

Universal Controller

POLYGYR®
RWF32...



RWF32... with casing ARG61.01

The RWF32... is a universal digital boiler temperature / pressure controller designed for use in oil- and / or gas-fired heat generating plant.

The controller and this data sheet are intended for use by OEMs that integrate the RWF32... in their products!

Use

The RWF32... is designed specifically for the control of the boiler temperature or steam pressure in oil- or gas-fired heat generating plant.
It is also suited as a universal controller for other controlled variables.

Functions

The RWF32... is a combination of units with the following functions:

- **Digital PID controller** that acts on the modulating burner via its three-position output. Using an external operating mode selector, the controller can be switched over and used as a two-position controller for the control of a two-stage burner, for example for oil-firing of a dual-fuel burner
- Automatic **control thermostat (or pressurestat) function** in the burner's low-flame operation (with an adjustable reaction threshold for activating high-flame operation, which means low-flame priority)
- **Shift controller** for weather-dependent shifting of the setpoint
- **Minimum limiter** for the boiler temperature, in the case of weather-dependent shifting of the setpoint

Mechanical design

The RWF32... is supplied as a plug-in unit with coding plates and labels.

Type references

- AC 230 V version **RWF32.000**
- AC 110 V version **RWF32.000A17**

Casings, to be ordered as **separate items**

- For control panel mounting
 - Individual casing **ARG61.00**
 - Casing (attachable) **ARG61.04**
- Flush panel mounting (attachable) **ARG61.01**

The front of the casings is protected by a transparent plastic cover, which can be swung downward. The terminal base is at the rear.

The controller is matched to the controlled variable and the required setpoint setting range by means of **setting range inserts**, which carry the setpoint setting scale. The setting unit is an integral part of the controller, but switching over to a remote setting unit is possible.

All the other setting elements are easily accessible and located behind the unit's front plate. The control parameters can be set and fine-tuned while the burner is running. The settings are analog and can be read directly although the controller provides digital operation.

LEDs on the front of the unit indicate the following operational statuses:

- Control ON/ OFF
- The positioning pulses OPEN and CLOSE for the actuator of the burner's air damper with modulating burner control, or "Stage I" / "Stage II" in the case of two-stage burner control

The digital display below the LEDs shows the deviation of the actual value from the setpoint as a percentage of the range insert's setting range. If a deviation exceeds + 19 % or - 19 %, symbols «□» and «┘» appear in place of digits. Measurements and displays are made at 2-second intervals and in increments of 1 %.

Technical data

Operating voltage	AC 230 V ±15 % AC 110 V -15 % / +10 %	Neutral zone selectable with jumper NZ 1 % or 2 %* (factory setting: 1 %)	
Frequency	50...60 Hz	Slope	0...3
Power consumption	4.5 VA	Reaction threshold for switching over to high-flame operation, Q	1...33. integral of control deviation (in K) x time (in s)
Safety extra low voltage	24 V	Recommended running time of actuator	15...60 s
Safety class	II to VDE 0631	Protection standard of casing	
Perm. loading of control outputs (relays K1...K3)		- Front	IP42, DIN 40050
- For up to 2 x 10 ⁵ switching cycles	2 A, AC 24...240 V	- Base	IP10, DIN 40050
- For up to 10 ⁷ switching cycles	0.1 A, AC 24...240 V	Mounting position	optional
Radio interference protection	N to VDE 0875	Terminals for	2 x 1.5 mm ² or 1 x 2.5 mm ²
Proportional band Xp	3.7...150 %*	Weight	
Integral action time tN	20...250 s	- Without casing	410 g
Derivative action time tv (D-part)	0...5, (with no unit)	- With casing	760 g
Switching differential SD	3...19 %*	CE conformity	
Environmental conditions:		According to the directives of the European Union	
- Transport	IEC 721-3-2	Electromagnetic compatibility EMC	89/336 EEC incl. 92/31 EEC
Climatic conditions	class 2K2	Gas appliance directive	90/396 EEC
Temperature range	-50...+60 °C	Emissions	EN 50081-1
Humidity	< 95 % r.h.	Immunity	EN 50082-2
Mechanical conditions	class 2M2		
- Operation	IEC721-3-3		
Climatic conditions	class 3K5		
Temperature range	-20...+60 °C		
Humidity	< 95 % r.h.		
	Condensation, formation of ice and ingress of water are not permitted		

* % of setting range of setting range insert AZW61...

Warning notes

- **If the geographical areas where DIN standards are in use, the installation must be in compliance with VDE requirements, particularly with the standards DIN / VDE 0100 and 0722!**
- **All regulations and standards applicable to the particular application must be observed!**
- **Installation and commissioning work must always be carried out by qualified personnel!**
- **The electrical wiring must be made in compliance with national and local standards and regulations!**
- **Burner ignition cables must always be laid separately, maintaining the greatest possible distance to the unit and other cables!**
- **Check wiring carefully before putting the unit into operation!**
- **The RWF32... must be completely isolated from the mains before performing any work on it!**
- **Ensure protection against electric shock on the unit and on all electrical connections through appropriate mounting!**
- **Electromagnetic emissions must be checked from an application point of view!**

Function of the controller when used for burner control

Control thermostat or pressurestat function

When controlling the burner in low-flame operation, the RWF32... basically operates like a control thermostat or pressurestat, that is, it operates as a two-position controller, maintaining the setpoint by switching the burner on and off. To do this, the controller closes the start control loop at terminals Q13 and Q14, which causes signal lamp «0 - I» to light up. The switching differential for this two-position operation can be adjusted within a wide range. This means that the burner's switching ratio can be selected such that low wear operation will be assured.

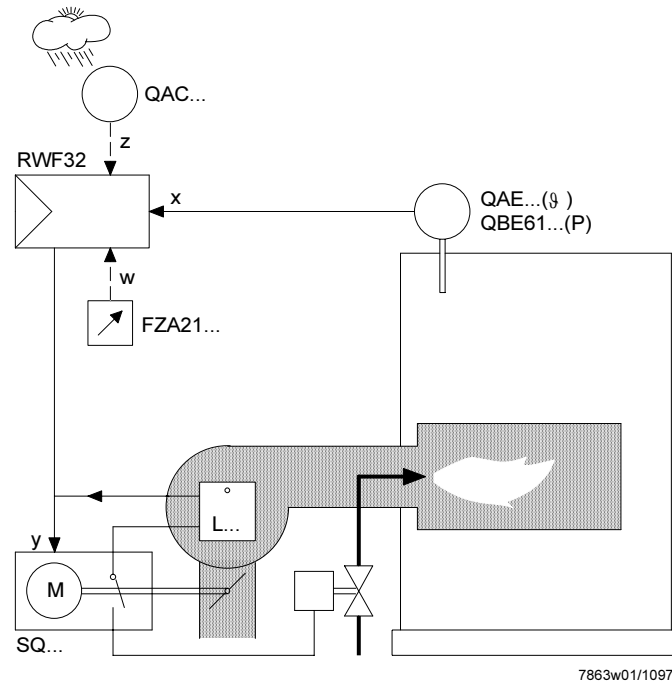
If, during on / off operation, the demand for heat increases, causing the actual value to occasionally drop below the switch-on limit (S_{don}) of the selected switching differential, the controller does not immediately switch to high-flame operation, but first checks and ascertains the dynamics of the control deviations and switches to high-flame only when an adjustable limit - the reaction threshold «Q» - is exceeded («Q» is the integral of the control deviation(s) x time). This adjustable reaction threshold is another feature of the RWF32... aimed at reducing the burner's switching ratio if permitted by the control accuracy called for. The function diagrams on the next pages give more details.

Changeover of operating mode

With an AC 230 V signal fed to terminal «L9», it is determined if, in high-flame operation («Q» exceeded), the RWF32... provides modulating («L9» = 0 V) or two-stage («L9» = AC 230 V) operation. As a modulating controller, the RWF32... operates as a PID controller with a three-position output.

Two-stage two-position control

In two-stage operation, the selected switching differential «SD» also determines the switching on and off of the second stage, which is indicated by signal lamps «I» and «II». Half of the selected switching differential lies above and half below the setpoint. When the load decreases, the burner will be shut down as soon as the actual value exceeds the setpoint by the **total** of the switching differential.



Operating principle. For connection of fuel valves, refer to "Connection diagram"

Modulating control

With modulating control - in contrast to two-position control - one third of the selected switching differential «SD» lies below and two thirds lie above the setpoint. If the same ratio as with two-position control is required (fifty / fifty), wire link «B2» on the printed circuit board must be cut away. Also, in the case of modulating control, an adjustable neutral zone «NZ», which is 1 % or 2 % of the range insert's setting range, is active. If control deviations exceed the neutral zone, the controller's microprocessor ascertains not only the direction of the positioning pulses (indicated by the signal lamps «▲» and «▼»), but also their optimum duration, down to pulse durations of 1/10 second.

Adjustable are the P-band, and the derivative and integral action times. Also, as with two-position control, the controller continuously indicates the deviation of the actual value from the setpoint (as a percentage of the range insert's setting range) so that the plant operator always obtains a clear picture of the accuracy and stability of the control.

If, during modulating burner operation, the actual value exceeds the switch-off limit of the selected switching differential, the controller will shut the burner down and resume control operation only when the actual value falls again below the switch-on limit, starting with the control thermostat or pressurestat function, that is, in low-flame operation.

If, however, after a long off period, for example, the control deviation is more than **twice** the selected switching differential, modulating operation will start immediately. This, of course, applies analogously to the above described two-stage burner.

Function as a universal controller

To provide this function with a freely selectable detector / setting range insert combination of the POLYGYR control system, plug «J1» on the controller's printed circuit board must be removed. Potentiometer «Q», which is required for burner control, is put out of operation by the same action. This means that over the entire control range, the RWF32... now operates as a PID controller with a three-position output and an adjustable neutral zone, which is 1 % or 2 % of the setting range insert's range. The manipulated variable is increased via terminal «Y1», and decreased via terminal «Y2».

When using this function, relay «K3» becomes a limit value signalling device. Its contact closes (signal lamp «0 - I» lit) when the actual value falls below the switch-on limit of the selected switching differential and reopens only when the actual value reaches the switch-off limit. One third of the selected switching differential lies below the setpoint and two thirds lie above it. When wire link «B2» is cut, the ratio is fifty / fifty.

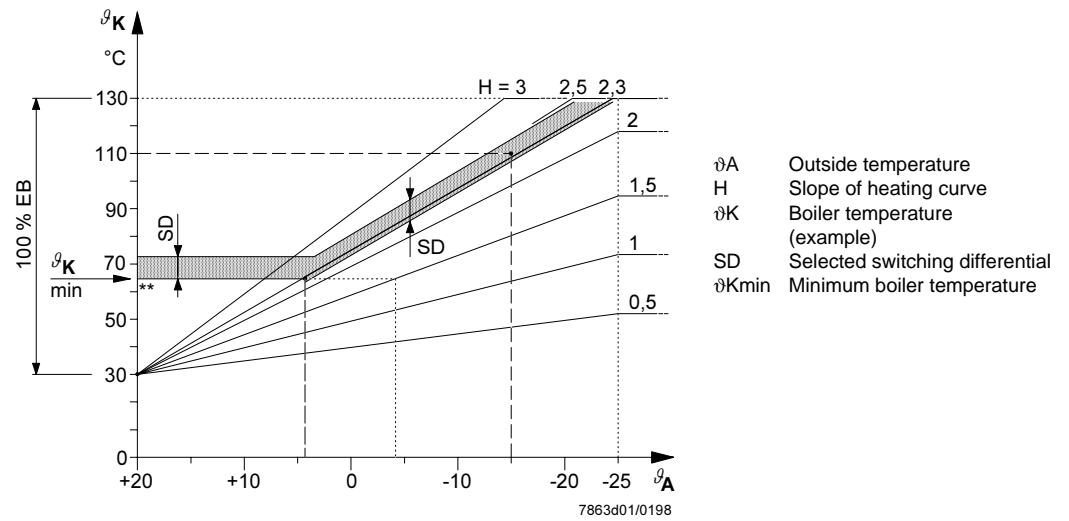
External setpoint shift

External setpoint shift can be accomplished by feeding a DC 0...10 V signal to terminal «Z1 / M». In that case, the setpoint setting slider must be set to «ext».

At +5 V, the authority is 0 %. An increase of 1 V raises the setpoint, the shift being 10 % of the setting range insert's range, a decrease of 1 V lowers the setpoint by 10 %. In the case of weather-dependent setpoint shift, a signal at terminal «Z1» will not, however, change the compensation curve, but the minimum limit value set with the slider of the setting range insert!

Weather-dependent setpoint shift

Weather-dependent setpoint shift is activated as soon as the QAC... outside detector is connected. The lower reference value is not adjustable and represents the "pivot" for the heating curve. Potentiometer «H» is used to set the slope of the heating curve. With weather-dependent setpoint shift, the slider of the setting range insert is used for setting the minimum limitation (e.g. the minimum boiler temperature), whereby the value set (level of **switch-on limit**) represents the selected switching differential.

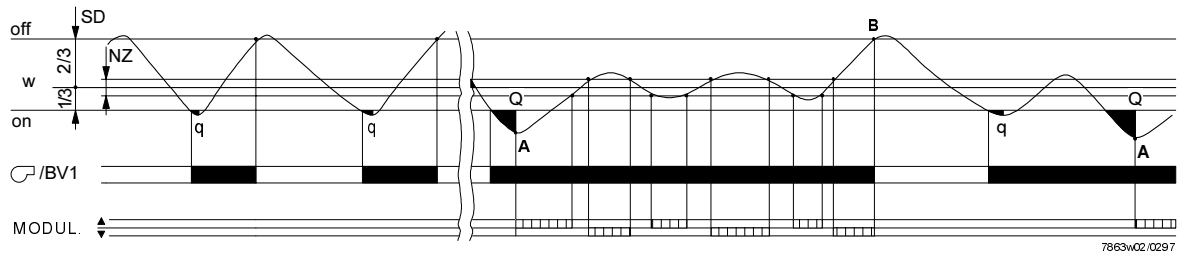


Setting range of heating curve slope with weather-dependent shifting of setpoint by the QAC... outside detector in connection with the setting range insert AZW61.113-t30/130 (example). The lower setting value of the setting range insert determines the "pivot" of the heating curve (at 30 °C in the above example).

** Characteristic of curve when potentiometer «H» is set to 2.3 and minimum limitation of boiler temperature is set to 65 °C (with setpoint setting slider)

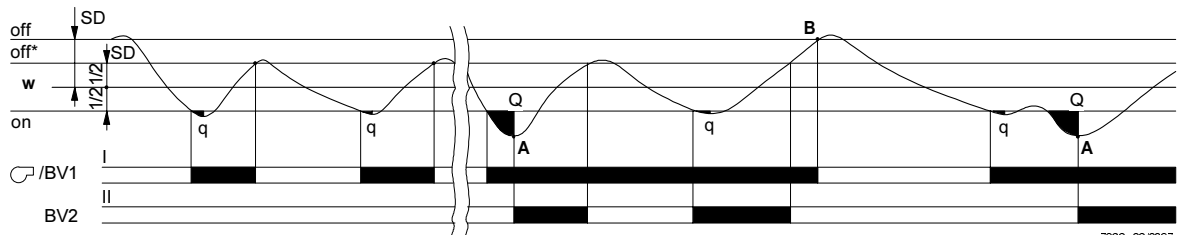
Function diagrams

Modulating (PID) control (e.g. for modulating burner), with automatic on / off function in low-flame operation.



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Two-position control, two-stage, e.g. for two-stage oil-fired burner



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The diagrams show the control thermostat / pressurestat function on the left (on / off operation).

Since the control deviations «q» remain under the reaction threshold «Q» set on the controller, switchover to high-flame operation (two-stage or modulating) will **not** take place.

When the actual value falls repeatedly below the switch-on threshold, the controller **adds up** the «q»-deviations and switches over to high-flame when the set «Q»-value is reached. However, if the setpoint is reached in low-flame operation, the counter will be reset to zero.

At «A», the set reaction threshold is reached and the controller immediately switches to high-flame operation, e.g. it changes to modulating control (top) or two-stage burner control (bottom).

This modulating or two-stage burner control will remain operative until the actual value exceeds the setpoint by the value of the set switching differential - independent of the extent of further control deviations. This means burner and control are switched off at «B».

Automatic burner restart as soon as the actual value falls below the switching differential. Another change to modulating or two-stage burner control is made at «A», because reaction threshold «Q» is again exceeded.

w Adjusted setpoint
SD Selected switching differential
NZ Neutral zone with PID control

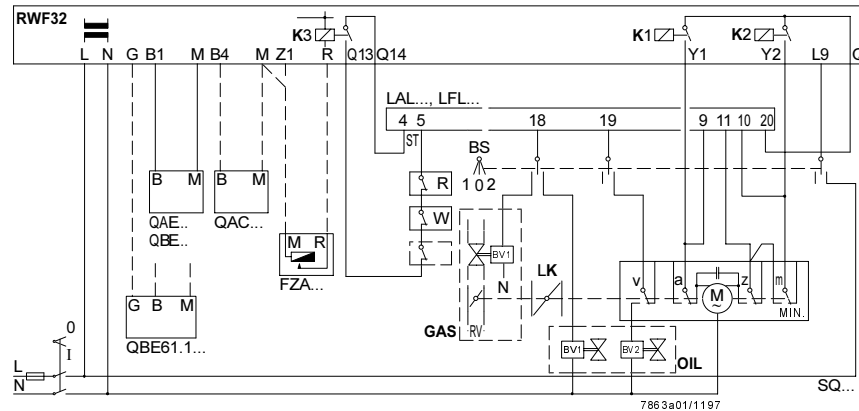
on Burner on
off* Stage I or II off
off Burner off

Connection diagram (basic diagram)

For temperature or pressure control in connection with a dual-fuel burner. Burner control and supervision are provided by a burner control LAL... or LFL... (example).

Note

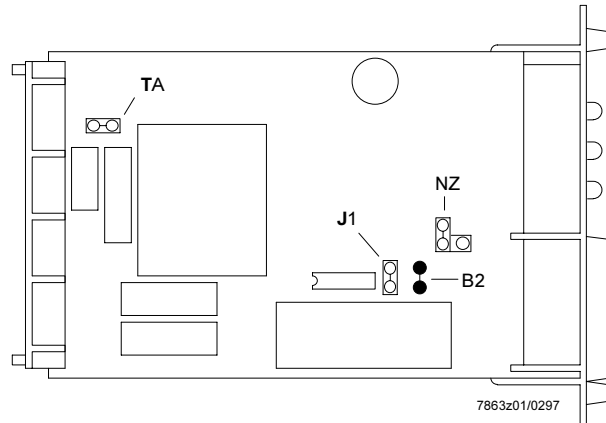
- The AC 24 V power supply available at terminals «G» and «M» may only be used for powering the QBE61.6... pressure detector!
- The voltage for the control signal at terminal «L9» must be picked up at terminal «L»
- Loads, such as signal lamps, relays, hours run meters, etc., may not be connected to terminal «L9»!



Legend

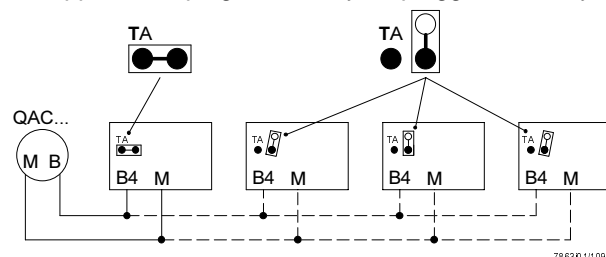
a	Limit changeover switch for air damper position fully OPEN	QAC...	Outside detector for weather-dependent shifting of setpoint
BS	Operation selector 1 = gas (modulating burner control) 2 = oil (2-stage burner control)	QAE...	Immersion temperature detector
BV...	Fuel valve	QBE...	Pressure detector
FZA...	Remote setting unit (becomes operative when setting the built-in setting unit to «ext»)	R	Boiler control thermostat or pressurestat
K1, K2	Output relays for the control loop's regulating unit (in this case: actuator)	RV	Gas regulating damper
K3	Limit value relay (potential-free)	SQ...	Actuator of burner's air damper and gas control damper
L...	Burner control	ST	Connections of burner control's start control loop
LK	Burner's air damper	v	Auxiliary changeover switch for the release of the second fuel valve depending on the position of the air damper
L9	See «BS»	W	Thermal (or manual) reset limit thermostat or pressure monitor
m (MIN)	Auxiliary changeover switch for the control of the flow-flame stage	z	Limit changeover switch for the fully CLOSED position of the air damper of air / fuel ratio control
Z1	Input terminal for reference signal from building automation system or similar		

Location of plugs «TA», «J1» and «NZ» mentioned in the text, and of wire link «B2» on the controller's printed circuit board



- B2 Wire link for changing the level of switching differential SD in relation to the setpoint with PID control (B2 cut away = $\frac{1}{2}$ - $\frac{1}{2}$ in place of $\frac{1}{3}$ - $\frac{2}{3}$; refer to text)
- NZ Plug for neutral zone 1 % or 2 %
- TA When connecting the QAC... outside detector to several (max. 4) controllers in parallel, plug «TA» may be plugged into only one of the controllers
- J1 When using the RWF32... as a universal controller, plug «J1» must be removed, thus making potentiometer «Q» inoperative

The signal delivered by the QAC... outside detector may be fed to a maximum of four RWF32... controllers (parallel connection to controller terminals «B4» and «M»). With this application, plug «TA» may be plugged into only **one of the controllers!**



Setting range inserts

The setting range inserts are used for determining the controlled variable and the setting range of the RWF32.... controller. If the controlled variable required lies within the range of several setting range inserts, the insert with the narrowest range is to be used. For example: a boiler temperature of 180 °C requires a setting range of 100...200 °C, and not 0...250 °C!

Controlled variable	Setpoint setting range	Setting range insert Type reference
Temperature	0...130 °C	AZW61.117-t130
	30...95 °C	AZW61.131t95
	30...130 °C **	AZW61.113-t30/130
	100...200 °C **	AZW61.118-t100/200
	0...250 °C	AZW61.114-t250
	150...450 °C *	AZW61.115-t450
Pressure	0...0,5 bar	AZW61.292-p0,5
	0...2 bar	AZW61.292-p2
	0...10 bar	AZW61.292-p10
	0...20 bar	AZW61.292-p20
	0...40 bar	AZW61.292-p40

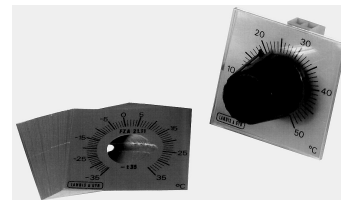
* For non-Landis & Staefa products using sensing elements Pt 1000 Ω

** 1 °C = 1 % EB (range of setting range insert)

Refer to data sheet 3428

Remote setting unit

The remote setting unit becomes automatically active when the setting unit integrated in the controller is set to «ext». Designed for flush panel mounting, measuring 48 x 48 mm. Angular rotation can be locked and limited. The remote setting unit is supplied with a set of scales for all measuring ranges.



Refer to data sheet 1981

FZA21.11

Temperature detectors

Sensing element: Ni 1000 Ω/0 °C
Pt 1000 Ω/0 °C

E.g. type reference	QAC22...	outside detector	refer to data sheet 1811
	QAE22...	temperature detector	refer to data sheet 1791
	QAD22...	clamp-on detector	refer to data sheet 1801

Pressure detectors

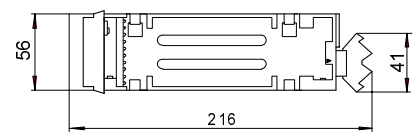
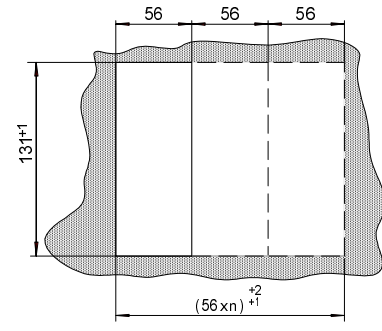
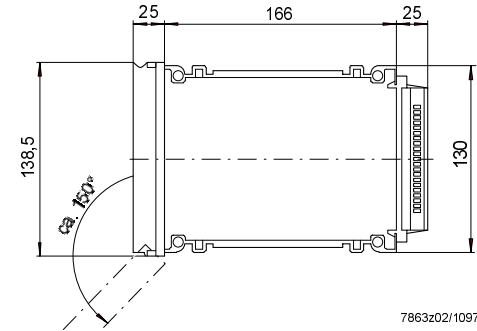
Use	Measuring range	Overload-proof up to	Type reference
Water (pH max. 10)	0...0.5 bar	0.75 bar	QBE61.1-p0,5
Water vapour	0...2 bar	3 bar	QBE61.1-p2
Compressed air and similar	0...10 bar	15 bar	QBE61.1-p10
with a linearized signal DC 0...10 V	0...20 bar	30 bar	QBE61.1-p20
	0...40 bar	60 bar	QBE61.1-p40
Water trap pipe			4 286 1652 0

Refer to data sheet 1901

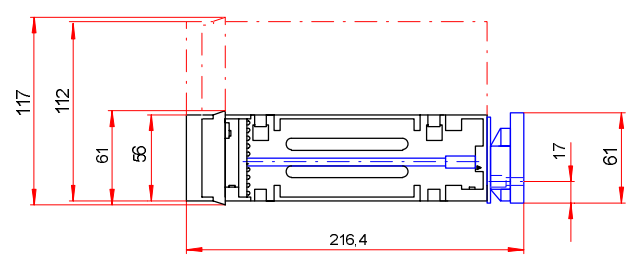
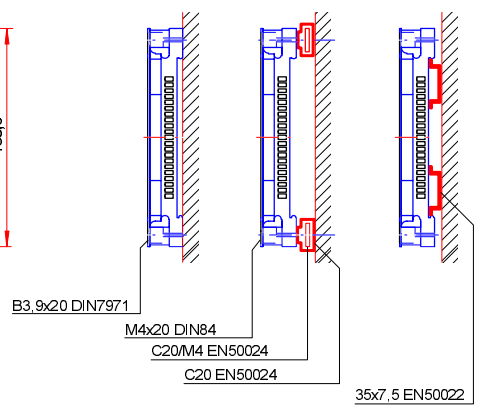
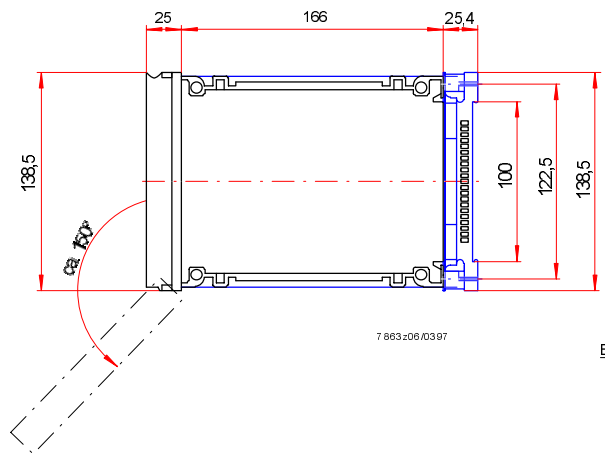
Dimensions

Dimensions in mm

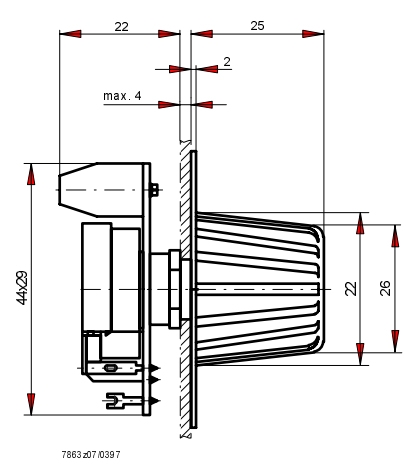
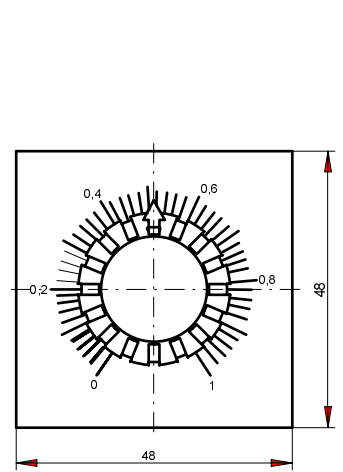
RWF32.000/ARG...



AR G61.01



ARG61.00, ARG61.04



FZA21...

