or movement speeds that may partially reflect the microwave energy. The relay can be set to either energise or de-energise when product flow is detected. LED indicators are provided to indicate flow detection and relay status.

Primary Areas of Application

Detection of moving materials or moving objects where the microwave energy will be reflected back to the sensor from the falling material or moving objects, where a switch point or continuous output is required.

Features

- State of the art Circular transmission
- Flow / No Flow detection
- Speed detection 0.2-20m/s
- LCD push button setup / diagnostics on remote amplifier
- Simple sensitivity adjustment and calibration on Integral system
- Simple '1-minute' setup application presets
- 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.

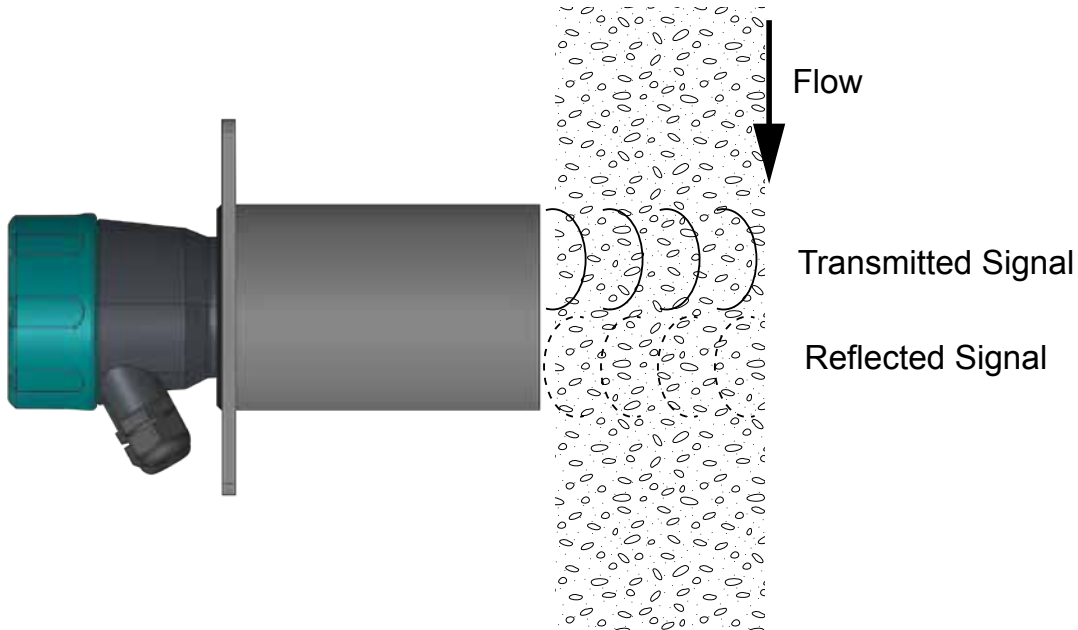
Typical Applications

Gladiator Doppler Microwave Series

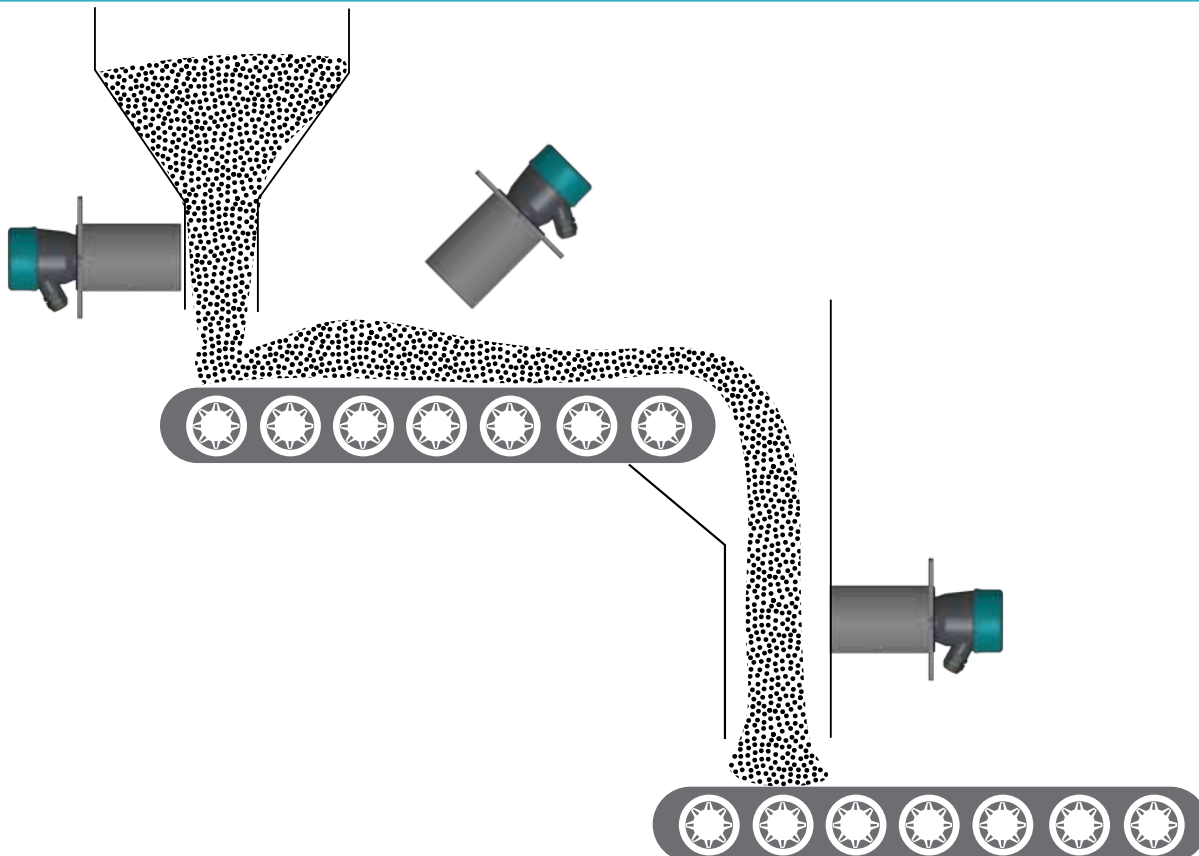


The Doppler Effect

The Doppler effect is used to measure small Microwave reflections from moving materials in the 10.25GHz frequency range. The amount of signal reflected is dictated by the volume, speed and dielectric of the flowing material.



Conveyor Flow / Protection

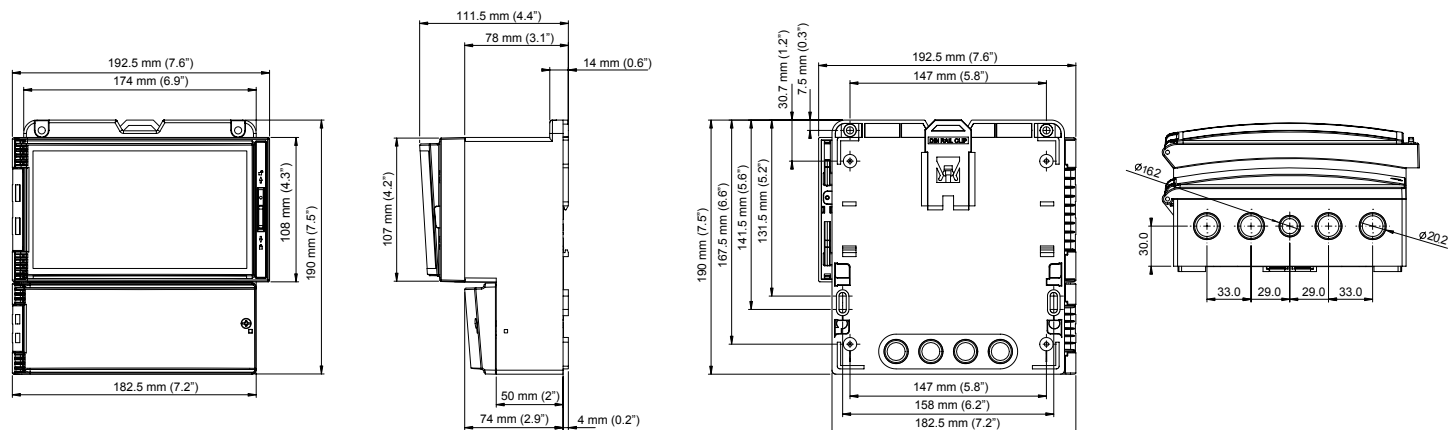


Gladiator Doppler Microwave Series

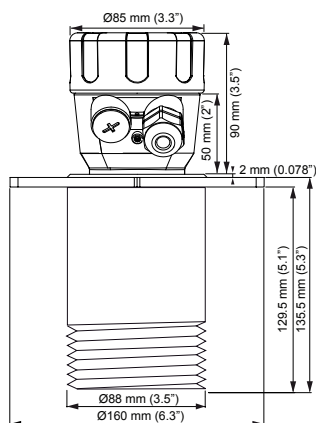


Remote Microwave System

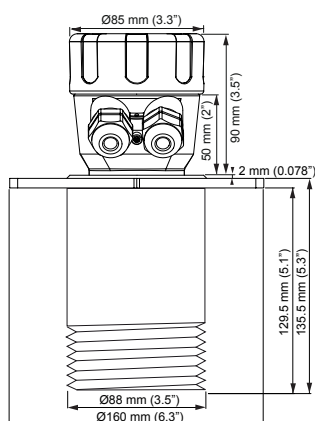
Remote Amplifier



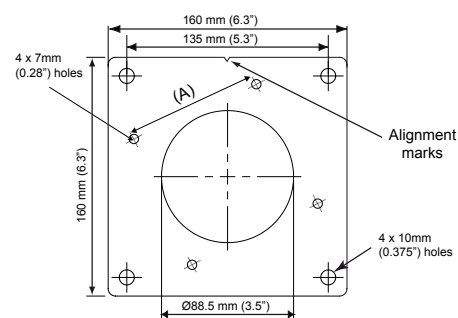
Remote Sensor



Integral Sensor



Mounting Bracket



Dimensions

Gladiator Doppler Microwave Series



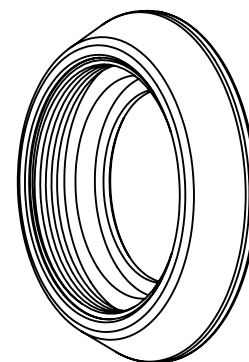
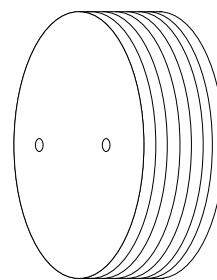
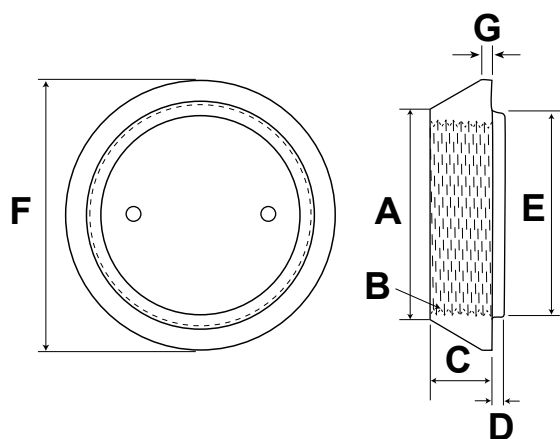
MA Series Weldments and Windows (UHMW / PTFE)

Weldment with UHMW / PTFE Windows

Weldment is welded to the vessel. Window threads into Weldment

Window

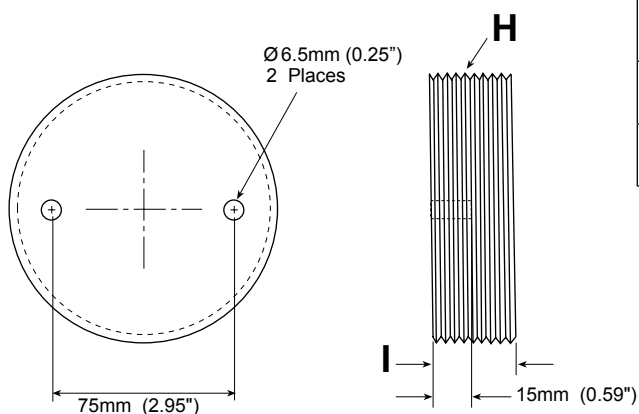
Weldment



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 Doppler Microwave Series

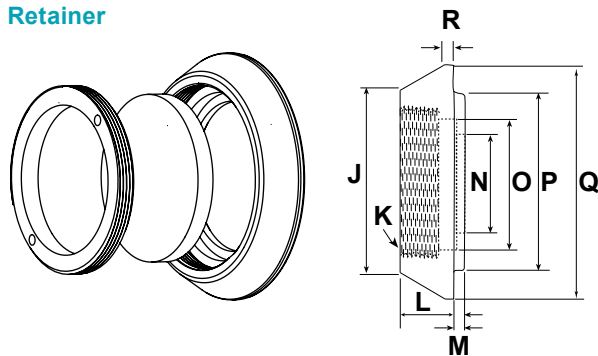


MA Series Weldments and Windows (Ceramic)

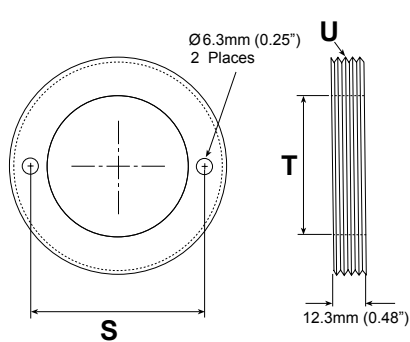
Weldment with Ceramic Windows

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

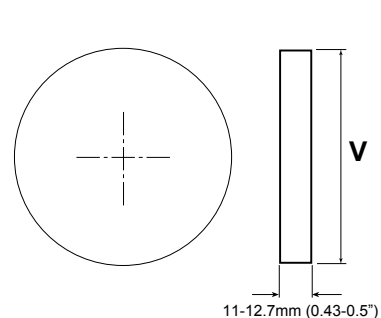
Locking Window Weldment Retainer



Locking Retainer



Ceramic Window



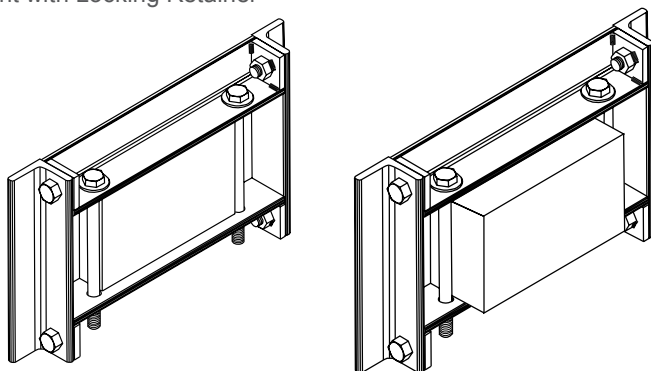
Size	J	K	L	M	N	O	P	Q	R	S	T	U	V
3"	100 (3.94")	3" NPT	22 (0.87")	5 (0.2")	65 (2.56")	75 (2.95")	92.5 (3.64")	118 (4.65")	4 (0.16")	75 (2.95")	65 (2.56")	3" NPT	74.5 (2.93")
4"	125 (4.92")	4" NPT	24.4 (0.96")	5 (0.2")	90 (3.54")	101 (3.98")	120 (4.72")	148 (5.83")	4 (0.16")	100 (3.94")	90 (3.54")	4" NPT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

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

Weldments and Windows (Ceramic Tile & Firebrick Assemblies)

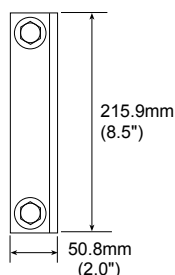
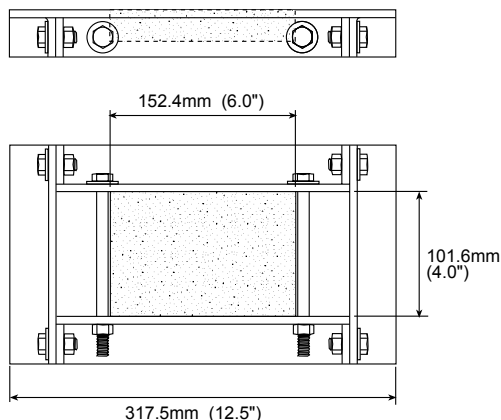
Weldment with Ceramic Windows

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

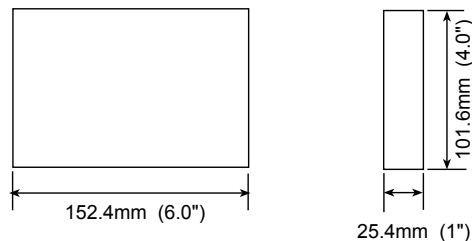


Weldment / Window Parts			
Part Number	Size	Window	Weldment
MA9	Special	✓	✓
MA10	Special	✓	✓
MA16	3"	✓	✓
MA17	4"	✓	✓

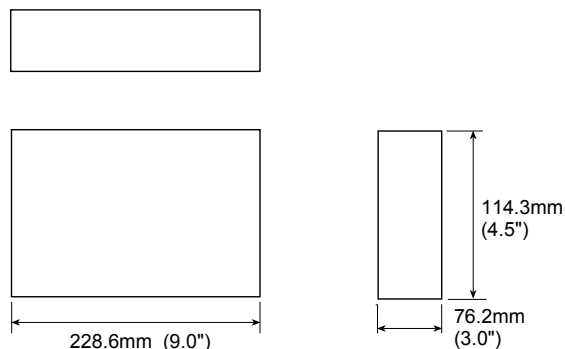
Mounting Assemblies



Ceramic Tile



Firebrick



Dimensions

Gladiator Doppler Microwave Series

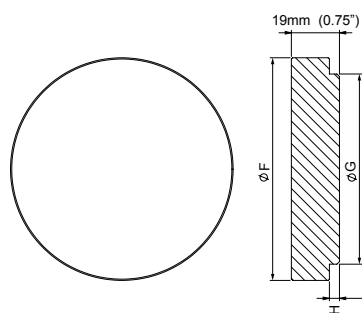


MD Series Weldments and Windows

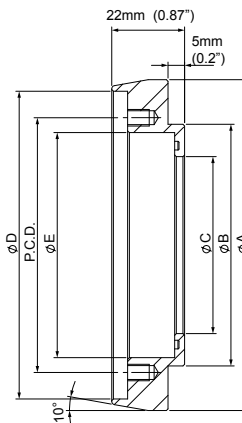
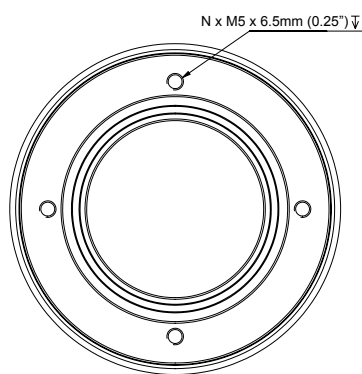
Weldment with UHMW or PTFE Windows

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

UHMW / PTFE Window



Weldment



Assembled Piece



Part No ¹	Window Material	A		B		C		D		E		P.C.D		No. Holes
		mm	in	mm	in	mm	in	mm	in	mm	in	mm	in	
MD3-X	UHMW	122	4.8	93	3.7	77	3.0	115	4.5	90	3.5	99	3.9	4
MD4-X	UHMW	148	5.8	120	4.7	102	4.0	141	5.6	116	4.6	125	4.9	6
MD5-X	UHMW	203	8.0	175	6.9	153	6.0	196	7.7	171	6.7	180	7.1	6
MD6-X	PTFE	122	4.8	93	3.7	77	3.0	115	4.5	90	3.5	99	3.9	4
MD7-X	PTFE	148	5.8	120	4.7	102	4.0	141	5.6	116	4.6	125	4.9	6
MD8-X	PTFE	203	8.0	175	6.9	153	6.0	196	7.7	171	6.7	180	7.1	6

¹X = Weldment Material Selection

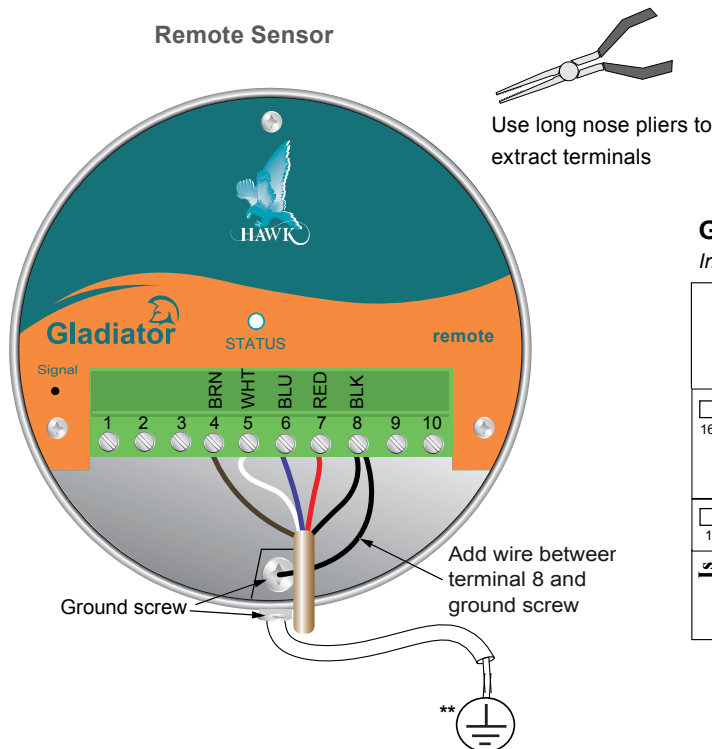
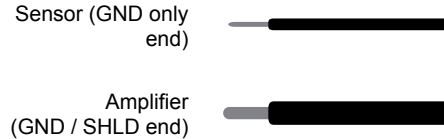
Part No ¹	Window Material	F		G		H		P.C.D		No. Holes
		mm	in	mm	in	mm	in	mm	in	
MD3-X	UHMW	89	3.5	76	3.0	4	1.6	99	3.9	4
MD4-X	UHMW	115	4.5	102	4.0	4	1.6	125	4.9	6
MD5-X	UHMW	170	6.7	153	6.0	4.5	1.8	180	7.1	6
MD6-X	PTFE	89	3.5	76	3.0	4	1.6	99	3.9	4
MD7-X	PTFE	115	4.5	102	4.0	4	1.6	125	4.9	6
MD8-X	PTFE	170	6.7	153	6.0	4.5	1.8	180	7.1	6

¹X = Weldment Material Selection



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.



Gladiator Remote Amplifier

Inputs model dependent

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

Remote Receiver

Remote Sensor

Status LED

- High illumination = no movement detected
- Low / flickering illumination = flow detected

TEST Button

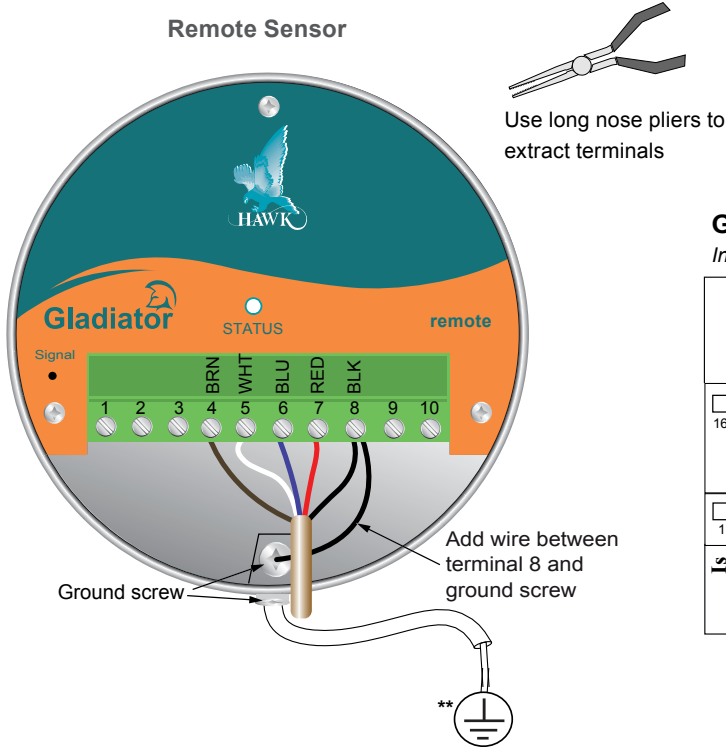
- Press and hold to test level relay action

*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.



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	NC	COM	NO
16	19	20	21	22	23	24	25	26	27	28	29	30						
Sender																		
1	4	5	6	7	8	9	10	11	12	13	14	15						
Is	RED	BLACK	BLUE	WHITE	BROWN	B	A	-	+	⊕	⊖	L1						
4-20mA	SENSOR					COMMS		DC-In		AC-In								

Remote Receiver

Remote Sensor

Status LED

- High illumination = no movement detected
- Low / flickering illumination = flow detected

TEST Button

- Press and hold to test level relay action

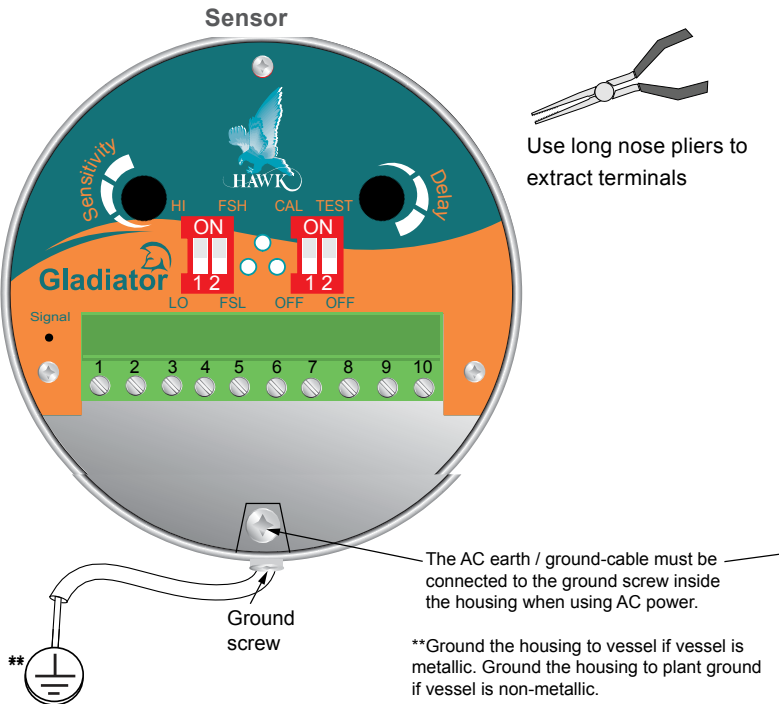
Alternate cable type between Amplifier and Sensors

- 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	Dekorons
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



Wiring Terminal Plug

RELAY				COMMS		DC-IN		AC-IN	
1. NC	2. COM	3. NO	4. Test	5. A	6. B	7. +	8. -	9. N	10. L1
				RS 485		12-30VDC		80-260VAC	

Remote Sensor

Status LED

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

TEST Button

- Press and hold to test level relay action

Note:

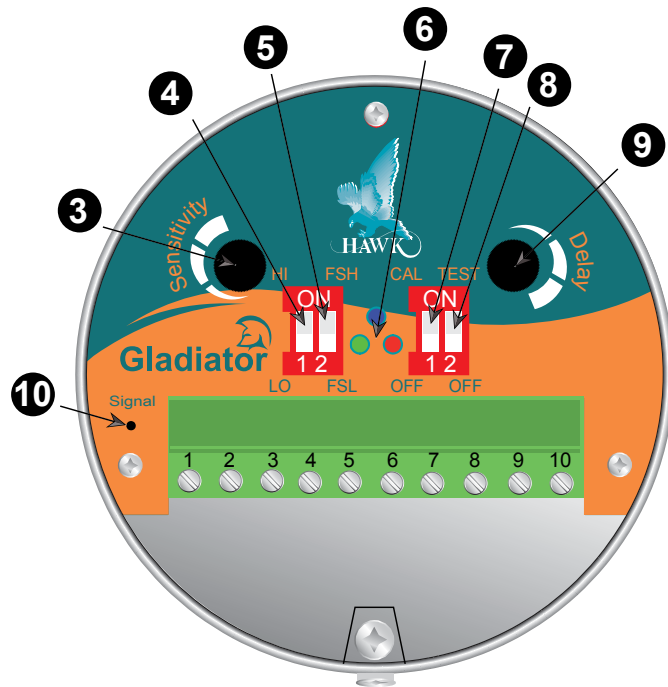
AC power terminals may only be used when universal AC power supply option has been selected - see part numbers - AC terminals have no function in products without universal AC power option.

Unit Setup

Gladiator Doppler Microwave Series



Functionality Layout



(3) Sensitivity dial

- In 'Hi' switch mode used to set unit Gain
- In 'Lo' switch mode used to adjust unit sensitivity

(4) Hi / Lo switch

- Hi mode for High Sensitivity to movement
- Lo mode for low sensitivity to movement.

(5) FSH / FSL switch

- FSH relay normally closed.
- FSL relay normally open.

(6) Status LEDs

- Green: High illumination indicates strong movement
Low illumination indicates weak or no movement
- Red: Relay indication. Illuminated when closed.

(7) Cal switch

- Fluorescent light frequency filter. Cal (up) for 120Hz. Off (down) for 100Hz

(8) Test switch

- Can be used for a failsafe / test relay.

(9) Delay pot

- Rotate clockwise to increase Relay on/off delay time.

(10) 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.

Setup Procedure

1. Mount the units according to Mounting Requirements

1.1 If units are AC powered ensure proper grounding is connected to ground screw.

2. Power the unit

3. Select the required relay action

The Relay can switch 'ON' (FSL) or 'OFF' (FSH) FSH is recommended (ordinarily on/energized, switches off/ DEN when no movement is detected).

4. Choose Hi / Lo Sensitivity mode

For Hi Sensitivity setup - use the Sensitivity dial to adjust Sensitivity to movement (clockwise to increase sensitivity)

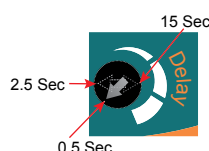
For Lo Sensitivity setup - First set the switch to Hi mode and then rotate the dial to set Gain setting (clockwise increases Gain making the unit more sensitive to movement). After this, set switch to Lo mode. You can now rotate Sensitivity dial to adjust Sensitivity to movement (clockwise to increase sensitivity).

Most applications should start in 'Hi' mode with pot fully clockwise.

5. Set Delay timer

Choose relay delay time.

Approximate values indicated



Part Numbering

Gladiator Doppler Microwave 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

X Option 'S' plus 4-20mA output

E 2 x SPDT relays with Ethernet

Approval

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

GSA S U S

Remote Sensor

GDMR Gladiator Doppler Microwave Remote Sensor

Frequency

1 10.525 GHz

Facing Material Selection

0 UHMW Polyethylene

1 PTFE Teflon

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

GDMR 1 0 1 X X

Connection Cable

CA-GMR Pre-cut cable for remote sensor

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 Doppler Microwave Series



Integral Version

GDMI Gladiator Doppler Microwave Integral System

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 316L Stainless Steel

Output Option

S Switch, 1 output relay with Modbus

Approval Standard

X Not Required

GDMI B 1 0 1 S X

Accessories

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



MA Series Mounting Accessories

MA Standard Mounting Accessories

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

MD Series Mounting Accessories - Kit

MD Mounting Accessories Kit

Window Facing Material

3	3" UHMW Window (-30°C to +75°C)
4	4" UHMW Window (-30°C to +75°C)
5	6" UHMW Window (-30°C to +75°C)
6	3" PTFE Window (-30°C to +200°C)
7	4" PTFE Window (-30°C to +200°C)
8	6" PTFE Window (-30°C to +200°C)
-	

Weldment Material

A	SS304
S	SS316
M	Mild Steel

MD 3 - A



MD Series Mounting Accessories - Parts

BASE Weldment Only

-

Weldment Size

MD3 Matches MD3 & MD6

MD4 Matches MD4 & MD7

MD5 Matches MD5 & MD8

-

Material

A SS304

S SS316

M Mild Steel

WIN Window only

-

Window Facing Material

MD3 UHMW for MD3 (-30°C to +75°C)

MD4 UHMW for MD4 (-30°C to +75°C)

MD5 UHMW for MD5 (-30°C to +75°C)

MD6 PTFE for MD6 (-30°C to +200°C)

MD7 PTFE for MD7 (-30°C to +200°C)

MD8 PTFE for MD8 (-30°C to +200°C)

WIN - MD3

BASE - MD3 - A

LRING Locking Ring Only

-

Ring Size

MD3 Matches MD3 & MD6

MD4 Matches MD4 & MD7

MD5 Matches MD5 & MD8

-

Material

A SS304

S SS316

M Mild Steel

LRING - MD3 - A

MD Series Part Combinations				
Full Kit ¹	Size	Window	Weldment ¹	Locking Ring ¹
MD3-X	3"	WIN-MD3	BASE-MD3-X	LRING-MD3-X
MD4-X	4"	WIN-MD4	BASE-MD4-X	LRING-MD4-X
MD5-X	6"	WIN-MD5	BASE-MD5-X	LRING-MD5-X
MD6-X	3"	WIN-MD6	BASE-MD6-X	LRING-MD6-X
MD7-X	4"	WIN-MD7	BASE-MD7-X	LRING-MD7-X
MD8-X	6"	WIN-MD8	BASE-MD8-X	LRING-MD8-X

¹X = Material Selection

Specifications

Gladiator Doppler Microwave 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
- <6W @ 48VDC
- <5VA @ 240VAC
- <3VA @ 115VAC

Communications

- GosHawk, Modbus

Relay Output: (1) SMART (2) Remote

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

Speed Detection

- 0.2-20m/s

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 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°.

Motion Threshold

- 1 to 128Hz

Fail-Safe

- Selectable - energised or de-energised

Sensor 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 IP66/67
- Remote Electronics IP65 (NEMA 4x)
- Remote Sensors IP66/67

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

Weight

- GSA 1kg
- GDMS 5kg
- GDMR 5kg

**Consult Safety Instructions*



HAWK, Since 1988

Hawk Measurement Systems Pty Ltd (HAWK) was established in 1988. It's founding members saw the universal requirement of various industries requiring improved process control and efficiency in their operations.

We Can Help

HAWK understands the difficulties customers face when seeking accurate level measurement. Every application is different, involving a multitude of environmental factors. This is where HAWK excels. Our aim is to ensure that customers feel comfortable with our technology, and are provided with long term and reliable solutions. We believe that a combination of application and product expertise, as well as forward thinking and proactive support policies are the foundation of successful customer-supplier relationships.

Progressive Technical Support

HAWK believes that the future of the Level Measurement Industry revolves around the quality of pre and post sales - support. Our aim is for all sales & support staff to be product experts, and more importantly application experts making our customers applications as efficient and consistent as possible.

Knowledge Sharing

HAWK believes that knowledge sharing is key to creating long term relationships. Empowering our customers and our worldwide distribution network, whilst being available at all times to lend a helping hand, is the perfect recipe for long term solutions and relationships. HAWK openly extends an invitation to share our 25 years of level measurement experience, and ensure that your day to day processes are efficient, understood, and always working.

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

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