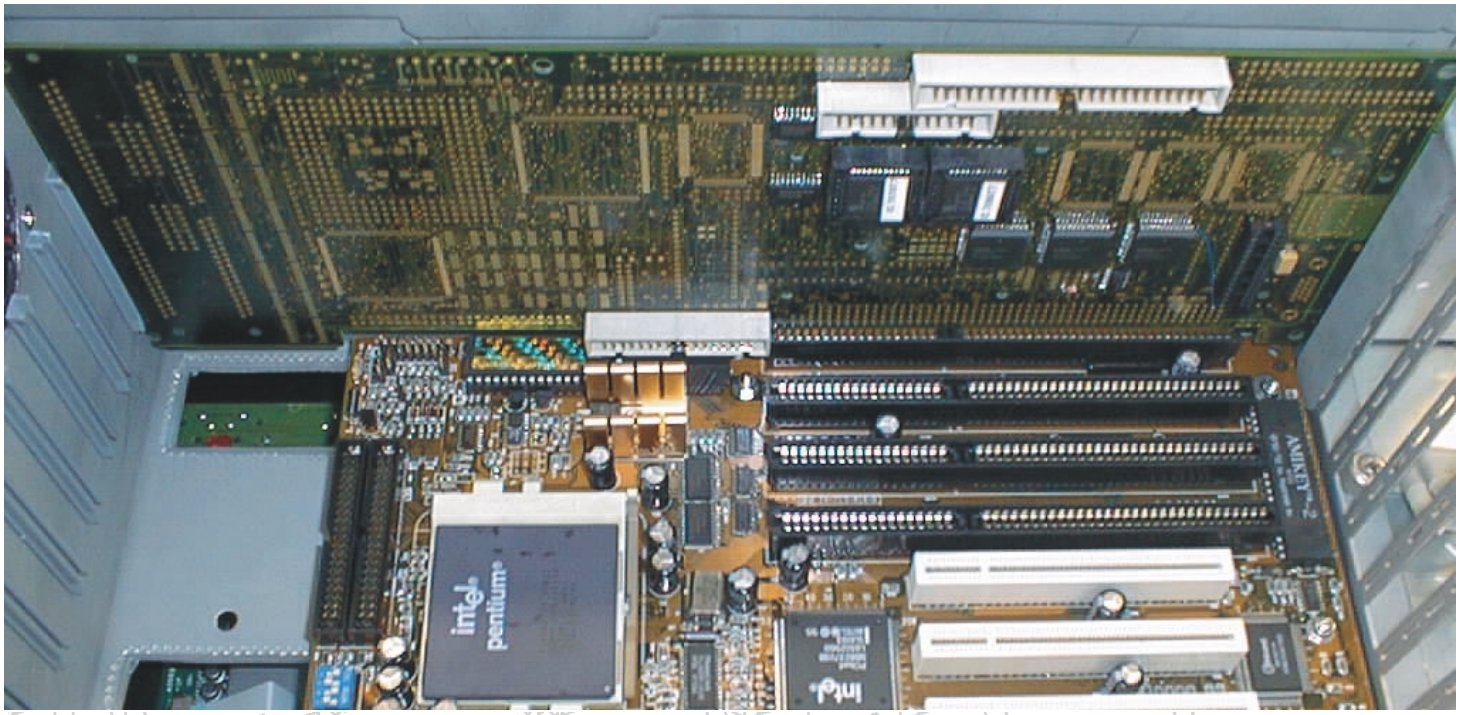


ISA-Bus interface card C1230S

Supplement for Industrial PCs with standard motherboard

Technical hardware description

Version 1.0

BECKHOFF
INDUSTRIE ELEKTRONIK

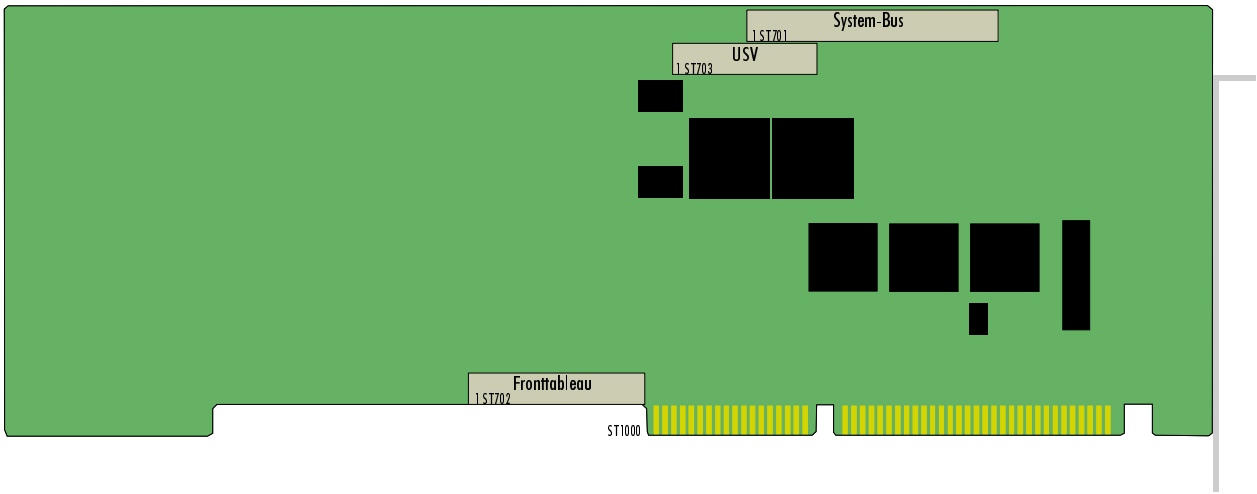
Table of Contents

Overview

The ISA bus C1230S PC interface card provides an extension to industry PCs with standard motherboards for the drive of various IPC components that are not present in standard PCs.

The C1230S allows up to 10 special keys to be interrogated, and up to 10 LEDs to be driven. The card, in combination with the C2000 BAT control board, allows a 24V UPS (uninterruptible power supply) to be driven. The industry PC can also be given an NC backplane, driven by means of the C1230S interface card. The NC backplane makes 32 digital inputs, 32 digital outputs, 4 analogue inputs, 4 analogue outputs and 4 incremental encoder inputs available centrally at the PC. The function and programming of the NC backplane are described in a separate NC backplane documentation.

The C1230S interface card is a partially populated variant of the C1230 All-in-One motherboard.



Connections for:

- C2000BAT control board for uninterruptible power supply
- NC backplane
- Front panel

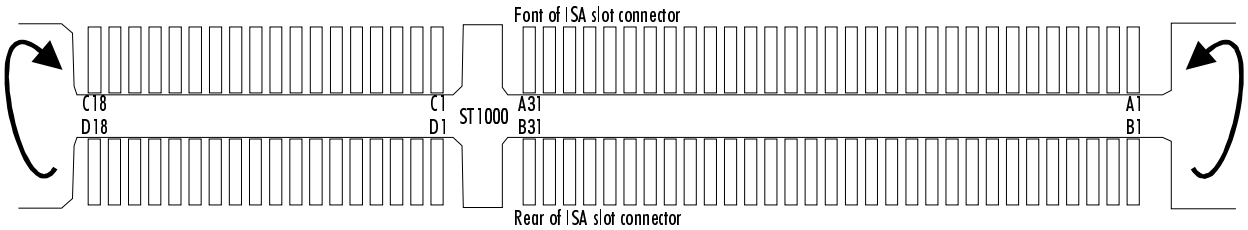
Pin Assignment for the Connections

AT bus

Pin assignment ST 1000 AT bus	Function
A1	IOCHK#
A2	SD7
A3	SD6
A4	SD5
A5	SD4
A6	SD3
A7	SD2
A8	SD1
A9	SD0
A10	IOCHRDY#
A11	AEN
A12	SA19
A13	SA18
A14	SA17
A15	SA16
A16	SA15
A17	SA14
A18	SA13
A19	SA12
A20	SA11
A21	SA10
A22	SA9
A23	SA8
A24	SA7
A25	SA6
A26	SA5
A27	SA4
A28	SA3
A29	SA2
A30	SA1
A31	SA0

Pin assignment ST 1000 AT bus	Function
B1	GND
B2	RESETDRV
B3	VCC
B4	IRQ9
B5	-5V
B6	DRQ2
B7	-12V
B8	CARDSLCT#
B9	+12V
B10	GND
B11	SMEMW#
B12	SMEMR#
B13	IOW#
B14	IOR#
B15	DACK3#
B16	DRQ3
B17	DACK1#
B18	DRQ1
B19	REF#
B20	SYSCLK
B21	IRQ7
B22	IRQ6
B23	IRQ5
B24	IRQ4
B25	IRQ3
B26	DACK2#
B27	T/C
B28	BALE
B29	VCC
B30	OSC
B31	GND

Pin assignment ST 1000 AT bus	Function
C1	SBHE#
C2	LA23
C3	LA22
C4	LA21
C5	LA20
C6	LA19
C7	LA18
C8	LA17
C9	MEMR#
C10	MEMW#
C11	SD8
C12	SD9
C13	SD10
C14	SD11
C15	SD12
C16	SD13
C17	SD14
C18	SD15
D1	MEMCS16
D2	IOCS16
D3	IRQ10
D4	IRQ11
D5	IRQ12
D6	IRQ15
D7	IRQ14
D8	DACK0#
D9	DRQ0
D10	DACK5#
D11	DRQ5
D12	DACK6#
D13	DRQ6
D14	DACK7#
D15	DRQ7
D16	VCC
D17	MASTER#
D18	GND



System bus; front panel; UPS

Pin assignment ST 701 system bus	Function
1	GND
2	GND
3	D0
4	D8
5	D1
6	D9
7	D2
8	D10
9	D3
10	D11
11	D4
12	D12
13	D5
14	D13
15	D6
16	D14
17	D7
18	D15
19	GND
20	GND
21	A0
22	A1
23	A2
24	A3
25	A4
26	A5
27	A6
28	A7
29	BLE#
30	BHE#
31	MEMR#
32	MEMW#
33	GND
34	GND
35	CSK#
36	CSX1#
37	CSX2#
38	CSWD#
39	CSIO#
40	GND
41	PWRGOOD
42	KBCLK-EXT
43	+5v
44	+5v
45	+5v
46	+5v
47	+5v
48	GND
49	KBDATA-EXT
50	GND

Pin assignment ST 702 front panel	Function
1	PA0
2	PA1
3	PA2
4	PA3
5	PA4
6	PA5
7	PA6
8	PA7
9	PCL0
10	PCL1
11	PCL2
12	PCL3
13	PB0
14	PB1
15	PB2
16	PB3
17	PB4
18	PB5
19	PB6
20	PB7
21	PCH0
22	PCH1
23	PCH2
24	PCH3
25	INTDAT
26	INTCLK
27	+5V
28	+5V
29	+5V
30	+5V
31	GND
32	GND
33	GND
34	GND

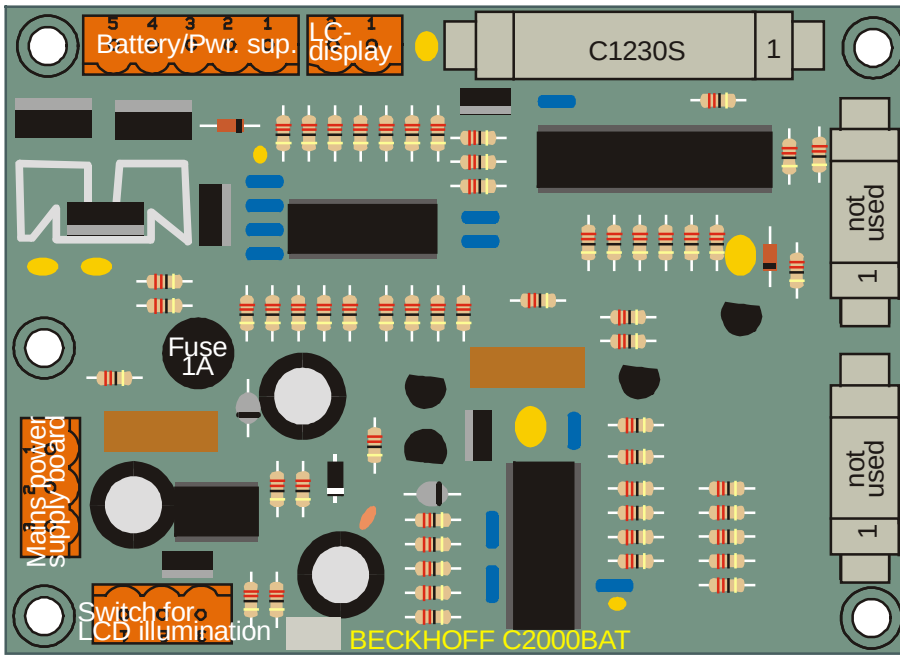
Pin assignment ST 703 UPS	Function
1	PA0
2	PA1
3	PA2
4	PA3
5	PA4
6	PA5
7	PA6
8	JUMP
9	PCL0
10	PCL1
11	PCL2
12	PCL3
13	PB0
14	PB1
15	PB2
16	PB3
17	PB4
18	PB5
19	PB6
20	PB7
21	PCH0
22	PCH1
23	PCH2
24	PCH3
25	+5V
26	GND

The C2000BAT UPS Control Board

Uninterruptible power supply

An industry PC with a 24 V power supply can optionally be fitted with an uninterruptible power supply, which maintains correct operation of the device for about 15 minutes by means of a NiCad battery after failure of the main power supply. The control is performed by the C2000BAT UPS control board.

Not all connections are used in the application with the C1230S.



Battery reverse connection protection

The UPS control board is fitted with a simple form of protection against reverse battery connection. If the battery is accidentally connected with the wrong polarity, high current flows for a short period, and this blows the fuse (1A) on the C2000BAT board. The location of the fuse on the board can be seen in the figure.

Switch for the LCD background illumination

The UPS control board allows the LCD background illumination to be switched on and off by means of a switch on the side of the housing, or by software through the PIO chips on the C1230S. Switching the LCD background illumination off can save current under battery operation. If the software has switched the background illumination off when under battery power, it can be switched on again for operation using the switch.

Programming

The 8255 Parallel Input/Output Chip

There are three 8255 parallel input/output chips, PIOs for short, on the C1230S ISA bus card. One of these components interrogates the special keys on the front panel and controls the LEDs. If your PC does not have special keys, the chip can be used for other purposes. The connections to the chip are brought to the C1230S card's front panel interface in TTL compatible form. The second PIO controls an uninterruptible power supply. You need the C2000BAT UPS control board in order to connect the UPS. The third chip is not used on the C1230S card.

Each component has three 8-bit ports that can be configured as inputs or outputs. The configuration is made through the control register. Each port and each control register is located at a memory address.

The addresses of the three PIO chips on the C1230S

Front panel	Address
Port A	220H
Port B	221H
Port C	222H
Control register	223H

UPS control	Address
Port A	230H
Port B	231H
Port C	232H
Control register	233H

not used	Address
Port A	240H
Port B	241H
Port C	242H
Control register	243H

In the control register of an 8255 parallel input/output component you specify which port will function as input or output.

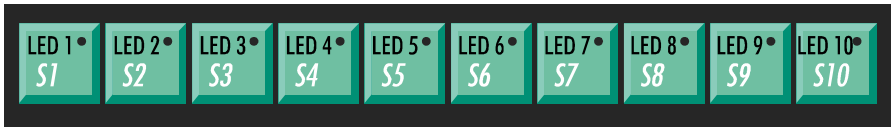
Configuration:
After power-up, write 91H into address 223H and 93H into address 233H.

After a reset, or after the computer has been switched on, all the ports are configured as inputs. In order to configure the chip appropriately for its tasks in the industry PC, write the value 91H into the control register at address 223H, and 93H into address 233H. The configuration is retained until these addresses are over-written, until the computer is re-booted.

The Special Keys

The industry PC has up to 10 special keys on the front panel, each of which contains an LED.

Each of the 10 special keys contains an LED



The special keys on the front panel are not connected via the keyboard interface, but are interrogated by means of port A and the lower part of port C of the parallel input/output chip, whose address range lies between 220H and 223H.

Special keys	S10	S9	S8	S7	S6	S5	S4	S3	S2	S1
Port	Port C		Port A							
Address	222H		220H							
Bit	1	0	7	6	5	4	3	2	1	0
Pressed=	0	0	0	0	0	0	0	0	0	0
Cleared=	1	1	1	1	1	1	1	1	1	1

Since, after a reset, all the component's ports are configured for input, the keys can be interrogated without altering the control register.

Example:
- Press keys S5 and S9, and interrogate addresses 220H and 222H at the same time.
- From address 220H you obtain 11101111B, while 222H returns XXXXXX10B. The X stands here for an undefined value that need not be considered.

The LEDs

The 10 special keys each contain a light emitting diode that can be driven through the software. They are addressed through port B and the upper half of port C of the same input/output component as the special keys. This is located in the address range from 220H to 223H.

Inverted drive

Note that drive of the LEDs is inverted, so that if the bit is set, the LED is out.

The component must be re-configured for output in the control register.

Since after a reset all the component's ports are configured as inputs, the value 10010001B (= 91H) must be written into the control register at address 223H before the LEDs are first used, so that port B and the upper half of port C function as outputs. The configuration is retained until this is over-written.

Example:
- Write 10010001B (91H) into address 223H.
- In order to switch on LED 6 and to switch all the others off, write DFH to address 221H and set bits 4 and 5 of address 222H, by writing a value in which bits 4 and 5 are 1, for instance 30H or FFH.

LEDs	10	9	8	7	6	5	4	3	2	1
Port	Port C		Port B							
Address	222H		221H							
Bit	5	4	7	6	5	4	3	2	1	0
LED on=	0	0	0	0	0	0	0	0	0	0
LED off=	1	1	1	1	1	1	1	1	1	1

The C2000BAT UPS Control Board

Uninterruptible power supply

An industry PC with a 24 V power supply can optionally be fitted with an uninterruptible power supply, which maintains correct operation of the device for about 15 minutes by means of a NiCad battery after failure of the main power supply.

Configure the component

Control is exercised by the C2000BAT UPS control board. It is accessed through the parallel input/output chip located in the address range from 230H to 233H. The value 93H must be written into the control register at address 233H in order to configure the component.

Register	Address	Function
Port A	230H	not used
Port B	231H	Read the charge state
Port C lower half	232H bit 0-3	Various inputs
Port C upper half	232H bit 4-7	Various outputs
Control register	233H	For this configuration: 10010011B = 93H

Port C							
Address 232H							
Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Output				Input			
UPS active/ passive	not used	not used	LC display illumi-nation	external supply voltage	Battery voltage	not used	Interro-gation of LCD switch
0=passive 1= active			0= off 1= on	0= failed 1= OK	0=U<16 V 1=U>16 V		0= on 1= off

Controlling the LCD Background Illumination

Switch for the LCD background illumination

In devices with a uninterruptible power supply built in, the side of the computer's housing has a switch for the LC display's background illumination.

The background illumination can also be controlled by the software through bit 4 of port C. Setting the bit switches the illumination on.

If the software clears bit 4, so switching the background illumination off, you can switch it on again with this switch. The position of the switch can be interrogated through bit 0 of port C in the input/output component belonging to the multi-function board at address 232H.

Uninterruptible Power Supply

Monitoring of the external 24 V power supply can be activated by setting bit 7 of port C in the input/output component belonging to the multi-function board at address 232H.

If the external voltage supply falls below 16 volts when active, the multi-function board switches over to battery operation, and informs the software of this by clearing bit 3 of port C.

The NiCad battery (18 V / 0.65 Ah) supplies the device for up to 15 minutes, depending on how fully charged the battery is and on the hardware installed in the IPC, giving the software time to save all its data. When all the data has been saved the software can switch the device off by clearing bit 7 of port C at address 232H.

If, during operation under emergency power, the battery voltage falls below 16 V, a signal is sent to the software by clearing bit 2 of port C at address 232H.

The Charging System

An integrated charger ensures that the battery is always kept fully charged. The charging current is 1/3 of the full capacity, i.e. about 230 mA. The charging procedure therefore takes up to 3 hours, depending on the charge already in the battery. Overcharging, and consequent damage to the battery, is prevented through the use of an integrated charging controller.

Port B of the input/output chip carries a signal that provides information about the state of charge.

Port B							
Address 231H							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input							
Charge controller	not used	not used	not used	not used	not used	not used	not used

The signal from the charge controller provides information about the state of charge.

The battery charger on the multi-function board can take up the following states:

Fast charging

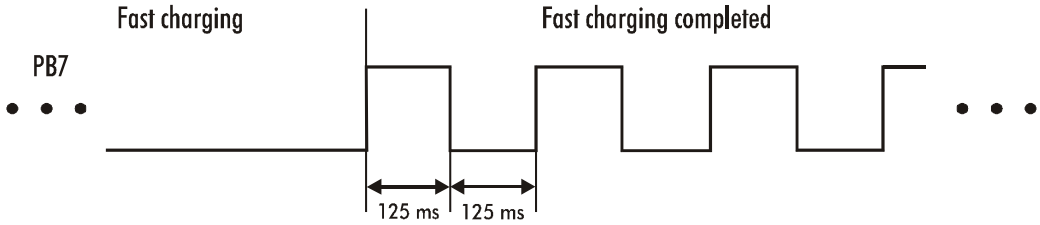
When the operating voltage has been switched on, the charger goes into the fast charging state if a battery is connected. The battery is charged with a constant current of about 230 mA. Bit 7 of port B at address 231H is 0.

Battery not connected

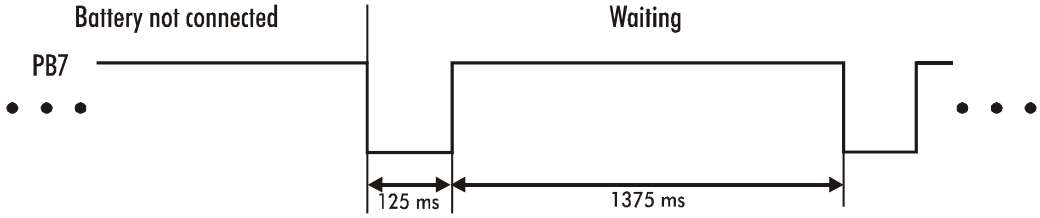
The charger recognises whether or not the battery is connected. If there is no battery connection, bit 7 of port B at address 231H is set.

Fast charging completed

If the charging has been ended by the charging controller, bit 7 of port B at address 231H alternates between 0 and 1 with a period of 250 ms.



Waiting
In this state the charging controller waits for the presence of a valid battery voltage. Only then does the quick charging continue. Bit 7 of port B at address 231H alternates between 0 and 1 with a period of 1.5 seconds and a mark-space ratio of 1:11.



Operating Conditions

Ambient temperature:	0 to 55 °C
Atmospheric humidity:	Maximum 95 %, non-condensing
Supply voltage:	5 V direct voltage ± 5% 12 V direct voltage ±5 %