# SmartDisk®

## System 2

*U.S. patents 6,598,454 and 6,843,098 apply; other U.S. and international patents pending.*

## BS&B®

**BS&B WIRELESS, L.L.C.**

**www.bsbwireless.com**

AN ISO 9001 CERTIFIED COMPANY

# Wireless Monitoring System for Pressure Relief Devices

# SmartDisk®
# Wireless
# Monitoring System

## Cut the wires, cut the $$$!

### Flexible Wireless Platform
- Eliminates wiring between sensor transmitter and monitor
- Battery powered, DC powered with battery backup, optional solar power
- Ready to use; complete with enclosures
- Supports discrete switch-type sensors
- Supports analog type sensors
- Range to over 10 mi; even greater using repeater
- Multi-zone capability
- 32:1 system ratio; expandable to 992
- -40°F to 185°F temperature range (-40°C to 85°C)
- External switched output option at each transmitter
- Immediate data transmission (DTM)

### Communication Choice from Monitor/Receiver
- Stand-alone monitoring
- Programmable relay outputs
- Operate as Modbus "slave"; RS232/RS485 connection options
- Connect to PC using Windows® HyperTerminal

### Simple to Apply
- Modular construction
- Class 1, Division II, Group B/C/D (CSA: US and Canada)
- ATEX: II 3 GD EEx d nA T4 (Europe)
- Rugged industrial design
- Standard internal antenna
- Optional external antenna; omni-directional and directional

## Introduction
The SmartDisk® wireless monitoring system brings intelligent, reliable and cost effective radio communications technology to pressure relief devices eliminating the traditional expense of wiring between the pressure event sensor (see back page) and the monitor.

## Operating Principle
A pressure event sensor is connected to and may be powered by a SmartDisk radio transmitter. Every electrical "change of state" of the switch type sensor is broadcast by the transmitter radio. This information is collected by a receiver which provides monitoring and annunciation options to the user. Up to 32 transmitters can communicate through each receiver (system ratio 32:1).

## License Free Radio Operation
SmartDisk uses ultra high frequency radio communication (RF) that does not require user licensing. Three system frequencies are offered:
- **902~928 MHz:** for use in the United States, Canada, Mexico and South America
- **915 MHz:** for use in Australia and New Zealand
- **2.4 GHz:** for use in Europe, most of Asia, the United States and Canada.

It is important that the correct radio frequency is selected to meet local regulations such as FCC Part 15 in the United States and equivalent Industry Canada requirements, or ETSI requirements covering Europe.

Please consult your BS&B representative for countries not listed.

The radio components of a SmartDisk system are identified with their frequency of operation by the designation "09" or "9A" for Australasia, or "24" in their model names. All components of a SmartDisk system must operate at the same frequency.

## Operating Range
All standard SmartDisk transmitters are designed to operate up to one mi (1.6 km) using a convenient internal antenna. In typical industrial applications, the 902~928 MHz and 915 MHz systems have better than 1/2 mi (0.8 km) range while the 2.4 GHz system has better than 1/3 mi (1/2 km) range. Effective range can be increased by elevating transmitters and/or the receiver radio module, or by the use of an optional external antenna to gain range of 10 miles or more (directional type antenna).

A repeater module can also be used to extend communication range or to get around physical obstacles that cannot be penetrated by RF.

## Multiple Zone Capability
- Up to seven zones selectable; ideal for overlapping systems
- Each zone has unique transmission frequency sequence
- Zones user set by internal switches - no programming
- Allows "repeater zones" to operate separately

## SmartDisk System Components
### Data Transmission Module (DTM)



The DTM wirelessly transmits the electrical "changes of state" of a pressure event sensor (e.g. Burst Alert® Sensor or pressure switch) immediately.

The DTM may power most sensors using its integral replaceable battery (up to five-year battery life). Optional external DC power with battery back up or optional solar power can be used.

*DTM Module*
*with Standard Internal Antenna*

A DTM can be installed up to 100 ft (30 m) from its sensor using shielded cable.

### Analog Transmission Module (ATM)

The ATM transmits 4~20mA, 0-5 VDC, or pulse type outputs wirelessly to a receiver/monitor. The ATM data update interval is user programmable up to an 18-hour interval. With each transmission, comes the latest sensor reading.

### Data Monitoring Module (DMM, DM4) Receiver

The DMM (DM4) comprises two components, the RTM receiver radio that collects incoming information from up to 32 (4 for DM4) transmitters and the monitor that processes and reports SmartDisk system information. The RTM is connected to the monitor enclosure by a cable (up to 50 ft/15 m length) through which electrical power is supplied. The monitor is external DC powered. The RTM can be installed above ground level to optimize RF communication while the monitor remains at a convenient accessible point.



The DMM (DM4) monitor includes an LCD screen and keypad that can be used for programming, accessing SmartDisk System information, and to annunciate and silence user selected alarms and warnings. Colored LEDs (green, yellow, red) provide additional local information.

The 4-channel DM4 can be upgraded in the field to a 32-channel DMM.

### Data Receiving Module (DRM, DR4) Receiver

The DRM (DR4) has the same two-part construction receiver function but without the LCD screen, keypad and LEDs. It is applied with user external equipment for programming and annunciation.

The 4-channel DR4 can be upgraded in the field to a 32-channel DRM.

## External Communication with SmartDisk System

All receiver modules are provided with RS232/RS485 ports for external communication using Modbus protocol. Connected to a PC or Laptop, Windows® HyperTerminal program may be used for receiver programming and capture of SmartDisk System output.

All receivers have two relay outputs that may be user programmed individually to respond to sensor changes of state in either a "latched" or "unlatched" manner.

All receiver modules are Modbus "slave" units, addressed by the user during system set up. SmartDisk system information is contained in registers that the user can poll using a Modbus "master."

## Mounting Brackets

Brackets are provided for mounting of all SmartDisk DTM, ATM, RTM, and RPZ modules. RF performance is enhanced by and has been verified with this bracket.

For convenience, receivers are supplied with brackets for wall mounting.

## Optional External Digital Output

Each DTM (or ATM) module can switch a local electrical DC power circuit via a solid state switch that is controlled from the SmartDisk system monitor. This allows any DTM (or ATM) in the same SmartDisk system to be programmed to activate its internal switch to handle up to 1/2 Amp of external power. This feature can be used for field annunciation (horn, lamp, etc.) or control purposes; higher currents can be accommodated using additional field hardware.

An external DC powered DTM (or ATM) can respond to a switching command from its monitor right away since its radio is always "on" to receive an "on/off" message. A battery powered DTM (or ATM) will respond at its next "heartbeat" or data update interval.

DTM and ATM modules installed in Class 1, Division II, Group B/C/D and ATEX Zone 3 environments may use this external power switching capability when appropriately wired to external devices and optional power supply.
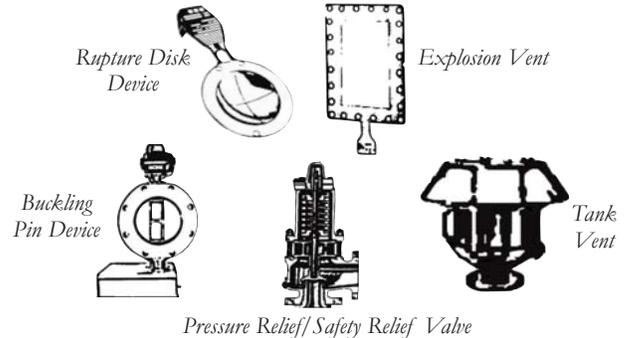
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| **DMM** – Data Monitoring Module |
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| **DR4** – 4-channel Data Receiving Module |
| **RTM** – Receiver Transceiver Module |
| **RPZ** – Repeater Module |
| **ATM** – Analog Transmission Module |

## Building a Wireless Sensor System

The freedom of wireless technology gives SmartDisk the flexibility to adapt to local installation conditions. Up to 32 DTM or ATM transmission modules can be programmed to a single receiver. Using RS232/RS485, up to 32 receivers and user devices can be connected together with communication by Modbus protocol. The modular construction of the SmartDisk system makes application of the technology both simple and cost effective. Basic guidelines to follow are:

◆ All applications require one transmitter (DTM or ATM) per sensor (unless wired in series with DTM).

◆ All applications require a receiver. If annunciation of alarm conditions or programming without the need for external computer equipment is required, use the DMM or DM4.

◆ When central monitoring of pressure relief devices is desired, connect receivers to existing safety management systems using RS232/RS485. Each SmartDisk receiver is a Modbus slave, addressable by the user.

◆ To add a sensor to a SmartDisk system, install a new DTM or ATM to the sensor and add its unique identity number to the receiver memory.

◆ To gain the best RF communication, plan a SmartDisk system using the Site Survey Kit.

Typical functions of the SmartDisk system are to alarm the operation or leakage of:

*Rupture Disk Device*

*Explosion Vent*

*Buckling Pin Device*

*Tank Vent*

*Pressure Relief/Safety Relief Valve*

## Pressure Event Sensors

Any simple "change of state" sensor can be integrated into the SmartDisk Wireless Monitoring System, including:

### Burst Alert® Sensors

Initially developed for use with rupture disk devices, a perforated polymer membrane supports a Tantalum conductor wire (selected for its superior corrosion resistance) that is designed to break in response to a pressure event. When activated by a pressure event the sensor changes from "normally closed" to "normally open".

◆ Burst Alert Sensors: BS&B catalog #77-1010.

### Leak Detector Alert Sensors

Using the same "broken wire" design concept as the Burst Alert Sensor, a seal is added to allow detection of leakage through a pressure relief device.

◆ Leak Detector Alert Sensors: BS&B catalog #77-1010

### Proximity Switches

The function of many pressure relief devices can be detected by a proximity switch installed to sense either linear or rotary movement.

◆ e.g. Type MBS Sensors: BS&B catalog #77-1009B

### Pressure Switches

A single point pressure switch can be set to indicate the operation of a pressure relief device or to detect the pressure at which a device shall respond to pressure. The "tell-tale" function required by the ASME Boiler and Pressure Vessel Code for rupture disk/relief valve combinations is frequently satisfied by a pressure switch.

## Installation Configurations - Industrial, Hazardous and Non-hazardous

All ATM, DTM, RTM, DRM, DR4 and RPZ modules may be installed in Class 1, Division II, Group B/C/D, ATEX Zone 3, or non-hazardous areas. According to the application environment, appropriate electrical connections must be identified at the time of order for all SmartDisk system components. Three standard connections are available:

**1. Quick Connect** - water-resistant design.

**2. Conduit** - 1/2" standard size (3/4" alternate), rigid or flexible hub connections.

**3. Gland seals**

Connector selection is determined by local code and user requirements. The required number of connections must be identified at time of order to cover:

**Transmitters**

◆ Sensor connection; always required.

◆ External DC power connection; when selected.

◆ External antenna connection; when selected.

◆ External switched power output; when selected.

*Maximum of three connections may be affixed to each DTM or ATM module.*

**Receivers**

◆ External DC power connection; always required.

◆ RTM connection; always required.

◆ Relay connection (one or two); when selected.

◆ RS232/RS485 connection; when selected.

**RTM**

◆ External power and communication to monitor; always required.

◆ External antenna connection; when selected.

***Note:*** *Follow installation instructions to ensure proper field compliance with Class 1, Division II, Group B/C/D or ATEX Zone 3 requirements.*