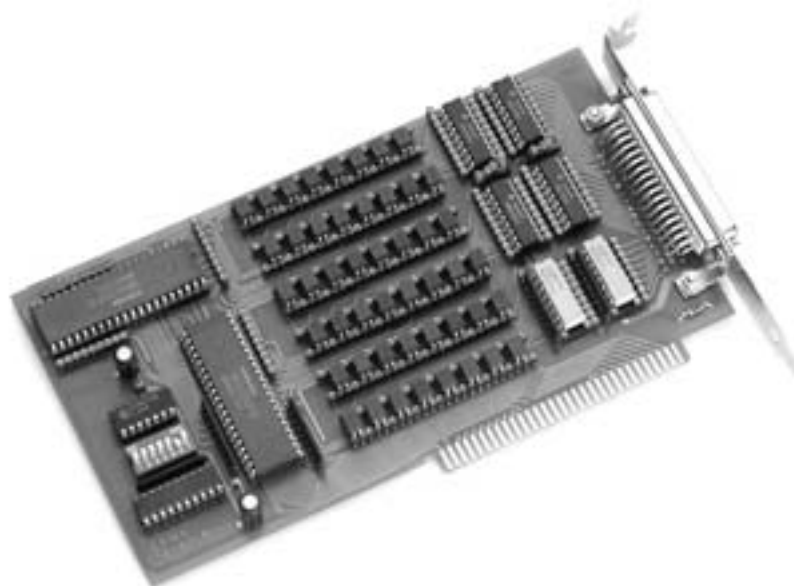# IO 1213
Digital I/O Board
Input and Output Channels

Instruction Manual

ERMA
Electronic GmbH

Warranty

For delivered products our "Allgemeine Lieferungs- und Zahlungsbedingungen" are effective.
In no event ERMA-Electronic or its suppliers shall be liable for any other damages whatsoever
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other pecuniary loss) arising out of or inability to use this product.

All products from ERMA-Electronic are warranted against defective material and workmanship
for a period of two (2) years from date of delivery. If it is necessary to return the product to ERMA,
the sender is responsible for shipping charges, freight, insurance and proper packaging to pre-
vent breakage in transit. ERMA's warranty does not apply to defects resulting from action of the
buyer, such mishandling, improper interfacing, operation outside of design limits, improper repair
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Corporation.
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recognized by ERMA-Electronic.

CONTENTS

1. *Safety Instructions*

This instrument is produced in accordance with Class II of IEC 348 and VDE 0411. When delivered the intrument has been tested to meet all functions described. Before installing the instrument please read the mounting and servicing instructions. We have no liability or responsibility to customer or any other person or entity with respect to any liablity, loss or damage caused or alleged to be caused directly or indirectly by equipment or software sold or furnished by us. Read the installation instruction carefully. No liability will be assumed for any damage caused by improper installation.

Inspect the instrument module carton for obvious damage. Be shure there are no shipping and handling damages on the module before processing. Do not apply power to the instrument if it has damaged.

ERMA's warranty does not apply to defects resulting from action of buyer, such as mishandling, improper interfacing, operation outside of design limits, improper repair or unauthorized modifications.

1.1. *Symbol Explanation*

Caution	Attention	Instuction	Tip

Caution: Will be used at **dangerous for life and health !**

Attention: Will cause **damage.**

Hinweis: If not noticed, **Trouble** may occur.

Tip: Useful hints for **better operation.**

2. *Repair*

Wartung und Instandsetzung dürfen nur von sach- und fachkundig geschulten Personen vorgenommen werden, die mit den damit verbundenen Gefahren und Garantiebestimmungen vertraut sind.

Es empfiehlt sich, die Originalverpackung für einen eventuell erforderlichen Versand zu Reparaturzwecken aufzubewahren. Durch den in unseren Verpakkungen verwendeten Antistatik-Noppenschaumstoff ist die PC-Karte für die Lagerung und den Transport optimal geschützt.

3. *General*

The board IO 1213 was designed to interface with the PCs internal ISA-BUS through any available expansion slot.

The board is supplied with 48 digital input channels respectively 48 digital output channels. All input and output channels are optically isolated. In addition input and output voltage levels of 24 V are allowed. By this reason all input and output channels can directly connected to a PLC.

Following configuration of input and output channels can be delivered.
- 48 Output channels
- 40 Output channels and8 input channels
- 32 Output channels and16 input channels
- 24 Output channels and24 input channels
- 16 Output channels and32 input channels
- 8 Output channels and40input channels
- . . . . 48input channels

All the configurations above are done by plugged components. By this way the user is able to change th configuration by himself. Care must be taken by changing the configuration (see appendix).

4. *Function*

The block diagramm of the IO-board is shown in figure 1. The different blocks are:
- the address decoding,
- 2 programmable interface circuits with 24 I/O pins
- optocoupler for each I/O-pinout
- plugged resistor networks for signal level adapting.

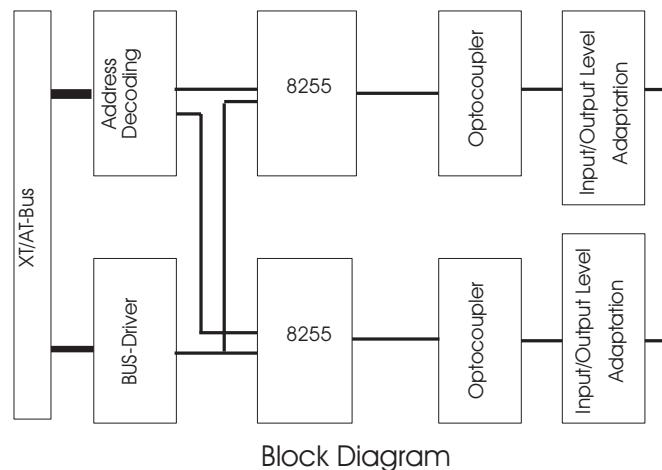Input respectively output signals are fed to a 50 pole D-SUB connector.

Block Diagram

Fig. 1

PCB layout was designed for best performance against noise caused by capacitive and inductive coupling. This was done to avoid misfunction of the computer and/or the signal processing. For optimal noise rejectiopn, when developing this card, no autorouting could be used for the PCB layout.

5. Hints against noisy environment

All inputs and outputs are protected against noisy environment and high voltage spikes. Nevertheless the location should be selected to ensure that no capacitive or inductive interference can have an effect on the instrument or connection lines.

It is advisable:
* To use shielded cables.
* The wiring of shields and groung (0V) should be star-shaped.
* The distance to interference sources should be as far as possible. If necessary, protective screen or metal enclosures must be provided.
* Coils of relays must be supplied with filters.
* Parallel wiring of input signals and AC power lines should be avoided.
* The parallel output lines must be as short as possible.
* It is necessary to use shielded twisted pair cable for the lines.

6. Installation

6.1. Selection of the base address

When selecting the base address many mistakes can occur. That's why the hardware of the computer and the suplied boards are using different address ranges. Only one time an address can be used. Table 1 page 9 shows the mostly used addresss.

Hints: Never use an address range which is already in use. The computer will work not at all or some curious effects may occur.

Example:
You want to use address 3E8h. This address is normally used ba COM 3. If there is no seriell interface COM 3 installed in your computer, it is possible to install the address 3E8h. If you switch ON your computer, it will seek the interfaces COM 1, COM 2, COM 3, and COM 4if they are present. Some software commands are then using address 3E8h and will disturb the function of the installed board. Therefore it is better to adjust the base address in a I/O range which is free.
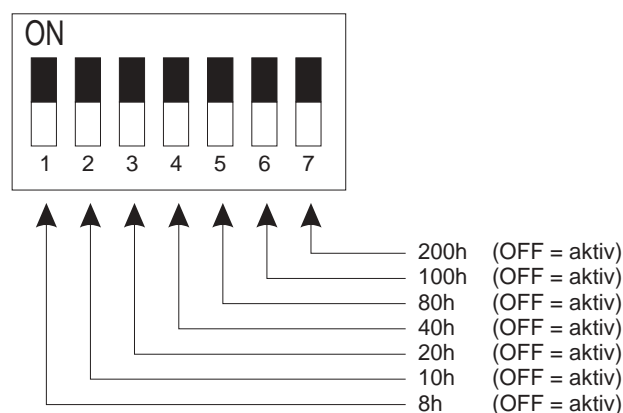
Fig. 2: Values of the DIP-Switches

The desired I/O address can be adjusted by the DIP switch located on the board IO 1213. The position of the DIP switch can be seen in figure 3 page 8. When delivering the base address of the board is 100h. The software enclosed with the board will work with this base address.

Each switch of the 7 pole DIP switch has a distinct value when switched OFF. The least significant switch has the value of "8h", the most significant switch the value "200h". The values of the switches are added.

Examples:
• Address 100h
  DIP-switch 6 = OFF, all other switches ON (= 0)
• Address 300h
  DIP-switch 6 and 7= OFF, all other switches ON
• Adresse 330h
  DIP-switch 2, 3, 6 and 7 = OFF, all other switches ON

6.2. *Layout*

Fig. 3: Layout

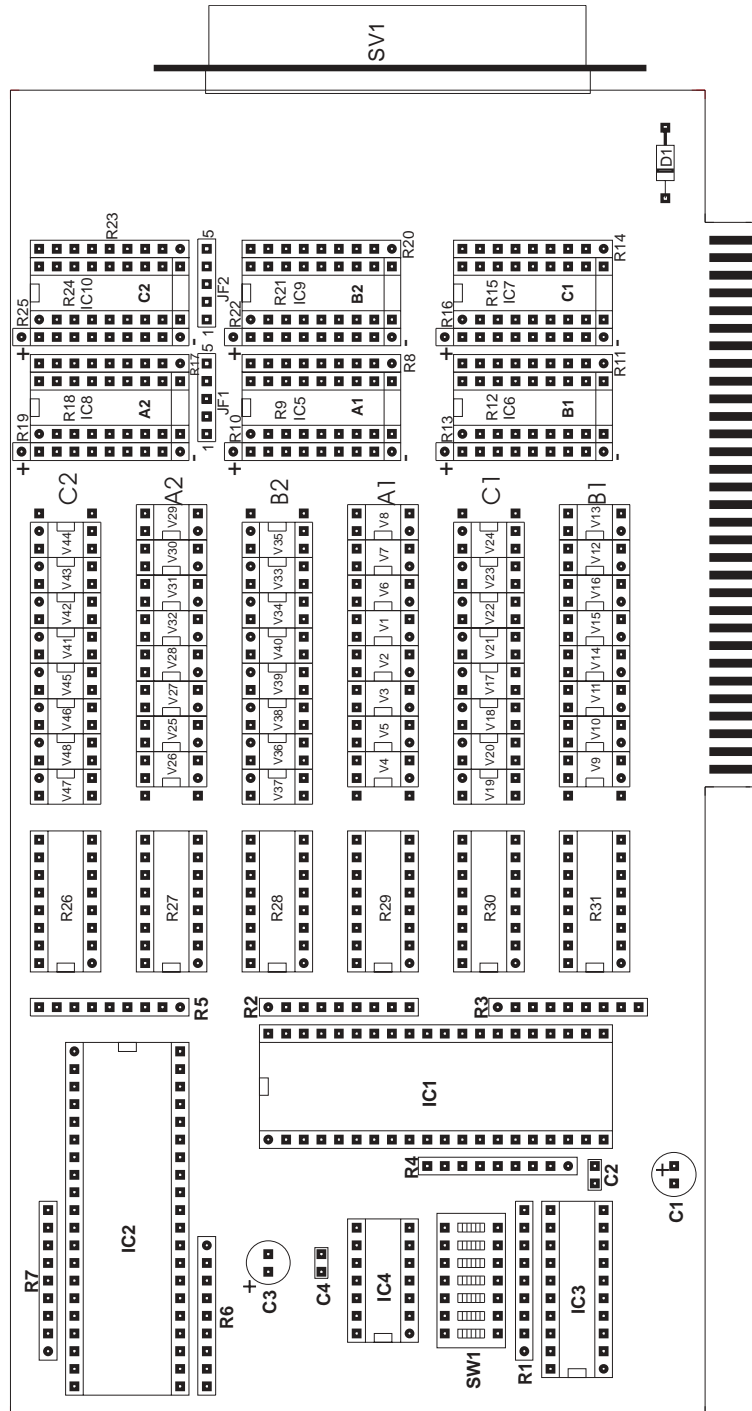| Address	Function	Hint
000h...00Fh	1. DMA-Controller	**System Range! Never use these addresses!**
020h...021h	1. Interrupt-Controller	
040h...043h	Timer 82C54	
060h...063h	Keyboard-Controller	
070h...071h	Clock	
080h...083h	DMA-Register	
0A0h...0AFh	2. Interrupt-Controller	
0E0h...0EFh	Coprozessor	
0C0h...0CFh	2. DMA-Controller	
100h...1FFh	**free**	**if free, can be used**
200h...20Fh	Game-Port	
210h...25Fh	reserved	
260h...277h	**free**	
278h...27Fh	LPT 2	
280h...2E7h	reserved	
2E8h...2EFh	COM 4	
2F0h...2F7h	reserved	
2F8h...2FFh	COM2	
300h...31Fh	mostly free	
320h...32Fh	HDD-Controller	
330h...35Fh	**free**	
360h...36Fh	Net-Boards	
370h...377h	2. Disk-Controller	
378h...37Fh	LPT 1	
380h...38Fh	SDLC-Adapter	
390h...39Fh	**free**	
3A0h...3AFh	SDLC-Adapter	
3B0h...3BFh	Monochrom Grafic-Board	**Nicht benutzen!**
3C0h...3CFh	EGA-Grafic-Board	
3D0h...3DFh	CGA-Grafic-Board	
3E0h...3E7h	**frei verfügbar**	**benutzbar, falls frei**
3E8h...3EFh	COM 3	
3F0h...3F7h	1. Diskettencontroller	
3F8h...3FFh	COM1	

Table 1: Addresses free and occupied by a PC

6.3.   *Placing the I/O board*

- Select the desired I/O port base address with the aid of the DIP switch (default address = 100H). Attention! 8 addresses (base address to base address+8) are used.
- Disconnect all cables from the rear of your computer
- Turn your computer around so that its back faces you.
- Using a standard screwdriver, remove the chassis cover mounting screws
- Carefully slide the system unit cover out.
- Power OFF all devices (display, printer, ...etc.) attached to your computer then power OFF your computer system.
- Remove the screw and expansion slot cover from the slot you wish to use.
- Hold the I/O board by its top corners and press it down into the expansion slot. Make sure that the board is fully seated in the expansion slot, then secure the board with the screw you removed.
- Replace the computer chassis cover and reconnect all cables to the rear of the computer.
- Power ON the computer and the attached peripheral devices.

6.4.   *Connector list*

Pinouts of the 50 pole SUB-D-connector

Bit	A1	B1	C1	A2	B2	C2
0	7	5	36	31	13	44
1	24	21	1	30	12	43
2	8	4	34	33	29	46
3	9	18	35	32	10	47
4	25	2	37	15	26	45
5	23	20	38	14	27	48
6	22	3	40	16	11	49
7	6	19	39	17	28	50

Ground for input and output channels   42
Power supply for the output channels   41

6.5. Ports

Karte	A1	B1	C1	A2	B2	C2
IO 1213/01/X/00	Out	Out	Out	Out	Out	Out
IO 1213/02/X/XX	Out	Out	In	Out	Out	Out
IO 1213/03/X/XX	Out	In	In	Out	Out	Out
IO 1213/04/X/XX	In	In	In	Out	Out	Out
IO 1213 /05/X/XX	In	In	In	Out	In	Out
IO 1213/06/X/XX	In	In	In	In	In	Out
IO 1213/07/0/XX	In	In	In	In	In	In

In = Input Channel
Out = Output Channel

6.6. Layout of the input channels

The inputs channels are supplied with resistor networks. These network can be used as voltage divider. By this way the desired input voltage levels can realized.
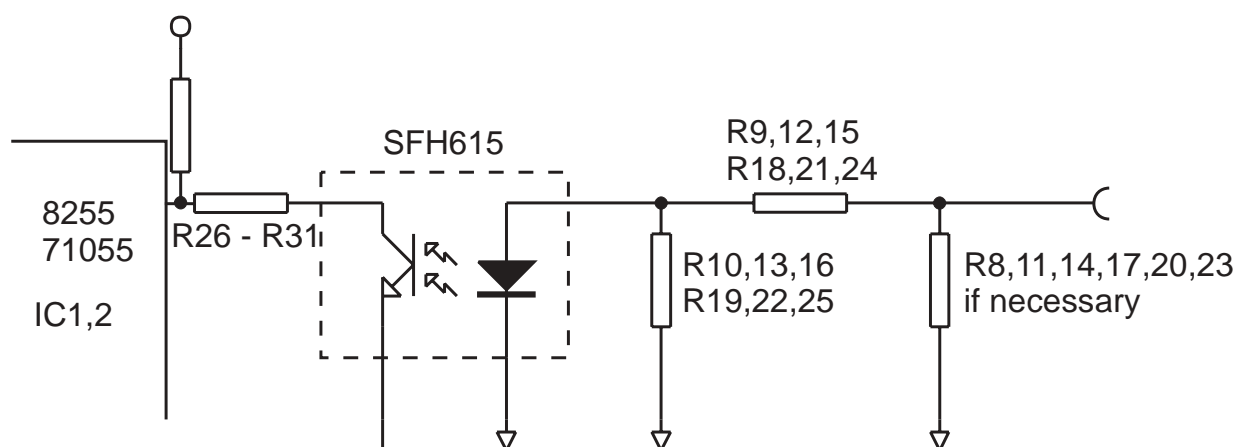
In addition a high noise immunity will be reached.

6.7. Layout of the output channels

The output channels of the board IO 1213 are able to switch voltages up to 30 VDC and currents up to 100 mA. The output circuit of the output channels are not short cicuit protected. For this reason a short circuit will destroy the output circuit. The output channels are deliverable as sink current outputs or as source current outputs.

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IO 1213/xx/P/xx (High Side Switching)
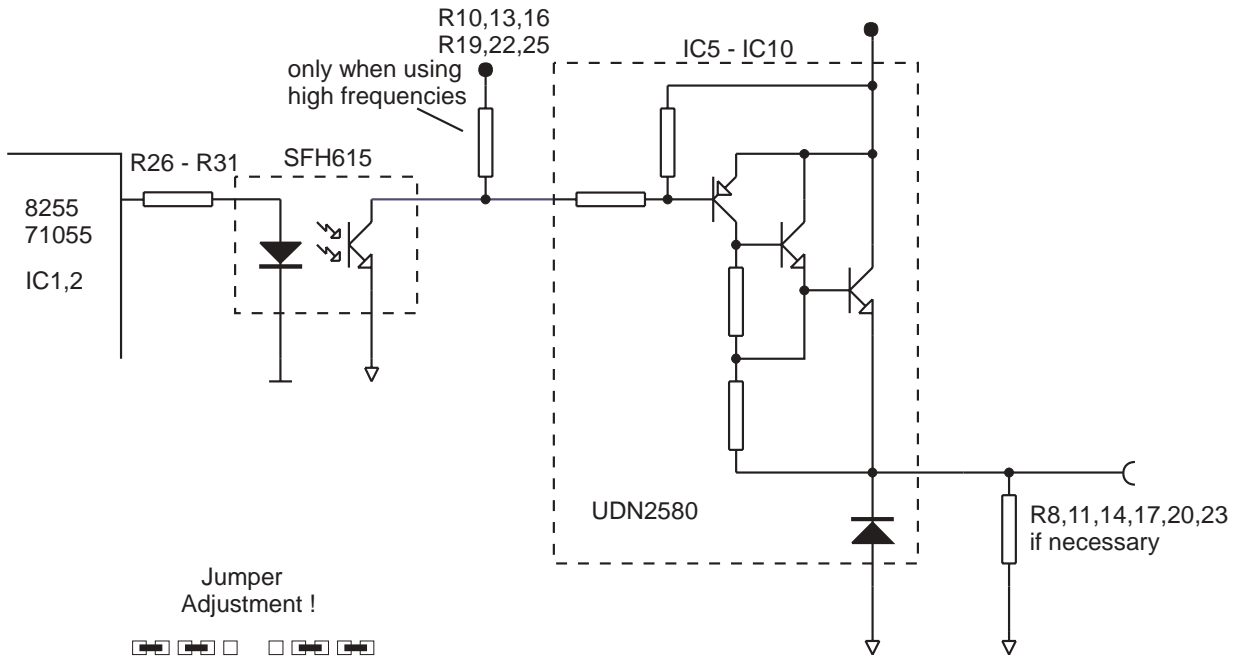
IO 1213/xx/M/xx (Low Side Switching)
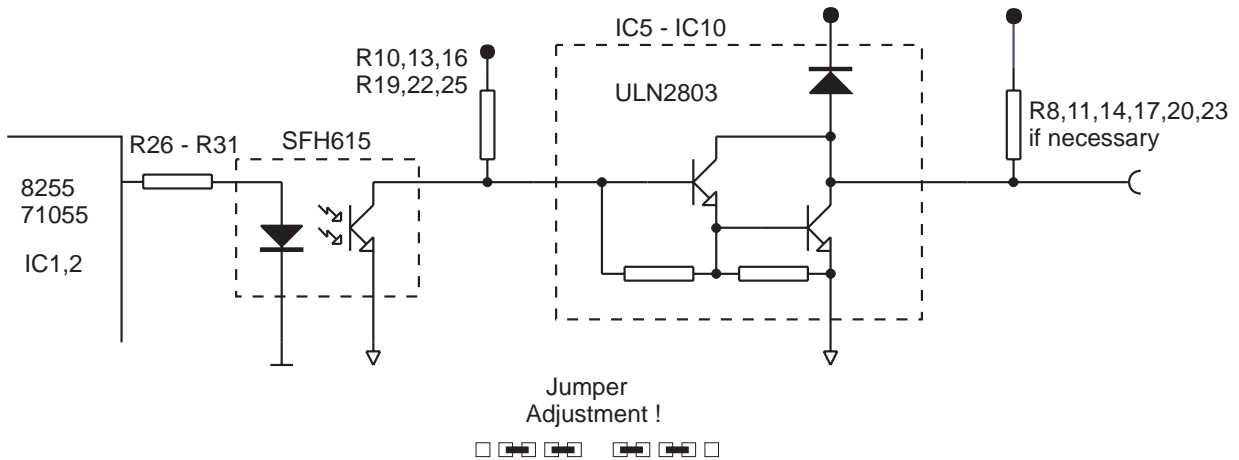
6.8.   Software

If you has changed the default address of the IO 1213 board it is necessary to change the address of the enclosed software samples too. For this reason the samples are also enclosed with their source code. After changing the base address the program must be compiled.

7. Software

The board is shipped with a software to maximize programming flexibility. Examples demonstrating the use of the function of the IO 1213 board. The source code of the examples is enclosed for many programming languages

8. Programming

The IO 1213 board needs 8-Bit-Addresses. Using read and write commands with these addresses the functions of the board can be used.

8.1. Initialisation

There are two integrated circuit of the type NEC 71055 on the board. These circuits must be initialized. By this way the features of the ports are defined. For the IO 1213 board the commands for initialisation are listed below.

8.1.1. IO1213/01/x/00
OUT Base address + 3, 80h
OUT Base address + 7, 80h

8.1.2. IO 1213/02/x/xx
OUT Base addresse + 3, 89h
OUT Base address + 7, 80h

8.1.3. IO1213/03/x/xx
OUT Base address + 3, 8Bh
OUT Base address + 7, 80h

8.1.4. IO 1213/04/x/xx
OUT Base address + 3, 9Bh
OUT Base address + 7, 80h

8.1.5. IO1213/05/x/xx
OUT Base address + 3, 9Bh
OUT Base address + 7, 82h

8.1.6. IO 1213/06/x/xx
OUT Base address + 3, 9Bh
OUT Base address + 7, 92h

8.1.7. IO 1213/07/0/xx

OUT Base address + 3, 9Bh
OUT Base address + 7, 9Bh

8.2. Reading and Writing of the Ports

Writing the ports, the output channels are set or reset according to a bit pattern. With a read command, the input channels or the the state of the output channels are red (only when using the NEC 71055). The register has a length of 8 Bit (Bit 7 to Bit 0).

The ports can be accessed by the follwing addresses:

Port	Adresse
A1	Base address + 0
B1	Base address + 1
C1	Base address + 2
A2	Base address + 4
B2	Base address + 5
C2	Base address + 6

8.3. Programming with DOS

It's very easy programming with DOS. All programming languages for DOS have input and output commands for the IO addresses of a PC.

8.3.1. QBASIC

Using QBASIC there are the commands *OUT* and *INP* to communicate with the die IO 1213 board. The command *OUT* transmits one byte to 8 output channels. The command *INP* receives one byte from 8 input channels.

Beispiel: OUT &H100,255   Alle Ausgänge von Port A1durchschalten

Beispiel: wert = INP(&H104) Alle Eingänge von Port A2 einlesen

8.3.2. Turbo Pascal

Using Turbo Pascal input and output commands are possible by two arrays. These arrays are *Port[ ]* and *PortW[ ]*.

Example: Port[$100]:=255;   All output channels of port A1 are conductive.

Example: wert:=Port[$104];   All input channels of port A2 are red.

8.3.3. C

Usding C, there are the commands *inportb*, *inport*, *outportb*, and *outport* . These commands are used for reading and writing to the different IO addresses. The board IO 1213 only uses the commands *outportb* and *inportb*. The command *outportb* write one byte and the command *inportb* reads one byte.

Example: outportb(0x100,255);   All output channels of port A1 are conductive.

Example: wert=inportb(0x104);   All input channels of port A2 are red.

8.4.   Programming with WINDOWS 3.X

using Windows 3.X, normally you can program in the same way like DOS. But it must be noticed, that some programming languages like Visual Basic have no IO commands. Therefore it is necessary to use a DLL with the the IO commands implemented. This file, named IO.DLL, is included on the disk shipped with the IO board. This DLL makes it possible to use 8 and 16 bits I/O commands. It must be noticed, that the IO 1213 board only uses 8 bit commands.

8.4.1. Visual Basic 16 Bit

With the aid of the file IODLL.DLL the ports can be written and read similar to DOS. To use the function of the DLL by Visual Basic, the function must be declared in a form or in the global modul with a declare command. "ReadBytePort" will be used for reading of a 8-bit byte and "ReadWordPort" for reading a 16-bit word. The write functions are similar to read functions.

Declare Function ReadBytePort Lib "IODLL.DLL"
(ByVal portNr As Integer) As Integer

Declare Function ReadWordPort Lib "IODLL.DLL"
(ByVal portNr As Integer) As Integer

Declare Function WriteBytePort Lib "IODLL.DLL"
(ByVal portNr As Integer, ByVal Wert As Integer) As Integer

Declare Function WriteWordPort Lib "IODLL.DLL"
(ByVal portNr As Integer, ByVal Wert As Integer) As Integer

8.4.2. Delphi 16 Bit

For addressing I/O ports there are used similar to Turbo Pascal the arrays *Port[ ]* und *PortW[ ]*. Programming can be done similar to Turbo Pascal.
Of course you can use the functions of the file IODLL. For more informations about programming with DLL see the dokumentation of Delphi.

8.5.   *Programming with Windows 95*

Programming with Windows 95 is generally similar to that of DOS. But you must notice that some programming languages like Visual Basic have no I/O commands. With the aid of the file ERMA_IO_32BIT.DLL the ports can be written and read similar to DOS. This file is included on the disk shipped with the IO board. This DLL makes it possible to use 8 and 16 bits I/O commands. It must be noticed, that the IO 1213 board only uses 8 bit commands

8.5.1. *Visual Basic 32 Bit*

With the aid of the file ERMA_IO_32BIT.DLL the ports can be written and read similar to DOS. To use the function of the DLL by Visual Basic, the function must be declared in a form or in the global modul with a declare command. "ReadByte-Port" will be used for reading of a 8-bit byte and "ReadWordPort" for reading a 16-bit word. The write functions are similar to read functions.

Declare Function ReadBytePort Lib "ERMA_IO_32BIT.DLL"
(ByVal portNr As Integer) As Integer

Declare Function ReadWordPort Lib "ERMA_IO_32BIT.DLL"
(ByVal portNr As Integer) As Integer

Declare Function WriteBytePort Lib "ERMA_IO_32BIT.DLL"
(ByVal portNr As Integer, ByVal Wert As Integer) As Integer

Declare Function WriteWordPort Lib "ERMA_IO_32Bit.DLL"
(ByVal portNr As Integer, ByVal Wert As Integer) As Integer

8.5.2. *Delphi 32 Bit*

Using the file ERMA_IO_32BIT.DLL you can program the ports similar to DOS. The functions for input and output commands of the file ERMA_IO_32Bit.DLL are included in the Unit "ERMA_IO_32Bit.PAS". To make use of these functions the unit "ERMA_IO_32BIT" must be integrated in the program.

```
  .
  .
Uses
  ERMA_IO_32BIT;
  .
  .
```

The unit "ERMA_IO_32BIT" makes available the following funktions:

function ReadBytePort (Adresse: Word): Word
(8-Bit Leseoperation)

function ReadWordPort (Adresse: Word): Word;
(16-bit Leseoperation)

WriteBytePort (Adresse: Word; Daten: Word): Word;
(8-Bit Schreiboperation)

WriteWordPort (Adresse: Word; Daten: Word): Word;
(16-Bit Schreiboperation)

8.6. Programmierung with WINDOWS NT 4.0
The board is shipped with an universal driver for Windows NT 4.0. The application of the driver and its programming is described in the manual of the driver.

8.7. Hints for OS/2
Using OS/2 programing of the ports is only similar to DOS is only possible when in the file CONFIG.SYS the item IOPL=YES is included. This item causes that all applications are running with the IO-Privileg-Level. This solution causes a safety gap, because all application can use the I/O addresses.

A better solution is to create a DLL for the IO-Privileg-Level where the I/O functions are implemented.
For further details see the technical reference for OS/2 or the online hotline.

9. Repair of Failures
All PC-boards of Firma ERMA-Electronic GmbH are tested during manufacturing as well as when delivered. Nevertheless it can occur that a new board doesn't work. That must not be a failure of the board. There are many minor details when a new board doesn't work. In that case at first some points should be paid attention to.
- One of the most frequent failures are dirty slots. It is recommended to clean the connector of the board with a cloth and a little spirit.
- Further it can happen that the board doesn't fit correctly into the slot or into the PC case. The dimensions of the board are standardized. But the dimension of the PC cases are sometimes out of the prescribed dimensions.

- Furthermore it si possible that the selected address is not free. In this case it is possible that the PC can be damaged. Therefore it is very important to select the base address carefully.
- The cable of the peripherie should be tested.

If you have observed the hints above and the board doesn't work call the ERMA - Team. The ERMA-Team will help you.

10. Accessories

For the I/O board IO 1213 we recommend our accessories like:

- Screw Terminal Board for DIN Rail Mounting Model SKB 50 B
- 50 pole cable supplied with SUB-D-Male and Female connector. This cable is available with 1.5 , 3 , or 5 meters length (type MKS 50-1.5, MKS 50-3, and MKS 50-5).

11. *Technical Datas*

Number of Output Channels	: 0, 8, 16, 32, 40, 48 isolated
Switching Mode	High Side (P), Low Side (M)
Isolation Voltage	: 500 VDC
Switching Voltage	: max. 30 VDC
Switching Current	: max. 100mA per Channel
	not short cicuit protected
Number of Input Channels	: 0, 8, 16, 32, 40, 48 isolated
	low-aktiv
Isolation Voltage	: 500 VDC
Input Voltage	: 5, 12, 24 V configurated
Power Supply	
Voltage	: +5 V
Current	: max. 0,1 A
Peripherie Connector	: 50-pol. SUB-D
EMV	: EMV according to EG-Richtlinie
	89/336/EWG
Operating Temperature	: 0 to 50 °C
Storage Temperature	: -25 to +85°C
Dimensions	: 190 x 110 mm
Weight	: 200g

12. Ordering Information

IO 1213	xx	/	x	/	xx	
						Input Voltage Level
						00 = no input channels
						05 = 5 V
						12 = 12 V
						15 = 15 V
						24 = 24 V
						Output Channels
						0 = no output channels
						P = high side switching
						M = low side switching
						Configuration of the channels
						01 = 48 Output
						02 = 40 Output , 8 input
						03 = 32 Output , 16 input
						04 = 24 Outpute , 24 input
						05 = 16 Output , 32 input
						06 = 8 Output , 40 input
						07 = 48 input

13. Notizen

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