DATA SHEET

vibro–meter®

VibroSmart®
VSN010
real-time Ethernet switch

VSN010 real-time Ethernet switch

CE UK CA ⟨Ex⟩ IECEx CSA EAC Ex

IEC 61850-3 EMC

KEY FEATURES AND BENEFITS

- 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 to improve 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 modules in applications where the cost of failure is high

- Machinery protection and/or condition monitoring

- Conforms to IEC 61850-3 requirements for power plant and utility applications

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® 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, 158°F) and high mechanical stress. VibroSmart complements the VM600 series of rack-based solutions from Meggitt's 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 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 modules and standard Ethernet networks, which typically include the host computer running the VibroSight software.

VibroSmart distributed monitoring system

A VibroSmart® distributed monitoring system (DMS) is a network of small and economical modules providing measurement, communications or other functions that are connected together in distributed, networked measurement blocks in order to provide the functionality normally offered by rack-based machinery monitoring systems. A VibroSmart system consists of one or more measurement blocks, each containing up to sixteen VibroSmart modules, such as VSV30x monitoring 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 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 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

DESCRIPTION *(continued)*

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-time packets) from one port to the other on the ring (RP 1↔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 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 modules and devices, the VibroSight System Manager software is used to configure and manage a VSN010 switch. For example, to configure the network interface (Ethernet/IP) settings, configure network time server (NTP and PTP) settings, update firmware, etc.

Note: The address of any network time servers (NTP and/or PTP) used by a VibroSmart system should be configured before use.

Communications

All VibroSmart 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 recommended when a VibroSmart DMS uses the VibroSight software when data logging is required (for example, condition monitoring applications).

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.
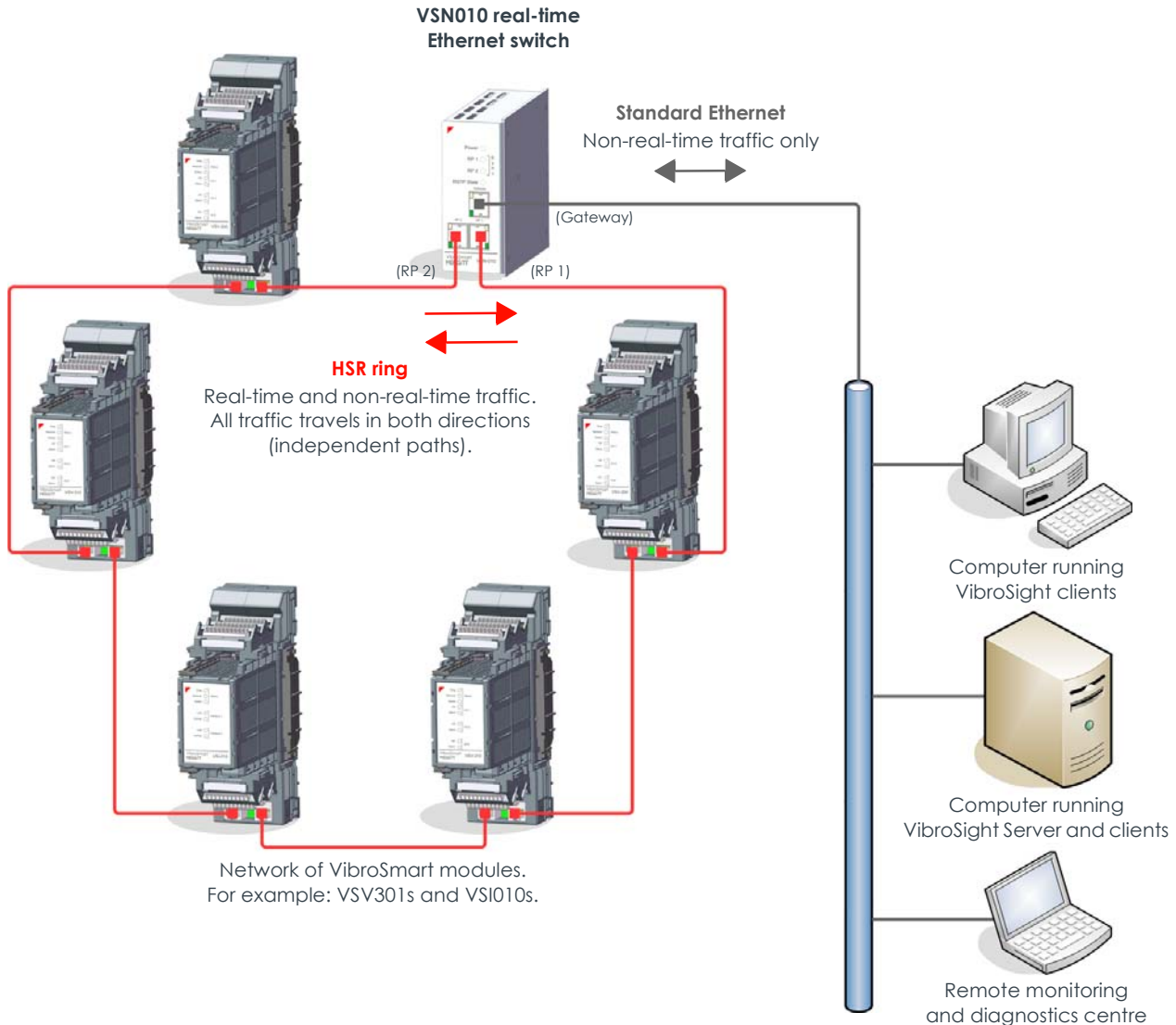
Applications information

The VSN010 real-time Ethernet switch enables cost-effective redundant networks of VibroSmart 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.

VibroSmart® systems (VSV30x + VSB300, VSI010 + VSB010 and VSN010) conform to the IEC 61850-3 requirements for power plant and utility applications – when installed in specific configurations. Contact Meggitt SA and/or refer to the *VibroSmart® distributed monitoring system (DMS) hardware manual* for further information.

For specific applications and other information, contact your local Meggitt 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).

Network of VibroSmart modules.
For example: VSV301s and VSI010s.

Computer running
VibroSight clients

Computer running
VibroSight Server and clients

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® 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 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.
                                     Note: Full-duplex mode with auto-negotiation enabled.
Connectors   : RP 1 and RP 2 (see **Connectors on page 8**)
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 VSV30x 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. It also 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. The SBUS is also used for communication with external NTP and/or PTP network time server(s), if used.

Ethernet gateway

Type   : Ethernet
Network interface   : 100BASE-TX.
                                     Note: Full-duplex mode with auto-negotiation enabled.
Connector   : Gateway (see **Connectors on page 8**)
Data transfer rate   : Up to 100 Mbps
Distance between devices   : Up to 100 m at 100 Mbps (100BASE-T compliant)

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 modules and devices within an industrial housing in order to attain a rating of IP56.
                                     Contact Meggitt for further information.

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

SPECIFICATIONS *(continued)*

Potentially explosive atmospheres

Ex approved for use in hazardous areas

Type of protection Ex nA: non sparking		
Europe	EC type examination certificate	⟨Ex⟩ II 3 G (Zone 2) Ex nA IIC T6 Gc LCIE 12 ATEX 3092 X
International	IECEx certificate of conformity	Ex nA IIC T6 Gc IECEx LCIE 13.0001X
North America	cCSAus certificate of compliance	Class I, Division 2, Groups A, B, C, D Ex nA IIC T6 Gc Class I, Zone 2 AEx nA IIC T6 Gc cCSAus 70002380
United Kingdom	Type examination certificate*	⟨Ex⟩ II 3 G Ex nA IIC T6 Gc CML 21 UKEX 4546 X
Russian Federation	ЕАЭС RU certificate of conformity	2Ex nA IIC T6 Gc X ЕАЭС RU C-CH.АД07.B.04690/22

*Not engraved/marked on the product.

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

⚠ **When using protection mode "Ex nA" (non-sparking), the user must ensure that the VSN010 is installed in an industrial housing or enclosure that ensures a protection rating of at least IP54 (or equivalent).**

⚠ **For the most recent information on the Ex certifications that are applicable to this product, refer to the *Ex product register (PL-1511) document* that is available from Meggitt SA.**

Approvals

Conformity	: European Union (EU) declaration of conformity (CE marking). United Kingdom (UKCA) declaration of conformity. EAC marking, Eurasian Customs Union (EACU) certificate/ declaration of conformity.
Electromagnetic compatibility (EMC)	: EN 61000-6-2:2005. EN 61000-6-4:2007 + A1:2011. EN 61326-1:2006. TR CU 020/2011. IEC 61850-3 (Note: Specific VibroSmart configurations only).
Electrical safety	: EN 61010-1:2010. TR CU 004/2011.
Environmental management	: RoHS compliant (2011/65/UE)
Hazardous areas	: Ex approved (see **Potentially explosive atmospheres on page 6**)
Russian federal agency for technical regulation and metrology (Rosstandart)	: Pattern approval certificate OC.C.28.004.A N° 60224

Configuration

VibroSmart devices : The address of the network time server (NTP and/or PTP) used as a time reference is configurable over Ethernet, using a host computer running the VibroSight software

Time synchronisation

Local synchronisation between VibroSmart modules (inter-module synchronisation)

- Protocol : Precision time protocol (PTP)
- Accuracy : <1 μs.
  Note: Module to module measurement time synchronisation between different VibroSmart modules in the same measurement block.
- Required : Yes (mandatory).
  For each VibroSmart measurement block, one module automatically acts as the PTP server (slave) for the other (client) modules in the measurement block.

Global synchronisation between VibroSmart systems and other systems (extra-module synchronisation)

- Protocols : Network time protocol (NTP)
- Accuracy : <10 ms typ. with an external NTP server.
  Note: Module to module measurement time synchronisation between different VibroSmart modules (VSV30x and VSI010) in the same VibroSmart system.
- Required : No (optional).
  For a VibroSmart system, an NTP server can be manually configured as a common time reference in order to synchronise VibroSmart modules and/or third-party systems.

Local/global synchronisation between VibroSmart modules, VibroSmart systems and other systems (using a VSN010 switch as a PTP bridge)

- Protocols : Precision time protocol (PTP)
- Accuracy : <1 ms (<0.5 ms typ.) with an external PTP server.
  Note: Module to module measurement time synchronisation between different VibroSmart modules (VSV30x only) and VibroSmart systems.
- Required : No (optional).
  For a VibroSmart system, a VSN010 switch can be used as a PTP bridge device (that is, configured to use a PTP server) in order to synchronise VibroSmart modules, VibroSmart systems and/or third-party systems.

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

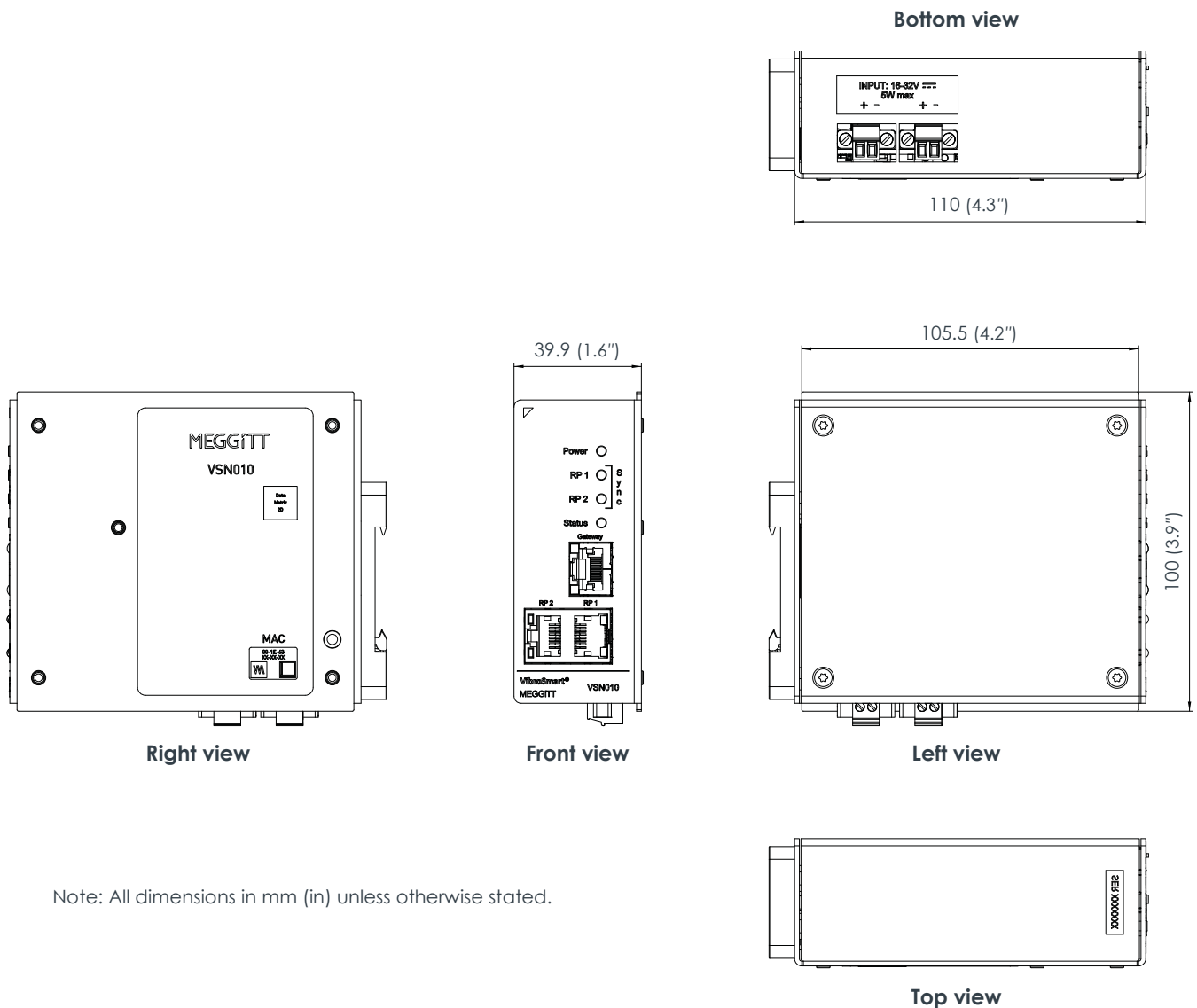|	
RP 1, front	: 8P8C (RJ45) connector, female. First network port (ring port 1) for connection to a redundant VibroSmart network (DANHs). The RP1 connector is IEEE 802.3 Ethernet compatible with an isolation voltage of 1500 V$_{RMS}$.
RP 2, front	: 8P8C (RJ45) connector, female. Second network port (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

Device mounting	: The VSN010 switch mounts directly on a TH 35 DIN rail (according to EN 50022 / IEC 60715). For example, TH 35-7.5 or TH 35-15.
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.
Connection to power supply	: Two separate inputs on bottom of enclosure for connection to different external power supplies

SPECIFICATIONS *(continued)*

Dimensions	: See **Mechanical drawings on page 9**
Weight	: 310 g (0.68 lb) approx.

MECHANICAL DRAWINGS

Bottom view

INPUT: 16-32V ⎓
5W max
+ -   + -

110 (4.3")

39.9 (1.6")

105.5 (4.2")

MEGGITT
VSN010

Data
Matrix
2D

Power
RP 1   S y n c
RP 2
Status
Gateway

RP 2   RP 1

VibroSmart®
MEGGITT   VSN010

100 (3.9")

MAC

Right view   **Front view**   **Left view**

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

Top view

ORDERING INFORMATION

To order please specify

Type	Designation	Part number (PNR)
VSN010	VibroSmart real-time Ethernet switch	600-012

RELATED PRODUCTS

APF19x	24 V_{DC} power supplies	: Refer to corresponding data sheets
APF20x	24 V_{DC} power supplies with Ex approval	: Refer to corresponding data sheets
VSA00x	VibroSmart® BNC cable assemblies and patch panels	: Refer to corresponding data sheet
VSI010 + VSB010	VibroSmart® communications interface module	: Refer to corresponding data sheet
VSV301 + VSB300	VibroSmart® monitoring module	: Refer to corresponding data sheet
VibroSight	VibroSight® machinery monitoring system software	: Refer to corresponding data sheet

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