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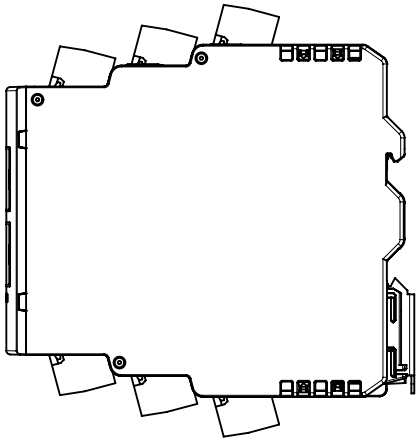
Device manual
Diagnostic unit
with EtherNet/IP interface
for vibration sensors

VSE151



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Contents

1 Preliminary note

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

1.1 Key to the 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 product 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 EtherNet/IP 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

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

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 1x 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 EtherNet/IP ports are used for communication between the diagnostic electronics and an EtherNet/IP controller (e.g. PLC).

Functions of the EtherNet/IP interface

- 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

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

5.1 Firmware

► Recommendation: Install the 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.

5.2 Description of functions

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 EtherNet/IP controller via the EtherNet/IP 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 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 eliminate electrostatic charges, the device many only be operated in 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.

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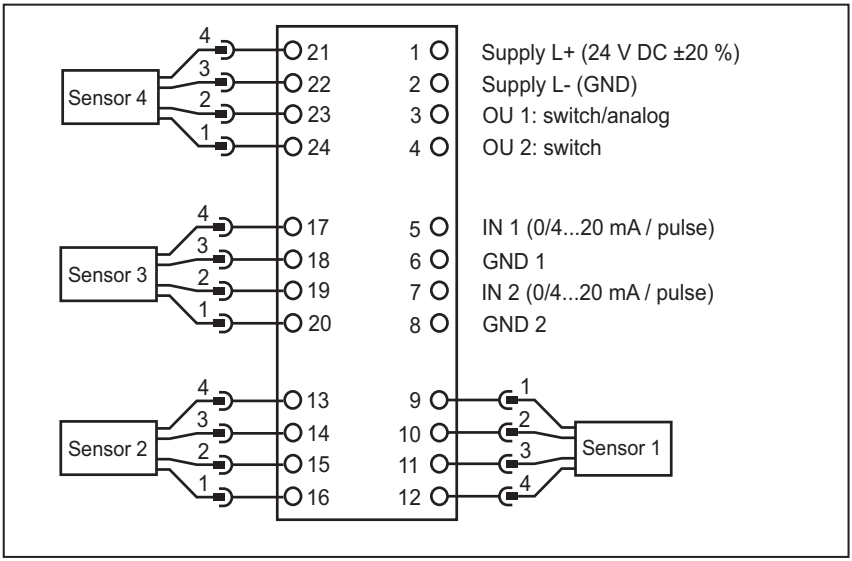
In addition an analogue signal can be provided on output [OU 1] (0/4...20 mA) (e.g. acceleration values).

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 DC + 20% (Integrated Electronics Piezo Electric)

The ground GND of the DC supply is directly connected with 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. 2A).

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 Config 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 EtherNet/IP

8.1 EtherNet/IP object classes, messages and services

The device supports the Common Industrial Protocol (CIP) according to the ODVA specification V3.20. EtherNet/IP™ uses the Common Industrial Protocol as the application layer. IP and TCP or UDP are used for the network and transport layers. CIP and EtherNet/IP™ are standardised by the ODVA on a manufacturer-neutral basis. The Common Industrial Protocol is an object-oriented protocol with two different types of communication between a controller and termination devices.

8.2 EtherNet/IP data model

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)

8.3 Supported communication types

Requirement	Parameters
Explicit messaging	Based on the request/response principle (e.g. use for device configuration) Message Protocol: TCP
Implicit messaging	Based on the producer/consumer model (e.g. cyclic transmission of I/O data) Message Protocol: UDP

8.4 CIP object classes

The device supports the following CIP object classes:

Class ID	Object
0x01	Identity
0x02	Message Router
0x04	Assembly
0x06	Connection Manager
0x47	Device Level Ring (DLR)
0x48	Quality of Service (QoS)
0xF5	TCP/IP Interface
0xF6	Ethernet Link

8.4.1 Identity object (class code 0x01)

The identity object is required by all devices and provides the device ID and general information about the device.

Class attributes

Attribute	Name	Access	Data type	Value
1	Revision	Get	UINT	1
2	Max instance	Get	UINT	1

Instance attributes

Attribute	Name	access	Data type	Value/description
1	Vendor ID	Get	UINT	322(dez)
2	Product type	Get	UINT	43 (Generic Device, keyable)
3	Product code	Get	UINT	151
4	Revision – Major Revision – Minor revision	Get	STRUCT of: – USINT – USINT	e.g. 1 1
5	Status	Get	WORD	Bit 0 - n.a. (Default Value = 0) Bit 1 - n.a. (Default Value = 0) Bit 2 - n.a. (Default Value = 0) Bit 3 - n.a. (Default Value = 0) Bit 4...7- n.a. (Default Value = 0) Bit 8 - n.a. (Default Value = 0) Bit 9 - n.a. (Default Value = 0) Bit 10 - Major recoverable fault (Address conflict detection) Bit 11 - n.a. (Default Value = 0) Bit 12...15 n.a. (Default Value = 0)
6	Serial number	Get	UDINT	Defined in the product process
7	Product name	Get	STRING	VSE151

Common services

Service code	Class	Instance	Service name
0x01	yes	yes	Get_Attribute_All
0x05	no	yes	Reset
0x0E	yes	yes	Get_Attribute_Single

8.4.2 Message router object (class code 0x02)

The message router object provides a messaging connection point through which an EtherNet/IP client may address a service to any object class or instance. The device does not support any access to object attributes.

8.4.3 Assembly object (class code 0x04)

The Assembly Object combines attributes of several objects to allow data to be sent to or received from each object via one connection.

Class attributes

Attribute	Name	Access	Data type	Value
1	Revision	Get	UINT	2
2	Max instance	Get	UINT	255

Instance attributes

Attribute	Name	access	Data type	Value
3	Data	Get	Array of Byte	Current Process data of the correspondent Assembly instance

Common services

Service code	Class	Instance	Service name
0x0E	yes	yes	Get_Attribute_Single

8.4.4 Connection manager object (class code 0x06)

The connection manager object allocates and manages the internal resources that are used for I/Os and explicit messaging connections. Forward Open/Close is supported. The device does not support any access to object attributes.

8.4.5 Device level ring object (class code 0x47)

The device level ring object (DLR) is the interface for configuration and status information for the DLR protocol.

Class attributes

Attribute	Name	Access	Data type	Value
1	Revision	Get	UINT	3

Instance attributes

Attribute	Name	Access	Data type	Value/description
1	Network topology	Get	USINT	0 = Linear 1 = Ring
2	Network status	Get	USINT	0 = Normal 1 = Ring fault 2 = Unexpected Loop detected 3 = Partial Network fault 4 = Rapid fault/Restore cycle
10	Active supervisor address	Get	STRUCT of: – UDINT – ARRAY of 6 USINTs	IP and/or MAC address of the active ring supervisor: Supervisor IP address Supervisor MAC address
12	Capability flags	Get	DWORD	Bit 0 Announced-based ring node (Value = 1) Bit 1 Beacon-based ring note (Value = 0) Bit 2...4 Reserved (Value = 0) Bit 5 Supervisor capable (Value = 0) Bit 6 Redundant Gateway Capable (Value = 0) Bit 7 Flush Table Frame Capable (Value = 1) Bit 8..31 Reserved (Value = 0)

Common services

Service code	Class	Instance	Service name
0x01	yes	yes	Get_Attribute_All
0x0E	yes	yes	Set_Attribute_Single

8.4.6 Quality of service object (class code 0x48)

Quality of service (QoS) affects the forwarding and handling of data streams and results in individual data streams being given differential treatment (usually preferential). QoS can be used to ensure a transmission bandwidth for separate data flows. The device uses QoS in connection with prioritisation.

Class attributes

Attribute	Name	access	Data type	Value
1	Revision	Get	UINT	1

Instance attributes

Attribute	Name	access	Data type	Value/description
4	DSCP urgent	Get, Set	USINT	DSCP value for CIP transport class 0/1 Urgent priority message (default 55)
5	DSCP scheduled	Get, Set	USINT	DSCP value for CIP transport class 0/1 Scheduled priority message (default 47)
6	DSCP high	Get, Set	USINT	DSCP value for CIP transport class 0/1 High priority message (default 43)
7	DSCP low	Get, Set	USINT	DSCP value for CIP transport class 0/1 Low priority message (default 31)
8	DSCP explicit	Get, Set	USINT	DSCP value for CIP transport class 0/1 Low priority message (default 31)

Note: DSCP - Differentiate Service Code Points

Common services

Service code	Class	Instance	Service name
0x0E	yes	yes	Get_Attribute_Single
0x10	no	yes	Set_Attribute_Single

8.4.7 TCP/IP object (class code 0xF5)

The TCP/IP interface object makes it is possible to configure the physical network interface. This includes, for example, the IP address, subnet mask and gateway address.

Class attributes

Attribute	Name	Access	Data type	Value
1	Revision	Get	UINT	4

Instance attributes

Attribute	Name	Access	Data type	Value/description
1	Status	Get	DWORD	Bit 0...3 - Interface configuration Status Bit 4 - Mcast pending (always 0) Bit 5 - Interface configuration pending Bit 6 - ACD Status Bit 7 - ACD Fault Bit 8...31 - Reserved
2	Configuration capability	Gett	DWORD	Bit 0 - BOOTP Client Bit 1 - Reserved Bit 2 - DHCP Client Bit 3 - Reserved Bit 4 - TCP/IP config setable via ETH/IP Bit 5 - Not supported Bit 6 - Not supported Bit 7 - ACD Capable Bit 8...31 Reserved
3	Configuration control	Get, Set	DWORD	Bit 0...Bit 3 - 0 = The device use static IP configuration; 1 = The device use BOOTP; 2 = The device use DHCP Bit 4 - Reserved Bit 5...31 - Reserved Note: BOOTP is not supported

Attribute	Name	Access	Data type	Value/description
4	Physical link object – Path size – Path	Get	STRUCT of – UINT – Padded EPATH	Path to Physical link object Size of Path Logical segments identifying the physical link object
5	Interface configuration – IP address – Network mask – Gateway address – Name Server – Name Server 2 – Domain name	Get, Set	STRUCT of: – UDINT – UDINT – UDINT – UDINT – UDINT – STRINT	TCP/IP Network Interface configuration The device's IP address The device's Network mask Default Gateway address Primary Name Server (always 0.0.0.0) Secondary Name Server (always 0.0.0.0) Default Domain Name (always empty)
6	– Host name	Get,Set	STRING	Default Domain Name (always empty)
10	– Select ACD	Get,Set	Bool	0 = disable; 1 =enable (default)
11	Last conflict detected -ACD Activity -Remote MAC -ArpPdu	Set	STRUCT of: – USINT – ARRAY of 6 USINTs – ARRAY of 28 USINTs	Structure containing Information related to the last conflict detected State of ACD activity when last conflict detected (0 = No conflict detected (Default) 1 = Probe Ipv4 Address 2 = On going Detection 3 = Semi Active Probe) MAC address of remote node from the ARP PDU in which a conflict was detected Copy of the raw ARP PDU in which a conflict was detected
12	Ethernet/IP quick connect	Get, Set	BOOL	0 = disable(Default); 1 = enable
13	Encapsulation Inactivity Timeout	Get, Set	UINT	Number of seconds of inactivity before TCP connection or DTLS session is closed.

Common services

Service code	Class	Instance	Service name
0x01	yes	yes	Get_Attribute_All
0x0E	yes	yes	Get_Attribute_Single
0x10	no	yes	Set_Attribute_Single

8.4.8 Ethernet link object (class code 0xF6)

The Ethernet link object contains specific status information of the Ethernet interface (IEEE 802.3).

Class attributes

Attribute	Name	Access	Data type	Value
1	Revision	Get	UINT	4
2	Max instance	Get	UINT	2
3	Number of instances	Get	UINT	2

Instance attributes

Attribute	Name	Access	Data type	Value/description
1	Interface speed	Get	UDINT	Interface Speed currently in use. Speed in bps (e.g. 10,100)
2	Interface flags	Get	DWORD	Bit 0 - Link Status Bit 1 - Half/Full Duplex Status (0 = Half Duplex, 1 = Full Duplex) Bit 2...4 - Auto negotiation Status (0 =Auto negotiation in progress; 1 = Auto negotiation and Speed detection failed; 2 = Auto negotiation failed but detected Speed; 3 = Successfully negotiated; 4 = Auto negotiation not attempted) Bit 5 - Not supported Bit 6 - Not supported Bit 7...31 - Reserved
3	Physical address	Get	ARRAY of 6 USINTs	MAC layer address
4	Interface counters	Get	Structure of 11 UINTs	Interface specific counters Details are defined in "THE CIP NETWORKS LIBRARY Volume 2 EtherNet/IP Adaptation of CIP"

Attribute	Name	Access	Data type	Value/description
5	Media counters	Get	Structure of 12 UINTs	Media specific counters. "THE CIP NETWORKS LIBRARY Volume 2 EtherNet/IP Adaptation of CIP"
6	Interface control	Get, Set	Structure of WORD	Interface Control Bits Bit 0 - Auto negotiation (0 = active; 1 = inactive) Bit 1 - Half/Full Duplex (0 = half duplex; 1 = full duplex) Bit 2...15 - reserved Data rate (10 = 10Mbps; 100 = 100Mps)
7	Interface Type	Get	USINT	Type of interface: 0 = Unknown interface type 1 = The interface is internal to the device 2 = Twisted pair 3 = Optical fiber 4..255 = Reserved
8	Interface State	Get	USINT	Current operational state of the interface: 0 = Unknown interface state 1 = The interface is enabled and is ready to send and receive data 2 = The interface is disabled 3 = The interface is testing 4...255 = Reserved
9	Admin State	Get	USINT	Settings of the interface state: 0 = Reserved 1 = Enable the interface 2 = Disable the interface 3...255 = Reserved
10	Interface Label	Get	SHORT STRING	Interface name
11	Interface Capability	Get	Structure of DWORD Structure of USINT ARRAY of Structure of UINT USINT	Interface capabilities, other than speed/duplex Speed/Duplex Array Count Speed/Duplex Array Interface Speed Interface Duplex Mode

Common services

Service code	Class	Instance	Service name
0x0E	yes	yes	Get_Attribute_Single
0x10	no	yes	Set_Attribute_Single

8.5 EtherNet/IP - assembly instances

The device has several assembly instances for input and output processes with different data lengths.

Input process data

Object Class	Assembly instance no.	Byte	Description
0x04	100	0...15	Input Assembly 16 Bytes
0x04	101	0...31	Input Assembly 32 Bytes
0x04	102	0...63	Input Assembly 64 Bytes
0x04	103	0...127	Input Assembly 128 Bytes
0x04	104	0...254	Input Assembly 255 Bytes_A
0x04	105	0...254	Input Assembly 255 Bytes_B
0x04	106	0...254	Input Assembly 255 Bytes_C
0x04	107	0...254	Input Assembly 255 Bytes_D

Output process data

Object Class	Assembly instance no.	Byte	Description
0x04	150	0...9	Output Assembly 16Bytes
0x04	151	0...31	Output Assembly 32Bytes
0x04	152	0...63	Output Assembly 64Bytes
0x04	153	0...127	Output Assembly 128Bytes
0x04	154	0...254	Output Assembly 255Bytes

8.6 EtherNet/IP - connection types

EtherNet/IP - connection types

Connection type	Is suported by VSE151	Description
Exclusive Owner	yes	Connections can be configured as multicast or as point-to-point connection in target or originator direction from the scanner.
Input Only	yes	Connections can be configured as multicast or as point-to-point connection in target or originator direction from the scanner.
Listen Only	yes	Connections can only be used as multicast

8.6.1 EtherNet/IP - defined connections in the Standard EDS File

EtherNet/IP - connection types

Connection no.	Connection type	Input Assembly	Output assembly	Description
1	Exclusive Owner	100	150	Connection with 16 byte input and 16 byte output data
2	Exlusive Owner	101	151	Connection with 32 byte input and 32 byte output data
3	Exlusive Owner	102	152	Connection with 64 byte input and 64 byte output data
4	Exlusive Owner	103	153	Connection with 128 byte input and 128 byte output data
5	Exlusive Owner	104	154	Connection with 255 byte input and 255 byte output data
6	Input Only	100	-	Connection with 16 byte input
7	Input Only	101	-	Connection with 32 byte input
8	Input Only	102	-	Connection with 64 byte input
9	Input Only	103	-	Connection with 128 byte input
10	Input Only	104	-	Connection with 255 byte input
11	Input Only	105	-	Connection with 255 byte input
12	Input Only	106	-	Connection with 255 byte input
13	Input Only	107	-	Connection with 255 byte input
14	Listen Only	100	-	Connection with 16 byte input
15	Listen Only	101	-	Connection with 32 byte input
16	Listen Only	102	-	Connection with 64 byte input
17	Listen Only	103	-	Connection with 128 byte input
18	Listen Only	104	-	Connection with 255 byte input
19	Listen Only	105	-	Connection with 255 byte input
20	Listen Only	106	-	Connection with 255 byte input
21	Listen Only	107	-	Connection with 255 byte input

8.7 Ethernet/IP functions

The following EtherNet/IP functions are supported. All functions that are not listed here are explicitly NOT supported.

8.7.1 Quality of Service (QoS)

Requirement	Parameter
Quality of Service	yes
Description	Quality of service (QoS) affects the forwarding and handling of data streams and results in individual data streams being given differential treatment (usually preferential). QoS can be used to ensure a transmission bandwidth for separate data flows. The device uses QoS in connection with prioritisation.

8.7.2 Device Level Ring (DLR)

Requirement	Parameter
Device Level Ring	yes
Description	The device supports the development of a redundant 1-ring topology by using the DLR protocol.

8.7.3 Address Conflict Detection (ACD)

Requirement	Parameters
Address Conflict Detection (ACD)	yes
Description	The device supports the recognition of IPv4 address conflicts.

8.8 EtherNet/IP properties

Requirement	Parameters
Type of unit	EtherNet/IP adapter
Transmission rate	10/100 MBit/s (with auto-negotiation)
Minimum cycle time	5ms (RPI)
EtherNet/IP protocols	ACD, DLR, IGMP v2
Additional protocols	DHCP
EtherNet/IP transmission format	Little Endian
Max. I/O connections	10 (1 input and output assembly per connection)
Max. data size	1024 bytes (max. 255 bytes per assembly)
Device description file	ifm_VSE151.eds
Specification	CIP Edition 3.20 EIP Adaptation of CIP 1.21

8.9 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 11.

9 Factory setting

9.1 General factory setting

Requirement	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

9.2 Factory setting VSE151 - EtherNet/IP

Requirement	Parameter
IP address	No IP address assigned
Subnet mask	No subnet mask assigned
Default gateway	No default gateway address assigned
DHCP	activated
MAC addresses	Defined in the product process.

9.2.1 First set-up

Assignment of the IP address via DHCP server

A valid IP address is not assigned and communication is therefore not possible. The device transmits continuous DHCP requests.

Two cases are possible:

1. The DHCP server assigns a new IP address
   – The device applies the new IP parameters.
2. The DHCP server does not respond
   – The device transmits continuous DHCP discover messages until IP parameters have been received.

Assignment of the IP address via parameter setting tool VES004

A static IP address can be assigned to the device via the parameter setting tool VES004.

10 Parameter setting

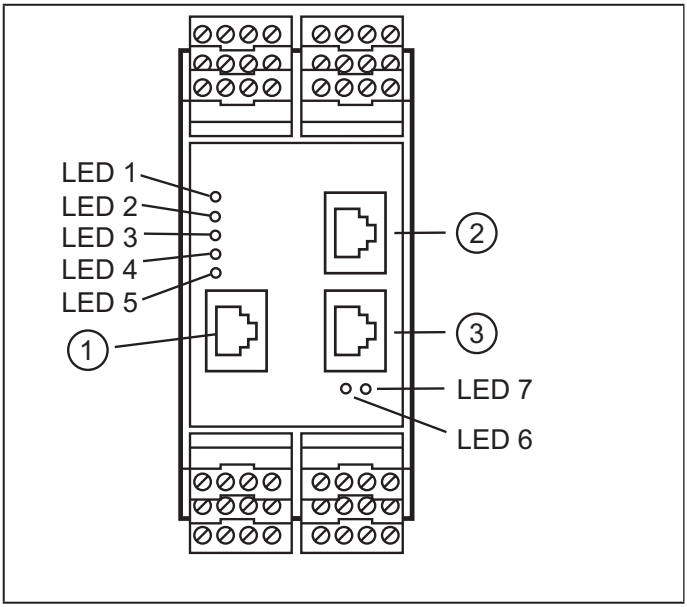
The device parameters are set exclusively via the VES004 PC software. All parameters of the configured application are bundled in a parameter set and transferred to the device.

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

The parameter setting of the EtherNet/IP device is done via the configuration tool of the EtherNet/IP controller. Integrate the associated EDS file of the device into the corresponding software tool.

11 Operating and display elements

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



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

11.1 Sensor operating states

LED 1 for sensor 1... LED 4 for sensor 4	
Green on	Sensor connected and configured
Green flashing	Sensor is configured; VSA type: sensor is not connected or faulty IEPE type: sensor not connected
Yellow on	Pre-alarm
Red on	Main alarm
Green/yellow flashing alternately	Teach process active
Yellow/red flashing alternately	No parameter set loaded

11.2 Operating states of the system

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

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

Description	Description	Colour	Status	Description
NET (LED 6)	Network status	n.a.	off	The device is switched off (no supply voltage) or no IP address.
		green	flashing (approx. 2 Hz)	An IP address is configured, no CIP connection is yet in place, and the exclusive owner connection has no timeout.
		green	on	At least one CIP connection is in place and the exclusive owner connection has no timeout.
		red	on	ACD has determined an IP address conflict.
		red	flashing (approx. 2 Hz)	Connection Timeout. A timeout of an exclusive owner connection has occurred.

Description	Description	Colour	Status	Description
MOD (LED 7)	EtherNet/IP status	n.a.	off	Device is switched off (no voltage supply)
		green	on	Device functions reliably (normal operation)
		green	flashing (approx. 2 Hz)	The device is not configured
		red	on	An unrecoverable error has occurred
		red	flashing	A recoverable error has occurred
		orange	flashing	Firmware image is loaded to the RAM
		orange	on	Firmware image is written to the flash
		green	flashing (approx. 2 Hz)	Firmware images has been written correctly to the flash
		orange	flashing (approx. 2 Hz)	Parameter set was successful transferred

11.4 LED test when device is switched on

For the network and modus status LED, the following switching sequence is to be carried out as LED test when the device is switched on.

Switching sequence	NET (LED 6)	MOD (LED 7)
1	orange for approx. 3 s	orange for approx. 3 s
2	off	off
3	off	green for approx. 0.25 s
4	off	red for approx. 0.25 s
5	off	orange for approx. 0.25 s
6	off	off
7	green for approx. 0.25 s	off
8	red for approx. 0.25 s	off
9	orange for approx. 0.25 s	off
10	current operating status	current operating status

12 Maintenance, disposal

The unit is maintenance-free.

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