Flow Detection

MDS Integral or Remote Housing

Microwave Doppler Switch

Solids - Chute and Conveyor

10.525 GHz Sender Receiver

Installation and Operating Instructions
INTRODUCTION

PROPRIETARY NOTICE
The information contained in this publication is derived in part from proprietary and patent data. This information has been prepared for the express purpose of assisting operating and maintenance personnel in the efficient use of the instrument described herein. Publication of this information does not convey any rights to use or reproduce it, or to use for any purpose other than in connection with the installation, operation and maintenance of the equipment described herein.

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WARNING
This instrument contains electronic components that are susceptible to damage by static electricity. Proper handling* procedures must be observed during the removal, installation, or handling of internal circuit boards or devices.

* Handling Procedure
1. Power to unit must be removed.
2. Personnel must be grounded, via wrist strap or other safe, suitable means, before any printed circuit board or other internal device is installed, removed or adjusted.
3. Printed circuit boards must be transported in a conductive bag or other conductive container. Boards must not be removed from protective enclosure until the immediate time of installation. Removed boards must be placed immediately in a protective container for transport, storage, or return to factory.

Comments:
This instrument is not unique in its content of ESD (electrostatic discharge) sensitive components. Most modern electronic designs contain components that utilize metal oxide technology (NMOS, CMOS, etc.) Experience has proven that even small amounts of static electricity can damage or destroy these devices. Damaged components, even though they appear to function properly, exhibit early failure.

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**PRINCIPLE of OPERATION**

The Hawk MDS series microwave doppler flow switch was developed for use in process applications requiring highly reliable non-contact product flow detection. 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 MDS system where it is processed to determine if the product is flowing. The MDS system uses the Doppler principle to determine if the product is moving by monitoring small charges in the reflected signal frequency. When product flow is detected, a timer is initiated and after the user set time-out period, the relay output is switched. The system also has adjustable sensitivity to compensate for products that may partially reflect the microwave energy. The SPST relay can be set to either energise or de-energise when product flow is detected. Three LED indicators are provided to indicate power, flow detection, and relay energised status. The system is available in either an integral or remote housing and is powered by 115Vac, 240Vac or 24Vdc. The system is housed in a FM listed NEMA 4X housing and is mounted using the standard 3 inch NPT weldment or flange.

**ADJUSTMENT PROCEDURE**

**MDS Doppler Systems**

1. Mount the MDS in an area where the product flow is to be monitored.
2. Ensure there is low vibration on the mounting if the product flow is low.
3. Mount the MDR sender-receiver in a position where stationary material will not build up on the sensor face. Ensure the face of the sensor is flush with the inside of the flow chamber. (If used in a closed environment)
4. Correctly wire the MDR to the MDA as per the connection diagram. If extension cable is used, S and T are single cables. The remainder are all then combined to form a solid ground connection back to terminal labelled P.
5. RV1 and RV2 must be adjusted together with the potentiometer positional arrows both basically aligned in the same direction. They are parallel potentiometers. Begin at minimum anti-clockwise position.
6. Position Lo-Hi slide switch to low position
7. Apply power to the unit. The green LED LD1 will be illuminated.
8. When material is flowing at normal speed, slowly increase RV 1 and then RV2, then RV1 then RV2 etc. until flow is detected. Flow is detected when the Red LED LD2 is illuminated.
9. The yellow LED, LD3 will be illuminated when the relay becomes energised.
10. The relay energisation is timed via an ON delay and OFF delay potentiometers ON delay is the delay when LD2 is constantly illuminated prior to the relay pulling in.

When LD2 is no longer illuminated (i.e. no flow) the delay before the relay switches off is controlled by the OFF is controlled by the OFF delay potentiometer.
11. When LD2 is illuminated increase RV1 and RV2 by a further 15% (approx.) of the adjusted distance from the zero position. This allows for some variation in the flow indeed - the larger the percentage used the greater the flow change needed before the relay switches.
12. Intermittent flow surges can be removed via the ON delay OFF delay potentiometers
13. If you increase RV 1 and RV2 to maximum and LD2 is not illuminated, decrease anti-clockwise back to zero. Slide, slide switch LO-HI to the Hi position and repeat the slow step by step adjustment of RV 1 and RV2.

If possible stop the flow to ensure the sensitivity (RV1 and RV2) are set correctly.

The time delays can be checked without stopping the flow of the material. The pushbutton on the RHS of the board is a press to test pushbutton. This simulates no received flow signal and consequently you can adjust your on and off delays.

Microwave Doppler Switch
SPECIFICATIONS

Input Voltage:
- 240Vac nominal, 200-270Vac acceptable, 50-60 Hz
- 115Vac nominal, 100-130Vac acceptable, 50-60 Hz
- AC supply line fuse: 100mA, 250Vac
  Units have terminals for 24Vdc supply power.

Power Consumption:
- <3VA

Power Density:
- Rated from emitter at approximately 20µW/cm². Complies with FCC Title Rules Part 15. Caution sign posting not required.

Transmitted Signal:
- Frequency: 10.525 GHz, ±25 MHz
- Average Power Density: 20µW/cm² typical
- Linearly Polarised Field
- Beam angle (3dB) approximately 30° (conservative)

Range:
- Maximum range under ideal conditions: 10m (33 ft.)
- Expected maximum practical range: 5m (16 ft.)
- Minimum range under ideal conditions: 0cm (0 in)
- Expected minimum practical range: 1cm (0.4 in)

Note: Ranges are dependent on application reflectivity.

L.E.D. Indicators:
- Power on (green) Signal detect (red)
- Relay state (amber) EMI indicator (red)

Mounting cont’d:
- 4. Firebrick window assemblies available on custom basis
- 5. 2” NPT sight glass window
- 6. Flanged Pipe Mount.

Adjustments:
- Test switch - momentary push-button
  Single turn coarse and single turn fine adjustment potentiometers for set point.
  Relay time delays adjustable from 100ms to 30 seconds via two independent on/signal make and off/signal break potentiometers with automatic reset.

Fail-safe:
- Switch selectable - presence or absence of material flow
- High level fail-safe position: relay is activated when flow is present
- Low level fail-safe position: relay is activated when no material flow is present

Temperature:
- -30°C to +65°C (-20°F to +150°F)
  Note: for higher temperature applications, remote mounting with windows is necessary. Custom waveguide assemblies can also be provided.
  UHMW Window: Consult factory for manufacturer’s specifications.
  Firebrick Assemblies: Consult factory for manufacturer’s specifications.

Cabling Entry:
- 3 x 10mm (3/8” NPT)

Relay Contact Output:
- SPDT - 10amps @ 250Vac resistive
  10amps @ 125Vac resistive

Enclosure:
- NEMA 4X, IP67/IP66
- SAA LISTED
- Meets Class 2, Div 1, Group E, F & G (DIP-Dust Ignition Proof) classification.
  FM Approval Pending

Sealing:
- NEMA 4X

Shipping Weights:
- 4.5kg (10lb)
APPLICATIONS

Product Movement Detection

Conveyor
Moving product on conveyors

Flow Detector
Flowing Solids/Powders

Coal Feeder

Product flow movement detection

Conveyor
Moving product on conveyors

Microwave Doppler Switch
**WIRING**

**MDS DOPPLER FLOW SYSTEM**

- L.E.D. Indicators: Green - Power, Red - Signal, Amber - Relay
- Sensitivity 'A' Pot
- EMI Indicator
- Sensitivity 'B' Pot (TS3) Terminals
- (TPS) Positive (TP6) Gnd
- P = OV (Black), S = Rx Sig (Blue), T = Remote Rx Power (Red) (Remote Version only)
- 100mA Fuse (F1)
- EXTEND CABLE BELDEN #9512 (Max. 50 metres)
- To remote RX/TX Module (Remote Versions only)

**Remote RX/TX Module**
- Polyester coated steel
- 1" BSP Nipple
- 3" N.P.T.

**NOTE:** Maximum cable length including extension is 50 metres.
**Remote Microwave Doppler System - Remote Amplifier (MDA)**

- 4 x 5.0mm holes
- 25.5mm (1")
- 61.5mm (5.4")
- 137mm (5.4")
- 61.5mm (5.4")
- 25.5mm (1")

**Remote Microwave Doppler System - Remote Sensor (MDR)**

- UHMW Window
- 3" N.P.T.
- 1" BSP nipple
- Polyester coated mild steel pipe
- 160mm (6.3")
- 130mm (5")
- 192mm (7.6")

**Integral Microwave Doppler System (MDI)**

- 3" N.P.T.
- 160mm (6.3")
- 135mm (5.25")
- 130mm (5.1"
- 310mm (12.2")
- 4 X Ø22.0 holes thru equi spaced on 241 P.C.D.
- 86.5mm (3.4")
- 135mm (5.25")
- 155mm (6.1")
**WARRANTY**

Hawk control products will be replaced, put in good operating condition, or the purchase price refunded, at the option of Hawk, free of charges except transportation, if defective in their manufacture, labelling, packaging, or shipping, and if notice of said defect is received by Hawk within one year from the date of shipment. The cost of such replacement, repair or refund or purchase price shall be the exclusive remedy for any breach of warranty, and Hawk shall not be liable to any person for consequential damages for injury or commercial loss resulting from any breach of any warranty. Hawk makes no warranty of fitness for a particular purpose, and makes no other warranty, express or implied, including implied warranty arising from course of dealing or usage of trade.

**PART NUMBERING**

<table>
<thead>
<tr>
<th>MODEL</th>
<th>MDS-I = Integral Microwave Doppler Switch System</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>MDS-R = Remote Microwave Doppler Switch System (Sensor and Amplifier)</td>
</tr>
<tr>
<td></td>
<td>MDS-S = Remote Microwave Doppler Switch - Sensor only</td>
</tr>
<tr>
<td></td>
<td>MDS-A = Remote Microwave Doppler Switch - Amplifier only</td>
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<table>
<thead>
<tr>
<th>SUPPLY VOLTAGE</th>
<th>Note: 24Vdc standard on all units</th>
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<tbody>
<tr>
<td>240 = 240Vac</td>
<td></td>
</tr>
<tr>
<td>220 = 220Vac</td>
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<td>115 = 115Vac</td>
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<table>
<thead>
<tr>
<th>OUTPUTS</th>
<th>0 = Standard Relay outputs</th>
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<tr>
<td></td>
<td>6 = Solid State relay outputs</td>
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<tr>
<th>FACIAL MATERIAL</th>
<th>0 = UHMW Polyethene</th>
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<tr>
<td></td>
<td>1 = PTFE (Teflon)</td>
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<tr>
<td></td>
<td>Z = Special Request</td>
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</table>

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<thead>
<tr>
<th>MOUNTING ACCESSORIES</th>
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<tbody>
<tr>
<td>1 = 2&quot; Glass Window</td>
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<tr>
<td>2 = 4&quot; Glass Window</td>
</tr>
<tr>
<td>3 = 3&quot; UHMW Window</td>
</tr>
<tr>
<td>4 = 4&quot; UHMW Window</td>
</tr>
<tr>
<td>5 = 6&quot; UHMW Window</td>
</tr>
<tr>
<td>6 = 3&quot; PTFE Window</td>
</tr>
<tr>
<td>7 = 4&quot; PTFE Window</td>
</tr>
<tr>
<td>8 = 6&quot; PTFE Window</td>
</tr>
<tr>
<td>9 = 9&quot;x 4.5&quot; Firebrick</td>
</tr>
<tr>
<td>10 = 6&quot;x 4&quot; Ceramic</td>
</tr>
<tr>
<td>11 = Isolation Shock Mounts (pack of 4)</td>
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<tr>
<td>12 = Adjustable Mount-UHMW</td>
</tr>
<tr>
<td>13 = Adjustable Mount-PTFE</td>
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<tr>
<td>15 = Flange Pipe Mounting</td>
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<tr>
<td>16 = 3&quot; Ceramic Window</td>
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<tr>
<td>17 = 4&quot; Ceramic Window</td>
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<tr>
<td>X = Not Required</td>
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MDS R - 240 - 0 0 - X