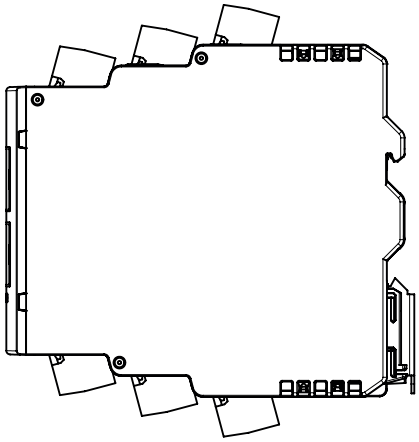
Device manual
Diagnostic electronics
with PROFINET-IO interface
for vibration sensors

VSE150

UK



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Contents

1 Preliminary note

Technical data, approvals, accessories and further information at www.ifm.com.

1.1 Explanation of symbols

Symbols

► Instruction

> Reaction, result

[…] Designation of keys, buttons or indications

→ Cross-reference

Important note
Non-compliance may result in malfunction or interference.

Information
Supplementary note

2 Safety instructions

- Read this document before setting up the product and keep it during the entire service life.
- The product must be suitable for the corresponding applications and environmental conditions without any restrictions.
- Only use the product for its intended purpose (→ Functions and features).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.
- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, operation and maintenance of the unit must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.
- The design of the unit corresponds to protection class III (EN61010) except for the terminal blocks. Protection against accidental contact (safety from finger contact to IP 20) for qualified personnel is only ensured if the terminals have been completely inserted. Therefore the unit must always be mounted in a control cabinet of at least IP 54 which can only be opened using a tool.

- For DC units the external 24 V DC supply must be generated and supplied according to the requirements for safe extra-low voltage (SELV) since this voltage is provided near the operating elements and at the terminals for the supply of sensors without further protection measures.

3 Documentation

This documentation relates to the hardware and firmware status at the time of editing this manual. The features of the devices are continuously developed further and improved.

4 Functions and features

The devices have been designed for use in applications described in this manual and the device-specific data sheets.

Adhere to the data indicated in the data sheets and in the manual. If the handling specifications and safety instructions for configuration, installation and operation indicated in the documentation are adhered to, the devices normally do not lead to a danger for persons and objects.

5 Sensor functions

The diagnostic electronics has

- 2 analogue inputs
- 4 dynamic inputs
- 1 analogue or digital output
- 1 digital output
- 1 TCP/IP parameter setting interface
- 2 PROFINET IO ports

An analogue current signal (0/4…20 mA) or a pulse signal (HTL) can be connected to the analogue inputs.

The analogue inputs can be used

- as trigger for measurements (e.g. rotational speed for vibration diagnostics)
- as trigger of a counter
- for process monitoring

Type VSA accelerometers can be connected to the dynamic inputs.

The dynamic inputs can be used for

- vibration monitoring

– vibration diagnostics
– analysis of other dynamic signals

Alternatively, the dynamic inputs can also be used like an analogue input with an analogue current signal (4...20 mA).

The hardware outputs can be configured as 2 x binary (NO/NC) or as 1 x analogue (0/4…20 mA) and 1 x binary (NO/NC).

The outputs can be used for

– time-critical alarms (e.g. machine protection, response time up to 1 ms)
– alarm output
– analogue value output of values measured by the diagnostic electronics

The parameter setting interface (TCP/IP) is used for the communication between the diagnostic electronics and a PC (e.g. VES004 parameter setting software).

The parameter setting interface can be used for

– parameter setting of the device
– online data monitoring
– reading the history memory
– firmware update

The PROFINET IO ports are used for the communication between the diagnostic electronics and a PROFINET controller (e.g. PLC).

The PROFINET IO interface can be used for

– transferring the current measured values, limits and alarm states of the diagnostic electronics to the PLC
– reading the counter readings of the diagnostic electronics
– writing rotational speeds and other values from the PLC to the diagnostic electronics
– writing limits from the PLC to the diagnostic electronics

The device is not approved for safety-related tasks in the field of operator protection.

5.1 Firmware

► Install the firmware to use all device functions.

Firmware and operating software → download area www.ifm.com

A description of all firmware parameters and their meaning → VES004 PC software manual.

5.2 Function description

With the device

- vibration monitoring (total vibration to ISO)
- condition monitoring (condition-based monitoring on the basis of vibration characteristics)
- machine protection/process monitoring (monitoring vibration characteristics in real time with a very fast reaction time up to 1 ms)

can be implemented.

Monitoring of up to 24 objects (indicators for different machine parts, vibration characteristics or process values)

- dynamic values within the time range (e.g. v-RMS to ISO)
- dynamic values within the frequency range FFT or HFFT (e.g. imbalance or rolling element bearing)
- process values (analogue signals) for current value above or below the limit

The device has an internal history memory (600,000 values) with real-time clock and flexible memory interval per object. The memory is a ring memory (FIFO).

Up to 32 counters can be configured to measure the duration of exceeding the limit and/or operating times.

The signals at the inputs are permanently picked up and continuously monitored according to the set parameters.
With objects within the frequency range (imbalance, rolling element bearing ...) the duplex mode is used for monitoring.
With objects within the time range (v-RMS, a-RMS and a-Peak) all 4 dynamic inputs are monitored simultaneously and without interruption.

The two outputs OU1/2 can be used for alarms. The respective object states per sensor are also indicated via the 4 sensor LEDs.

The system LED displays the operating status of the device.

Parameter setting of the monitoring tasks and alarming is effected by the VES004 software. The software allows to display and record the current measured values, spectra and time signals (online data).

Via the Ethernet interface of the device networking is possible to visualise data (measured values, alarm states ...) in other systems (e.g. SCADA, MES ....).

Data (e.g. measured values, alarm states, limits, rotational speeds, timer readings, ...) is exchanged between the diagnostic electronics and the PROFINET controller via the PROFINET IO ports.

6 Installation

► Mount the unit in a control cabinet with a protection rating of at least IP 54 to ensure protection against accidental contact with dangerous contact voltages and against atmospheric influence.

The control cabinet should be installed in accordance with local and national rules and regulations.

► Mount the unit vertically on a DIN rail.

► Leave enough distance to neighbouring heat sources and between the unit and the top or bottom of the control cabinet to enable air circulation and to avoid excessive heating.

► Prevent the penetration of conductive or other dirt during installation and wiring.

When preparing for cable installation, the local conditions and the corresponding mounting regulations are very important. Cables can be installed, for example, in cable ducts or on cable bridges.

Data corruption and loss

A minimum distance between the cabling and possible sources of interference (e.g. machines, welding equipment, power lines) is defined in the applicable regulations and standards. During system planning and installation, these regulations and standards must be taken into account and observed.

Protect the bus cables from sources of electric/magnetic interference and mechanical strain.

Observe the following guidelines regarding "electromagnetic compatibility" (EMC) to keep mechanical risks and interference to a minimum.

6.1 Sources of interference

Signal cables and power supply lines should not be installed in parallel.

► If necessary, metal isolating segments should be placed between the power supply lines and signal cables.

► During installation, all connector locking mechanisms (screws, coupling nuts) must be firmly tightened in order to ensure the best possible contact between shielding and ground. Before initial start-up, the ground or shielding connection of cables must be checked for low-resistance continuity.

6.2 Cable routing in control cabinets

► Install network/bus cables in separate cable ducts or separate cable bundles.

► Where possible, do not install network/bus cables parallel to power supply lines.

► Install network/bus cables at least 10 cm away from power lines.

6.3 Installation instructions

Electrostatic discharge

The device contains components that can be damaged or destroyed by electrostatic discharge.

► When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) according to EN 61340-5-1 and IEC 61340-5-1.

► In order to dissipate electrostatic charges, the unit may only be operated on a grounded DIN rail.

7 Electrical connection

The national and international regulations for the installation of electrical equipment must be adhered to. Avoid contact with dangerous contact voltages.

► Disconnect power.

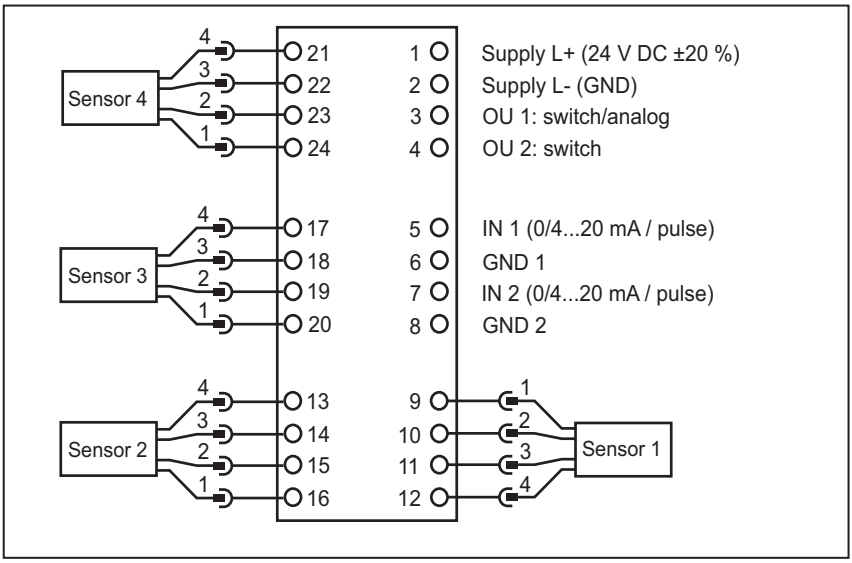
► Connect device, connection via COMBICON connectors (pre-mounted).

► To prevent negative effects on the functions caused by noise voltages, lay sensor cables and load cables separately. Maximum length of the sensor cable: 250 m.

► Use a screened sensor cable.

The outputs are short-circuit proof and can be configured as either normally closed or normally open.
In addition an analogue signal can be provided on output [OU 1] (0/4...20 mA) (e.g. acceleration values).

7.1 Wiring



Wiring of the sensors 1...4 (S1...S4) according to the connected unit

Sensor				VSA	IEPE/VSP	0...20 mA
S1	S2	S3	S4			
09	16	20	24	BN: L+ (+ 9 V)	not connected (n.c.)	not connected (n.c.)
10	15	19	23	WH: signal	IEPE +	signal
11	14	18	22	BU: GND	IEPE -	GND
12	13	17	21	BK: test	not connected (n.c.)	not connected (n.c.)

Terminal 1 supply L+
When using an IEPE input 24 V + 20%
(Integrated Electronics Piezo Electric)

The ground GND of the DC supply is directly connected to the ground GND of the sensor supply. Therefore the SELV criteria have to be met for the DC supply.

► Protect the supply voltage externally (max. 2 A).

7.2 Connection of the sensors

Adhere to the SELV criteria (safety extra-low voltage, circuit electrically isolated from other circuits, ungrounded) when the sensors are connected so that no dangerous contact voltages are applied to the sensor or transferred to the device.

If the DC circuit is to be grounded (e.g. due to national regulations), the PELV criteria must be adhered to (protective extra-low voltage, circuit electrically isolated from other circuits).

Sensor and diagnostic electronics supply are not electrically isolated.

7.3 Ethernet connection

The RJ45 socket is used for the connection to the Ethernet. Ethernet cables can be supplied as accessories, e.g.:

cross-over cable, 2 m, article no. EC2080

cross-over cable, 5 m, article no. E30112

8 PROFINET IO

8.1 Manufacturer and device information

Manufacturer	
Request	**Parameter**
Vendor	ifm electronic gmbh
Vendor ID	0x0136
Device	
Name	VSE150
Device ID	0x0B00
Order ID	VSE150
PROFINET device type	PROFINET IO device
Main family	Sensors
Product family	ifm electronic

8.2 PROFINET IO device description

Request	**Parameter**
Device description	like GSDML file
File name	GSDML-V2.32-IFM-VSE150-20170424.xml
File name	GSDML-V2.31-IFM-VSE150-20170424.xml (to be used with Step7 without support of the medium redundancy) This file is not certified by PNO (PROFINET organisation).

The file name can differ in the date .....20170424.xml.

8.3 PROFINET IO characteristics

Request	Parameter
Bit rate	100 Mbits/s
Supported protocols	SNMP, LLDP, MRP, DCP, DCE-RPC, PTCP, HTTP
DAP Module Ident Number	0x00000200
PNIO Version	V2.33
Conformance Class	C
Netload Class	III
Maximum Input Length	1024 bytes
Maximum Output Length	1024 bytes
Maximum Data Length	1024 bytes
Physical Slots	0...64
Minimum Device Interval	1 ms
Number of Application Relationships	2

8.4 PROFINET IO data model

The IO data to be transferred is selected via the VES004 PC software. After respective parameter setting of the requested input and output data the PROFINET IO data model is created flexibly and transferred to the device via writing the parameter set.The created data model is then available in the respective IO controller (see "Parameter setting").

Input (PLC)					
Source			**Type**	**Size**	**Use**
Analogue inputs (DC)					
	<input name>		Real	4 bytes	Value of the signal connected to the analogue input (IN1, IN2)
External inputs					
	<input name>		Real	4 bytes	Value of the external input (External_xx)
Objects					
	Time domain				
	<object name>				
		Value	Real	4 bytes	Object value in SI unit (m/s², m/s)
		State	Byte	1 byte	(Alarm) state of the object 0: OK 1: warning alarm 2: damage alarm 3: inactive 4: error (description: see Error)

	Error	Word	2 bytes	Error code for object state Hex0000: no error Hex0001: internal error Hex0002: calculation error Hex0004: speed out of range Hex0008: speed unstable Hex0010: invalid base line Hex0020: invalid reference value (1) Hex0040: invalid reference value (2) Hex0100: deactivated by signal weighting Hex0200: reference value out of range Hex1000: warning alarm Hex2000: damage alarm Hex8000: object inactive (by variant)
	Rotational speed	Real	4 bytes	Trigger - rotational speed
	Reference value	Real	4 bytes	Trigger - reference value
	Warning alarm	Real	4 bytes	Limits - warning alarm (relative)
	Damage alarm	Real	4 bytes	Limits - damage alarm (relative)
	Base line	Real	4 bytes	Limits - base line in SI unit (m/s², m/s)
Frequency domain				
<object name>				
	Value	Real	4 bytes	Object value in SI unit (m/s², m/s, m)
	State	Byte	1 byte	(Alarm) state of the object 0: OK 1: warning alarm 2: damage alarm 3: inactive 4: error (description: see Error)
	Error	Word	2 bytes	Error code for object state Hex0000: no error Hex0001: internal error Hex0002: calculation error Hex0004: speed out of range Hex0008: speed unstable Hex0010: invalid base line Hex0020: invalid reference value (1) Hex0040: invalid reference value (2) Hex0100: deactivated by signal weighting Hex0200: reference value out of range Hex1000: warning alarm Hex2000: damage alarm Hex8000: object inactive (by variant)
	Rotational speed	Real	4 bytes	Trigger - rotational speed
	Reference value	Real	4 bytes	Trigger - reference value

	Warning alarm	Real	4 bytes	Limits - warning alarm (relative)
	Damage alarm	Real	4 bytes	Limits - damage alarm (relative)
	Base line	Real	4 bytes	Limits - base line in SI unit (m/s², m/s, m)
Upper/lower limit monitor				
<object name>				
	Value	Real	4 bytes	Object value in SI unit (m/s², m/s, m)
	State	Byte	1 byte	(Alarm) state of the object 0: OK 1: warning alarm 2: damage alarm 3: inactive 4: error (description: see Error)
	Error	Word	2 bytes	Error code for object state Hex0000: no error Hex0001: internal error Hex0002: calculation error Hex0004: speed out of range Hex0008: speed unstable Hex0010: invalid base line Hex0020: invalid reference value (1) Hex0040: invalid reference value (2) Hex0100: deactivated by signal weighting Hex0200: reference value out of range Hex1000: warning alarm Hex2000: damage alarm Hex8000: object inactive (by variant)
	Rotational speed	Real	4 bytes	Trigger - rotational speed
	Reference value	Real	4 bytes	Trigger - reference value
	Warning alarm	Real	4 bytes	Limits - warning alarm (relative)
	Damage alarm	Real	4 bytes	Limits - damage alarm (relative)
Counter				
<counter name>		DINT	4 bytes	Counter value (in seconds)
Alarms				
<alarm name>		Byte	1 byte	Alarm state (0, 1)
General				
Variant		Byte	1 byte	Current variant (0...31)
System mode		Byte	1 byte	System mode: 0 : self-test 1: supervise (normal monitoring) 2: set-up (parameter setting) 3: measure (spectrum, raw data) 4: start-up (system booting)

	Self-test result	Byte	1 byte	Binary bit pattern 0: sensors OK 1: sensor 1 self-test failed 2: sensor 2 self-test failed 4: sensor 3 self-test failed 8: sensor 4 self-test failed
	Current queue level	Byte	1 byte	Current level of the fieldbus communication
	Queue overflow counter	DINT	4 bytes	Overflow counter of the fieldbus communication
	Checksum error counter	DINT	4 bytes	Checksum error counter of the fieldbus communication
Output (PLC)				
External inputs				
	<input name>	Real	4 bytes	Set value of the external input (External_xx)
Objects				
	<object name>			
	Base line	Real	4 bytes	Limits - set base line in SI unit (m/s², m/s, m) to adapt the limits
General				
	Variant	Byte	1 byte	Set current variant (0...31)
	Do self-test	Byte	1 byte	Do self-test (≠ 0)
	Set time	DINT	4 bytes	Set time, always UTC, format: - VSE150: U32: 0x00ssmmhh - VSE151: U32: 0x00hhmmss - VSE152: U32: 0x00hhmmss - VSE153: U32: 0x00hhmmss
	Set counter ID	Byte	1 byte	Set ID (1...32) of the counter
	Set counter value	DINT	4 bytes	Set value of the counter selected with the ID (in seconds)

8.5 PROFINET IO functions

The following chapters 8.5.1...8.5.3 describe the supported PROFINET IO functions. Functions not listed are not supported.

8.5.1 I&M functions

The PROFINET IO device supports identification & maintenance functions (I&M). The general identification & maintenance functions 0...3 can be read via slot 0.

Request	Parameter
I&M 0	Device identification (only read access)
I&M 1...3	Extended device identification (read and write access)

I&M 0

I&M data	Access / data type	Default values
MANUFACTURER_ID	Read / 2 bytes	0x136
ORDER_ID	Read / 20 bytes	VSE150
SERIAL_NUMBER	Read / 16 bytes	Defined in the product process
HARDWARE_REVISION	Read / 2 bytes	Corresponds to the hardware revision of the device
SOFTWARE_REVISION	Read / 4 bytes	Corresponds to the firmware revision of the device
REVISION_COUNTER	Read / 2 bytes	0x0001
PROFILE_ID	Read / 2 bytes	0x0000
PROFILE_SPECIFIC_TYPE	Read / 2 bytes	0x0000
IM_VERSION	Read / 2 bytes	0x0101
IM_SUPPORTED	Read / 2 bytes	0x000E

I&M 1

I&M data	Access / data type	Default values
TAG_FUNCTION	Read/write / 32 bytes	Blank
TAG_LOCATION	Read/write / 22 bytes	Blank

I&M 2

I&M data	Access / data type	Default values
INSTALLATION_DATE	Read/write / 16 bytes	Blank
RESERVED	Read/write / 38 bytes	0x00

I&M 3

I&M data	Access / data type	Default values
DESCRIPTOR	Read/write / 54 bytes	Blank

8.5.2 Shared Device

The device supports the Shared Device function. It allows two controllers to simultaneously set up a cyclical connection to the device.

Request	Parameter
Shared Device	Yes
Max. number of PROFINET IO controllers	– 2 controllers on input module access to output module is always exclusive

8.5.3 Reset to factory

The device supports the Reset to factory function. This function supports the reset (factory setting) of the following parameters of the PROFNET IO device by the PROFINET IO controller.

Request	Parameter
Reset to factory	Yes
Reset data	– IP address – Netmask – Gateway – I&M data

8.6 PROFINET IO protocols

8.6.1 SNMP - Simple Network Management Protocol

Request	Parameter
SNMP	Yes
Description	Simple Network Management Protocol A UDP-based communication protocol (User Datagram Protocol) for maintenance and monitoring of network components. PROFINET uses this protocol for example for creating topology information.

8.6.2 LLDP - Link Layer Discovery Protocol

Request	Parameter
LLDP	Yes
Description	Link Layer Discovery Protocol The LLDP is a manufacturer-independent layer-2 protocol specified to IEEE 802.1AB standard. It contains information about network topology and devices used for administration and error diagnostics.The information collected via LLDP is stored in an MIB (Management Information Base). The data in the MIB can be read by SNMP (Simple Network Management Protocol), for example.

8.6.3 MRP - Media Redundancy Protocol

Request	Parameter
MRP	Yes
Description	Media Redundancy Protocol Protocol to implement media redundancy. Implements the selection in case a transmission medium fails.

8.6.4 DCP - Discovery and Configuration Protocol

Request	Parameter
DCP	Yes
Description	Discovery and Configuration Protocol DCP distributes the addresses and names of the individual participants in a PROFINET IO system. DCP allows, for example, to assign the IP addresses by means of the symbolic name.

8.6.5 DCE/RPC – Distributed Computing Environment Remote Procedure

Request	Parameter
DCE/RPC	Yes
Description	Distributed Computing Environment/Remote Procedure Call The connectionless DCE/RPC protocol is used for reading and writing data and reading diagnostics.

8.6.6 PTCP – Precision Transparent Clock Protocol

Request	Parameter
PTCP	Yes
Description	Precision Transparent Clock Protocol Protocol for time synchronisation with IRT (Isochronous Real Time).

8.7 Behaviour if parameter set is changed

Writing of the parameter set (even without changes) or changing the system mode of the diagnostic unit to "set-up" triggers an initialisation (reboot) of the fieldbus module.The connection of the PLC (master / controller / supervisor) to the diagnostic unit is interrupted. It depends on the programming of the PLC how a connection loss is handled. The LED behaviour is described in chapter 12.

9 Delivery status / Factory settings

On delivery there are the following factory settings:

IP settings of the parameter setting interface

Request	Parameter
Parameter set	None
Host name	No name assigned
IP address	192.168.0.1
TCP/IP port	3321
Subnet mask	255.255.255.0
Default gateway	192.168.0.244
MAC address	Defined in the product process

IP settings PROFINET IO interface

Request	Parameter
PROFINET IO device name	No name assigned
IP address	No IP address assigned
Subnet mask	No subnet mask assigned
Default gateway	No default gateway assigned
Device designation	VSE150
Device ID	0x0B00
MAC address	Defined in the product process

10 Parameter setting

The device parameters are set exclusively via the VES004 PC software. All parameters of the configured application are bundled in a parameter set and transferred to the device.

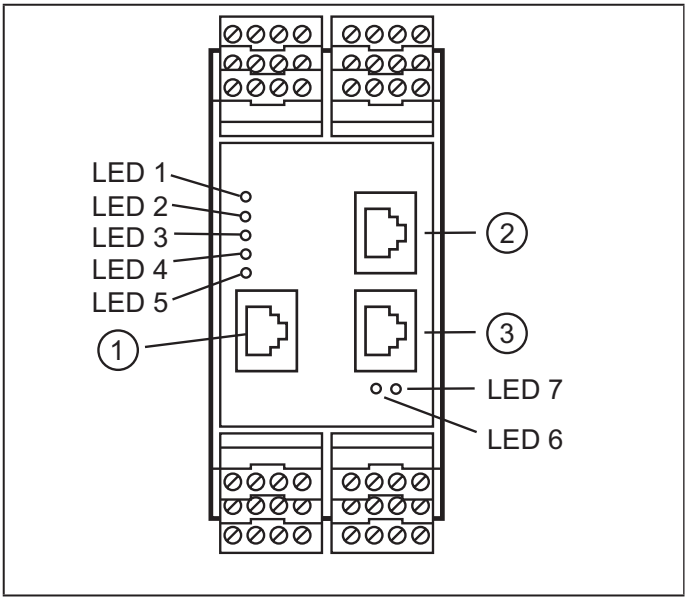
For a detailed description of all parameters and possible configurations we refer you to the VES004 software manual.

The parameters of the PROFINET IO device are set via the PROFINET IO controller configuration tool. Integrate the corresponding GSDML file of the device into the respective software tool (STEP 7/ hardware config. ...).

11 Firmware update

The firmware can only be updated via the VES PC software. Only the firmware of the entire device can be updated.

12 Operating and display elements



1: Config: TCP/IP, IP address 192.168.0.1 (factory setting), parameter setting and data interface (e.g. VES004)
2: IE 1: PROFINET IO
3: IE 2: PROFINET IO

LED 1 for sensor 1... LED 4 for sensor 4	
Green on	Sensor connected and configured
Green flashing	Sensor is configured; type VSA: sensor is not connected or faulty type IEPE: sensor not connected
Yellow on	Warning alarm
Red on	Damage alarm
Green/yellow flashing alternately	Teach process active
Yellow/red flashing alternately	No parameter set loaded
LED 5 for system	
Green on	System OK, monitoring running
Yellow on	System OK, no monitoring due to parameter setting, self-test or FFT mode
Green/yellow flashing alternately	Monitoring not possible, faulty parameter set
Green/red flashing alternately	System error, EEPROM faulty, other states Error in the system, device function restricted

LED 6 bus error (BF) and LED 7 status error (SF)		
LED 6 (BF)	**LED 7 (SF)**	**Description**
Off	Off	Parameter set and PROFINET IO settings must be written
Green on	Off	A PROFINET controller has established an active connection to the PROFINET IO device
Orange on	Orange on	Firmware image is loaded to the RAM via VES004
Green on	Orange on	Firmware image is written to the flash
Green on	Green on	Firmware image was successfully written to the flash
Orange briefly on	Off	Parameter set was successful transferred
Red	Off	No or faulty PROFINET IO communication
Off	Orange flashing	PROFINET IO device detection active
Red flashing	Off	Faulty PROFINET IO module configuration (e.g. parameter setting of the input/output modules of the device differ from parameter setting in the controller)

13 Maintenance, disposal

The unit is maintenance-free.

► Dispose of the device including the battery in accordance with the national environmental regulations.