



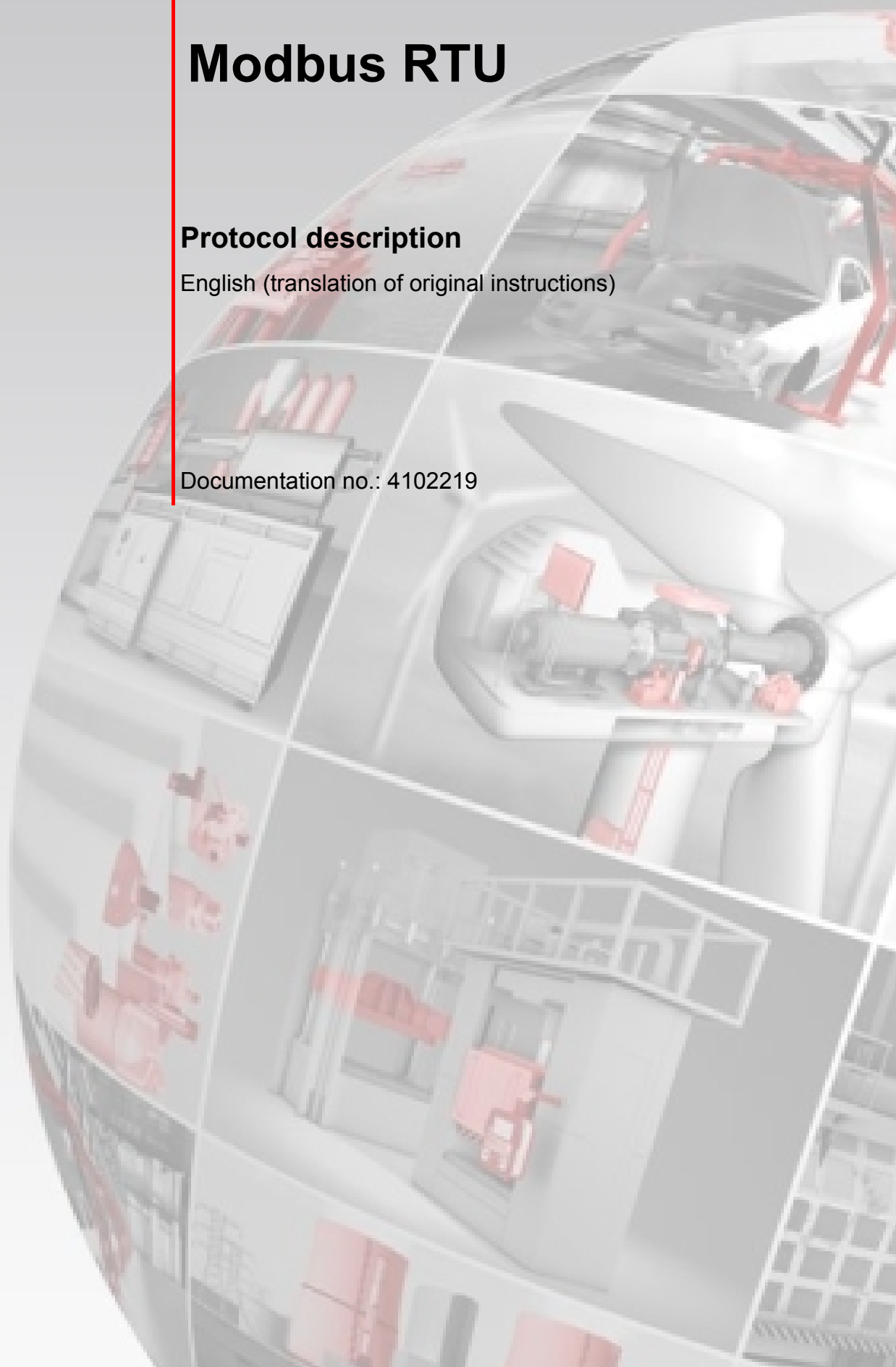
# FILTER SYSTEMS

## Modbus RTU

### Protocol description

English (translation of original instructions)

Documentation no.: 4102219



## Imprint

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These documents have been created and inspected with the greatest care. However, errors cannot be ruled out completely.

Technical specifications are subject to change without notice.

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## **Preface**

This operating manual was made to the best of our knowledge. Nevertheless and despite the greatest care, it cannot be excluded that mistakes could have crept in. Therefore please understand that in the absence of any provisions to the contrary hereinafter our warranty and liability – for any legal reasons whatsoever – are excluded in respect of the information in these operating instructions. In particular, we shall not be liable for lost profit or other financial loss. This exclusion of liability does not apply in cases of intent and gross negligence. Moreover, it does not apply to defects which have been deceitfully concealed or whose absence has been guaranteed, nor in cases of culpable harm to life, physical injury and damage to health. If we negligently breach any material contractual obligation, our liability shall be limited to foreseeable damage. Claims due to Product Liability shall remain unaffected.

## **Technical Support**

Contact our technical sales department if you have any questions on our product. When contacting us, please always include the model/type designation, serial no. and part-no. of the product:

Fax: +49 6897 509 9046

E-mail: [filtersystems@hydac.com](mailto:filtersystems@hydac.com)

## **Modifications to the Product**

We would like to point out that changes to the product (e.g. purchasing options, etc.) may result in the information in the operating instructions no longer being completely accurate or sufficient.

When making modifications or performing repair work to components affecting the safety of the product, the product may not be put back into operation until it has been examined and released by a HYDAC representative.

Please notify us immediately of any modifications made to the product whether by you or a third party.

## **Warranty**

For the warranty provided by us, please refer to the General Terms of Sale and Delivery of HYDAC FILTER SYSTEMS GMBH.

You will find these under [www.hydac.com](http://www.hydac.com) -> Legal information.

**Using the documentation**



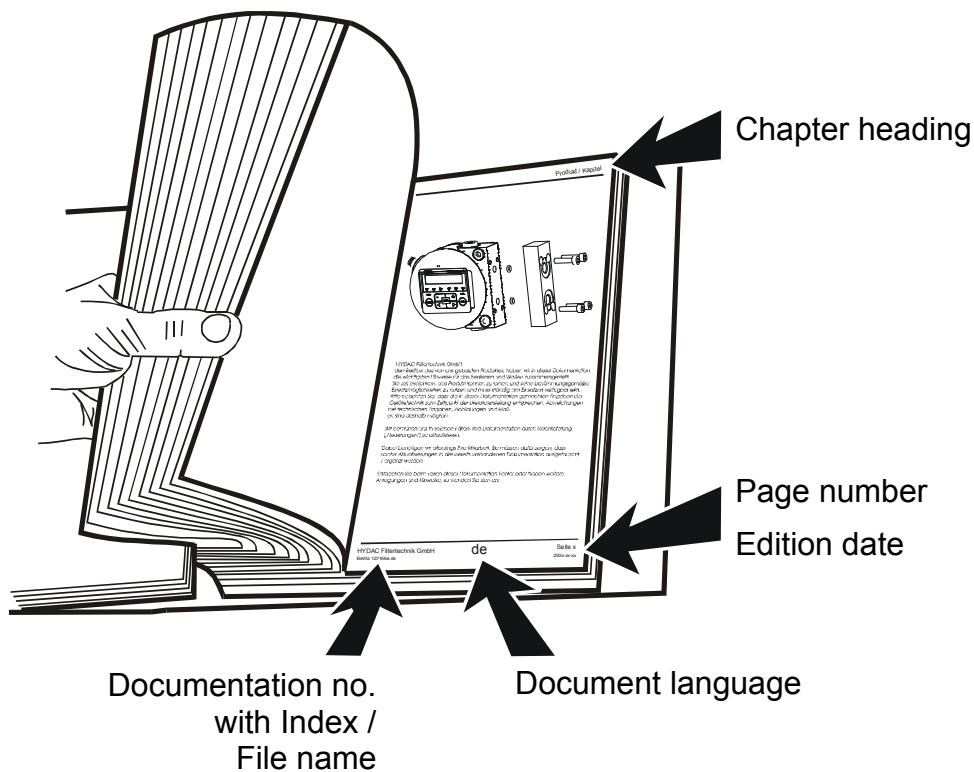
Note that the method described for locating specific information does not release you from your responsibility of carefully reading these instructions prior to starting the unit up for the first time and at regular intervals in the future.

**WHAT do you want to know?**

I determine which topic I am looking for.

**WHERE can I find the information I'm looking for?**

The documentation has a table of contents at the beginning. There, I select the chapter I'm looking for and the corresponding page number.



The documentation number with its index enables you to order another copy of the operating and maintenance instructions. The index is incremented every time the manual is revised or changed.

## Safety Information

We assume that you are familiar with the operation and the design of Modbus.

### Proper/designated use

Use the Modbus only for the application described in the following.

The Modbus transmission serves the communication of HYDAC SMART sensors such as:

- MetallicContamination Sensor, MCS1000 series

### NOTICE

#### **Wrong sensor**

Erroneous or no communication

- ▶ Communicate only with suitable HYDAC SMART sensors.

### NOTICE

#### **Exceeding the maximum permissible line length**

Erroneous or no communication

- ▶ Observe the maximum permissible line lengths.

Proper or designated use of the product extends to the following:

- observing all instructions contained in these operating instructions.

### **Improper use or use deviating from intended use**

Any use extending beyond or deviating therefrom shall not be considered intended use. HYDAC FILTER SYSTEMS GMBH will assume no liability for any damage resulting from such use. The user alone, shall assume any and all associated risk.

Improper use may result in problems. Examples of improper use:

- Operation with sensors other than the intended design.

### **Qualifications of personnel / target group**

Persons working with the Modbus must be familiar with handling (programming) the Modbus.

The operating instructions and applicable regulations are to be kept so they are accessible for operating and specialist personnel.

These operating instructions are intended for:

Specialist personnel: such persons have corresponding specialist training and several years' work experience. They are able to assess and perform the work assigned to them, they are also able to recognize potential hazards.

Activity	Person	Knowledge
Programming, operation, monitoring	Specialist personnel	<ul style="list-style-type: none"><li>• Knowledge of using Windows PCs</li><li>• Extensive knowledge of network communication</li><li>• Protocol-specific knowledge</li></ul>

## Modbus RTU communication

Communication of the Modbus RTU proceeds via the RS485 interface. Here, a master (PC, control system, etc.) can request the measured values of a slave (device). Each bus participant must have an unambiguous address. The address 0 is reserved for a "broadcast".

### Read Holding Register (functional code 0x03)

Using the Modbus "Read Holding Register" function, one or several registers are read out and the data are sent back. Per register, 2 byte will be sent (high byte first).

Register		Default
0x 0000	Modbus Adress	1
0x 0001	Modbus Baudrate	19200
0x 0002	Modbus Parity	None
0x 0003	Modbus Stop Bits	1
0x 0004	Cycle Time --> 1 ... 1440	60
0x 0005	Register Offset	0

### Write Holding Register (functional code single 0x06, multiple 0x10)

Using this function, one or several registers can be written. This function is necessary to complete configurations.

Register	
0x 0000	Modbus Adress
0x 0001	Modbus Baudrate
0x 0002	Modbus Parity
0x 0003	Modbus Stop Bits
0x 0004	Cycle Time --> 1 ... 1440
0x 0005	Register Offset



**Read Input Register (functional code 0x04)**

Using the Modbus "Read Input Register" function, one or several registers are read out and the data are sent back. Per register, 2 byte will be sent (high byte first).

(0x04)		Read Input Register	
Device ID (16 characters) 8 registers for every 2 characters		0x0000 + Register Offset	
		0x0001 + Register Offset	
		0x0002 + Register Offset	
		0x0003 + Register Offset	
		0x0004 + Register Offset	
		0x0005 + Register Offset	
		0x0006 + Register Offset	
		0x0007 + Register Offset	
Status code		0x0008 + Register Offset	
Error Code		0x0009 + Register Offset	
Channel 1	FE A (32bit)	0x000A + Register Offset	high
		0x000B + Register Offset	low
Channel 2	FE B (32bit)	0x000C + Register Offset	high
		0x000D + Register Offset	low
Channel 3	FE C (32bit)	0x000E + Register Offset	high
		0x000F + Register Offset	low
Channel 4	nFE D (32bit)	0x0010 + Register Offset	high
		0x0011 + Register Offset	low
Channel 5	nFE E (32bit)	0x0012 + Register Offset	high
		0x0013 + Register Offset	low
Channel 6	nFE F (32bit)	0x0014 + Register Offset	high
		0x0015 + Register Offset	low
Channel 7	Cycle FE A (16bit)	0x0016 + Register Offset	
Channel 8	Cycle FE B (16bit)	0x0017 + Register Offset	
Channel 9	Cycle FE C (16bit)	0x0018 + Register Offset	
Channel 10	Cycle nFE D (16bit)	0x0019 + Register Offset	
Channel 11	Cycle nFE E (16bit)	0x001A + Register Offset	

(0x04)		Read Input Register	
Channel 12	Cycle nFE F (16bit)	0x001B + Register Offset	
Channel 13	Temperature (16bit) 1/10 °C	0x001C + Register Offset	
Channel 14	Sum FE (32bit)	0x001D + Register Offset	high
		0x001E + Register Offset	low
Channel 15	Sum nFE (32bit)	0x001F + Register Offset	high
		0x0020 + Register Offset	low
Channel 16	Cycle Sum FE (16bit)	0x0021 + Register Offset	
Channel 17	Cycle Sum nFE (16bit)	0x0022 + Register Offset	

## Examples - reading out / analyzing / interpreting measured values

In the following, you will find examples with different sensors.

### MetallicContamination sensor MCS1000

The MetallicContamination sensor provides you with the measured values from the following registers:

Channel 1:	FE A (32 bit)			
Registers to be read out	0x000A		0x000B	
hex	0x 00	0x01	0x17	0x 60
dec	71520			
Permissible measured value range	0 ... 2 <sup>31</sup> -> 0 ... 2 <sup>31</sup> particles			

Channel 2:	FE B (32 bit)			
Registers to be read out	0x000C		0x000D	
hex	0x 00	0x00	0x08	0x 48
dec	2120			
Permissible measured value range	0 ... 2 <sup>31</sup> -> 0 ... 2 <sup>31</sup> particles			

Channel 3:	FE C (32 bit)			
Registers to be read out	0x000E		0x000F	
hex	0x 00	0x00	0x 01	1xF4
dec	500			
Permissible measured value range	0 ... 2 <sup>31</sup> -> 0 ... 2 <sup>31</sup> particles			

Channel 4:	NFE D (32 bit)			
Registers to be read out	0x 0010		0x 0011	
hex	0x 00	0x 00	0x0C	0xB2
dec	3250			
Permissible measured value range	0 ... 2 <sup>31</sup> -> 0 ... 2 <sup>31</sup> particles			

Channel 5:	NFE E (32 bit)			
Registers to be read out	0x 0012		0x 0013	
hex	0x 00	0x00	0x 07	0xE7
dec	2023			
Permissible measured value range	0 ... 2 <sup>31</sup> -> 0 ... 2 <sup>31</sup> particles			

Channel 6:	NFE F (32 bit)			
Registers to be read out	0x 0014		0x 0015	
hex	0x 00	0x00	0x 00	0xD6
dec	470			
Permissible measured value range	0 ... 2 <sup>31</sup> -> 0 ... 2 <sup>31</sup> particles			

Channel 7:	Cycle FE A (16 bit)	
Registers to be read out	0x 0016	
hex	0x 00	0xD6
dec	470	
Permissible measured value range	0 ... 2 <sup>15</sup> -> 0 ... 2 <sup>15</sup> particles	

Channel 8:	Cycle FE B (16 bit)	
Registers to be read out	0x 0017	
hex	0x 08	0x 48
dec	2120	
Permissible measured value range	0 ... 2 <sup>15</sup> -> 0 ... 2 <sup>15</sup> particles	

Channel 9:	Cycle FE C (16 bit)	
Registers to be read out	0x 0018	
hex	0x 01	0xF4
dec	500	
Permissible measured value range	0 ... 2 <sup>15</sup> -> 0 ... 2 <sup>15</sup> particles	

<b>Channel 10:</b>	<b>Cycle NFE D (16 bit)</b>
Registers to be read out	0x 0019
hex	0x0C      0xB2
dec	3250
Permissible measured value range	0 ... 2 <sup>15</sup> -> 0 ... 2 <sup>15</sup> particles
<b>Channel 11:</b>	<b>Cycle NFE E (16 bit)</b>
Registers to be read out	0x001A
hex	0x 07      0xE7
dec	2023
Permissible measured value range	0 ... 2 <sup>15</sup> -> 0 ... 2 <sup>15</sup> particles
<b>Channel 12:</b>	<b>Cycle NFE F (16 bit)</b>
Registers to be read out	0x0001B
hex	0x 00      0xD6
dec	470
Permissible measured value range	0 ... 2 <sup>15</sup> -> 0 ... 2 <sup>15</sup> particles
<b>Channel 13:</b>	<b>Temperature (16 bit)</b>
Registers to be read out	0x001C
hex	0x 00      0x 92
dec	402
Permissible measured value range	-600 ... 1500 -> -60.0 ... 150.0 °C
<b>Channel 14:</b>	<b>Sum FE (32 bit)</b>
Registers to be read out	0x001D      0x001E
hex	0x 00    0x 00    0x0C    0xB2
dec	3250
Permissible measured value range	0 ... 2 <sup>31</sup> -> 0 ... 2 <sup>31</sup> particles

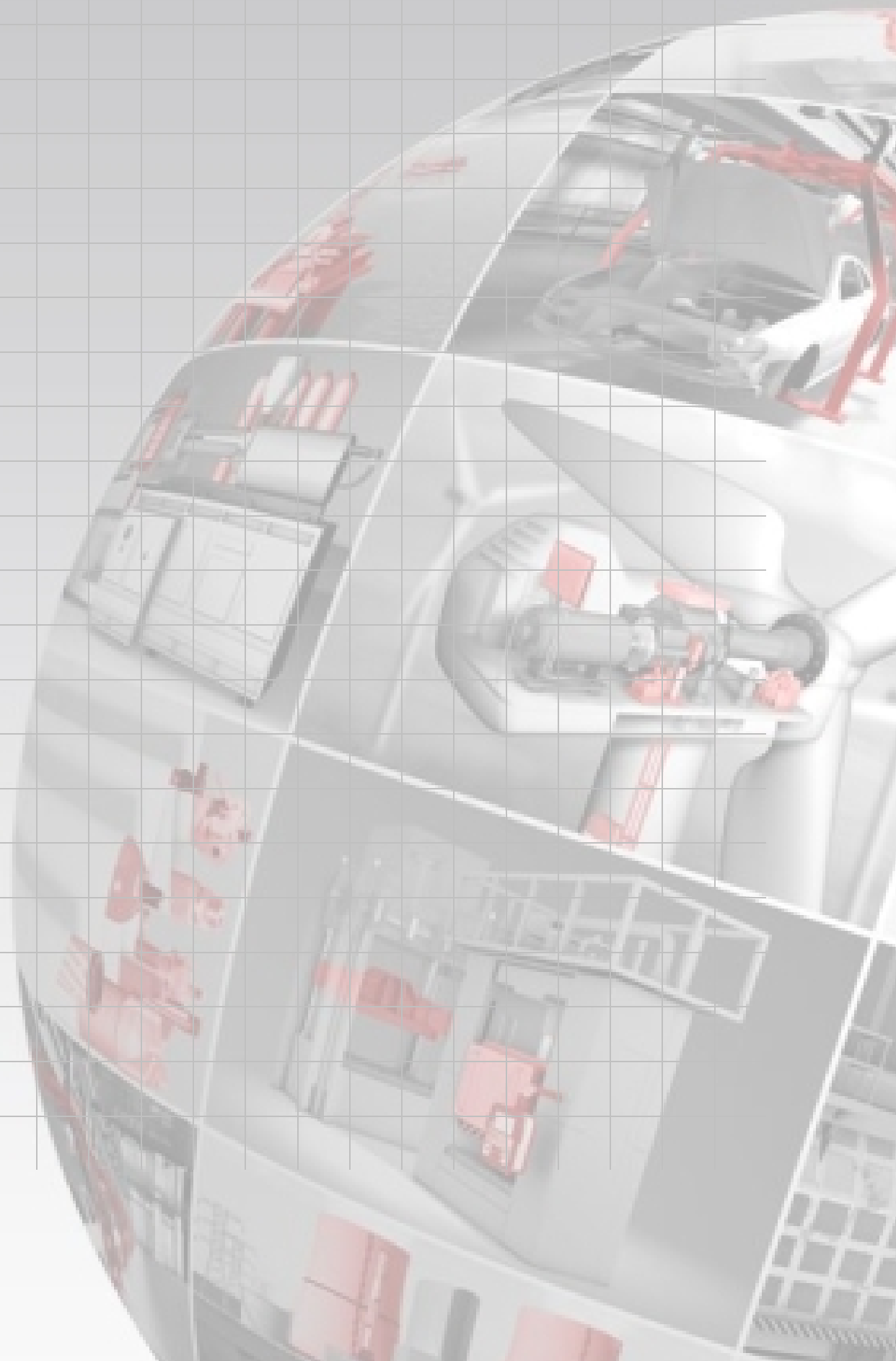
Channel 15:	Sum NFE (32 bit)			
Registers to be read out	0x001F		0x 0020	
hex	0x 00	0x00	0x 07	0xE7
dec	2023			
Permissible measured value range	0 ... 2 <sup>31</sup> -> 0 ... 2 <sup>31</sup> particles			

Channel 16:	Cycle Sum FE (16 bit)	
Registers to be read out	0x 0021	
hex	0x 00	0xD6
dec	470	
Permissible measured value range	0 ... 2 <sup>15</sup> -> 0 ... 2 <sup>15</sup> particles	

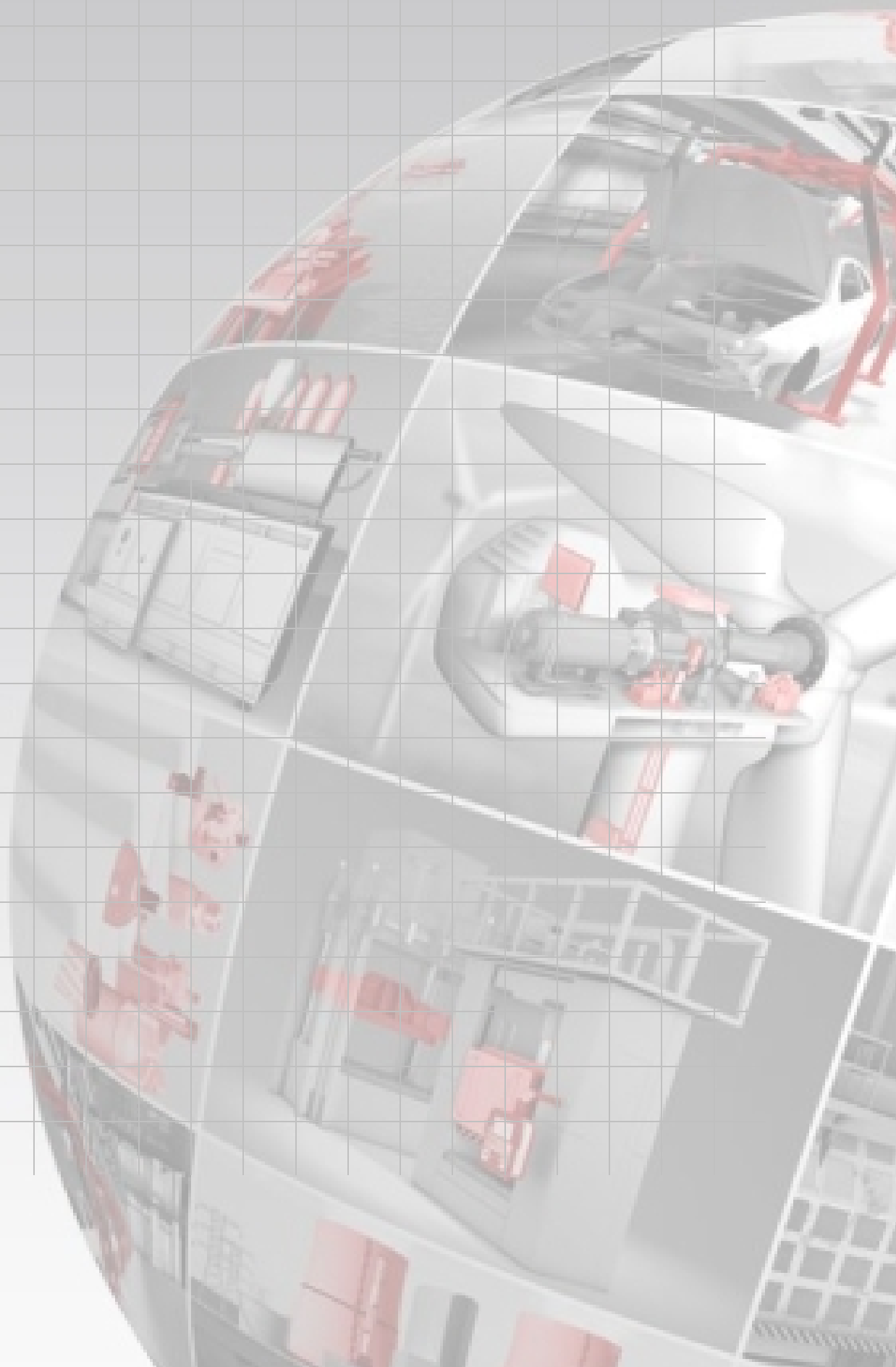
Channel 17:	Cycle Sum NFE (16 bit)	
Registers to be read out	0x 0020	
hex	0x 00	0xD6
dec	470	
Permissible measured value range	0 ... 2 <sup>15</sup> -> 0 ... 2 <sup>15</sup> particles	

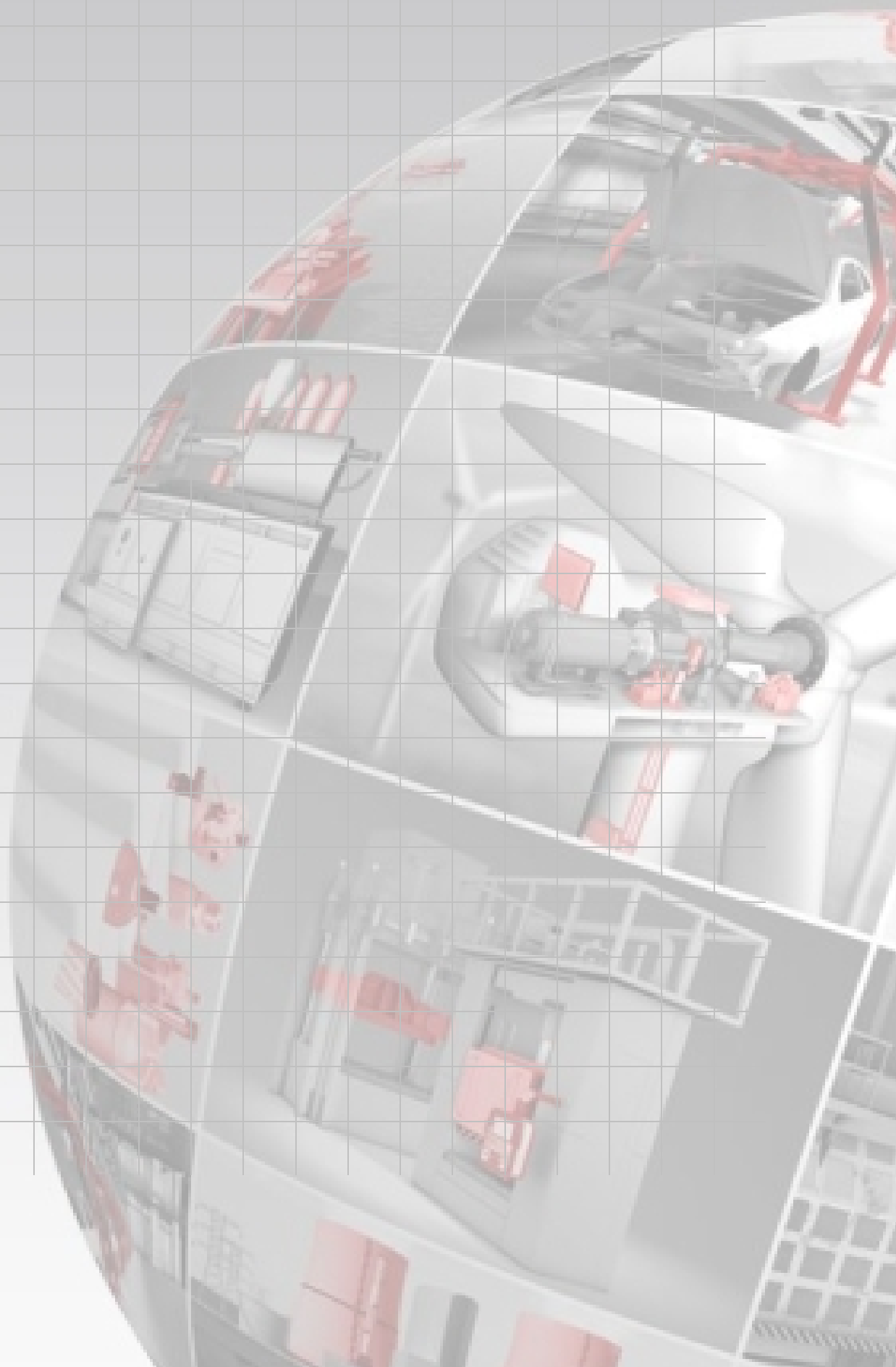
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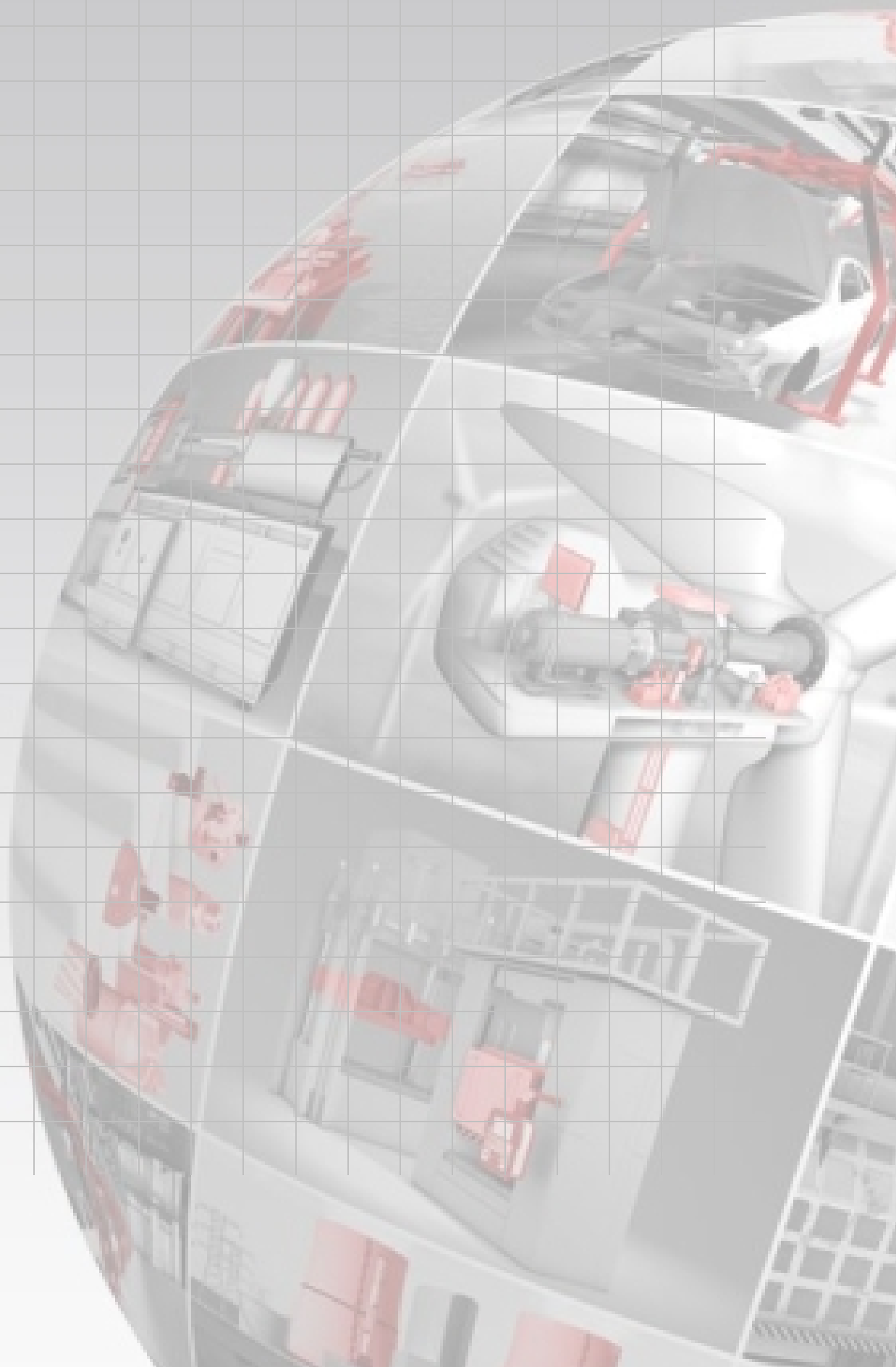
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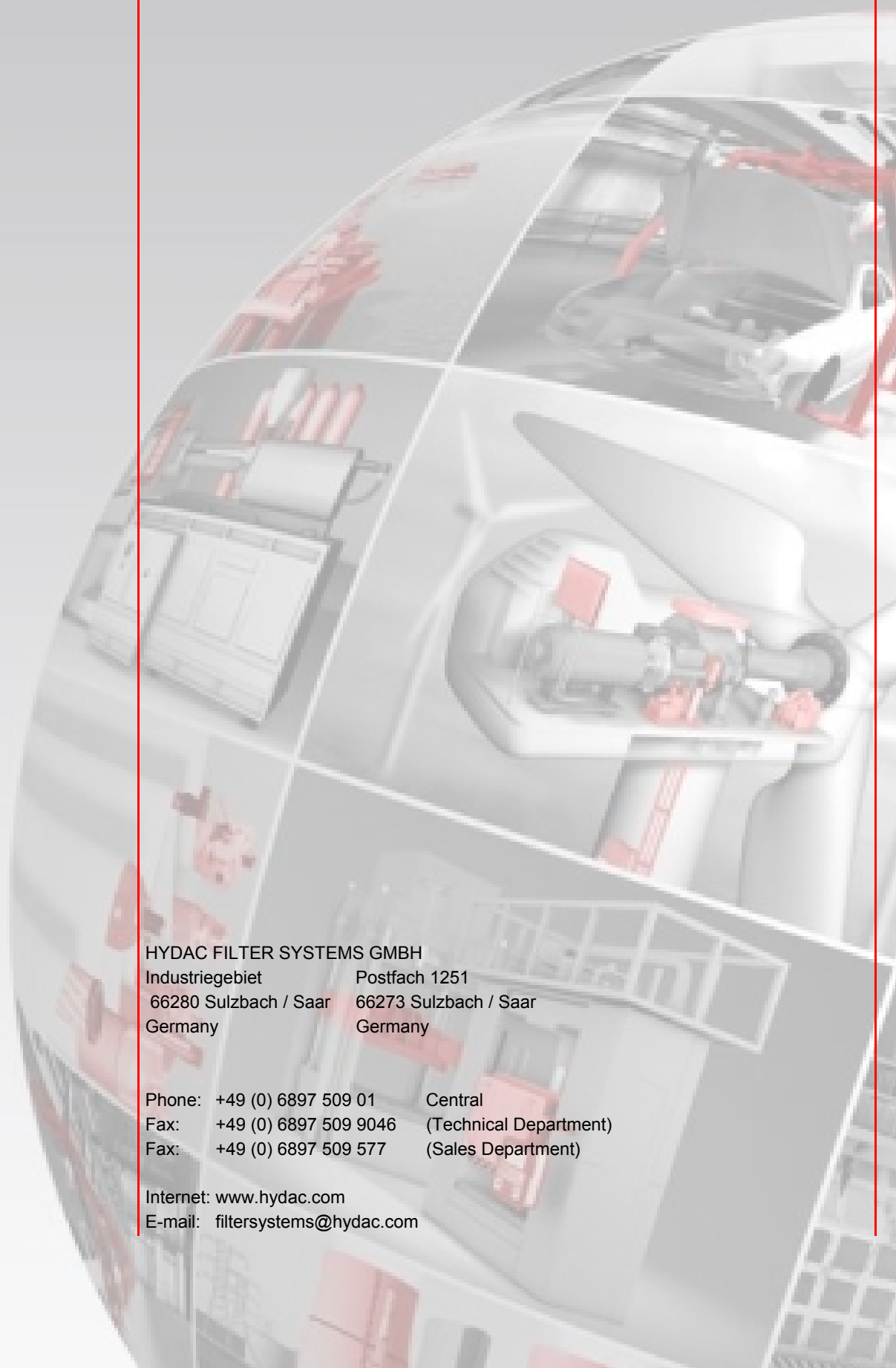






The HYDAC logo consists of the word "HYDAC" in white, bold, uppercase letters inside a red rounded rectangle.

# FILTER SYSTEMS

A detailed cutaway illustration of a car engine, showing various internal components like the cylinder block, pistons, valves, and timing belt. The illustration is rendered in a light gray color with red highlights on certain parts, set against a light gray background.

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