SIGMATEK

HZS 521-1

Boiler Module Power Board

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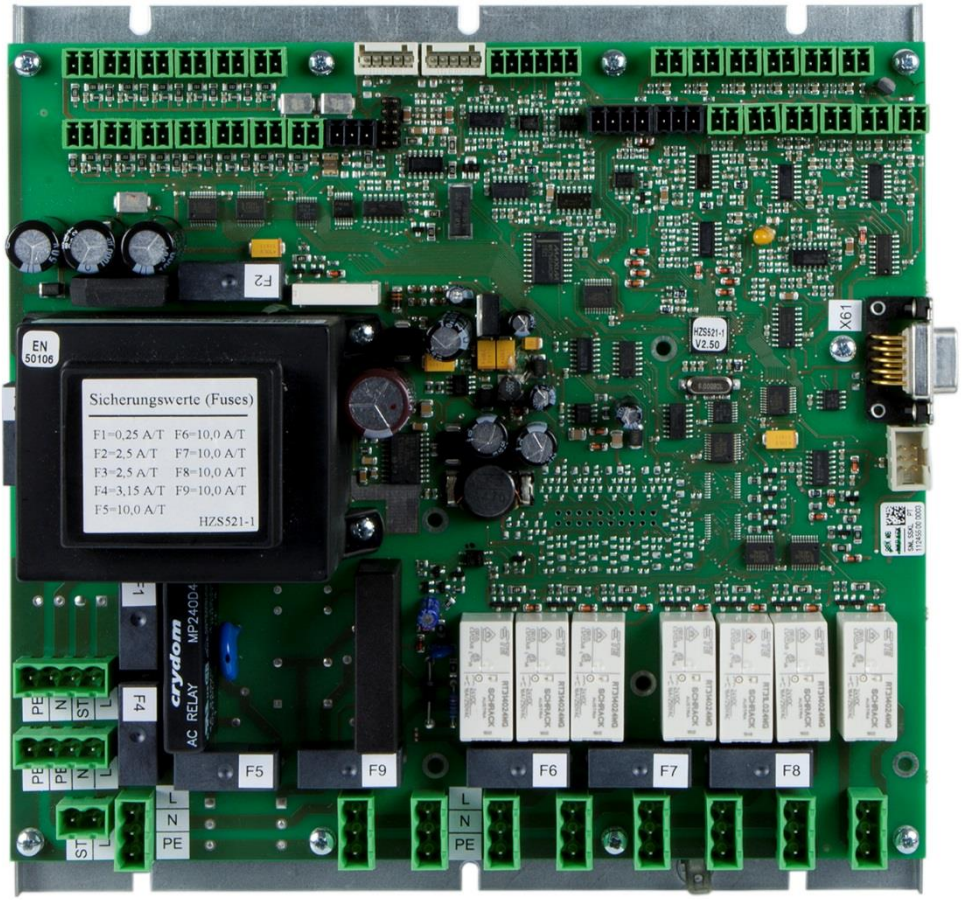
Translation from German

Boiler Module Power Board HZS 521-1



1 System Description

This heating system has a modular construction. The HZS 521-1 function module is a module used for the boiler. It communicates with the CPU module and executes the commands sent. The HZS is a simple component that is used to control automated processes in a heating system.

All interfaces and connections for controlling the heating boiler are located on the control board. They are customized to the requirements of the oven.

Contents

1.1 Configuration

- Heater control with AT90CAN32 controller
- 230 V AC supply
- 13x digital inputs DI1-13 24 V/5 ms for:
  - DI1: auger temperature
  - DI2: grate sensor
  - DI3: flap sensor 1
  - DI4: external contact
  - DI5: worm gear
  - DI6: reserve
  - DI7: reserve
  - DI8: reserve
  - DI9: reserve
  - DI10: reserve
  - DI11: reserve
  - DI12: reserve
  - DI13: reserve
- 1x digital input DI16 for safety temperature limit STB-cutoff active
- 1x digital input DI17 for primary fan rotation speed feedback
- 1x digital output DA1 (230 V AC/3 A potential-free contact) for:
  - DA1: error message
- 3x digital outputs DA2-4 (230 V AC/10 A relays) for:
  - DA2: heat exchange cleaner (switched over STB)
  - DA3: grate open (switched over STB)
  - DA4: grate closed (switched over STB)
- 3x digital outputs DA5-7 (230 V AC/10 A relays) for:
  - DA5: ignition (switched over STB)
  - DA6: turbine (switched over STB)
  - DA7: return flow pump (not switched over STB)
- 1x digital output DA20 (Triac 230 V AC/3 A) for:
  - DA20: screw (switched over STB)
- 1x digital output DA22 Heating sensor on (internal)
- 1x phase angle control (230 V AC/1.1 A) for:
  - Primary fan (switched over STP)

- 1x analog input AI1: -100 ... +100 mV, Lambda sensor LSM11
  - With heating for Lambda sensor LSM11: 12 V AC/1.4 A

- 1x analog input AI2: 40-500 kΩ: CO sensor SGAS220
  - With heating for CO sensor SGAS220 with control over reference temperature

- 2x analog inputs AI3, AI20: 0-2.5 V: Air volume sensor
  - With +24 V power supply for sensor and analog output

- 6x KTY 81 - 110 temperature inputs AI4-6 and AI8-10: -25 ... +100 °C
  - AI4: Boiler temperature
  - AI5: Return flow temperature
  - AI6: External temperature
  - AI8: reserve
  - AI9: reserve
  - AI10: reserve

- 1x PT1000 temperature input AI7: 0-250 °C
  - AI7: Exhaust temperature

- 1x KTY10 Temperature input AI11: -25 ... +100 °C
  - AI11: Thermal coupling temperature

- 1x NiCr-Ni temperature input AI12: 0-600 °C reserve

- 1x NiCr-Ni temperature input AI13: 0-1200 °C reserve

- 1x analog input AI21: 0-10 V: external control

- 1x analog input AI22: 0-3 V: reserve

- 1x analog output AO1: 0-10 V: Secondary fan

2 Technical Data

2.1 Power Supply

Supply voltage	230 V AC ±10 % (Input voltage for power transformer on the power board, input voltage for STB, Phase for phase angle, relay and Triac output)
Power supply frequency	50-60 Hz
Current consumption Supply voltage (230 V AC)	**Total current consumption** **200 mA + current consumption of the connected loads** **(up to HW 2.70: max. 12 A)** **(starting with HW 2.80: max. 16 A)**
	Power supply transformer **Supply for the power board and CPU electronics** **Supply for heater Lambda sensor:** **200 mA**
	The power supply is switched of STB, L-STB ***Loads connected over fuse F4 (3,15 AT):*** X11 Primary fan: maximum 690 W/**maximum 3 A** ***Loads connected over fuse F5 (10 AT):*** X14 Screw: maximum 690W/**maximum 3 A** ***Loads connected over fuse F6 (10 AT):*** X9 Turbine: maximum 2300 W/**maximum 10 A** ***Loads connected over fuse F7 (10 AT):*** X8 Ignition: maximum 2300 W/**maximum 10 A** ***Loads connected over fuse F8 (10 AT):*** X5 Heat exchange cleaner: maximum 690 W/**maximum 3 A** X6 Grate open: maximum 690 W/**maximum 3 A** X7 Grate closed: maximum 690 W/**maximum 3 A**
	The power supply not switched over STB, L ***Loads connected over fuse F9 (10 AT):*** X10 Boiler circuit return flow pump: maximum 2300 W/**maximum 10 A**

The cross sectional area of the outputs must be large enough for the maximum continuous current at 230 V AC for each connected load.

It is important to note that at high currents, thermal loads affect the wiring and with continuous over loading, can lead to a break down!

It should be noted that only the supply connector X1 with the appropriate opposing connector (FKC 2.5 HC / 3-ST-5.08) is designed for a maximum current (up to HW 2.70: max. 12 A; starting with HW 2.80 max. 16 A). The X2 connector for the 230 V supplies is designed for a maximum current of 12 A.
Up to HW 2.70, the STB is designed for a maximum of 12 A; starting with HW 2.80, a maximum of 16 A. For the remaining 230 V outputs, the maximum current for the connector is defined by the fuse value of the respective output.

The maximum load of the respective relay contacts can be found in the chapter "Digital Output Specifications DA2-4 and DA5-7: Relay Outputs". These load values are based on the relay contact only, not the respective connected circuits.

2.2 +24 V Supply Specifications

Minimum current available for external users (CPU for the heating control, internal expansion modules…)	minimum 400 mA at +24 V DC
Applicable connectors	X61

2.3 Performance Data

Processor	AT90CAN32
Controller frequency	6.0 MHz
Command execution time	circa 2 µs
Interfaces	1x CAN
Internal program memory	32-kbytes (Flash)
Internal data and/or program buffering (internal EEPROM)	1-kbyte (Flash) no battery buffering required
External data memory	no
Signal generator	no
Real-time clock	no

2.4 Terminal Requirements

Up to HW 2.70

Connection technology	**Connector terminals are not included in delivery!** The following spring terminals are required: 1x 2-pin FKC 2.5/ 2-ST-5.08 Phoenix Contact spring terminal connector RM 5.08 11x 3-pin FKC 2.5/ 3-ST-5.08 Phoenix Contact spring terminal connector RM 5.08 3x 4-pin FKC 2.5/ 4-ST-5.08 Phoenix Contact spring terminal connector RM 5.08 25x 2-pin FK-MCP 1.5/ 2-ST-3.5 Phoenix Contact spring terminal connector RM 3.5 2x 3-pin FK-MCP 1.5/ 3-ST-3.5 Phoenix Contact spring terminal connector RM 3.5 (option) 1x 4-pin FK-MCP 1.5/ 4-ST-3.5 Phoenix Contact spring terminal connector RM 3.5 1x 6-pin FK-MCP 1.5/ 6-ST-3.5 Phoenix Contact spring terminal connector RM 3.5 2x 5-pin 733-105 Wago connector plug with Clamp technology RM 2.5

Starting with HW 2.70

Connection technology	**Connector terminals are not included in delivery!** The following spring terminals are required: 1x 2-pin FKC 2.5 HC/ 2-ST-5.08 Phoenix Contact spring terminal connector RM 5.08 11x 3-pin FKC 2.5/ 3-ST-5.08 Phoenix Contact spring terminal connector RM 5.08 1x 4-pin FKC 2.5/ 4-ST-5.08 Phoenix Contact spring terminal connector RM 5.08 1x 4-pin FKC 2.5 HC/ 4-ST-5.08 Phoenix Contact spring terminal connector RM 5.08 25x 2-pin FK-MCP 1.5/ 2-ST-3.5 Phoenix Contact spring terminal connector RM 3.5 2x 3-pin FK-MCP 1.5/ 3-ST-3.5 Phoenix Contact spring terminal connector RM 3.5 (option) 1x 4-pin FK-MCP 1.5/ 4-ST-3.5 Phoenix Contact spring terminal connector RM 3.5 1x 6-pin FK-MCP 1.5/ 6-ST-3.5 Phoenix Contact spring terminal connector RM 3.5 2x 5-pin 733-105 Wago connector plug with Clamp technology RM 2.5

2.5 Digital Input Specifications DI1-13

Input voltage	typically +24 V	maximum +30 V
Signal level	low: <+8 V	high: >+14 V
Switching threshold	typically +11 V	
Input current	5 mA at +24 V	

Input delay	typically 5 ms
Number	13
Connector	13x 2-pin, RM 3.5
Application	- DI1: Worm gear temperature X44 - DI2: Grate sensor X45 - DI3: Valve sensor 1 X46 - DI4: External contact X47 - DI5: Worm gear X48 - DI6: Reserve X49 - DI7: Reserve X50 DI8: Reserve X51 DI9: Reserve X52 DI10: Reserve X53 DI11: Reserve X54 DI12: Reserve X55 DI13: Reserve X56

2.6 Digital Input Specifications DI16

Number	1
Connector	without internal circuit
Application	DI16: STB cutoff active (230 V AC)

2.7 Digital Input Specifications DI17

Input signal	open collector (up to HW-Version 1.1) +24 V (starting from HW-Version 2.0)
Input frequency	maximum 600 Hz
Signal analysis	1X
Counter resolution	8-bit
Input current	3 mA at +24 V
Input delay	typically 20 µs
Number	1
Connector	3-pin, RM 3.5
Application	DI17: Speed feedback primary fan X57

2.8 Digital Output Specifications DA2, DA4: Relay Outputs – 230 V AC/10 V

Number	2
Relay type	normally open
Relays	RT314024 WG

Switching range	16.8-30 V DC
Switching current	typically 11 mA at +24 V
Switching time	circa 10 ms
Switching power	see data sheet: Tyco Schrack RT1 series
Fuse	T 10 A
Connector	2x 3-pin, RM 5.08
Application	- DA2: Heat exchange cleaner X5 (switched by STB) - DA4: Grate closed X7 (switched by STB)

2.9 Digital Output Specifications DA5-7: Relay Outputs – 230 V AC/10 V

Number	3
Relay type	normally open
Relays	RT314024 WG
Switching range	16.8-30 V DC
Switching current	typically 11 mA at + 24 V
Switching time	circa 10 ms
Switching power	see data sheet: Tyco Schrack RT1 series
Fuse	T 10 A
Connector	3x 3-pin, RM 5.08
Application	- DA5: Ignition X8 (switched by STB) - DA6: Turbine X9 (switched by STB) - DA7: Return flow pump X10 (not switched by STB)

2.10 Digital Output Specifications DA1: 230 V AC/3 A Potential-free Contact

Number	1
Relay type	changeover contacts, potential-free
Relays	RT314024 WG
Switching range	16.8-30 V DC
Switching current	typically 11 mA at + 24 V

Switching time	circa 10 ms
Switching power	see data sheet: Tyco Schrack RT1 series
Fuse	-
Connector	1x 3-pin, RM 5.08
Application	DA1: Error X4

2.11 Technical Data RT314024 WG Relay

TE connectivity RELAY PRODUCTS

General Purpose Relays
PCB Relays

SCHRACK

Power PCB Relay RT1

- 1 pole 12A/16A, 1 form C (CO) or 1 form A (NO) contact
- DC or AC coil
- 5kV/10mm coil-contact, reinforced insulation
- Ambient temperature 85°C (DC coil)
- WG version: product in accordance to IEC 60335-1
- Reflow version: for THR (Through-Hole Reflow) soldering process

Typical applications
Boiler control, timers, garage door control, POS automation, interface modules

Approvals
VDE Cert. No. 40007571, cULus E214025, cCSAus 1142018;
CQC in preparation
Technical data of approved types on request

Contact Data	12A	16A
Contact arrangement	1 form C (CO) or 1 form A (NO)	
Rated voltage	250VAC	
Max. switching voltage	400VAC	
Rated current	12A	16A
Limiting continuous current	12A	16A, UL: 20A
Limiting making current max. 4s, duty factor 10%	25A	30A
Breaking capacity max.	3000VA	4000VA
Contact material	AgNi 90/10, AgNi 90/10 gold plated	
Frequency of operation, with/without load		
DC coil	360/72000h^{-1}	
AC coil	360/36000h^{-1}	
Operate/release time max., DC coil	8/6ms	
Bounce time max., DC coil, form A/form B	4/6ms	
Electrical endurance	see electrical endurance graph [1]	

Contact ratings

Type	Contact	Load	Cycles
IEC 61810			
RT314 DC-coil	A (NO)	16A, 250VAC, cosφ=1, 85°C	30x10^3
RT314 DC-coil	C (CO)	16A, 250VAC, cosφ=1, 85°C	10x10^3
RT314 DC-coil	A (NO)	10A, 400VAC, cosφ=1, 85°C	150x10^3
RT114 DC-coil	A (NO)	12A, 250VAC, cosφ=1, 85°C	50x10^3
RT114 AC-coil	A (NO)	12A, 250VAC, cosφ=1, 70°C	100x10^3
UL 508			
RT314	A/B (NO/NC)	20A, 250VAC, general purpose, 85°C	6x10^3
RT334	A (NO)	16A, 250VAC, gen. purpose, 85°C	50x10^3
RT314	A (NO)	1hp, 240VAC, 40°C	1x10^3
RT314	A (NO)	FLA/LRA, 4.5/13.1A, 480VAC, 70°C	100x10^3
EN60947-5-1			
RT314 DC-coil	A/B (NO/NC)	2A, 24VDC, DC13	6.050
EN60730-1			
RT314 DC-coil	A (NO)	12(2)A, 250VAC, 85°C	100x10^3

1) For reflow solderable versions: actual contact performance may be influenced by the reflow soldering process.

Contact Data (continued)

Mechanical endurance	
DC coil	>30x10^6 operations
AC coil	>10x10^6 operations
AC coil, reflow version	>5x10^6 operations

Coil Data

Coil voltage range, DC coil/ AC coil	5 to 110VDC / 24 to 230VAC
Operative range, IEC 61810	2
Coil insulation system according UL	class F

Coil versions, DC coil

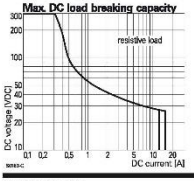
Coil code	Rated voltage VDC	Operate voltage VDC	Release voltage VDC	Coil resistance Ω±10% [2)]	Rated coil power mW
005	5	3.5	0.5	62	403
006	6	4.2	0.6	90	400
009	9	6.3	0.9	200	400
012	12	8.4	1.2	360	400
020	20	14.0	2.0	952	420
024	24	16.8	2.4	1440	400
048	48	33.6	4.8	5520	417
060	60	42.0	6.0	8570 [2]	420
110	110	77.0	11.0	28800 [2)]	420

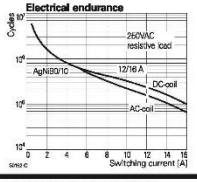
2) Coil resistance ±12%.
All figures are given for coil without pre-energization, at ambient temperature +23°C.
Other coil voltages on request.

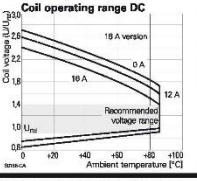
Coil versions, AC coil 50/60 Hz

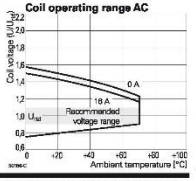
Coil code	Rated voltage VAC	Operate voltage VAC	Release voltage VAC	Coil resistance Ω±15% [3)]	Rated coil power VA
024	24	18.0	3.6	350 [3)]	0.76
615	115	86.3	17.3	8100	0.76
620	120	90.0	18.0	8800	0.75
700	200	150.0	30.0	24350	0.76
730	230	172.5	34.5	32500	0.74

3) Coil resistance +10%.
All figures are given for coil without pre-energization, at ambient temperature +23°C, 50 Hz.
Other coil voltages on request.









2.12 Digital Output Specifications DA3: Relay Outputs – 230 V AC/10 V

Number	1
Relay type	normally open
Relays	RT31L024 WG
Switching range	16.8-30 V DC
Switching current	typically 11 mA at + 24 V
Switching time	circa 10 ms
Switching power	see data sheet: Tyco Schrack RT1 series
Max. output current	10 A output
Max. inrush current	80 A for 20 ms 30 A for 4 s
Fuse	T 10 A
Connector	1x 3-pin, RM 5.08
Application	X6

2.13 Technical Data RT31L024 WG Relay

TE connectivity RELAY PRODUCTS

General Purpose Relays
PCB Relays

SCHRACK

Power PCB Relay RT1 Inrush

- 1 pole 16A, 1 form C (CO) or 1 form A (NO) contact
- For inrush peak currents up to 80A
- Mono- or bistable coil
- 5kV/10mm coil-contact
- Reinforced insulation
- Ambient temperature 85°C
- WG version: product in accordance to IEC 60335-1

Typical applications
Domestic appliances, heating control, lighting control

Approvals

VDE Cert. No. 40007571, UL E214025, cCSAus 1142018
Technical data of approved types on request

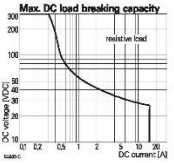
Contact Data

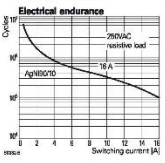
Contact arrangement	1 form C (CO) or 1 form A (NO)
Rated voltage	250VAC
Max. switching voltage	400VAC
Rated current	16A
Limiting continuous current	16A, UL: 20A (K-version)
Limiting making current, max. 4s, df 10%	30A
max. 20ms (incandescent lamps), RT33L version	80A
Breaking capacity max.	4000VA
Contact material	AgNi90/10, AgSnO
Frequency of operation, with/without load	360/72000h^{-1}
Operate/release time max., DC coil	9/6ms
Operate/Reset time max., bistable version	10/10ms
Bounce time max., form A/form B	3/6ms

Contact ratings

Type	Contact	Load	Cycles
IEC 61810			
RT33L	A (NO)	16A, 250VAC resistive, 85°C	50x10^3
RT33L	A (NO)	10A, 400VAC resistive, 85°C	10x10^3
RT31	C (CO)	16A, 250VAC resistive, 85°C	6x10^3
RT33K	A (NO)	16A, 250VAC resistive, 85°C	30x10^3
UL 508			
RT33K	A (NO)	20A, 277VAC general purpose, 40°C	10x10^3
RT33L	A (NO)	16A, 250VAC resistive, 85°C	50x10^3
RT31	C (CO)	16A, 250VAC resistive, 85°C	6x10^3
RT33L	A (NO)	1000W Tungsten, 120VAC, 60 Hz, 40°C	6x10^3
RT33L	A (NO)	1000W standard ballast, 120VAC, 60 Hz, 40°C	6x10^3

Mechanical endurance
monostable version >30x106 operations
bistable version >5x106 operations





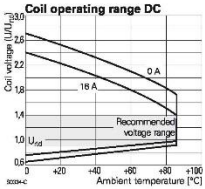
Coil Data, DC coil

Coil voltage range	5 to 110VDC
Operative range, IEC 61810	2
Coil insulation system according UL	class F

Coil versions, DC coil

Coil code	Rated voltage VDC	Operate voltage VDC	Release voltage VDC	Coil resistance Ω±10%[1]	Rated coil power mW
005	5	3.5	0.5	62	403
006	6	4.2	0.6	90	400
012	12	8.4	1.2	360	400
024	24	16.8	2.4	1440	400
048	48	33.6	4.8	5520	417
060	60	42.0	6.0	8570[1]	420

1) Coil resistance ±12%.
All figures are given for coil without pre-energization, at ambient temperature +23°C.
Other coil voltages on request.



Coil Data, bistable coils

	1 coil	2 coils
Magnetic system	polarized, bistable	
Coil voltage range	5 to 24VDC	
Operative range, IEC 61810	2	
Limiting voltage, % of rated coil voltage	120%	150%
Min./Max. energization duration	30ms/1min at <10% duty factor	
Coil insulation system according UL	class F	

2.14 Digital Triac Output Specifications (zero-point switching, not clocked)

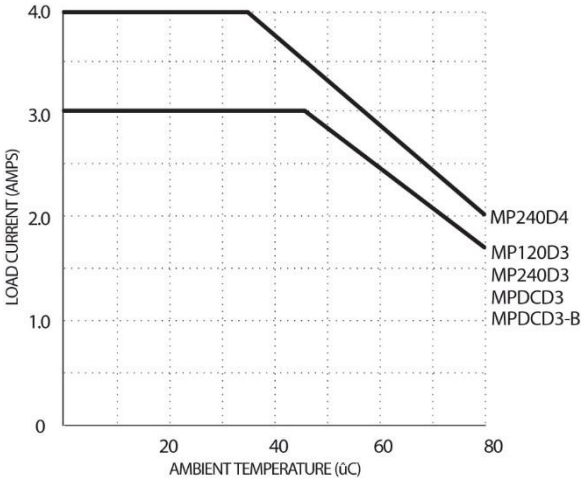
Number of relays	1
Relays	Crydom MP240D4
Switching range	3-32 V
Switching current	typically 2.6 mA at +5 V
Switching time	< 10 ms
Switching power	230 V/4.0 A at 0 °C ambient temperature 230 V/4.0 A at 35 °C ambient temperature 230 V/2.0 A at 80 °C ambient temperature details can be found in the MP240D4 data sheet
Zero-point switching	yes
Protective circuit	yes (RC network and Varistor on output)
Fuse	10 AT
Connector	1x 3-pin, RM 5.08
Application	DA20: Worm gear X14 (switched by STB)

2.15 Technical Data for the MP240D4 Solid State Relay

MODEL NUMBER	MP120D3	MP240D3	MP240D4
AC OUTPUT SPECIFICATIONS ①			
Operating Voltage Range (47-63 Hz) [Vrms]	12-140	24-280	24-280
Load Current Range [Arms]	.02-3	.02-3	.02-4
Transient Overvoltage [Vpk]	400	600	600
Max. Surge Current, (16.6ms) [Apk]	90	90	130
Max. On-State Voltage Drop @ Rated Current [Vpk]	1.6	1.6	1.6
Maximum I^2t for Fusing, (8.3 msec.) [A^2sec]	36	36	72
Max. Off-State Leakage Current @ Rated Voltage [mArms]	5.0	5.0	5.0
Min. Off-State dv/dt @ Max. Rated Voltage [V/µsec] ②	200	200	200
Max. Turn-On Time	1/2 Cycle	1/2 Cycle	1/2 Cycle
Max. Turn-Off Time	1/2 Cycle	1/2 Cycle	1/2 Cycle
P o evF atoo (Mn). withM xaL oda	0.5	0.5	0.5

INPUT SPECIFICATIONS	AC/DC Output	DC Output (-B)
Control Voltage Range [Vdc]	3-32	3-32
Must Turn-On Voltage [Vdc]	3.0	1.0
Must Turn-Off Voltage [Vdc]	1.0	3.0
Typical Input Current @ 5Vdc [mA]	2.6	2.6
Nominal Input Impedance [Ohms]	1500	1500

CURRENT DERATING CURVES



2.16 Digital Triac Output Specifications (Phase Angle Control), X11

Number of Triac outputs	1
Operation mode	phase angle control angle of ignition 0-155° value setting 0-255 (0-100 %) phase shift through load > -27° ... < 72°
Solid state relay	Celduc SKA20421
Switching range	3-30 V
Switching current	typically 3 mA at +5 V
Switching time	<= 0.1 ms
Switching power	230 V/5.0 A at 0 °C ambient temperature 230 V/4.0 A at 30 °C ambient temperature 230 V/2.0 A at 80 °C ambient temperature Details can be found in the SKA20421 data sheet
Zero-point switching	no
Protective circuit	yes (Varistor on output)
Fuse	3.15 AT
Connector	1x 3-pin, RM 5.08
Application	Primary fan X11 (switched by STB)

2.17 Technical Data for the SKA20421 Solid State Relay

Caractéristiques d'entrée (20°C) / *Input characteristics (20°C)*

Types / *Models*		DC INPUT				
Modèles / *References*		SKA104xx	SKA204xx	SKA114xx	SKA214xx	
Paramètre / *Parameter*	Symbol			Avec/with LED	Avec/with LED	Unit
Plage de tension de commande (Uc) / *Input voltage range (Uc)*	Uc	2,5-10	4-30(*)	3-10	7-30	VDC
Tension maximum de commande / *Maximum control voltage*	Uc max	10	30(*)	10	30	VDC
Tension minimum de commande / *Minimum control voltage*	Uc min	2,5	4(*)	3	7	VDC
Courant de fonctionnement/*Operating current*	Ic	3	3(*)	5	6	mADC
Courant maximum de commande / *Maximum control current*	Ic max	30	30	40	40	mADC
Tension de relachement/*Release voltage*	Uc off	0,8	0,8	0,8	0,8	VDC
Résistance interne / *Input internal resistor*	Rc	330	1000	220	750	Ω

(*) 3-30VDC & 2mA for random relays

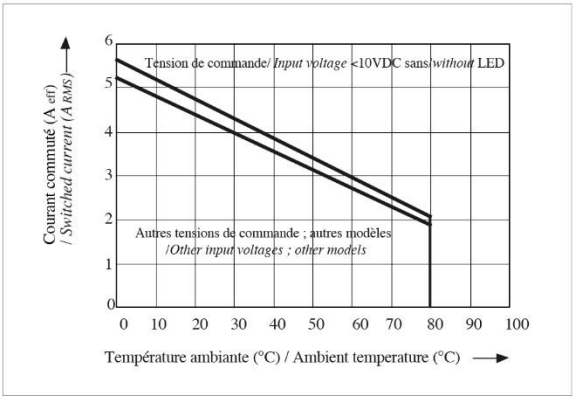
Caractéristiques générales / *General characteristics*

Paramètre / *Parameter*			Unit
Température de stockage / *Storage temperature*		- 40 à/*to* +150	°C
Température de fonctionnement /*Operating temperature*		-40 à/*to* +80	°C
Tension d'isolement entrée-sortie / *Input-output isolation voltage*		4000	VRMS
Capacité entrée-sortie/ *Input-output capacity*		3	pF
Poids/*Weight*		20	g

Caractéristiques de sortie (à 20°C) / *Output characteristics(20°C)*

Types / *Models*	AC OUPUT				
Modèles / *References*	SKA..420	SKA..421	SKA..440	SKA..441	
Paramètre / *Parameter*					Unit
Types / *Models*	Synchrone *Zero Cross*	Asynchrone *Random*	Synchrone *Zero Cross*	Asynchrone *Random*	
Tension nominale / *Nominal voltage*	230	230	400	400	VRMS
Plage tension de fonctionnement / *Operating range*	12 à/*to* 275	12 à/*to* 275	12 à/*to* 460	12 à/*to* 460	VRMS
Tension crête (écrêteur de surtension) /*Peak voltage (clamping voltage)*	600 (450)	600 (450)	900 (720)	900 (720)	VPEAK
Niveau de synchonisation / *Synchronizing level*	± 12	-	± 12	-	V
Courant nominal (voir les caractéristiques thermiques) / *Nominal current (see thermal curves)*	4	4	4	4	ARMS
Courant de surcharge accidentel admissible maximum (10ms) : / *Maximum accidental overload current (10ms) : ITSM*	100	100	100	100	APEAK
Chute tension directe (In) / *On state voltage drop (IN)*	1,6	1,6	1,6	1,6	VPEAK
Courant de fuite état bloqué (@Un/50Hz) / *Off state leakage current (@Un/50Hz)*	0,3	0,3	0,3	0,3	mARMS
Courant de charge minimum / *Minimum load current*	5	5	5	5	mARMS
Courant de maintien / *Holding current*	50	50	100	100	mA
Temps de fermeture (50Hz) / *Turn on time (50Hz)*	10	0,1	10	0,1	ms
Temps d'ouverture (50Hz) / *Turn off time (50Hz)*	10	10	10	10	ms
Fréquence d'utilisation / *Operating frequency*	10 à/*to* 440	10 à/*to* 440	10 à/*to* 440	10 à/*to* 440	Hz
dv/dt état bloqué / *Off state dv/dt*	500	500	500	500	V/µs
I^2t (<10ms)	50	50	50	50	A^2s
di/dt non répétitif / *No repetitive di/dt*	20	20	20	20	A/µs
Homologation / *Approval*	UL-VDE				

Fig.2 Caractéristiques thermiques / *thermal curves* :



2.18 Digital Relay Output Lambda Sensor Specifications

Number of relays	1
Relay Types	normally open
Relays	NY-24W-K
Switching range	16.8-30 V DC
Switching current	typically 11 mA at + 24 V
Switching time	< 10 ms
Switching power	see data sheet: NY-24W-K
Fuse	2.5 AT
Connector	1x 4-pin Phoenix RM3.5 mm

2.19 Technical Data HF49FD024 Relay

HF49FD MINIATURE POWER RELAY

c UL us
File No. : E133481
File No. : 40033644
File No. : R50149334
File No.:CQC10002049162

Features

- 5A switching capability
- 3kV dielectric strength (between coil and contacts)
- Slim size (width 5mm, height 12.5mm)
- High sensitive: Min. 120mW
- Meets IEC61131-2 reinforce insulation
- Creepage/clearance distance: Min. 3.5mm
- Sockets available
- UL insulation system: Class F available
- Environmental friendly product (RoHS compliant)
- Outline Dimensions: (20.0 x 5.0 x 12.5) mm

CONTACT DATA

Contact arrangement	1A
Contact Resistance (at 1A 6VDC)	No gold plated: 100mΩ max. Gold plated: 50mΩ max.
Contact material	$AgSnO_2$, AgNi
Contact rating (Res. load)	5A 250VAC/30VDC
Max. switching voltage	250VAC /30VDC
Max. switching current	5A
Max. switching power	1250VA / 150W
Min. contact load 1)	No gold plated: 5VDC 10mA Gold plated: 5VDC 1mA
Mechanical endurance	2×10^7 OPS
Electrical endurance	1×10^5 OPS (3A 250VAC/30VDC, Resistive load, AgNi, at 85°C, 1s on 9s off) 5×10^4 OPS (5A 250VAC/30VDC, Resistive load, AgNi, Room temp., 1s on 9s off)

Notes: 1) Min. contact load is reference value. Please perform the confirmation test with the actual load before usage since reference value may change according to switching frequencies, environmental conditions and expected life cycles.

CHARACTERISTICS

Insulation resistance		1000MΩ (at 500VDC)
Dielectric strength	Between coil & contacts	3000VAC 1min
	Between open contacts	1000VAC 1min
Surge voltage(between coil & contacts)		6kV (1.2 / 50μs)
Operate time (at nomi.volt.)		10ms max.
Release time (at nomi.volt.)		5ms max.
Shock resistance	Functional	98m/s²
	Destructive	980m/s²
Vibration resistance		10Hz to 55Hz 1.5mm DA
Humidity		5% to 85% RH
Ambient temperature		-40°C to 85°C
Termination		PCB
Unit weight		Approx. 3g
Construction		Plastic sealed

Notes: 1) The data shown above are initial values.
2) Please find coil temperature curve in the characteristic curves below.
3) UL insulation system: Class F, Class B, Class A.

COIL

Coil power	Approx. 120mW (at 5VDC to 18VDC) Approx. 180mW (at 24VDC)

COIL DATA at 23°C

Nominal Voltage VDC	Pick-up Voltage VDC max.	Drop-out Voltage VDC min.	Max. Voltage VDC *	Coil Resistance Ω
5	3.50	0.25	6.0	208 x (1±10%)
6	4.20	0.30	7.2	300 x (1±10%)
9	6.30	0.45	10.8	675 x (1±10%)
12	8.40	0.60	14.4	1200 x (1±10%)
18	12.6	0.90	21.6	2700 x (1±15%)
24	16.8	1.20	28.8	3200 x (1±15%)

Notes: 1) All above data are tested when the relays terminals are downward position. Other positions of the terminals, the pick-up and drop-out voltages will have ±5% tolerance. For example, when the relay terminals are transverse position, the max. pick-up voltage change is 75% of nominal voltage.
2) *Maximum voltage refers to the maximum voltage which relay coil could endure in a short period of time.
3) 24VDC 120mW type are also available, please see ordering information for more details.

SAFETY APPROVAL RATINGS

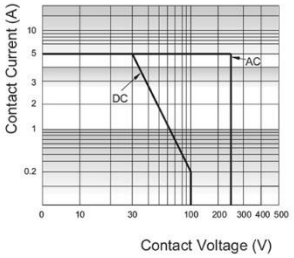
UL/CUL	1H1 type	$AgSnO_2$	3A 250VAC COSØ=1 at 85°C 3A 30VDC L/R =0ms at 85°C
		AgNi	5A 250VAC COSØ=1 5A 30VDC L/R =0ms
	1H2 type	AgNi	3A 250VAC COSØ=1 at 85°C 3A 30VDC L/R =0ms at 85°C 5A 250VAC COSØ=1 5A 30VDC L/R =0ms
VDE			5A 250VAC COSØ=1 at 85°C 5A 30VDC L/R =0ms at 85°C
TÜV			5A 250VAC COSØ=1 at 70°C 5A 30VDC L/R =0ms at 70°C

Notes: 1) All values unspecified are at room temperature.
2) Only typical loads are listed above. Other load specifications can be available upon request.

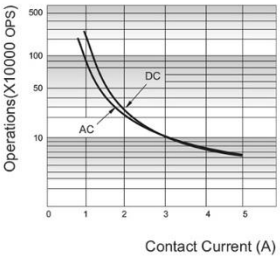
HONGFA RELAY
ISO9001, ISO/TS16949 , ISO14001, OHSAS18001, IECQ QC 080000 CERTIFIED 2015 Rev. 1.13

CHARACTERISTIC CURVES

MAXIMUM SWITCHING POWER

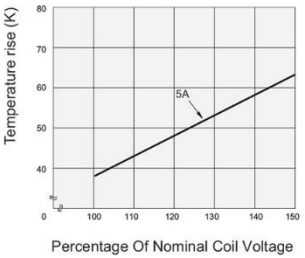


ENDURANCE CURVE



Test conditions:
1H1 type: AgNi, Resistive load, 250VAC/30VDC,
Room temp., 1s on 9s off.

COIL TEMPERATURE RISE



Test conditions:
5A 85℃
(Typical curve of 24VDC standard type)

2.20 Digital Output Specifications DA22: PWR Sensor ON

Number	1
Connector	without internal circuit
Application	DA22: Supply power sensor on (Lambda and CO sensors)

2.21 Analog Input Specifications AI1, X38: Lambda Sensor Interface

Lambda sensor type	LSM 11 Robert Bosch GmbH No. 0 258 104 002 001
Heating supply	14 V AC - switched by the controller
Heating current	at 13 V AC, approximately 1.4 A
Max. Measurement range analog voltage of the Lambda sensor	-100 … +100 mV
Input resistance analog input	> 1 MΩ
Current load of the lambda sensor	<1 µA
Control range with an exhaust gas temperature = 220 °C	1,00-2,00 Lambda value λ 1.85-10.24 % oxygen +68 mV … +3,5 mV Lambda sensor output voltage
Number	1
Connector	1x 4-pin, RM 3.5

2.22 Analog Input Specifications AI2, X39: CO Sensor Interface

CO-Sensor Type	SGAS220 Steinel Solutions AG
Heater voltage	<10 V DC (regulated through the reference temperature, switched by the controller)
Heating current	up to 100 mA (at activation approximately 300 mA)
Measurement range	0-500 ppm 500-40 kΩ
Number	1
Connector	1x 6-pin, RM 3.5

2.23 AI3 and AI20, X60 and X59 analog input specifications: Air Volume Sensor

Power supply	+24 V
Output current	maximum 500 mA
Analog output	5 V
Measurement range	0-2.5 V
Number	2
Connector	1x 5-pin, RM 2.5

2.24 Analog Input Specifications AI4-6 and AI8-10: KTY81-110 (-25 ... +100 °C)

Number of channels	6
Sensor Type	KTY81-110 (Ohmic temperature sensor)
Measurement range	-25 ... +100 °C
Sensor range	653-1696 Ω
Measurement value	-250 … +1000
Resolution	0.2 °C
Typical current measurement	0.9 mA
Input resistance	4,7 KΩ
Connector	1x 2-pin, RM 3.5
Application	- AI4: Boiler temperature X28 AI8: Reserve X32 - AI5: Return flow temperature X29 AI9: Reserve X33 - AI6: Ambient temperature X30 AI10: Reserve X34

2.25 Analog Input Specifications AI7: PT1000 (0-250 °C)

Number of channels	1
Sensor Type	PT1000
Measurement range	0-250 °C
Sensor range	1000-1941 Ω
Measurement value	0-2500
Resolution	0.4 °C
Typical current measurement	0.7 mA
Input resistance	5,6 KΩ
Connector	1x 2-pin, RM 3.5
Application	AI7: Exhaust temperature X31

2.26 Analog Input Specifications AI11: KTY10-62 (-25 … +100 °C)

Number of channels	1
Sensor Type	KTY10-62 (ohmic temperature sensor)
Measurement range	-25 ... +100 °C
Sensor range	1308.9-3399.9 Ω
Measurement value	-250 … +1000
Resolution	0.4 °C
Typical current measurement	0.8 mA
Input resistance	10 kΩ
Connector	1x 2-pin, RM 3.5
Application	AI11: X35: thermal coupling compensation (option) The KTY sensor is located on the control

2.27 Analog Input Specifications AI12: NiCr-Ni (0-600 °C)

Number of channels	1
Sensor Type	NiCr-Ni (TYPE K thermo element)
Measurement range	0-600 °C
Sensor range	0-24.905 mV
Measurement value	0-6000
Resolution	0.4 °C
Input resistance	10 kΩ
Connector	1x 2-pin, RM 3.5
Application	AI12: Reserve X36

2.28 Analog Input Specifications AI13: NiCr-Ni (0-1200 °C)

Number of channels	1
Sensor Type	NiCr-Ni (TYPE K thermo element)
Measurement range	0-1200 °C
Sensor range	0-48.828 mV
Measurement value	0-12000
Resolution	0.4 °C
Input resistance	24 kΩ
Connector	1x 2-pin, RM 3.5
Application	AI13: Reserve X37

2.29 Analog Input Specifications AI21: 0-10 V

Number of channels	1
Measurement range	0-10 V
Measurement value	0-10000
Resolution	20 mV
Input resistance	100 KΩ
Connector	1x 3-pin, RM 3.5
Application	AI21: External controller X42

2.30 Analog Input Specifications AI22: 0-3 V

Number of channels	1
Measurement range	0-3 V
Measurement value	0-3000
Resolution	20 mV
Input resistance	150 KΩ
Connector	1x 2-pin, RM 3.5
Application	AI22: Reserve X27

2.31 Analog Output Specifications AO1: 0-10 V

Number of channels	1
Output range	0-10 V
Output value	0-10000
Resolution	20 mV
Output current	maximum 10 mA
Connector	1x 2-pin, RM 3.5
Application	AO1: Secondary fan X43

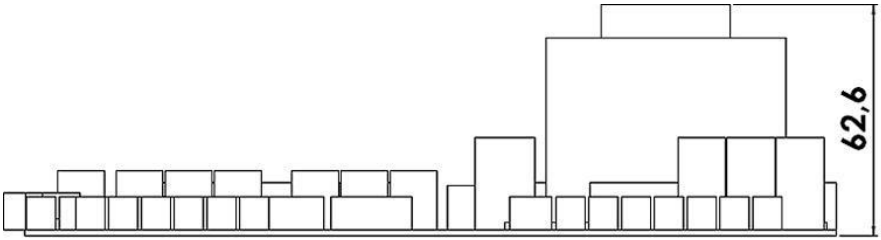
2.32 Miscellaneous

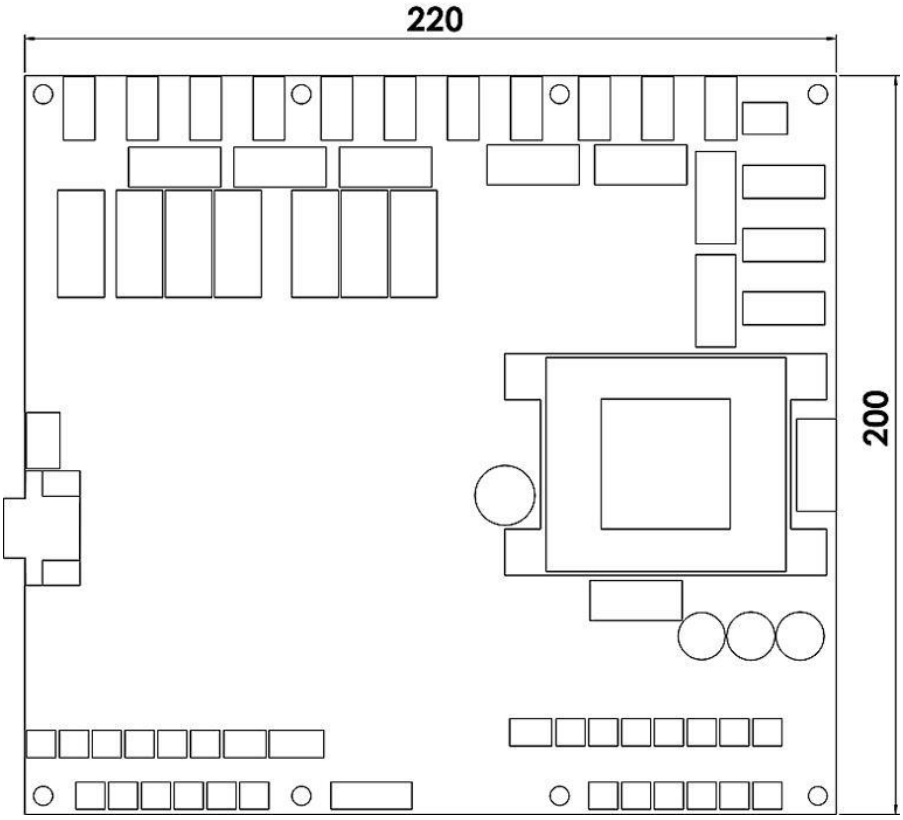
Article number	05-895-521-1
HW Version	1.x

2.33 Environmental Conditions

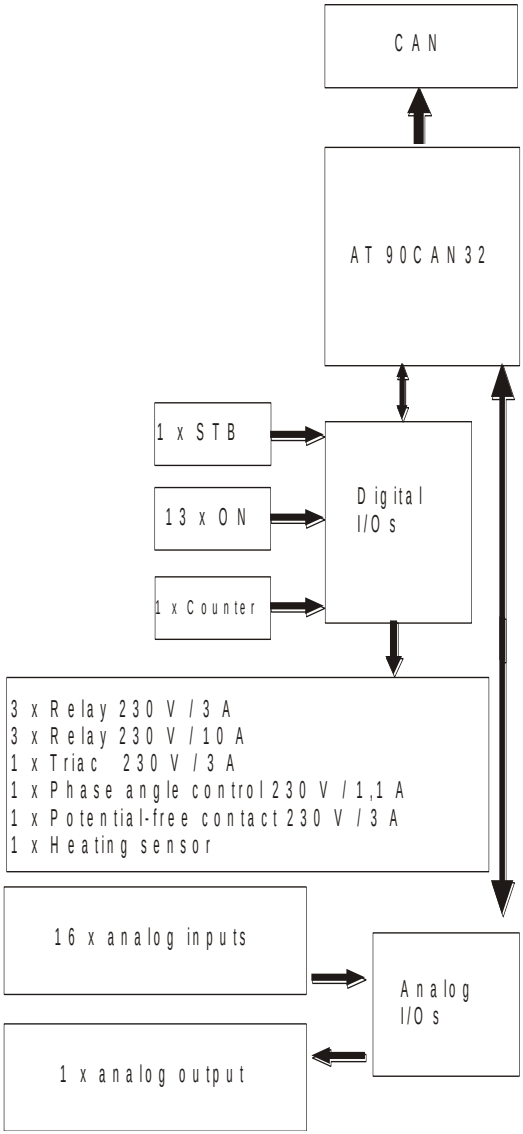
Storage temperature	-20 ... +70 °C	
Operating temperature	0 ... +60 °C	
Humidity	0-95 %, non-condensing	
EMC stability	according to EN 61000-6-2:2001	
Shock resistance	EN 60068-2-27	150 m/s²

3 Mechanical Dimensions





3.1 Block Diagram



4 Connector Layout

All connectors are located on the edge of the power board.

It is important to ensure that the connector cable and/or connector wiring is equipped with stress relief.

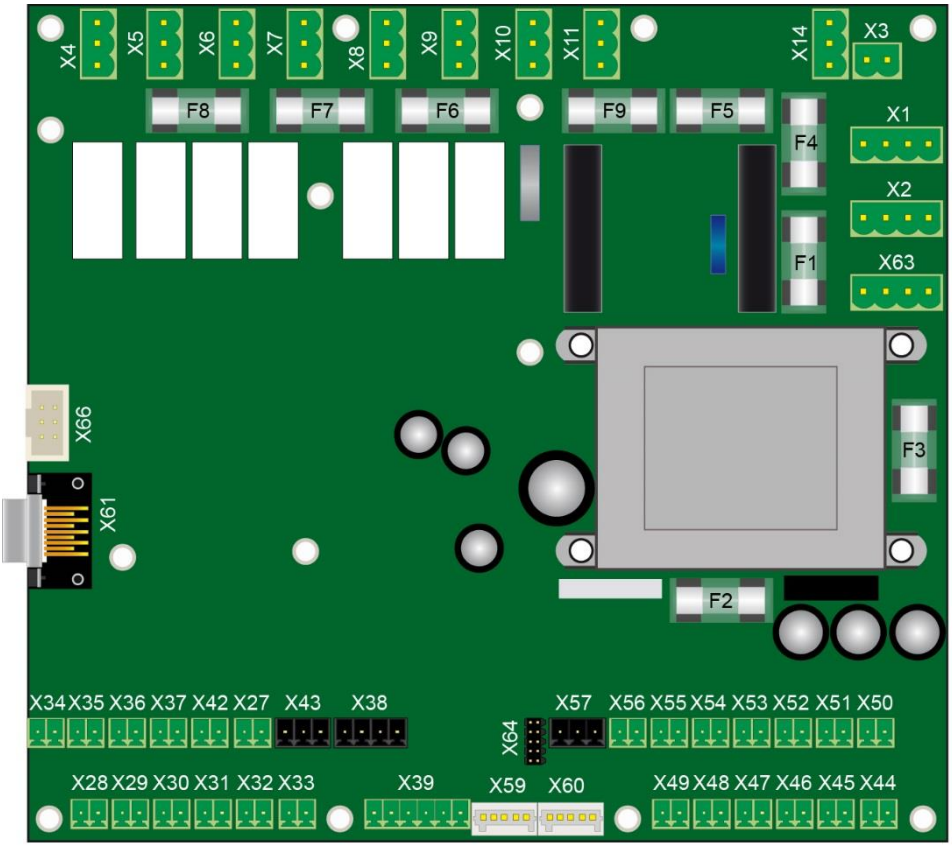
When connecting the control, it is important to ensure that the connector terminals are plugged into the correct socket!

When mounted in a boiler, the control must be protected by a cover that can only be opened using a tool. Opening the cover and connecting the cable can only be done by trained personnel and with the 230 V AC power supply disconnected!
Current safety regulations and rules must be observed!

Do not connect wiring while voltage is applied!
Once the wiring is complete, the plug X1 (230 V AC power line) can be connected.

Do not insert connectors while voltage is applied!

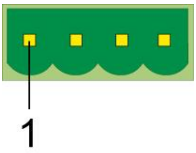
4.1 Connector and Terminal Electronics Layout



4.2 Connector Layout

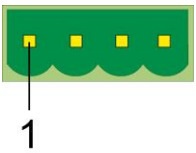
X1: 230 V AC Power Line
(4-pin connector plug with spring terminals Phoenix RM 5.08)

(up to HW 2.70: max. 12 A;
starting with HW 2.80: max. 16 A with opposing connector FKC 2.5 HC/ 3-ST-5.08)



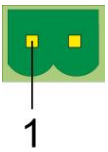
Pin	Signal	Function
1	L	Phase
2	N	Null circuit
3	PE	Ground wire
4	PE	Boiler housing ground wire

X2: 230 V AC Expansion Module Output
(4-pin connector plug with spring terminals Phoenix RM 5.08)



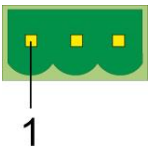
Pin	Signal	Function
1	L	Phase
2	L-STB	Phase switched over STB
3	N	Null circuit
4	PE	Ground wire

X3: STB Safety Contact (230 V AC)
(2-pin connector plug with spring terminals Phoenix RM 5.08)



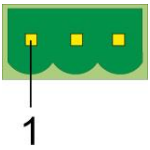
Pin	Signal	Function
1	L	Phase
2	L-STB	Phase L- switched over STB

X4: Relay Output with Potential-free Contact: Error Message
(3-pin connector plug with spring terminals Phoenix RM 5.08)



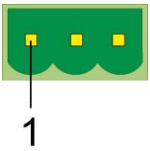
Pin	Signal	Function
1	NC	Normally closed
2	C	Common
3	No	Normally open

X5: 230 V AC Relay Output: Heat Exchange Cleaner
(3-pin connector plug with spring terminals Phoenix RM 5.08)



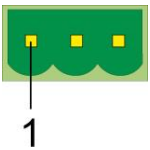
Pin	Signal	Function
1	L	Relay output - switched over STB
2	N	Null circuit
3	PE	Ground wire

X6: 230 V AC Relay Output: Grate Open
(3-pin connector plug with spring terminals Phoenix RM 5.08)



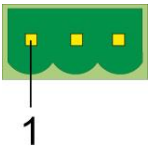
Pin	Signal	Function
1	L	Relay output - switched over STB
2	N	Null circuit
3	PE	Ground wire

X7: 230 V AC Relay Output: Grate Closed
(3-pin connector plug with spring terminals Phoenix RM 5.08)



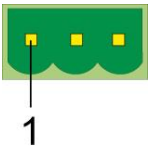
Pin	Signal	Function
1	L	Relay output - switched over STB
2	N	Null circuit
3	PE	Ground wire

X8 230 V AC Relay Output: Ignition
(3-pin connector plug with spring terminals Phoenix RM 5.08)



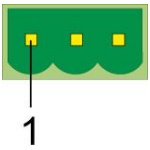
Pin	Signal	Function
1	L	Relay output - switched over STB
2	N	Null circuit
3	PE	Ground wire

X9: 230 V AC Relay Output: Turbine
(3-pin connector plug with spring terminals Phoenix RM 5.08)



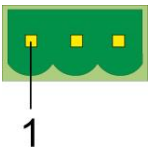
Pin	Signal	Function
1	L	Relay output - switched over STB
2	N	Null circuit
3	PE	Ground wire

X10: 230 V AC Relay Output: Return Flow Pump
(3-pin connector plug with spring terminals Phoenix RM 5.08)



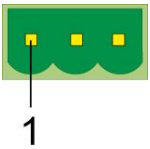
Pin	Signal	Function
1	L	Relay output - not switched over STB
2	N	Null circuit
3	PE	Ground wire

X11: 230 V AC Phase Angle Control: Primary Fan
(3-pin connector plug with spring terminals Phoenix RM 5.08)



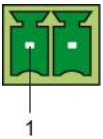
Pin	Signal	Function
1	L	Phase angle control output - switched over STB
2	N	Null circuit
3	PE	Ground wire

X14: Triac Output: Auger
(3-pin connector plug with spring terminals Phoenix RM 5.08)



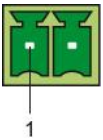
Pin	Signal	Function
1	L	Triac output - switched over STB
2	N	Null circuit
3	PE	Ground wire

X27: Analog Voltage Input: Reserve
(2-pin connector plug with spring terminals Phoenix RM 3.5)



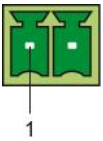
Pin	Signal	Function
1	AI22	Analog input AI22 Analog voltage 0-3 V
2	AGND	AGND

X28: Temperature Input: Boiler Temperature
(2-pin connector plug with spring terminals Phoenix RM 3.5)



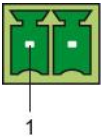
Pin	Signal	Function
1	AI4	Analog input AI4 KTY81-110 (-25 ... +100 °C)
2	AGND	AGND

X29: Temperature Input: Return Flow Temperature
(2-pin connector plug with spring terminals Phoenix RM 3.5)



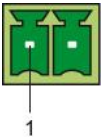
Pin	Signal	Function
1	AI5	Analog input AI5 KTY81-110 (-25 ... +100 °C)
2	AGND	AGND

X30: Temperature Input: Ambient Temperature
(2-pin connector plug with spring terminals Phoenix RM 3.5)



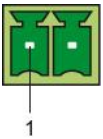
Pin	Signal	Function
1	AI6	Analog input AI6 KTY81-110 (-25 ... +100 °C)
2	AGND	AGND

X31: Temperature Input: Exhaust Temperature PT1000
(2-pin connector plug with spring terminals Phoenix RM 3.5)



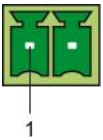
Pin	Signal	Function
1	AI7	Analog input AI7 PT1000 (0-250 °C)
2	AGND	AGND

X32: Temperature Input: Reserve
(2-pin connector plug with spring terminals Phoenix RM 3.5)



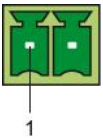
Pin	Signal	Function
1	AI8	Analog input AI8 KTY81-110 (-25 ... +100 °C)
2	AGND	AGND

X33: Temperature Input: Reserve
(2-pin connector plug with spring terminals Phoenix RM 3.5)



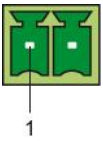
Pin	Signal	Function
1	AI9	Analog input AI9 KTY81-110 (-25 ... +100 °C)
2	AGND	AGND

X34: Temperature Input: Reserve
(2-pin connector plug with spring terminals Phoenix RM 3.5)



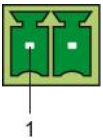
Pin	Signal	Function
1	AI10	Analog input AI10 KTY81-110 (-25 ... +100 °C)
2	AGND	AGND

X35: Temperature Input: Thermal Coupling Temperature
(2-pin connector plug with spring terminals Phoenix RM 3.5)



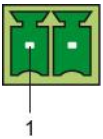
Pin	Signal	Function
1	AI11	Analog input AI11 Thermal coupling temperature KTY10-62 (-25 ... +100 °C)
2	AGND	AGND

X36: Temperature Input: Reserve
(2-pin connector plug with spring terminals Phoenix RM 3.5)



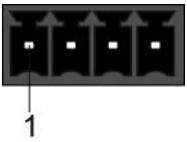
Pin	Signal	Function
1	AI12	Analog input AI12 Reserve NiCr-Ni (Type K) (0-600°C)
2	AGND	AGND

X37: Temperature Input: Reserve
(2-pin connector plug with spring terminals Phoenix RM 3.5)



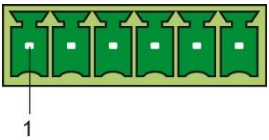
Pin	Signal	Function
1	AI13	Analog input AI13 Reserve NiCr-Ni (Type K) (0-1200°C)
2	AGND	AGND

X38: Lambda Sensor: LSM11
(4-pin connector plug with spring terminals Phoenix RM 3.5)



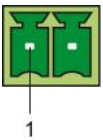
Pin	Signal	Function
1	AI1+	Analog input AI1 Positive Lambda sensor input signal
2	AI1-	Analog input AI1 Negative Lambda sensor input signal
3	12 V AC1	12 V AC heater sensor
4	12 V AC2	12 V AC heater sensor

X39: CO Sensor: SGAS220
(6-pin connector plug with spring terminals Phoenix RM 3.5)



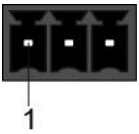
Pin	Signal	Color	Function
1	RH1	brown	Heater +
2	RH2	yellow	Heater -
3	RH700-1	gray	CO sensor - Heater reference temperature
4	RH700-2	pink	GND
5	CO1	green	Analog input AI2 CO - sensor signal
6	CO2	white	AGND

X42: Analog Voltage Input: External Control
(2-pin connector plug with spring terminals Phoenix RM 3.5)



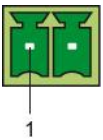
Pin	Signal	Function
1	AI21	Analog input AI21 Analog voltage (0-10 V)
2	AGND	AGND

X43: Analog Output: Secondary Fan
(3-pin connector plug with spring terminals Phoenix RM 3.5)



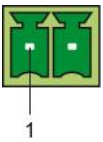
Pin	Signal	Function
1	+24 V	+24 V DC Analog supply voltage output
2	AO	Analog output (0-10 V)
3	AGND	AGND

X44: Digital Input: Worm Gear Temperature
(2-pin connector plug with spring terminals Phoenix RM 3.5)



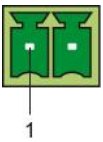
Pin	Signal	Function
1	+24 V	+24 V DC digital power supply inputs
2	DI1	Digital input 1: worm gear temperature

X45: Digital Input: Grate Sensor
(2-pin connector plug with spring terminals Phoenix RM 3.5)



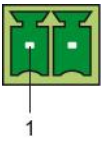
Pin	Signal	Function
1	+24 V	+24 V DC digital power supply inputs
2	DI2	Digital input 2: grate sensor

X46: Digital Input: Valve Sensor 1
(2-pin connector plug with spring terminals Phoenix RM 3.5)



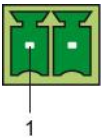
Pin	Signal	Function
1	+24 V	+24 V DC digital power supply inputs
2	DI3	Digital input 3: valve sensor 1

X47: Digital Input: External Contact
(2-pin connector plug with spring terminals Phoenix RM 3.5)



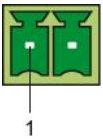
Pin	Signal	Function
1	+24 V	+24 V DC digital power supply inputs
2	DI4	Digital input 4: External contact

X48: Digital Input: Worm Gear
(2-pin connector plug with spring terminals Phoenix RM 3.5)



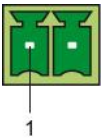
Pin	Signal	Function
1	+24 V	+24 V DC digital power supply inputs
2	DI5	Digital Input 5: worm gear

X49: Digital Input: Reserve
(2-pin connector plug with spring terminals Phoenix RM 3.5)



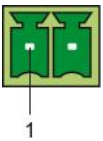
Pin	Signal	Function
1	+24 V	+24 V DC digital power supply inputs
2	DI6	Digital input 6: reserve

X50: Digital Input: Reserve
(2-pin connector plug with spring terminals Phoenix RM 3.5)



Pin	Signal	Function
1	+24 V	+24 V DC digital power supply inputs
2	DI7	digital Input 7: reserve

X51: Digital Input: Reserve
(2-pin connector plug with spring terminals Phoenix RM 3.5)

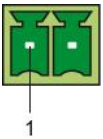


Pin	Signal	Function
1	+24 V	+24 V DC digital power supply inputs
2	DI8	Digital Input 8: reserve

X52: Digital Input: Reserve
(2-pin connector plug with spring terminals Phoenix RM 3.5)

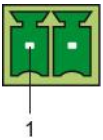
Pin	Signal	Function
1	+24 V	+24 V DC digital power supply inputs
2	DI9	Digital Input 9: reserve

X53: Digital Input: Reserve
(2-pin connector plug with spring terminals Phoenix RM 3.5)



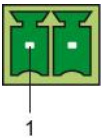
Pin	Signal	Function
1	+24 V	+24 V DC digital power supply inputs
2	DI10	Digital Input 10: reserve

X54: Digital Input: Reserve
(2-pin connector plug with spring terminals Phoenix RM 3.5)



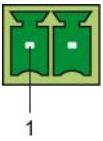
Pin	Signal	Function
1	+24 V	+24 V DC digital power supply inputs
2	DI11	Digital Input 11: reserve

X55: Digital Input: Reserve
(2-pin connector plug with spring terminals Phoenix RM 3.5)



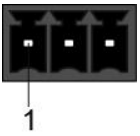
Pin	Signal	Function
1	+24 V	+24 V DC digital power supply inputs
2	DI12	Digital Input 12: reserve

X56: Digital Input: Reserve
(2-pin connector plug with spring terminals Phoenix RM 3.5)



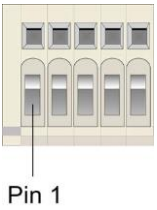
Pin	Signal	Function
1	+24 V	+24 V DC digital power supply inputs
2	DI13	Digital Input 13: reserve

X57: Digital Input: Speed Feedback Primary Fan
(3-pin connector plug with spring terminals Phoenix RM 3.5)



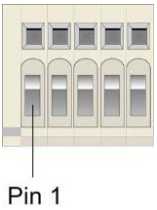
Pin	Signal	Function
1	+24 V	+24 V DC digital power supply inputs
2	DI17	Counter input speed feedback primary fan
3	GND	GND

X59: Air Volume Sensor
(5-pin connector plug with CLAMP technology Wago RM 2.5)



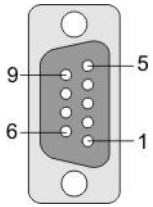
Pin	Signal	Function
1	PRI-LUEFT	Analog output primary fan
2	GND	GND
3	AI20	Analog input AI20 Air volume (0-2.5 V)
4	GND	GND
5	+24 V	+24 V power supply

X60: Air Volume Sensor
(5-pin connector plug with CLAMP technology Wago RM 2.5)



Pin	Signal	Function
1	SEC-LUEFT	Analog output secondary fan
2	GND	GND
3	AI3	Analog input AI3 Air volume (0-2.5 V)
4	GND	GND
5	+24 V	+24 V power supply

X61: CAN Interface to the HZS 511 (9-pin D-Sub socket)



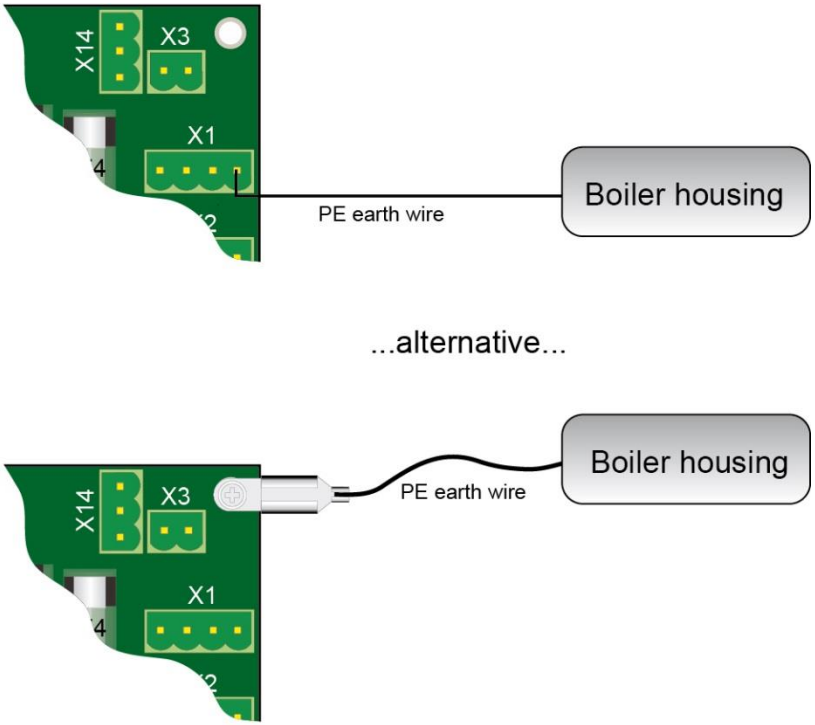
Pin	Signal	Function
1	CAN_A	CAN low signal
2	+24 V	+24 V power supply output
3	GND	
4	GND	
5	GND	
6	CAN_B	CAN high signal
7	+24 V	+24 V power supply output
8	+5 V	+5 V power supply output
9	+5 V	+5 V power supply output

X64: Connector for internal use (multi-pin connector RM 2.54)

X66: Programming input for the controller (multi-pin connector RM 2.54)

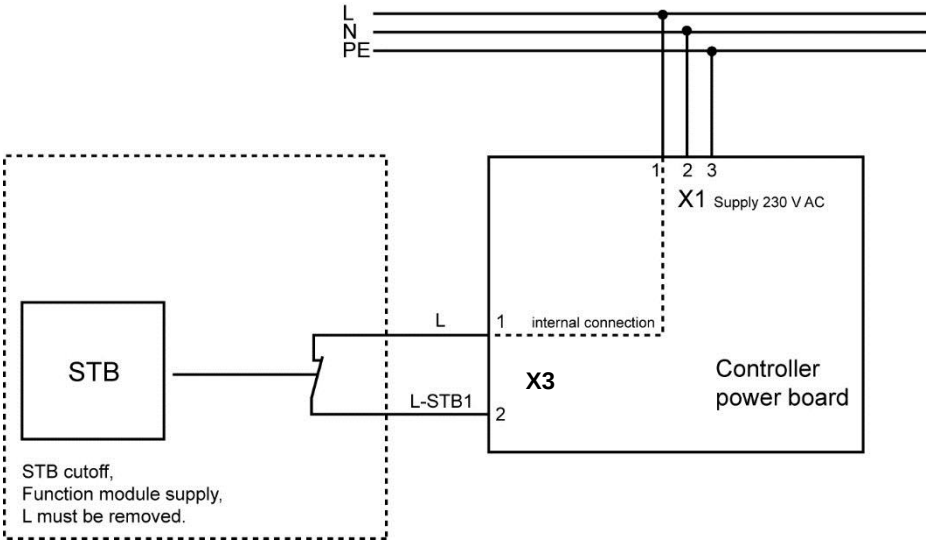
5 Ground connection

The PE ground wire for the 230 V AC power supply on connector X1, pin 4 must be connected to the boiler. Alternatively, the boiler can be connected to a terminal on the screw near X3.



6 STB cutoff (temperature safety limit)

The STB cutoff must be wired externally!



IF THE STB CUTOFF IS ACTIVATED, THE FOLLOWING 230 V AC OUTPUTS ON THE POWER BOARD ARE NO LONGED SUPPLIED WITH VOLTAGE:

- 230 V AC relay output: Heat exchange cleaner, DA" X5
- 230 V AC relay output: Grate open, DA3 X6
- 230 V AC relay output: Grate closed, DA4 X7
- 230 V AC relay output: Ignition, DA5 X8
- 230 V AC relay output: Turbine, DA6 X9
- 230 V AC Triac output: Worm gear, DA20 X14
- Phase angle control Primary fan, X11

7 Wiring Guidelines

The signals recorded by the analog inputs are very small in comparison to the digital signals. To ensure error-free operation, a careful wiring method must be followed:

- The lines connected to the source of the analog signals must be as short as possible and parallel wiring to digital signal lines must be avoided.
- The signal lines must be shielded.
- 230 V AC lines (power circuit and relay outputs etc.) must not be wired parallel to analog and digital input lines.

7.1 Wiring Guidelines for Digital Inputs

The input filters used, which suppress noise signals, allow operation in harsh environmental conditions. A careful wiring method is also recommended to ensure error-free function.

The following guidelines should be observed:

- Avoid parallel connections between input lines and load bearing or AC circuits.
- Correct wiring to mass

7.2 General Information on the Relay Outputs

All relay coils are powered by the internal +24 V DC supply. The cross sectional area of the relay outputs must be large enough for the maximum continuous current at 230 V AC for each connected load as stated in the chapter "Technical Data, Power". It is important to note that at high currents, thermal loads affect the wiring and with continuous over loading, can lead to a break down! High voltages can cause current leakage or arcing between different potentials!

The maximum load of the relay contacts can be found in the chapter "Specifications for Output Relays". These load values are based on the relay contact only, not the respective connector circuits.

It is also important to ensure that the relay opens when shut down or the when the +24 V DC or 230 V AC power supply fails as well as when the STB cutoff is activated. The relays that are switched by the STB can be found in the chapter "STB Cutoff"

To ensure error-free operation, a careful wiring method must be followed.

- Avoid parallel wiring between input lines and load-bearing circuits.

7.3 Wiring Guidelines for the Analog Output

To ensure error-free operation, a careful wiring method must be followed:

- The connection lines to the source of the analog signals must be as short as possible and parallel wiring to digital signal lines or AC wiring must be avoided.
- The signal lines must be shielded.

7.4 Wiring Guidelines for the Analog Input

The signals recorded by the analog modules are very small in comparison to the digital signals. To ensure error-free operation, a careful wiring method must be followed.

- The connection lines to the source of the analog signals must be as short as possible and parallel wiring to digital signal lines or AC circuits must be avoided.
- The signal lines should be 2-pin shielded or twisted pair wires.

7.5 Measuring Temperature with Thermo Elements

Temperature measurement using thermocouples is based on the temperature-dependent voltage, which is generated through the combination of two conductors from different metals (alloys); this is called the Seebeck effect.

This voltage exists therefore not only at the measurement point (where it is desired) but also at the coupling between the thermo element conductors and the copper connection (connector clamp). Thermo voltage at location is undesired, however, it is unavoidable. This means that a thermo element always measures a relative temperature (temperature difference between the sensor tips and the coupling).

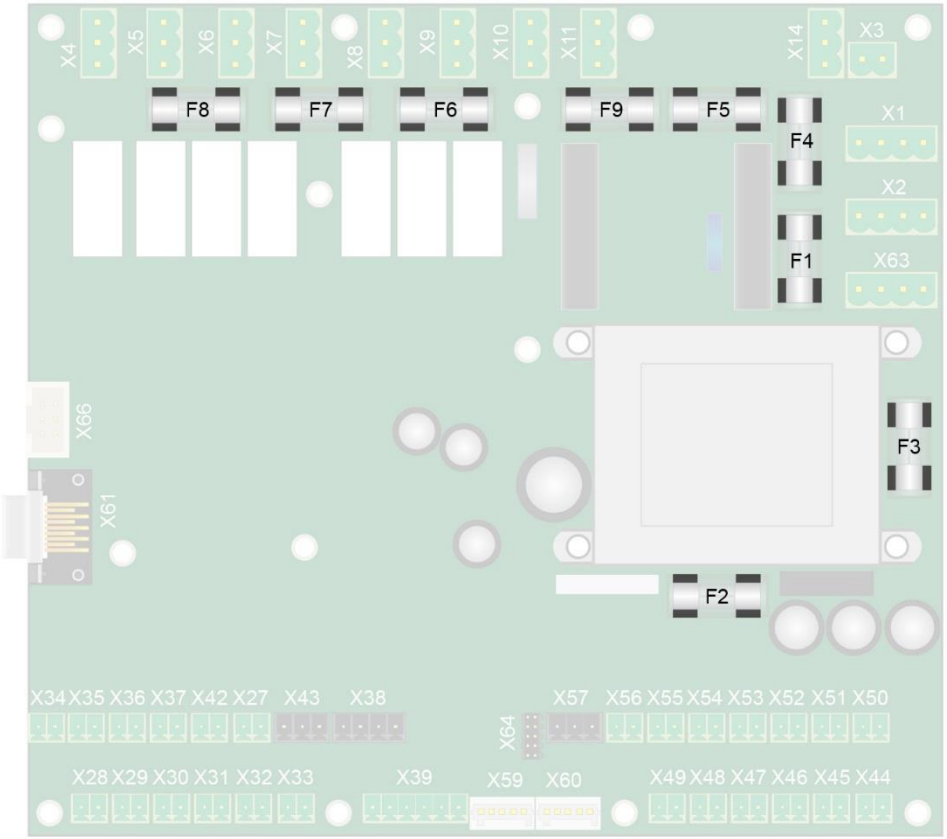
An exact measurement is therefore only possible if the voltage corresponding to temperature of the coupling is measured and added the voltage at the measurement point. There is no room temperature compensation

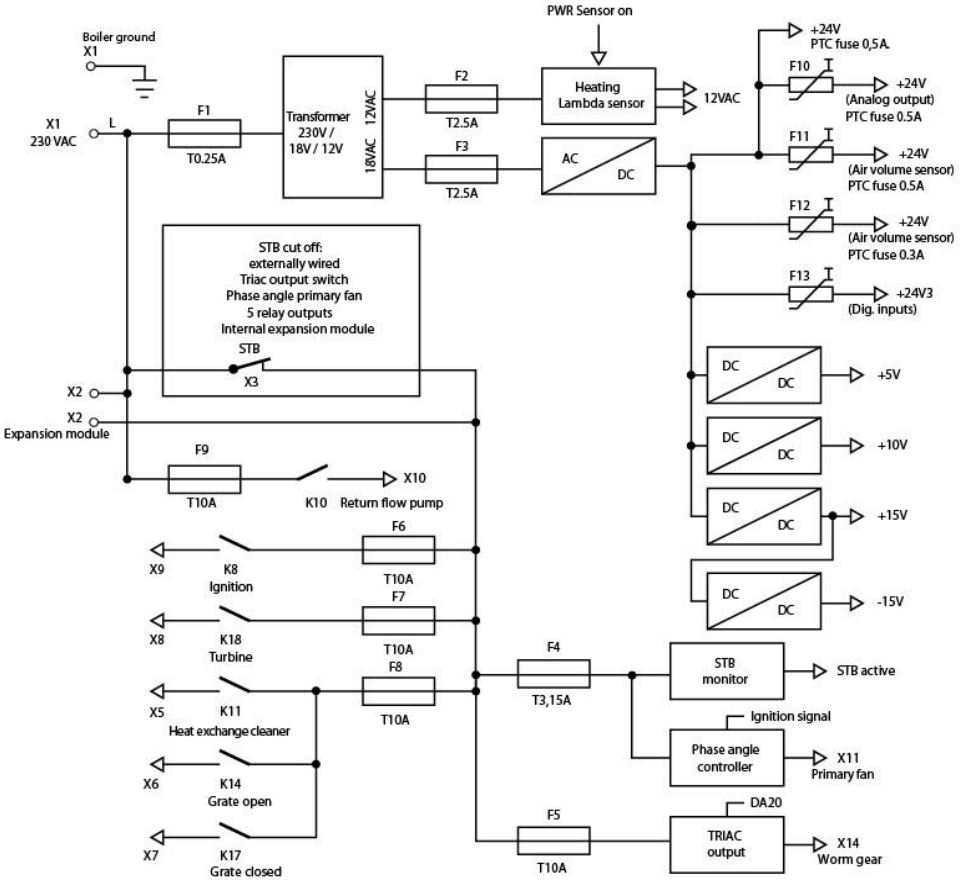
8 Fuses

The fuses may only be exchanged by qualified personnel after the 230 V AC power supply has been disconnected! Current safety regulations and rules must be observed!

The power supply for the electronics as well as all 230 V AC circuits, except X2, is protected by micro fuses.

When changing the fuses, please refer to the following overview with the assignment of the fuses on the power board:




PWR Sensor on
Boiler ground
X1
X1
230 VAC
L
F1
T0.25A
Transformer
230V /
18V / 12V
18VAC
12VAC
F2
T2.5A
F3
T2.5A
Heating
Lambda sensor
12VAC
AC
DC
+24V
PTC fuse 0,5A.
F10
+24V
(Analog output)
PTC fuse 0.5A
F11
+24V
(Air volume sensor)
PTC fuse 0.5A
F12
+24V
(Air volume sensor)
PTC fuse 0.3A
F13
+24V3
(Dig. inputs)
STB cut off:
externally wired
Triac output switch
Phase angle primary fan
5 relay outputs
Internal expansion module
STB
X3
X2
X2
Expansion module
DC
DC
+5V
+10V
+15V
-15V
F9
T10A
K10
Return flow pump
X10
F6
T10A
X9
K8
Ignition
F7
T10A
X8
K18
Turbine
F8
T10A
X5
K11
Heat exchange cleaner
X6
K14
Grate open
X7
K17
Grate closed
F4
T3,15A
STB
monitor
STB active
Ignition signal
Phase angle
controller
X11
Primary fan
DA20
F5
T10A
TRIAC
output
X14
Worm gear

8.1 Micro Fuses

Fuse	Value	Label	Assignment
F1	0.25 AT	L	230 V AC power supply for the transformer-power board
F2	2.5 AT	12 V AC	12 V AC power supply for the Lambda sensor-heater
F3	2.5 AT	24 V AC	24 C AC power supply for the power board
F4	3.15 AT	L-STB	The 230 V AC power supply is switched over STB for: phase angle control X11 for the primary fan STB + phase zero crossing detection
F5	10 AT	L-STB	The 230 V AC power supply is switched over STB for: Triac output X14 for the screw
F6	10 AT	L-STB	The 230 V AC power supply is switched over STB for: Relay output X9 for the turbine
F7	10 AT	L-STB	The 230 V AC power supply is switched over STB for: Relay output X8 for the ignition
F8	10 AT	L-STB	The 230 V AC power supply is switched over STB for: Relay output X5 for heat exchange cleaner Relay output X6 for grate open Relay output X7 for grate closed
F9	10 AT	L	230 V AC power supply for: relay output for the X10 return flow pump

Additionally protected with self-resetting PTC fuses:

Fuse	Value	Label	Assignment
F10	0.5 A	+24 V	+24 V output for: Analog output X43 for the secondary fan
F11	0.5 A	+24 V	+24 V output for: power supply X59 for the air volume sensor
F12	0.5 A	+24 V	+24 V output for: Power supply X60 for the air volume sensor
F13	0.5 A	+24 V	+24 V output for digital inputs: DI1 X44 for the screw temperature DI2 X45 for the grate sensor DI3 X46 for the valve sensor 1 DI4 X47 for the external contact DI5 X48 for the screw gear DI6 X49 for the reserve DI7 X50 for the reserve DI8 X51 for the reserve DI9 X52 for the reserve DI10 X53 for the reserve DI11 X54 for the reserve DI12 X55 for the reserve DI13 X56 for the reserve DI17 X57 for rotation speed feedback from the primary fan

These PTC fuses are maintenance-free and can only be changed by SIGMATEK!

The PTC fuse remains high ohmic as long as current is applied. The PTC fuse provides continuous protection until the error is corrected or the current is removed. During self-reset, the PTC fuse resistance quickly returns to its output value

9 AT90CAN32 Port Assignment

PORT	I/O	Signal	Description of functions
PA0	I/O	D0	Data bus
PA1	I/O	D1	
PA2	I/O	D2	
PA3	I/O	D3	
PA4	I/O	D4	
PA5	I/O	D5	
PA6	I/O	D6	
PA7	I/O	D7	
PB0	I/O	n.c.	Not connected
PB1	I/O	SCK	Clock signal for controller programming
PB2	I/O	n.c.	Not connected
PB3	I/O	n.c.	Not connected
PB4	I/O	n.c.	Not connected
PB5	I/O	/PH1_START	Start signal for the phase angle control of the ignition pulse (optional)
PB6	I/O	/PH1_HLT	Stop signal for the phase angle control of the ignition pulse (optional)
PB7	I/O	n.c.	Not connected
PC0	I/O	A08	address bus
PC1	I/O	A09	
PC2	I/O	A10	
PC3	I/O	A11	
PC4	I/O	n.c.	Not connected
PC5	I/O	n.c.	Not connected
PC6	I/O	n.c.	Not connected
PC7	I/O	n.c.	Not connected
PD0	Input	ZERCR	Zero crossing detection
PD1	input	CNT_I	Rotation speed feedback from primary fan (optional)
PD2	I/O	n.c.	Not connected
PD3	I/O	n.c.	Not connected
PD4	I/O	n.c.	Not connected
PD5	Output	\CANTX	CAN send data
PD6	input	\CANRX	CAN receive data
PD7	I/O	n.c.	Not connected
PE0	input	PDI	serial data for the controller programming
PE1	Output	PDO	serial data for the controller programming
PE2	I/O	I/O	Not connected
PE3	Output	\PH4_START	Start signal for the phase angle control of the ignition pulse
PE4	Output	\PH4_HLT	Stop signal for the phase angle control of the ignition pulse
PE5	Output	\TRIG-WD	Watchdog trigger
PE6	Output	PWM1	Air volume sensor
PE7	Output	PWM2	Air volume sensor

PF0	Input	AI01	Analog input 1: Lambda sensor LSM11
PF1	input	AI02	Analog input 2: CO sensor SGAS220
PF2	input	AI03	Analog input 3: Air volume sensor
PF3	input	AI04	Analog input: MUX Analog input 4: KTY81-110, boiler temperature -25 ... +100 °C Analog input 5: KTY81-110, return flow temperature -25 ... +100 °C Analog input 6: KTY81-110, ambient temperature -25 ... +100 °C Analog input 7: PT1000 exhaust temperature 0-250 °C Analog input 8: KTY81-110, reserve -25 ... +100 °C Analog input 9: KTY81-110, reserve -25 ... +100 °C Analog input 10 - KTY81-110, reserve -25 ... +100 °C Analog input 11: KTY10-62, thermal couple temperature -25 ... +100 °C
PF4	input	AI05	Analog input: MUX Analog input 12: NiCrNi, reserve 0-600 °C Analog input 13: NiCrNi, reserve 0-1200 °C Analog input 14: not connected Analog input 15: not connected Analog input 16: not connected Analog input 17: not connected Analog input 18: not connected Analog input 19: not connected
PF5	input	AI06	Analog input 20: Air volume sensor
PF6	input	AI07	Analog input 21: 0-10 V external regulator
PF7	Input	AI08	Analog input 22: 0-3 V
PG0	Output	\WR	write signal
PG1	Output	\RD	read signal
PG2	I/O	n.c.	not connected
PG3	I/O	n.c.	Not connected
PG4	I/O	n.c.	Not connected

10 Addressing

Address 16-Bit	Access	Function	Description
$00xx	RD	\CS_R0	read digital input DI1-8
$01xx	RD	\CS_R1	Digital inputs DI9-17 reading
$02xx	RD	\CS_R2	Counter input DI19 read
$00xx	WR	\CS_W0	Digital outputs DA1-8 write enable
$01xx	WR	\CS_W1	Digital outputs DA1-8 write Standby mode
$04xx	WR	\CS_W4	Digital outputs DA17-18, 22 write enable Digital outputs DA17-18 22 write Standby mode
$05xx	WR	\CS_W5	CS for digital analog converter (DAC)
$06xx	WR	\CS_W6	Write DAC Data (H-Byte) Analog output on
$07xx	WR	\CS_W7	Write multiplexer control signal Write Triac output control signal Clear counter

11 I/O ports

Port/Bit	I/O	Signal	Descriptions of functions: Read digital inputs DI1-8
IN-PORT1-0	input	DI1	Digital input 1: Auger temperature, active = log.1
IN-PORT1-1	input	DI2	Digital input 2: Grate sensor, active = log.1
IN-PORT1-2	input	DI3	Digital input 3: Flap sensor 1, active = log.1
IN-PORT1-3	input	DI4	Digital input 4: External contact, active = log.1
IN-PORT1-4	input	DI5	Digital Input 5: Worm gear, active = log.1
IN-PORT1-5	input	DI6	Digital input 6: Reserve, active = log.1
IN-PORT1-6	input	DI7	Digital input 7: Reserve, active = log.1
IN-PORT1-7	Input	DI8	Digital input 8: Reserve, active = log.1

Port/Bit	I/O	Signal	Descriptions of functions: **Read digital input DI9-16**
IN-PORT2-0	input	DI9	Digital input 9: Reserve, active = log.1
IN-PORT2-1	input	DI10	Digital Input 10: Reserve, active = log.1
IN-PORT2-2	input	DI11	Digital Input 11: Reserve, active = log.1
IN-PORT2-3	input	DI12	Digital Input 12: Reserve, active = log.1
IN-PORT2-4	input	DI13	Digital Input 13: Reserve, active = log.1
IN-PORT2-5	input	GND	log.0
IN-PORT2-6	input	GND	log.0
IN-PORT2-7	Input	DI16	Digital Input 16: STB detection, active = log.1

Port/Bit	I/O	Signal	Description of Functions Read counter input DI17 (8-bit) (Rotation speed feedback for induced draft fan counter
IN-PORT3-0	input	QA	
IN-PORT3-1	input	QB	
IN-PORT3-2	input	QC	
IN-PORT3-3	input	QD	
IN-PORT3-4	input	QE	
IN-PORT3-5	input	QF	
IN-PORT3-6	input	QG	
IN-PORT3-7	Input	QH	

Port/Bit	I/O	Signal	Descriptions of functions: Digital outputs DA1-8 write enable
OUT-PORT1-0	Output	RO00	digital output 1: relay output error message, log1: On On
OUT-PORT1-1	Output	RO01	digital output 2: heat exchange cleaner relay output, log1: On
OUT-PORT1-2	Output	RO02	digital output 3: Relay output, grate open, log1: On
OUT-PORT1-3	Output	RO03	digital output 4: Relay output, grate closed, log1: On
OUT-PORT1-4	Output	RO04	digital output 5: Relay output, ignition, long1: On
OUT-PORT1-5	Output	RO05	digital output 6: Relay output, turbine; log1: On
OUT-PORT1-6	Output	RO06	digital output 7: Relay output, return flow pump, log1: On
OUT-PORT1-7	Output	RO07	digital output 8: Relay output: not used

Port/Bit	I/O	Signal	Descriptions of functions: Digital outputs DA1-8 write Standby mode
OUT-PORT2-0	Output	ROS00	digital output 1: relay output error message, log1: On standby
OUT-PORT2-1	Output	ROS01	digital output 2: heat exchange cleaner relay output, log1: standby
OUT-PORT2-2	Output	ROS02	digital output 3: Relay output, grate open, log1: standby
OUT-PORT2-3	Output	ROS03	digital output 4: Relay output, grate closed, log1: standby
OUT-PORT2-4	Output	ROS04	digital output 5: Relay output, ignition, long1: standby
OUT-PORT2-5	Output	ROS05	digital output 6: Relay output, turbine; log1: standby
OUT-PORT2-6	Output	ROS06	digital output 7: Relay output, return flow pump, log1: standby
OUT-PORT2-7	Output	ROS07	digital output 8: Relay output: not used

Port/Bit	I/O	Signal	Descriptions of functions: **Digital outputs DA17-19 enable / Power save mode write:**
OUT-PORT5-0	Output	RO20	Digital output 17: Relay output: not used
OUT-PORT5-1	Output	RO21	Digital output 18: Relay output: not used
OUT-PORT5-2	Output	PWR-SOND	Digital output 19: Relay output: Heating CO sensor and Lambda sensor on, log1: On
OUT-PORT5-3	Output	n.c.	Not connected
OUT-PORT5-4	Output	ROS20	Digital output 17: Relay output: not used
OUT-PORT5-5	Output	ROS21	Digital output 18: Relay output: not used
OUT-PORT5-6	Output	PWR-SOND-S	Digital output 19: Relay output: Heating CO sensor and Lambda sensor on, log1: standby
OUT-PORT5-7	Output	n.c.	Not connected

Port/Bit	I/O	Signal	Descriptions of functions: **Write DAC Data (H-Byte)** **Analog output on**
OUT-PORT7-0	Output	DL0	Data bit DB8 DAC (H-Byte)
OUT-PORT7-1	Output	DL1	Data bit DB9 DAC (H-Byte)
OUT-PORT7-2	Output	DL2	Data bit DB10 DAC (H-Byte)
OUT-PORT7-3	Output	DL3	Data bit DB11 DAC (H-Byte)
OUT-PORT7-4	Output	n.c.	Not connected
OUT-PORT7-5	Output	n.c.	Not connected
OUT-PORT7-6	Output	AO-ON	Analog output AO1 on: On = log.1
OUT-PORT7-7	Output	n.c.	Not connected

Port/Bit	I/O	Signal	Descriptions of functions: **Write multiplexer control signal** **Triac output control signal** **Clear counter**
OUT-PORT8-0	Output	MUX_A0	Multiplexer address A0
OUT-PORT8-1	Output	MUX_A1	Multiplexer address A1
OUT-PORT8-2	Output	MUX_A2	Multiplexer address A2
OUT-PORT8-3	Output	MUX1_EN	Multiplexer Enable EN (AI4-11), active = log.1
OUT-PORT8-4	Output	MUX2_EN	Multiplexer Enable EN (AI12-13), active = log.1
OUT-PORT8-5	Output	n.c.	Not connected
OUT-PORT8-6	Output	TRIAC3	Digital output 20: Triac output, screw
OUT-PORT8-7	Output	\RES-CNT	Reset counter DI17

12 Flash Calibration Data

For the hardware, the offset, multiplier and divisor calibration values are determined at the manufacturer. These values are stored in a Flash in the AT90CAN32 controller.

12.1 Flash in the Controller

Address	Data	Description
		Organization of data in Words
$40	$xxxx	header checksum (2 words) + length of reference data (70 words) = 72 words
$42	12345	Identification
$44	70	Length of the reference data in Words
$46	21	Variant 21 = HZS521 = power board
$48	-630	AI1 Offset – Lambda sensor (±100 mV)
$4A	1000	AI1 Multiplicand
$4C	272	AI1 divisor
$4E	-60	AI2 Offset – CO sensor (40-500 kΩ)
$50	1000	AI2 Multiplicand
$52	893	AI2 divisor
$54	0	AI3 Offset - air volume sensor (0-2.5 V)
$56	2500	AI3 Multiplicand
$58	670	AI3 divisor
$5A	-909	AI4 Offset - KTY81-110 -25 ... +100 °C (653-1696 Ω)
$5C	1000	AI4 Multiplicand
$5E	-835	AI4 divisor
$60	-909	AI5 Offset - KTY81-110 -25 ... +100 °C (653-1696 Ω)
$62	1000	AI5 Multiplicand
$64	-823	AI5 divisor
$66	-910	AI6 Offset - KTY81-110 -25 ... +100 °C (653-1696 Ω)
$68	1000	AI6 Multiplicand
$6A	-831	AI6 divisor
$6C	-913	AI7 Offset - 0-250 °C (1000-1941 Ω)
$6E	1000	AI7 Multiplicand
$70	-831	AI7 divisor
$72	-910	AI8 Offset - KTY81-110 -25 ... +100 °C (653-1696 Ω)
$74	1000	AI8 Multiplicand
$76	-832	AI8 divisor
$78	-911	AI9 Offset - KTY81-110 -25 ... +100 °C (653-1696 Ω)
$7A	1000	AI9 Multiplicand

$7C	-833	AI9 Divisor
$7E	-911	AI10 Offset - KTY81-110 -25 ... +100 °C (653-1696 Ω)
$80	1000	AI10 Multiplicand
$82	-833	AI10 Divisor
$84	-891	AI11 Offset - KTY10-62 -25 ... +100 °C (1309-3400 Ω)
$86	1000	AI11 Multiplicand
$88	-740	AI11 Divisor
$8A	-20	AI12 Offset - NiCr-Ni (Type K thermo element) 0-600 °C, 0-24.905 mV
$8C	1000	AI12 Multiplicand
$8E	899	AI12 Divisor
$90	-24	AI13 Offset - NiCr-Ni (Type K thermo element) 0-1200 °C, 0-48.828 mV
$92	1000	AI13 Multiplicand
$94	822	AI13 Divisor
$96	0	AI14 Offset - not used
$98	1	AI14 Multiplicand
$9A	1	AI14 Divisor
$9C	0	AI15 Offset - not used
$9E	1	AI15 Multiplicand
$A0	1	AI15 Divisor
$A2	0	AI16 Offset - not used
$A4	1	AI16 Multiplicand
$A6	1	AI16 Divisor
$A8	0	AI17 Offset - not used
$AA	1	AI17 Multiplicand
$AC	1	AI17 Divisor
$AE	0	AI18 Offset - not used
$B0	1	AI18 Multiplicand
$B2	1	AI18 Divisor
$B4	0	AI19 Offset - not used
$B6	1	AI19 Multiplicand
$B8	1	AI19 Divisor
$BA	0	AI20 Offset - air volume sensor (0 - 2.5 V)
$BC	2500	AI20 Multiplicand
$BE	671	AI20 Divisor
$C0	-11	AI21 Offset - voltage (0-10 V)
$C2	10000	AI21 Multiplicand
$C4	918	AI21 Divisor
	-11	AI22 Offset - voltage (0-3 V)
$C8	3000	AI22 Multiplicand

$CA	888	AI22 Divisor
$CC	2050	AO01 Offset - analog output (0-10 V)
$CE	1886	AO01 Multiplicand
$D0	10000	AO01 Divisor

13 Calculating the Analog Input Values for the PT1000 (-50 ... +200 °C, 10-Bit)

Example: PT1000 measurement range -50 ... +200 °C

Offset	-909 d
Gain multiplier	1000 d (resolution fix)
Gain divisor	-835 d

Standardized VALUE = (read analog input values + Offset)*Gain multiplier /Gain divisor

Example: (Display)
Value for -25 °C:[909 + (-909)] x 1000 / -835 = 0000 (*)
Value for -100 °C:[74 + (-909)] x 1000 / -835 = 1000 (*)

(*) For these values, the correctly linearized temperatures must be assigned from the temperature table!
0 → -25 °C/ 1000 → +100 °C

Documentation Changes

Change date	Affected page(s)	Chapter	Note