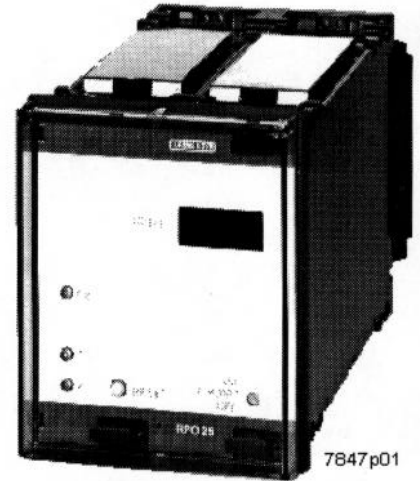


# Oxygen Trim Control for Modulating Burners

## RPO25...



FM740



7847p01

The RPO25... is a programmable control unit designed to measure and control the residual oxygen content (O<sub>2</sub>) of flue gases. The unit is suitable for use with modulating single or dual fuel burners of any capacity.

### Application

In connection with the oxygen sensor type QGO..., the programmable RPO25... control unit measures and controls the residual oxygen content of flue gases.

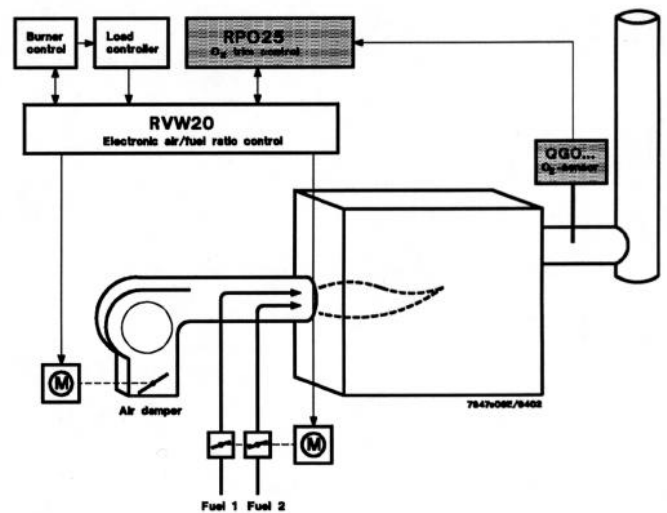
To control the oxygen content, it is possible to drive correcting devices on the air or fuel side.

When using the RVW20... electronic air/fuel ratio control, installation of an additional correcting air damper is not required.

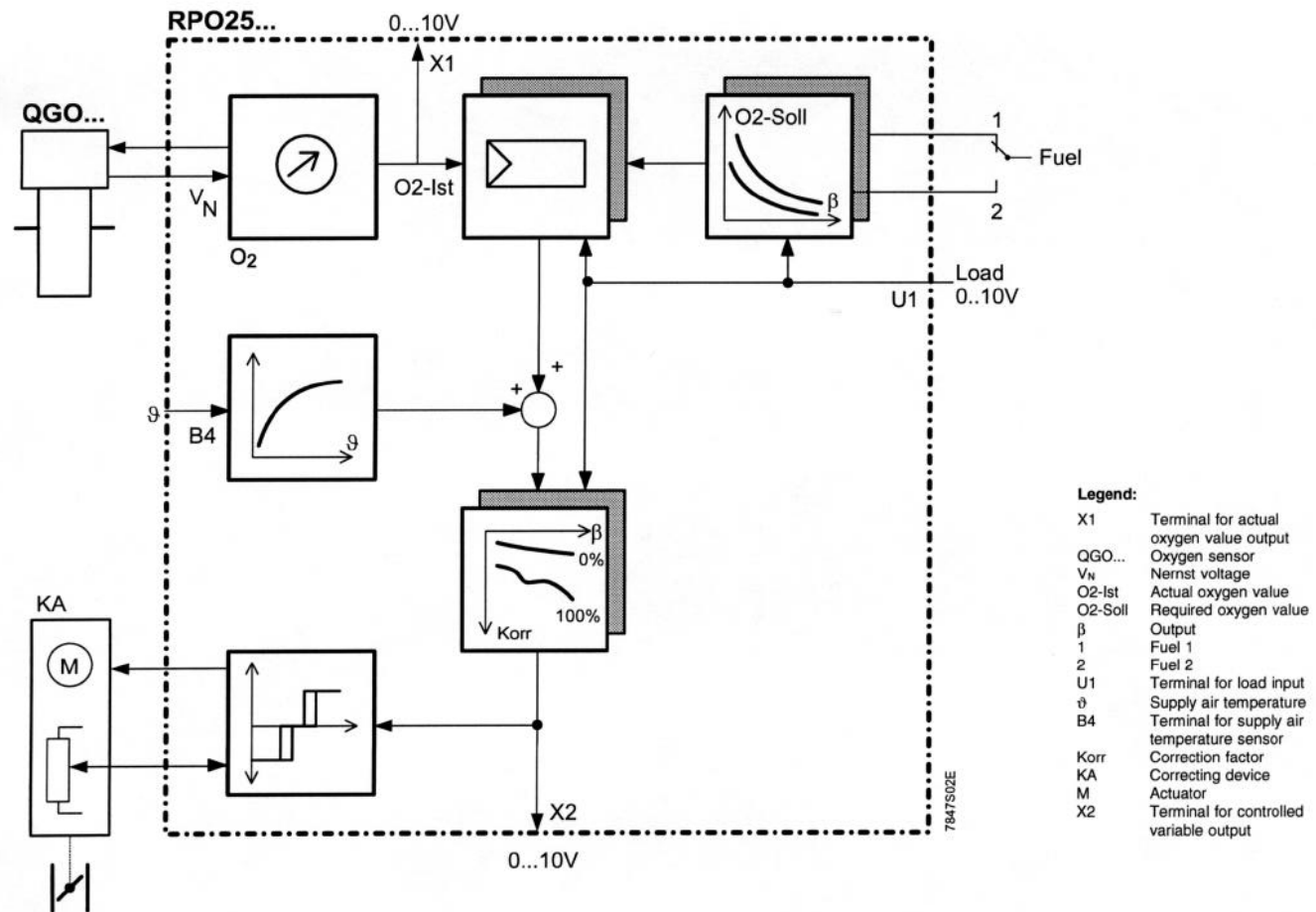
The RPO25... can be used as:

- a control unit with temperature compensation
- an oxygen trim controller

### Application Example



## Block diagram



## Functions

### Measuring the oxygen content

The RPO25... controls and monitors the QGO... oxygen sensor and evaluates its measuring signal. After switching on the RPO25..., the measuring function is activated, provided the QGO... is correctly connected, even if the operating mode selector on the front of the unit is set to «OFF».

The measuring transducer of the RPO25... acquires the oxygen sensor's cell temperature and controls it to the preselected set value of 700°C. The measuring transducer converts the sensor signal into a linear output signal, proportional to the oxygen content of the flue gases, which then becomes available at terminal X1 as a DC 0...10 V signal. The measuring system is ready to operate when the measuring cell's working temperature is reached.

With the AZW20.20 handheld terminal, the number of operating hours of the QGO... can be read off via the hours run meter incorporated in the RPO25... Also, in the programming mode, the condition of the oxygen sensor with regard to aging can be checked.

The RPO25... checks the internal resistance and the measuring cell's response time at 500-hour intervals during burner off periods.

### Oxygen trim control

To start oxygen trim control, the operating mode selector on the front of the unit must be set to position «O<sub>2</sub>», which also activates the temperature compensation provided it is switched on and a temperature sensor is connected.

The RPO25... is suitable for use with two types of fuel. The operational status of the burner plant and the selected type of fuel are acquired with AC 230 V signals, the output with an analogue DC 0...10 V signal.

The control function is only active during burner operation. This means, on completion of the delay time, the RPO25... enables oxygen trim control. The oxygen set value is dependent upon both the burner output and the type of fuel. Below a selectable output limit, the control can be switched off.

For the definition of the load dependent oxygen set values, a separately programmable curve (5 or 9 points) is available for each type of fuel.

The controller calculates corrections based on the control deviation and the programmed control parameters. This correction, together with the correction of the supply air temperature, is translated into a correcting signal.

The correcting signal of 0...10% is delivered as a DC 0...10 V signal either to the electronic air/fuel ratio control (RVW20) or to a three-position converter with potential-free contacts for a correcting actuator (e.g. the SQN37).

The OPEN contact for the actuator is an N.C. contact, the CLOSE contact an N.O. contact. This ensures that in the event of a power failure, the actuator will travel towards «excess air».

### Supply air temperature compensation ( $\vartheta$ -function)

By using supply air temperature compensation, adequate consideration can be given to changing physical conditions (density) of the combustion air at different temperatures (summer/winter).

This function produces a correcting signal which is fed to the oxygen trim control. If oxygen trim control is out of operation (operating mode selector set to position « $\vartheta$ -KOMP»), the  $\vartheta$ -function drives the air damper to a preselected position, which changes in function of the supply air temperature fluctuations.

To enable the function, the operating mode selector on the front of the unit must be set to the position «O<sub>2</sub>» or « $\vartheta$ -KOMP». When in the latter position, only the  $\vartheta$ -function is switched on. When the function is switched on, it becomes active as soon as the burner is started up. In normal control mode («O<sub>2</sub> on»), the function is always active, if  $\vartheta$ -KOMP is switched on via the AZW.

In addition to general use during burner startup, the function is particularly suited for plants with preheating of the combustion air.

### Control of actuator

For special applications, it is possible to program a load dependent basic curve. Control of the correcting actuator follows that curve in the event of a malfunction or when oxygen trim control and temperature compensation are switched off. The correcting actuator must be wired such that the oxygen content will be reduced when the correction increases.

### Output of data

Data output is achieved via an interface with RS232 signal levels. The data are prepared such that they can be displayed directly on a PC.

During burner operation, a standard protocol is delivered, containing the following data:

- Output,
- oxygen value (% O<sub>2</sub>),
- oxygen set value (% O<sub>2</sub>), and
- correcting variable (%).

### Display

The three-digit display provides the following information:

Selector position	Display
O <sub>2</sub>	O <sub>2</sub> -value in %
ϑ-Komp	Temperature in °C
OFF	Position in %

### Programming

Programming of the RPO25... is menu driven, with the help of the AZW20.20 handheld terminal. To do this, the terminal must be connected to the RPO25... with a cable. As the handheld terminal is connected, the programming function is automatically put into operation.

Flashing of the respective fuel LED (1 or 2) indicates that the programming function has been activated.

#### Programming can be done at any time.

During burner operation it is also possible to trigger a measurement to automatically ascertain the oxygen control parameters.

The basic positions and the control parameters must be programmed separately for each type of fuel and each output point (5 or 9). In addition, it is possible to program the oxygen set values and the time interval from the moment the oxygen value stabilizes to the enabling of oxygen trim control.

All values can be programmed accurately and quickly and be stored several times in non-volatile memory (EEPROM). When replacing the RPO25..., the programmed values can be transferred to the new unit with the aid of the **RZD20** data carrier.

### Supervision

The RPO25... continually monitors the oxygen sensor and the operating sequence. In the event of inadmissible operational statuses or system malfunctions, warnings or alarms are delivered. The RPO25... differentiates between various types of malfunctions and their severity:

#### • Warnings (indication by error code)

Warnings are automatically cleared as soon as the error disappears. The readiness contact remains closed (message via the data interface).

Warnings can be triggered by the following errors, for example: Excess air, measuring cell of oxygen sensor too cold.

#### • Alarms (indication by error code)

Depending on the severity of the alarm, the RPO25... will trigger the following actions:

- Message via the data interface and shutdown of oxygen trim control. The readiness contact remains closed.
- Burner shutdown  
The readiness contact has opened.

Alarms must be cleared. This can be done either by pressing the reset button on the front of the unit (in the programming mode) or by switching the mains voltage off and on again.

Alarms can be triggered by the following errors, for example:

- Wrong position of the regulating unit,
- surpassed limit switch position, or
- measuring cell of oxygen sensor not connected.

In the event of a malfunction, the controller will provide the maximum amount of excess air as defined by the basic position. If this is not possible, the burner will be shut down.

All errors are displayed in clear text on a special level.

## Design Features

The PRO25... is designed in the form of a plug-in insert with European standard printed circuit boards (100 x 160 mm) and with two 32-pin DIN plugs, design D to DIN 41612.

The RPO25... is always supplied without a casing.

It requires **two** casings type ARG61... each using a 32-pin screw terminal base.

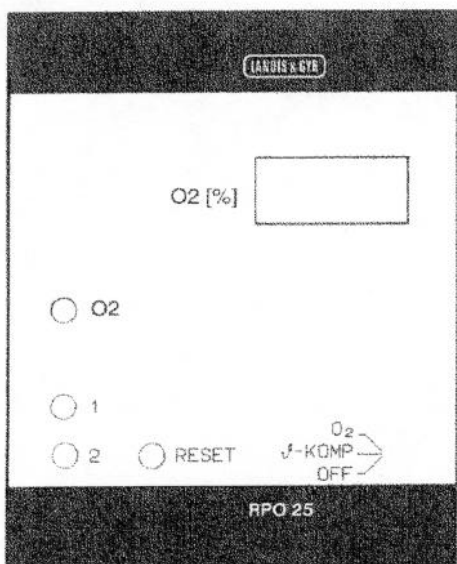
The casings must be **ordered separately** (refer to «Ordering»).

Casings type ARG61... are made of impact-proof plastic and have a hinged transparent front cover.

The ARG61... must be attached to one another with the help of clips (refer to Mounting Instructions M7850.1).

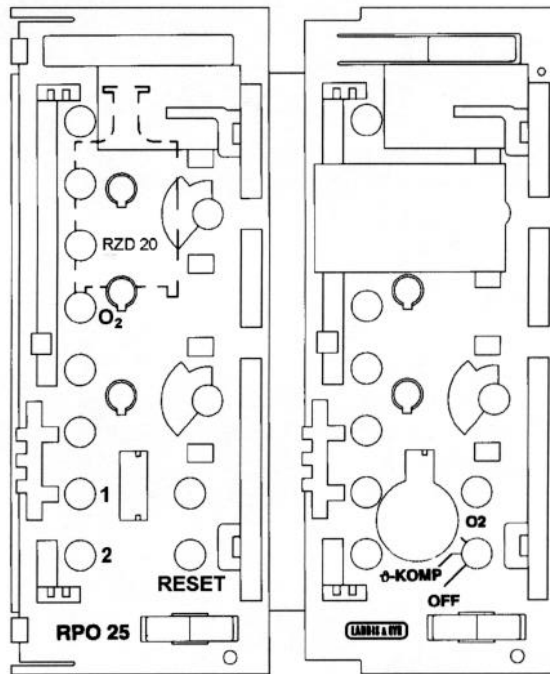
On the front of the unit are located:

- The hinged front plate
- The **plate can be sealed** to prevent unauthorized interventions via the handheld terminal
- The hole to fit the seal (on the front plate, on the left below the type reference)



- 3 LEDs for status indication
  - O<sub>2</sub>: Oxygen trim control enabled
  - 1: Fuel 1 active
  - 2: Fuel 2 active
- 7-segment display (3 digits) for the operating phases, oxygen values and indication of errors
- The reset button (refer to «Supervision»)
- The operating mode selector «O<sub>2</sub>/ϑ-KOMP/OFF» (refer to «Functions»)
  - O<sub>2</sub>: Oxygen trim control and ϑ-function active
  - ϑ-KOMP: Oxygen trim control switched off, only ϑ-function active
  - OFF: Oxygen trim control and ϑ-function out of operation; display of basic position

Behind the hinged front plate are located:



- The jack for the AZW20.20 handheld terminal
- The operating mode selector

The exchangeable RZD20 data carrier is located behind the plastic front. It is plugged in from above.

To do this, the RPO25... must be removed from its casing.

## Application and Commissioning Guide

For details on planning and application, also refer to the Data Sheets of the associated sensors (e.g. QGO20, QGO30, QAE21...) and actuators (e.g. SQN..., VKF...).

To commission the RPO25..., the AZW20.20 handheld terminal is required.

For the connecting terminals and their use, refer to «Wiring Diagram».

The technical data of the unit must be observed.

For additional information, refer to Product Information P7847 and the respective application sheets.

## Mounting Guide

When used with two casings type ARG61.01, the RPO25... is suitable for flush panel mounting, with two ARG61.04, it is suitable for wall mounting. If several modules are required, it is recommended to attach them together, using their clips to form a subassembly.

Various mounting accessories are available for other mounting modes, such as control panel mounting with a tilting console (several modules attached to one another).

When mounting the RPO25... in a control panel, its front should be visible, e.g. through a plexiglas window, so that the signal lamps and the display can be seen.

The screw terminal base must be mounted upside down with connection 32 facing upward and connection 2 facing downward.

The wiring must be made according to the plant wiring diagram.

**Mounting and installation must be in compliance with local and country-specific safety codes and standards.**

## Ordering

Oxygen trim control for modulating burners  
incl. plugged-in RZD20 data carrier  
(supplied without casing)

**RPO25.000A27**

Casing: Each RPO25... requires two casings  
– For flush panel mounting  
– For wall mounting

**2x ARG61.01**  
**2x ARG61.04**

Handheld terminal for programming,  
commissioning and service,

**AZW20.20**

incl. cable of 2 m  
Extension cable of 20 m for handheld terminal

**KF8859**  
**KF8860**

Data carrier (EEPROM)

**RZD20**

Conductive plastic potentiometers for actuators:

1000 Ω / 90°  
1000 Ω / 130°

**ASZ12.803**  
**ASZ12.833**

Oxygen sensor for plants operating  
on gas or light oil

**QGO20**

Flue gas collector for QGO20

**AGO20...**

Oxygen sensor for dirt-laden  
and aggressive flue gases

**QGO30...**

Accessory for QGO30

**AGO30...**

Correcting actuator for SKP70

**SQN37.401A278**

Temperature sensor LG-Ni-1000

**QAE21.2**

Temperature sensor Pt-1000

**QAE21.1**

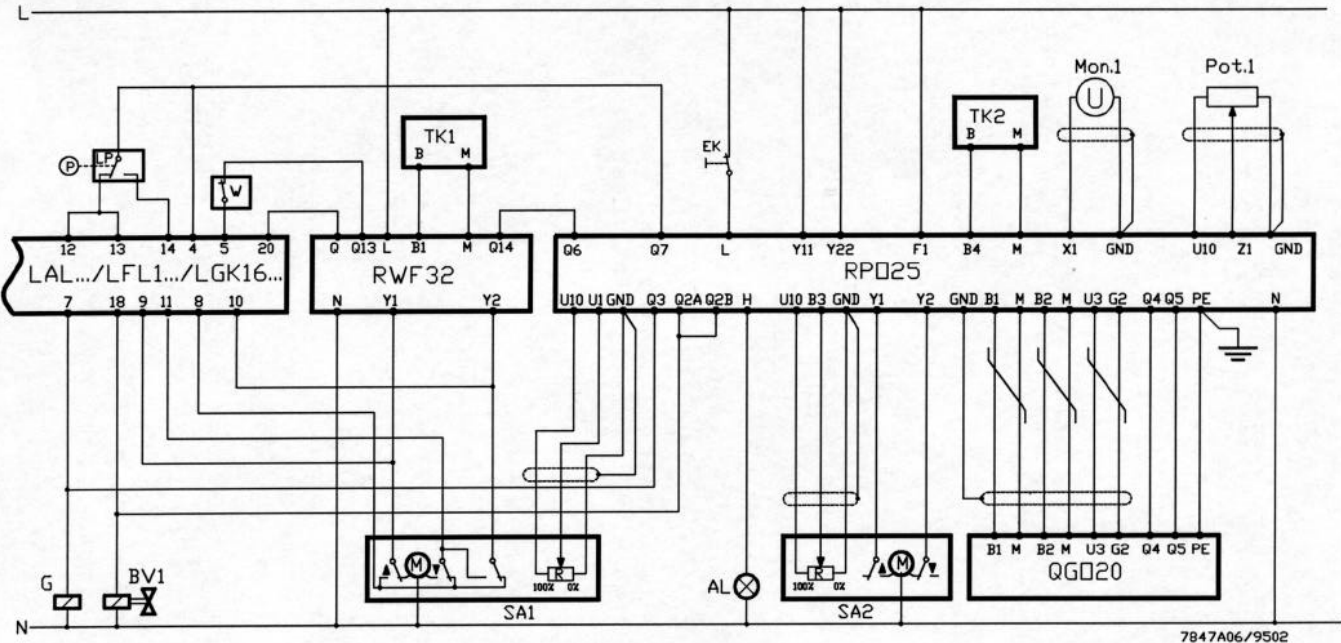
## Technical Data

Operating voltage	AC 230 V ±15%	Power supply for temperature compensation element G2:	
Frequency	50...60 Hz ±6%	– Voltage	DC 10 V
Power consumption (excl. sensor)	15 VA	– Current	< 1 mA
Switching capacity of relays Q6, Q7/H:		Terminal X1 (actual oxygen value)	DC 0...10 V = programmed oxygen range
– Voltage	AC 24...265 V	– Internal resistance	470 Ω
– Current at AC 230 V at AC 24 V	0.005...2 A 0.02...2 A	Terminal X2	DC 0...10 V
Switching capacity of control outputs Y1-Y11, Y2-Y22:		TxD terminal, RxD terminal	RS232 level 9600 baud 8 data bits, 1 stop bit, no parity bit
– Voltage	operating voltage	Oxygen measurement: (applies to measuring system GQO.../RPO25)	
– Current (max.)	0.005...2 A	– Oxygen measuring range	0.2...21% O <sub>2</sub>
Switching capacity of triac for oxygen sensor heating (Q4-Q5):		– Resolution	0.1% O <sub>2</sub>
– Voltage	operating voltage	– Measuring accuracy	±5% of measured value, but not better than ±0.2 % O <sub>2</sub> absolute
– Current (max.)	1.5 A	Supply air temperature sensor	Ni/Pt-1000 Ω
Safety low voltage inputs:		Potentiometer:	refer to «Ordering»
Terminal B1:		– Resistance	1000 Ω
– Voltage measuring range	DC -25...+125 mV	– Angular rotation	90...130°
– Voltage (max.)	DC ±15 V	Perm. running time of actuators	20...120 s
– Impedance	68 kΩ	Protection standard with ARG61...:	
Terminal B2:		– Front	IP42, DIN 40050
– Voltage measuring range	DC 0...33 mV	– Base	IP10, DIN 40050
– Voltage (max.)	DC ±15 V	Insulation class	II, VDE 0631
– Impedance	2 MΩ after DC +5 V	Perm. ambient temperatures	
Terminal U3:		– Storage	-25...+70°C
– Current measuring range	223...473 μA	– Operation	0...+60°C
– Voltage (max.)	DC ±15 V	Perm. ambient humidity	Klasse F, DIN 40040
– Impedance	10 kΩ	Radio interference protection	EN 55011
Terminal B3:		Connecting terminals for	2 x 1.5 mm <sup>2</sup> or 1 x 2.5 mm <sup>2</sup>
– Voltage	DC 0...10 V	Weight:	
– Impedance	130 kΩ	– With casing	1.34 kg
Min. damper position	DC 0.2 V	– Without casing	0.82 kg
Max. damper position	DC 9.8 V	Mounting position	optional
Max. humming voltage	AC 50 mV		
Terminal B4:			
– Voltage	DC 0...10 V		
– Impedance	130 kΩ		
Safety low voltage outputs:			
Terminal U10:			
– Voltage	DC 10 V		
– Current (max.)	20 mA		



# Application Example

Basic diagram of a burner plant with a modulating single fuel burner



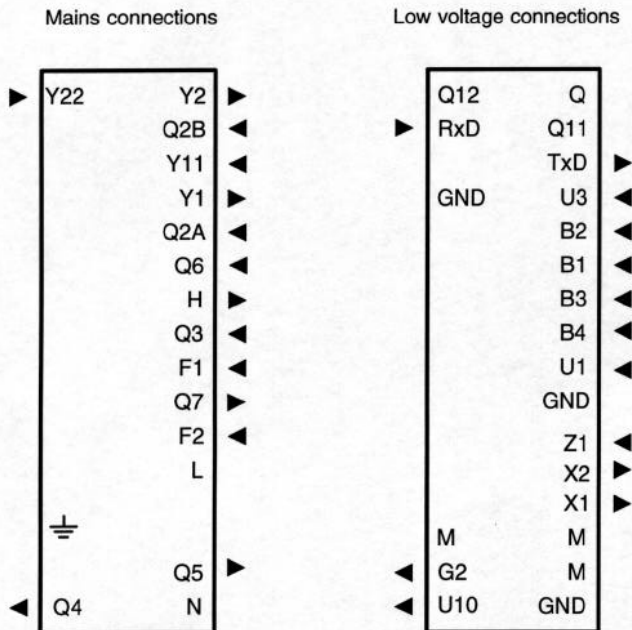
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- Legend:**
- |               |                                  |               |                     |
|---------------|----------------------------------|---------------|---------------------|
| P             | Feedback potentiometer           | V             | Fuel valve          |
| LP            | Air pressure monitor             | QAE.../QAD... | Temperature sensor  |
| W             | Limit thermostat or pressurestat | M             | Actuator            |
| EK            | Remote reset button for RPO25    | SA            | Air damper actuator |
| LFL.../LGK... | Burner control                   | R             | Potentiometer       |
| RWF32         | Boiler controller                | AL            | Remote alarm device |
| RPO25         | Oxygen trim control              | KA            | Correcting actuator |
| K1            | Auxiliary relay                  | QGO...        | Oxygen sensor       |

## Wiring Diagram

B1	Nernst voltage of oxygen measuring cell
B2	Thermocouple voltage
B3	Feedback signal from actuator
B4	Supply air temperature sensor
F1	Input fuel 1
F2	Input fuel 2
G2	Power supply for temperature compensation element
GND	Ground for feedback potentiometer, data output, and shielding
L	Live
M	Ground for B1, B2, and X1
N	Neutral
Q3	Control input burner requisition
Q2/A/B	Redundant input to enable burner operation
Q4	QGO... sensor heating
Q5	QGO... sensor heating
Q6, Q7/H	Readiness, alarms
TxD/RxD	Serial data output/input
U1	Input DC 0...10 V output signal
U3	Signal temperature compensation element
U10	Power supply for feedback potentiometer (DC 10 V)
X1	Output for actual oxygen value (DC 0...10 V)
X2	Output controlled variable DC 0...10 V
Y1	Control output OPEN, air damper actuator
Y2	Control output CLOSED, air damper actuator
Y11, Y22	Power supply for actuator
Z	Input oxygen set value air, DC 0...10 V
Q, Q11, Q12	Unused signal contacts

### Connecting terminals (viewed from the rear, wall mounting)

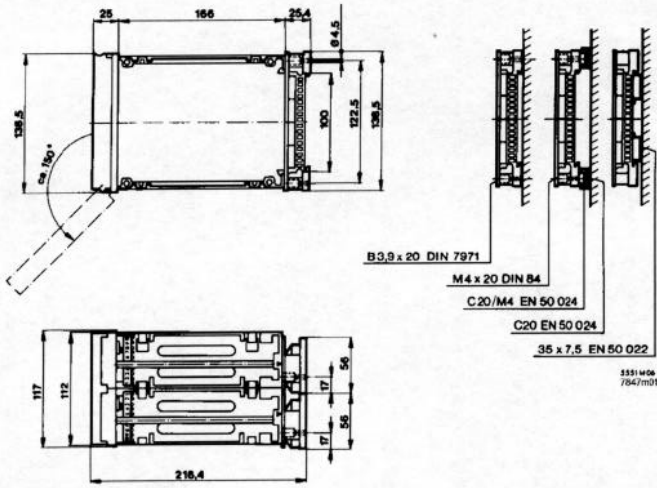


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# Dimensions

Dimensions in mm

2x ARG61.04



2x ARG61.01

