VibroSmart® DMS real-time Ethernet switch

VSN010

FEATURES

» VibroSight® compatible hardware from the Vibro-Meter® product line

» Designed for operation with the VibroSmart® distributed monitoring system (DMS)

» Real-time Ethernet switch providing fault-tolerant protocol redundancy for networks

» Redundant real-time communications based on high-availability seamless redundancy (HSR, IEC 62439-3) with zero recovery time

» Redundant non-real-time communications based on the rapid spanning tree protocol (RSTP, IEEE 802.1D)

» Redundant power supply inputs for improved availability

» Three RJ45 sockets with 100 Mbps Ethernet (IEEE 802.3)

» Front panel LEDs provide network status information

» Robust metal enclosure with DIN rail mounting adaptor

APPLICATIONS

» Communications gateway between a redundant VibroSmart DMS network and a standard Ethernet network

» Enables cost-effective redundant networks (HSR ring topology) of VibroSmart DMS modules in applications where the cost of failure is high

VSN010
real-time Ethernet switch

(Some certifications pending)

DESCRIPTION

Introduction

The VibroSmart® distributed monitoring system (DMS) is a system of modular and scalable products designed for condition monitoring and machinery protection applications for power generation turbines, oil and gas applications and auxiliary balance-of-plant equipment.

VibroSmart DMS modules can be mounted directly on machinery, eliminating the need for costly cabling, because they are designed and certified to work in extremes, such as harsh industrial environments characterized by potentially explosive atmospheres (ATEX Zone 2), high temperatures (70°C) and high mechanical stress. VibroSmart complements the VM600 series of rack-based solutions from Meggitt Sensing Systems' Vibro-Meter® product line and is compatible with the same VibroSight® software.

The VSN010 real-time Ethernet switch is an Ethernet switch designed specifically for operation with VibroSmart DMS modules connected in redundant network topologies, such as a redundant HSR ring. The VSN010 switch acts as a communications gateway between redundant networks of VibroSmart DMS modules and standard Ethernet networks, which typically include the host computer running the VibroSight software.

VibroSmart DMS

A Meggitt Sensing Systems VibroSmart DMS is a network of small and economical modules (providing measurement, communications or other functions) that are connected together in measurement blocks in order to provide the functionality normally offered by rack-based machinery monitoring systems.
A VibroSmart DMS consists of one or more measurement blocks, each containing up to 16 VibroSmart modules, a power supply and an optional host computer running the VibroSight software.

A measurement block is a logical grouping of VibroSmart modules that allows data such as tachometer, trigger and alarm information to be shared, for example, in order to monitor the same machine. Measurement blocks are configured using the VibroSight software.

Note: A VibroSmart DMS is limited to a maximum of 8 measurement blocks without VSN010 real-time Ethernet switches but if each measurement block contains a VSN010, then a higher number of measurement blocks can be achieved, limited only by overall system performance (network traffic, VibroSight computer configuration and so on).

A VibroSmart DMS module incorporates two Ethernet ports that are interconnected by full-duplex links (operating in parallel) and implements protocols based on the rapid spanning tree protocol (RSTP) and the high-availability seamless redundancy (HSR) specification. The RSTP ensures a loop-free network topology for non-real-time traffic, while the HSR implementation ensures redundant communications for real-time traffic. This allows a VibroSmart DMS module to connect to a standard (non-redundant) Ethernet network as a singly attached node (SAN) using a single Ethernet port, or to connect to a redundant HSR ring network as a doubly attached node implementing the HSR protocol (DANH) using both Ethernet ports.

VSN010 real-time Ethernet switch

The VSN010 real-time Ethernet switch is a "redundancy box" that enables cost-effective redundant networks of VibroSmart modules, with zero time to recovery for a single point of failure. It does this by acting as a gateway (communications bridge) between a redundant VibroSmart network and a standard Ethernet network, that is, it allows DANHs and SANs to communicate.

The VSN010 Ethernet switch implements the HSR and RSTP protocols, which allows VibroSmart modules to be arranged in a HSR ring network topology for increased system availability.

In general, when connected in standard (non-redundant) networks, such as a linear network topology, the dual Ethernet ports of a VibroSmart module are simply used to connect the modules together in a line.

However, when connected in redundant networks, the dual Ethernet ports of a VibroSmart module allow it to behave as a DANH. For example, in a HSR ring network topology the HSR protocol of the transmitting VibroSmart module transmits copies of the message (packet) in both directions (that is, on different independent network paths) at the same time. The HSR protocol of the receiving VibroSmart module processes the message that arrives first, discarding any duplicates. Thus, in the case of a single point of failure (for example, due to a broken cable or individual VibroSmart module being reconfigured online or even failing), the message will still be received via the other direction (network path).

In a HSR ring network topology, the VSN010 Ethernet switch forwards all traffic (both real-time and non-real-

DESCRIPTION (*continued*)

time packets) from one port to the other on the ring (RP1↔RP 2) but only forwards non-real-time packets to and from the standard Ethernet network (RP 1↔Gateway and RP 2↔Gateway).

A redundant VibroSmart DMS therefore includes a VSN010 and additional network cabling, in addition to the existing VibroSmart modules and host computer. The modules are connected together in a ring with the VSN010 acting as the gateway between this VibroSmart HSR ring and the host computer.
See **Example VibroSmart DMS in a HSR ring configuration on page 4**.

Like all VibroSmart DMS modules and devices, the VibroSight System Manager software is used to configure the network time protocol (NTP) server settings and for VSN010 firmware upgrades. The address of the NTP server used by the VibroSmart DMS should be configured before use.

Communications

All VibroSmart DMS modules and devices communicate using a system bus (SBUS), based on Ethernet technology. The SBUS ensures the transfer of both non-real-time (standard) and real-time (time critical) information between VibroSmart modules, and supports communication with the host computer running the VibroSight software. The SBUS also communicates with the network time server that is required when a VibroSmart DMS uses the VibroSight software for data logging.

The VSN010's RP 1 and RP 2 ring ports support all SBUS traffic (both real-time and non-real-time packets), while the Gateway port supports standard (non-real-time) Ethernet only. All of the VSN010 ports support data transfer rates of 100 Mbps at distances up to 100 m.
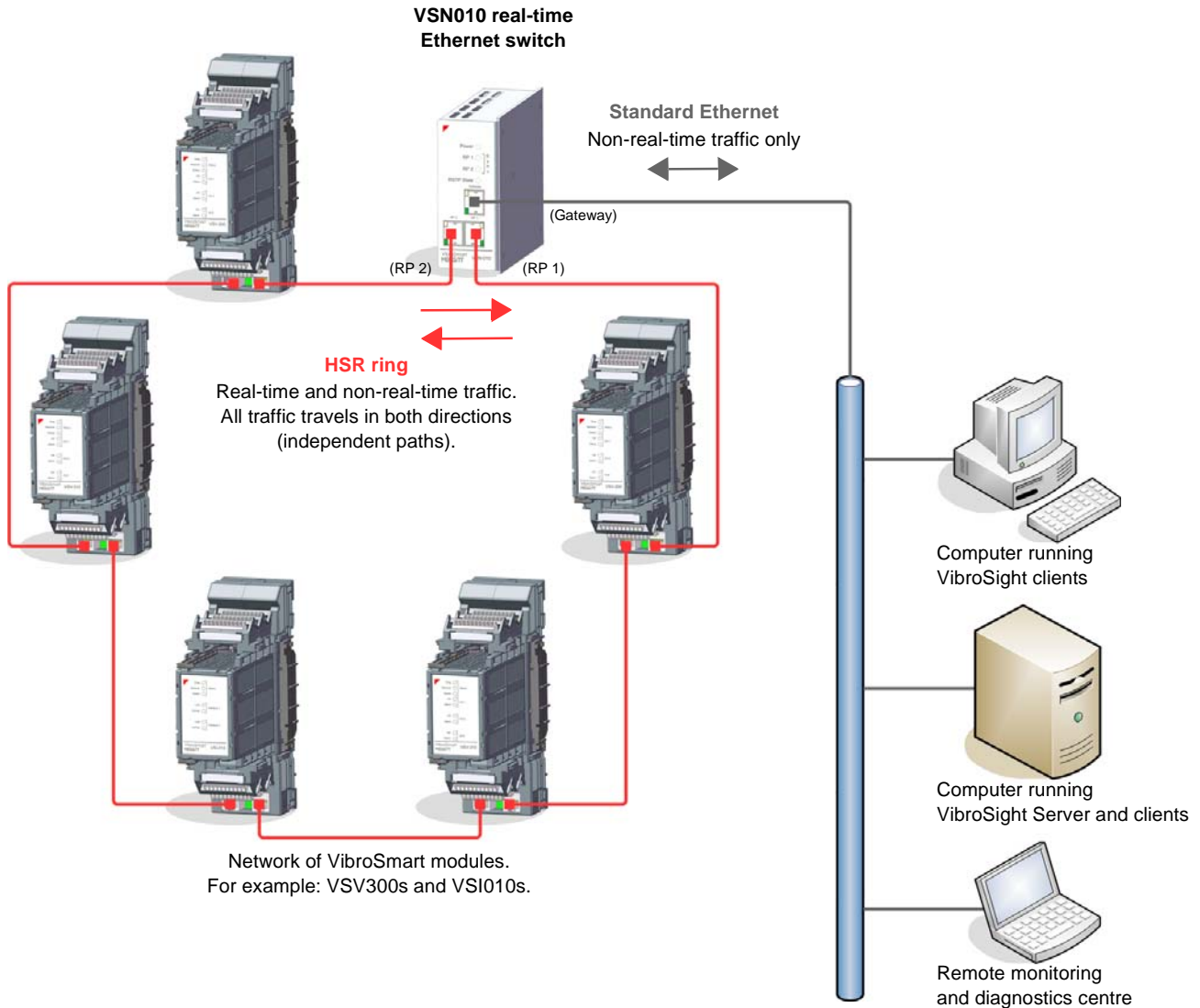
Applications information

The VSN010 real-time Ethernet switch enables cost-effective redundant networks of VibroSmart DMS modules where increased system reliability and availability are required. Such networks are ideal for monitoring, protecting, analysing and diagnosing critical assets such as gas turbines, steam turbines and other rotating machines in applications where the cost of failure is high.

For specific applications, contact your nearest Meggitt Sensing Systems representative.

BLOCK DIAGRAM

Example VibroSmart DMS in a HSR ring configuration

VSN010 real-time Ethernet switch

Standard Ethernet
Non-real-time traffic only

(Gateway)

(RP 2) (RP 1)

HSR ring
Real-time and non-real-time traffic.
All traffic travels in both directions
(independent paths).

Computer running
VibroSight clients

Computer running
VibroSight Server and clients

Network of VibroSmart modules.
For example: VSV300s and VSI010s.

Remote monitoring
and diagnostics centre

Notes

The typical HSR network topology is a ring where Ethernet packets travel in both directions around the ring in order to provide redundancy.

Any network node attached to a HSR ring must be a doubly attached node implementing the HSR protocol (DANH). All VibroSmart DMS modules can function as DANHs because they incorporate two ring ports (RP 1 and RP 2) interconnected by full-duplex links (operating in parallel) and implement a HSR-based protocol.

Any network node attached to (standard) Ethernet must be a singly attached node (SAN), that is, a device such as a computer with one Ethernet port.

The VSN010 real-time Ethernet switch acts as a communications bridge that allows a VibroSmart DMS ring to communicate with a standard Ethernet network, that is, it allows DANHs and SANs to communicate.

Due to the nature of the RSTP protocol, some VibroSmart DMS modules will not be available for a short period of time when a new spanning tree (logical loop-free network topology) is converging after a change to the DMS, for example, due to adding/removing a module or a link/ node failure. The period of time will vary depending on network complexity but is typically within a few seconds and being RSTP related, it only affects non-real-time traffic.

SPECIFICATIONS

SBUS communications (VibroSmart DMS)

Type	: Real-time Ethernet
Network interface	: 100BASE-TX
Data transfer rate	: Up to 100 Mbps
Distance between devices	: Up to 100 m at 100 Mbps (100BASE-T compliant)
Network topologies	: Linear and HSR ring
Number of modules	: Up to 128 modules per VibroSmart DMS (without using VSN010 real-time Ethernet switches):

• Up to 16 modules per measurement block (2 VSI010 modules max. and 16 VSV300 modules max.)
• Up to 8 measurement blocks per VibroSmart DMS.

Signals shared across a measurement block

• *Real-time*	: Tachometric time-stamp, trigger and alarm messages
• *Non-real-time*	: Remote DSI inputs. Measurement data (processed outputs and extracted data).

Note: SBUS is the system bus, based on real-time Ethernet, used by a VibroSmart DMS for all communications.
The SBUS supports inter-module communication between VibroSmart modules such as the transfer of non-real-time information and real-time information such as tachometric time-stamps, triggers and alarms.
The SBUS supports extra-module communications such as the exchange of commands, configuration information and measurement data between VibroSmart modules and a host computer running the VibroSight software, and communication between VibroSmart modules and a network time server.

Environmental

Operating

• *Temperature*	: −20 to +70°C (−4 to +158°F)
• *Humidity*	: 0 to 90% non-condensing

Storage

• *Temperature*	: −40 to +85°C (−40 to +185°F)
• *Humidity*	: 0 to 95% non-condensing
Protection rating	: IP20 according to IEC 60529. It is also possible to deploy VibroSmart DMS modules and devices within an industrial housing in order to attain a rating of IP56. Contact Meggitt Sensing Systems for more information.

⚠ **For Ex Zone 2 applications, a protection rating of at least IP54 (or equivalent) is mandatory.**

SPECIFICATIONS *(continued)*

Explosive atmospheres

Available in Ex approved versions for use in hazardous locations

Type of protection Ex nA: non sparking		
Europe	EC type examination certificate	LCIE 12 ATEX 3092 X II 3 G (Zone 2) Ex nA IIC T6 Gc
International	IECEx certificate of conformity	IECEx LCIE 13.0001X Ex nA IIC T6 Gc
North America	cCSAus certificate of compliance	cCSAus 70002380 Class I, Division 2, Groups A, B, C, D Ex nA IIC T6 Gc Class I, Zone 2 AEx nA IIC T6 Gc

⚠ **When using protection mode 'nA' (non-sparking), the user shall ensure that the real-time Ethernet switch is installed in an enclosure that ensures a protection rating of at least IP54 (or equivalent).**

⚠ **For specific parameters of the mode of protection concerned and special conditions for safe use, please refer to the Ex certificates that are available from Meggitt SA on demand.**

Approvals

Conformity	: CE marking
Electromagnetic compatibility (EMC)	: EN 61000-6-2 Edition 2. EN 61000-6-4 Edition 2. EN 61326-3-1 Edition 1.

Approvals (pending)

Electrical safety	: IEC/EN 61010-1 Edition 3
Hazardous area	: Ex (see **Explosive atmospheres on page 6**)
Other	: DNV (maritime) and GOST

Configuration

VibroSmart devices	: The address of the NTP server used as a system time reference is configurable over Ethernet, using a host computer running the VibroSight software

Time synchronisation

Local synchronisation between VibroSmart devices (inter-module)
- *Protocol*   : Precision time protocol (PTP)
- *Accuracy*   : <1 µs between VibroSmart modules in the same measurement block

Global synchronisation between VibroSmart and other systems (extra-module)
- *Protocol*   : Network time protocol (NTP)
- *Accuracy*   : <10 ms between VibroSmart modules and an NTP server
- *Required*   : No (optional).
For a system, an NTP server can be manually configured as a common time reference in order to synchronise VibroSmart devices and a host computer and/or third-party systems, such as a DCS or PLC.

SPECIFICATIONS *(continued)*

Power supply (input)

Voltage	: +24 V_{DC} nominal (+16 to +32 V_{DC} input range)
Redundancy	: Two separate inputs for connection to different external power supplies
Power consumption	: 3.5 W (typ.), 6 W (max.)

LED indicators

Power	: Indicates the status of the device's power supplies (input and internal)
Sync	: RP 1 / RP 2 – indicates the status of the real-time Ethernet on ring port 1 and ring port 2
Status	: Indicates the status of the redundant network structure for non-real-time frames (that is, reflects the state of the underlying RSTP algorithm)

Connectors

|	
RP 1, front	: 8P8C (RJ45) connector, female. First network port (ring port 1) for connection to a redundant VibroSmart network (DANHs). The RP1 connector is IEEE 802.3 Ethernet compatible with an isolation voltage of 1500 V_{RMS}.
RP 2, front	: 8P8C (RJ45) connector, female. Second network port (ring port 2) for connection to a redundant VibroSmart network (DANHs). The RP2 connector is IEEE 802.3 Ethernet compatible with an isolation voltage of 1500 V_{RMS}.
Gateway, front	: 8P8C (RJ45) connector, female. Network port (Gateway) for connection to a standard Ethernet network (SANs) such as a VibroSight control network, including the host computer running the VibroSight software. The Gateway connector is IEEE 802.3 Ethernet compatible with an isolation voltage of 1500 V_{RMS}.
Power supply input, bottom	: Two 2-contact terminal strip connectors. Redundant power supply inputs.

Physical

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Device mounting	: The VSN010 switch mounts directly on a TH 35-7.5 DIN rail.
Connection to other modules	: Ring port connectors (RP 1 and RP 2) on front of enclosure for connection to VibroSmart modules in a HSR ring (DANHs), using twisted-pair Ethernet cable: See **Example VibroSmart DMS in a HSR ring configuration on page 4**.
Connection to a host computer	: Gateway connector (Gateway) on front of enclosure for connection to a standard Ethernet network (SANs), using twisted-pair Ethernet cable. See **Example VibroSmart DMS in a HSR ring configuration on page 4**.
Ethernet cabling	
• *Cable lengths (network segments) less than 50 m*	: Category 5 enhanced (Cat 5e) cable of type SF/UTP. A SF/UTP cable has overall (outer) screening using braided or foil shielding.
• *Cable lengths (network segments) up to 100 m*	: Augmented category 6 (Cat 6a) or augmented category 7 (Cat 7a) cable of type S/FTP. A S/FTP cable has overall (outer) screening using braided shielding and individual pair shielding using foil.

SPECIFICATIONS *(continued)*

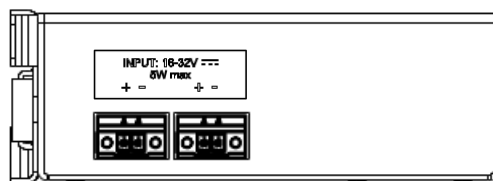|		
Connection to power supply	:	Two separate inputs on bottom of enclosure for connection to different external power supplies
Dimensions	:	See **Mechanical drawings on page 8**
Weight	:	310 g (0.68 lb) approx.

MECHANICAL DRAWINGS
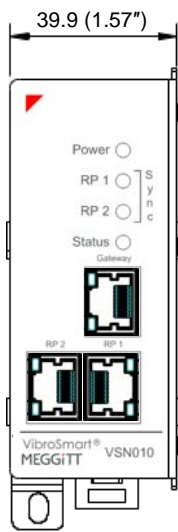
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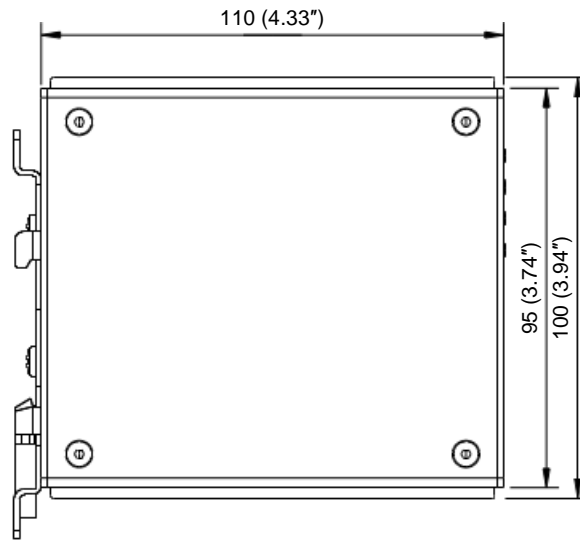
Side view

Bottom view

Note: All dimensions are in mm (in) unless otherwise stated.

ORDERING INFORMATION

To order please specify

Type	Designation	Ordering number
VSN010	VibroSmart real-time Ethernet switch	600-012

RELATED PRODUCTS

APF 19x	AC-DC converters	: Refer to corresponding data sheets
APF 20x	AC-DC converters with Ex approval	: Refer to corresponding data sheets
VSI010	Communications interface module	: Refer to corresponding data sheet
VSV300	Vibration monitoring module	: Refer to corresponding data sheets

Headquartered in the UK, Meggitt PLC is a global engineering group specializing in extreme environment components and smart sub-systems for aerospace, defence and energy markets.

Meggitt Sensing Systems is the operating division of Meggitt specializing in sensing and monitoring systems, which has operated through its antecedents since 1927 under the names of ECET, Endevco, Ferroperm Piezoceramics, Lodge Ignition, Sensorex, Vibro-Meter and Wilcoxon Research. Today, these operations are integrated under one strategic business unit called Meggitt Sensing Systems, headquartered in Switzerland and providing complete systems, using these renowned brands, from a single supply base.

The Meggitt Sensing Systems facility in Fribourg, Switzerland was formerly known as Vibro-Meter SA, but is now Meggitt SA. This site produces a wide range of vibration and dynamic pressure sensors capable of operation in extreme environments, leading-edge microwave sensors, electronics monitoring systems and innovative software for aerospace and land-based turbo-machinery.

Sales offices	Your local agent	Head office
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ISO 9001
FS 584089

ISO 14001
BUREAU VERITAS
Certification