GB

Operating instructions
Diagnostic electronics with PROFINET-IO interface for vibration sensors
VSE950

11421665 / 00 11 / 2021

Contents

1 Safety instructions

- The unit described is a subcomponent for integration into a system.
  - The system architect is responsible for the safety of the system.
  - The system creator undertakes to perform a risk assessment and to create documentation in accordance with legal and normative requirements to be provided to the operator and user of the system. This documentation must contain all necessary information and safety instructions for the operator, the user and, if applicable, for any service personnel authorised by the architect of the system.
- 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 (→ Intended use).
- 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 product must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.

2 Preliminary note

You will find instructions, technical data, approvals, accessories and further information using the QR code on the unit / packaging or at www.ifm.com.

2.1 Symbols used

✓	Requirement
▶	Instructions
▷	Reaction, result
[...]	Designation of keys, buttons or indications
→	Cross-reference
	Important note Non-compliance may result in malfunction or interference.
	Information Supplementary note

2.2 Warnings used

ATTENTION

Warning of damage to property

CAUTION

Warning of personal injury

▷ Slight reversible injuries may result.

WARNING

Warning of serious personal injury

▷ Death or serious irreversible injuries may result.

3 Intended use

The device has been designed for process value monitoring, vibration monitoring and analysis of dynamic signals.

4 Device 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

Input IN1: connection for a pulse signal (HTL).

Input IN2: connection for an analogue current signal (4...20 mA).

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

VSA, VSP or standard IEPE acceleration sensors can be connected to the dynamic inputs.

The dynamic inputs can be used for

- vibration monitoring
- vibration diagnostics
- analysis of other dynamic signals

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 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 Modbus 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 teach values from the PLC to the diagnostic electronics

ATTENTION

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

4.1 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 response 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. unbalance or rolling element bearing)
- process values (analogue signals) for current value above or below the limit

The device has an internal history memory (> 850,000 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 operating times and/or how long a limit value is exceeded.

The signals at the inputs are permanently picked up and continuously monitored according to the set parameters.

With objects in the frequency range (unbalance, rolling element bearing,...), monitoring is done in multiplex mode.

With objects in 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.

Parameter setting of monitoring tasks and alarming is done via 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, counter readings,...) is exchanged between the diagnostic electronics and the PROFINET controller (e.g. PLC) via the PROFINET IO ports.

4.2 Firmware

▶ Recommendation: Install/Use the latest firmware to use all device functions.

The firmware can only be updated via the VES004 PC software. Only the firmware of the entire device can be updated.

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

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

During the firmware update, the parameter set and the history on the device are deleted. All counters are reset.
The IP settings of the configuration and fieldbus interface are retained.

▶ Recommendation: Run a parameter backup before the firmware update.

5 Mounting

- ▶ Disconnect the power to the machine during installation.
- ▶ Use a flat mounting surface for installation.

▶ Fasten the module onto the mounting surface using M6 screws and washers.

▶ Ground the device with the earthing screw provided.

▶ To guarantee the protection rating IP 67, M12 sockets from ifm must be used.

▶ Cover the unused sockets with protective caps (to be ordered separately).

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.

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

5.1 Emission

This is a class A product. The device may cause radio interference in domestic areas.

▶ It if necessary, take measures to prevent radio interference.

5.2 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.

5.3 Cable routing

Network/bus cables: 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.

5.4 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.

6 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 the unit.
- ▶ To prevent negative effects on the functions caused by noise voltages, lay sensor cables and load cables separately.

Maximum cable length for the sensors 1…4: 250 m.

Maximum cable length for the inputs IN1 and IN2: 30 m.

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).

6.1 Wiring

Sensor 1…4	
M12 socket, A-coded	
1: L+ (bn)	
2: Signal (wh)	
3: GND (bu)	
4: Test (bk)	
5: not used	

Config / IE1 / IE2	
M12 socket, D-coded	
1: TxD+	
2: RxD+	
3: TxD-	
4: RxD-	
5: not used	

IN 1	
M12 socket, A-coded	
1: 24 V DC (bn)	
2: not used	
3: GND (bu)	
4: IN pulse (bk)	
5: not used	

IN 2	
M12 socket, A-coded	
1: 24 V DC (bn)	
2: IN 4...20 mA (wh)	
3: GND (bu)	
4: not used	
5: not used	

OU / Supply	
M12 connector, A-coded	
1: 24 V DC (bn)	
2: analogue or digital (wh)	
3: GND (gn)	
4: OU2: switch	

6.2 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 PROFINET IO interface

7.1 Manufacturer and device information

Manufacturer **Request**	**Parameter**
Vendor	ifm electronic gmbh
Vendor ID	0x0136
Unit	
Name	VSE950
Device ID	0x0B00
Order ID	VSE950
PROFINET device type	PROFINET IO device
Main family	Sensors
Product family	ifm electronic

7.2 PROFINET IO device description

Request	**Parameter**
Device description	like GSDML file
File name	GSDML-V2.32-IFM-VSE950-20170424.xml
File name	GSDML-V2.31-IFM-VSE950-20170424.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.

7.3 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

7.4 PROFINET IO data model

The PROFINET 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”).

7.5 Fieldbus parameter data model

Input (PLC)				
Source		**Data type / Byte order / Unit**	**Data size**	**Use**
Dynamic inputs				
	<input name>	• Real or DINT with factor • Big or Little Endian	4 bytes	Value of the signal connected to dynamic input (sensor 1…4) if it has been configured as a “DC input”.
Analogue inputs				
	<input name>	• Real or DINT with factor • Big or Little Endian	4 bytes	Value of the signal connected to the analogue input (IN1, IN2)
External inputs				
	<input name>	• Real or DINT with factor • Big or Little Endian	4 bytes	Value of the external input (External_xx)
Objects (time domain, frequency domain, upper/lower limit monitor)				
	<object name>			
	Value	• Real or DINT with factor • Big or Little Endian • Has a unit (default SI unit)	4 bytes	Object value has a unit
	Status	Byte	1 byte	Current status/state of the object 0: OK 1: warning alarm 2: damage alarm 3: inactive 4: error

Input (PLC)				
	Error	Word	2 bytes	Error codes for description of error in object state 0x0000: no error 0x0001: internal error 0x0002: calculation error 0x0004: speed out of range 0x0008: speed not stable 0x0010: invalid baseline 0x0020: invalid reference value (1) 0x0040: invalid reference value (2) 0x0100: deactivated by signal weighting 0x0200: reference value out of range 0x1000: warning alarm 0x3000: warning and damage alarm 0x8000: object inactive (by variant)
	Rotational speed	• Real or DINT with factor • Big or Little Endian	4 bytes	Trigger - rotational speed
	Reference value	• Real or DINT with factor • Big or Little Endian	4 bytes	Trigger - reference value
	Warning alarm	• Real or DINT with factor • Big or Little Endian	4 bytes	Limit - warning alarm (relative)
	Damage alarm	• Real or DINT with factor • Big or Little Endian	4 bytes	Limit - damage alarm (relative)
	Baseline	• Real or DINT with factor • Big or Little Endian • Has a unit (default SI unit)	4 bytes	Limit - unit-based baseline for time and frequency objects Note: This parameter is not applicable for the upper/lower limit monitor objects
Counter				
	<counter name>	• DINT • Big or Little Endian	4 bytes	Counter value (in seconds)
History				
	<object name>			
	History value	• Real or DINT with factor • Big or Little Endian • Has a unit (default SI unit)	4 bytes	Unit-based current history entry of the object

Input (PLC)				
	Average value of the history	• Real or DINT with factor • Big or Little Endian • Has a unit (default SI unit)	4 bytes	Unit-based average value of the current history entry of the object
	Speed of the history	• Real or DINT with factor • Big or Little Endian	4 bytes	Trigger - speed of the current history entry of the object
	Reference value of the history	• Real or DINT with factor • Big or Little Endian	4 bytes	Trigger - reference value of the current history entry of the object
	Input counter of the history values	• DINT • Big or Little Endian	4 bytes	Counter of the received history entries of the object
Alarms (OUT1 / OUT2)				
	<alarm name (OUT1)>	• Float or DINT with factor • Big or Little Endian	4 bytes	Configuration as analogue alarm output: value of alarm output
		Byte	1 byte	Configuration as digital alarm output: alarm state Configuration as NC No alarm: 1 Alarm: 0 Configuration as NO No alarm: 0 Alarm: 1
	<alarm name (OUT2)>	Byte	1 byte	Alarm state Configuration as NC No alarm: 1 Alarm: 0 Configuration as NO No alarm: 0 Alarm: 1
Alarms (IO1 - IO8)				
	<alarm name>	Byte	1 byte	Alarm state Configuration as NC No alarm: 1 Alarm: 0 Configuration as NO No alarm: 0 Alarm: 1
General				
	Variant	Byte	1 byte	Value of the active variant (0...31)
	System mode	Byte	1 byte	Current system mode of the device 0x00: reserved 0x01: supervise (normal monitoring) 0x02: set-up (parameter setting) 0x03: measure (spectrum, raw data) 0x04: start-up (system booting) 0x05: self-test (self-test active)

Input (PLC)				
	Self-test result	Byte	1 byte	Bit pattern Bit1 - sensor 1 Bit2 - sensor 2 Bit3 - sensor 3 Bit4 - sensor 4 Note on evaluation 0x00: Sensors OK 0x01: sensor 1 self-test failed 0x02: sensor 2 self-test failed 0x04: sensor 3 self-test failed 0x08: sensor 4 self-test failed 0x0F: sensor1…4 self-test failed
	Current queue level	Byte	1 byte	Current queue level of the internal device communication
	Queue overflow counter	• DINT • Big or Little Endian	4 bytes	Overflow counter of the internal device communication
	Checksum error counter	• DINT • Big or Little Endian	4 bytes	Checksum error counter of the internal device communication
	Read time	DINT	4 bytes	Read device time (UTC) PROFINET devices: U32:0x00ssmmhh EtherNetIP devices: U32:0x00hhmmss EtherCAT devices: U32:0x00hhmmss MODBUS devices: U32:0x00hhmmss
Placeholder				
	<placeholder>	Byte	xx byte	Placeholder for fieldbus transmission

Output (PLC)				
Source		Data type / Byte order / Unit	Data size	Fieldbus representation
External inputs				
	<input name>	• Real or DINT with factor • Big or Little Endian	4 bytes	Set value of the external input (External_xx)
Objects (time domain, frequency domain)				
	<object name>			
	Baseline	• Real or DINT with factor • Big or Little Endian • Has a unit (default SI unit)	4 bytes	Limits - set unit-based baseline for time and frequency objects to adjust damage limits
General				
	Variant	Byte	1 byte	Set current variant (0...31)

Output (PLC)				
	Do self-test	Byte	1 byte	Execute self-test Note A value change from 0 to ≠ 0 starts the self-test After completion of the self-test, the unit automatically switches to the “Monitoring” system mode
	Set time	DINT	4 bytes	Set time (always UTC format) PROFINET devices: U32:0x00ssmmhh EtherNet/IP devices: U32:0x00hhmmss EtherCAT devices: U32:0x00hhmmss MODBUS devices: U32:0x00hhmmss
	Set counter ID	Byte	1 byte	Set the ID of the counter (1…32)
	Set counter value	• DINT • Big or Little Endian	4 bytes	Set value of the counter selected with the ID (in seconds)
Placeholder				
	<placeholder>	Byte	xx byte	Placeholder for fieldbus transmission

7.6 PROFINET IO functions

The following PROFINET IO functions are supported. All functions that are not listed here are explicitly NOT supported.

7.6.1 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	VSE950
SERIAL_NUMBER	Read / 16 bytes	Is defined in the production 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

I&M data	Access / data type	Default values
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

7.6.2 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 modules Access to output modules is always exclusive

7.6.3 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 • Network mask • Gateway • I&M data

7.7 PROFINET IO protocols

7.7.1 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.

7.7.2 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.

7.7.3 MRP - Media Redundancy Protocol

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

7.7.4 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.

7.7.5 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 establishing the connection, reading and writing data and reading diagnostics.

7.7.6 PTCP - Precision Transparent Clock Protocol

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

7.8 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 10.1.

8 Factory setting

8.1 General factory setting

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	Is defined in the production process

8.2 Factory setting VSE950 - PROFINET IO

There is read and write access to the device settings. The following default values are set by the factory:

Request	Parameter
IP address	192.168.0.100
Subnet mask	255.255.255.0
Gateway	192.168.0.244
Port	502

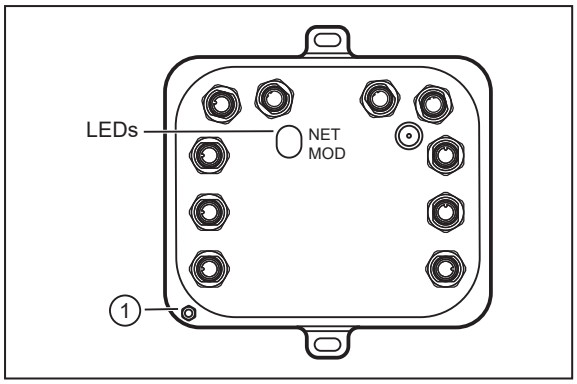
9 Parameter setting

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.

10 Operating and display elements

For quick identification of error states, the device has two diagnostic LEDs on the device front.



1: Earthing screw

10.1 Operating states of the network (NET) and mode (MOD) status LED

Designation	Meaning	Colour	State	Description
LED NET	Network status	n.a.	Off	The device is switched off
		Green	Flashing (approx. 2 Hz)	No connection has been established, an IP address was assigned
		Green	On	Device connected to the network
		Red	On	Error on the fieldbus
LED MOD	PROFINET-IO status	n.a.	Off	Device is switched off (no voltage supply)
		Green	On	Device functions reliably (normal operation)
		Red	On	Device error
		Orange	Flashes	Firmware image is loaded to the RAM
		Orange	Flashes	Firmware image is loaded to the flash
		Green	Flashing for 2 s (approx. 2 Hz)	Firmware image has been written correctly to the flash
		Orange	Flashing for 2 s (approx. 2 Hz)	Parameter set was successfully transferred

11 Maintenance, repair and disposal

The operation of the unit is maintenance-free.

Only the manufacturer is allowed to repair the unit.

▶ After use dispose of the device in an environmentally friendly way in accordance with the applicable national regulations.

Cleaning the unit:

▶ Disconnect the unit from the voltage supply.

▶ Clean the unit from dirt using a soft, chemically untreated and dry micro-fibre cloth.