

Programme timing Model 33-33	secs.
pre-purge time supervised	30
pre-purge time with open air damper	37
response time for air-proving switch	9
pre-ignition time (short)	3.5
pre-ignition time (long)	46
safety time, pilot valve	3
safety time, start valve	3
safety time main valve	3
time to lockout during operation	<1
activated time of pilot	11
delay time to valve 1	9
delay time to valve 2	6
post-purge	8.5



APPLICATION FEATURES

1. Information system – SGU 930i

The information system for the SGU 930i is controlled by a microprocessor. It is designed to report on every aspect of the burner control box's operation and on flame supervision. It records continuously every function of the control box. In the case of a lock-out, it offers a fault diagnosis and also stores the number of lock-outs which occur. The information is conveyed by means of an LED display and a serial interface. The micro-processor is used only for information purposes and is not connected with the safety functions of the control box. All signals which are checked by the information system are electrically isolated from the remainder of the control box circuit.

1.2. Reconstruction of the cycle and lockout-diagnosis

The information system uses certain signals of the control box to reconstruct the programme cycle. The system measures these signals at every stage of the cycle, checks them and decides if the next stage of the programme cycle has been reached.

1.3. Report

The programme cycle is observed and recorded continuously by the information system. As soon as a new stage is reached, a message is passed through the serial interface. The report line contains the time between "thermostat ON" and the function, the input and output signals, the strength of the flame signal in percentages (refer to 2.1) and a comment in simple language. The report lines for the lockouts are the same.

1.4 Report line format

Title.

Is printed when control thermostat switches on

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          F L M S V Flame Cycle
h : m : s T I H P L Signal step
-----
hh:mm:ss .|.|. . . . . F xx% Text      reportline
hh:mm:ss

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h : m : s hours :minutes :seconds – since Controlthermostat on

.|.|. Input/Output signals
| signal valid (e.g. thermostat is switched on)
. signal not valid (e.g. thermostat is switched off)
F flame relay
T control thermostat
L air proving switch
I safety relay
M synchronous motor
H main relay
S lockout relay
P pilot valve
V main valve 1
L high flame thermostat
F flame signal in xx% of max. current
Text programme stage or lockout in simple language

1.5 Report line examples

		F	L	M	S	V		
		T	I	H	P	L		
00:00:16	F: 00%	pre-purge
00:00:46	F: 00%	LK running
00:00:48	F: 00%	LK at min
00:00:54	.|	|	|	|	|	..	F: 00%	ts 1 PV/SV

1.6 LED Display

Together with the report, a code is given to the LED display. This gives a visual display of which stage the programme has reached or where lockout has occurred. The dual-coloured LED display can show 11 different programme stages and 10 different lockout causes. The lockout display is retained until the control box is reset, whether locally or remotely.

1.7 Lockout memory

The causes for a lockout are stored in the lockout memory. The last 8 lockouts are retained in this memory. They are stored in a non-volatile EEPROM even after power is switched off. The information is transmitted through the serial interface by the following means:

- reset of the information system by the reset button
- a request via the serial interface from a test base, PC, etc.

1.8 Format of a lockout line

1. lockout in Program part
Time hh:mm:ss cycle nr. xx

lockout	reason for the lockout in simple language
programme stage	programme stage at which the lockout occurred in simple language
hh:mm:ss	hours, minutes, seconds of the occurrence of the lockout since the beginning of the particular programme stage
xx	number of completed cycles before lockout occurred

1.9 Print-out examples from the lockout memory

1. stray light	in pre-purge	time 00:00:11	Cycle No.	128
2. LW closed	in RT on	time 00:00:04	Cycle No.	109

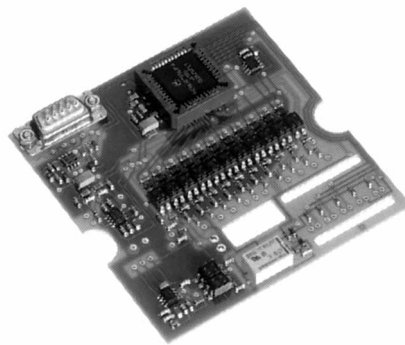
The lockouts are stored in the memory so that the most recent lockout is printed on the top line, etc.

1.10 Additional information

Besides the record of the programme and the lockouts, the information system supplies additional details about the performance of the burner. They are transmitted through the serial interface on command.

- a) delay time in operation of air proving device (sec.)
- b) damper running time until max. position is reached (min.sec.)
- c) damper running time until min. position is reached (min.sec.)
- d) usage of the safety time, delay in flame establishment (sec. 1/10 sec.)
- e) operation time for stage 1 (h.min.)
- f) operation time for stage 2 (h.min.)

- g) operation time of the control box (h.min.)
- h) number of programme cycles
- i) number of lockouts



1.11 Print-out example

SGU INFORMATION SYSTEM
VERSION 1.0.4

Auxiliary information:

LW switch time (sec):	20
LK cycle time (min):	1.11
LK cycle time (min):	0.18
Ignition delay (sec):	1.60
Hrs. low flame :	1.11
Hrs. High flame :	1.31
Hrs. control box :	3.30
No. of cycles :	38
No. of lockouts :	29

Lockout information:

1. Flame out	in Low flame	Time 00:01:08	Cycle No.	38
2. LW open	in SI relay on	Time 00:00:01	Cycle No.	37
3. LK failure	in LK running	Time 00:00:29	Cycle No.	36
4. LW open	in SI relay on	Time 00:00:15	Cycle No.	34
5. No flame	in End ts 1	Time 00:00:01	Cycle No.	33
6. LK failure	in LK running	Time 00:00:42	Cycle No.	32
7. Flame out	in Low flame	Time 00:00:05	Cycle No.	31
8. LW open	in Pre-purge	Time 00:00:02	Cycle No.	30

00:00:00	.|	.....	F: 00%	Synch
00:00:00	.|	.....	F: 00%	RT off

		F	L	M	S	V	Flame	Cycle	
		T	I	H	P	L	signal	step	
h :m :s		-----							

00:00:09	.|	|	|	.....	F: 00%	RT on
00:00:02	.|	|	|	.....	F: 00%	H relay on
00:00:08	.|	|	|	.....	F: 00%	LK running
00:00:23	.|	|	|	.....	F: 00%	LK at max.
00:00:28	.|	|	|	.....	F: 00%	SI relay on
00:00:29	.|	|	|	.....	F: 00%	Pre-purge
00:00:29	.|	|	|	.....	F: 00%	LK running
00:01:01	.|	|	|	.....	F: 00%	LK at min.
00:01:23	.|	|	|	.....	F: 00%	ts 1 PV/SV
00:01:29	|	|	|	.....	F: 00%	End ts 1
00:01:32	|	|	|	.....	F: 73%	ts 2 V1
00:01:38	|	|	|	.....	F: 78%	End ts2
00:01:40	|	|	|	.....	F: 77%	Low flame
00:02:46	.|	|	|	.....	F: 77%	Post-purge

1.12 Supervision functions

The microprocessor in the information system is also used to carry out the following additional supervisory functions:

- supervision of the damper running time, and cause lock-out after >100 sec.
- supervision of the cam assembly during the safety times
- supervision of the control box life, a "heart-attack" occurs after 250 000 cycles (A warning is given after 240 000 cycles by the information system; but an emergency operation facility exists).

1.13 LED information system code

The dual-coloured LED display contains 5 independent LED's and is mounted on the front of the control box. With this visual information display, 11 different programme stages and 10 different lockout causes can be shown.

programme stages

- start
- waiting for damper max. position
- pre-purge
- waiting for damper min. position
- flame establishment
- safety time
- operation stage 1
- operation stage 2
- post-purge
- return to start
- pause

lockout-stages and warning

- air proving switch
- air proving switch at start
- stray light
- stray light at start
- flame not established
- flame extinguished
- damper running time
- safety time check
- approaching end-of-life
- heart attack

green green flashing red red flashing

1.14 Serial Interface

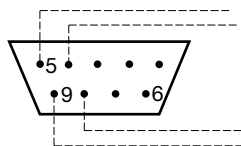
The serial interface works according the RS 422 standard with power level between 0V and 5V. The data transfer is 9600 baud, bidirectional, 8 data bit, 1 stop bit, none parity bit.

The levels of the transmit signals are as follows:

- logical 1: transmit + \approx 4.5V; transmit - \approx 0.5V
- logical 0: transmit + \approx 0.5V; transmit - \approx 4.5V

The receive signals require the following levels:

- logical 1: difference betw. receive+ and receive- > 0.5V
- logical 0: difference betw. receive - and receive+ > 0.5V



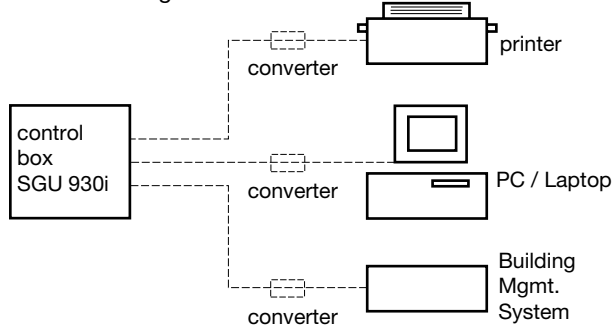
Overlay 9pol Dsub SGU:

- 4 Tx+ 5Tx-
- 8 Rx+ 9Rx-

1.15 Serial Interface

Generally speaking, any printer or computer with a serial interface type RS 422 can be connected to the SGU 930i, otherwise through a converter.

Possible configurations



1.16 Configuration of the Info-system

Simple adjustments as well as requests for additional information can be done through a PC or laptop in conjunction with any terminal program. Below you will find the different commands which must be entered in capital letters confirmed by the return key. By writing to the report the info-system then will acknowledge the reception accordingly to the command. This message acts as a proof that the command has been received.

SPRA1/SPRA2

The info-system is designed to handle two languages. The second language can be selected by the commands "SPRA1" for German and "SPRA2" for English.

LWBRE/LWBRA

The operation of burners with no air pressure switch requires the bridging of the terminals 9, 10 and 11. This must be communicated to the info-system with the command "LWBRA" to avoid confusion. The command "LWBRA" returns the info-system to operation with air pressure switch.

SGUIN

Print out of the additional information as well as of the lockout history.

PROTZ

With this command one always will receive the print out of a protocol line informing about the current status of the burner. The info-system only delivers a protocol line when it comes to an other program step. During the operation it therefore could be the case, that there won't be any print out for a long time. With the above mentioned command "PROTZ" a protocol line always can be requested.

PMOD1 / PMOD0

The "PMOD1" switches into the protocol mode 1. The Info system then delivers an extended protocol which includes all changes of the input signals. Usually the system works in the protocol mode 0. This mode only reports the single program steps. Not all proceedings are important for the program phases and therefore will not always being reported. With the mode 1 also these proceedings will be visible. The command "PMOD0" returns the system back to protocol mode 0.

INIAN

This command is used to check the self control function of the processor software and therefore whether the processor software itself works correctly. When the command "INIAN" is sent to the info system the following response must be reported:

SGU INFORMATIONSSYSTEM
VERSION 1.X.X

If this report does not appear, then the processor itself is defective.

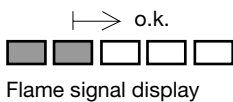
2. Flame supervision

Flame supervision can be carried out by one of the following detectors:

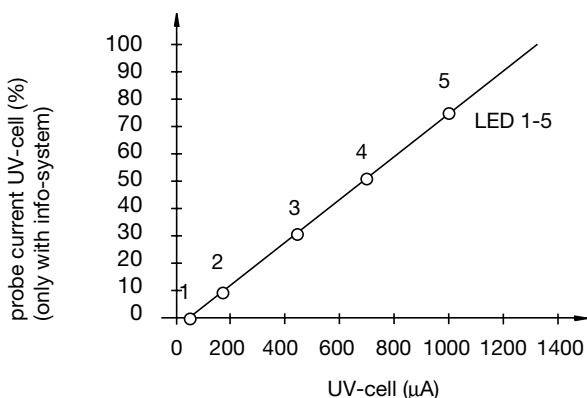
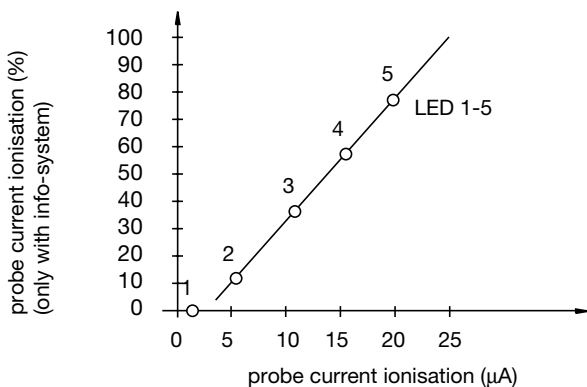
- ionisation rod where the mains supply provides a neutral earth connection
- U-V cell type UVZ 780 for oil/gas- and dual fuel burners
- Infra-red flicker detector type IRD 1020 for all type of burners

The different flame detectors are connected to separate terminals on the base, so that each detector is linked in the best possible way to the flame amplifier.

The flame signal display at the front of the control box is a 5-digit row of LED's. It displays continuously the value of the flame current and provides a constant indication of the flame signal strength. Any change in flame signal strength can be recognised immediately and corrective action can be taken without delay.



2.1 Relation between flame signal indication and probe current



3. Control sequence for the burner

3.1 Selection of the programme

- The various control programmes can be selected by external selector switches or by the appropriate wiring to the base:
- long pre-ignition time (terminal 18) or short pre-ignition time terminal 19
 - lockout or recycling due to loss of flame, recycling is selected by a link between terminal 34 + 35
 - ignition spark detection by U-V cell, no link between terminal 36 + 37
 - fan motor with post-purge (terminal 17), or no post-purge terminal 16

3.2 Conditions to start

1. Control box at start position.
Supply voltage connected to terminal 1 + N
2. Controlling thermostat calls for heat and safety interlocks are closed (between terminals 2 + 3)
3. Start command circuit SB, closed (terminals 7 + 8).
These contacts may be open after approx. 6 secs.

3.3 Air damper control

With 3 separate output feeds, the air damper control can be set to either "closed", "low" air or "high" air positions. These monitored positions ensure "high" air for purging and "low" air before the initial release of fuel. Failure to reach both the "closed" and "high" air positions interrupt the control box sequence. If the air damper does not reach the required position within 100 seconds, the control box will go to lockout. Is no feed back from the air damper end position available, since no end contacts exist, then the terminals 28 and 2 must be connected together. Note, the air damper position is no longer controlled with this change. The output terminals of the air damper control are electrically isolated from the internal circuit of the control box after power is switched to the high flame or modulation stage thermostat. The modulation stage thermostat LR then controls the air damper, depending on the required firing rates of V1 (main flame) or V2 (high flame).

3.4 Air proving switch

The changeover contact of the air proving switch is connected to the safety circuit of the control box. Practically, a changeover contact for a switching current of 0.5 A will be used. If the contact is not in the "no air" position, the control sequence will not start. If this check is satisfied, the burner motor and air damper motor circuits are switched on. Combustion air supply must be proved within 9 seconds or the control box will go to lockout. Supervision of the combustion air supply ends with the interruption of the control thermostat circuit, the post-purge period is not monitored. To operate burner with no air proving switch, the terminals 9, 10 and 11 must be linked together.

Note, at SGU 930i this change must be told to the info-system (refer to 1.16 under LWBRE/LWBRA).

3.5 Valves

4 different valves can be connected, start valve or pilot valve, main valve (V1) and high flame or modulation stage valve (V2). On a single jet burner 3 firing rates can be achieved by use of the start valve and the main valves. Gas which flows through valves SV, V1 and V2 must join a common jet and the appropriate standards for the maximum firing rate of the start valve should be checked. Power is switched off to the pilot valve once the main flame is established. The maximum flow rate of the gas through the pilot valve is also limited by the relevant standard. It is not permitted to use the pilot valve and start valve at the same time.

3.6 Remote lockout facility

As a safety check, the control box can be put to lockout by closing the circuit between terminals 3 + 4. Reset from lockout can be achieved immediately by pressing the reset button at the front of the control box or by means of a remote switch.

4. Safety

The control boxes types SGU 930 and SGU 930i comply with the latest European standards - EN 230 for oil burner control boxes and EN 298 for gas burner control boxes. The control boxes also offer the following safety features in addition to those set down in EN 230 and EN 298:

4.1 Stray light check

The stray light check begins approximately 8 seconds after the end of a programme cycle by applying a higher voltage to the U-V cell. During a shutdown, a flame signal of more than several seconds duration will lead to a lockout. Any flame signal due to stray light or breakdown of the U-V cell during the pre-purge period will result in an immediate lockout.

4.2 Safety circuit

In the safety circuit, the input signals (e.g. from the air proving switch or flame relay) are checked by cam switches. This check begins after the start of the programme cycle. If the input signal does not match the required one, the safety circuit will be interrupted and lockout will occur immediately. The safety circuit has the advantage that it can be easily extended to add an unlimited number of input signals, which can be checked and are fail-safe.

4.3 Additional safety features

All output voltages to the valves are supplied via the cam switches and the flame relay as normal and in addition, via two independent contacts on the safety and main relays. Together with the lockout switch, five switches control the voltage supply to each of the valves.

The control box will not start unless the mains supply is above 175 V. If the voltage drops to 150 V during the control sequence, power to the burner is shut off. When power returns to normal, the control box will relight the burner.

The micro-processor in the information system of the SGU 930i does not affect the control functions in any way. However, the micro-processor provides additional safety functions by supervising the safety times and the age of the control box.

The cam assembly, which controls the different timings of the control programme, is monitored during the safety times by the information system. Any irregularity results in a lockout.

The cam and switch assembly of the SGU 930i has a guaranteed lifetime of 250 000 cycles. If a control box reaches this number of cycles, the information system induces a "heart attack". The control box will then run to the end of the programme cycle and lockout. After resetting this lockout, an additional start is possible in an "emergency".

5. Mounting and Installation

5.1 Base

In the new base with its 44 terminals, all burner components, detectors, control devices and other connections can be made with up to 2 wires per terminal, and is therefore more practical and easier to check. Despite the high number of terminals, the construction of the base allows easy access to each terminal. The terminal screws are enclosed in a metal shoe, thus preventing any damage to the wiring. Apart from the 38 terminals for the control box, additional terminals are also available. They are as follows:

- 7 extra neutral terminals, internally linked in the base to the main neutral terminal
- 6 earth terminals, linked to the main earth tag
- 16 knock-out cable entry holes \varnothing 7 mm in diameter
- 4 knock-out cable entry holes with a PG 11 thread

To assist trouble free operation the main neutral connection terminal in the wiring base must be fully tightened.

A keying arrangement on the base prevents the possibility of the incorrect control box being fitted onto the base.



5.2 General

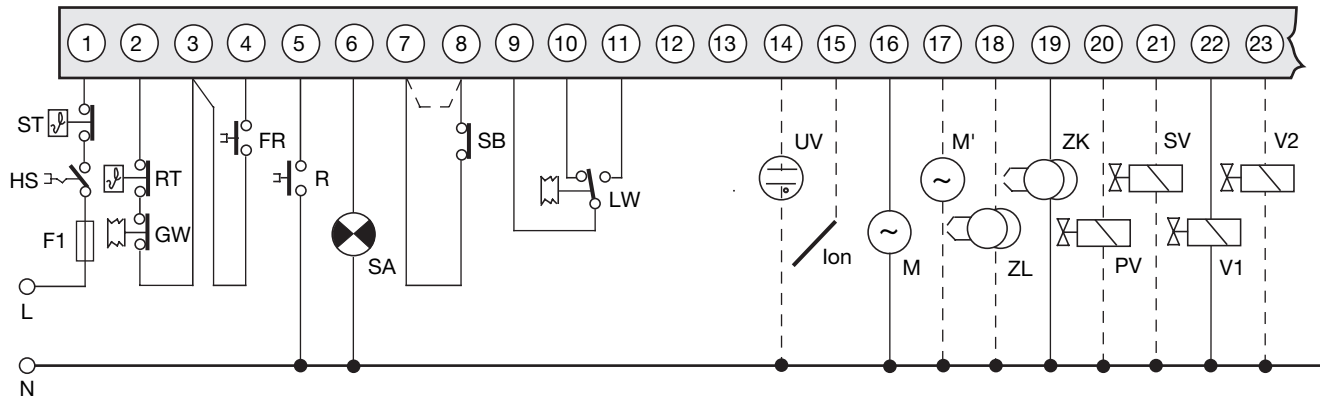
Any mounting attitude is possible, but it is recommended to mount it in a way so that the LED displays and the coloured programme indicator can be easily seen. The control box itself is resistant to spray water (IP 44), but the flame detectors may be sensitive to water and moisture. If the U-V cell UVZ 780 is used, good contact with the burner earth by means of the mounting flange is essential. Control box and flame detectors should be protected from harsh vibration.

Where flame supervision is by ionisation electrode, safety regulations require that it should be properly insulated in order to prevent the risk of an electric shock. A voltage in excess of 25 V between neutral and earth will prevent troublefree operation. In this case, use of an isolating transformer is recommended.

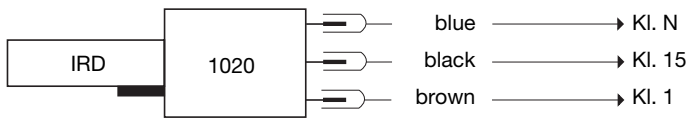
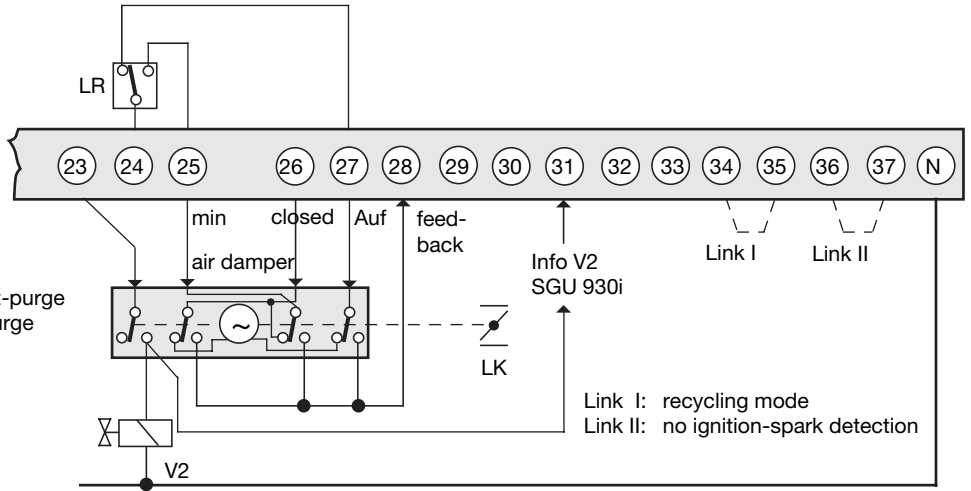
As listed under technical data, the maximum cable length for the flame detector should not be exceeded for trouble-free operation. It is not recommended to run the flame detector cables adjacent to power cables over long distances. Multi-cored cables should also not be used.

If during the test of the burner the click-rate (according to EN 55014) is higher than the max. allowed valve, a X2-capacitor of 0.1 μ F can be connected between terminal 1 and N.

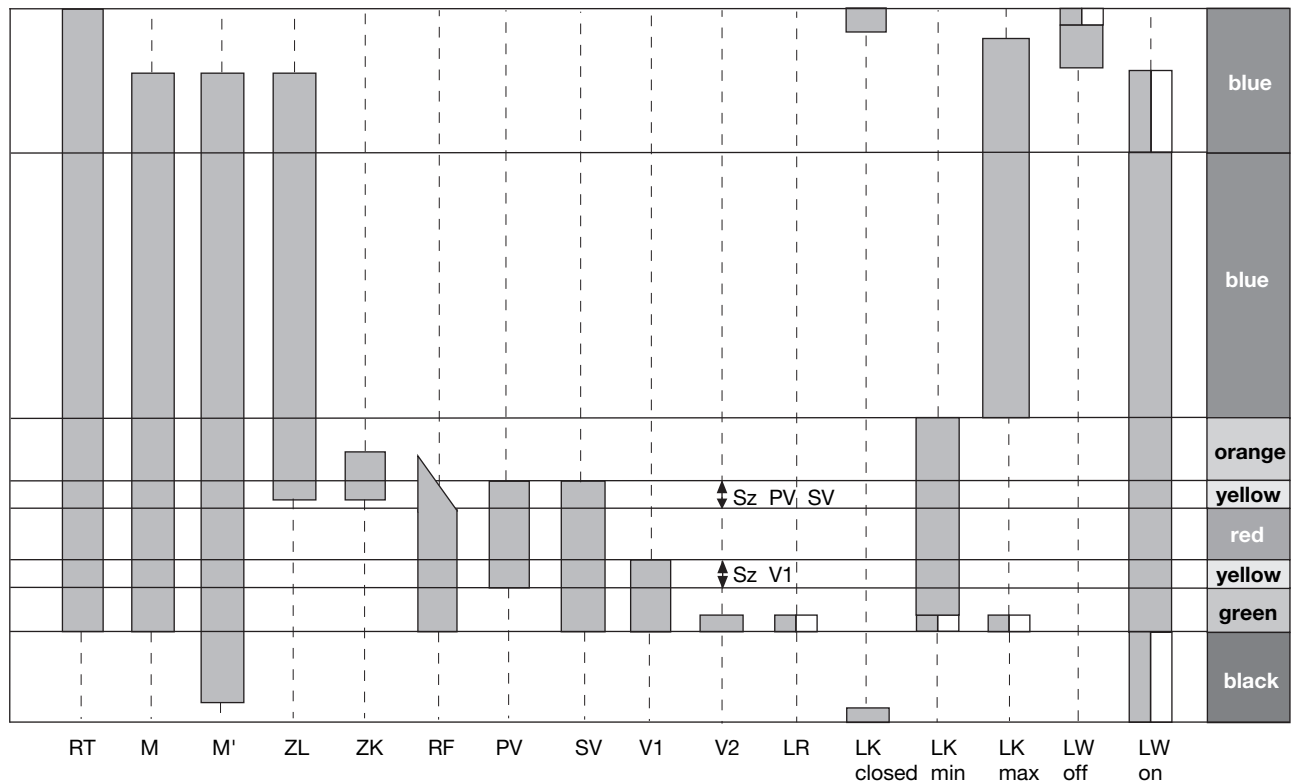
WIRING DIAGRAM



- HS mains switch
- LR high flame or modulation stage thermostat
- RT control thermostat
- ST limit thermostat
- GW gas pressure switch
- LW air pressure switch
- SB start interlock
- FR remote lockout
- R reset
- SA external lockout lamp
- M burner motor without post-purge
- M' burner motor with post-purge
- LK air damper motor
- Ion flame ionisation electrode
- UV U-V cell
- IRD I-R flicker detector
- PV pilot valve
- SV start valve
- V1 main valve
- V2 high flame or modulation stage valve
- ZK ignition (short)
- ZL ignition (long)
- L,N mains voltage
- F1 external fuse



PROGRAMME CYCLE



INSTALLATION INSTRUCTIONS AND MAINTENANCE

1. Important notes

- Ensure that the control box is correctly wired in accordance with the appropriate diagram. Faulty or incorrect wiring could cause damage to the control box or installation.
- When mounting and wiring to the control box, the appropriate installation standards must be observed.
- The external fuse rating should be as stated in the technical data. The built-in fuse must only be exchanged by one of the same rating, T6.3 A slow, according to DIN 41571. If this is ignored, damage and hazardous conditions as a result of a short circuit could occur.
- In compliance with the relevant standards, a shutdown must occur at least once every 24 hours.
- Power must be switched off whenever removing or fitting the control box.
- Control boxes are safety equipment and therefore sealed. They must not be opened and any interference with the internal workings of the control box may have hazardous consequences.

2. Function test

The safety test for the flame detector must be carried out when the control box is installed, and at every routine maintenance check and after any lengthy break in operation.

- Shut off the fuel supply and link out the gas pressure switch and allow the burner to start:
 - at the expiry of the ignition safety time the control box must go to -> LOCKOUT
- When the burner is in the "run" position cover the flame detector:
 - LOCKOUT must occur if the lockout mode is selected
 - or burner will shutdown and attempt to relight if the recycling mode is selected

3. Trouble shooting

With the help of the information system, time consuming and expensive trouble shooting is no longer necessary. The recording of the programme cycle and the fault diagnosis are new "tools", resulting in less difficult fault finding procedures and saving on maintenance cost. If an interpretation of the lockout and information memory is not needed at the site of the application, the investigation can be done afterwards. The non-volatile memory can be later connected to a printer, laptop or a PC to analyse it's contents while the burner is running with a replacement control box.

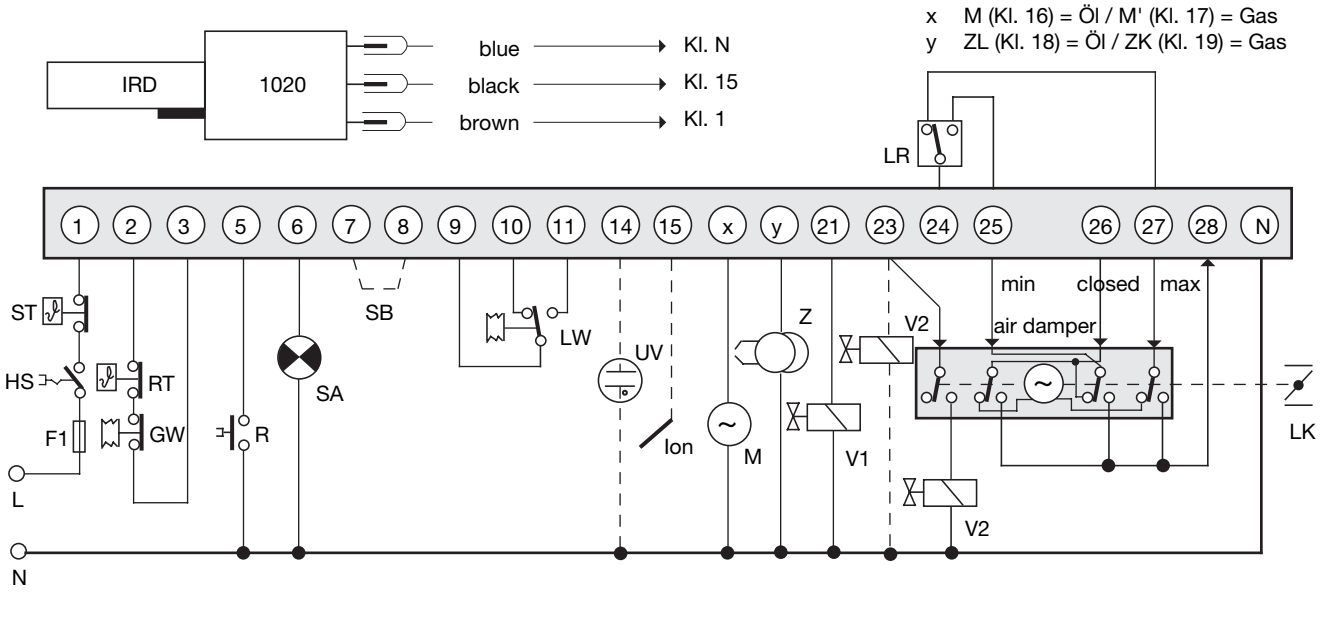
Another useful device to help follow the programme cycle and assist with trouble shooting is the built-in LED code display at the front of the control box. This shows all the various programme stages and lockouts or warnings. It is a continuous display and indicates at which stage the programme cycle has reached. When a lockout occurs, the reason for failure is shown on the display, it remains displayed until the control box is reset. Alongside the LED display, the most common codes are printed. Further decoding is listed in section 1.13 of this document. A detailed description of the complete information system can be found under the heading "APPLICATION FEATURES".

The coloured programme indicator of the cam assembly on control boxes without a built-in information system, at SGU 930, provides some help for trouble shooting. Faults during installation, operation or shutdown can be identified by this programme indicator. After lockout, it is recommended to make a note of the position of the indicator before re-setting.

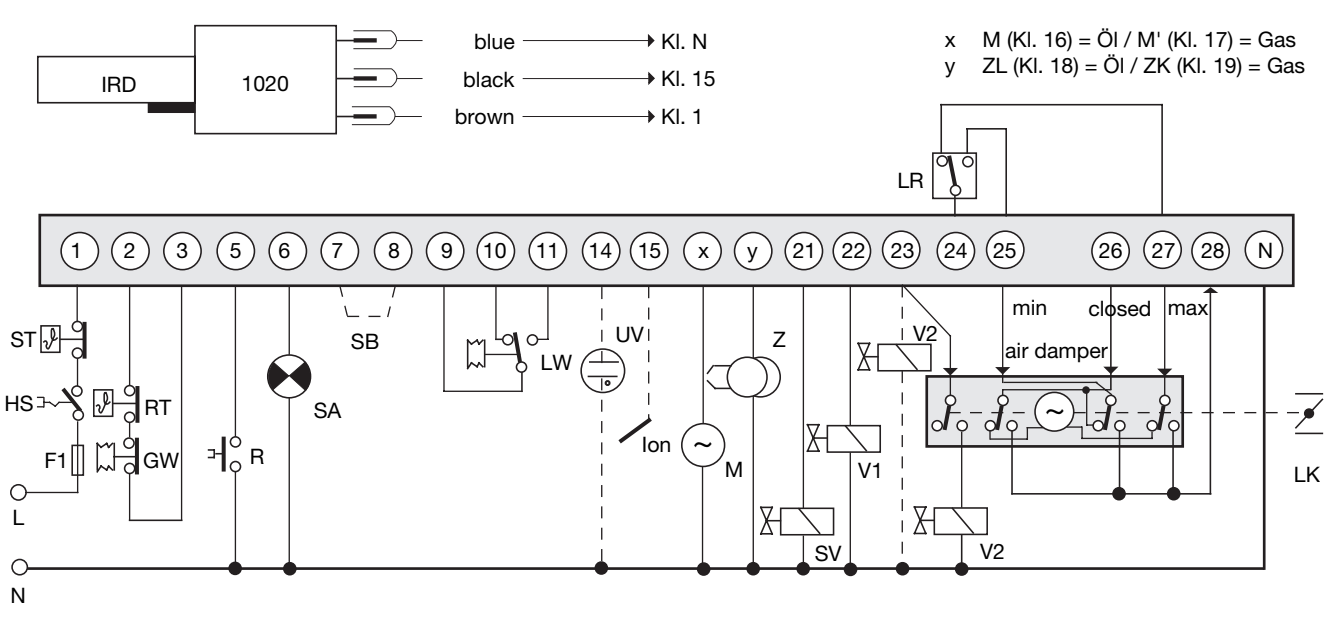
The following list can be used for trouble shooting. Both cams of the SGU 930's cam assembly rotate synchronously and both programme indicators are identical.

Colour	Position	Fault	possible reason
BLUE	start	no start	no mains voltage, control or start circuit open
BLUE	after start	no start	air pressure switch not in "no air" position
BLUE	before red line	continuous	air damper not open (at "high" air position)
BLUE	red line	lockout	air pressure switch not in "air proved" position
BLUE	after red line	lockout	stray light, faulty flame detector
BLUE	after red line	burner stops	mains voltage <150 V
ORANGE	start	continuous	air damper not at "Low" air position
YELLOW	end	lockout	no flame established by start valve or pilot valve no flame signal or signal too weak ign. spark detection active without U-V cell no flame established after recycling
RED			
YELLOW	end	lockout	no flame signal after 2nd safety time or signal too weak (on 2-nozzle burners only)
GREEN	end	lockout	loss of flame in "run" position (in lockout mode) loss of combustion air supply
BLACK	end	lockout	stray light due to "after-burn" U-V cell failed the switch-off test due to aged or faulty U-V cell faulty flame detection circuit

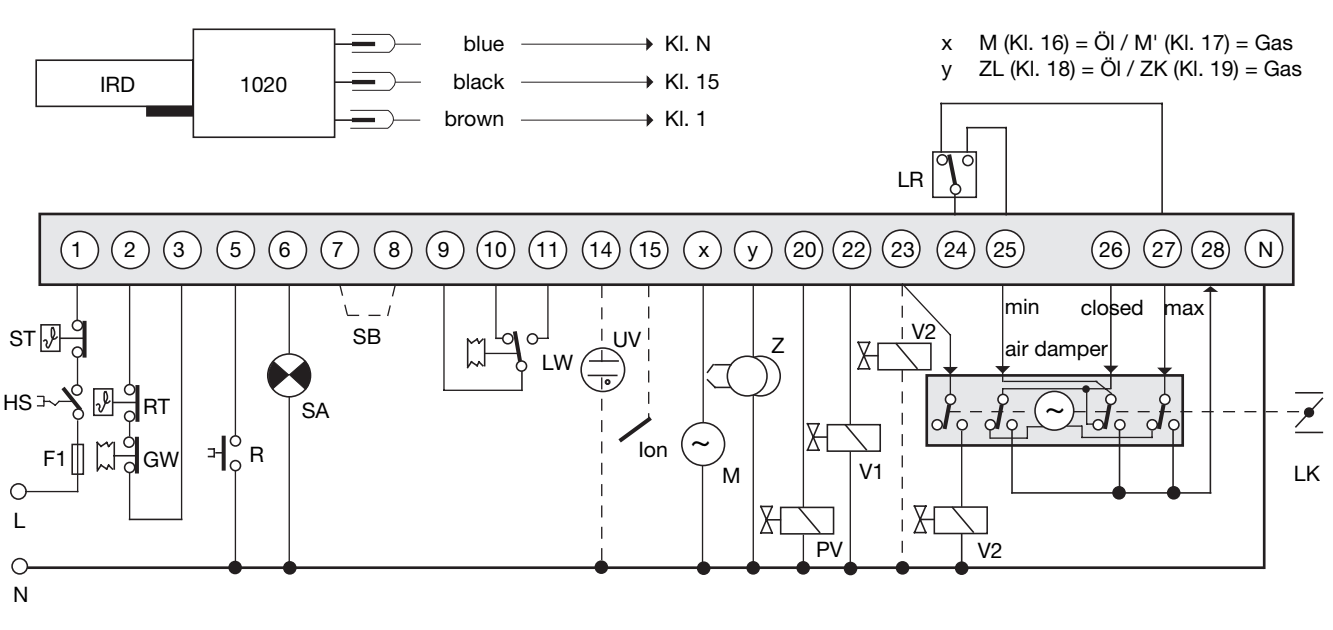
BURNER 1- OR 2-STAGE



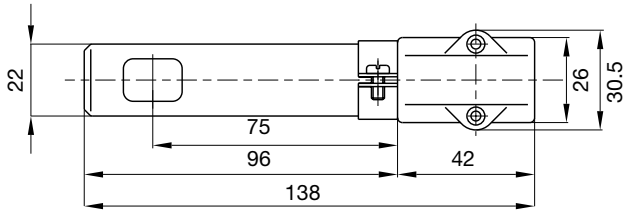
BURNER WITH START-VALVE



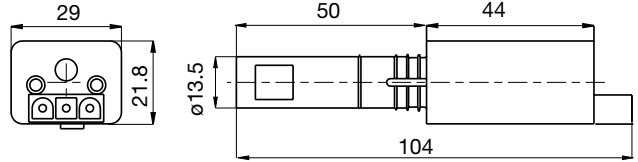
BURNER WITH 2 NOZZLES



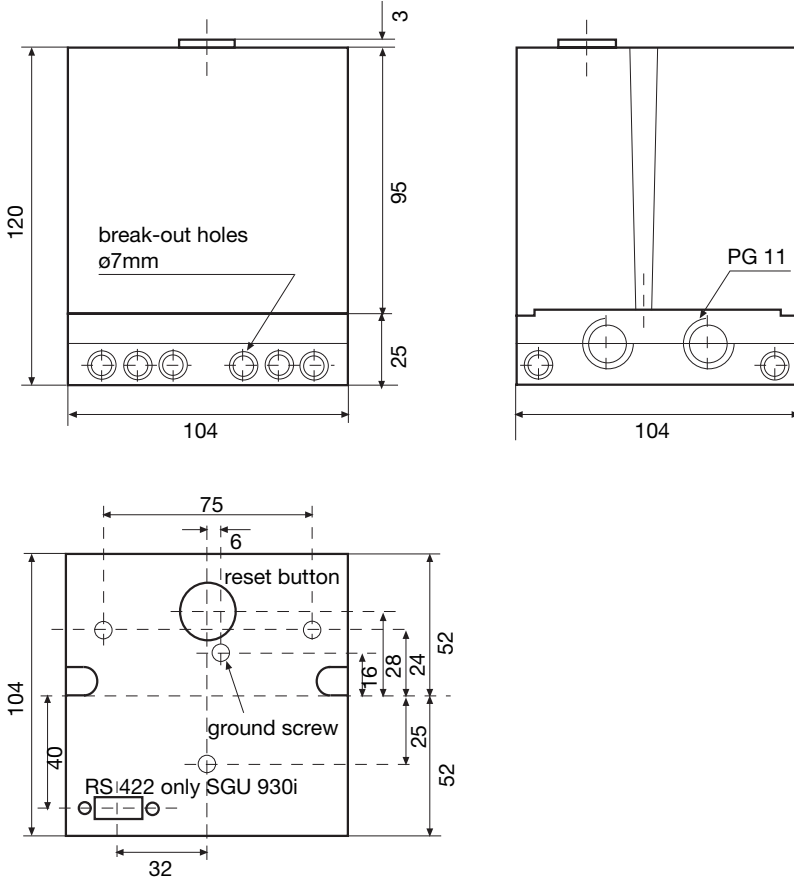
UVZ 780



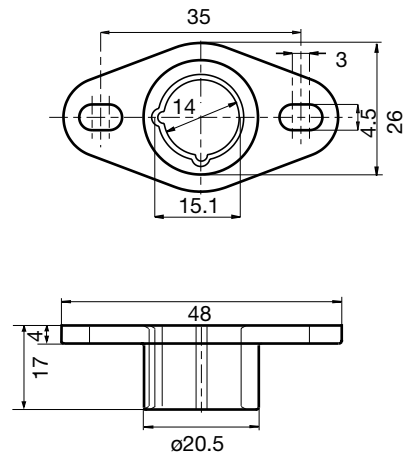
IRD 1020



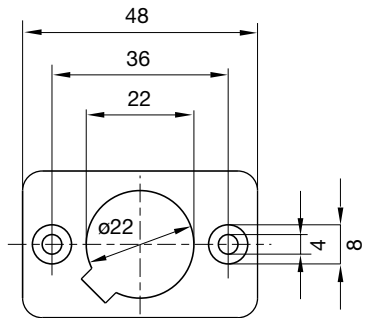
SGU 930 AND SGU 930i WITH BASE



MOUNTING FLANGE IRD



MOUNTING FLANGE UVZ



ORDERING INFORMATION

ITEM	DESIGNATION	ITEM NO.
Control box without info. system	SGU 930 Mod. 33-33	08910
Control box with info. system	SGU 930i Mod. 33-33	08911
Base	Base 930	70301
Flame detector	UVZ 780 blue	18812
Flame detector	UVZ 780 white	18814
Flame detector	UVZ 780 red	18813
Flame detector	IRD 1020 end-on viewing	16522
Flame detector	IRD 1020 side-on left	16523
Flame detector	IRD 1020 side-on right	16521
Mounting flange	UV Holder	18807
IRD mounting flange	IRD Holder M93	59093
Flame detector cable	3-wire, 0.5m	7236001

The above ordering information refers to the standard version. Special versions are also included in our product range.

Specifications subject to change without notice.

SGU 930
SGU 930i



A Honeywell Company

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