IPC/REL12-1AE

Document Ordercode: DOC/IPC_REL12-E

Revision	Date	Author	Modification
1.0	23.11.2005	U. Müller	
1.1	15.05.2007	U. Müller	minor corrections
1.2	18.08.2009	U. Müller	references corrected

Contents

List of Tables

List of Figures

1 Introduction

1.1. General Remarks

The content and presentation of this document has been carefully checked. No responsibility is accepted for any errors or omissions in the documentation.
Note that the documentation for the products is constantly revised and improved. The right to change this documentation at any time without notice is therefore reserved.
Syslogic is grateful for any help referring to errors or for suggestions for improvements.
The following registered trademarks are used:

IBM-PC, PC/AT, PS/2	trademarks of IBM Corporation
FBCube, EUROLOG,	trademarks of Syslogic Datentechnik AG

1.2. Contents of this Documentation

This document addresses to system integrators, programmers and instructed installation and maintenance personal working with the IPC system. It provides all information needed to configure, setup and program the relays interface board IPC/REL12-1AE. For complete information also the documentation of the mounted CPU board and communications and I/O boards must be consulted. As the IPC/REL12 board may be delivered in various versions with optional hardware blocks the standard version (IPC/REL12-1AE) is described here, which includes all hardware function blocks.

1.3. Additional Products and Documents

1.3.1. Hardware Products

The following hardware products are useful together with the IPC/REL12 board:

- IPC startup guide and tools
- IPC/NETIPC CPU boards
- IPC communication boards
- IPC I/O boards

(see product catalog for details)

1.3.2. Software Products

The following software products are useful together with the IPC/REL12 board:

- Firmware for IPC CPU boards: e.g. IPC/NETIPCFW-1A
- Sample program code and utilities for x86 based FBCube systems: IPC/IOCOMSW-1A

1.3.3. Documents

The following documents are *required* for correct installation and operation of the IPC/REL12 board:

- DOC/CUBINST: User Documentation for FBCube Installation

  Note : also contains the necessary information related to the "ce"-certification of the products
- User Documentation for Basic Firmware (dependent on CPU board)
- DOC/IPC_IOCOMSW: User Documentation for Programming Examples and Utilities

1.4. Items delivered

The IPC/REL12 module is delivered without any mechanical mounting material. The user should order the required mechanical mounting material according to his needs (open frame mounting, 19"-rack mounting, DIN-rail mounting etc.). Note that the technical documentation is not part of the delivery and must be ordered separately or downloaded from the Internet.
A CPU board, power supply board and enclosure are necessary to build a complete system. All items must be ordered separately and installed according to the respective user documentations.
A standard base configuration could be as follows:

- IPC system with NETIPC-2A CPU board and free slot for I/O board: IPC/COMPACT2-2E
- external power adapter
- CompactFlash

Note : Mounting procedure is described in DOC/COMPACT2-2E

1.5. Installation

The installation of the IPC system is described in the documentation DOC/CUBINST.
The firmware configuration and download is described in the appropriate firmware documentation.

Important Note

Before applying power to the IPC system the all boards must be correctly configured and mounted (please consult User Documentation of the selected boards).

1.6. Safety Recommendations and Warnings

The products are intended for measurement, control and communications applications in industrial environments. The products must be assembled and installed by specially trained people. The strict observation of the assembly and installation guidelines is mandatory.

The use of the products in systems in which the life or health of persons is directly dependent (e.g. life support systems, patient monitoring systems, etc.) is not allowed.
The use of the products in potentially explosive atmospheres requires additional external protection circuitry which is not provided with the products.
In case of uncertainty or of believed errors in the documentation please immediately contact the manufacturer (address see chapter 8). Do not use or install the products if you are in doubt.
In any case of misuse of the products, the user is solely liable for the consequences.

1.7. Life Cycle Information

1.7.1. Transportation and Storage

During transportation and storage the products must be in their original packing. The original packing contains an antistatic bag and shock-absorbing material. It is recommended, to keep the original packing in case of return of the product to the factory for repair. Note that the packing is recyclable.

1.7.2. Assembly and Installation

Observe the EMI-precautions against static discharge. Carefully read the assembly and installation documentation (Document DOC/CUBINST) before unpacking the products. Make sure that you have all the necessary items ready (including all the small parts). Follow the assembly guidelines in DOC/CUBINST strictly.
The installation procedures (contained in document DOC/CUBINST) must be strictly observed. Note that deviations from the installation guidelines may result in degraded operational reliability or in unfavourable EM-radiation or EM-susceptibility.

1.7.3. Operation

The operating environment must guarantee the environmental parameters (temperature, power supply, etc.) specified in the technical specification section of the product manuals.
The main functionality of the system is defined by the application programs running on the system. The application programs are not part of the delivery by Syslogic but are defined, developped and tested by the customer or a system-integrator for each specific application. Refer to the respective documentation for more information.

1.7.4. Maintenance and Repair

The product features error- and malfunction-detection circuitry. Diagnostic information gathered is transferred to the applications software where it can be used. In the rare case of a module hardware-failure or malfunction, the complete module should be exchanged. The faulty module must be returned to the factory for repair. Please use whenever possible the original packing for return of the product (EMI and mechanical protection).

1.7.5. Disposal

At the end of the lifespan the product must be properly disposed. IPC products contain a multitude of elements and must be disposed like computer parts. Some of the IPC products contain batteries which should be properly disposed.

2 Product Description

2.1. Features

The 12 channel relays interface board IPC/REL12-1AE provides twelve potential-free mechanical contacts. Make and break contact connection is available on the interface connector.
In addition 8 open collector transistor outputs are available for driving light loads like relays or LEDs.

The block diagram of the board is shown in Fig. 1.

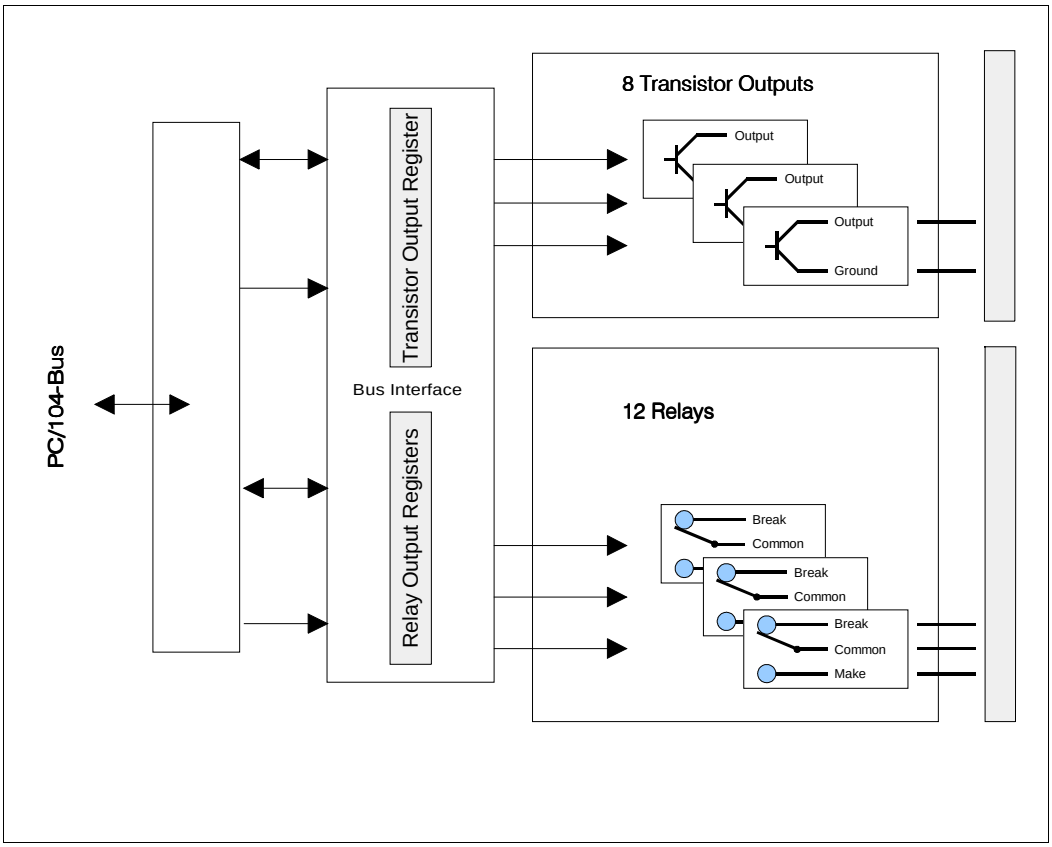

Fig. 1 Block Diagram

The main functional elements are:

- PC/104 local bus interface
- board base address selection switch
- 12 relays with make and break contacts
- 8 open collector transistor outputs

2.2. Connector Assignments

The relay connector/pin assignment for the board is shown in Tab. 1.
Mating plug type: Weidmüller B2L 3.5/36F SN SW (Weidmüller ordering code 1748320000)
Field wiring: AWG18...28 / 0.5-1.0 mm^2

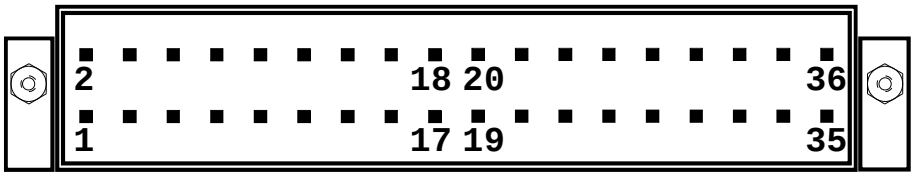

Fig. 2 Process Interface Connector P1

I/O Connector Pin	Process Interface Signal	I/O Connector Pin	
1	Relay 0 Make Contact	2	Relay 1 Make Contact
3	Relay 0 Common Contact	4	Relay 1 Common Contact
5	Relay 0 Break Contact	6	Relay 1 Break Contact
7	Relay 2 Make Contact	8	Relay 3 Make Contact
9	Relay 2 Common Contact	10	Relay 3 Common Contact
11	Relay 2 Break Contact	12	Relay 3 Break Contact
13	Relay 4 Make Contact	14	Relay 5 Make Contact
15	Relay 4 Common Contact	16	Relay 5 Common Contact
17	Relay 4 Break Contact	18	Relay 5 Break Contact
19	Relay 6 Make Contact	20	Relay 7 Make Contact
21	Relay 6 Common Contact	22	Relay 7 Common Contact
23	Relay 6 Break Contact	24	Relay 7 Break Contact
25	Relay 8 Make Contact	26	Relay 9 Make Contact
27	Relay 8 Common Contact	28	Relay 9 Common Contact
29	Relay 8 Break Contact	30	Relay 9 Break Contact
31	Relay 10 Make Contact	32	Relay 11 Make Contact
33	Relay 10 Common Contact	34	Relay 11 Common Contact
35	Relay 10 Break Contact	36	Relay 11 Break Contact

Tab. 1 Process Interface Connector P1

The transistor output connector/pin assignment for the board is shown in Tab. 2.

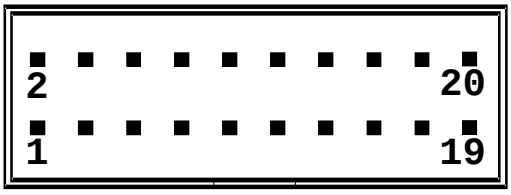

Fig. 3 Transistor Output Connector P2

I/O Connector Pin	Process Interface Signal	I/O Connector Pin	
1	Output D0	2	Pullup Resistor to VCC
3	Output D1	4	Pullup Resistor to VCC
5	Output D2	6	Pullup Resistor to VCC
7	Output D3	8	Pullup Resistor to VCC
9	Output D4	10	Pullup Resistor to VCC
11	Output D5	12	Pullup Resistor to VCC
13	Output D6	14	Pullup Resistor to VCC
15	Output D7	16	Pullup Resistor to VCC
17	Ground	18	Vext
19	Ground	20	Vext

Tab. 2 Transistor Output Connector P2

2.3. Bus Interface (PC/104)

The PC/104 bus interface of the IPC/REL12 allows connection to a wide range of processor boards. The bus interface is described in the IEEE 996 and 996.1 standards documentation. The bus connector pinout is shown in Tab. 2. Depending on the board version the bus connector may have a different form factor but the position of the PC/104 signals stay the same. This enables to support additional bus signals (Vbatt, Power, etc) on one single connector block.

Pin		*Signal Name*	*Pin*		*Signal Name*	*Pin*		*Signal Name*	*Pin*		*Signal Name*
						A1	⊗	IOCHCK#	B1	⊗	GND
P11			P12			A2	⊗	SD7	B2	⊗	RESETDRV
1	⊗	GND	1	⊗	GND	A3	⊗	SD6	B3	⊗	+5V
2	⊗	no connection	2	⊗	+5V	A4	⊗	SD5	B4	⊗	IRQ9
3	⊗	no connection	3	⊗	TRIGGER*	A5	⊗	SD4	B5	⊗	-5V (not used)
4	⊗	Vbatt	4	⊗	STOP*	A6	⊗	SD3	B6	⊗	DRQ2
						A7	⊗	SD2	B7	⊗	-12V (not used)
						A8	⊗	SD1	B8	⊗	0WS#
D0	⊗	GND	C0	⊗	GND	A9	⊗	SD0	B9	⊗	+12V (not used)
D1	⊗	MEMCS16#	C1	⊗	SBHE#	A10	⊗	IOCHRDY	B10	⊗	(KEY)
D2	⊗	IOCS16#	C2	⊗	LA23	A11	⊗	AEN	B11	⊗	SMEMW#
D3	⊗	IRQ10	C3	⊗	LA22	A12	⊗	SA19	B12	⊗	SMEMR#
D4	⊗	IRQ11	C4	⊗	LA21	A13	⊗	SA18	B13	⊗	IOW#
D5	⊗	IRQ12	C5	⊗	LA20	A14	⊗	SA17	B14	⊗	IOR#
D6	⊗	IRQ15	C6	⊗	LA19	A15	⊗	SA16	B15	⊗	DACK3#
D7	⊗	IRQ14	C7	⊗	LA18	A16	⊗	SA15	B16	⊗	DRQ3
D8	⊗	DACK0#	C8	⊗	LA17	A17	⊗	SA14	B17	⊗	DACK1#
D9	⊗	DRQ0	C9	⊗	MEMR#	A18	⊗	SA13	B18	⊗	DRQ1
D10	⊗	DACK5#	C10	⊗	MEMW#	A19	⊗	SA12	B19	⊗	REFRESH#
D11	⊗	DRQ5	C11	⊗	SD8	A20	⊗	SA11	B20	⊗	SYSCLK
D12	⊗	DACK6#	C12	⊗	SD9	A21	⊗	SA10	B21	⊗	IRQ7
D13	⊗	DRQ6	C13	⊗	SD10	A22	⊗	SA9	B22	⊗	IRQ6
D14	⊗	DACK7#	C14	⊗	SD11	A23	⊗	SA8	B23	⊗	IRQ5
D15	⊗	DRQ7	C15	⊗	SD12	A24	⊗	SA7	B24	⊗	IRQ4
D16	⊗	+5V	C16	⊗	SD13	A25	⊗	SA6	B25	⊗	IRQ3
D17	⊗	MASTER#	C17	⊗	SD14	A26	⊗	SA5	B26	⊗	DACK2#
D18	⊗	GND	C18	⊗	SD15	A27	⊗	SA4	B27	⊗	TC
D19	⊗	GND	C19	⊗	(KEY)	A28	⊗	SA3	B28	⊗	BALE
						A29	⊗	SA2	B29	⊗	+5V
						A30	⊗	SA1	B30	⊗	OSC
						A31	⊗	SA0	B31	⊗	GND
						A32	⊗	GND	B32	⊗	GND

Tab. 3 PC/104 Bus Connectors PA/PB, PC/PD

3 Hardware Description

3.1. Overview

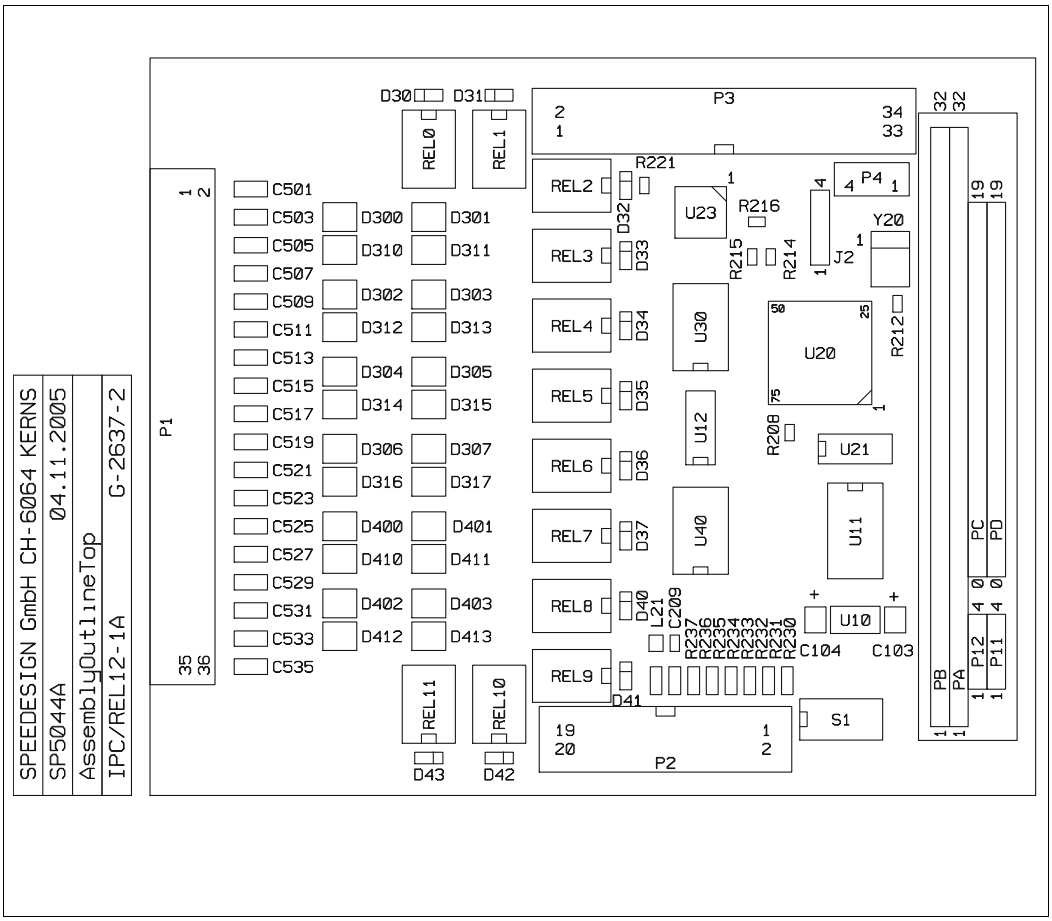

Fig. 4 Board Layout

3.2. Relay Outputs

The twelve Relay outputs provide make and break contacts for connection of external AC or DC loads. Each contact is protected with a transient voltage supressor and high voltage capacitor to earth/shield.
Relay outputs are galvanically isolatet from logic/transistor outputs and from the other relay outputs.
See technical data section for output ratings.

3.3. Transistor Outputs

The eight transistor outputs (open collector) may be used to drive small external loads like relays or LEDs. On the connector a pullup connection to Vcc is provided for each transistor output on the opposite pin for easy direct connection of LEDs. All outputs share a common ground.
If driving external relays or inductive loads a clamping circuit is available on the Vext pins of the connector to protect the transistors. Connect the external supply of the relays or inductive load to Vext pin to activate the clamping circuit, otherwise leave it open/unconnected.
The transistor outputs are not isolated from logic and therefor should only be used for internal loads or externally protected loads.
See technical data section for output ratings.

3.4. Memory and I/O Resources

3.4.1. General Memory Layout and Configuration

The IPC/REL12 board does not use any memory resources.

3.4.2. General I/O Layout and Configuration

Address	Device / Register	Remarks
Base + 00..03H	Control/Status Registers	
Base + 04..07H	Digital I/O Registers	
Base + 08..0FH	reserved	

Tab. 4 I/O Address Space Layout

3.4.3. Board Base Address Configuration

The base address of the IPC/REL12 can be selected in the range 0x200..0x3FF and 0x8200..0x83FF according to Tab. 4. The IPC/REL12 board uses a block of 16 bytes in the I/O space, starting at the configured base address. The base address is defined by setting the sliders of switch S1. Several IPC/REL12 boards (with different base addresses !) can be used in the same system.

CAUTION: Each board in the IPC system must have its own, unique address range. Overlapping address ranges may damage the boards.

Switch S1 / No	**6**	**-**	**-**	**-**	**-**	**-**	**-**	**5**	**4**	**3**	**2**	**1**	
address line	**A15**	**A14**	**A13**	**A12**	**A11**	**A10**	**A9**	**A8**	**A7**	**A6**	**A5**	**A4**	**A3..0**
I/O address													
0x0200	on	0	0	0	0	0	1	on	on	on	on	on	0
0x0210	on	0	0	0	0	0	1	on	on	on	on	off	0
..		0	0	0	0	0	1						0
0x03E0	on	0	0	0	0	0	1	off	off	off	off	on	0
..		0	0	0	0	0	1						0
0x8200	off	0	0	0	0	0	1	on	on	on	on	on	0
0x8210	off	0	0	0	0	0	1	on	on	on	on	off	0
..		0	0	0	0	0	1						0
0x83F0	off	0	0	0	0	0	1	off	off	off	off	off	0

Tab. 5 I/O Base Address Configuration Switch S1

Note: Switch off: 1
Switch on: 0

3.4.4. Other Configuration Options

Switch S1	Configuration	Remarks
7	reserved	do not change
8	reserved	**must be OFF!**

Tab. 6 Configuration Options Switch S1

Pin Number	Signal	Remarks
1	TCK	do not use
2	TDO	do not use
3	TMS	do not use
4	TDI	do not use

Tab. 7 Factory Programming Header J2 (1x4 pin)

4 Programming Information

4.1. Overview

The programming of the IPC/REL12 board is done with standard I/O read and write operations. For detailled information refer to the CPU board's user documentation, firmware documentation and other related documents as listed in paragraph 1.3.

4.2. Register Model and Bit-Utilization

Warning: Do not read from or write into addresses not defined in the register model !

All registers of the IPC/REL12 are located in the I/O address space. The register model is shown in Tab. 7 and the utilization of the individual bits is listed in Tab. 8 and Tab. 10.
The programming of the relays outputs in Tab. 11.

4.3. Memory and I/O Resources

4.3.1. General Memory Layout and Configuration

The IPC/REL12 board does not use any memory resources.

4.3.2. General I/O Layout and Configuration

Register Number	READ Registers	WRITE Registers
00H	Status Register	reserved
01H	Control Register	Control Register
02H	Function ID Register	reserved
03H	Revision ID Register	reserved
04H	Relay Outputs 0..7	Relay Outputs 0..7
05H	Relay Outputs 8..11	Relay Outputs 8..11
06H	Transistor Outputs L0..L7	Transistor Outputs L0..L7
07H	reserved	reserved
08-0FH	reserved	reserved

Tab. 8 I/O Address Space Layout

Register	Bit	Meaning	Programming
00H	D0	reserved	= always 1
	D1	reserved	= always 1
	D2	reserved	= always 1
	D3	reserved	= always 1
	D4	not used	= always 1
	D5	not used	= always 1
	D6	not used	= always 1
	D7	not used	= always 1
01H	D0	reserved	reserved
	D1	reserved	reserved
	D2	FREEZE STOP mode	= 0: outputs reset on STOP* active = 1: outputs freeze on STOP* active Default = 0 (outputs reset on STOP* active)
	D3..D7	not used	= always 1
02H	D0-D7	FID	= EEH
03H	D0-D7	RID	revision ID (see table 16)
04H	D0-D7	Read back of Register 04H	D0 = REL0, D7 = REL7 (Tab. 10)
05H	D0-D7	Read back of Register 05H	D0 = REL8, D3 = REL11 (Tab. 10) (D4..D7 = 0)
06H	D0-D7	Read back of Register 06H	D0 = L0, D7 = L7 0 = output OFF, 1 = output ON
07H	D0-D7	reserved	
08H-0FH	D0-D7	reserved	

Tab. 9 Utilization of the individual Bit (READ-Registers)

Register	Bit	Meaning	Programming
00H	D0..D7	not used	
01H	D0	reserved	not used
	D1	reserved	not used
	D2	FREEZE STOP mode	= 0: outputs reset on STOP* active = 1: outputs freeze on STOP* active Default = 0 (outputs reset on STOP* active)
	D3..D7	reserved	
02H	D0-D7	reserved	not used
03H	D0-D7	not used	
04H	D0-D7	Relays Outputs (REL0 .. REL7)	D0 = REL0, D7 = REL7 (Tab. 10)
05H	D0-D7	Relays Outputs (REL8 .. REL11)	D0 = REL8, D3 = REL11 (Tab. 10) (D4..D7 = 0)
06H	D0-D7	Transistor Outputs (L0 .. L7)	D0 = L0, D7 = L7 0 = output OFF, 1 = output ON
07H	D0-D7	reserved	do not write
08H-0FH	D0-D7	reserved	do not write

Tab. 10 Utilization of the individual Bit (WRITE-Registers)

Bit in Register	relay make contact	relay break contact
Output "0" (= inactive)	open	closed
Output "1" (= active)	closed	open

Tab. 11 Interface Specifications and Programming for Relay Outputs

5 Technical Data

5.1. General Electrical Data

Important Note

Do not operate the REL12 board outside of the recommended operating conditions. Otherwise lifetime and performance will degrade.

Operating the board outside of the absolute maximum ratings may damage the hardware.

Absolute Maximum Ratings (over free-air temperature range)

Parameter	Symbol	min	nom	max	Unit
internal power supply voltage	Vcc	-0.5		5.5	Vdc
relay switching voltage	Vr			48	Vdc
relay switching current (at 48Vdc)	Ir			1	A
relay switching current (at 24Vdc)	Ir			2	A
transistor output collector-emitter voltage	Vce			48	Vdc
transistor output sink current	Itr			100	mA
clamping current on Vext pin	Icl			500	mA
isolation logic to chassis (AC, 60s, 500m a.s.l., Ta=25°C)		1000			Vrms
isolation relay contacts to logic (AC, 60s, 500m a.s.l., Ta=25°C)		1500			Vrms
isolation relay contacts to chassis (AC, 60s, 500m a.s.l., Ta=25°C)		500			Vrms
creepage distance logic to chassis and PCB boarder		1.5			mm
creepage distance relay contacts to logic		2.4			mm
creepage distance relay contacts to chassis		1.3			mm
creepage distance between two different relay contacts		0.5			mm
storage temperature range	Tst	-40		90	°C

Tab. 12 General Absolute Maximum Ratings

Recommended Operating Conditions

parameter	symbol	min	nom	max	unit
logic supply voltage	Vcc	4.75	5.00	5.25	V
relay switching voltage	Vr			48	Vdc
relay switching current (at 48Vdc)	Ir			1	A
relay switching current (at 24Vdc)	Ir			2	A
transistor output collector-emitter voltage	Vce			48	Vdc
transistor output sink current	Itr			100	mA
operating free air temperature extended range product	Ta	-40		85	°C

Tab. 13 General Recommended Operating Conditions

Electrical Characteristics
(over recommended operating range, unless otherwise noted)

Parameter	Symbol	min	typ	max	Unit
logic supply current (Vcc=5V, all outputs off)	Icc		65	100	mA
logic supply current (Vcc=5V, all outputs on, no loads on P2 pullups)	Icc		400	500	mA
initial relay contact resistance (10mA/20mV)	Rmax		<50		mOhm
minimum switching voltage			100		uVdc
transistor output saturation voltage	Vce(sat)		1		V
pullup resistors to Vcc on P2 (each of 8 pins)	Rpu		270		Ohm

Tab. 14 General Electrical Characteristics

Switching Characteristics (nominal conditions)

Parameter	Symbol	min	typ	max	
relay switch on delay	ton		1	4	ms
relay switch off delay	toff		3	6	ms
relay bounce time	tbounce		1	5	ms
relay maximum switching rate without load	fmax			50	Hz

Tab. 15 General Switching Characteristics

5.2. Mechanical Data

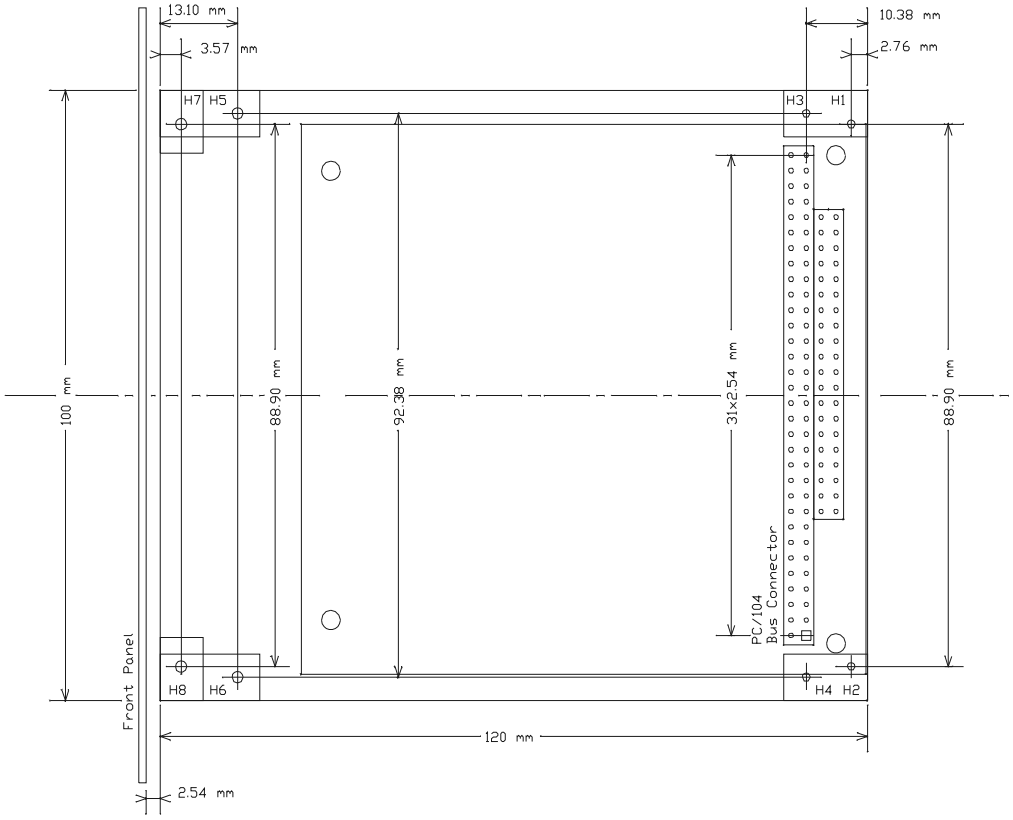

Fig. 5 Mechanical Outline

6 Firmware

The IPC/REL12 board does not contain any firmware.

7 Product Revision History

7.1. Hardware

This paragraph lists the different hardware revisions of the IPC/REL12 boards delivered beginning with the first production lot. Note that prototyping boards are not included and must be returned to factory for upgrade or replacement. All information listed in this document relies on definitive state hardware. Therefore this information may be incompatible with the prototyping board hardware.

Important Note

This document always covers the newest product revision listed in Tab. 15.
Please contact the manufacturers technical support for upgrade options.

Board Identification (see product label)	Product Revision	Revision ID Register	Remarks
IPC/REL12-1AE #1	#1	01H	Original Release

Tab. 16 Hardware Revision State

7.2. Firmware

The IPC/REL12 board does not contain any firmware.

8 Manufacturer Information

8.1. Contact

Our distributors and system integrators will gladly give you any information about our products and their use. If you want to contact the manufacturer directly, please send a fax or email message containing a short description of your application and your request to the following address or use one of the information or technical support request forms on our internet homepage:

Syslogic Datentechnik AG
Täfernstr. 28
CH-5405 Baden-Dättwil / Switzerland

Email: support@syslogic.ch
www: http://www.syslogic.ch
Tel: +41 56 200 9040
Fax: +41 56 200 9050

8.2. Warranty

Our products are covered by a world-wide manufacturers warranty. The warranty period starts at the delivery time from our official distributor to the customer. The duration of the warranty period is specified in the respective product catalogs and the offers. All products carry a date code and a job number for identification. The manufacturing data and deliveries are registered in a high level Quality Management System.
The warranty covers material and manufacturing defects. All products must be returned via the official distributor to the factory for repair or replacement. The warranty expires immediately if the products are damaged of operation outside of the specified recommended operating conditions. The warranty also expires if the date code or job number listed on the product is altered or rendered unintelligible. The warranty does not include damage due to errors in firmware or software delivered with the products.