HZS 537-1

Solar Module

Translation from German

Solar Module   HZS 537-1

1   System Description

The HZS 527-1 solar module is used to control the solar hot water processing in a modular heating system. Communication with the CPU (HZS 554-S or HZS 555-S operating unit) is established over the CAN bus.

The HZS 537-1 solar module is connected to the HZS boiler function module via the CAN bus. A CAN bus connection is made from the boiler function module to the HZS 554-S or HZS 555-S operating unit.

The solar module is powered with 230 V AC and thereby generates the internal +24 V supply voltage.

The electronics of the solar module are built into a plastic housing and can be mounted on a wall or DIN rails.

Contents

1.1   Configuration

- **Solar Module Supply:**

    - X1, 230 V AC (50 Hz, Phoenix, 3-pin)
    - 230 V AC transformer 2 x 115 V/18 V/3 V A with T250 mA primary-side fuse

- **Relay Output 230 V AC with F8.0 A Fuse:**

    - X2, solar circuit pump 2 (230 V AC/5 A/ Phoenix, 3-pin)

- **230 V AC Triac Output (zero cross point switching, pulsed) with F8.0 A Fuse, Switchable with Main Relays:**

    - X3, solar circuit pump 1 (230 V AC/2 A/Phoenix, 3-pin)

- **230 V AC Digital Input:**

    - 8 AF fuse (230 V AC/100 ms/1 mA/-)

- **+24 V DC Digital Input :**

    - X6, flow rate measurement (+24 V/5 ms/5 mA/Phoenix, 2-pin)

- **Analog inputs:**

Connectors	Label	Sensor	Range	Resolution	Accuracy	Connector Pins
X7	Collector sensor 1	PT1000 /KTY81-210	-30 … +150 °C	0.2 °C	±1.0° C	Phoenix, 2-pin
X8	Collector sensor 2	PT1000 /KTY81-210	-30 … +150 °C	0.2 °C	±1.0 °C	Phoenix, 2-pin
X9	Collector supply	KTY81-110 /PT1000	-30 … +130 °C	0.2 °C	±1.0 °C	Phoenix, 2-pin
X10	Tank sensor 2	KTY81-110 /PT1000	-30 … +130 °C	0.2 °C	±1.0 °C	Phoenix, 2-pin
X11	Collector return flow	KTY81-110 /PT1000	-30 … +130 °C	0.2 °C	±1.0 °C	Phoenix, 2-pin
X13	Flow rate	-	0-5 V	1 mV	±25 mV	Phoenix, 4-pin
X13	Collector return DFS	-	0-5 V	1 mV	±25 mV	

Analog outputs:

Connectors	Label	Range / Type	Resolu-tion	Accuracy	Connector Pins
X12	Solar circuit pump speed con-trol	0-10 V	50 mV	±100 mV	Phoenix, 3-pin
		10 V PWM	8-bit	-	

- **CAN bus interface:**

  - ➤ X4, outgoing CAN bus (Phoenix, 2-pin)
  - ➤ X5, outgoing CAN bus incl. opposing connector with terminating resistor (Phoenix, 2-pin)
  - ➤ The CAN bus connection is required to operate the end module and is made over a 4-pin Phoenix connector, including a terminating resistor.
  - ➤ CAN bus station number can be set with a HEX coding switch, this means that up to 16 solar modules can be connected in a CAN bus system.

- **Connectors:**

  - ➤ Phoenix MCV1.5/x-G-3.5 for digital +24 V inputs, analog inputs, CAN bus interface.
  - ➤ Phoenix MSTBVA2.5/x-G-5.08 for 230 V AC supply and 230 V AC outputs

2   Technical Data

2.1   Controller Performance Data

Controller	AT90CAN32
Controller frequency	16.0 MHz
Command execution time	ca. 70 ns
Interfaces	1x CAN
Internal program memory	32 kbytes (Flash)
Internal data and/or program buffering (internal EEPROM)	1 kbyte (Flash) no battery buffering required!

2.2   Power Supply

Supply voltage	230 V AC ± 10%	
Power supply frequency	50-60 Hz	
Electronics current consumption	typically 25 mA	maximum 30 mA
Current consumption of electronics and connected loads	maximum 8 A	
Fuses	T250 mA primary transformer fuse F8.0 fuse relay output and Triac output	

2.3   Terminal Requirements

Connection technology	Connector terminals are not included in delivery! The following spring terminals are required: 8x FK-MCP1.5/2-ST-3.5 Phoenix Contact spring terminal connector 1x FK-MCP1.5/3-ST-3.5 Phoenix Contact spring terminal connector 1x FK-MCP1.5/4-ST-3.5 Phoenix Contact spring contact connector 3x FKC2.5/3-ST-5.08 Phoenix Contact spring terminal connector

2.4   Digital Relay Output Specifications

Number of relays	1
Relay Types	normally open
Relays	RT314024WG
Switching range	16.8-30 V DC
Switching current	typically 16.7 mA at +24 V
Switching time	<10 ms
Switching power	see data sheet: Tyco Shack RT1 series
Fuse	F8.0A
Connection technology	1x 3-pin Phoenix RM5.08 mm

2.5 Technical Data RT314024WG Relay

TE RELAY PRODUCTS connectivity

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

F0*44-C

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.
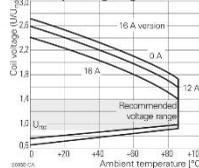Other coil voltages on request.

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
524	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.

Max. DC load breaking capacity   Electrical endurance   Coil operating range DC   Coil operating range AC

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Datasheets and product specification according to IEC 61810-1 and to be used only together with the 'Definitions' section.

Datasheets and product data is subject to terms of the disclaimer and all chapters of the 'Definitions' section, available at http://relays.te.com/definitions

Datasheets, product data, 'Definitions' section, application notes and all specifications are subject to change.

2.6   Digital Triac Output Specifications (zero cross point switching, pulsed)

Number of outputs	1
Operation mode	pulsed shortest pulse width: 1 full wave longest period: 100 full waves preset value 0 - 255 (0-100 %)
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/2.8 A at 60 °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	F8.0A
Connection technology	1x 3-pin Phoenix RM5.08 mm

2.7   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^{2}t for Fusing, (8.3 msec.) [A^{2}sec]	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
Power Factor (Min). with Max Load	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

2.8   230 V AC Digital Input Specifications

Number	1
Input delay	100 ms
Connection technology	1x internal (fuse F2 8AF)

2.9   Specifications for Digital Input with +24 V Supply

Number	1	
Input signal	+24 V	
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	
Connection technology	1x 2-pin Phoenix RM3.5 mm	

2.10   PT1000 / KTY81-210 Analog Output Specifications

Number of channels	2	
Sensor Type	PT1000	KTY81-210
Measurement range	-30 … +150 °C	
Sensor range	882.22-1573.25 Ω	1247-4280 Ω
Measurement value	-300 … +1500	
Resolution	0.2 °C	
Measurement precision	±1.0 °C	
Typical current measurement	0.9 mA	0.8 mA
Input resistance	10 kΩ	
Short circuit and open sensor detection	yes	
Connection technology	2x 2-pin Phoenix RM 3.5 mm	

2.11   KTY81-110 / PT1000 Analog Input Specifications

Number of channels	3	
Sensor Type	KTY81-110	PT1000
Measurement range	-30 … +130 °C	
Sensor range	624-2023 Ω	882.22-1498.32 Ω
Measurement value	-300 … +1300	
Resolution	0.2 °C	
Measurement precision	±1.0 °C	
Typical current measurement	1.1 mA	
Input resistance	8.2 kΩ	
Short circuit and open sensor detection	yes	
Connection technology	3x 2-pin Phoenix RM 3.5 mm	

2.12   0-5 V DC Analog Input Specifications

Number of channels	2
Sensor Type	t.b.d.
Supply voltage	5 V ±2 %
Output voltage capacity	maximum 10 mA
Measurement range	0-5 V
Sensor range	-
Measurement value	0-5000
Resolution	1 mV
Measurement precision	±25 mV
Input resistance	100 kΩ
Short circuit and open sensor detection	Sensor break detection only
Connection technology	1x 4-pin Phoenix RM 3.5 mm

2.13   0-10 V Analog Output Specifications

Number of channels	1
Output voltage	0-10 V
Output value	0-255
Resolution	50 mV
Accuracy	±100 mV
Capacity of the output voltage	maximum 10 mA
Connection technology	1x 3-pin Phoenix RM3.5 mm

2.14   10 V PWM Analog Output Specifications

Number of channels	1
Output voltage	10 V PWM
Base frequency	250 Hz
Output value	0-255
Resolution	8 bits (256d)
Accuracy	-
Output voltage capacity	maximum 10 mA
Connection technology	1x 3-pin Phoenix RM3.5 mm

2.15   Mechanics

Mechanical Dimensions	220 x 108 x 73 mm (L x W x H)

2.16   Miscellaneous

Article number	05-895-537-1
HW Version	1.x

2.17   Environmental Conditions

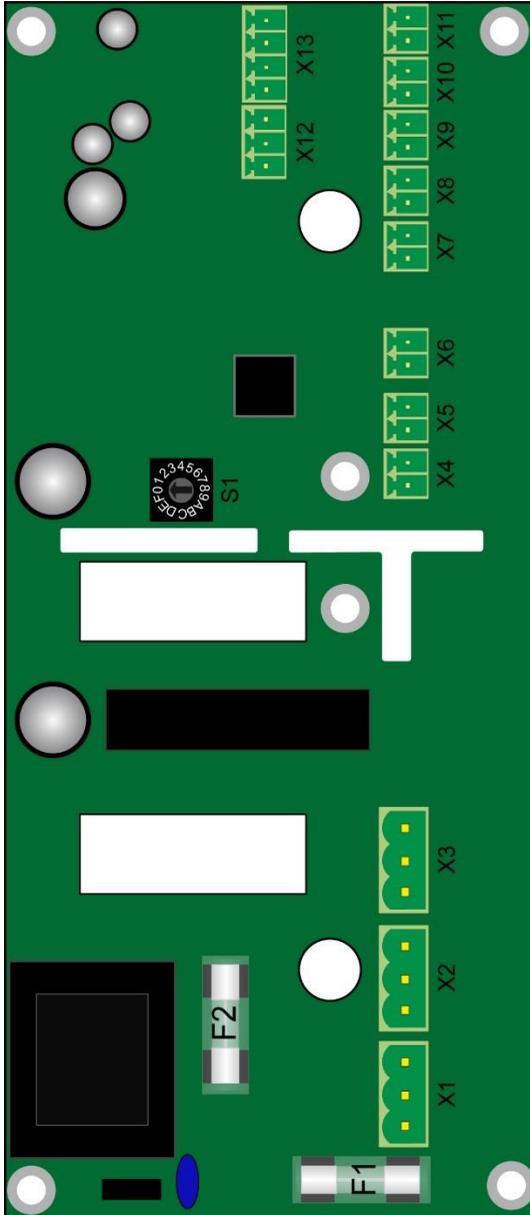| Storage temperature	-10 …+85 °C	
Operating temperature	0 … +60 °C	
Humidity	10-90 %, non-condensing	
EMC stability	in accordance with EN 61000-6-2 (industrial area)	
Noise emission	according to EN 61000-6-3 (living area)	
Shock resistance	EN 60068-2-27	150 m/s²

3   Mechanical Dimensions

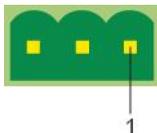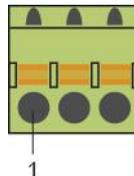# 4   Block Diagram

5   Connector Layout

6 Pin Layout

6.1 230 V AC Supply

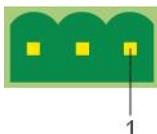**X1: 230 V supply from the power unit**
3-pin Phoenix RM5.08 connector

Pin	Signal	Function
1	L	230 V AC supply
2	N	neutral line N
3	PE	protective ground wire PE

6.2 230 V AC Relay Output

X2: 230 V AC Relay Output Solar Circuit Pump 2 – RO1
3-pin Phoenix RM5.08 connector

Pin	Signal	Function
1	RO1	230 V AC relay output RO1 Solar circuit pump 2
2	N	neutral line N
3	PE	protective ground wire PE

6.3 230 V AC Triac Output (pulse packet control)

X3: 230 V AC Triac Output Solar Circuit pump 1 – TO1
3-pin Phoenix RM5.08 connector

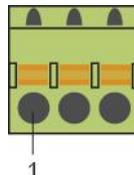| Pin	Signal	Function
1	TO1	230 V AC Triac output TO1: Solar circuit pump 1
2	N	neutral line N
3	PE	protective ground wire PE

6.4 CAN Bus

X4: CAN bus IN
2-pin Phoenix RM3.5 connector

Pin	Signal	Function
1	CAN_A	CAN low signal
2	CAN_B	CAN high signal

X5: CAN bus OUT
2-pin Phoenix RM3.5 connector

Pin	Signal	Function
1	CAN_A	CAN low signal
2	CAN_B	CAN high signal

6.5 Digital Input

X6: Digital Input +24 V DC: Flow Measurement – DI1
2-pin Phoenix RM3.5 connector

Pin	Signal	Function
1	+24 V	+24 V DC digital input supply
2	DI1	DI1: Flow measurement

6.6 Analog Inputs

X7: Analog Input: Collector Sensor 1 – AI1
2-pin Phoenix RM3.5 connector

Pin	Signal	Function
1	AI1	AI1: Collector sensor 1
2	AGND	AGND

X8: Analog Input: Collector Sensor 2 – AI2
2-pin Phoenix RM3.5 connector

Pin	Signal	Function
1	AI2	AI2: Collector sensor 2
2	AGND	AGND

X9: Analog Input: Collector Flow Sensor – AI3
2-pin Phoenix RM3.5 connector

Pin	Signal	Function
1	AI3	AI3: Collector supply sensor
2	AGND	AGND

X10: Analog Input: Tank Sensor 2 – AI4
2-pin Phoenix RM3.5 connector

Pin	Signal	Function
1	AI4	AI4: Tank sensor 2
2	AGND	AGND

X11: Analog Input: Collector Return Flow Sensor – AI5
2-pin Phoenix RM3.5 connector

Pin	Signal	Function
1	AI5	AI5: Collector return flow sensor
2	AGND	AGND

6.7   Analog Outputs

X12: Analog Output: Analog Speed control Solar Circuit Pump – AO1, AO2
3-pin Phoenix RM3.5 connector

Pin	Signal	Function
1	AO1	AO1: Speed control solar circuit pump 0-10 V DC
2	AO2	AO2: Speed control solar circuit pump 10 V PWM
3	AGND	AGND

6.8   Flow Rate Sensor Analog Inputs

X13: Analog input: Collector Return Flow Temperature DFS, Flow Rate DFS – AI6, AI7
4-pin Phoenix RM3.5 connector

Pin	Signal	Function
1	AI6	AI6: Collector return flow temperature DFS
2	AI7	AI7: Flow rate DFS
3	AGND	AGND
4	+5 V	+5 V DC supply

6.9   CAN Bus Station Number

S1: HEX Coding switch

With the HEX Coding switch, the station number (0-15) of the connected module is set.

CAN Bus Station Number Table:

SW	0	1	2	3	4	5	6	7	8	9	A	? B	? c	D	E)	F
Station	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

7   Status LED

LED Status	Definition
LED on	Controller active, CAN bus communication with CPU active
LED blinks (1 Hz)	Controller active, CAN bus communication with CPU inactive
LED blinks (5 Hz)	Controller active, Fuse F2 tripped
LED off	Controller not active, no supply

8   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.

8.1   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

8.2   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 is designed for the maximum continuous current at 230 V AC for each connected load as stated in the relay output specifications. 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!

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

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

8.3   Wiring guidelines for analog in/outputs

The analog signals 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.

8.4   CAN Bus Wiring Guidelines

For the CAN bus wiring, twisted pair shielded wires should be used. The cable shielding must be connected to ground either directly before the terminal over a large, low-Ohm surface (grounding clamps) or with a blade terminal.

Noise signals can therefore be prohibited from reaching the electronics and affecting the function.

9   CAN Bus Termination

In a CAN bus system, both end modules must be terminated. This is necessary to avoid transmission errors caused by reflections in the line.

CAN bus connections

A = termination resistor

If the external HZS 537-1 solar module is an end unit, the termination must be made on the HZS 537-1.

The CAN termination is made with a terminating resistor of 120 Ohms between CAN A and CAN B.

10 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 is protected by micro fuses.

When changing the fuses, please refer to the following overview with the assignment of the fuses on the solar module:

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

Fuse	Value	Construction	Assignment
F1	F8A	5x 20 mm	230 V AC fuse: Relays or Triac output
F2	T250mA	5x 20 mm	230 V AC fuse: main transformer fuse

Additionally protected with self-resetting PTC fuses:

Fuse	Value	Assignment
F3	0.14 A	+24 V output for analog inputs: DI1 X6 flow measurement

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

11 AT90CAN32 Port Assignment

PORT	I/O	Signal	Description of functions
PA0	Output	SEL_AI01	Output select collector sensor 1 (AI01)
PA1	output	SEL_AI02	Output select Collector sensor 2 (AI02)
PA2	output	SEL_AI03	Output select collector supply (AI03)
PA3	output	SEL_AI04	Output select tank sensor (AI04)
PA4	output	SEL_AI05	Output select collector return flow sensor (AI05)
PA5	output	SEL_AI06	Output select flow rate measurement (AI06)
PA6	output	SEL_AI07	Output select flow temperature (AI01)
PA7	Output	TO01	Triac output 01: (PPA) Solar circuit pump 1
PB0	Output	\START_RAMPE	\Start for AI ramp
PB1	Output	SCK	controller programming: Clock
PB2	I/O	N.C.	Not connected
PB3	I/O	N.C.	Not connected
PB4	I/O	N.C.	Not connected
PB5	I/O	N.C.	Not connected
PB6	I/O	N.C.	Not connected
PB7	Output	LED	Status LED
PC0	Output	RO01	Relay output 01: Solar circuit pump 2
PC1	Output	RO02	Relay output 02: main relay
PC2	input	DI1	Digital input 1: DI 230 V AC: L_FUSED
PC3	input	DI2	Digital input 2: flow measurement
PC4	input	HEXCOD_1	HEX Coding switch
PC5	input	HEXCOD_2	HEX Coding switch
PC6	input	HEXCOD_4	HEX Coding switch
PC7	input	HEXCOD_8	HEX Coding switch
PD0	input	Start	start signal for AI
PD1	input	AI	AI input
PD2	input	STOP	stop signal for AI
PD3	input	ZEROCR	Zero cross (null point crossover detection)
PD4	I/O	N.C.	Not connected
PD5	Output	\CANTX	CAN: Transmit data
PD6	input	\CANRX	CAN: Receive data
PD7	I/O	N.C.	Not connected
PE0	input	PDI	Controller programming: serial data input
PE1	Output	PDO	Controller programming: serial data output
PE2	output	\TRIG_WD	hardware watchdog trigger
PE3	output	PWM_AO1	PWM analog output 0 – 10 V

PE4	Output	PWM_AO2	PWM analog input 10 V PWM
PE5	I/O	N.C.	Not connected
PE6	I/O	N.C.	Not connected
PE7	I/O	N.C.	Not connected
PF0	I/O	N.C.	Not connected
PF1	I/O	N.C.	Not connected
PF2	I/O	N.C.	Not connected
PF3	I/O	N.C.	Not connected
PF4	input	TCK	JTAG Test Clock
PF5	input	TMS	JTAG test Mode Select Input
PF6	Output	TDO	JTAG Test Data Output
PF7	input	TDI	JTAG Test Data Input
PG0	I/O	N:C.	Not connected
PG1	I/O	N.C.	Not connected
PG2	I/O	N.C.	Not connected
PG3	I/O	N.C.	Not connected
PG4	I/O	N.C.	Not connected

12 HZS 537-1 Module Identifications: Atmel AVR AT90CAN32 (internal FLASH)

(Labels are based on the C-DIAS Labels and are managed under C-DIAS)

Address	Data	Description
		Organization of data in bytes
00	$xx	checksum from CDIAS header (addresses 1 to 5) = 5 bytes
01	123	identification
02	230	module group 230 = Biomass heating control
03	37	variant HZS 537-1 = solar expansion
04	8	Number of channels HZS 537-1 = solar expansion
05	$10	hardware version $XY ($10=HW 1.0, $32=HW 3.2)

Checksum formula:
See C-DIAS hardware identification

13 HZS537-1 Calibration Data: Atmel AVR AT90CAN32 (internal FLASH)

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	35	length of the reference data in Words
$46	37	Variant 37 = HZS537-1 = solar module
$48	20000	Vref [mV] for converting AI to absolute voltage not supported since measurement is only possible from 0.6 to 3.3 V! E.g. for 0 to 48 mV, offset and gain from the amplifier are also required!
$4A	0	Vref [d] = Ramp Stop value at the time of calibration for the reference voltage compensation (drift of C) at 0 to 48 mV and 0 to 10 V, etc. not supported, since by the standardization of AI to Ramping value = Stop at 10000, a reference voltage correction already occurs.
$4C	6346	Ramp start voltage [mV] /Vref [mV] * 10000 = the ratio Start/Vref for the resistance measurement
$50	20000	Ramp stop voltage [mV] /Vref [mV] * 10000 = the ratio Start/Vref for the resistance measurement
$54	0	reserved
$56	0	reserved
$58	0	reserved
$5A	0	reserved
$5C	0	reserved
$5E	0	reserved
$60	10000	AI1 series resistor – PT1000 / KTY81-210 – -30 °C – +150 °C
$62	1	AI1 runtime offset
$64	1	AI1 divisor
$66	10000	AI2 series resistor – PT1000 / KTY81-210 – -30 °C – +150 °C
$68	1	AI2 runtime offset
$6A	1	AI2 divisor
$6C	8200	AI3 series resistor – PT1000 / KTY81-110 – -30 °C – +130 °C
$6E	1	AI3 runtime offset

$70	1	AI3 divisor
$72	8200	AI4 series resistor – PT1000 / KTY81-110 – -30 °C – +130 °C
$74	1	AI4 multiplier
$76	1	AI4 divisor
$78	8200	AI5 series resistor – PT1000 / KTY81-110 – -30 °C – +130 °C
$7A	1	AI5 runtime offset
$7C	1	AI5 divisor
$7E	-900	AI6 offset – voltage input – 0 V– 5 V
$80	5000	AI6 multiplier
$82	20000	AI6 divisor
$84	-900	AI7 offset – voltage input – 0 V– 5 V
$86	5000	AI7 multiplier
$88	20000	AI7 divisor
$8A	-10	AO1 offset – voltage output – 0 V – 10 V
$8C	9100	AO1 multiplier
$8E	10000	AO1 divisor

Calculating an Analog Input Value AI (0 V to +5 V)

Example: AI (0 V to +5 V)

Offset -1186 d
Gain Multiplier 10000 d (resolution fixed)
Gain Divisor 16443 d

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

Example: (Display)
Value for   0 V: [1186 + (-1186)] x 5000 /16443 = 0000
Value for   +5 V: [17629 + (-1186)] x 5000 /16443 = 5000

Documentation Changes

Change date	Affected page(s)	Chapter	Note
02.11.2015	19	6. Pin Layout	X1 sequence changed
22.11.2017		2.4 and 2.5 Specifications Relays	Relay data and pictures changed to WG version
	19	6.1 230 V AC supply	Pin assignment corrected