Operating instructions

Diagnostic electronics with EtherCAT interface for vibration sensors

VSE152

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Contents

1 Preliminary note ... 3
1.1 Symbols used ... 3
1.2 Warnings ... 3
1.3 Legal notice ... 3
2 Safety instructions ... 4
3 Transport, handling and storage ... 5
4 Intended use ... 6
5 Function ... 7
5.1 Interfaces ... 7
6 Installation ... 9
6.1 Installation instructions ... 9
7 Electrical connection ... 10
7.1 Connection of the sensors ... 11
7.2 Notes on electrical connection ... 11
7.3 Notes on cable routing ... 12
8 Operating and display elements ... 13
8.1 LED operating states ... 13
8.2 LED test when device is switched on ... 15
9 Set-up ... 16
9.1 Firmware ... 16
10 Parameter setting ... 17
11 Maintenance, repair and disposal ... 18
12 Factory settings ... 19
13 Appendix ... 20
13.1 EtherCAT interface ... 20
13.1.1 Technical data EtherCAT ... 20
13.1.2 PDO data mapping ... 20
13.1.3 Identity information ... 21
13.1.4 Slave Information Interface (SII) / EEPROM ... 22
13.1.5 Application Layer (AL) Status Codes ... 22
13.1.6 SDO Abort Codes ... 23
13.1.7 EtherCAT data model ... 23

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1 Preliminary note

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

1.1 Symbols used

✓	Requirement
▶	Instruction
▷	Reaction, result
bold	Designation of keys, buttons or indications
	Cross-reference without link
	Cross-reference with link
	Important note Non-compliance may result in malfunction or interference
	Information Supplementary note

1.2 Warnings

Warnings indicate the possibility of personal injury and damage to property. This enables safe product handling. Warnings are graded as follows:

WARNING

Warning of serious personal injury

▷ If the warning is not observed, fatal and serious injuries are possible.

CAUTION

Warning of minor to moderate personal injury

▷ If the warning is not observed, minor to moderate injuries are possible.

ATTENTION

Warning of damage to property

▷ If the warning is not observed, damage to property is possible.

1.3 Legal notice

EtherCAT® is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

2 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 architect 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.



The design of the device 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.

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3 Transport, handling and storage

- Store the device in its original packaging.
- When the device is to be stored again, use the original packaging.
- Otherwise, provide unused connections with either a mating connector or a protective cap and pack the device in suitable packaging.
- Observe the permissible ambient conditions for the device during storage (→ Technical data).

4 Intended use

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

For use in the USA and Canada, the following applies:

For USA and Canada, this product is specified for the control of a production process in a dedicated building or factory (industrial area).

5 Function

The following monitoring functions can be carried out using this device:

- vibration monitoring (total vibration in accordance with 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)

Monitoring functions

The device enables the monitoring of up to 24 parameters (indicators for various machine components, vibration parameters or process values).

The following parameters can be monitored:

- dynamic values in the time domain (e.g. v-RMS in accordance with 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

Data storage

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).

Counter

Up to 32 counters can be configured to measure the duration of operating times and/or how long a limit value is exceeded.

Signal processing and monitoring

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.

Alarms and displays

The two outputs, OU1 and OU2, can be used for triggering an alarm.

The respective object states per sensor are also indicated via the 4 sensor LEDs.

Additional LEDs provide information on the device's operating and communication status.

Communication and networking

- The device is connected to a piece of software via the configuration interface:
  - The VES004 parameter setting software can be used to configure monitoring tasks and alarms as well as to display and record current measured values, spectra and time signals (online data).
  - The data can be processed further using higher-level software systems, such as ifm moneo, SCADA or MES systems.
- Data (e.g. measured values, alarm states, limit values, speeds and counter values) is exchanged between the diagnostic electronics and the higher-level control system via the fieldbus interfaces.

5.1 Interfaces

The device has the following interfaces (→ Electrical connection):

6 inputs

Input		Use
IN1 IN2	• Input for a pulse signal (HTL) • Input for an analogue current signal (4–20 mA)	• Trigger for a measurement (e.g. speed for vibration diagnostics) • Counter trigger • Process value monitoring
Sensor 1 Sensor 2 Sensor 3 Sensor 4	4 dynamic inputs: Connection of 4 acceleration sensors of the VSA, VSM or VSP type, or standard IEPE sensors.	• Vibration monitoring • Vibration diagnostics • Analysis of other dynamic signals • Alternatively: Input for an analogue current signal (4–20 mA)

2 hardware outputs

Output		Use
OU1	Analogue output (4…20 mA) or digital output	• 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
OU2	digital output	

1 parameter setting interface

Interface		Use
CONFIG	TCP/IP over Ethernet	Communication between the diagnostic electronics and a PC (e.g. VES004 parameter setting software). Use: • parameter setting of the device • online data monitoring • reading the history memory • Firmware update

2 fieldbus interfaces

Interface		Use
IE1	EtherCAT Port 1 (signal input)	Communication between the diagnostic electronics and an EtherCAT controller (e.g. PLC). • 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
IE2	EtherCAT Port 2 (signal output)	

Description of all input and output data for the fieldbus interface: Appendix → 20.

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6 Installation

- Disconnect the power to the machine during installation.

- Follow the instructions on cable routing 12.

- Mount the unit vertically on a DIN rail.
- Leave enough space between the unit and neighbouring heat sources 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.

6.1 Installation instructions

The design of the device 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.

- 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.

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.
- Only operate the device when mounted on a grounded DIN rail in order to dissipate electrostatic charges.

7 Electrical connection

The unit must be connected by a qualified electrician.

- Observe the national and international regulations for the installation of electrical equipment.

- Disconnect power.
- Connect the unit as follows:

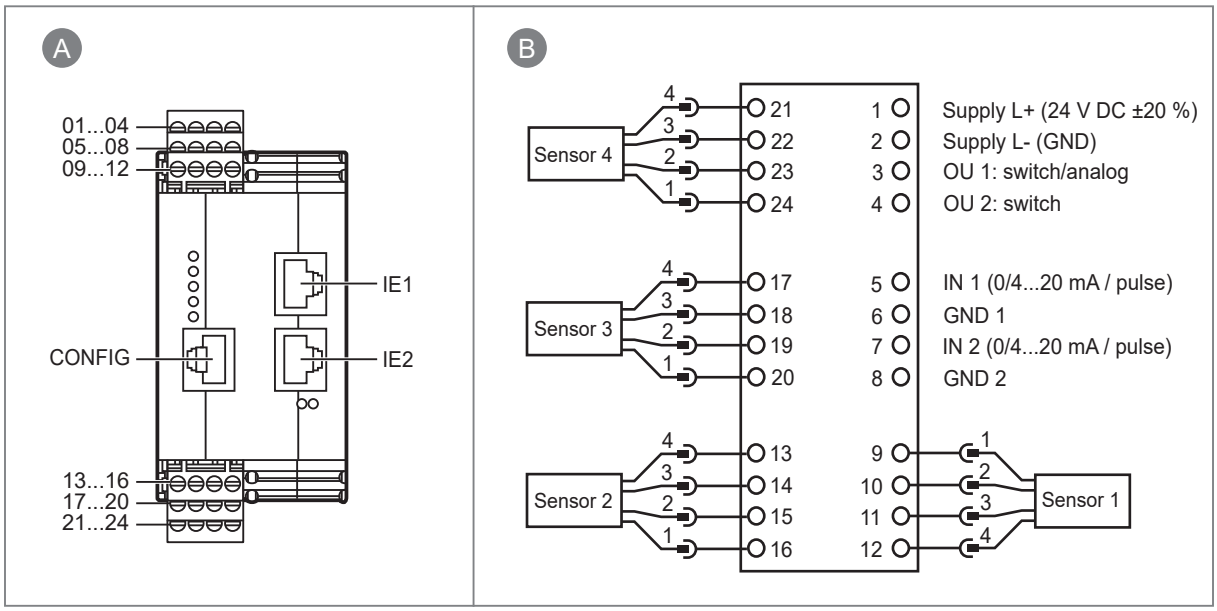


Fig. 1: Wiring

A:
- COMBICON connectors:
  - 01…02: Voltage supply
  - 03: Hardware output OU1 for a digital or analogue signal
  - 04: Hardware output OU2 for switching signal
  - 05: Input IN1 for analogue or pulse signals
  - 08: Input IN2 for analogue or pulse signals
  - 09…24: Sensor inputs
- RJ45 sockets:
  - IE1: EtherCAT Port 1 (fieldbus interface)
  - IE2: EtherCAT Port 2 (fieldbus interface)
  - CONFIG: TCP/IP over Ethernet (configuration interface)

B: Wiring of the COMBICON connectors

The hardware outputs OU1 and OU2 are short-circuit-proof and can be configured as normally open or normally closed contacts. OU1 can be used as an analogue output (4–20 mA).

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7.1 Connection of the sensors

The diagnostic electronics feature 4 COMBICON terminal blocks as dynamic inputs for connecting up to 4 sensors (S1…S4).

Connecting the VSA, VSP and analogue sensors:

COMBICON connectors				Assignment		
Sensor 1	Sensor 2	Sensor 3	Sensor 4	VSA [1]	VSP [2]	0…20 mA [3]
09	16	20	24	BN: L+ (+ 9 V)	not connected	not connected
10	15	19	23	WH: Signal	IEPE +	Signal
11	14	18	22	BU: GND	IEPE -	GND
12	13	17	21	BK: Test	not connected	not connected

[1] Acceleration sensor from the VSAxxx product family (analogue signal 0…10 mA)

[2] Acceleration sensor from the VSPxxx product family (IEPE signal) or another sensor with an IEPE signal

[3] Analogue signal 0...20 mA.

Connecting the VSM sensors:

COMBICON connectors				Assignment		
Sensor 1	Sensor 2	Sensor 3	Sensor 4	VSM [1]		
09	16	20	24	not connected		
10	15	19	23	IEPE x	IEPE y	IEPE z
11	14	18	22	IEPE -		
12	13	17	21	not connected		Test [2]

[1] Acceleration sensor from the VSMxxx product family (IEPE signal)

[2] The self-test is only carried out via the z axis.

7.2 Notes on electrical connection

ATTENTION

Unused terminal points reduce the protection rating.

▷ Protection rating IP 20 not ensured.

▶ Cover unused terminals with connectors.

The design of the device 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.

Sensor and diagnostic electronics supply are not electrically isolated.

Supply voltage requirements (SELV / PELV):

Adhere to the SELV criteria (safety extra-low voltage, circuit electrically isolated from other circuits, ungrounded) when connecting the device, so that no dangerous contact voltages will be 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).

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.

Connection of the sensors

- Connect both wires to the same terminal on the diagnostic electronics unit.

Terminal 1 Supply L+
24 V + 20% if an IEPE input is used (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. 2 A).

7.3 Notes on cable routing

ATTENTION

Interference caused by unshielded cabling

- ▷ Data corruption and data loss
- When laying cables, ensure a minimum distance from potential sources of interference (e.g. machinery, welding equipment, high-voltage power lines) in accordance with the relevant 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.

- When preparing to lay the cables, take account of the local conditions and the relevant regulations governing the work.
- Lay cables, for example, in cable ducts or on cable trays.

- To prevent negative effects on the functions caused by noise voltages, lay sensor cables and load cables separately.
- Where necessary, use metal spacers between the power supply and the signal lines.
- 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.

Sensor cables

- Use sensor cables with a maximum length of 250 m.
- Use a screened sensor cable to connect the sensors.

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.

8 Operating and display elements

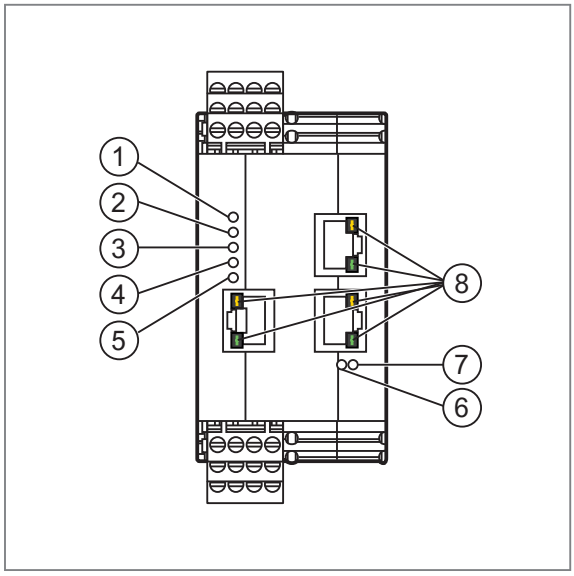


Fig. 2: Light indicators

1: LED 1 = Sensor 1
2: LED 2 = Sensor 2
3: LED 3 = Sensor 3
4: LED 4 = Sensor 4
5: LED 5 = System
6: LED 6 = Error indication (ERR)
7: LED 7 = EtherCAT status (RUN)
8: Linkand ActivityLEDs (L/A) = status indicators for the Ethernet interfaces

8.1 LED operating states

8.1.1 LED 1...4: Sensor

Colour	Status	Description
Green	On	The sensor is connected and configured.
Green	Flashes	The sensor has been configured. Type VSA: The sensor is not connected or is faulty. Type IEPE: The sensor is not connected.
Yellow	On	Warning
Red	On	damage alarm
Green/yellow	Flashing alternately	The teach mode is active.
Yellow/red	Flashing alternately	No parameter set has been loaded.

8.1.2 LED 5: System

Colour	Status	Description
Green	On	System OK, Monitoring is in progress.
Yellow	On	System OK, no monitoring due to parameter setting, self-test or FFT mode
Green/yellow	Flashing alternately	Monitoring is not possible. Invalid set of parameters.
Green/red	Flashing alternately	System error, EEPROM faulty, other states Error in the system, device function restricted

8.1.3 LED 6: ERR (error indication)

Colour	Status	Description
---	Off	No error
Red	Flashes (2.5 Hz)	Invalid configuration
Red	Flashes (200 ms on, 200 ms off, 200 ms on, 1000 ms off)	SyncManager watchdog error
Red	Flashes (200 ms on, 1000 ms off)	The slave application has changed the EtherCAT status autonomously.

8.1.4 LED 7: RUN (EtherCAT status)

Colour	Status	Description
---	Off	The device is in INIT state or switched off (no voltage supply).
Green	On	The device is in the OPERATIONAL state
Green	Flashes (2.5 Hz)	The device is in the PRE-OPERATIONAL state
Green	Flashes (200 ms on, 1000 ms off)	The device is in the SAFE-OPERATIONAL state.

LED behaviour during firmware updates and parameter setting:

Colour	Status	Description
Firmware update		
Orange	Flashes	The firmware is loaded into RAM.
Orange	On	The firmware is loaded into the flash memory.
Green	Flashes 2 s (2 Hz)	After restarting: The firmware has been successfully loaded into the flash memory.
Parameter setting		
Orange	Flashes 2 s (2 Hz)	The parameter set has been transferred successfully.

8.1.5 Link and activity LEDs

Link LED

Colour	Status	Description
---	Off	No connection to the port.
Green	On	Connection to port established

Activity LED

Colour	Status	Description
---	Off	No link available. No data is currently being transferred.
Yellow	On	The link is active. No data is currently being transferred.
Yellow	Flashes	The link is active. Data is currently being transferred.

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8.2 LED test when device is switched on

For LED 6 (ERR error indication) and LED 7 (RUN EtherCAT status indication), the following switching sequence must be performed when the device is powered on as an LED test.

Switching sequence	LED 6	LED 7
1	Orange, on for approx. 3 s	Orange, on for approx. 3 s
2	Off	Off
3	Off	Green, on for approx. 0.25 s
4	Off	Red, on for approx. 0.25 s
5	Off	Orange, on for approx. 0.25 s
6	Off	Off
7	Green, on for approx. 0.25 s	Off
8	Red, on for approx. 0.25 s	Off
9	Orange, on for approx. 0.25 s	Off
10	Current operating status	Current operating status

9 Set-up

To integrate the device into an EtherCAT network, the corresponding ESI file must be imported into the EtherCAT controller's engineering system and the device must be added to the hardware configuration.

How to proceed:

- ✓ The device is mechanically installed and electrically connected correctly.
- ✓ The VES004 parameter setting software is installed on the PC.
- ▶ Setting up the Ethernet connections:
  - ▷ The parameter setting interface (TCP/IP) is connected to the VES004 parameter setting software on the PC.
  - ▷ The EtherCAT ports are connected to the EtherCAT controller.
- ▶ Download the device's EtherCAT Slave Informationfile (ESI) from documentation.ifm.com.
- ▶ If necessary, update the firmware using the VES004 parameter setting software → 16.
- ▶ Integrate the device into the EtherCAT system using the ESI file and the EtherCAT controller's configuration software.
- ▶ Configure the device using the VES004 parameter setting software.

The device is configured exclusively using the VES004 PC parameter setting software.
→ Description of all parameters and configuration options in the Software manual for the parameter setting software at documentation.ifm.com.

Description of all input and output data for the fieldbus interface: Appendix → 20.

9.1 Firmware

It is recommended that you use the latest firmware to ensure you can make full use of all the device's functions.

The firmware can only be updated using the VES004 PC parameter setting software.

Only the firmware of the entire device can be updated.

→ Firmware and parameter setting software available at documentation.ifm.com.
→ A description of all firmware parameters can be found in the parameter setting software manual at documentation.ifm.com.

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.

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10 Parameter setting

ATTENTION

The internal device memory (EEPROM) only allows a limited number of write accesses (max. 1,000,000).

- ▷ Frequent or unnecessary write operations may lead to premature wear and tear of the device's internal EEPROM memory. This may shorten the service life of the device and cause malfunctions or even lead to the device breaking down.
- ▶ Prepare parameter settings in a targeted manner and minimise write accesses to the device memory as far as possible.
- ▶ Avoid frequent switching between variants or changes to the baseline, repeated writing of parameter sets, and unnecessary device restarts.

Writing the parameter set

Writing of the parameter set (even without changes) or changing the system mode of the diagnostic electronics to "set-up" triggers an initialisation (reboot) of the fieldbus module.

- ▷ The connection of the PLC (master / controller / supervisor) to the diagnostic electronics is interrupted. How a loss of connection is handled is determined by the PLC's programming.

The device is configured exclusively using the VES004 PC parameter setting software.

→ Description of all parameters and configuration options in the Software manual for the parameter setting software at documentation.ifm.com.

How to proceed:

- ✓ The device is mechanically installed and electrically connected correctly.
- ✓ The sensors are connected to the device.
- ✓ The device is connected to the PC via the parameter setting interface (TCP/IP).
- ✓ The VES004 parameter setting software is installed on the PC.
- ▶ Establish a connection between the device and the VES004 parameter setting software.
- ▶ Configure the device and write the complete parameter set to the device in a single operation.

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.
- In case of heavy soiling use a cloth moistened with water.

12 Factory settings

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 production process

13 Appendix

13.1 EtherCAT interface

13.1.1 Technical data EtherCAT

Requirement	Parameter
Device type	EtherCAT slave
Transmission rate	100 Mbit/s
Minimum cycle time	1ms
Data format	Little Endian (default), VSE004 allows for configuration to Big Endian
Max. data size	1024 bytes
Configuration	Via PC with configuration tool: VES004
Device description	ESI file (e.g. ifm_VSE152.xml)
Slave Information Interface (SII)	EEPROM file (e.g. ifm_VSE152.bin)

13.1.2 PDO data mapping

13.1.2.1 Process data configuration

The device features a "Fixed process data configuration". The general process data structure is defined in the ESI file and in the Slave Information Interface (EEPROM). A PDO upload/download is not supported.

13.1.2.2 Input module

Number	Module name	Description
1	4x4bytesIn(16B in)	16 bytes input module for 4 bytes data types
2	8x4bytesIn(32B in)	32 bytes input module for 4 bytes data types
3	16x4bytesIn(64B in)	64 bytes input module for 4 bytes data types
4	32x4bytesIn(128B in)	128 bytes input module for 4 bytes data types
5	24x2bytesIn(48B in)	48 bytes input module for 2 bytes data types
6	40x1byte(38B in)	40 bytes input module for 1 byte data types

13.1.2.3 Output module

The SyncManager watchdog for monitoring correct and timely process data communication is activated per default. If you do not set parameters for an output module, there will be a SyncManager watchdog timeout.

- ▶ Recommendation: set parameters for at least one output. If this is not possible, the SyncManager watchdog timer (ESC Register. 420h) has to be set to "0" via the PLC development environment.
- ▷ The SyncManager watchdog is switched off.
- ▷ The ERR LED will no longer signal any errors in process data communication.

Number	Module name	Description
1	4x4bytesOut(16B out)	16 bytes output module for 4 bytes data types

Number	Module name	Description
2	8x4bytesOut(32B out)	32 bytes output module for 4 bytes data types
3	16x4bytesOut(32B out)	64 bytes output module for 4 bytes data types
4	32x4bytesOut(32B out)	128 bytes output module for 4 bytes data types
5	4x1byteOut(3B out)	4 bytes output module, is filled with 1 byte data types (byte).

13.1.2.4 RxPDO and TxPDO object index

Project-specific parameter setting is done via the PC software VES004. The RxPDO and TxPDO index is assigned to the individual input and output modules via the VES004 parameter setting software.

This is done by using the following formula:

Number	Module name	Description
RxPDOs	Index = 0x1600 + (slot number of the module - 1)	16 bytes output module for 4 bytes data types
TxPDOs	Index = 0x1A00 + (slot number of the module - 1)	32 bytes output module for 4 bytes data types

13.1.3 Identity information

13.1.3.1 Object Directory Communication Area

Index	Description	Parameter	Data type	Access
0x1000	Device Type	0 (Generic Device)	UINT32	read only
0x1008	Manufacturer Device Name	VSE152	STRING	read only
0x1009	Manufacturer Hardware Version	e.g. "AA"	STRING	read only
0x100A	Manufacturer Software Version	e.g. "V1.0"	STRING	read only
0x1018	Identity Object			
	Sub-index 0x01: Vendor ID	0x622	UDINT32	read only
	Sub-index 0x02: Product Code	152dez (98hex)	UDINT32	read only
	Sub-index 0x03: Revision Number	Minor Rev.: Bit0-15 Major Rev.: Bit16-31 e.g. 00010002hex (Revision 1.2)	UDINT32	read only
	Subindex 0x04: Serial Number	Defined in the production process	UDINT32	read only

13.1.3.2 Object Directory Manufacturer Specific Area

Index	Description	Parameter	Data type	Access
0x2001	Component Name	“Diagnostic Electronics VSE152”	STRING	read only
0x2002	Vendor Name	“ifm electronic”	STRING	read only
0x2003	Vendor URL	"www.ifm.com"	STRING	read only

Index	Description	Parameter	Data type	Access
0x2004	Order Number	“VSE152”	STRING	read only
0x2007	Installation Location	Location of installation (user-defined)	STRING	read/write
0x200A	Equipment ID	Device name (user-defined)	STRING	read/write

13.1.4 Slave Information Interface (SII) / EEPROM

13.1.4.1 Slave Information Interface

Description

SII is an EEPROM in the EtherCAT slave that can be read by the master directly via the EtherCAT fieldbus chip.
In addition to information on the configuration of the EtherCAT chip, it contains further information for the master.

Definition

1) The Slave Information Interface Area is coded according to EtherCAT Specification - Part 6. (Application Layer protocol specification ETG.1000.6)

2) The serial number information is not stored in the SII of the device. The default value is entered (Serial number = 0).

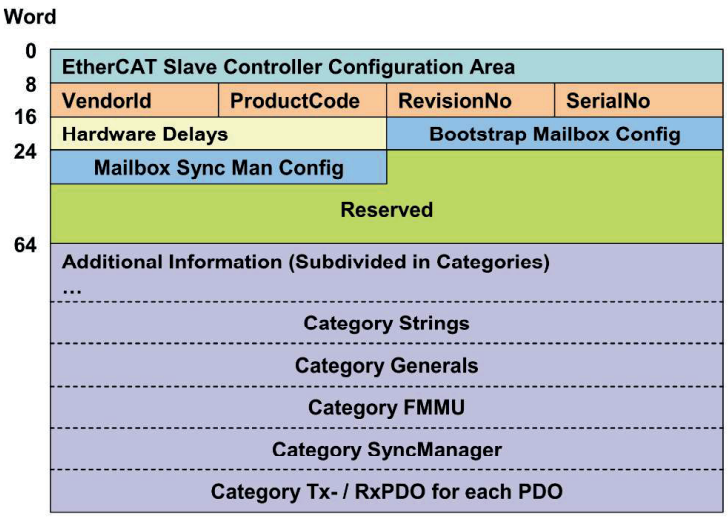


Figure 6: EEPROM Table of Register Values

13.1.5 Application Layer (AL) Status Codes

AL status code	Meaning
0x0000	No error
0x0004	Output / input configuration not valid for this hardware or software revision
0x0011	Requested state inadmissible (e.g. OP with slave being in PREOP)
0x0012	Requested state undefined
0x0013	BOOT state is not supported
0x0016	Mailbox configuration invalid

AL status code	Meaning
0x0018	No valid inputs available
0x001B	SyncManager watchdog timeout
0x001D	SyncManager 2 settings (output data) invalid
0x001E	SyncManager 3 settings (input data) invalid
0x001F	Watchdog settings invalid
0x0030	DC Sync settings invalid
0x8000	The slave application has changed the EtherCAT status autonomously (e.g. write parameter set via VES004)

13.1.6 SDO Abort Codes

SDO Abort Code	Meaning
0x00000000	No error
0x05040005	Not enough memory
0x06010000	Access to the object is not supported. (e.g. complete access to a sub-index greater 1)
0x06010002	Attempt to write on a read only object
0x06020000	Object does not exist
0x06070010	Data type does not match. Length of the service parameter does not match.
0x06070012	Data type does not match. Length of the service parameter too long.
0x06090013	Data type does not match. Length of the service parameter too short.
0x06090030	Value range of the parameter exceeded (for write access only).
0x08000000	General error
0x08000020	Data can neither be transferred to nor stored in the application.
0x08000021	Data can neither be transferred to nor stored in the application. No "write" permission for manufacturer data.
0x08000022	Data cannot be transferred to the application or stored due to the current device status.
0x08000023	Dynamic generation of the object directory fails or there is no object directory.

13.1.7 EtherCAT data model

The EtherCAT data to be transferred is selected via the VES004 PC software. After respective parameter setting of the requested input and output data the EtherCAT 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 controller (see “Parameter setting”).

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 (PLC)				
	<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
	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)

Input (PLC)				
	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
	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

Input (PLC)				
		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)

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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>			

Output (PLC)				
	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)
	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

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