Watch-DOG Installation Reference Guide

Advanced Flow Technologies' Watch-DOG is a low cost battery/solar powered solution for remote monitoring that has been designed for easy installation. Since Watch-DOG uses satellite communications for data transmission, it can be installed almost anywhere. The data gathered by the system may be employed to limit downtime, optimize production, or schedule maintenance. Typical applications include monitoring oil wells, natural gas wells and equipment, such as tank levels or compressors.

**Principle of Operation**

The Watch-DOG monitor consists of a controller unit and up to 6 sensors (depending on model) that are connected via cables. Sensors are available to measure temperature, pressure and vibration with others under development. The controller inputs must be configured at the factory for the type of sensor that will be attached (i.e. a pressure sensor cannot be connected to an input configured for a temperature sensor and vice versa). Electronic signals from the sensors are gathered and processed by the controller. Sensor data is stored until a transmission is sent to the satellite. A solar panel on the controller is used to keep the battery charged. If there is no sunlight (total darkness) to charge the battery, the battery will last for about 2 weeks before it runs out of power.

**Safety**

1. Controllers are suitable for use in Class I, Div 1, Groups C & D
2. Warning: Explosion Hazard - Batteries must only be changed in an area that is known to be non-hazardous.
3. DO NOT connect/disconnect the programming cable unless an area is known to be non-hazardous.
4. Before commencing installation all required permits must be obtained.
5. Occupational Health and Safety guidelines must be followed.
6. Proper Personal Protective Equipment (PPE) must be worn at all times.
7. This unit incorporates a Radio Frequency Transmitter. Unit must be turned off before commencing perforation work.
8. Unused inputs must always have the protective cover installed.

**General Installation Guidelines**

1. The unit should be positioned to minimize interference with well service activity.
2. Ensure that the top of the unit is kept clear. The satellite antenna is located at the top of the enclosure and any items on top of the unit may disrupt transmissions.
3. Do not install the unit where its line of site to the sky will be impeded (e.g. piping or overhead rack), or lost satellite transmissions may result. Metal overhangs or awnings are particularly undesirable.
4. Ensure the solar panel is clean and not shaded to ensure proper battery charging. Unit should have the solar panel pointed due south if possible (never due north).

5. At no time should stress/strain be applied to the cables. Ensure there is adequate strain relief at both ends.
6. To ensure a positive connection when attaching cables to the controller, rotate the locking collar clockwise until it clicks.

**Controller Mounting Options**

The Watch-DOG controller is supplied with a universal mounting bracket that allows the controller to be mounted in a number of ways, including pipe mount (up to 6-inch OD), stand mount and surface mount configurations.

**Stand Mount Installation**

1. Loosen the U-bolts on the mounting bracket to provide clearance for the vertical stand pole.
2. Slide bracket assembly on to stand pole and tighten U-bolts so that the bracket is secure.
3. Orient the controller so that the solar panel is pointed due south.
4. If sensors have already been installed, connect the cables to the bottom of the controller to complete the installation. Note: sensor types must be noted to their corresponding input on the unit. Mixing up sensors may damage the unit.

**Pipe Mount Installation**

1. Attach appropriately sized pipe clamp to the pipe (near pipe support if possible).
2. Coat threads of support pole with anti-seize compound and screw into clamp.
3. Using a pipe wrench, tighten the pole onto the clamp.
4. Orient the controller so that the solar panel is pointed due south (loosen u-bolts if necessary).
5. Tighten U-bolts to hold unit securely.
6. If sensors have already been installed, connect the cables to the bottom of the controller to complete the installation. Note: sensor types must be noted to their corresponding input on the unit. Mixing up sensors may damage the unit.

**Surface Mount Installation**

The universal bracket can be mounted to any surface with screws. Be sure to choose a South facing surface, with an unobstructed view of the sky to allow for proper sun exposure for charging the battery and clear line of sight for satellite data transmissions.

**RTD Temperature Sensor (RED BAND)**

Surface mount RTD sensors are used to make non-intrusive surface temperature measurements on pipes or other wellhead components such as stuffing boxes. The recommended location of the oil temperature sensor is on the outside of the oil line as close to the wellhead as possible as shown by the arrow in the wellhead diagram. For proper system operation, bullet style temperature sensors must be secured to the BOTTOM of the pipe using the supplied metal hose clamp. Tape the sensor to the pipe and then apply the clamp. To avoid damage to the sensor, DO NOT OVERTIGHTEN the clamp. The sensor should then be wrapped with a layer of 2-inch wide heavy duty pipeline tape to waterproof the sensor. Then a section of the supplied waterproof pipe insulation must be installed around the sensor and pipe. DO NOT include any heat trace lines within the insulation. Finally, wrap the insulation with heavy duty pipeline insulation so that the entire area is waterproof. To prevent sensor damage, ensure that the cable is adequately strain relieved.

**Vibration Sensor (YELLOW BAND)**

The Watch-DOG vibration sensor will detect the mechanical vibration generated by mechanical equipment and can be used to determine when that equipment has stopped operating. Securely attach the sensor to the equipment with a screw or bolt through the mounting hole on the sensor body. Vibration sensors should be mounted on a part that is free to vibrate when the equipment is operating, such as the pump jack ladder or gearbox housing. If possible avoid mounting the vibration sensor right next to structural anchor points that can reduce vibration. **NOTE:** Please take care when handling and installing the vibration sensors as they are sensitive devices. A drop of 1.5 metres onto a hard surface is sufficient to damage the sensor.

**Pressure Sensor Installation**

1. BEFORE attaching cable to sensor, install sensor in pipe using Teflon tape to seal threads. Mount sensor so that pins are not pointing straight up to prevent water from pooling on the connector. Align connector to cable by rotating sensor in pipe fitting. **Warning:** To prevent damage to sensor DO NOT twist pins or black collar to align connector to cable.
2. Attach connector and supplied gasket to pressure transducer and tighten screw.
3. Connect other end of the cable to the controller.
4. Ensure cable is strain relieved by using a suitable cable tie. If the install is complete, turn the unit on. Refer to the Unit Operation section.

**Note:** in some cases, a pressure sensor equipped with a 6-pin Bendix connector and mating cable may be supplied.
Normally the unit is shipped in the “ON” mode, so that when the battery is connected, the unit will power up and begin making measurements. The battery cable must be plugged into the battery connector on the main circuit board. Remove the cover to access the battery connector. The cover is held in place by 4 screws, one in each corner. The battery connector is located as shown in the photo at right.

A single LED is visible through a sight window on the bottom of the unit. This LED is used to indicate the device is taking readings and to provide programming feedback. If the unit ever needs to be placed into the “OFF” or “ON” modes, this is done by activating a magnetic switch. The switch is activated by holding the supplied programming magnet to the front of the solar panel near the LED window as shown in the photo at right. By slowly swiping magnet across the target area or by holding the magnet on the target area and watching the LED window, it is possible to verify power and turn the unit on and off as shown in the following table:

<table>
<thead>
<tr>
<th>Magnet Input</th>
<th>LED Response</th>
</tr>
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<tbody>
<tr>
<td>TO CHECK STATUS:</td>
<td>- The LED flashes. This confirms that the battery is connected and has sufficient power. Mode will be indicated in newer versions (4 or 5 flashes if unit is ON).</td>
</tr>
<tr>
<td></td>
<td>- A self check message is transmitted to the satellite.</td>
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<tr>
<td>TO TURN UNIT ON:</td>
<td>- 1 rapid blink burst, then remove magnet – LED will flash 4 times – unit will now transmit 3x/day.</td>
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<tr>
<td></td>
<td>- 2 rapid blink bursts, then remove magnet – LED will flash 5 times – unit will now transmit 6x/day.</td>
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<tr>
<td></td>
<td>- Unit will transmit a status update message.</td>
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<tr>
<td></td>
<td>- LED will flash once every minute when unit takes a reading.</td>
</tr>
<tr>
<td>TO TURN UNIT OFF:</td>
<td>- 5 rapid blink bursts – unit will now be in OFF mode.</td>
</tr>
<tr>
<td></td>
<td>- Unit will transmit a status update message.</td>
</tr>
<tr>
<td></td>
<td>- LED will display one long blink.</td>
</tr>
</tbody>
</table>

NOTE: To confirm that the unit is ON, please observe the LED and verify that it flashes once per minute, indicating that the unit is taking readings. If the LED does NOT flash once per minute, the unit is in the OFF state.

Troubleshooting

If you are experiencing difficulty with the Watch-DOG controller, there are a few things that should be checked:
1. Confirm sensors are connected correctly (see diagram on controller beside connectors)
2. Battery voltage should be above 5.6 volts.
3. The unit must be in the ON mode (verify that the LED flashes every minute).
4. The solar panel must be clean and not shaded to ensure proper battery charging.
5. Ensure that the top (connectors are on the bottom) of the box is clear and has a clear view of the southern sky.

If assistance is required with troubleshooting, please contact AFTI at (403) 212-2382 or Toll Free at (866) 412-2383

WARNING: Sensors MUST be connected to the correct input. Connecting sensors to the wrong input port will cause unit to malfunction and may damage the unit voiding warranty.

Field Certifications

CSA for Canada and U.S.A. Class I Div. 1 Exia Groups C&D T3A Type 4
TX IC Certification No.: 3989A-STX21 This Class B digital apparatus complies with Canadian ICES-003.
TX FCC ID: L2V-STX2-1 Complies with Part 15 of FCC rules

Installation must not be within 160 Km of an RAS exclusion zone without special configuration

Technical Specifications

Controller Model No: 4001-002
Operating Cycle: 1 minute (typical)
Transmission Cycle: 1 to 6 per day
Input (Internal): 6 Vdc, 630 mA Intermittent
Output (Pressure): 12 Vdc, 150 ma Intermittent
Output (RTD): 5 Vdc, 1mA Intermittent
Rechargeable Battery: 6 Vdc, 2.8 Ah @ 20 hr.
Sealed Lead Acid type

Replace only with approved models, contact Advanced Flow Technologies for details.

WARNING
1. EXPLOSION HAZARD
2. BATTERY MUST ONLY BE CHANGED IN AN AREA KNOWN TO BE NON-HAZARDOUS
3. SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY

Connector detail for boxes designated 2P+1T (see label on side of unit)