BS&B®

BS&B WIRELESS, L.L.C.

BS&B SmartSystem™

U.S. patent 6,598,454 and other
U.S. and international patents pending.

The flexible wireless instrumentation platform.

Visit our website at www.bsbwireless.com for the most complete, up-to-date information.

Wireless Sensor and Monitoring System

Flexible Wireless Platform

- Supports digital and analog sensors
- Battery powered digital transmitter
- DC powered digital transmitter
- DC powered analog transmitter
- 32:1 system ratio
- Frequency choice (902~928 MHz/2.4 GHz)
- -40°F to 185°F temperature range (-40°C to 85°C)

Choice of Communication Interface

- Optional stand-alone monitor
- Programmable monitor relay outputs
- RS232/RS485 interface (Modbus)

Simple to Apply

- License free operation*
- Class 1, Division 2, Group B/C/D certified (CSA; U.S. and Canada)
- Rugged industrial design
- Up to one mile range

Cut the wires, cut the $$$!

*	No user license required for the USA for either frequency, 2.4 GHz only in Europe. Check with your distributor for other countries.

Introduction

The BS&B SmartSystem is a wireless communication platform with optional monitoring capability that provides the user with the flexibility of supporting multiple sensor types:

- Digital switch type sensors
- Four-wire analog sensors (4 ~ 20 mA and 0-5 Volt)
- Two-wire analog sensors (4 ~ 20 mA and 0-5 Volt)

Wiring costs can be eliminated between the sensing and central control or monitoring locations.

Operating Principle

A sensor is connected to a radio transmitter. In the case of analog sensors, at the user selected update interval, the sensed value is broadcast by the transmitter radio. In the case of a switch type sensor, each electrical "change of state" is broadcast and the sensor may be powered by the transmitter. In both analog and simple digital cases the transmitted information is collected by a receiver which determines the actions to be taken according to how the user has programmed the BS&B SmartSystem. Up to 32 transmitters can communicate through each receiver with any combination of analog and digital sensors.

Choice of License Free Radio Frequencies

SmartSystem uses ultra high frequency radio communication (RF) that does not require user licensing. A choice of system frequencies is offered: 902 ~ 928 MHz, or 2 .4 GHz.

Both are in compliance with United States FCC part 15 regulations and the 2.4 GHz option additionally in compliance with ETSI requirements covering Europe. (For other countries, please consult your BS&B distributor). In the United States, the 902 ~ 928 MHz option is recommended due to its slightly greater operating range.

The radio components of SmartSystem are identified with their frequency of operation by the designation "09" or "24" in their model names. All components of SmartSystem must operate at the same frequency.

SmartSystem Reliability and Security

All SmartSystem radios use two-way communication together with five design measures to optimize performance:

1. **Heartbeat:** In simple switch digital applications, a transmitter sends a status OK message to its receiver (two-minute default settings) at the user set interval. This assures system integrity in applications with long time periods between "changes in state."
2. **Acknowledgment:** Every transmission requires a response from the receiver. Absence of this response causes the transmitter to resend its message.
3. **Retry mode:** In the absence of an acknowledgment, a transmitter automatically goes into retry mode. Repeated attempts are made by the transmitter to get its signal to the receiver with a "loss of comunication" alarm generated after multiple retries.
4. **Unique Identity Numbers:** Each transmitter has a unique digital address.
5. **Unique Preamble:** SmartSystem transmitters have a unique digital signal preamble receivers are looking for at the start of every incoming transmission.

Operating Range

All SmartSystem transmitters are designed to operate up to one mile (1.6 km). In typical industrial applications, the 902-928 MHz radio has better than 1/2 mile range (800 m) while the 2.4 GHz radio has better than 1/3 mile (500 m) range. Effective range can be increased by placing a repeater module (RPT) in the system.

Range can be verified before SmartSystem purchase by using the Site Survey Kit. The portable transmitter and receiver are used to walk the site to verify performance at component locations. Receiver models with integral monitoring also indicate RF quality for each transmitter.

SmartSystem Components
Data Transmission Module (DTM)

DTM module

The DTM is designed to wirelessly transmit the electrical changes of state of a pressure event sensor such as a Burst Alert Sensor. The DTM may be used to power the sensor using its integral long life Lithium battery. The optional use of external DC power can be employed. Every sensor change of state is immediately transmitted by a DTM.

Typically a DTM should be installed in close proximity to its sensor but it can be installed up to 100 feet (30 Meters) away using shielded cable. Indicating the radio frequency selected, models DTM 09 and DTM 24 are available.

SmartDisk Module Index
DTM – Data Transmission Module
ATM – Analog Transmission Module
DMM – Data Monitoring Module
DM4 – 4-channel Data Monitoring Module
RPT – Repeater Module
DRM – Data Receiving Module
RTM – Receiver Transceiver Module

Analog Transmission Module (ATM)

The ATM is designed to wirelessly transmit analog sensor output.

Any 4 ∼ 20 mA and 0-5 Volt sensor can be connected to an ATM unit. Flexible connections are provided to allow both four-wire and two-wire sensor output. Provided with local DC power, the ATM can supply power to both four-wire and two-wire sensors provided the voltage is compatible with both sensor and ATM requirements (5-32 VDC for the ATM).

The sensor output is transmitted by the ATM at an interval selected by the user of between five seconds and 255 seconds. At the chosen interval, the ATM collects 1000 sensor readings within a few milliseconds and, using a propriety averaging algorithm, transmits the sensor output information. Use of a 12-bit A/D connector in the ATM ensures accuracy of data transfer.

An ATM should be installed in close proximity to its sensor but it can be installed up to 100 feet (30 meters) away using shielded cable.

Indicating the radio frequency selected, models ATM 09 and ATM 24 are available.

Data Monitoring Module (DMM)

The DMM comprises two components, the receiver information center that processes incoming information from up to 32 DTM modules and the receiver radio called the RTM. The RTM is supplied in its own separate housing to permit its installation in an elevated external location to maximize RF performance while allowing the DMM information center to remain at ground level for convenient access. The DMM and its RTM may be up to 50 feet (15 meters) apart.

The DMM information center includes an LCD screen and keypad that can be used for receiver programming, accessing information regarding the status of all DTM transmitters reporting to the DMM, and to annunciate user selected alarms and warnings. The colored LEDs (green, yellow and red) are provided for additional annunciation of alarms and warnings.

Repeater Module (RPT)

One RPT module may be applied to each SmartSystem to expand effective operating range, typically by 100%, or to circumvent physical barriers to RF communication.

Data Receiving Module (DRM)

The DRM has the same receiver function as a DMM but without the LCD screen, keypad and LEDs. It may be applied with user external control systems for both programming and annunciation. A DRM is always provided with an RTM module and can accommodate up to 32 DTM devices.

4-Channel Data Monitoring Module (DM4)

The DM4 provides communication with up to four DTM or ATM modules. Designed for small SmartSystem applications, the DM4 provides the full features of the DMM.

Field upgrade of a DM4 to a DMM is available should increased system capacity be required.

External Communication with SmartSystem

All DMM, DM4 and DRM modules are provided with internal RS232/RS485 ports for external communication using Modbus protocol. The DRM requires such a connection for the management of its assigned annunciation functions (it may be programmed by temporary connection to a PC or laptop using Windows hyperterminal facility).

Additionally, all receivers have 2-relay outputs that may be programmed individually by the user to respond to sensor outputs in either a latched or unlatched mode.

DMM, DM4 and DRM modules are Modbus "slaves," addressed by the user during system set-up.

Installation Configurations - Hazardous and Non-hazardous

All DTM, ATM, RTM and DRM modules may be installed in Class 1, Division 2, Group B/C/D or in non-hazardous areas. According to the application environment, appropriate connections must be identified at time of order. Three standard connections are available.

1. **Quick Connect** - suitable for battery powered DTM service only.
2. **Conduit** - 1/2" standard.
3. **Gland seals**

The required number of connections must be identified at time of order to cover:

◆ External DC power supply connection, where required
◆ Sensor connection
◆ RS232/RS485 cable connection (receivers only).
◆ Relay output connection(s) (receivers only).

Note: For Class 1, Division 2, Group B/C/D service, external power must be supported through conduit. All connections must be provided by BS&B. SmartSystem is CSA approved (U.S. and Canada) for all RF modules and the DRM.

Mounting Brackets

Brackets are provided for mounting of all SmartSystem DTM, ATM, RTM and RPT modules. RF performance has been verified with the provided bracket. Other brackets may hinder radio communication. Mounting brackets are also provided for the DMM, DM4 and DRM.

Related Publications:

1. Burst Alert and Leak Detector Sensors
2. Relief Device Manager
3. Guideline to Wireless Technology for Instrumentation

Building a Wireless Sensor System

The freedom of wireless technology gives SmartSystem the flexibility to adapt to local installation conditions. Up to 32 DTM or ATM transmitter modules can be programmed to a single DRM or DMM receiver. Using RS232/RS485, up to 32 receivers and user devices can be connected together. (The DM4 supports up to four DTM or ATM transmitters).

The modular construction of SmartSystem makes application of the technology both simple and cost effective. Basic guidelines to be followed are:

◆ All applications need one DTM or ATM per sensor.

◆ All applications require either a DRM, DM4 or a DMM. If integral annunciation of alarm conditions and/or programming without the need for external PC equipment is required, use the DMM or DM4

◆ When central monitoring of sensors is desired, connect the receiver to existing safety management systems using RS232/485. Each SmartSystem receiver is a Modbus "slave," addressable by the user.

◆ To add a sensor to SmartSystem, install a new DTM or ATM to the sensor and add the unique transmitter identity number to the DRM, DM4 or DMM.

◆ To gain the best RF communication, plan a SmartSystem installation using the Site Survey Kit.

BS&B SmartSystem, the Flexible Wireless Instrumentation Platform

Typical applications include:

◆ Level controls
◆ Temperature sensors
◆ Pressure Sensors
◆ Gas Analyzers
◆ Vibration Sensors

◆ Position Indicators
◆ Pressure Switches
◆ Temperature Switches
◆ Proximity Sensors
◆ Motion Sensors