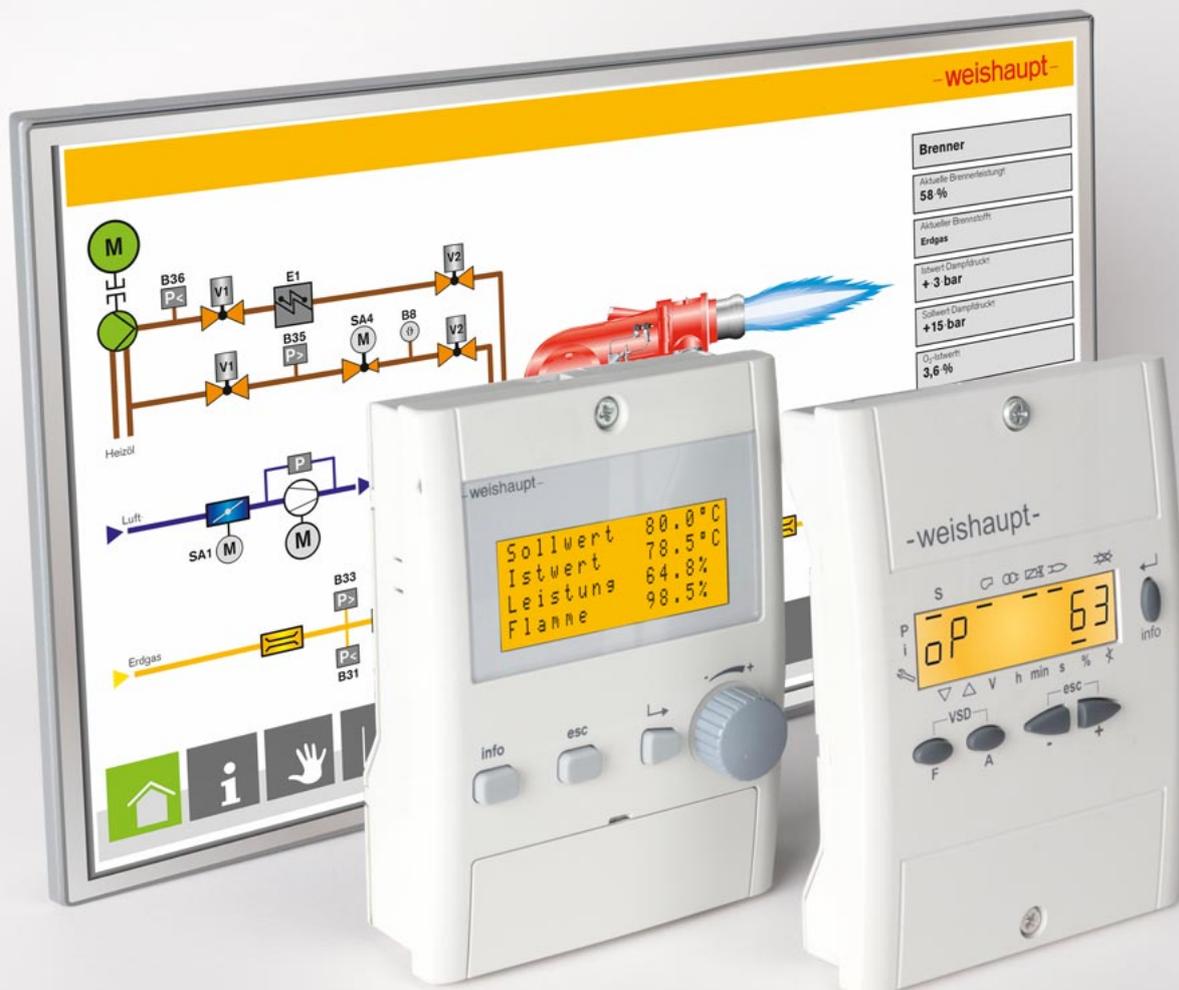-weishaupt-

The capabilities of
Weishaupt combustion managers

Combustion managers
W-FM 50 / 54
W-FM 100 / 200
W-FM 1000 CMS

For more than 25 years, Weishaupt burners with digital combustion management have been proving their worth on a wide variety of heat generators and thermal process plant. One of the compelling features of this technology is its universal adapatability to completely different burner types and operating conditions.

Tailored products that continually set new technological benchmarks are developed by Weishaupt, working in their own R&D Centre in close collaboration with the combustion manager manufacturers.

Today, it is possible to cover the full spectrum of combustion technology applications with just a few different types of combustion manager.

Combustion managers incorporate efficiency-increasing and emissions-reducing technologies, as well as connections for external control systems.
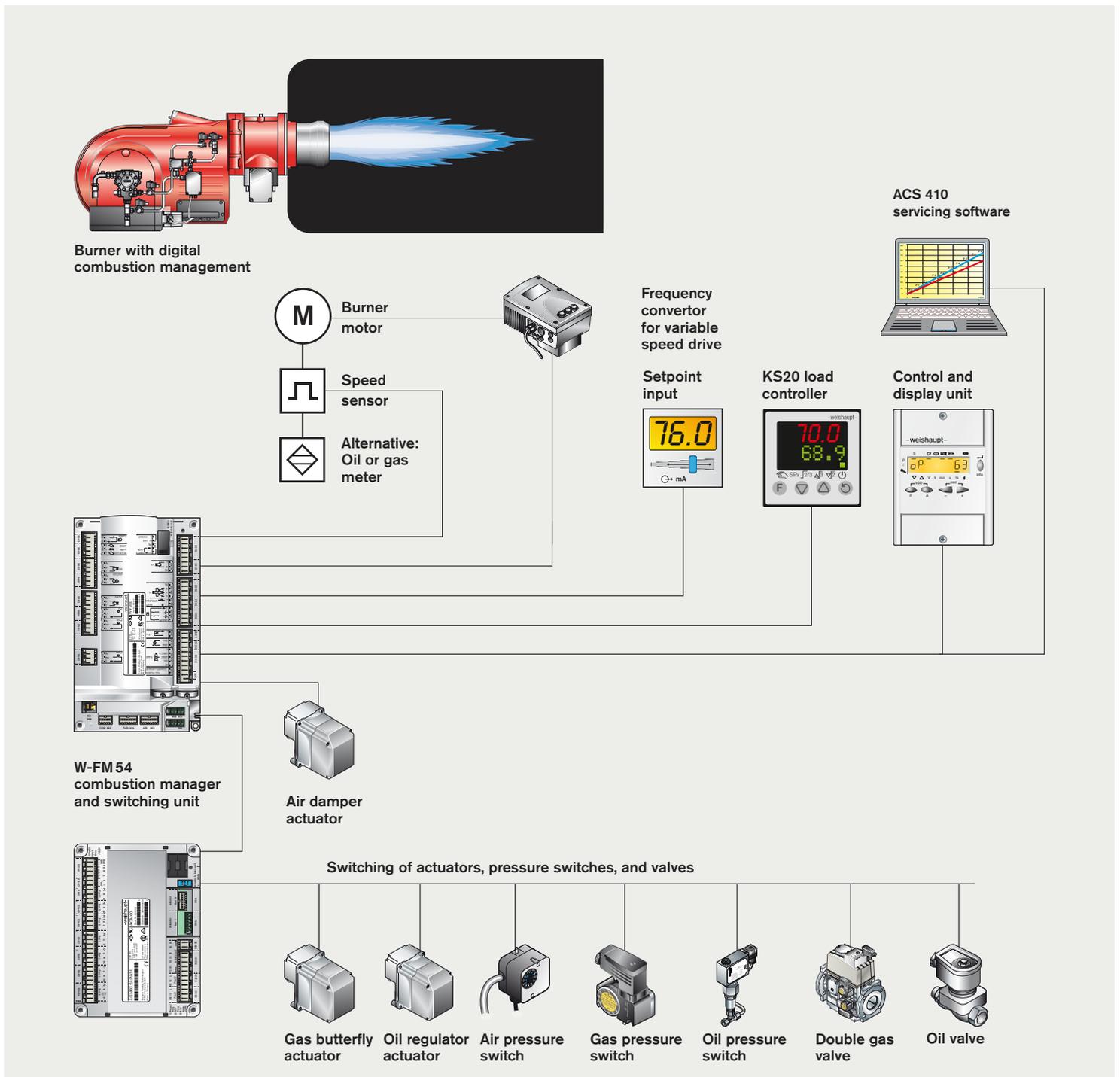
The Weishaupt range also runs the gamut of modern control technology, up to and including fully comprehensive solutions for complex building automation projects.

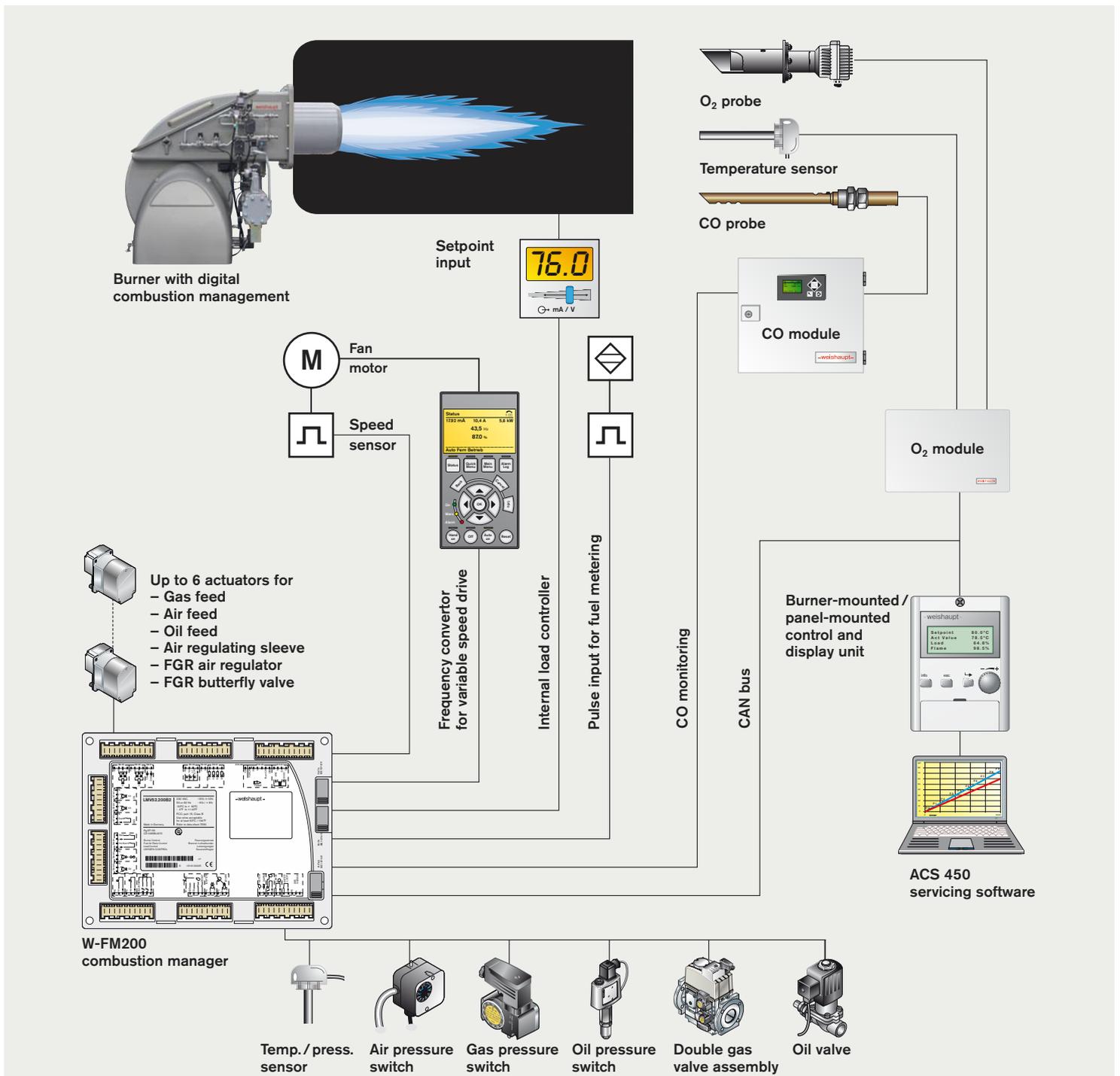Future-oriented, cost-effective, flexible.

Contents

W-FM
50 / 54

System components

Burner with digital combustion management

M Burner motor

Speed sensor

Alternative: Oil or gas meter

Frequency convertor for variable speed drive

ACS 410 servicing software

Setpoint input

76.0

KS20 load controller

70.0
68.9

Control and display unit

W-FM 54 combustion manager and switching unit

Air damper actuator

Switching of actuators, pressure switches, and valves

Gas butterfly actuator

Oil regulator actuator

Air pressure switch

Gas pressure switch

Oil pressure switch

Double gas valve

Oil valve

Schematic representation of W-FM 54

W-FM
100 / 200

System components

Burner with digital combustion management

O₂ probe

Temperature sensor

CO probe

Setpoint input

76.0

⊖→ mA / V

CO module

Fan motor M

Speed sensor

CO monitoring

CAN bus

O₂ module

Up to 6 actuators for
– Gas feed
– Air feed
– Oil feed
– Air regulating sleeve
– FGR air regulator
– FGR butterfly valve

Frequency convertor for variable speed drive

Internal load controller

Pulse input for fuel metering

Burner-mounted / panel-mounted control and display unit

W-FM200 combustion manager

ACS 450 servicing software

Temp. / press. sensor

Air pressure switch

Gas pressure switch

Oil pressure switch

Double gas valve assembly

Oil valve

Schematic representation of W-FM 200

W-FM
1000 CMS

System components

CO / O$_2$ combi-probe

Servicing software

Burner with digital combustion management

CO / O$_2$ module

Touchscreen HMI

Frequency convertor

Actuators

Secure analogue inputs

Boiler temp. / press. sensor

External load signal input

Secure pulse inputs

Gas and oil metering

Oil valve

Low / high oil pressure switch

Double gas valve

Other valves

Low / high gas pressure switch

Other pressure switches

Air pressure switch

Low / high gas pressure switch

Gas valve proving pressure switch

Low / high oil pressure switch

Double gas valve

Ignition gas valve
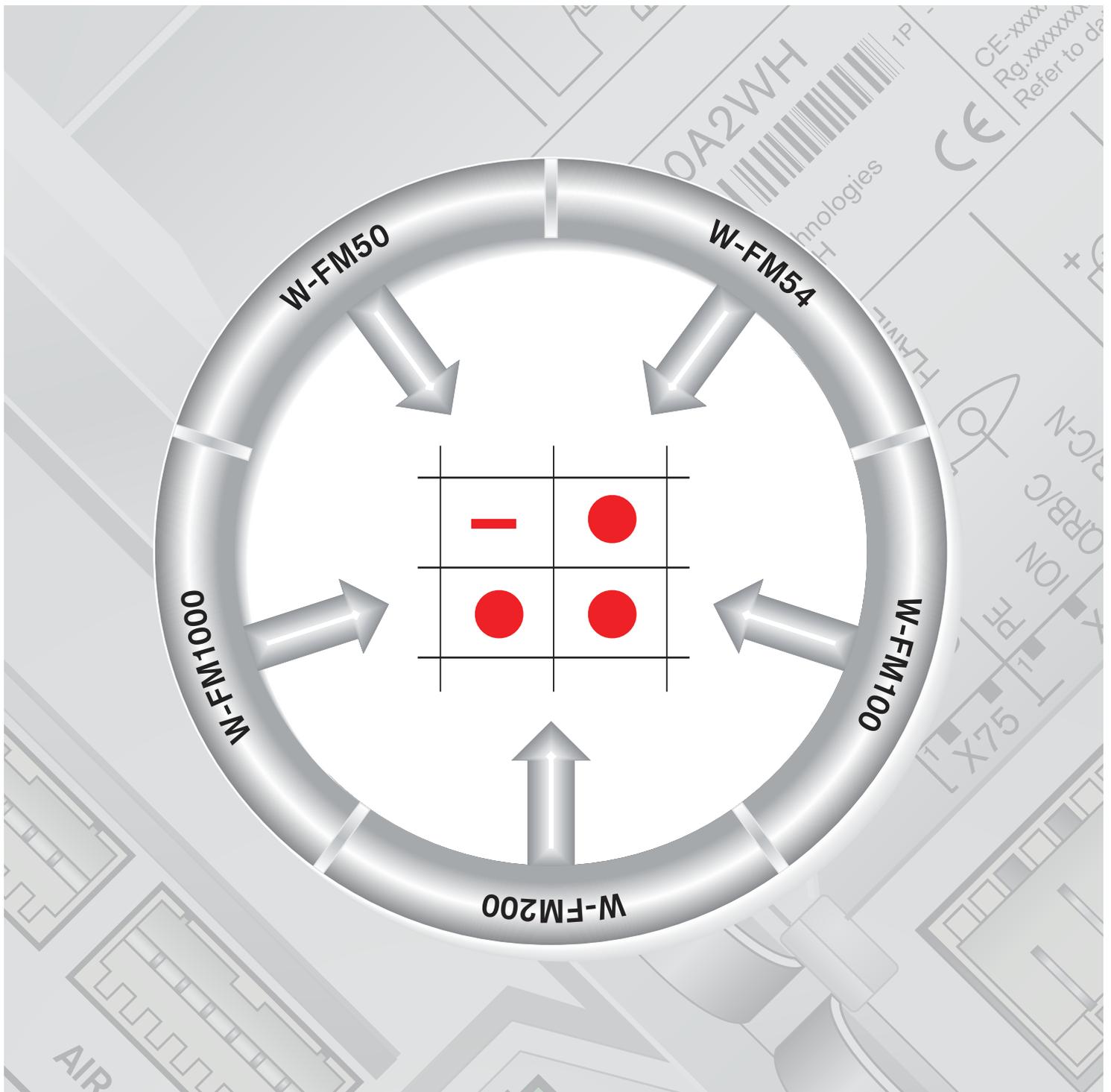
Oil valve

Oil safety valve

Schematic representation of W-FM 1000 CMS

Shared features
and differences

| Combustion manager | | WM-series burners | | | | WK-series burners |
		W-FM 50	W-FM 54	W-FM 100	W-FM 200	W-FM 1000 CMS
Fuels						
Gaseous		●	●	●	●	▲
Liquid		●⁵⁾	●	●	●	▲
Gaseous / liquid		–	●⁵⁾	●	●	▲
Gaseous / gaseous		–	●	▲²⁾	▲³⁾,⁴⁾	▲
Gaseous / gaseous / liquid		–	–	▲²⁾	▲³⁾,⁴⁾	▲
Gaseous / liquid / liquid		–	–	▲²⁾	▲²⁾	▲
Combinations of up to 4 fuels available		–	–	–	–	▲
Operating mode						
Max. number of compound curves		1	2	2	2	16
Simultaneous operation with one 100 % base fuel and one fixed fuel volume ratio		–	–	–	●	▲
Simultaneous operation with multiple base fuels and multiple fixed fuel volume ratios		–	–	–	–	▲
On-the-fly fuel changeover		–	–	–	–	▲
Efficiency and emissions optimisation						
Variable speed drive (VSD)		●	●	–	●	▲
O₂ trim		–	–	–	●	▲
CO monitoring		–	–	–	○	▲
O₂ trim with CO control		–	–	–	○	▲
Flue gas recirculation (FGR)		–	–	–	○	△
Number of fuel consumption meters (output available)		1¹⁾	1¹⁾	2	2	4
Combustion efficiency display available		–	–	–	●	▲
Air temperature compensation (ZMH)		–	–	–	–	▲
Fuel quality compensation		–	–	–	–	▲
Wobbe index control		–	–	–	–	▲⁶⁾

● Standard
○ Optional
– Not available

▲ Standard – control panel required
△ Optional – control panel required

¹⁾ Instead of VSD
²⁾ 2x combustion managers for burners with actuated mixing assemblies
³⁾ 2x combustion managers for WM and WK-series burners witht O₂ trim or FGR
⁴⁾ 2x combustion managers for 3LN- and 4LN-version WK-series burners

⁵⁾ Operation < 24h
⁶⁾ Available soon
⁷⁾ See fieldbus communication, pp. 33–35
⁸⁾ Gaseous fuels with ionisation
⁹⁾ Liquid fuels only for WM-series burners

Shared features and differences

Combustion manager		W-FM 50	W-FM 54	W-FM 100	W-FM 200	W-FM 1000 CMS
				WK-series burners		
		WM-series burners				
Control and regulation						
Three-term switching signal input		●	●	●	●	▲
Analogue signal input (0 / 4–20 mA / 0 / 2–10 V)		● / –	● / –	○ / ○	● / ●	▲ / ▲
Setpoint input (temperature / pressure)		– / –	– / –	○ / ○	● / ●	▲ / ▲
Load signal output (0 / 4–20 mA / 0 / 2–10 V)		– / ●[1]	– / ●[1]	○ / –	● / –	▲ / ▲
Integrated load controller		–	–	○	●	△
Parallel firing	Standard	–	–	▲	▲	▲
	Fail-safe, up to 3 burners	–	–	–	–	▲
Connectivity						
Modbus RTU (RS232) 1 participant, max. 10 m length		–	–	●	●	–
Modbus RTU (RS485)		○	○	○	○	–
Modbus TCP/IP						▲
Profibus DP			GATEWAY [7]			△
Profinet						△
Ethernet IP						△
OPC UA		△	△	△	△	△
Power supply						
24 V dc		–	–	–	–	▲
120 V, 50 / 60 Hz		●	–	●	●	▲
230 V, 50 / 60 Hz		●	●	●	●	▲
Flame monitoring						
Dual flame monitoring (AND/OR logic)		–	–	●	▲	▲
Extraneous light supression – multiple flame sources		–	–	–	▲	▲
Extraneous light supression – biomass (ignition and ancillary burners)		●	●	●	●	▲

● Standard ▲ Standard – control panel required
○ Optional △ Optional – control panel required
– Not available

[1] Instead of VSD
[2] 2x combustion managers for burners with actuated mixing assemblies
[3] 2x combustion managers for WM and WK-series burners witht O_2 trim or FGR
[4] 2x combustion managers for 3LN- and 4LN-version WK-series burners
[5] Operation < 24h
[6] Available soon
[7] See fieldbus communication, pp. 33–35
[8] Gaseous fuels with ionisation
[9] Liquid fuels only for WM-series burners

| Combustion manager | WM-series burners | | | | WK-series burners |
	W-FM 50	W-FM 54	W-FM 100	W-FM 200	W-FM 1000 CMS
Ignition systems					
Direct electrical ignition	●	●	●	●	▲
Gas pilot ignition	–	–	●	●	▲
Gas ignition burner	–	–	–	●	▲
Distillate oil ignition burner	–	–	–	●	▲
Features					
Continuous firing > 24 h	●[8]	–	●	●	▲
Maximum number of actuators	2	3	4	6	8
Maximum number of frequency convertors	1	1	–	1	2
Language-neutral control and display unit	●	●	–	–	▲
Multi-language control and display unit with clear text	–	–	●	●	–
Multi-language, graphical touchscreen display	–	–	–	–	○
Max length of connecting line between control and display unit and W-FM	20 m	20 m	100 m	100 m	100 m
Data backup available	●	●	●	●	▲
Mounting position					
Burner-mounted combustion manager (ambient / preheated air)	● / –	● / –	● / –	● / –	– / –
Panel-mounted combustion manager (ambient / preheated air)	– / –	– / –	△ / ▲	△ / ▲	▲ / ▲
Approvals					
Europe (CE / EN), 230 V, 50 Hz	●	●	●	●	▲
Australia (AGA), 240 V, 50 Hz, EN 298 equivalent	●	●	●	●	▲
USA / Canada (ETL, electrical components UL), 120 V, 60 Hz	●	–	●	●	▲
Marine (ABS / BV / CCS / DNV / LR / RINA)	–	–	●[9]	●[9]	–

● Standard
○ Optional
– Not available

▲ Standard – control panel required
△ Optional – control panel required

[1] Instead of VSD
[2] 2x combustion managers for burners with actuated mixing assemblies
[3] 2x combustion managers for WM and WK-series burners witht O_2 trim or FGR
[4] 2x combustion managers for 3LN- and 4LN-version WK-series burners

[5] Operation < 24h
[6] Available soon
[7] See fieldbus communication, pp. 33–35
[8] Gaseous fuels with ionisation
[9] Liquid fuels only for WM-series burners

Combustion managers
in detail
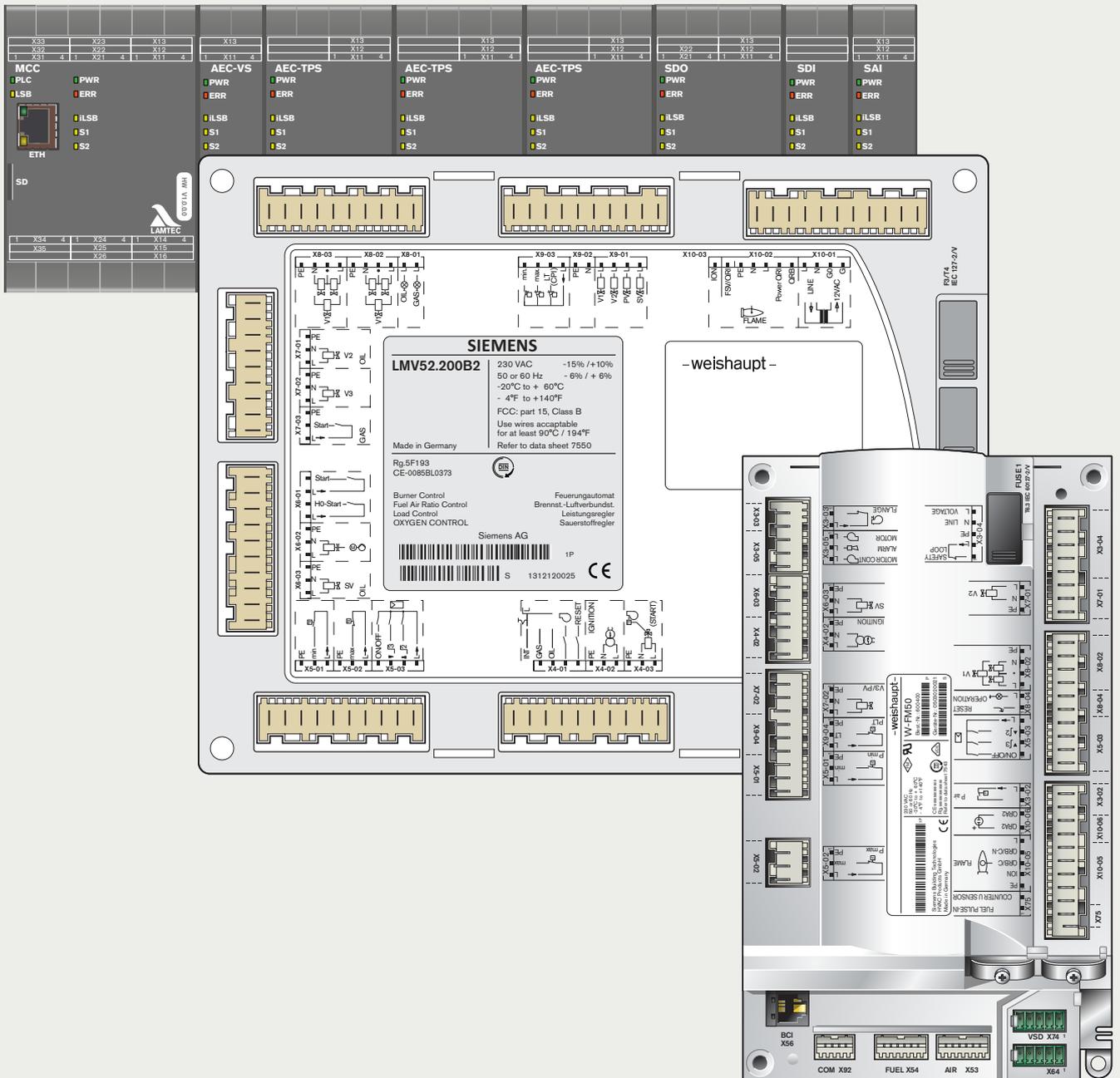
W-FM 50 / 54 features

Well-thought-out solutions
Pre-programmed combustion manager and frequency convertor, computer-aided systems test at the factory, and an error-free product for the customer: That's Weishaupt.

Control unit can be mounted on the burner or installed remotely (max. 20 m cable length)

Burner-mounted W-FM 54 combustion manager

W-FM 54 switching unit in maintenance position

Short setup times
Electrical components are connected by keyed plugs that are labelled and tested, ensuring that commissioning and servicing of the burner is fast and safe.

Maintenance position
The switching unit can be swung out into a maintenance position that provides optimal access to the service technician.

Fuel changeover
The fuel selection switchbuilt into the cover facilitates fuel changeover either locally at the burner or remotely by a higher-level control system.

Data backup
The more flexible a system is, the greater the number of possible settings. So it is a good thing to be able to save them all for calling up again in the future. Even if they never need to be accessed again, it is still reassuring to know that you can have your system up and running, and producing heat again, within the shortest amount of time.

Backup function

Restore function

Brilliantly simple, or simply brilliant?
The W-FM 54 unit has everything the W-FM 50 unit has, but twice over, which is why it is used for dual-fuel and dual-gas burners. The universal fuel supply assignment makes it very flexible; fuel combinations such as gas / oil or gas / gas can be implemented without any external components. Fuel-dependent signals for pressure switches, valves, and actuators are fed to the W-FM 54 via the switching box. Of course, the correct method of load control is also provided. There are digital and analogue inputs for two-stage, three-stage, and modulating operation, making it possible to use signals from temperature or pressure sensors just as easily as switching signals from electronic load controllers or a 4–20 mA control signal. The W-FM5 4 can also be controlled digitally via Modbus, and that is far from all.

Many useful digital tools help keep both operator and service technician abreast of the burner's condition. Conclusions about plant performance can be drawn from the recording of the number of burner starts and hours run, and suitable adjustments can then be made as required.

An error memory, which records the last 25 faults, gives detailed information about the conditions under which an error occurred. Anyone who needs to probe the system more deeply can call up the setpoints and actual values of inputs and outputs via the process data. Why? For fast and reliable localisation of the source of an error, so only those parts that are truly defective get replaced. A win in every sense.

W-FM 100 / 200 features

*Control and display unit with clear text display
20 available languages*

*Burner-mounted W-FM 100 or W-FM 200
combustion manager*

Mounted in a control panel

Variable system technology

The W-FM 100 and the W-FM 200 combustion managers utilise CAN bus technology and can be mounted neatly onboard the burner or in a separate control panel as required. The system's control and display unit, which is also connected by CAN bus, can be installed in any suitable location. The control and display unit also houses the interface for connection to a BMS via a choice of fieldbus protocols, and a port for connecting to a windows PC running ACS450 servicing software.

Compact and capable

An analogue burner control box and a digital combustion manager are as different from one another as a typewriter and a PC. A combustion manager unifies diverse conventional burner control systems within a very small amount of space. That brings with it all kinds of benefits. Switching contacts and connecting lines reduce mechanical sources of error to a minimum. Monitoring systems, such as the contact feedback network, increase reliability by recognising improper voltage signals and then reacting appropriately to them.

There are external benefits too. A smaller equipment footprint, faster installation, and computer-aided system checks both reduce costs and increase quality; a win–win situation for the customer and the manufacturer.
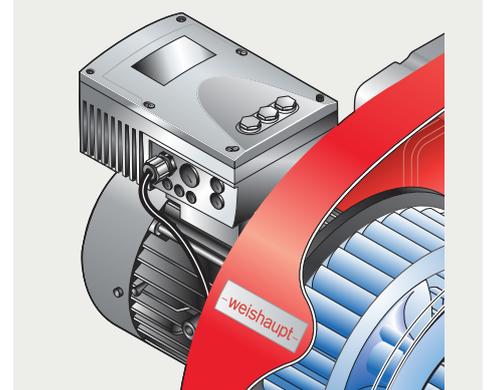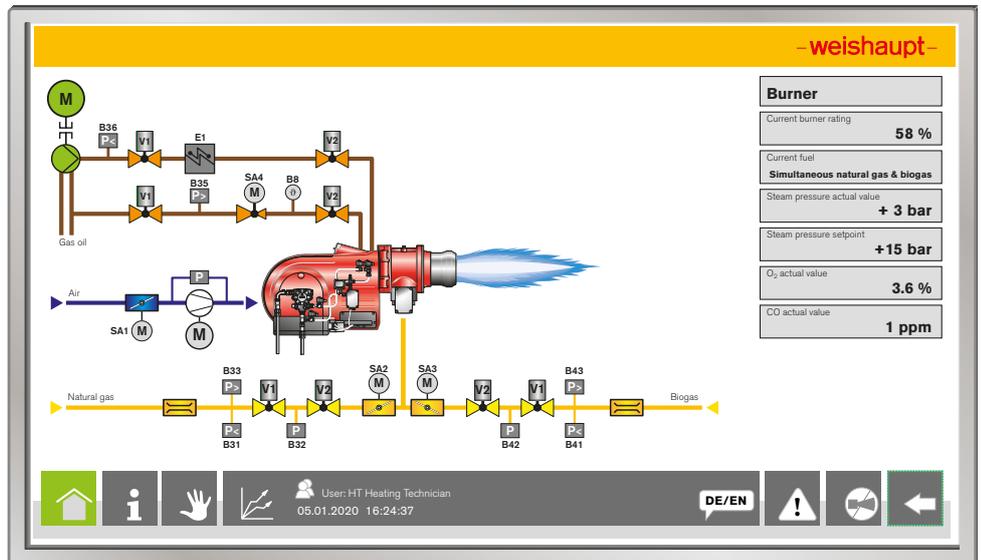

Burner motor junction box
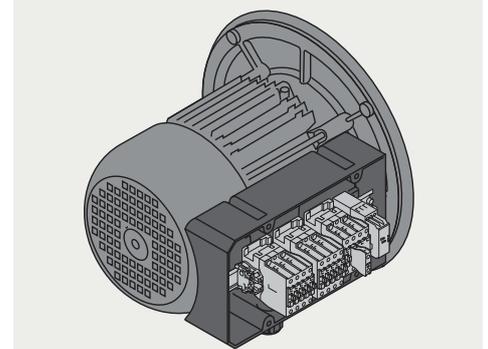
*Integrated star-delta switching
with optional overcurrent trip*

Optional motor-mounted frequency convertor

W-FM 1000 CMS features


Commissioning software

Touchscreen panel with clear text display

Variable system technology

The W-FM 1000 CMS digital combustion manager with its Lamtec eLSB system bus is always mounted in a separate control panel. In this way, the modular technology and other components can be tailored to system-specific requirements. The user-friendly colour touchscreen with its clearly structured menus is intuitive to operate and signitifcantly simplifies system configuration and monitoring. Secure input modules and the fail-safe PLC detect impermissible voltage signals and respond appropriately to the situation.

There are also additional benefits for external applications. The integrated bus systems mean direct integration with PLC systems or higher-level control centres is possible with minimal effort.
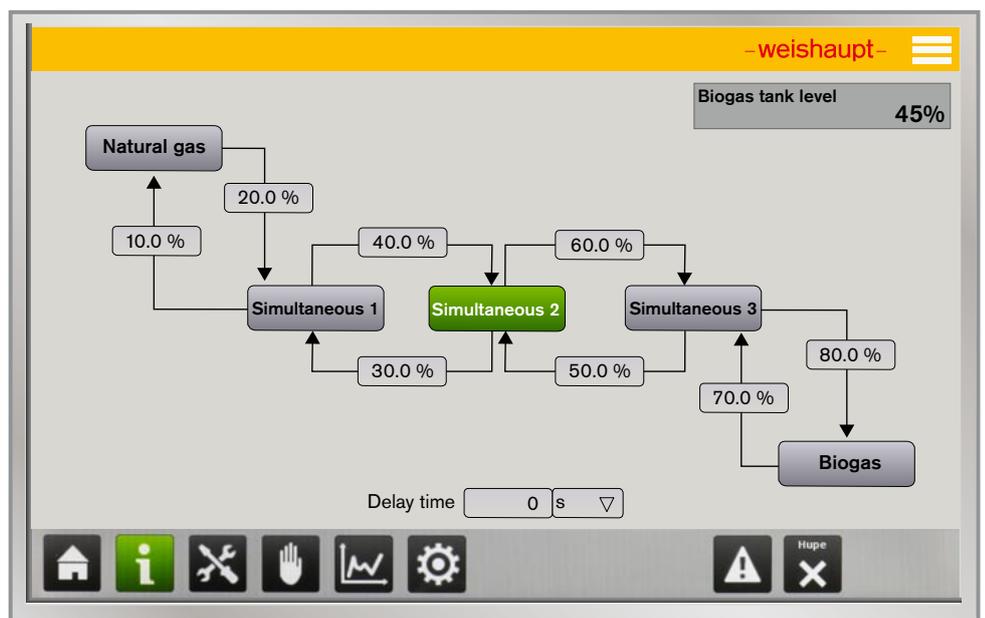
Touchscreen panel displaying a tank level

W-FM 1000 CMS system components

MCC burner control module
- 24 V dc power supply
- 12 fail-safe digital inputs
- 9 fail-safe digital outputs
- Ethernet with Modbus TCP
- 3 versions available:
  24 V dc input / 24 V dc output
  24 V dc input / 120 V ac output
  24 V dc input / 230 V ac output
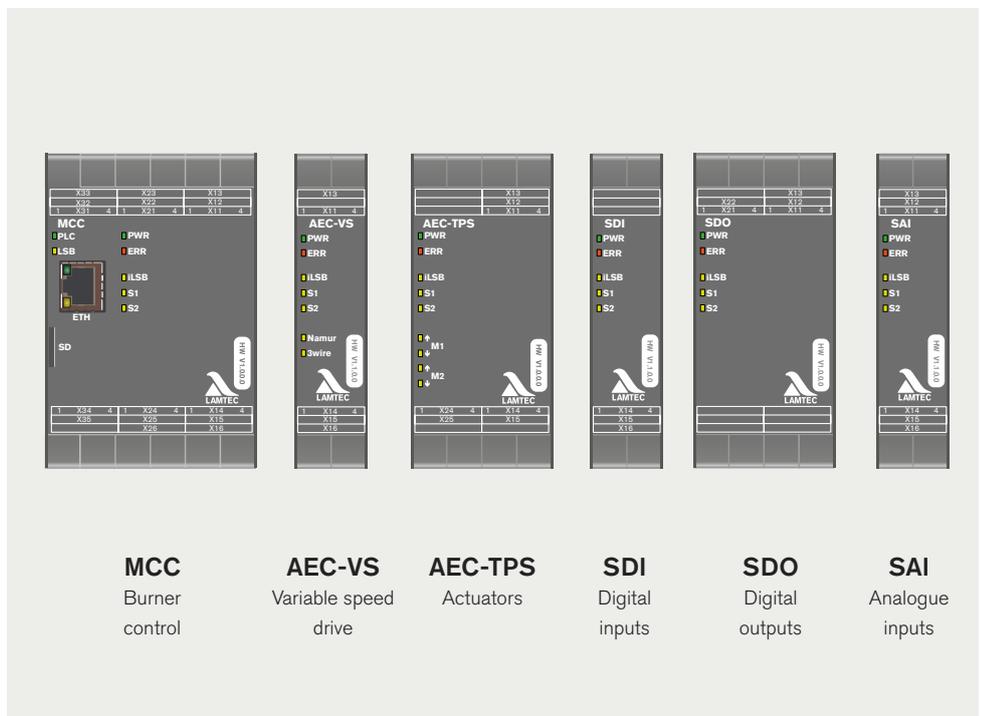- Input for an ionisation sensor, FFS08 optical flame sensor, or F200K flame monitor, as required

AEC-VS variable speed drive module
- 4–20 mA output for frequency convertor
- Alternatively, 4–20 mA output for positioner
- NAMUR speed sensor, 3-wire sensor, or 4–20 mA
- Digital output for "Fan ON"
- Digital input for "FC ready"
- Max. 10 control elements per burner*

CMS remote software
- Complete configuration software
- Backup and restore settings
- Ethernet connection to W-FM 1000 CMS
- Print wiring diagrams
- Checklists for equipment tests
- Parameters checking against standards

| **MCC** | **AEC-VS** | **AEC-TPS** | **SDI** | **SDO** | **SAI** |
| Burner control | Variable speed drive | Actuators | Digital inputs | Digital outputs | Analogue inputs |

AEC-TPS actuator module for WM50, WKmono80, and WK-series burners
- 2 outputs: open / close for synchronous motors
- Compatible with LAMTEC DPS motors
- Position feedback via potentiometer
- 120 / 230 V ac
- Max. 5 AEC-TPS modules per burner*
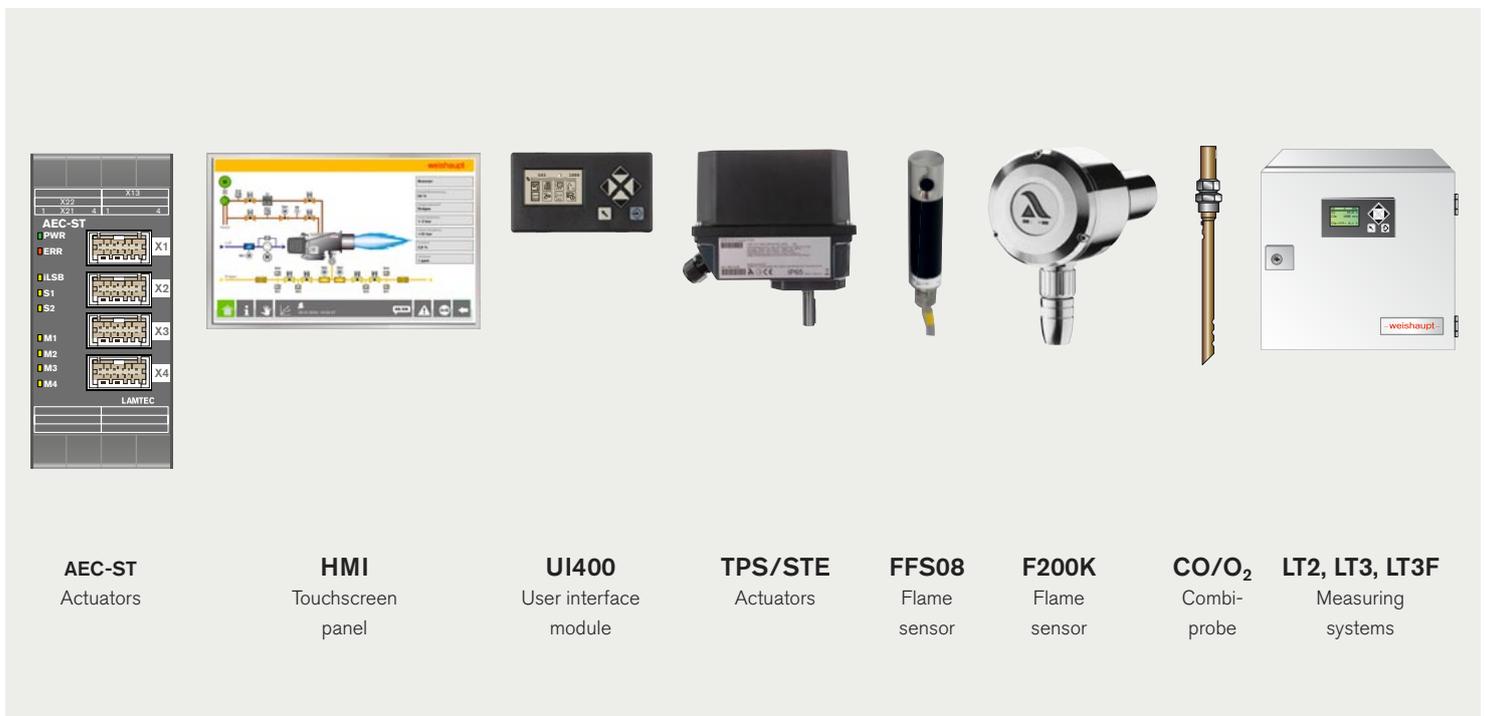
SDI fail-safe digital input module
- 8 fail-safe digital inputs
- 3 versions: 24 V dc, 120 V ac, 230 V ac
- Max. 6 SDI modules per burner control

SDO fail-safe digital output module
- 8 fail-safe digital outputs
- Max. 2 A per output
- 3 versions: 24 V dc, 120 V ac, 230 V ac
- Max. 4 SDO modules per burner

SAI analogue input module
- 3 fail-safe or 6 non-fail-safe analogue inputs, or any combination thereof, for 4–20 mA, Pt100, Pt1000, 0–20 mA, 2–10 V, or 0–10 V, as required
- 2 pulse inputs for fuel meters
- Max. 3 SAI modules per burner

* AEC-TPS and AEC-VS can be combined; a maxium of 5 modules controlling 2 actuators each can be addressed.

AEC-ST	HMI	UI400	TPS/STE	FFS08	F200K	CO/O₂	LT2, LT3, LT3F
Actuators	Touchscreen panel	User interface module	Actuators	Flame sensor	Flame sensor	Combi-probe	Measuring systems

AEC-ST actuator module for WM10–30
- 4 outputs: open/close for synchronous motors
- Max. 2x AEC-ST per burner control
- 120/230 V ac

HMI touchscreen panel
- Display of data
- Control/evaluation
- Status reports

UI400 user interface module
- Basic user interface (safety component)
- Graphic user interface
- Language-neutral display
- Simple operation
- Connection via internal bus
- Part of every system

CMS TPS actuator
- Three-point stepping motor
- 6 Nm, 20 Nm, 40 Nm, 60 Nm
- Max. 8 actuators per burner

CMS STE actuator
- Actuators
- 1.2 Nm, 3 Nm, 6 Nm
- Max. 8 actuators per burner
- Burner models WM10–30

F200K/FFS08 flame monitor/sensor
- Integral UV or IR flame sensor and switching amplifier
- Two-channel system with electronic self-monitoring
- Trend display available for optimal flame alignment
- Multi-level sensitivity adjustment
- Digital flame frequency evaluation
- LED status indicators
- SIL 3 per EN 61508-2
- Continuous operation per EN 298

O₂ trim/CO control
- O₂ trim/CO control connectable via internal bus
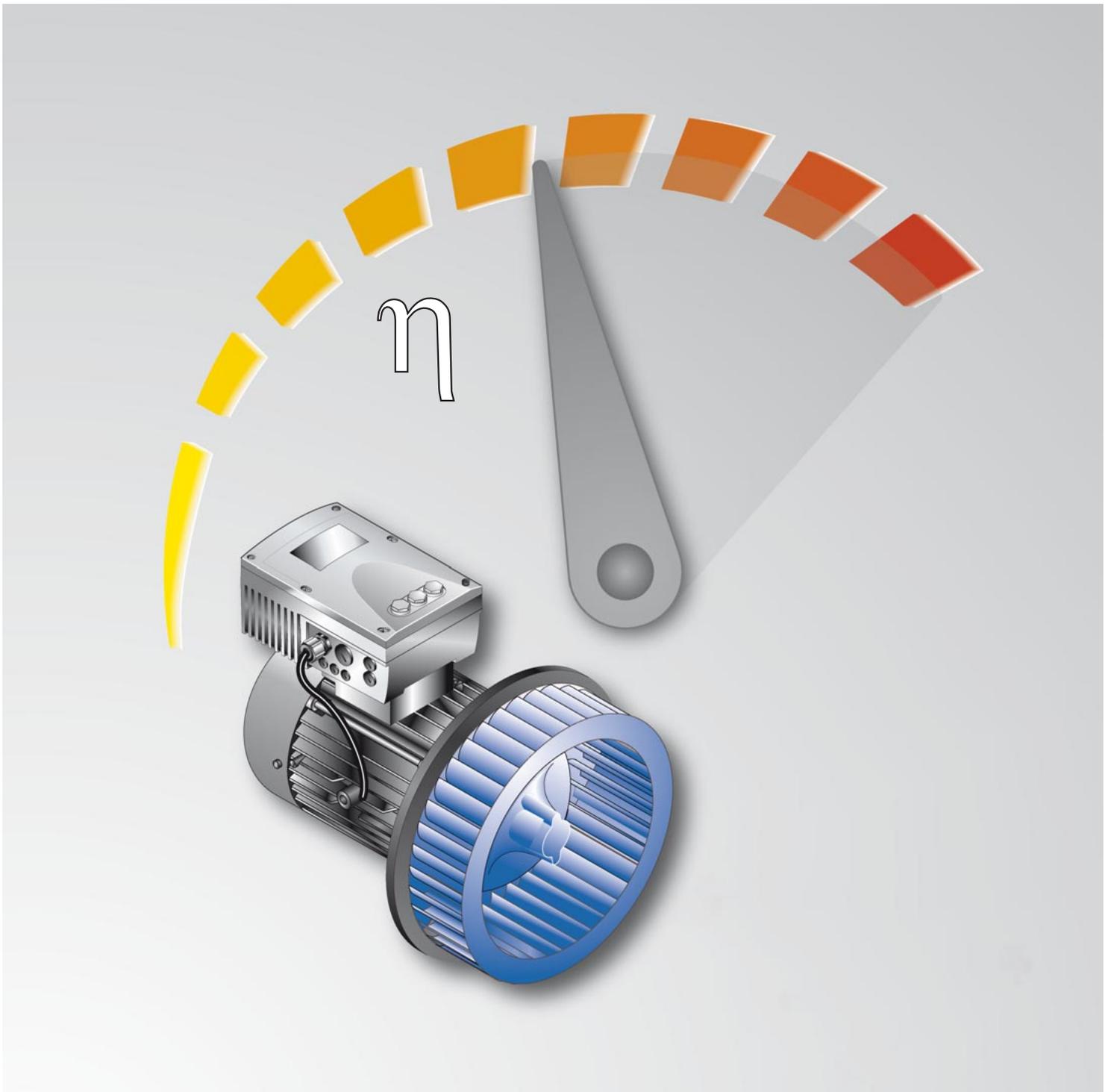- Higher efficiency
- Greater safety

Measuring systems
- All O₂/CO measuring systems can be connected to the W-FM 1000 CMS
- Increased safety and efficiency

The following systems are available:
- O₂ trim
- O₂ trim/CO control
- CO monitoring

Efficiency and
emissions optimisation

Variable speed drive

WM-GL30 dual-fuel monarch® burner with W-FM 200 and motor-mounted frequency convertor
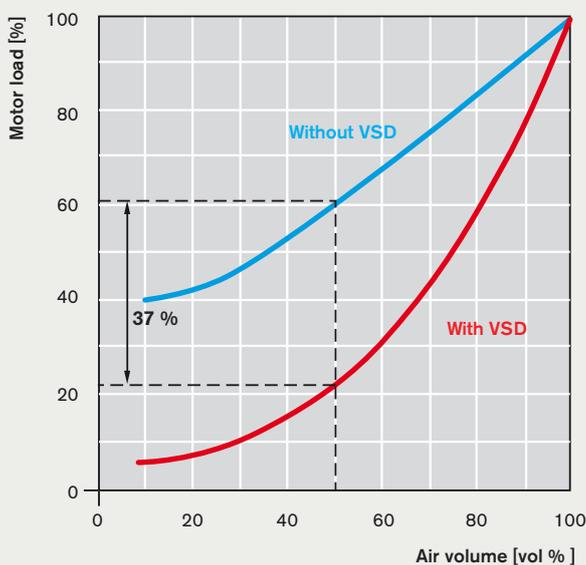
The key benefits

- Reduced electrical consumption when below the maximum burner rating
- Reduced noise emissions when below the maximum burner rating
- Soft start of the burner motor by the frequency convertor (minimal start current)
- Overload protection of the motor by the frequency convertor (overcurrent and excess temperature)
- Frequency convertor mounted directly onto the motor of WM-series burners
- Frequency convertor electrically connected (controls side), parameterised, and tested
- Basic configuration of the combustion manager
- Process-controlled function test at the factory
- VSD available with W-FM 50, W-FM 54, W-FM 200, and W-FM 1000 CMS
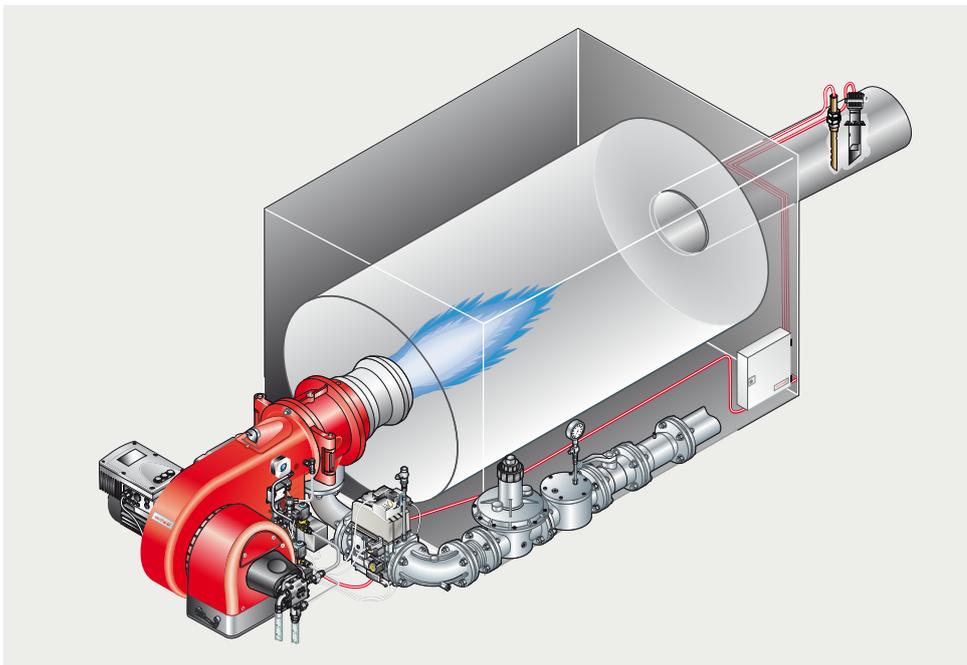
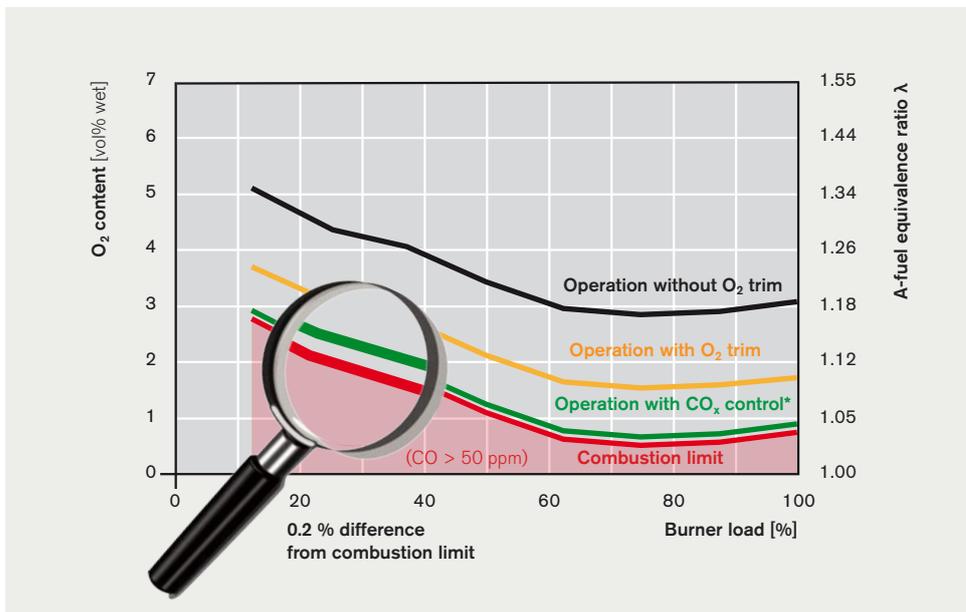**Reduced electrical consumption**

Reduced sound pressure level
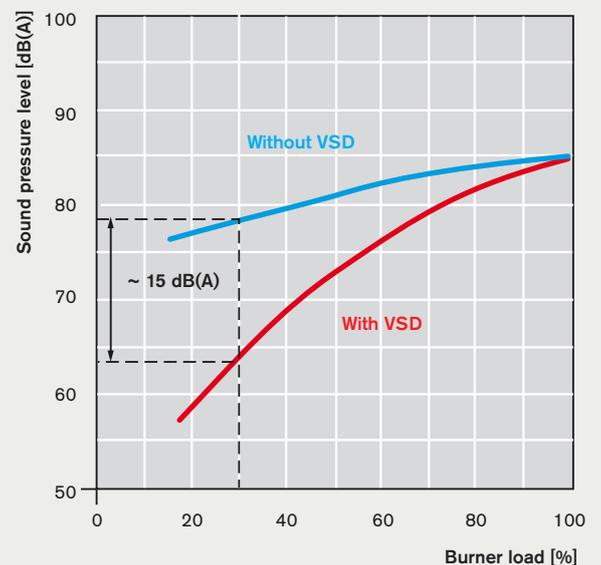
Curves based on measurements on aerodynamic equipment

O$_2$ trim

WM-GL30 dual-fuel monarch® burner with frequency convertor and O$_2$ trim

Well-proven technology is available to combat increasing energy prices, so it is always beneficial to change over to the latest equipment.

With amortisation periods of just a few years, operating costs will be reduced on a continuing basis thereafter.

How does O$_2$ trim increase efficiency?
A burner has to create a homogeneous mix of fuel and air in the right proportions for optimal combustion to occur.

Combustion quality, in other words, how close one can get to stoichiometric combustion with almost no CO, is one sign of the quality of a mixing assembly. This point is known as the combustion limit and it ultimately determines the amount of excess air with which the burner must be operated in order to counter-balance environmental influences, variations in fuel quality, pollution, and so on. Therefore excess air is ballast that increases the flue gas volume, causing the flow rate to increase. This results in reduced heat transfer and thus a reduction in efficiency.

Excess air volume can be reduced to a minimum by continually measuring and automatically adjusting the O$_2$ content of the flue gas. Then, the flue gas volume decreases, the flow rate reduces, heat transfer to the medium, e.g. water, improves, and efficiency increases.

Example: Combustion limit trend across the entire operating range of a gas burner and the associated air settings with and without O$_2$ trim

* in conjunction with W-FM 1000 CMS

CO control

Which fuels are suitable for CO control?

CO control works based on the premise that incomplete combustion (e.g. due to a lack of air) will result primarily in the formation of CO. For gaseous fuels such as natural gas, biogas, process gas, and waste gas, this is generally the case.

For liquid fuels such as gas oil, CO control is only possible with the so-called "blue-flame" burners, as they can burn soot-free even with insufficient air. Under-aired "yellow-flame" burners not only produce CO but also generate a significant amount of soot, something which occurs before the concentration of CO rises noticeably. This behaviour unfortunately rules out CO control for yellow-flame oil burners.

For the W-FM 1000 CMS with CO control/ O_2 trim, the option is provided to specify a load-based activation point for CO control or O_2 trim, or to regulate exclusively based on O_2, or based on CO in addition to O_2. A switch from CO control to O_2 trim may be necessary, for example, if the NO_x concentration in the flue gas requires a higher excess air level. Switching from CO control to O_2 trim on the fly without interrupting the control process is possible, depending on the load and fuel.

Optimisation strategy

The aim of the optimisation strategy is to automatically locate an operating point near the combustion limit, set it, maintain it, and further optimise it if necessary. This optimisation process is repeated cyclically, ensuring that optimal operating points are maintained even in the event of unfavourable weather or plant conditions.

For example, if the probe detects uncombusted components (CO, etc.) due to altered plant-specific conditions, the operating point is immediately shifted towards a higher lambda value (more air).

CO_x measurement

When combustion is "clean", both the O_2 and CO electrodes produce a voltage signal and the characteristic curves of the two electrodes align with one another. When combustion is poor with the presence of combustible components, however, the CO electrode produces an additional voltage, causing the characteristic curves of the two electrodes to diverge. When entering the air-deficient region, a significant rise in CO concentration occurs at the so-called combustion limit due to the poor/incomplete combustion caused by the lack of air.

The two resulting signal curves are shown in the diagram below. However, it should be noted that the combi-probe can only be used in the super-stoichiometric range of flue gas measurement, where safe operation is still ensured.

The advantages of CO control compared to O_2 trim :

- Greater energy savings through continuous self-optimisation at every load point
- Better control behaviour due to significantly shorter adjustment times
- Not affected by tramp air
- Fail-safe system
- High degree of operational safety and reliability
- Robust technology
- Low maintenance
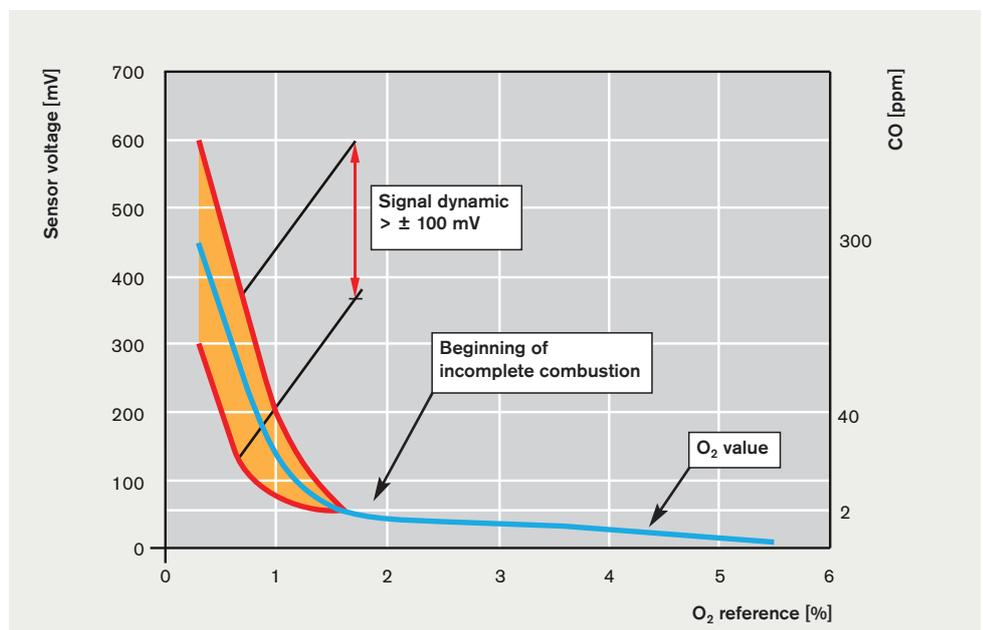
Sensor signal with incomplete combustion under excess air conditions

QGO 20 / 21 O$_2$ probes
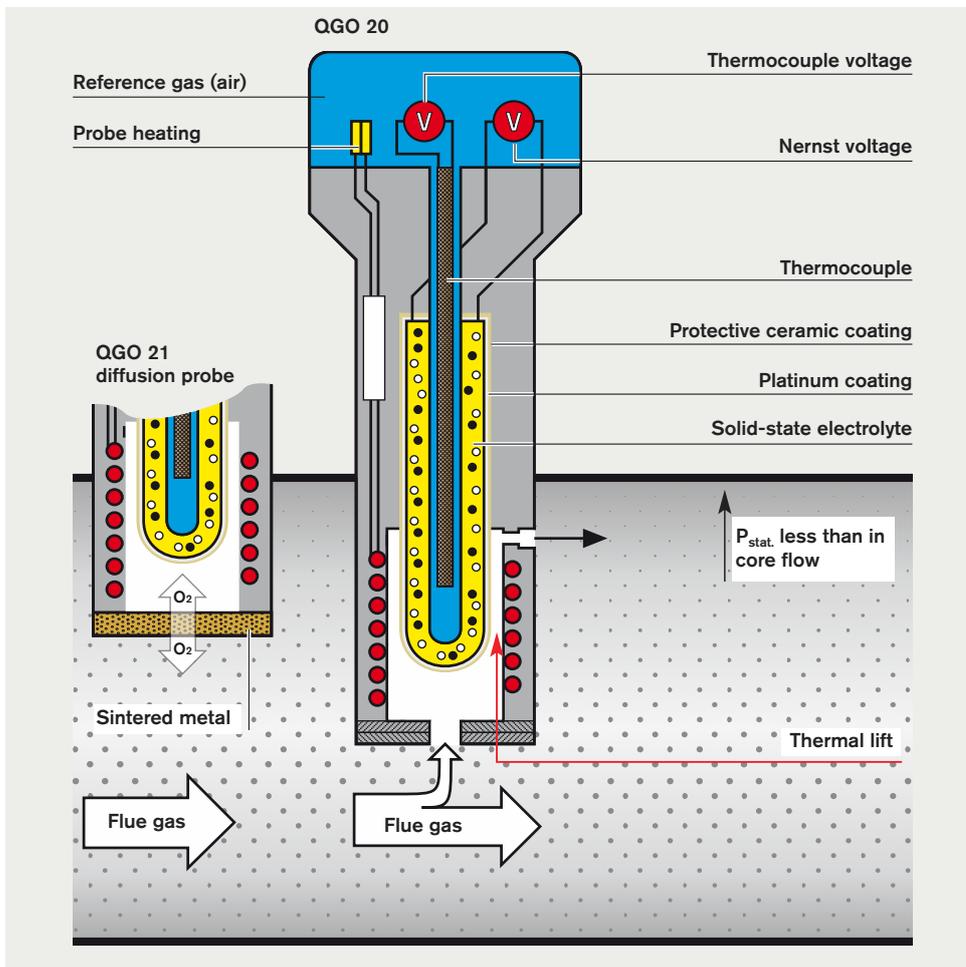
Cut-away drawing of an O$_2$ probe

The chemical constituents of a fuel react with oxygen present in the air during combustion.

For gas and oil, these are mainly hydrocarbons, which oxidise to form carbon dioxide (CO_2) and water (H_2O) when sufficient air is introduced.

"Sufficient" is an imprecise term, as an amount of additional air is also required to compensate for varying environmental influences. The problem with this excess air, however, is that it increases flue gas losses and fuel consumption. However, with the right measurement and control technology, it is possible to adjust the air volume to match current conditions.

The O$_2$ probe, part of the O$_2$ trim system, measures the amount of uncombusted oxygen present in the flue gas. The control system compares this measured value to the load-dependent setpoint and adjusts the air volume accordingly via actuators on the relevant correcting elements.

Lambda probes
Lambda probes, as they are called, are used for the fast, precise, and continuous measurement of oxygen.

Due to the way they operate, they are able to measure continuously without calibration cycles. They are able to take measurements directly from the flow of wet flue gas, so measurement results are generated very quickly. By way of contrast, flue gas analysers need the flue gas to be dried and cleaned.

Lambda probes like the QGO 20 and QGO 21 are relative measurement devices. At an operating temperature of 700 °C ± 15 K they compare the oxygen content of the flue gas with the oxygen content of the air around the head of the probe. If the O$_2$ concentration differs, the measuring cell generates a voltage corresponding to the deviation. The voltage itself is in the millivolt range and follows a logarithmic progression. For the subsequent processing, the voltage curve is linearised and amplified.
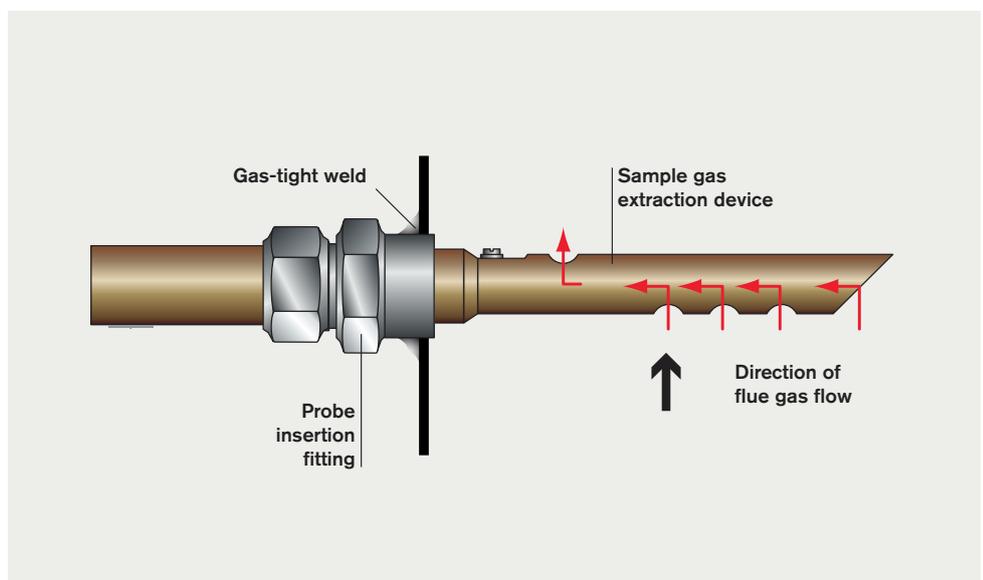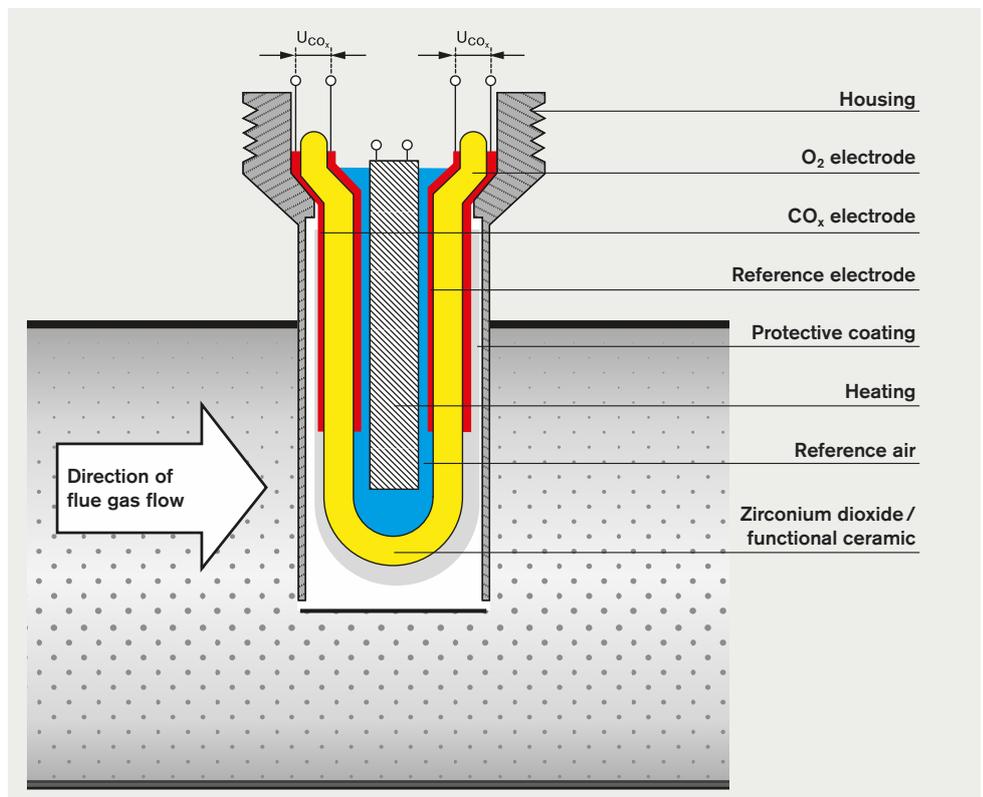
What is the difference between the QGO 20 and the QGO 21?
The measurement technique employed by the two probes is identical. The main difference between the two is that flue gas does not flow through the QGO 21. The oxygen concentration in the flue gas is instead diffused through the probe's sintered metal cap.
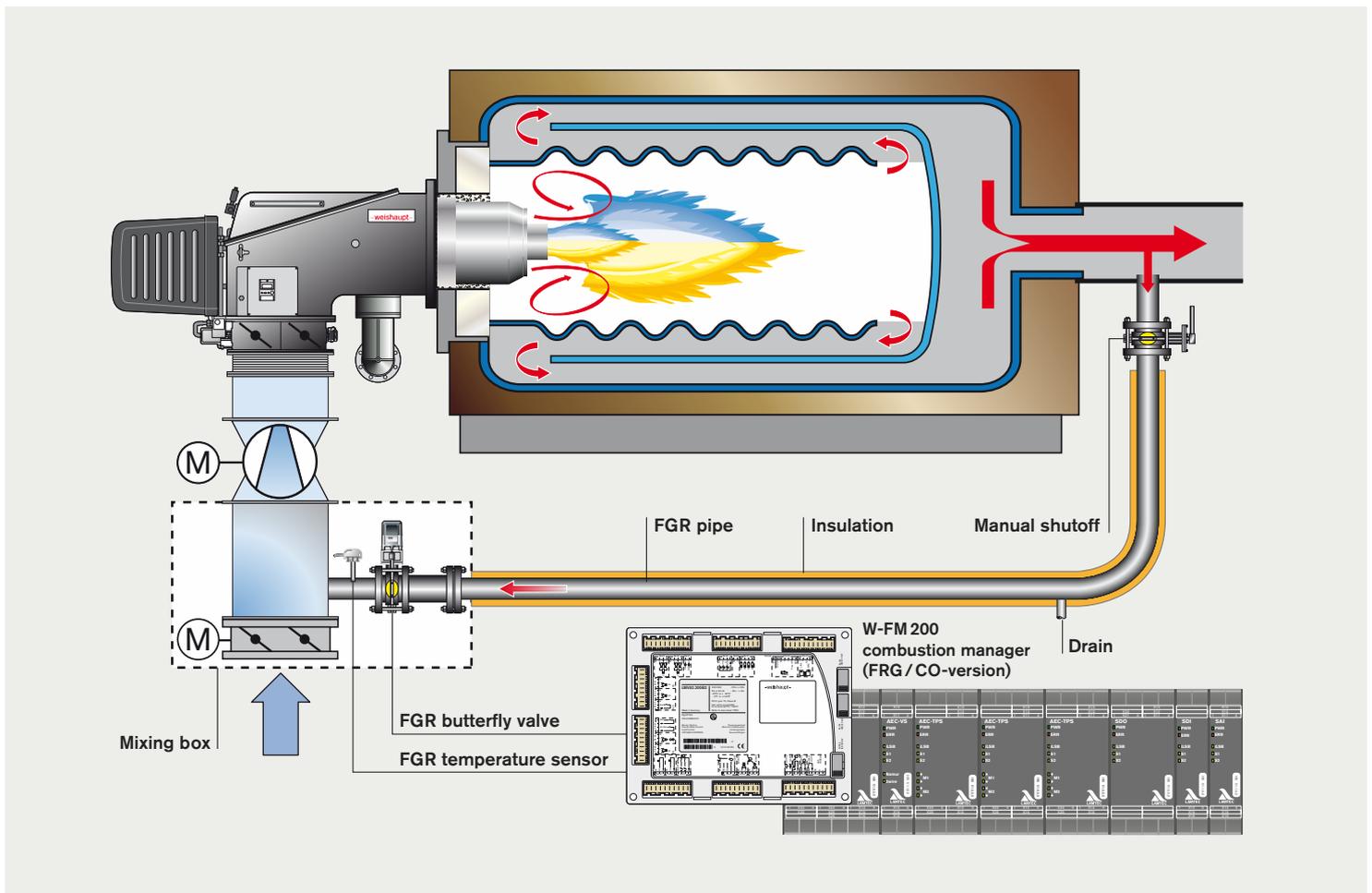
KS1-D CO$_X$ combi-probe

Operating principle

- The combi-probe is based on a heated electrochemical measuring cell made of zirconium dioxide ceramic. It contains three electrodes:
    - O$_2$ electrode (platinum)
    - CO$_x$ electrode (platinum / noble metal)
    - Reference electrode (platinum)

- The ceramic protrudes into the flue gas channel of the combustion plant, creating a gas-tight seal between the reference gas chamber, which contains the reference electrode, and the sample gas chamber (flue gas channel).

- The two measuring electrodes for O$_2$ and CO$_2$ are located on the outside of the ceramic directly in the sample gas.

- An integrated heater heats the probe to approximately 650 °C and regulates this temperature.

- At this temperature, the ceramic becomes conductive to oxygen ions. Two sensor signal voltages are thereby generated and can be measured:
    - U$_{O_2}$ (the voltage between the reference electrode and the O$_2$ electrode)
    - U$_{CO_x}$ (the voltage between the reference electrode and the CO$_x$ electrode)

U$_{CO_x}$ U$_{CO_x}$

Housing

O$_2$ electrode

CO$_x$ electrode

Reference electrode

Protective coating

Heating

Reference air

Zirconium dioxide / functional ceramic

Direction of flue gas flow

Gas-tight weld

Sample gas extraction device

Probe insertion fitting

Direction of flue gas flow

Temperature-compensated flue gas recirculation

General arrangement of an FGR system with a WK-series burner

Weishaupt burners offer an innovative development that enables the world's most stringent NO$_x$ emission limits to be met.

This development brings about the general integration of external flue gas recirculation. Results from the lab and the field prove that this technology can always meet NO$_x$ limit values of 30 mg/kWh for natural gas E, provided certain conditions are met.

The Weishaupt FGR system does not require an additional fan to feed the flue gas to the burner.

The flue gases are instead drawn in by the combustion air fan. Low pressure develops in the mixing box, which allows flue gas to flow down the FGR pipe and into the fan. The burner's combustion manager controls the FGR butterfly valve, thus ensuring the flue gas volume is precisely dosed.

Clean combustion is always the aim of every Weishaupt burner development.

With the new focus on extremely low NO_x emissions, Weishaupt developed various low NO_x technologies. Special mixing assemblies with flame distribution and additional swirl support, together with flue gas recirculation, reduce NO_x emissions to a minimum.

W-FM 200 and W-FM 1000 CMS combustion managers are perfectly equipped for FGR. With just two additional components – a flue gas temperature sensor and butterfly valve – their software controls the flow of flue gas so that the correct amount will be fed into the combustion air under all operating conditions, providing reliable startup and operational behaviour – just as you would expect.
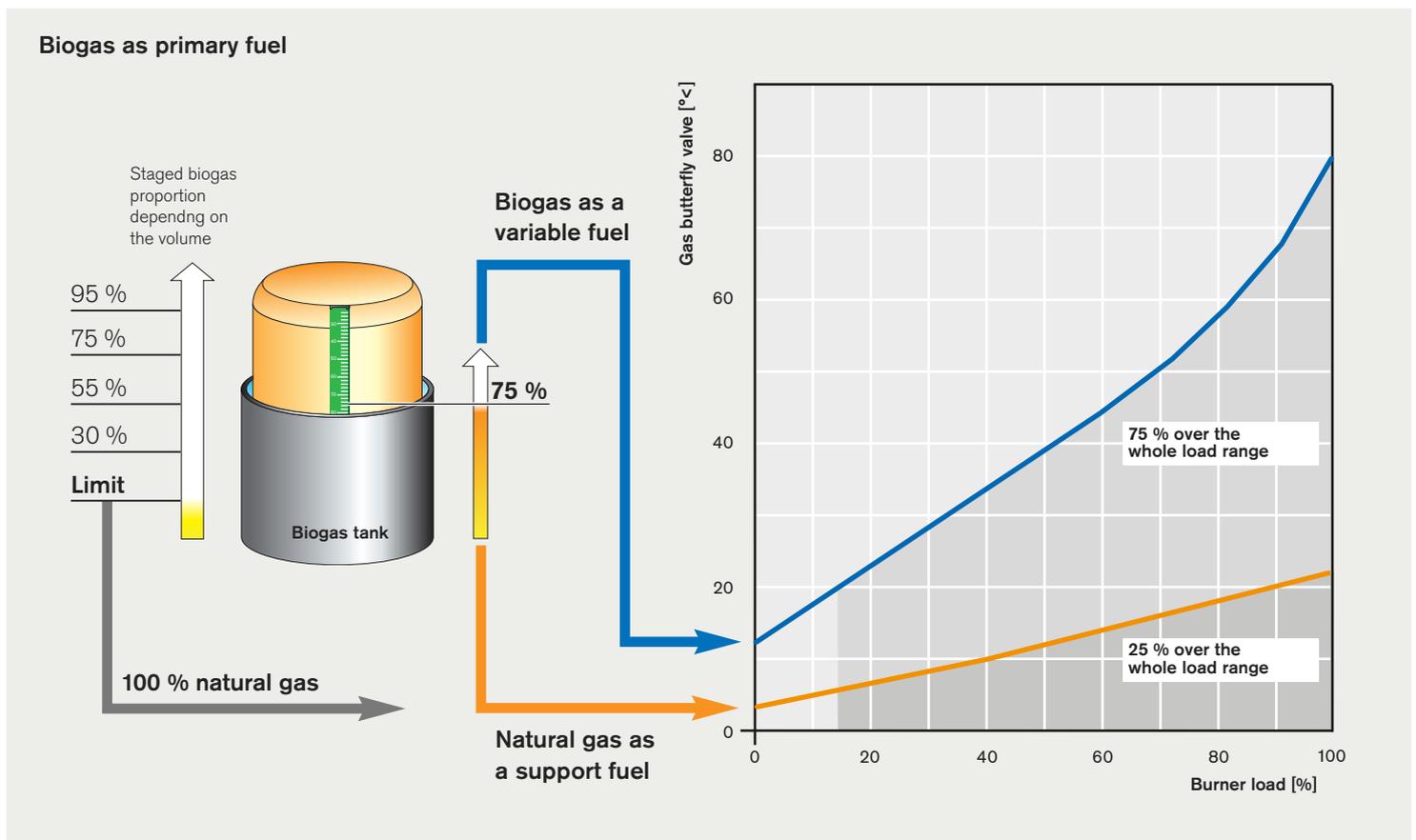
Service-friendliness applies not only to the burner but also to the combustion manager. Structured menu navigation, rapid response times, and precise compound regulation form the basis of effective work. Another significant advantage is the integrated bus communication, which enables control and regulation solutions that are not, or at least not yet, included in the combustion manager's software.
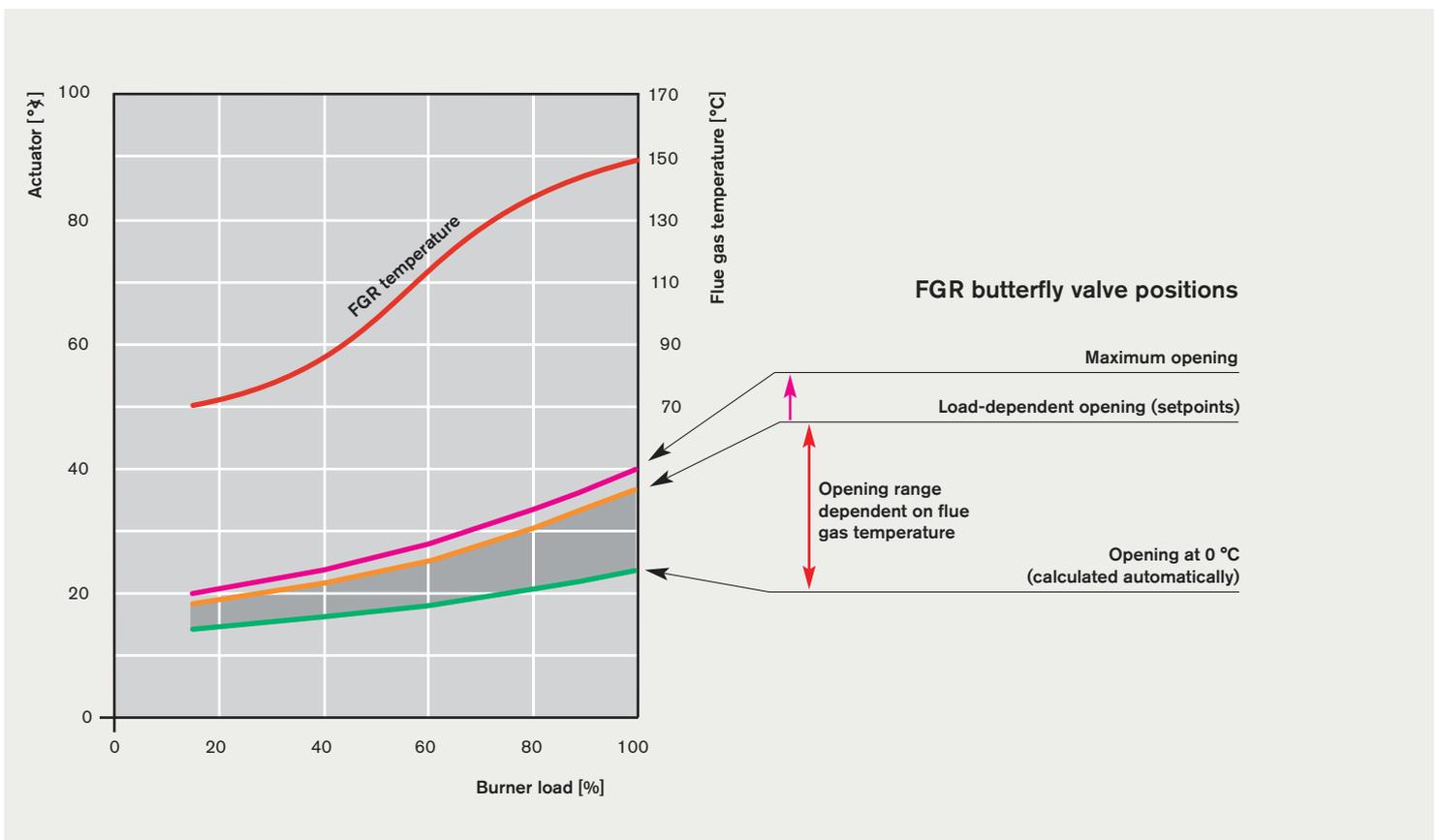
Temperature-controlled flue gas dosing is functional and safe

Special applications

Simultaneous combustion

Biogas as primary fuel

Staged biogas proportion dependng on the volume

95 %
75 %
55 %
30 %
Limit

Biogas tank

Biogas as a variable fuel

75 %

100 % natural gas

Natural gas as a support fuel

Gas butterfly valve [°<]

80

60

40

20

0

75 % over the whole load range

25 % over the whole load range

0   20   40   60   80   100
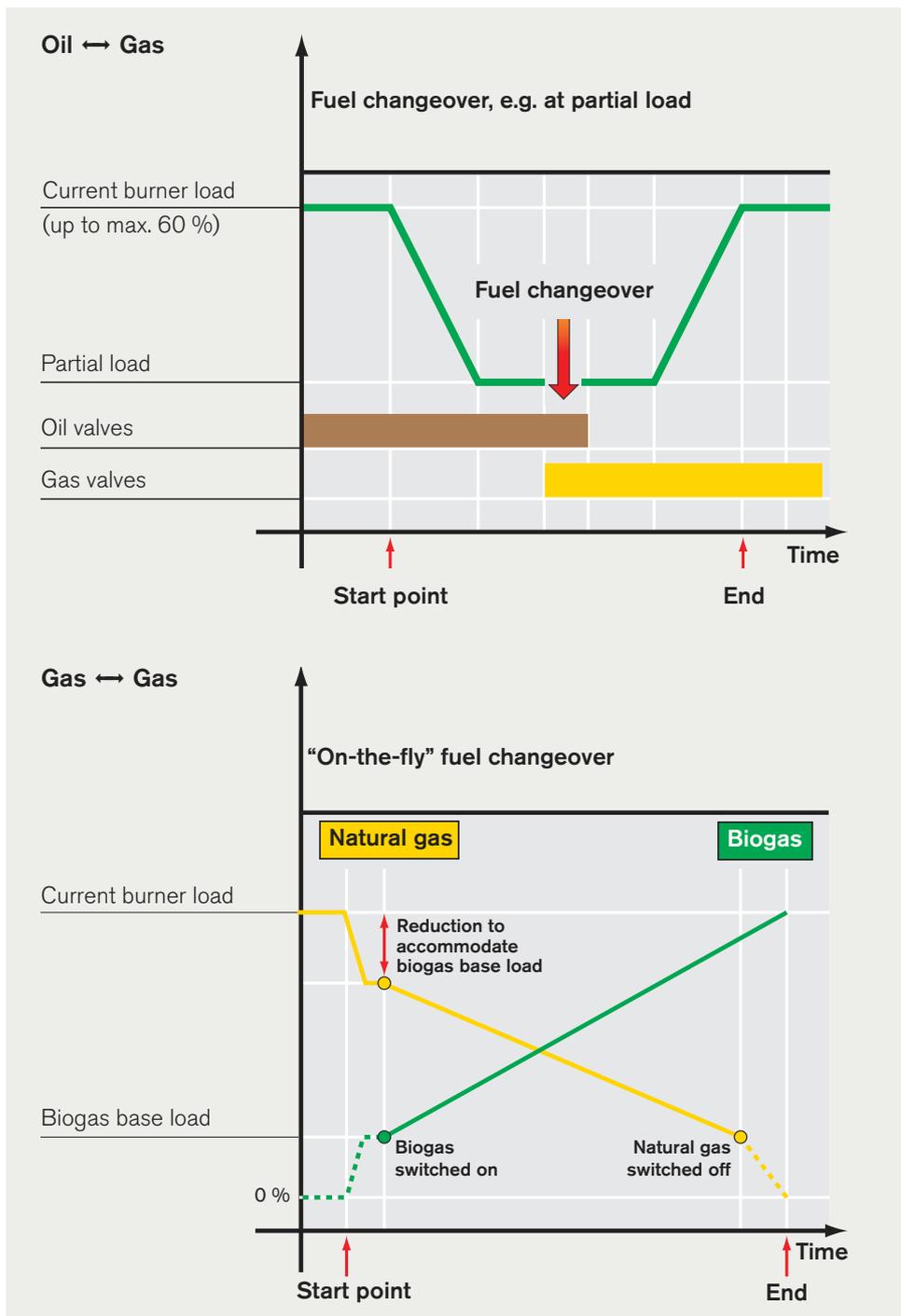
Burner load [%]

Biogas as primary fuel

One special variant is fuel dosing based on availability. As the stored volume of biogas increases, the dosing system automatically adjusts in stages, increasing the proportion of biogas while correspondingly reducing the volume of the support fuel, e.g. natural gas.

If the available biogas volume falls below the defined minimum threshold, the system will automatically switch to natural gas.

Advantages

- Optimal use of biogas.
- The fuel ratio can be switched on-the-fly without a break in burner firing.
- Single-fuel operation using natural gas or biogas is possible. Changeover takes place without a break in burner firing.
- Identification of the biogas volume via tank level.

- Optional O_2 trim compensates for minor fluctuations in calorific value, monitors combustion, and increases efficiency.
- Optional VSD reduces electrical costs.
- Oil can be used as a fuel, either individually or simutaneously.

On-the-fly fuel changeover

Oil ⟷ Gas

Fuel changeover, e.g. at partial load

Current burner load
(up to max. 60 %)

Fuel changeover

Partial load

Oil valves

Gas valves

Time

Start point **End**

Gas ⟷ Gas

"On-the-fly" fuel changeover

Natural gas **Biogas**

Current burner load

Reduction to
accommodate
biogas base load

Biogas base load

Biogas
switched on

Natural gas
switched off

0 %

Time

Start point **End**

By default, a fuel changeover involves shutting down and restarting the burner.

This results in waiting times during which the heat generator cools down, and the process temperature can no longer be optimally maintained. A fuel changeover without a break in firing prevents cooling and thereby ensures a significantly faster availability of output.

Oil ⟷ Gas

- Two fuel lines switchable at a freely definable load point up to approximately 60 % of burner capacity.
- Alternating operation between liquid and gaseous fuels.
- Burner remains in operation.
- Minimal system cooling during changeover.

Gas ⟷ Gas

- Two fuel lines switchable while maintaining the same load.
- Alternating operation between gaseous fuels.
- Burner remains in operation.
- Current burner load is maintained during changeover.
- No system cooling during changeover.

Note:
Biogas-only operation always depends on a sufficient supply. Additionally, the thermal load on the mixing assembly for 100 % biogas is different to that of biogas fired simultaneously with natural gas. This means that not every mixing assembly is suitable for pure biogas operation.

Fail-safe parallel firing with W-FM1000 CMS
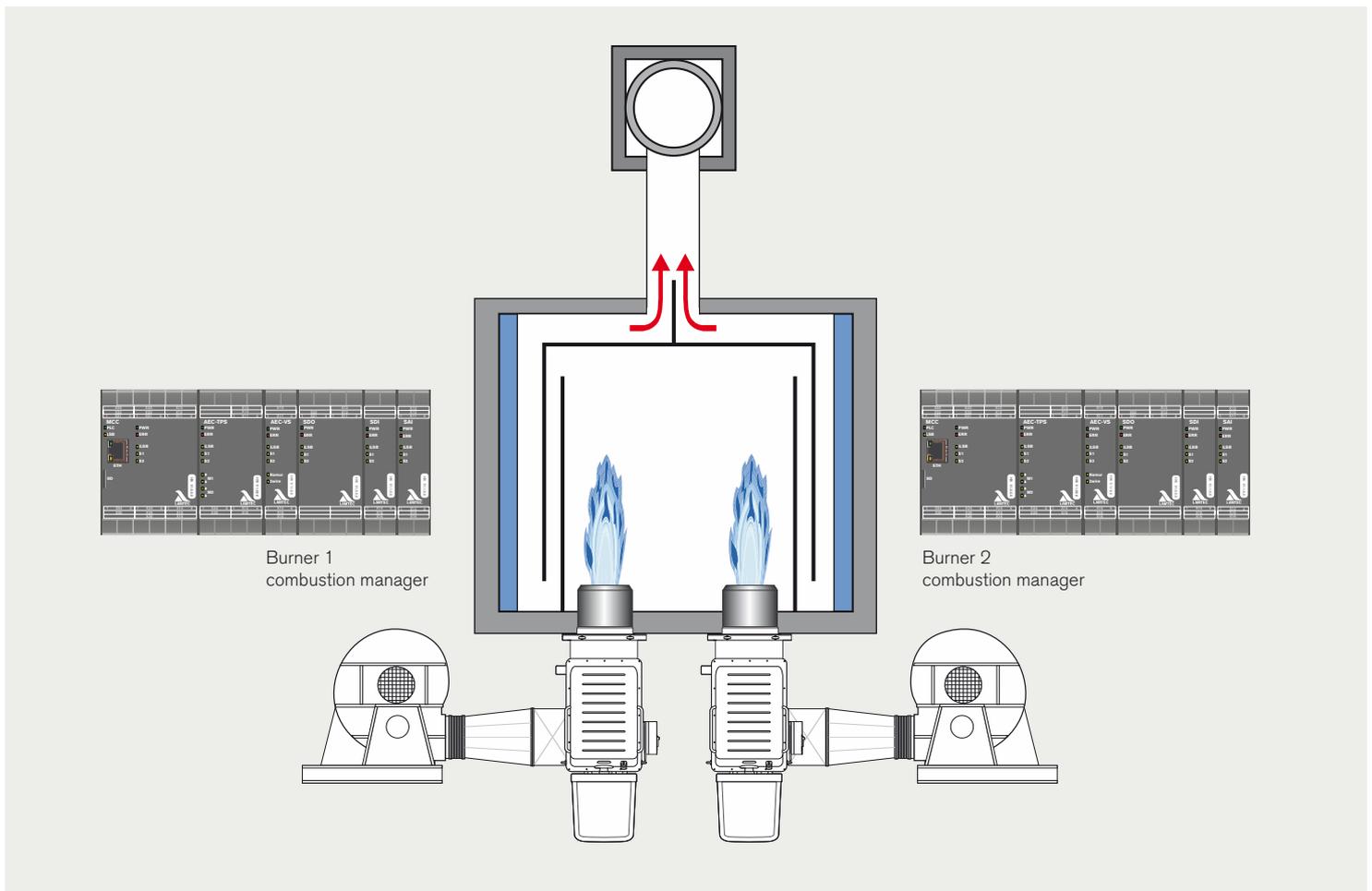
Example with 2 burners firing into a single combustion chamber

A combustion chamber equipped with multiple burners can be fired in different ways depending on specific conditions.

Flue gas pressure in the combustion chamber plays a crucial role. A negative pressure in the combustion chamber is never problematic, as it ensures that no backflow can occur, even if burner pressures vary. The control system that is overseeing the burner combustion

managers can control the burners in parallel with an equal output from each, or operate them in cascade mode with an extended turn-down range. This means that, at minimum load demand, only one burner is in operation. If load demand exceeds twice the minimum output, the second burner switches on, and the outputs of the two burners are adjusted to the same rate.

Combustion chambers with positive pressure need additional fail-safe monitoring systems. The W-FM 1000 CMS combustion manager, with its fail-safe input, output, and analogue modules, provides the ideal platform for such applications and requirements.

The right
control panel

An air-conditioned control panel for a twin-flue boiler with simultaneous combustion

Control technology

Everything under control

Every heater needs a control panel to ensure safe and efficient operation and to control the heat generation. This may be for:

- Power supply and protection of field devices
- Monitoring of safety systems
- Firing rate control
- Activation of additional peripherals
- Data provision
- Ultimately, heat distribution

The automation pyramid

Control technology in industrial and, increasingly, commercial applications can generally be divided into the following levels:

- **Field level**

  Sensors and actuators for acquiring input and output signals, possibly with local control (e.g. burners with an inbuilt combustion manager, oil pumps, etc.).

- **Control level**

  PLC systems for collecting and processing data from the field level. Based on the user's software, the field devices are activated, controlled, and visualised via a graphical HMI. Additionally, data is gathered, compressed, and structured for the management level.

- **Management level**

  A PC system is used for higher-level data acquisition, long-term archiving, and the monitoring and control of the overall system.

Smart solutions

The ongoing digitalisation of heating systems and thermal process plant, and the continuous search for energy-saving opportunities, is driving an increase in demand for data provision from burners and heat generators.

These days, without too much effort, a modern control system enables the collection of a wide range of system data – including consumption values, hours run, start counters, actual values, load profiles, and much more.

Management level

Control level

Field level

Collect data

Control and regulate
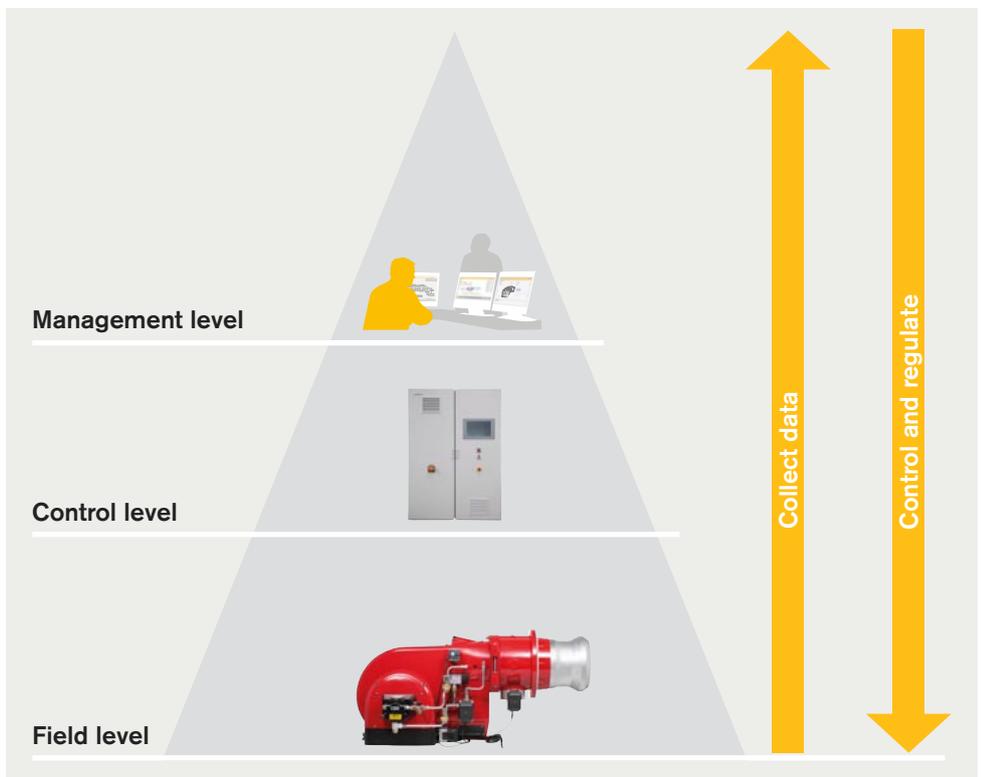
By analysing this data, starting points for efficiency improvements can be identified and implemented.

Expertise beyond the burner

Weishaupt is a competent partner offering solutions ranging from burners to overarching process control systems for entire plants.

The design and implementation of tailored solutions is one of our key strengths.

Burner and process technology expertise

- Safety systems for combustion and plant-related applications
- Various automation solutions
- Standardised OEM solutions
- Fieldbus interfaces
- Multi-boiler systems and sequencing controls

- Shorter commissioning times due to control panels being function tested at the factory
- Compliance with European and international standards

Fieldbus communication
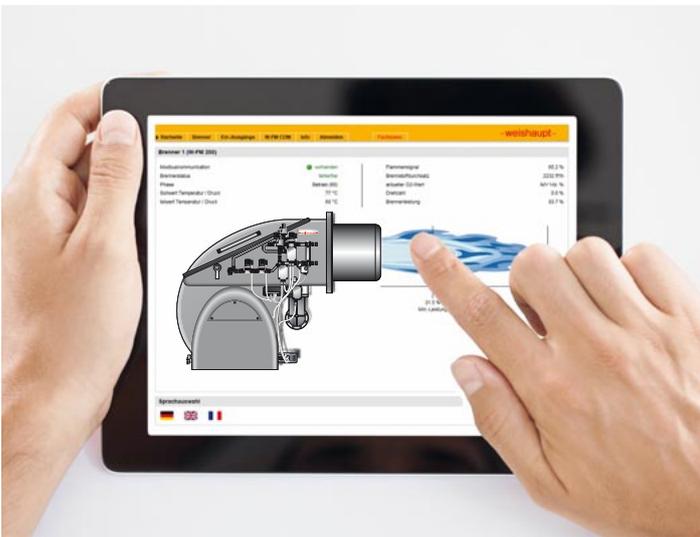
*Remote monitoring made easy
via tablet or laptop*

Digital combustion managers provide the basis for burner communications with other higher-level systems. Various signal-exchange protocols are available for this.
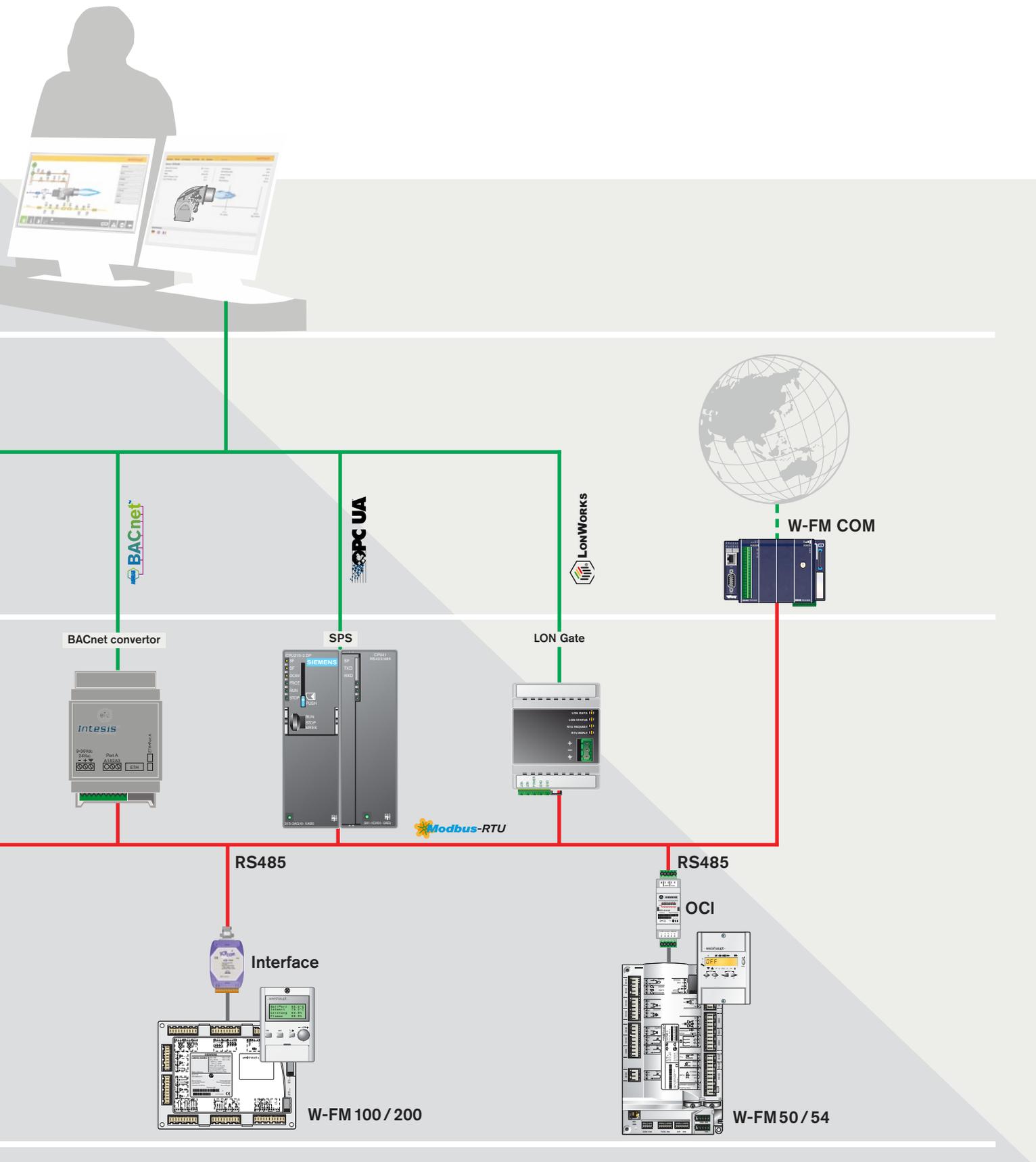
All of the usual burner and, optionally, boiler functions can be monitored and controlled through a direct, digital connection to a building management system.

A graphical HMI is available to provide a user-friendly overview of the system with its setpoints and measured values. The touchscreen display allows specific functions to be adjusted and monitored, such as the system parameters and the setpoints of individual and multi-boiler plant and other ancillary equipment.
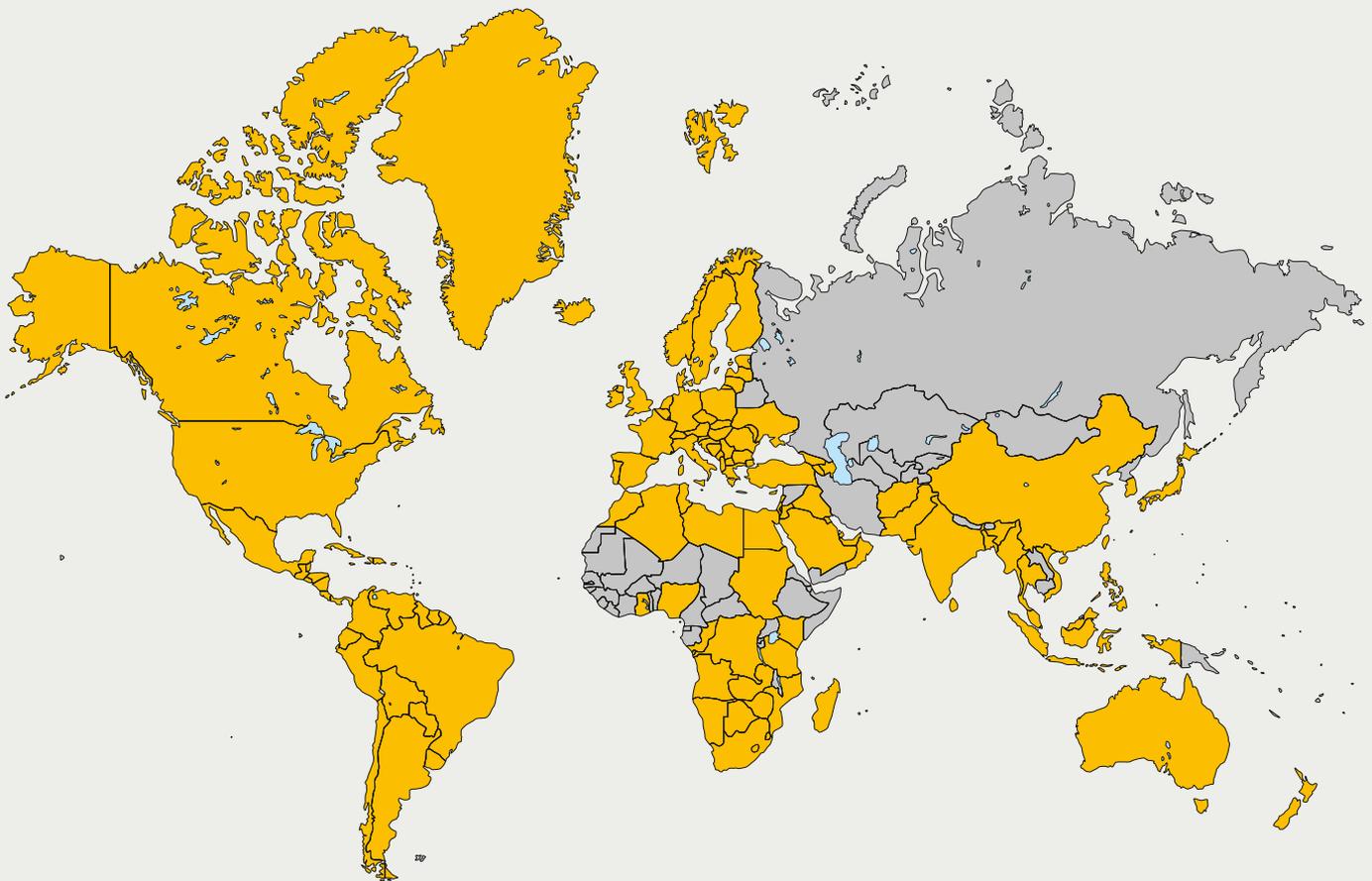
Weishaupt's own in-house control technology department is able to design and implement complex control solutions.

Data can be transmitted securely over the internet so that it can be called up and displayed in a browser window on a PC, tablet, or smartphone, which facilitates accurate service planning. Even away from the internet you can be kept up to date with the operation of the burner: In the event of a safety shutdown or some other predefined trigger, an SMS text message is sent automatically.

The operator can connect to the W-FM COM via a VPN and access the online user interface on a PC, laptop, tablet, or smartphone. Additionally, the control system features push notifications in the event of a burner safety shutdown or other predefined monitoring alerts.

Examples of bus combinations

Management level

Control level

MGate

ModGate

Modbus-TCP

PROFIBUS DP

PROFINET

EtherNet/IP

Modbus-RTU

Modbus-TCP

W-FM 1000 CMS

Field level

BACnet

OPC UA

LonWorks

W-FM COM

BACnet convertor

SPS

LON Gate

Intesis

SIEMENS

Modbus-RTU

RS485

RS485

OCI

Interface

W-FM 100 / 200

W-FM 50 / 54

If you need us, we're there.

Weishaupt worldwide:

Afghanistan	Chile	Faroe Islands	Israel	Malaysia	Oman	South Africa	Vatican City
Algeria	China	Finland	Italy	Malta	Pakistan	Spain	Venezuela
Angola	Columbia	France	Jamaica	Mauritius	Panama	Sri Lanka	Vietnam
Argentina	Congo (D. Rep.)	French Guiana	Japan	Mexico	Paraguay	Sudan	Zambia
Australia	Congo (Rep.)	Germany	Jordan	Moldova	Peru	Suriname	Zimbabwe
Austria	Costa Rica	Ghana	Kenya	Monaco	Philippines	Sweden	
Bahrain	Croatia	Greece	Korea (S.)	Montenegro	Poland	Switzerland	
Bangladesh	Cuba	Greenland	Kosovo	Morocco	Portugal	Taiwan	
Belgium	Cyprus	Guatemala	Kuwait	Mozambique	Puerto Rico	Tanzania	
Belize	Czechia	Guyana	Latvia	Myanmar	Qatar	Thailand	
Bolivia	Denmark	Haiti	Lebanon	Namibia	Romania	Tunisia	
Bosnia-Herzegovina	Dominican Rep.	Honduras	Lesotho	Netherlands	San Marino	Turkey	
Botswana	Ecuador	Hungary	Libya	New Zealand	Saudi Arabia	UAE	
Brazil	Egypt	India	Liechtenstein	Nicaragua	Serbia	Ukraine	
Bulgaria	El Salvador	Indonesia	Lithuania	Nigeria	Singapore	United Kingdom	
Canada	Estonia	Iraq	Luxembourg	North Macedonia	Slovakia	Uruguay	
	Eswatini	Ireland	Madagascar	Norway	Slovenia	USA	