

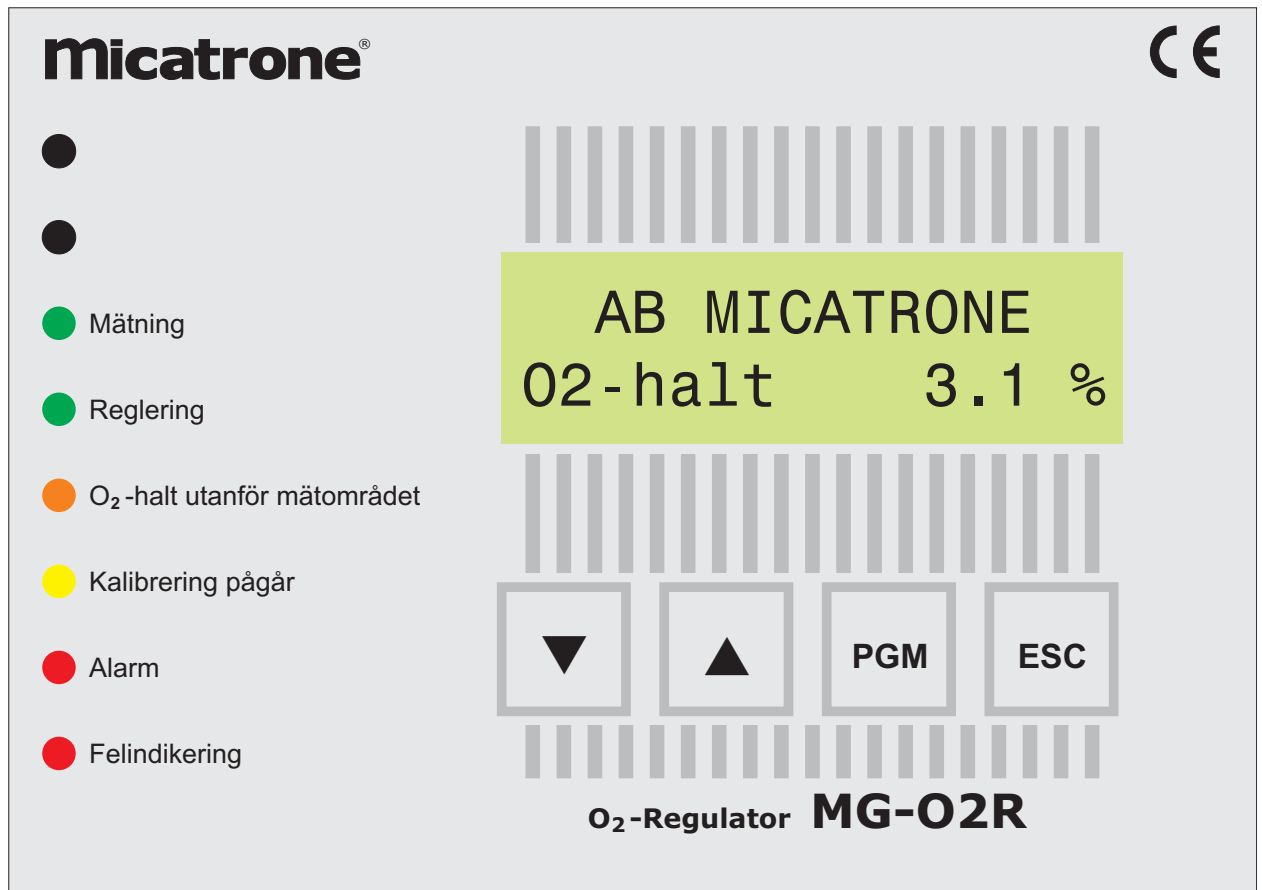
### Oxygen (O<sub>2</sub>) Controller and Analyzer with comprehensive monitoring

### MG-O2R

Version 3

Mi-233gb / 2009-06-12

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## USE

MG-O2R is intended for measuring the O<sub>2</sub>-content in flue gases from oil-fired boilers and bio-fired boilers. The MG-O2R has a built-in O<sub>2</sub>-controller developed for optimizing the air-to-fuel ratio. The result is that the highest possible technical performance of the combustion is obtained which also can be retained over time, independent of changes in the fuel composition or in the combustion intake air.

The Lambda-sensor is mounted directly into the flue gas duct after the boiler and the design makes it easy to have the sensor placed in the centre of the flue gas flow. Calibration can be done directly in ambient air without the use of a reference gas. Mounting and operating are as simple as for any ordinary temperature sensor installation.

The O<sub>2</sub>-measuring system consists of three parts, the Lambda-sensor, the signal converter and the central unit.

The Lambda-sensor includes the actual sensor with its heating element, a Ø15 mm probe with flue gas flow chamber and an adjustable fitting for positioning the probe inlet inside the duct.

The signal converter consist of electronics for converting and amplifying the signal from the Lambda-sensor to the central unit. The central unit includes the main electronics with analogue input/output, relay output for alarm function and the operating panel. All functions in the central unit are managed and monitored with an on-board micro controller.

With the operating panels display, all current values, control signals and all set parameter values can be read.

The operating panel also includes 6 function LED diodes for indicating the most common operating status or functions.

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This instruction is valid for MG-O2R with 30 terminals.

If your controller has 26 terminals, you own an older model, please contact Micatrone to obtain an instruction for that controller.

Our address and phone numbers are found on the last page.

## FUNCTIONS

### Measuring values

#### O<sub>2</sub>-content

MG-O2R measures the O<sub>2</sub>-content in the flue gas using a Lambda-sensor. The measuring range can be selected for 0...5%, 0...10% or 0...20% O<sub>2</sub>.

The selected range will also act as the MG-O2R control range and as the measuring range for the actual O<sub>2</sub>-content output signal.

The smallest measurable O<sub>2</sub>-content is 0,4%.

Par.no:	Description	Range	Value
O2-halt			
9	Mätområde	0..5% 0..10% 0..20%	0..10%
72	Lambdasond	NEJ JA	NEJ

When the burner shuts off, the Lambda-sensor supply voltage also shuts off to save the sensors EOL. When the burner starts again a delay of approx. one minute can be expected before the correct O<sub>2</sub>-content is displayed. A green function LED indicates that the measuring of the O<sub>2</sub>-content is activated.

For an accurate reading of the O<sub>2</sub>-content, the sensor should be calibrated before use. Calibration can be performed in ambient air, see page 23.

Instead of a Lambda-sensor, a secondary O<sub>2</sub>-measurement equipment can be used for calibration. In this case the output signal from the equipment must be 4...20mA.

Par.no:	Description	Range	Value
O2-halt			
9	Mätområde	0..5% 0..10% 0..20%	0..10%
72	Lambdasond	NEJ JA	JA

#### CO<sub>2</sub>-content

When knowing the O<sub>2</sub>-content, the CO<sub>2</sub>-content in the flue gas can be calculated. To use this function the maximum CO<sub>2</sub>-content for the present used fuel must be programmed into parameter 70.

Par.no:	Description	Range	Value
System inst.			
70	Max CO2	0,0...20,0	15,5

#### Flue gas temperature

The temperature of the flue gas is measured using a Pt-100 sensor. The range is 0...400 °C.

The measurement also operates during burner stops and no additional programming has to be done.

#### Combustion intake air

The temperature of the combustion intake air is measured using a Pt-1000 sensor. The measuring range is -30...+80 °C. Measuring the combustion intake air is not compulsory. If measurement is missing, parameter 11 must be set to off (AV), and an estimated temperature can be programmed into parameter 12.

Set parameter 11 to "Pt-1000" to activate the measurement of the combustion intake air.

Par.no:	Description	Range	Value
Lufttemperatur			
11	Mätning	AV Pt-1000	AV
12	Antag temp.	-30...80	25

#### Combustion performance

When knowing the O<sub>2</sub>-content, flue gas temperature and the combustion intake air temperature, the level of the overall performance in the combustion efficiency can be calculated. The fuel constant according to Siegerts formula and the max. CO<sub>2</sub>-content for the present fuel must be programmed into parameter 69 respectively parameter 70.

Par.no:	Description	Range	Value
System inst.			
69	Bränsle K	0,00...2,00	0,59
70	Max CO2	0,0...20,0	15,5

#### Capacity

When using stage burners, the display shows which stage (Steg) that is activated or if the burner is stopped; "Steg 1", "Steg 2", "Steg 3" or "Stoppad". Parameter 13, "Insignal" (input signal) must be set to "AV" (OFF) position. A 230 VAC activating signal should be connected through the solenoid valves for each stage to the MG-O2R.

When using modulating burners, the position of the actuator is displayed as a value between 0 and 100%, where 0% is the min. load and 100% is the max. load. MG-O2R has a 10 volt supply voltage used for connecting the actuators potentiometer direct to the analogue input on MG-O2R. Parameter 13, input signal, must be programmed to "0...10V" if using a potentiometer.

With other analogue input signal (Volt or mA), parameter 13, must be programmed for the correct signal type and range. DIL-switch on the circuit board must also be set for the selected signal type. See page 14.

Par.no:	Description	Range	Value
Kapacitet			
13	Insignal	AV 0..10V 2..10V 0..20mA 4..20mA	AV

## Control functions

### General

MG-O2R includes a continuous O<sub>2</sub>-controller for the O<sub>2</sub>-content control. The control range can be selected between **0...5%**, **0...10%** or **0...20%**.

Par.no:	Description	Range	Value
O2-halt			
9	Mätområde	0..5% 0..10% 0..20%	0..10%

Programming parameter 24 to "JA" (YES) activates the O<sub>2</sub>-controller. Programming parameter 24 to "NEJ" (NO) will make the MG-O2R acting merely as an O<sub>2</sub>-measurement meter.

If the O<sub>2</sub>-controller is activated it will turn on and shut off in conjunction with the burner. A green LED indicates that the controller has started.

When executing a calibration of the lambda-sensor, the O<sub>2</sub>-controller will automatically be inactivated and parameter 24 will be set to "NEJ". After completed calibration, parameter 24 must be manually set to "JA" for the O<sub>2</sub>-controller to activate again.

The neutral zone (parameter 29) is expressed in percent units (%) of the selected range. If, for example, the range is 0...5% and the neutral zone is set to 4 percent units (%), this will result in a neutral zone of  $5 * 0,04 = 0,2\%$  O<sub>2</sub>, divided 50/50 (0,1%) on each side of the set O<sub>2</sub> value.

Parameter 34 sets the direction of the output control signal. "DIREKT" (DIRECT) will result in an increasing control signal when the O<sub>2</sub>-content increases. "OMVÄND" (REVERSE) gives the opposite control signal.

Par.no:	Description	Range	Value
O2-regulator			
24	Aktiv	NEJ JA	NEJ
27	P-band	0...9999	50
28	I-tid [s]	0...999	300
29	NZ [%]	1...50	1
34	Riktning	DIREKT OMVÄND	OMVÄND

There is also the possibility to manually set the control signal from the O<sub>2</sub>-controller, see further on page 25.

### Stage burners

When using stage burners the controller has three set values, one for each power stage, which can be set individually. The set values are programmed into parameter 35, 36 and 37. An activation signal to the O<sub>2</sub>-controller for which stage is activated on the burner is done by connecting the

230 VAC signal of each stage solenoid valve to the O<sub>2</sub>-controller. The controller shifts automatically to correct set value for each change in the power stages.

When the burner is stopped, the controller also stops. The control signal is set to the start value, which is programmed into parameter 45. The start value should be set to obtain air excess when the burner is in the start procedure. When the burner is operating normally, an activation signal to the controller starts a set time delay before the controller begins to deflect with the O<sub>2</sub>-content to achieve the set value. The time delay can be set in parameter 46 and is used to have the pressure or air-quot control in balance before the O<sub>2</sub>-control begin. If a pressure or air-quot control is missing the time delay should be set to zero.

When the burner changes to another stage, the O<sub>2</sub>-controller stops for the set time delay in parameter 46. During the delay the control signal is set to the start value programmed in parameter 45.

When the O<sub>2</sub>-controller is activated again after a burner stop or stage change, the set value can deviate from the current O<sub>2</sub>-content. This difference causes the O<sub>2</sub>-controller to give a large P-pulse signal. This could set the entire control procedure to oscillate, which is not desirable. MG-O2R includes a control function to avoid this problem. The function is called "Bumpless" and uses automatically the current O<sub>2</sub>-content as the set value when the controller is activated. Then the set value successively return to the programmed set value for the current burner stage, and the large P-pulse is avoided. The time, in seconds, for the function to return to the set value is programmed in parameter 47.

Par.nor:	Description	Range	Value
O2-regulator			
35	Börvärde 1	0,0...20,0	6,0
36	Börvärde 2	0,0...20,0	5,5
37	Börvärde 3	0,0...20,0	5,0
45	Startvärde	0...100	100
46	Väntetid [s]	0...999	120
47	Bumpless [s]	0...999	60

## Modulating burners

For modulating burners and bio-fuel firing boilers, the O<sub>2</sub>-controller contains a table, which can store 10 different programmable set values. Together with each set value, the value of which valid capacity on the burner it equals, is programmed.

The capacity is programmed as a value between 1% and 99%, where 1% is the minimum load and 99% is the maximum load for the burner. If the capacity is between two set values, the controller will calculate a new value between the two set points in the table.

All 10 set values do not have to be used. To turn off a set value inside the table, the capacity is programmed to zero (0).

The set values do not have to be programmed in any order of significance since the O<sub>2</sub>-controller sorts them automatically by their value of capacity.

Par.no:	Description	Range	Value
Kapacitet			
14	Punkt 1	0...99	1
15	Punkt 2	0...99	10
16	Punkt 3	0...99	20
17	Punkt 4	0...99	30
18	Punkt 5	0...99	40
19	Punkt 6	0...99	50
20	Punkt 7	0...99	60
21	Punkt 8	0...99	70
22	Punkt 9	0...99	80
23	Punkt 10	0...99	90

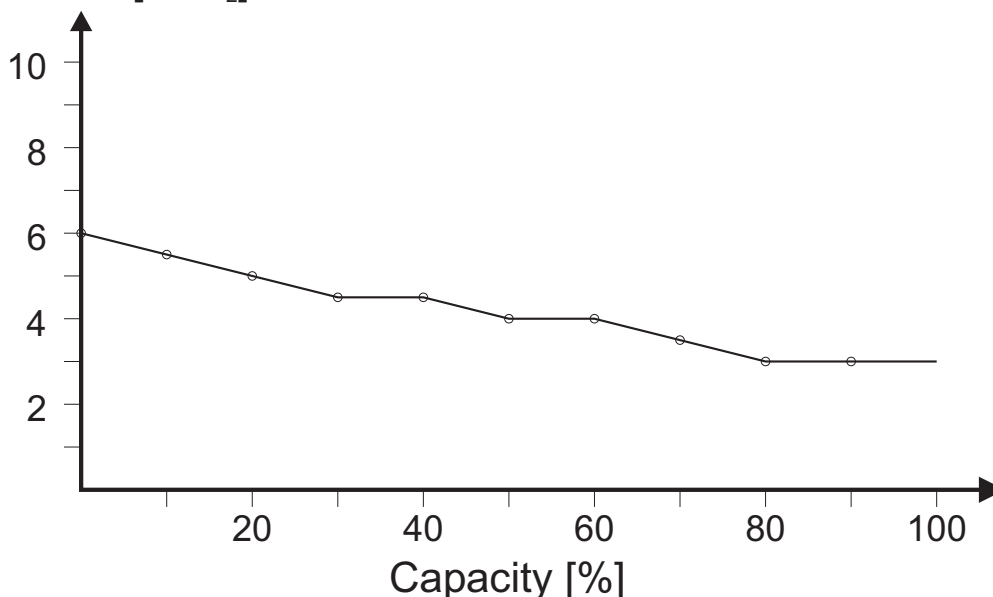
When the burner is stopped, the controller also stops. The control signal is set to the start value, which is programmed into parameter 45. The start value should be set to obtain air excess when the burner is in the start procedure. When the burner is operating normally, an activation signal to the

controller starts a set time delay before the controller begins to inflect with the O<sub>2</sub>-content to achieve the set value. The time delay can be set in parameter 46 and is used to have the pressure or air-quot control in balance before the O<sub>2</sub>-control begin. If a pressure or air-quot control is missing the time delay should be set to zero.

When the O<sub>2</sub>-controller is activated again after a burner stop, the set value can deviate from the current O<sub>2</sub>-content value. This difference causes the O<sub>2</sub> controller to give a large P-pulse signal. This could set the entire control procedure to oscillate, which is not desirable. MG-O2R includes a control function to avoid this problem. The function is called "Bumpless" and uses automatically the current O<sub>2</sub>-content as a set value when the controller is activated. Then the set value successively return to the programmed set value and the large P-pulse is avoided. The time, in seconds, for the function to return to the set value is programmed in parameter 47.

Par.no:	Description	Range	Value
O2-regulator			
35	Börvärde 1	0,0...20,0	6,0
36	Börvärde 2	0,0...20,0	5,5
37	Börvärde 3	0,0...20,0	5,0
38	Börvärde 4	0,0...20,0	4,5
39	Börvärde 5	0,0...20,0	4,5
40	Börvärde 6	0,0...20,0	4,0
41	Börvärde 7	0,0...20,0	4,0
42	Börvärde 8	0,0...20,0	3,5
43	Börvärde 9	0,0...20,0	3,0
44	Börvärde 10	0,0...20,0	3,0
45	Startvärde	0...100	100
46	Väntetid [s]	0...999	120
47	Bumpless [s]	0...999	60

Set value [% O<sub>2</sub>]



## Output signals

MG-O2R has two selectable output signals that can be connected to one measuring value or to the control output signal. The range for the output signal is as follows.

Mätsignal		Mätområde
O2-halt	Aktuell O <sub>2</sub> -halt	0...5 %, 0...10 % eller 0...20 % *
CO <sub>2</sub> -halt	Aktuell CO <sub>2</sub> -halt	0...15.5 % **
RökTmp	Rökgasttemperatur	0...400 °C
LuftTmp	Temperatur på förbränningsluft	-30...80 °C
n	Eldningsteknisk verkningsgrad	0...100 %
Kapac.	Kapacitet på brännare	0...100 %
O <sub>2</sub> -reg	Reglersignal från O <sub>2</sub> -regulator	0...100 %
*) Mätområdet väljs med parameter 9, Mätområde för O <sub>2</sub> -halt.		
**) Mätområdets max värde kan ändras med parameter 70, Max CO <sub>2</sub> .		

The output signals can be set between 0/2...10 Volt or 0/4...20 mA. The selection must be set with both the DIL switch on the circuit board, located on the right side of the connection terminal block, see page 14, as well as by programming of parameter 49 and 51.

Par.no:	Description	Range	Value
Utsignaler			
48	Källa 1	O <sub>2</sub> -halt CO <sub>2</sub> -halt RökTmp LuftTmp n Kapac. O <sub>2</sub> -reg	O <sub>2</sub> -halt
49	Signal 1	0..10V 2..10V 0..20mA 4..20mA	4..20mA
50	Källa 2	O <sub>2</sub> -halt CO <sub>2</sub> -halt RökTmp LuftTmp n Kapac. O <sub>2</sub> -reg	O <sub>2</sub> -reg
51	Signal 2	0..10V 2..10V 0..20mA 4..20mA	4..20mA

## Alarm

### General

Alarm is indicated with a red LED (light emitting diode) on the front panel and also in clear writing on the display. The alarm is self-locking and must be restored by pressing the ESC button on the front panel. The alarm can only be restored if the alarm condition no longer exists or if the burner has stopped. When an alarm has been restored, the display will indicate in clear writing the latest occurred alarm. Press the ESC button once to return to the default start menu.

MG-O2R has one potential-free changing relay for use as the alarm output signal. The relay is in activated position (powered) during normal operation (connection between terminal 8 and 10) and falls if an alarm occurs (connection between terminal 9 and 10).

### O<sub>2</sub>-content

MG-O2R monitors the O<sub>2</sub>-content and will alarm if the O<sub>2</sub>-content is too low, parameter 52, or too high, parameter 53. The value that is programmed is an allowed deviation in %-units to the set value for the O<sub>2</sub>-control.

The level of the overall performance in the combustion efficiency is monitored by parameter 54 and will raise an alarm condition if the level is below set limit.

The time delay, in seconds, for the alarm is programmed into parameter 55. For an alarm condition to be triggered, the deviation must exist during the entire time delay period.

The monitoring of the O<sub>2</sub>-content and the level of the overall performance of the combustion efficiency are only activated when the O<sub>2</sub>-control has started, see page 4. To turn off the monitoring entirely, respective parameters are programmed to zero (0).

Par.no:	Description	Range	Value
Alarm O <sub>2</sub> -halt			
52	Låg O <sub>2</sub>	0,0...20,0	2,0
53	Hög O <sub>2</sub>	0,0...20,0	3,5
54	Låg n	0,0...99,9	0,0
55	Fördröj [s]	0...999	120

## Flue gas temperature

MG-O2R monitors the flue gas temperature and alarms if the temperature is too high, parameters 56 to 65, or too low, parameter 66.

Stage burners use parameters 56, 57 and 58 for their respective stage. Modulating burners use a 10-point curve where the alarm limit for high flue gas temperature can be set to vary in conjunction with the present load on the burner. Compare to the O<sub>2</sub>-control on page 5.

The time delay, in seconds, for the alarm is programmed into parameter 67. For an alarm condition to be triggered, the deviation to the set value must exist during the entire time delay period.

The monitoring of the flue gas temperature is only activated when the burner has started. To turn off the monitoring entirely, respective parameters are programmed to zero (0).

Par.no:	Description	Range	Value
Alarm rökgastemp			
56	Hög temp 1	0...400	0
57	Hög temp 2	0...400	0
58	Hög temp 3	0...400	0
59	Hög temp 4	0...400	0
60	Hög temp 5	0...400	0
61	Hög temp 6	0...400	0
62	Hög temp 7	0...400	0
63	Hög temp 8	0...400	0
64	Hög temp 9	0...400	0
65	Hög temp 10	0...400	0
66	Låg temp	0...400	0
67	Fördröj [s]	0...999	120

## Communication

A communication module (accessory) can be mounted to the circuit board inside the MG-O2R to achieve data communication possibilities with the unit, using a RS-485 interface (2-wire current loop).

There is also a RS-232 serial adapter available as accessory. The adapter is intended for temporary use during installation and tuning and do not require that the communication module has been installed. Only one interface (RS-485 or RS-232) can be used at the same time.

The protocol used, to communicate with the unit, is Comli. Parameters and measuring values can be read with message type 2 and new values for parameters are transmitted using message type 0. The Comli number is the same as the parameter number. Data communication can be restricted to "read only" (parameter 8="JA").

Par.no:	Description	Range	Value
Kommunikation			
4	Adress	1...247	21
5	Platskod	0...32767	0
6	Språk	COMLI	COMLI
7	Baud	600 b 1200 b 2400 b 4800 b 9600 b	4800 b
8	Skyddad	NEJ JA	NEJ

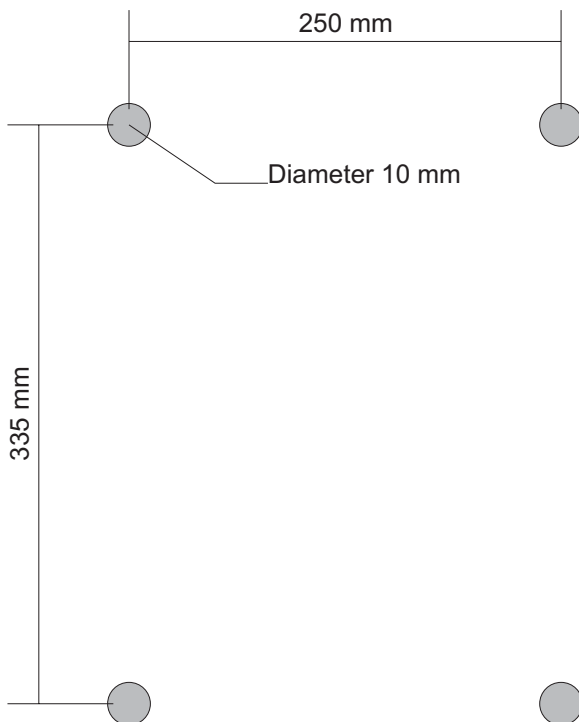
## MOUNTING

### Central unit

MG-O2R should be placed in a location where it is visible and easy to reach. Select a location with consideration to the surrounding temperature, which must not exceed 45 degrees Celsius. The MG-O2R is fitted with hinges on the left side of the door for easy access to the circuit board and electrical terminals inside during installation. Make sure that the door can be opened fully.

Outer dimensions H x W x D = 360x300x140 mm.

Mounting holes for the wall brackets are drilled according to following figure below.



### Wiring

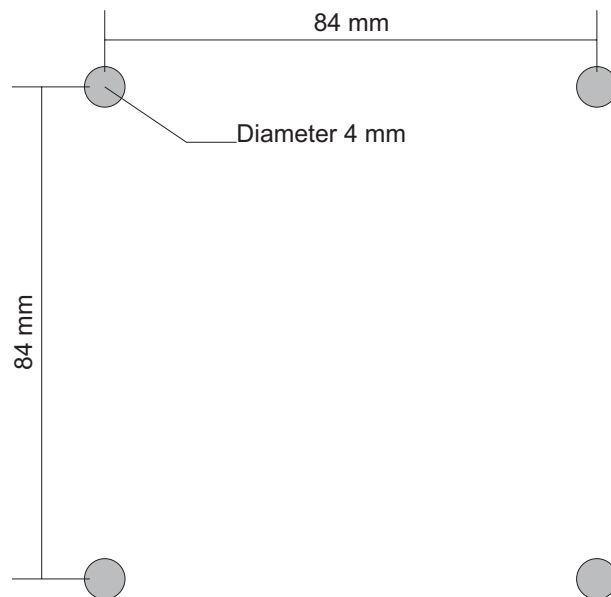
The cable between the Lambda-sensor and the signal converter is not to be extended. Leave some slack near the sensor to allow easy dismounting if necessary during calibration or sweeping.

The cable between the signal converter and the central unit together with cables for temperature sensor and output signals must be of a shielded type for the best measuring result. The shield should be connected to the ground at the central unit only.

### Signal converter

The signal converter amplifies the measuring signal from the Lambda-sensor to the central unit. The Lambda-sensor is connected to the signal converter using the pre-mounted cable on the sensor. The cable is not to be extended in any case. Due to the cable length, location of the signal converter must be nearby the sensor but not where it is exposed to radiation heat from boiler or flue gas duct.

Mounting holes for the signal converter enclosure are drilled according to following figure.



## Lambda-sensor

The sensor probe must be mounted in a 20-degree angle against the flow as follow:

1. Weld a G 3/4" inner threaded steel joint with a length of 5 to 7 cm to the duct in an angle according to figure 1. The joint should be placed on the top of the duct to avoid condensate to enter the sensor element.
2. Push the sensor probe into the joint and screw the attached fitting (G 3/4") to the welded joint and tighten. The push-in length can be varied between 10 and 25 cm.
3. Check that the measuring tip of the probe is placed inside the duct correctly before the clamp nut is tightened.
4. Turn the sensor probe until the measuring outlet nut is directed against the flow acc. to figure 1.

Protect the sensor against leakage of ambient air and condensate into the measuring chamber. The Lambda-sensor must be ventilated to avoid over-heating and is not to be painted or otherwise covered. The sensor takes its reference air through the wire entry. The wires and the sensor must be kept clean and dry. **Contact fluid or spray or similar must not be used at this part.**

**Note!** The probe must be dismantled during sweeping of the flue gas duct to avoid damage made by the sweeping tools. Place the attached warning label on a visible and easily to read location.

### Galvanic isolation

The lambda probe should always be mounted using the attached compression fitting which is fitted with a isolation socket made of PTFE (TEFLON®) to separate the probe galvanically from protective earth (ground) in the boiler/flue-gas duct which could interfere with the measuring.

Check that no electrical connection is between the probe and boiler/duct by measuring the resistance between them both.

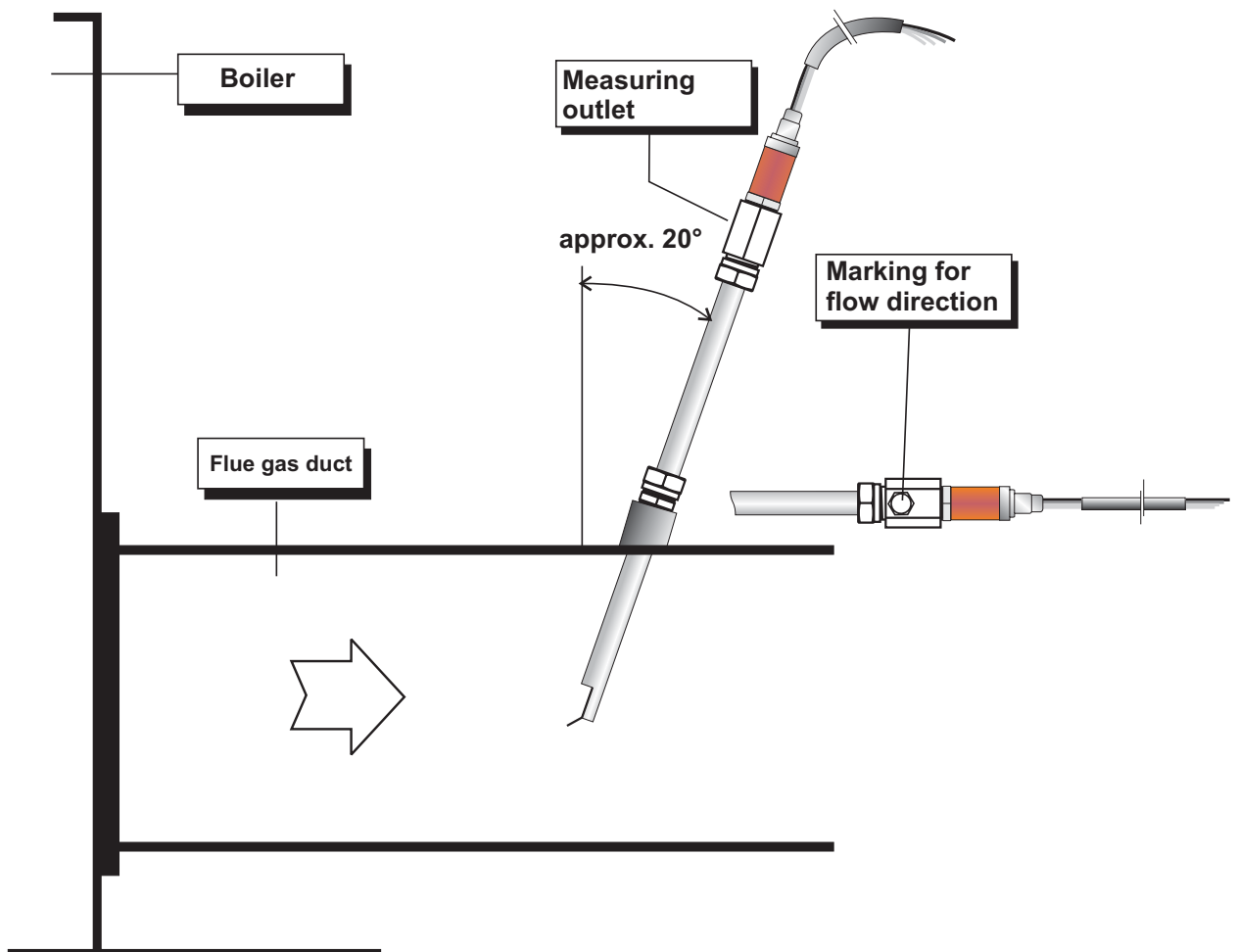


figure 1  
Mounting the Lambda-sensor probe into the flue gas duct.

## Temperature sensor

### Type MG-3000-RÖ-200/420

#### Use

The temperature sensor MG-3000-RÖ-200/420 is intended for measuring the flue gas temperature in boiler plants. The sensor uses a platinum element to sense the temperature. The element is placed in a thin  $\varnothing$  6mm acid proof steel pipe, which gives the sensing element a very short response time. An outer tube, also in acid proof steel, protects the pipe and also includes a gas test outlet. An adjustable clamp screw fitting with an external R1/2" thread is attached with the sensor. The fitting can be mounted to a welded steel joint on the duct with an internal 1/2" thread. The design makes it very easy to have the sensor tip position at the hottest point in the flue gas duct before fixing the sensor to the duct. Once installed, the sensor can easily be dismantled for inspection, and will be situated in the same position when remounted again. This is necessary to obtain and compare analyses in the future with the previous results.

**Note!** The sensor must be dismantled during sweeping of the flue gas duct to avoid damage made by the sweeping tools. Place the attached warning label on a visible and easily to read location.

#### Mounting

The withstanding figure shows alternative installations. The best way is when the sensor is mounted on the top of the duct between the boiler and flue gas damper according to figure 4 and 2.

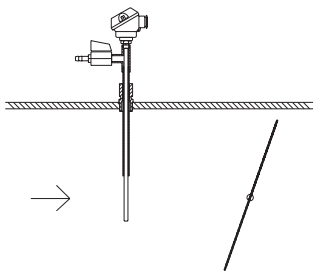


figure 4  
Side view of the duct.

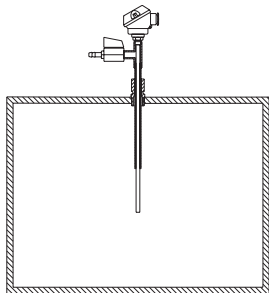


figure 2  
Front view of the duct.

If this is not possible, the sensor must be installed on the side of the duct, as high as possible to avoid radiation heat from the duct, but lower than the normal position of the flue gas damper when the burner is operating on its minimum load. See figure below, see figure 3.

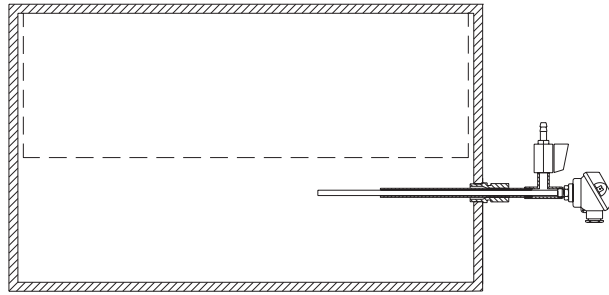


figure 3  
Side entry installation, front view of the duct.

#### Electrical installation

The cable to the sensor should have enough slack around the connection head to ensure that the sensor can be dismantled easily.

#### Dismounting the sensor

Dismounting the sensor from the outer protective steel pipe must be done by using a fixed wrench, 14 mm (SW14) and by turning the nut just below the sensor connection head anti clockwise.

**Note!** Never unscrew the sensor by gripping the head and turning it by hand since this will cause the internal wires to break.

### MG-O2R/RT

#### Use

The temperature sensor MG-O2R/RT is used for measuring the combustion intake air temperature. The sensor uses a platinum sensing element (PT-1000), which is mounted in a metal cap. A cable of 3 meter is fixed to the sensor.

#### Mechanical installation

The sensor should be placed in a location where it can measure the temperature of the air to the combustion intake.

#### Electrical installation

The cable can be shorten, or lengthen to a maximum length of 10 metres.

**Table for resistance values with Pt-100 temperature sensing element  
(acc. to DIN43760)**

Pt-100 = 100 Ω at 0 °C. All resistance values are in Ω.

°C	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9
0	100,00	100,39	100,78	101,17	101,56	101,95	102,34	102,73	103,12	103,51
10	103,90	104,29	104,68	105,07	105,46	105,85	106,24	106,63	107,02	107,40
20	107,79	108,18	108,57	108,96	109,35	109,73	110,12	110,51	110,90	111,28
30	111,67	112,06	112,45	112,83	113,22	113,61	113,99	114,38	114,77	115,15
40	115,54	115,93	116,31	116,70	117,08	117,47	117,85	118,24	118,62	119,01
50	119,40	119,78	120,16	120,55	120,93	121,32	121,70	122,09	122,47	122,86
60	123,24	123,62	124,01	123,39	124,77	125,16	125,54	125,92	126,31	126,69
70	127,07	127,45	127,84	128,22	128,60	128,98	129,37	129,75	130,13	130,51
80	130,89	131,27	131,66	132,04	132,42	132,80	133,18	133,56	133,94	134,32
90	134,70	135,08	135,46	135,84	136,22	136,60	136,98	137,36	137,74	138,12
°C	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9
100	138,50	138,88	139,26	139,64	140,02	140,39	140,77	141,15	141,53	141,91
110	142,29	142,66	143,04	143,42	143,80	144,17	144,55	144,93	145,31	145,68
120	146,06	146,44	146,81	147,19	147,57	147,94	148,32	148,70	149,07	149,45
130	149,82	150,20	150,57	150,95	151,33	151,70	152,08	152,45	152,83	153,20
140	153,58	153,95	154,32	154,70	155,07	155,45	155,82	156,20	156,57	156,94
150	157,31	157,69	158,06	158,43	158,81	159,18	159,55	159,93	160,30	160,67
160	161,04	161,42	161,79	162,16	162,53	162,90	163,27	163,65	164,02	164,39
170	164,76	165,13	165,50	165,87	166,24	166,61	166,98	167,35	167,72	168,09
180	168,46	168,83	169,20	169,57	169,94	170,31	170,68	171,05	171,42	171,79
190	172,16	172,53	172,90	173,26	173,63	174,00	174,37	174,74	175,10	175,47
°C	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9
200	175,84	176,21	176,57	176,94	177,31	177,68	178,04	178,41	178,78	179,14
210	179,51	179,88	180,24	180,61	180,97	181,34	181,71	182,07	182,44	182,80
220	183,17	183,53	183,90	184,26	184,63	184,99	185,36	185,72	186,09	186,45
230	186,82	187,18	187,54	187,91	188,27	188,63	189,00	189,36	189,72	190,09
240	190,45	190,81	191,18	191,54	191,90	192,26	192,63	192,99	193,35	193,71
250	194,07	194,44	194,80	195,16	195,52	195,88	196,24	196,60	196,96	197,33
260	197,69	198,05	198,41	198,77	199,13	199,49	199,85	200,21	200,57	200,93
270	201,29	201,65	202,01	202,36	202,72	203,08	203,44	203,80	204,16	204,52
280	204,88	205,23	205,59	205,95	206,31	206,67	207,02	207,38	207,74	208,10
290	208,45	208,81	209,17	209,52	209,88	210,24	210,59	210,95	211,31	211,66
°C	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9
300	212,02	212,37	212,73	213,09	213,44	213,80	214,15	214,51	214,86	215,22
310	215,57	215,93	216,28	216,64	216,99	217,35	217,70	218,05	218,41	218,76
320	219,12	219,47	219,82	220,18	220,53	220,88	221,24	221,59	221,94	222,29
330	222,65	223,00	223,35	223,70	224,07	224,41	224,76	225,11	225,46	225,81
340	226,17	226,52	226,87	227,22	227,57	227,92	228,27	228,62	228,97	229,32
350	229,67	230,02	230,37	230,72	231,07	231,42	231,77	232,12	232,47	232,82

**Table for resistance values with Pt-1000 temperature sensing element  
(acc. to DIN43760)**

Pt-1000 = 1000 Ω at 0 °C. All resistance values are in Ω.										
°C	-9	-8	-7	-6	-5	-4	-3	-2	-1	0
<b>-40</b>	811,8	815,6	819,5	823,4	827,2	831,1	835,0	838,8	842,7	846,6
<b>-30</b>	850,4	854,3	858,2	862,0	865,9	869,7	873,6	877,4	881,3	885,1
<b>-20</b>	889,0	892,8	896,7	900,5	904,4	908,2	912,0	915,9	919,7	923,5
<b>-10</b>	927,4	931,2	935,0	938,9	942,7	946,5	950,4	954,2	958,0	961,8
<b>0</b>	965,7	969,5	973,3	977,1	980,9	984,7	988,6	992,4	996,2	1000,0
°C	+0	+1	+2	+3	+4	+5	+6	+7	+8	+9
<b>0</b>	1000,0	1003,8	1007,6	1011,4	1015,2	1019,0	1022,8	1026,6	1030,4	1034,2
<b>10</b>	1038,0	1041,8	1045,6	1049,4	1053,2	1057,0	1060,8	1064,6	1068,4	1072,2
<b>20</b>	1076,0	1079,7	1083,5	1087,3	1091,1	1094,9	1098,7	1102,4	1106,2	1110,0
<b>30</b>	1113,8	1117,5	1121,3	1125,1	1128,9	1132,6	1136,4	1140,2	1143,9	1147,7
<b>40</b>	1151,4	1155,2	1159,0	1162,7	1166,5	1170,2	1174,0	1177,7	1181,5	1185,3
<b>50</b>	1189,0	1192,8	1196,5	1200,2	1204,0	1207,7	1211,5	1215,2	1219,0	1222,7
<b>60</b>	1226,4	1230,2	1233,9	1237,7	1241,4	1245,1	1248,9	1252,6	1256,3	1260,0
<b>70</b>	1263,8	1267,5	1271,2	1274,9	1278,7	1282,4	1286,1	1289,8	1293,5	1297,2
<b>80</b>	1301,0	1304,7	1308,4	1312,1	1315,8	1319,5	1323,2	1326,9	1330,6	1334,3
<b>90</b>	1338,0	1341,7	1345,4	1349,1	1352,8	1356,5	1360,2	1363,9	1367,6	1371,3

## ELECTRICAL CONNECTION

### Description

#### Supply voltage

MG-O2R should be connected to a supply voltage of 230 VAC, 50 Hz on terminal 5 (Line) and terminal 6 (Null). The supply voltage cable installation is preferable done using a main switch on the cable to make maintenance and service simple.

#### Oil-Burner

Terminal 1 (Null) and terminal 2 (Line) are connected to the burner for an activating signal to the MG-O2R when the burner is operating. If connecting to a stage burner, the second stage is connected to terminal 3 (Line) and if present the third stage, to terminal 4 (Line).

#### Alarm function

A potential-free changing relay output is located to terminals 8 to 10. An alarm state summary can be given by the MG-O2R to activate the output. The Output is limited to low voltage use of max. 230 VAC. At normal conditions the terminals 8 and 10 are connected. If an alarm condition occurs the relay changes and terminals 9 and 10 are connected instead.

#### O<sub>2</sub>-signal

Terminals 11, 13 and 16 to 18 are connected to the signal converter MG-O2R/SO terminals 1 to 5. Terminal 11 (-) and 13 (+) are the supply voltage for the Lambda-sensor heating-element and should be 12 Volt DC when the burner is operating. Terminal 16 is the actual O<sub>2</sub>-signal, terminal 17 (-) and 18 (+) is the supply voltage, 15 VDC, for the electronics inside the signal converter. The O<sub>2</sub>-signal should be 4...20 mA when the burner is operating.

If a secondary O<sub>2</sub>-measuring equipment is used, the O<sub>2</sub>-signal of 4...20mA from such device is connected to terminals 16 (+) and 17 (-) in the MG-O2R controller.

#### Sensor for the combustion intake air temperature

The temperature of the combustion intake air is measured using a Pt-1000 sensor. The sensor uses a 2-wire connection and should be connected to terminals 19 and 20.

This measurement is not necessary. If no sensor is used an estimated value for the temperature can be programmed into the MG-O2R.

#### Sensor for the flue gas temperature

The temperature of the flue gas is measured using a Pt-100 sensor, the sensor uses a 2-wire connection and should be connected to terminals 21 and 22.

#### Capacity (modulating)

For a modulating burner, an analogue signal, mA or Volt, is connected to terminal 23 (-) and 24 (+). On terminal 25 a supply voltage of 10 Volt is available for use together with a potentiometer connected to the burners actuator.

When using a capacity signal, two DIL-switches on the main circuit board must be set to correct input, see page 14. At delivery the DIL-switches are set for voltage input. Parameter 13 in the parameter list must also be programmed for the selected input signal.

#### Output signals

MG-O2R has 2 analogue output signals. They can be selected for either 0/2...10 Volt output or 0/4...20mA output. A free, selectable, measuring value or the control signal can be directed to the output signal.

The output signal 1 uses terminals 26 (+) and 28 (-). The output signal 2 uses terminals 27 (+) and 28 (-). **Note!** Common zero. The output signals are not galvanically separated to each other or to the input signals.

In connection to the electrical installation of the output signals, DIL-switches on the circuit board must set in the correct position, see page 14.

At delivery the DIL-switches are set for mA-output and the MG-O2R is programmed for 4...20mA.

If other output signal is selected, parameter 49 (output signal 1) and 51 (output signal 2) must be reprogrammed.

#### Communication

MG-O2R can use two interface for data communication, RS-232 and RS-485. Only one interface can be used at the time. RS-232 is connected to the modular socket (RJ45), this interface is suited for use together with Micatrone programming adaptor, P/N 60-0972-2. RS-485 interface is connected to terminals 29 (A) and 30 (B) and requires that Micatrone communication module, P/N 60-0973, is installed. If both RS-232 and RS-485 are connected and installed, RS-232 has priority to the communication. See also the function description on page 7.

#### Signal converter

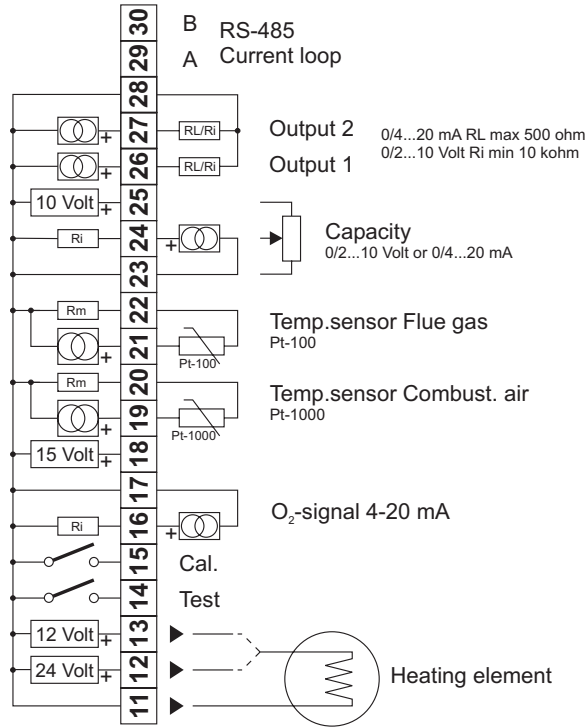
The converter is used for amplifying the signal from the Lambda-sensor. Terminals 1 to 5 at the signal converter is connected to terminals 11, 13 and 16 to 18 in the central unit, MG-O2R.

The Lambda-sensor wires, white pair, are connected to terminal 6 and 7. They are used for supply voltage to the heater inside the sensor. The supply voltage is 12 VDC but does not need to be polarized when connecting.

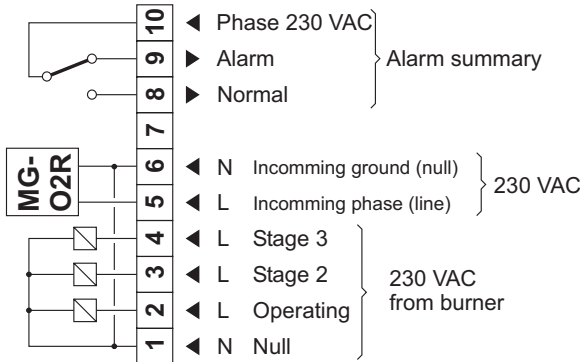
Lambda-sensor wire, grey, is connected to terminal 8 and the black is connected to terminal 9 on the signal converter.

# Connection diagram Central unit

## Signal voltage terminals

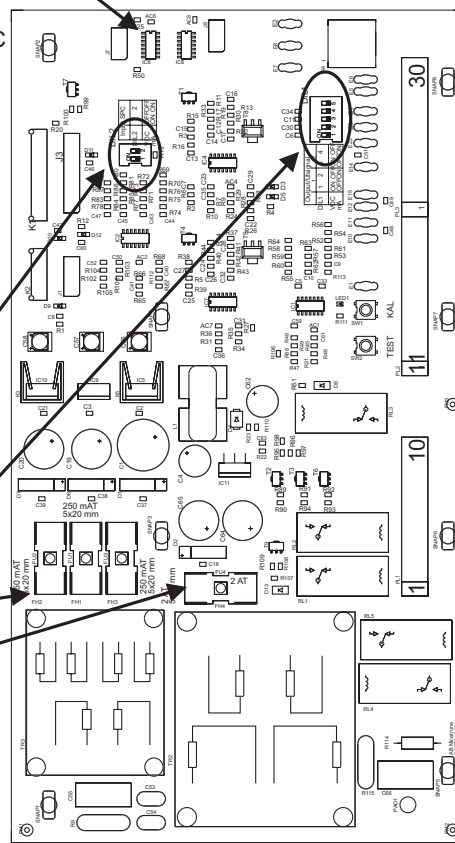


## Low voltage terminals 230 VAC



DIL switches	
Output signals DIL1	Input signals DIL2
Output 1: mA	Capacity
Output 1: Volt	Volt or Potentiometer
Output 2: mA	Capacity mA
Output 2: Volt	

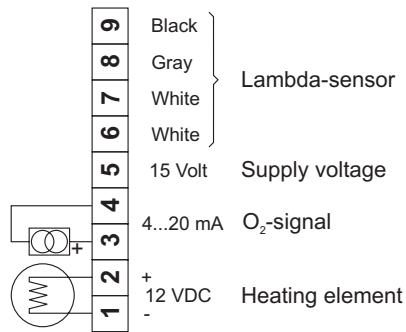
Fuses for electronics  
 3 pcs. 250 mA 5x20 mm  
 Fuse for lambda-sensor 2 AT 5x20 mm



Det. nr	Benämning	Material	Mod. nr / Ämne Dimension	Anmärkning
	Ritad LJ		2007-03-16	
<b>Micatrone</b>		Sökväg I:\MG-O2R\CDR\		
AB MICATRONE		Filnamn MG-O2R Inkoppling ver3_gb.cdr		
		Ritningsnummer S-3740		
		Connection diagram MG-O2R		
		Ver 3.00		
		Page 1 (2)		

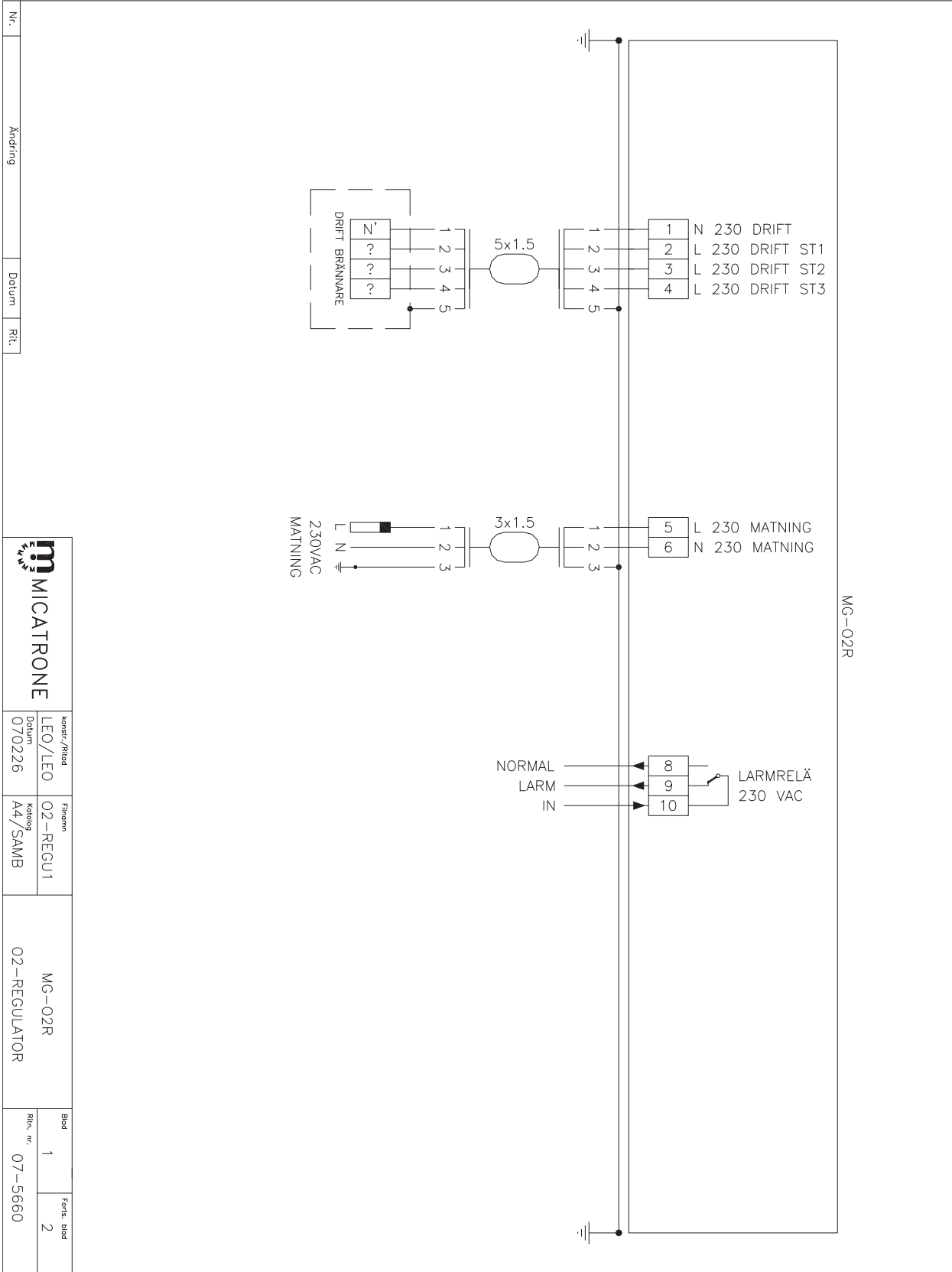
## Connection diagram Signal converter

### Signal voltage terminals



Det. nr	Antal	Benämning	Material	Mod. nr /Ämne Dimension	Anmärkning
		Ritad LJ		2007-03-16	SÄVäg 1: MG-O2R(CDR)
<b>micatrone</b> AB MICATRONE		Connection diagram MG-O2R		Skvåg	
		Ver 3.00	Page 2 (2)	Flisann	MG-O2R Inkoppling ver3_gb.cdr
				Ritningsnummer	S-3740

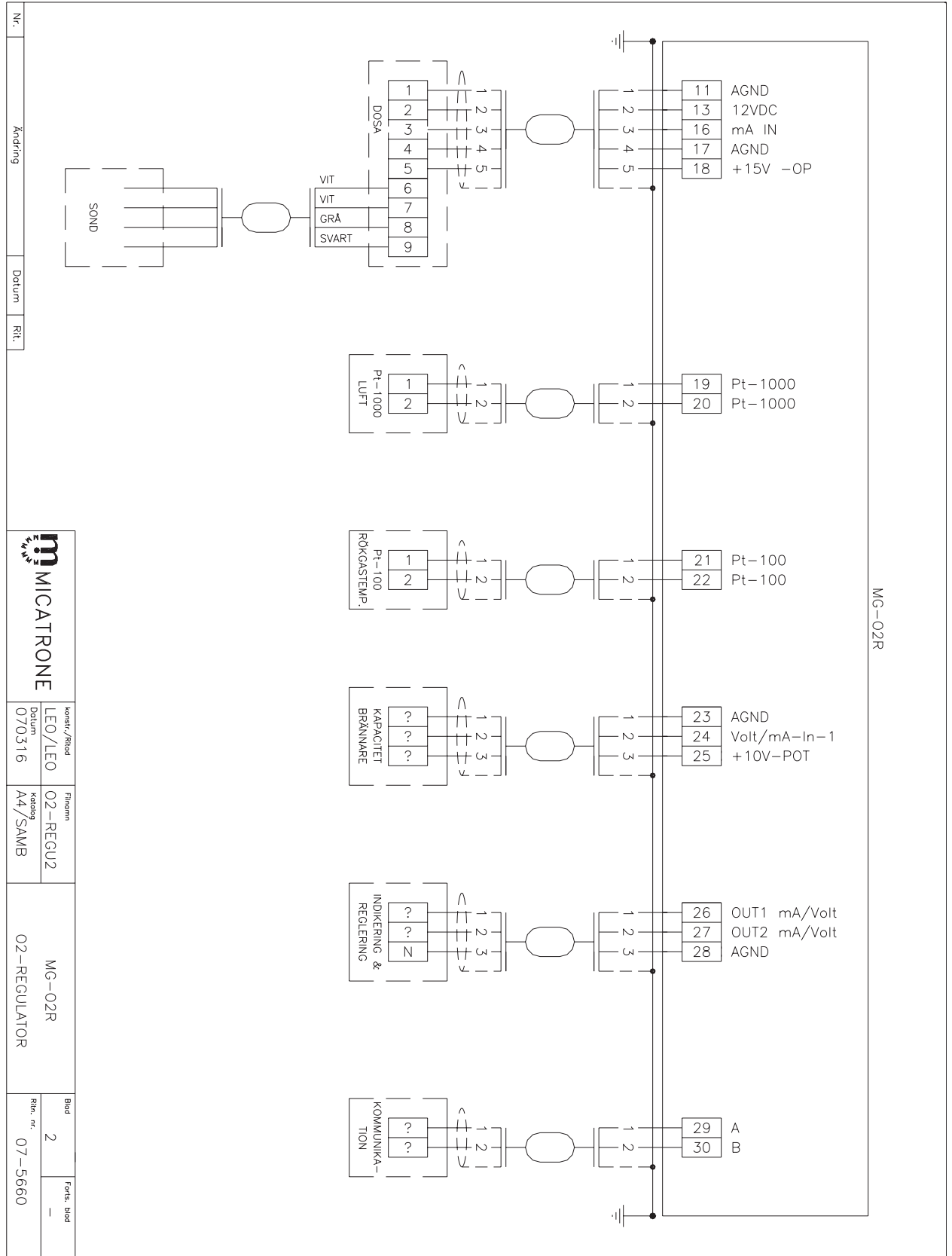
# Wiring diagram 1



Nr:   
 Ändring   
 Datum   
 Rit:

		Konstr./Ritad	Finns	MG-02R	Bid
		LEO/LEO	02-REGU1		
Datum	070226	Katalog	A4/SAMB	02-REGULATOR	Färd. bid
					2
					Ritn. nr 07-5660

# Wiring diagram 2



MG-02R

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Nr.:	Ändring	Datum	Rit:
konstr./ritad	LEO/LEO	Filmom	MG-02R
Datum	07/03/16	Kategori	02-REGU2
		A4/SAMB	02-REGULATOR
Bild	2	Färs. bild	-
Rit. nr.	07-5660		

# PROGRAMMING

## LCD display

MG-O2R has a two-row alphanumeric LCD display with back light and can show 16 characters on each row. Normally the display indicates present operating values but it is also used to indicate measurement values and programmed parameter values.



## Keypad

MG-O2R has a keypad with four keys, marked, ▼, ▲, PGM and ESC.

- The arrow keys, ▼ ▲, are used to scroll between different parameter groups, parameters and functions and increase or decrease the value of programmed parameters.
- The PGM key is used for programming and indicating of set parameters.
- By pressing the ESC key ongoing programming can be aborted. The ESC key is also used when returning to default programmed start menu.

## Start menu

The start menu is the entry point for indication and programming of parameters along with special functions such as default programming and calibration.



If the start menu is not showed on the display, press repeatedly on the ESC button. The start menu is by default replaced to indicate operating values. One press of the ESC button shows the start menu for a short while and returns automatically to indicate operating values. Use the arrow keys, ▼ ▲, to scroll between different display alternatives as follows.

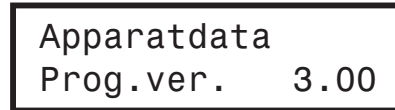
Övre raden	Nedre raden
AB MICATRONE	O <sub>2</sub> -halt
O <sub>2</sub> -halt	CO <sub>2</sub> -halt
O <sub>2</sub> -halt	Rökgastemperatur
O <sub>2</sub> -halt	Eldningsteknisk verkningsgrad
O <sub>2</sub> -halt	Kapacitet från brännare
Rökgastemperatur	Temperatur på förbränningsluft
Status för lambda-sond och steg 2 och 3 för stegbrännare	
O <sub>2</sub> -halt	Växelvís visning av: Aktuellt börvärde och Reglerutsignal
Alarmindikering	
Handkörning av reglersignal från O <sub>2</sub> -regulator	

In parameter 68, one of the listed display alternatives can be set as the default display. The selected display alternative will then always show when the MG-O2R is restarted after power failure or when pressing the ESC key when some other display alternative is showing.

Par.no:	Description	Range	Value
System inst.			
68	Display		O <sub>2</sub> O <sub>2</sub> +CO <sub>2</sub> O <sub>2</sub> +RÖK O <sub>2</sub> +n O <sub>2</sub> +KAP RÖK+LFT DIG IN O <sub>2</sub> +REG

## The indication of parameters

One press of the PGM key when default start menu is showing will activate an automatic scroll and list all parameters for about two seconds. The top row indicating the parameter group and bottom row the parameter and its value. The listing will end when all parameters has been showed, or if the ESC key is pressed.

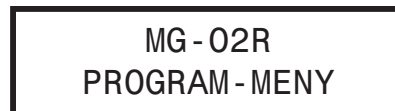


## Programming a parameter

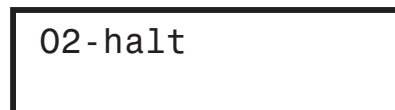
### Programme menu

The program menu includes all parameters and measuring values that are accessible. All parameters are divided into different parameter groups where each function has its own group.

To activate the program menu, continuously press the PGM key until following display is shown. Release the key.



The second parameter group is shown on the top row.



## Parameter selection

By using the arrow keys,  $\blacktriangledown$   $\blacktriangle$ , different groups of parameters can be selected. If the last group is shown and the arrow key,  $\blacktriangledown$ , is pressed, the first menu is shown and vice versa.

Parametergrupper			
1	Apparatdata	7	Alarm O2-halt
2	O2-halt	8	Alarm röktemp
3	Lufttemperatur	9	Kommunikation
4	Kapacitet	10	System inst.
5	O2-regulator	11	Mätvärden
6	Utsignaler		

When the desired group is shown, it can be selected by pressing the PGM key once. The first parameter inside the selected group is shown on the bottom row of the display.

O2-halt  
Mätområde 0..10%

With the arrow keys,  $\blacktriangledown$   $\blacktriangle$ , all parameters inside the group can be selected. If the last parameter in the selected group is shown and the arrow key,  $\blacktriangledown$ , is pressed, the first parameter is shown and vice versa.

To select another group of parameters when a parameter is shown on the bottom row, press the ESC key. The programming mode is cancelled when the ESC key is pressed repeatedly until the default start menu is shown.

## Programming a value

Parameters with a numeric value (integers and decimal values):

When the selected parameter is shown in the display it can be selected for programming by pressing the PGM key once. The first digit will flash to indicate that it can be changed using the arrow keys,  $\blacktriangledown$   $\blacktriangle$ .

O2-regulator  
Börvärde 1 06.0

If the digit flashing is "9" and the arrow key, 5, is pressed, the counter will start from "0" and count forwards (-9 for parameters that accept negative values) without changing any other of the digits in the value. The counter will continue in the opposite way if the digit is flashing "0" and the arrow key,  $\blacktriangledown$ , is pressed. Continue to the next digit by pressing the PGM key again.

When the last digit is set and the PGM key is pressed the actual change of the parameter value is affected. The entire bottom row in the display will flash to confirm that the programming was successful.

## Parameters with preset alternatives

When the selected parameter is shown in the display it can be selected for programming by pressing the PGM key once. The entire text will flash to indicate that it can be changed to the preset alternatives using the arrow keys,  $\blacktriangledown$   $\blacktriangle$ .

O2-regulator  
Aktiv NEJ

The same procedure as with digits will occur if an arrow key,  $\blacktriangledown$   $\blacktriangle$ , is pressed when the last, respectively the first, parameter alternative is shown.

By pressing the PGM key, when the desired parameter alternative is shown, will execute the programming and change the parameter. The entire bottom row in the display will flash to confirm that the programming was successful.

## Cancelling programming mode

Ongoing programming can be cancelled by pressing the ESC key. The parameter value will stop flashing and the original value remains the same.

## The function menu

To activate the function menu, press both PGM and ESC key simultaneously and keep the keys pressed until the following display is shown. Release the buttons.

MG-O2R  
FUNKTIONS-MENY

The first function is shown in the display.

Kalibrering  
Lambdasond

## Selecting a function:

With the arrow keys,  $\blacktriangledown$   $\blacktriangle$ , different functions can be selected, for instance, default programming and calibration. If the last function is shown and the arrow key,  $\blacktriangledown$ , is pressed, the first function will shown again and vice versa.

Funktioner	
1	Kalibrering Lambdasond
2	Kalibrering Analoga insgn.
3	Kalibrering Analoga utsign.
4	Nollställ senaste alarm
5	Visa omstarter
6	Grundprogram Fabriksinst.

When the desired function is displayed it can be selected by pressing the PGM key. The functions menu can be aborted by pressing the ESC key.

## Basic programme

### Default settings

Par.nr:	Description	Range	Value
Apparatdata			
0	Prog.ver.	0,00...9,99	3,00
O2-halt			
9	Mätområde	0..5% 0..10% 0..20%	0..10%
72	Lambdasond	NEJ JA	JA
Lufttemperatur			
11	Mätning	AV Pt-1000	AV
12	Antag temp.	-30...80	25
Kapacitet			
13	Insignal	AV 0..10V 2..10V 0..20mA 4..20mA	AV
14	Punkt 1	0...99	1
15	Punkt 2	0...99	10
16	Punkt 3	0...99	20
17	Punkt 4	0...99	30
18	Punkt 5	0...99	40
19	Punkt 6	0...99	50
20	Punkt 7	0...99	60
21	Punkt 8	0...99	70
22	Punkt 9	0...99	80
23	Punkt 10	0...99	90
O2-regulator			
24	Aktiv	NEJ JA	NEJ
27	P-band	0...9999	50
28	I-tid [s]	0...999	300
29	NZ [%]	1...50	1
34	Riktning	DIREKT OMVÄND	OMVÄND
35	Börvärde 1	0,0...20,0	6,0
36	Börvärde 2	0,0...20,0	5,5
37	Börvärde 3	0,0...20,0	5,0
38	Börvärde 4	0,0...20,0	4,5
39	Börvärde 5	0,0...20,0	4,5
40	Börvärde 6	0,0...20,0	4,0
41	Börvärde 7	0,0...20,0	4,0
42	Börvärde 8	0,0...20,0	3,5
43	Börvärde 9	0,0...20,0	3,0
44	Börvärde 10	0,0...20,0	3,0
45	Startvärde	0...100	100
46	Väntetid [s]	0...999	120
47	Bumpless [s]	0...999	60
Utsignaler			
48	Källa 1	O2-halt CO2-halt RökTmp LuftTmp n Kapac. O2-reg	O2-halt

Par.nr:	Description	Range	Value
49	Signal 1	0..10V 2..10V 0..20mA 4..20mA	4..20mA
50	Källa 2	O2-halt CO2-halt RökTmp LuftTmp n Kapac. O2-reg	O2-reg
51	Signal 2	0..10V 2..10V 0..20mA 4..20mA	4..20mA
Alarm O2-halt			
52	Låg O2	0,0...20,0	2,0
53	Hög O2	0,0...20,0	3,5
54	Låg n	0,0...99,9	0,0
55	Fördröj [s]	0...999	120
Alarm rökgastemp			
56	Hög temp 1	0...400	0
57	Hög temp 2	0...400	0
58	Hög temp 3	0...400	0
59	Hög temp 4	0...400	0
60	Hög temp 5	0...400	0
61	Hög temp 6	0...400	0
62	Hög temp 7	0...400	0
63	Hög temp 8	0...400	0
64	Hög temp 9	0...400	0
65	Hög temp 10	0...400	0
66	Låg temp	0...400	0
67	Fördröj [s]	0...999	120
Kommunikation			
4	Adress	1...247	21
5	Platskod	0...32767	0
6	Språk	COMLI	COMLI
7	Baud	600 b 1200 b 2400 b 4800 b 9600 b	4800 b
8	Skyddad	NEJ JA	NEJ
System inst.			
68	Display	O2 O2+CO2 O2+RÖK O2+n O2+KAP RÖK+LFT DIG IN O2+REG	O2
69	Bränsle K	0,00...2,00	0,59
70	Max CO2	0,0...20,0	15,5

## LCD DISPLAY

### Screen alternatives

On the start menu, see page 18, different screen alternatives is available for different operating values. Use the arrow keys, ▼ ▲, to scroll between the different alternatives.

Övre raden	Undre raden
AB MICATRONE	O <sub>2</sub> -halt
O <sub>2</sub> -halt	CO <sub>2</sub> -halt
O <sub>2</sub> -halt	Rökgastemperatur
O <sub>2</sub> -halt	Eldningsteknisk verkningsgrad
O <sub>2</sub> -halt	Kapacitet från brännare
Rökgastemperatur	Temperatur på förbränningsluft
Status för lambda-sond och steg 2 och 3 för stegbrännare	
O <sub>2</sub> -halt	Växelvis visning av: Aktuellt börvärde och Reglerutsignal
Alarmindikering	

### Measurement values

Following measurement values and readings are displayed using the programming menu, see page 18.

Par.nr:	Description	Range	Value
Mätvärden			
100	O <sub>2</sub> -halt	0,00...20,90	
101	CO <sub>2</sub> -halt	0,00...20,00	
102	Rökgaser	0...400	
103	Lufttemp.	-30...80	
104	n	0,0...100,0	
105	Kapacitet	0,0...100,0	
114	Reg anv.	NEJ JA	
106	Reg Uts.	0,00...100,00	
107	Akt. Börv	-327,68...327,67	
109	Alarm rökgas	-32768...32767	
110	O <sub>2</sub> -sond	AV PÅ	
111	Steg 2	AV PÅ	
112	Steg 3	AV PÅ	

### LED'S (light emitting diodes)

On front panel available LED's indicate:

#### Measurement LED

Green light when burner is operational and the Lambda-sensor is activated. If the LED is turned off, no reading of the O<sub>2</sub>-content is made.

#### Control LED

Green light when O<sub>2</sub>-controller has been activated after burner start or burner stage shift. If the LED is turned off, no control of the O<sub>2</sub>-content is made.

#### O<sub>2</sub>-content outside range LED

Amber light if O<sub>2</sub>-content value is outside the selected range set in parameter 9.

#### Calibration in progress LED

Yellow light during calibration of the Lambda-sensor.

#### Alarm LED

Red light when an alarm has been triggered. Alarms must be reset manually. The LED will go out when the alarm is restored.

#### Error message LED

This function is not used.

## INITIALIZE OPERATION

1. Connect supply voltage to the O<sub>2</sub>-controller with the Lambda-sensor connected and placed in ambient air.
2. Execute the calibration procedure according to page 23.
3. Mount the Lambda-sensor in the flue gas duct.
4. Measure the time from the point where the burner is powered until it is operational and a stable furnace pressure is established. The time, in seconds, should be programmed into parameter 46, see page 18 and 19.

Par.no:	Description	Range	Value
O2-regulator			
46	Väntetid [s]	0...999	120

5. Check that the range of the control output signal set in parameter 51 is in accordance with the input signal to the frequency converter.

Par.no:	Description	Range	Value
Utsignaler			
50	Källa 2	O2-halt CO2-halt RökTmp LuftTmp n Kapac. O2-reg	O2-reg
51	Signal 2	0..10V 2..10V 0..20mA 4..20mA	4..20mA

6. Programme the correct set value depending on which burner type is used. I.e a 2-stage burner should be set as follows:  
Set value stage 1 4,0% into parameter 35  
Set value stage 2 3,0% into parameter 36

Par.no:	Description	Range	Value
O2-regulator			
35	Börvärde 1	0,0...20,0	6,0
36	Börvärde 2	0,0...20,0	5,5
37	Börvärde 3	0,0...20,0	5,0

7. Activate the O<sub>2</sub>-controller by setting parameter 24 to "JA" (YES).

Par.no:	Description	Range	Value
O2-regulator			
24	Aktiv	NEJ JA	NEJ

8. Run the burner on stage 1. Read off and take a note of the control output signal, parameter 106, when the O<sub>2</sub>-controller is in balance.

One of the available screens will show the current O<sub>2</sub>-content, current set value and control output signal, see page 18.

9. Run the burner on stage 2. Read off and take a note of the control output signal, parameter 106, when the O<sub>2</sub>-controller is in balance.
10. The highest value of the control output signal should be programmed into parameter 45.

Par.no:	Description	Range	Value
O2-regulator			
45	Startvärde	0...100	100

11. Adjust, if necessary, the time for the "Bumpless" function set in parameter 47, P-band in parameter 27 and I-time in parameter 28.

Par.no:	Description	Range	Value
O2-regulator			
27	P-band	0...9999	50
28	I-tid [s]	0...999	300
47	Bumpless [s]	0...999	60

12. Note all settings in a suitable way for future use.

## CALIBRATING THE LAMBDA-SENSOR

### Introduction

For the O<sub>2</sub>-controller to make accurate measurement, the central unit, the signal converter and the Lambda-sensor, must be calibrated together. If any unit is replaced, a new calibration of the Lambda-sensor must be executed to uphold the accuracy in the measurement. The calibration takes approximately 30 minutes to do.

For the calibrations to be correct, the lambda-sensor must be in operation, i.e. 230 VAC supply voltage must be connected to terminal 1 and 2 inside the central unit. This is most easily made if the burner is in operation. Set the temperature control of the burner to a level where the burner will not stop for at least 30 minutes. If this is not a possible choice, the wires between the burner and terminal 1 and 2 in the central unit, must be disconnected temporary, and instead connect the terminals to other 230 VAC supply voltage, for instance by placing a ring-wire between terminal 1 and 6 and between 2 and 5 on the same terminal block.

### Step 1

Calibration is performed from the function menu, see page 19. When the following screen appears:

```
Kalibrering
Lambdasond
```

press the PGM key to start the calibration.

The function LED "Kalibrering" is lit and the following screen is shown:

```
[PGM] Fortsätt
[ESC] Avbryt
```

The calibration can be aborted at any time by pressing the ESC key once.

```
Avbryter...
```

The LED will go out and the screen will return to the function menu. No calibration has been executed and the previous calibration is still valid.

During the calibration, the O<sub>2</sub>-controller must be inactivated since the controller will not receive a current O<sub>2</sub>-content value to control against. If the O<sub>2</sub>-controller is left in active mode, the following text will appear in the screen:

```
Reglering stängs
av [PGM/ESC]
```

Press the PGM key to confirm that the O<sub>2</sub>-controller is inactivated, or the ESC key to abort the cali-

bration. When the calibration is finished, the O<sub>2</sub>-controller must be activated again manually.

### Step 2

The following screen appears:

```
Placera sonden i
luft [PGM/ESC]
```

The Lambda-sensor is calibrated in ambient air. Dismount the sensor from the flue gas duct and place the sensor in such way that the sensor tip is not in touch with anything else but the surrounding air. Take caution to that the tip of the sensor is very hot (> 500 °C). Press the PGM key to continue.

### Step 3

If the following error message is shown in the display,

```
O2-sond AV
[ESC] Avbryt
```

it is caused by missing supply voltage to the Lambda-sensor, most likely on terminals 1 and 2 inside the central unit.

Check the supply voltage. When the supply voltage is present and the Lambda-sensor is in operation, the following screen appears.

```
O2-sond PÅ
[PGM] Fortsätt
```

### Step 4

Leave the sensor for 20 minutes to reach a stable measuring signal to the ambient temperature. The controller uses a built-in timer and displays the remaining time on the screen.

```
Acklimatiserar..
20 min. [ESC]
```

Pressing the ESC key will abort the calibration.

If the supply voltage is disconnected during calibration, the following text will appear on the screen and the calibration repeats the procedure beginning at step 3.

```
O2-sond AV
[ESC] Avbryt
```

### Step 5

When the sensor has reached a stable measuring signal, following screen appears:

O<sub>2</sub>-signal 2.300  
[PGM] Kalibrera

The value that is shown in the display is received from the signal converter. The measuring signal should be between 1,100 and 2,900 mA for the signal to be acceptable.

Press the PGM key to accept the new measuring signal from the signal converter or press the ESC key to abort the calibration. Once pressing the PGM key, MG-O<sub>2</sub>R will automatically store the new measuring signal as reference signal to ambient air.

Sparar...

### Step 6

Return the sensor to its position in the flue gas duct.

Placera sonden i  
rökgas [PGM/ESC]

Press the PGM key to complete the calibration.

Avslutar...

Press the ESC key to close the function menu.

### Step 7

Make a final check of the calibration. Let the sensor measure the O<sub>2</sub>-content in the flue gas and read the measuring value on the display. Estimate if the measured value is reasonable or make a reference measuring using a secondary O<sub>2</sub>-measuring instrument. Make a change in the combustion intake air or fuel supply and check that the O<sub>2</sub>-content changes.

If the controller was inactivated during step 1, it is time to activate it again. Programme parameter 24 to "JA" (YES) (refer to the programming instruction on page 18)

## MANUAL OPERATING

### Connecting and disconnecting

To find out at which O<sub>2</sub>-content the combustions starts to produce carbon, MG-O2R offers the possibility to manually adjust the control output signal given by the MG-O2R. Manual operating mode is accessible from the start menu and will display the following screen if the O<sub>2</sub>-controller is activated (parameter 24 = "JA"):

O2-halt	3.1 %
AUTO	100.00 %

If the controller is turned off (parameter 24 = "NEJ"), the manual operating mode will display the following screen :

O2-REG. EJ AKTIV	
AUTO	100.00 %

Use the arrow keys, ▼ and ▲, to scroll between the different menus until one of the manual operating mode screens above is displayed.

Manual operating of the control output signal is possible whether the O<sub>2</sub>-controller is active or not. Using manual operating mode when the controller is active has the benefit of displaying the measured O<sub>2</sub>-content on the screen.

#### Step 1

Switch to manual mode by pressing the PGM key once. The text "AUTO" will change to "HAND" on the display and the LED for "Control" starts to flash.

O2-halt	3.1 %
HAND	100.00 %

#### Step 2

The control output signal is now adjustable, in steps of 0,2% percent units, by pressing the arrow keys, ▼ (decrease) or ▲ (increase). If any of the arrow keys is kept pressed the control output signal will change in steps of 2% percent units instead until the key is released. Keep the key pressed for an extended time to achieve large changes in the output signal and then push the key repeatedly a few times to fine adjust the output signal.

#### Step 3

Press the PGM key to leave the manual operating mode. Use the arrow keys, ▼ and ▲, to select another screen or press the ESC key to return to the default start menu.

### Keep the MG-O2R in manual operating mode

During manual operating mode (step 2 below "Connecting and disconnecting") the arrow keys, ▼ and ▲, are used to adjust the control output signal. To change screen to the preset start menu, press the ESC key, MG-O2R will remain in manual operating mode (LED "Control" flashes), and all screens, program menu and function menu are available.

The manual operating mode must be disconnected manually. There is no time delay which will disconnect the manual operating mode after set delay. Even if the MG-O2R is disconnected to the supply voltage it will remember to start in the manual operating mode after the supply voltage has been applied again.

## TROUBLESHOOTING

### **No text on the display**

Check that MG-O2R has supply voltage 230VAC on terminals 5 and 6.

Check that the three fuses to the right of the top placed transformer located at the left side on the circuit board has not broke.

All three fuses are rated for 250mA, slow, 5x20mm glass tube type.

### **LED indicating "Measuring" does not lit**

Check that MG-O2R has supply voltage 230VAC on terminals 1 and 2.

Check that the fuse to the right of the bottom placed transformer located at the left side of the circuit board has not broke.

This fuse is rated for 2A, slow, 5x20mm glass tube type.

### **LED indicating, "Control" does not lit**

Check that the green LED indicating "Measuring" is lit

Check that parameter 24 is set to "JA" (=YES).

Check the time delay programmed into parameter 46. The O<sub>2</sub>-controller waits set time delay after burner start or a stage change.

### **LED indicating "Control" flashes**

O<sub>2</sub>-controller is set to manual operation mode.

Use arrow keys to scroll between the menus until manual operation "HANDKÖRNING" is shown, press the PGM-key to leave the manual operation mode and then press ESC to return to the default start menu.

### **MG-O2R indicates a faulty O<sub>2</sub>-content**

Perform a new calibration of the Lambda-sensor, see page 23.

### **Calibration does not work**

The Lambda-sensor signal exceeds 2900 mA.

Check connections inside the Signal converter

The grey sensor wire should be connected to terminal 8 and the black wire to terminal 9 on the signal converter.

## TECHNICAL DATA

### Central unit

#### Common

Supply voltage:	230 VAC, 50/60 Hz
Power consumption:	9 VA excl. Lambda-sensor
Ambient temperature:	0...55 °C
Electrical connections:	Max. 2 x 1.5 mm <sup>2</sup> /terminal
Cable entries:	12 holes for M20 gland.
Degree of protection:	IP 65
Dimensions: h x w x d	360 x 300 x 140 mm
Weight:	6 kg

#### Acknowledgement signal for burner operation

Signal voltage:	230 VAC, 50/60 Hz
Power consumption:	1 VA

#### Acknowledgement signal for stage 2 and 3

Signal voltage:	230 VAC, 50/60 Hz
Power consumption:	1 VA

#### Relay alarm output

Max. load:	230 VAC, 2A
------------	-------------

#### Temperature inputs

Combustion intake air (Pt-1000)	
Connection:	2-wire connection
Measuring range:	-30...+80 °C
Resolution:	0,2 °C
Measuring error:	< ±1 °C

#### Flue Gas (Pt-100)

Connection:	2-wire connection
Measuring range:	0...+400 °C
Resolution:	0,5 °C
Measuring error:	< ±2 °C

#### Capacity input signal

mA	
Signal range:	0/4...20 mA
Internal resistance:	100 Ω

#### Volt

Signal range:	0/2...10 Volt DC
Internal resistance:	50 kΩ

#### 10 Volt DC ref. (terminal 25)

Max. load:	10 mA
------------	-------

#### Potentiometer in burner

Min. resistance:	1 kΩ
------------------	------

#### Output signal

mA	
Signal range:	0/4...20 mA
Max. load:	500 Ω

#### Volt

Signal range:	0/2...10 Volt DC
Min. load:	20 kΩ

#### Data communication (accessories)

Interface:	RS-485 alt. RS-232
Protocol:	Comli

#### Lambda-sensor

Temperature range on flue gas with operating sensor:	+150...+600 °C
Temperature on sensor tip:	> +500 °C
Heating element:	12 VDC, 16 W
Lift expectancy (Expected time to EOL) at flue gas temperature < +300 °C:	> 10.000 hours in operation
Cable length:	220 cm
Connection to duct:	G 3/4"
Signal converter	
Ambient temperature:	0...55 °C
Electric connections:	1.5 mm <sup>2</sup> /terminal
Cable entries:	2 holes for M20
Degree of protection:	IP 65
Dimensions: h x w x d	100 x 100 x 60 mm
Weight:	0,25 kg

#### Temperature sensor for flue gases

Measuring sensor:	Pt-100
Temperature range:	0...+350 °C
Insertion length:	0...200 mm
Connection to duct:	R ½" fitting
Wiring connection:	Terminal head

#### Temperature sensor for combustion intake air

Measuring sensor:	Pt-1000
Temperature range:	-50...+100 °C
Cable length:	300 cm

## PARAMETER LIST

Par.no:	Description	Range	Value
<b>Apparatdata</b>			
0	Prog.ver.	0,00...9,99	
<b>O2-halt</b>			
9	Mätområde	0..5% 0..10% 0..20%	
72	Lambdasond	NEJ JA	
<b>Lufttemperatur</b>			
11	Mätning	AV Pt-1000	
12	Antag temp.	-30...80	
<b>Kapacitet</b>			
13	Insignal	AV 0..10V 2..10V 0..20mA 4..20mA	
14	Punkt 1	0...99	
15	Punkt 2	0...99	
16	Punkt 3	0...99	
17	Punkt 4	0...99	
18	Punkt 5	0...99	
19	Punkt 6	0...99	
20	Punkt 7	0...99	
21	Punkt 8	0...99	
22	Punkt 9	0...99	
23	Punkt 10	0...99	
<b>O2-regulator</b>			
24	Aktiv	NEJ JA	
27	P-band	0...9999	
28	I-tid [s]	0...999	
29	NZ [%]	1...50	
34	Riktning	DIREKT OMVÄND	
35	Börvärde 1	0,0...20,0	
36	Börvärde 2	0,0...20,0	
37	Börvärde 3	0,0...20,0	
38	Börvärde 4	0,0...20,0	
39	Börvärde 5	0,0...20,0	
40	Börvärde 6	0,0...20,0	
41	Börvärde 7	0,0...20,0	
42	Börvärde 8	0,0...20,0	
43	Börvärde 9	0,0...20,0	
44	Börvärde 10	0,0...20,0	
45	Startvärde	0...100	
46	Väntetid [s]	0...999	
47	Bumpless [s]	0...999	
<b>Utsignaler</b>			
48	Källa 1	O2-halt CO2-halt RökTmp LuftTm n Kapac. O2-reg	

Par.no:	Description	Range	Value
49	Signal 1	0..10V 2..10V 0..20mA 4..20mA	
50	Källa 2	O2-halt CO2-halt RökTmp LuftTm n Kapac. O2-reg	
51	Signal 2	0..10V 2..10V 0..20mA 4..20mA	
<b>Alarm O2-halt</b>			
52	Låg O2	0,0...20,0	
53	Hög O2	0,0...20,0	
54	Låg n	0,0...99,9	
55	Fördröj [s]	0...999	
<b>Alarm rökgastemp</b>			
56	Hög temp 1	0...400	
57	Hög temp 2	0...400	
58	Hög temp 3	0...400	
59	Hög temp 4	0...400	
60	Hög temp 5	0...400	
61	Hög temp 6	0...400	
62	Hög temp 7	0...400	
63	Hög temp 8	0...400	
64	Hög temp 9	0...400	
65	Hög temp 10	0...400	
66	Låg temp	0...400	
67	Fördröj [s]	0...999	
<b>Kommunikation</b>			
4	Adress	1...247	
5	Platskod	0...32767	
6	Språk	COMLI	
7	Baud	600 b 1200 b 2400 b 4800 b 9600 b	
8	Skyddad	NEJ JA	
<b>System inst.</b>			
68	Display	O2 O2+CO2 O2+RÖK O2+n O2+KAP RÖK+LFT DIG IN O2+REG	
69	Bränsle K	0,00...2,00	
70	Max CO2	0,0...20,0	

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