

Control for Injection
moulding machines
CHS2002

Technical Manual

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1. GENERAL INFORMATION ON SAFETY

1.1. WARNINGS

- **Before installing and using the equipment read the instructions carefully.**
- **The manufacturer declines any responsibility for incorrect use of the equipment different from the description given in the handbook.**
- **No change or operation not included in the handbook is allowed without explicit authorisation of the manufacturer and has to be performed only by skilled staff. In the event of failure to comply with these indications, the manufacturer declines any responsibility for possible consequences and the guarantee shall not be effective.**
- **The starting up and installation are exclusive task of skilled staff who is responsible for complying with safety norms imposed by current laws.**
- **In the specific case of use it is necessary take into account the safety norms valid for accident prevention. All installation, cabling and opening operations related to the equipment shall be performed after cutting off the power supply.**
- **Equipment and converters must be installed in a contact-proof box with an IP protection degree complying with the relevant norms.**
- **Position the equipment in order to make maintenance easier without run the risk of interference with moving components.**
- **Always make sure that there is sufficient ventilation in order to bring down the temperatures generated within the system.**
- **In the event of a fire near the equipment, never use water-based extinguishing devices.**
- **Make sure that you avoid penetration of water or other fluids inside the equipment at all times.**
- **Always make sure that the power is cut off before performing any operation inside the equipment.**

2. TECHNICAL DATA

2.1. TECHNICAL CHARACTERISTICS OF THE SYSTEM CHS2002-PC

Model	CHS2002C-PC	CHS2002-PC
Power supply	24Vcc +-20% 30W	24Vcc +-20% 30W
Processor	Geode 300MHz	Geode 300MHz
Ram Memory	64Mb SODIMM	64Mb SODIMM
Flash Memory	32Mbyte Compact	32Mbyte Compact
10/100 Ethernet	Yes	Yes
LCD controller	Geode Inside	Geode Inside
Can-Bus	Yes	No
External keyboard	Max 78 Keys	Max 78 keys
External LED's	26	26
LCD	10,4' TFT	10,4' TFT
Synchronous serial for I/O	Yes	Yes
Overall dimension	455x300x90	455x300x90

2.2. TECHNICAL CHARACTERISTICS OF THE SYSTEM CHS2002-IO

Model	CHS2002C-IO24	CHS2002-IO48
Power supply	24Vcc +-20% 18W	24Vcc +-20% 18W
Digital inputs source type optoisolated	24	48
Digital outputs sink type optoisolated	18 with 2A 6 with 5A 14 relay interface	42 with 2A 6 with 5A 14 relay interface
ADC	12 bit	12 bit
DAC	12 bit	12 bit
Thermocouple inputs J-K	10	10
Inputs PT100	2	2
Generic inputs +-10Vdc	4	4
Power inputs 1mA PT100	2	2
PWM outputs with powered monitor +-10V	4 with 2A	4 with 2A
Incremental Encoder inputs with zero top	3 optoisolated	3 optoisolated
FC zero inputs	Yes	Yes
Encoder input type	Push-pull/line driver/sink/source	Push-pull/line driver/sink/source
Synchronous serial for I/O	Yes	Yes
Multipoint Connection	Yes	Yes
Overall dimension	330x190	330x190

2.3. TECHNICAL CHARACTERISTICS OF THE SYSTEM CHS2002-RL

Power supply	24Vdc +-20%
Outputs	14
Max power on contacts	2A on resistive load
Closing cycles	> 5 x 10 ⁶

3. INSTALLATION

3.1. INSTRUCTIONS FOR THE OPERATOR

The CHS2002 system must be installed in a **vertical** position. It should not be placed in an oblique or horizontal position, because in this way the heat transfer is hindered and this might be particularly harmful for the CHS2002-PC. It is necessary to guarantee easy access to all the control elements.



The regular operation and long life of the system can be ensured by keeping the room temperature within the allowable range of 0°C up to +50 °C.

N.B. The CHS2002-PC system contains an LCD in order to limit the temperature oscillations to a max of 40° on the LCD.

The temperature therefore needs to be checked at regular intervals.

The relative humidity in the air should not be higher than 90% with no condensation forming.

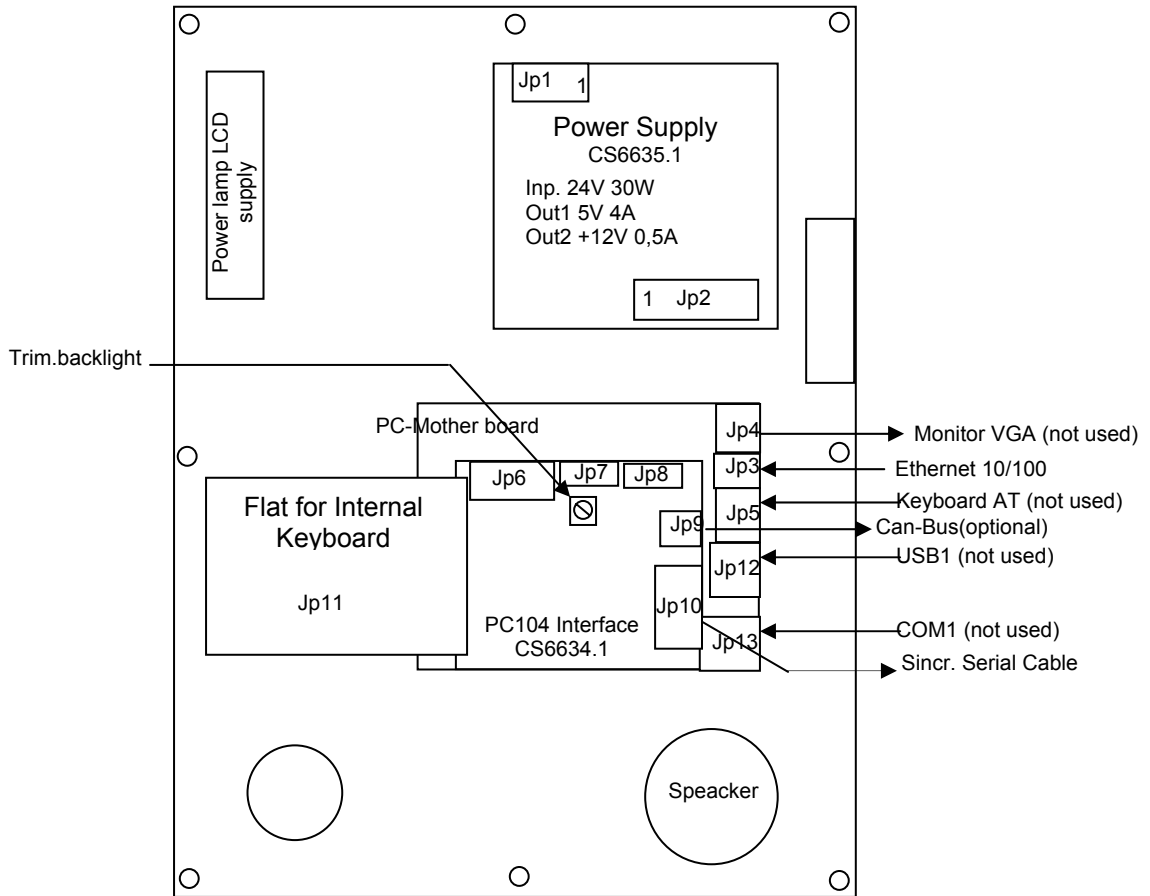
The CHS2002 should be installed in an area without dust and well ventilated. It is necessary to avoid areas where there are aggressive gases because the presence of abrasive powders, steam, nebulized oil or brackish air might jeopardise the life of the equipment.

Any further equipment should be mounted at a sufficient distance from the CHS2002 in order to prevent metal residues from drilling or electric cables from falling inside it. In no case should the CHS2002 be assembled near materials that are easily flammable.



The CHS2002 should not be installed in an area subject to strong vibrations; if the equipment it is installed on is of the moving type, it is necessary to include appropriate systems for vibration reduction.

4. Connections CHS2002-PC



4.1.1. Jp1 : Power supply input

1	+24VPC
2	0VPC
3	Ground

4.1.2. Jp2 : Power supply output

1	+5Vcc
2	+12V
3	
4	0Vcc
5	0V
6	Ground

4.2. Jp6: Board's Led connector

4.3. Jp7: Power supply backlight LCD

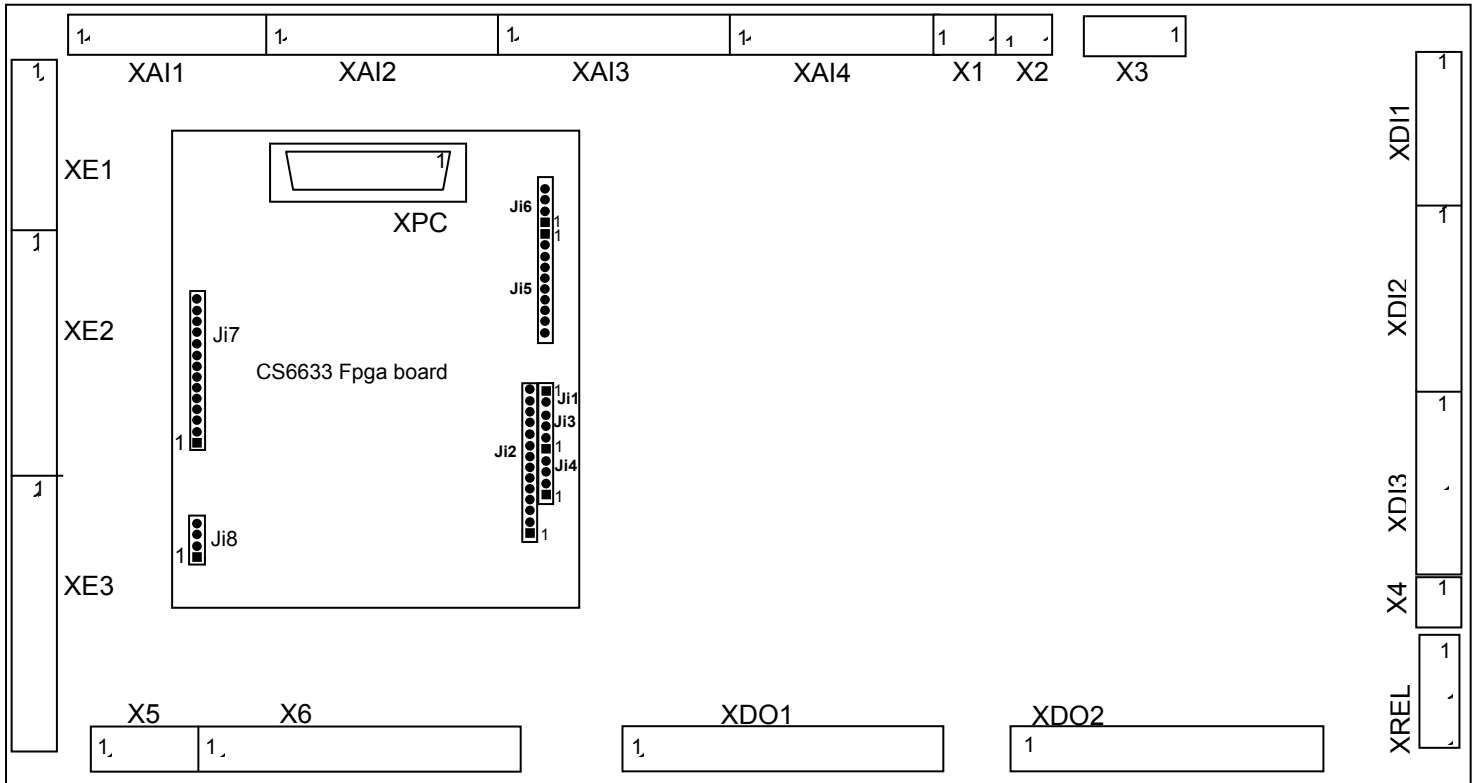
4.4. Jp8: Power supply CPU and PC104 interface

4.5. Jp10: Connector to I/O board

4.6. Jp9: can-bus connector

5. Scheda I/O: Connessioni

5.1. LAYOUT CONNETTORI



5.2. Main supply connector X3

1	GROUND
2	0Vcc
3	+24Vcc +-20%

5.3. Analogs input

5.3.1. XAI1 : Termocouple 1-4

1	Termocouple 1 +
2	Termocouple 1 -
3	Termocouple 2+
4	Termocouple 2 -
5	Termocouple 3 +
6	Termocouple 3 -
7	Termocouple 4 +
8	Termocouple 4 -

5.3.2. XAI2 : Connettore termocoppie 5-8

1	Termocouple 5 +
2	Termocouple 5 -
3	Termocouple 6 +
4	Termocouple 6 -
5	Termocouple 7 +
6	Termocouple 7 -
7	Termocouple 8 +
8	Termocouple 8 -

5.3.3. XAI3 : Connettore termocoppie 9-10 e PT100 1-2

1	Termocouple 9 +
2	Termocouple 9 -
3	Termocouple 10+
4	Termocouple 10 -
5	PT100 1 +
6	PT100 1 -
7	PT100 2 +
8	PT100 2 -

5.3.4. XAI4 : Connettore Ingressi analogici generici 1-4

1	Generic analog input 1 +
2	Generic analog input 1 -
3	Generic analog input 2 +
4	Generic analog input 2 -
5	Generic analog input 3 +
6	Generic analog input 3 -
7	Generic analog input 4 +
8	Generic analog input 4 -

5.3.5. Connettore alimentazione PT100

X1 prima PT100

1	Output current -
2	Output current +

X2 seconda PT100

1	Output current -
2	Output current+

5.3.6. Connettori ingressi encoder 1 XE1, encoder 2 XE2, encoder 3 XE3

1	+12Vcc encoder supply
2	F.C. meccanical zero +
3	F.C. meccanical zero -
4	Top zero encoder +
5	Top zero encoder -
6	Channel A +
7	Channel A -
8	Channel B +
9	Channel B -
10	0Vcc encoder supply

5.3.7. Digital input connector

XDI1

1	Input 1
2	Input 2
3	Input 3
4	Input 4
5	Input 5
6	Input 6
7	Input 7
8	Input 8

XDI2

1	Input 9
2	Input 10
3	Input 11
4	Input 12
5	Input 13
6	Input 14
7	Input 15
8	Input 16

XDI3

1	Input 17
2	Input 18
3	Input 19
4	Input 20
5	Input 21
6	Input 22
7	Input 23
8	Input 24

X4

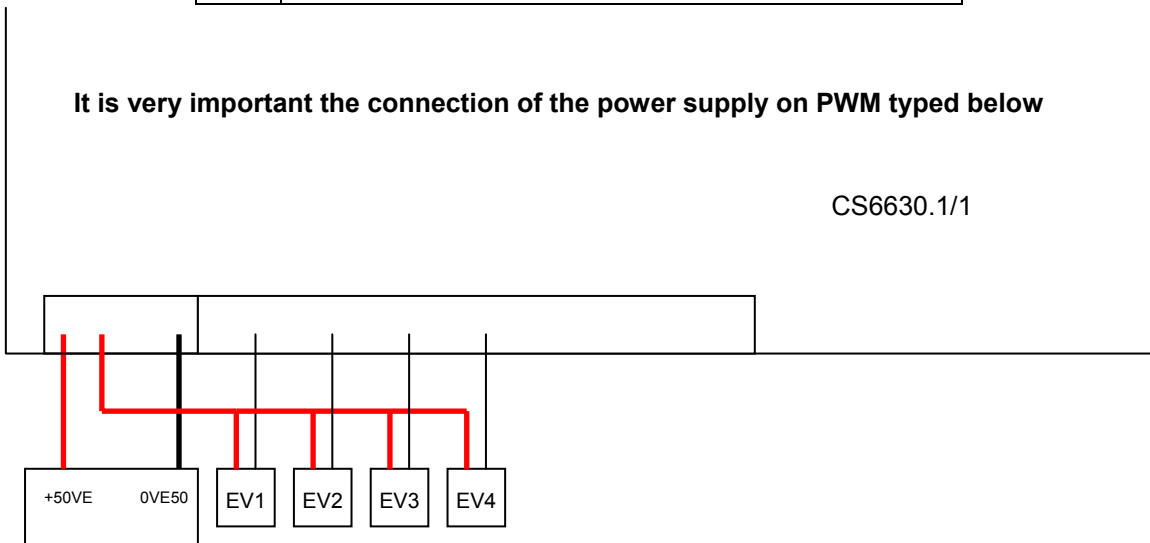
1	+24Vcc
2	n.c.

5.3.8. Power supply PWM X5

1	+50VE max. 50Vcc
2	+50VE max. 50Vcc
3	0VE50
4	0VE50

It is very important the connection of the power supply on PWM typed below

CS6630.1/1



5.3.9. Analog output and PWM

1	Output PWM 1
2	Output PWM 2
3	Output PWM 3
4	Output PWM 4
5	Analog GND
6	Analog Output 1
7	Analog Output 2
8	Analog Output 3
9	Analog Output 4
10	Analog GND

5.3.10. Digital output connectors

XDO1

1	+24Vcc output
2	Output 1
3	Output 2
4	Output 3
5	Output 4
6	0Vcc
7	Output 5
8	Output 6
9	Output 7
10	Output 8
11	0Vcc
12	Output 9
13	Output 10
14	Output 11
15	Output 12
16	0Vcc

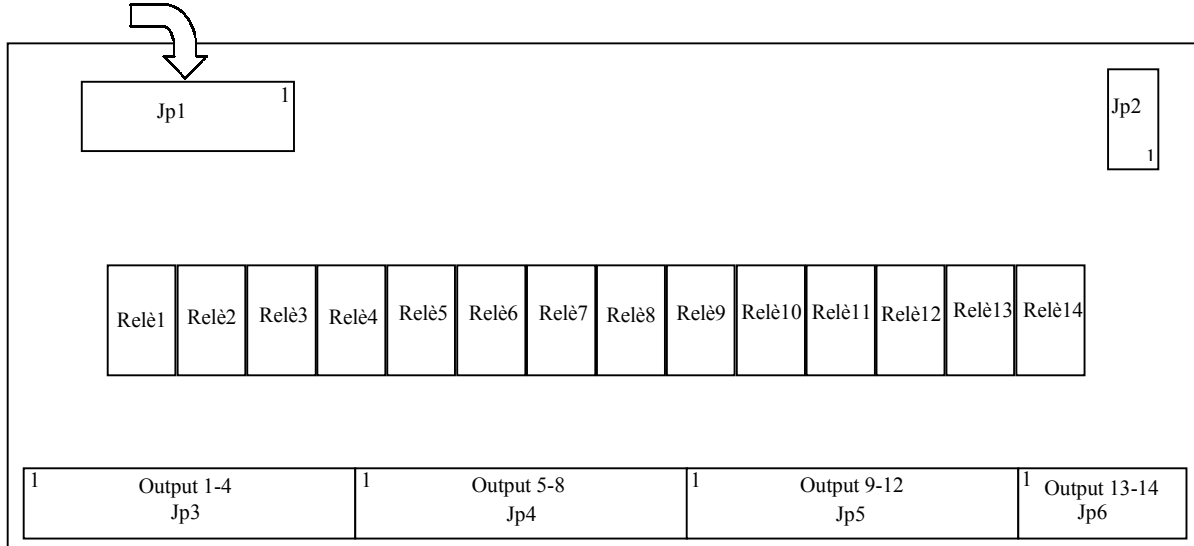
XDO2

1	+24Vcc
2	Output 13
3	Output 14
4	Output 15
5	Output 16
6	0Vcc
7	Output 17
8	Output 18
9	Output 19
10	Output 20
11	0Vcc
12	Output 21
13	Output 22
14	Output 23
15	Output 24
16	0Vcc

6. relè: Connections

6.1. Board layout

From CS6630 Relè



6.1.1. Connector Jp1

1	Coil relè 1
2	Coil relè 2
3	Coil relè 3
4	Coil relè 4
5	Coil relè 5
6	Coil relè 6
7	Coil relè 7
8	Coil relè 8
9	Coil relè 9
10	Coil relè 10
11	Coil relè 11
12	Coil relè 12
13	Coil relè 13
14	Coil relè 14
15	+VRel
16	+VRel

6.1.2. Connectors Jp2

1	+VRel
2	0VRel

6.1.3. Connector Jp3

1	Com. relè 1
2	N.O. relè 1
3	Com. relè 2
4	N.O. relè 2

5	Com. relè 3
6	N.O. relè 3
7	Com. relè 4
8	N.O. relè 4

6.1.4. Connector Jp4

1	Com. relè 5
2	N.O. relè 5
3	Com. relè 6
4	N.O. relè 6
5	Com. relè 7
6	N.O. relè 7
7	Com. relè 8
8	N.O. relè 8

6.1.5. Connector Jp5

1	Com. relè 9
2	N.O. relè 9
3	Com. relè 10
4	N.O. relè 10
5	Com. relè 11
6	N.O. relè 11
7	Com. relè 12
8	N.O. relè 12

6.1.6. Connector Jp6

1	Com. relè 13
2	N.O. relè 13
3	Com. relè 14
4	N.O. relè 14

7. NOISE PREVENTION

All pieces of electric or electronic equipment are likely to affect one another due to the network connections or to other metal connections between them. In order to reduce to a minimum or to eliminate the mutual influence it is necessary to install the system correctly, also adopting any necessary disturbance prevention measure.

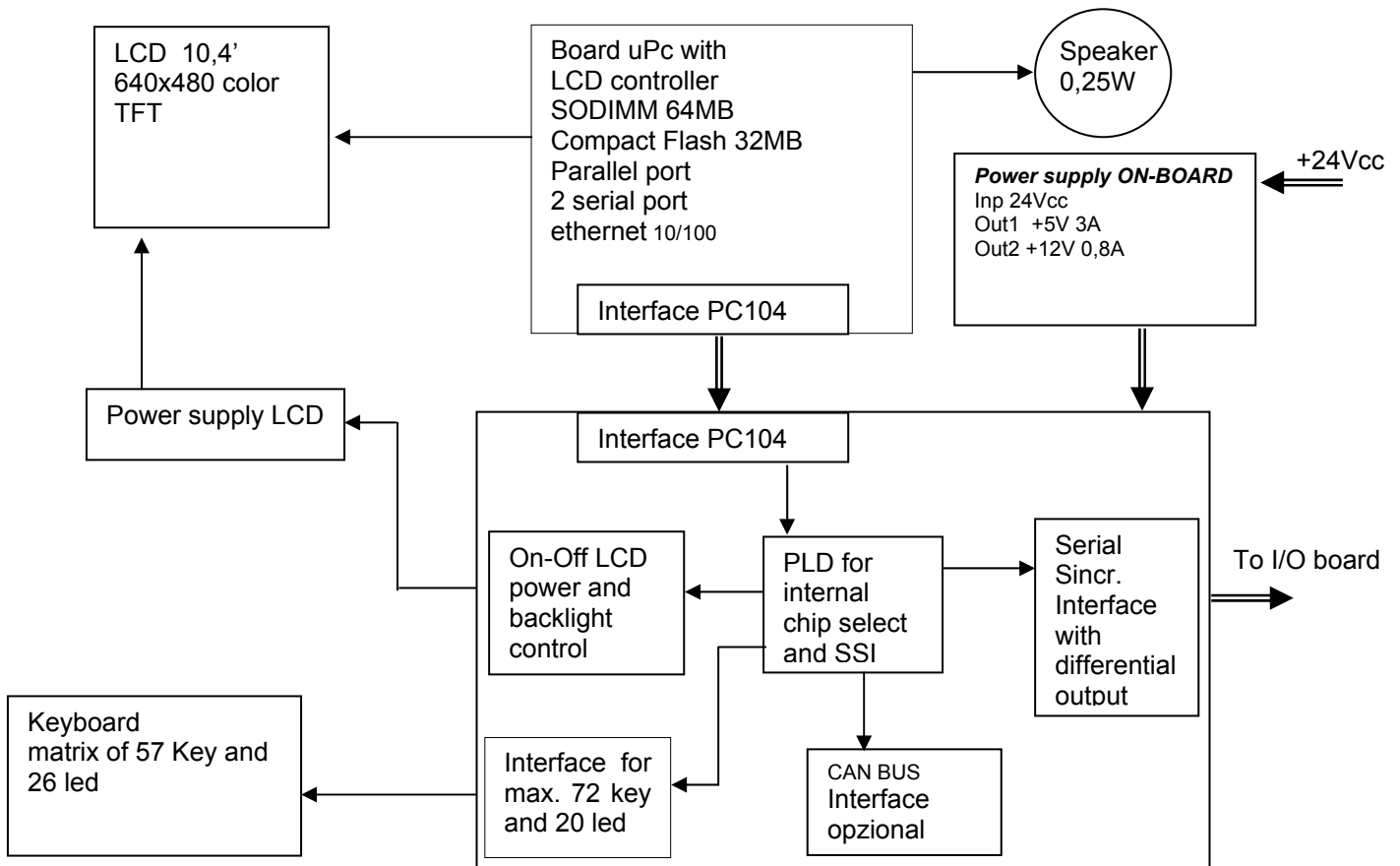
The following warnings refer to a power supply network without noises. If there are disturbances in the network it is necessary to take other measures in order to reduce noises.

In such cases it is not possible to give general advice and if the noise prevention measures are not sufficient, please refer to TDE MACNO.

- Make sure that all the equipment in the cabinet is well connected to the ground bar using short cables with a star connection. It is particularly important that any control equipment connected with the system, e.g. operating devices, is connected to the same ground using short cables.
- The system needs to be fixed using screws and dented washers in order to ensure good electric connection between the internal mass and the metal support which is linked to the ground of the board, if necessary remove the colour layer in order to ensure good contact.
- For the connection of thermocouples, PT100, analog inputs and encoder use **only** screened cables and connect the screening to the ground on both sides. The best connection of the screen to the ground is obtained through a band enveloping the screen fixed directly to the mechanics of the board.
- Keep the connection cables of the PWM outputs separate and distant from control cables of the thermo-regulation type.
- Always lay control cables at a distance of at least 10 cm from any parallel power cables. Also in this case it is advisable to use a metal cabling separated and connected to the ground. If the control cables cross the power cables, keep a crossing angle of 90°C.
- If the RC groups or flywheel diode for the spools of the contactors, relays and other electromechanical switches are installed in the same cabinet as the CHS2002, they need to be mounted directly on the connections of the same spools.
- Make all external control, measurement and adjustment connections using screened cables.
- Those cables that might cause noises have to be laid separately and at a distance from the control cables.

8. CHS2002-PC schematic diagram

- 1) CPU 486 DX5 133MHz, ram SIMM 16MB, HD DiskOnChip 32MB, SVGA-LCD controller C&T65550, parallel port, two serial port, ethernet 10/100
- 2) Main power supply CS6635 input 24V +-20% output 5V 3A, +12V 0,8A, -12V 0,2A
- 3) LCD Sharp 640x480 10,4' color STN
- 4) CS8FX interface LCD-CPU flat
- 5) Power supply for backlight LCD
- 6) Keyboard with 57 key
- 7) Board CS6636 with 26 led
- 8) Interface PC104 CS6634 with synchronus Serial line 2Mbaud, interface for keyboard and led, Can-Bus opzional, trimmer for control bachlight luminosity.
- 9) Speaker 0,25W

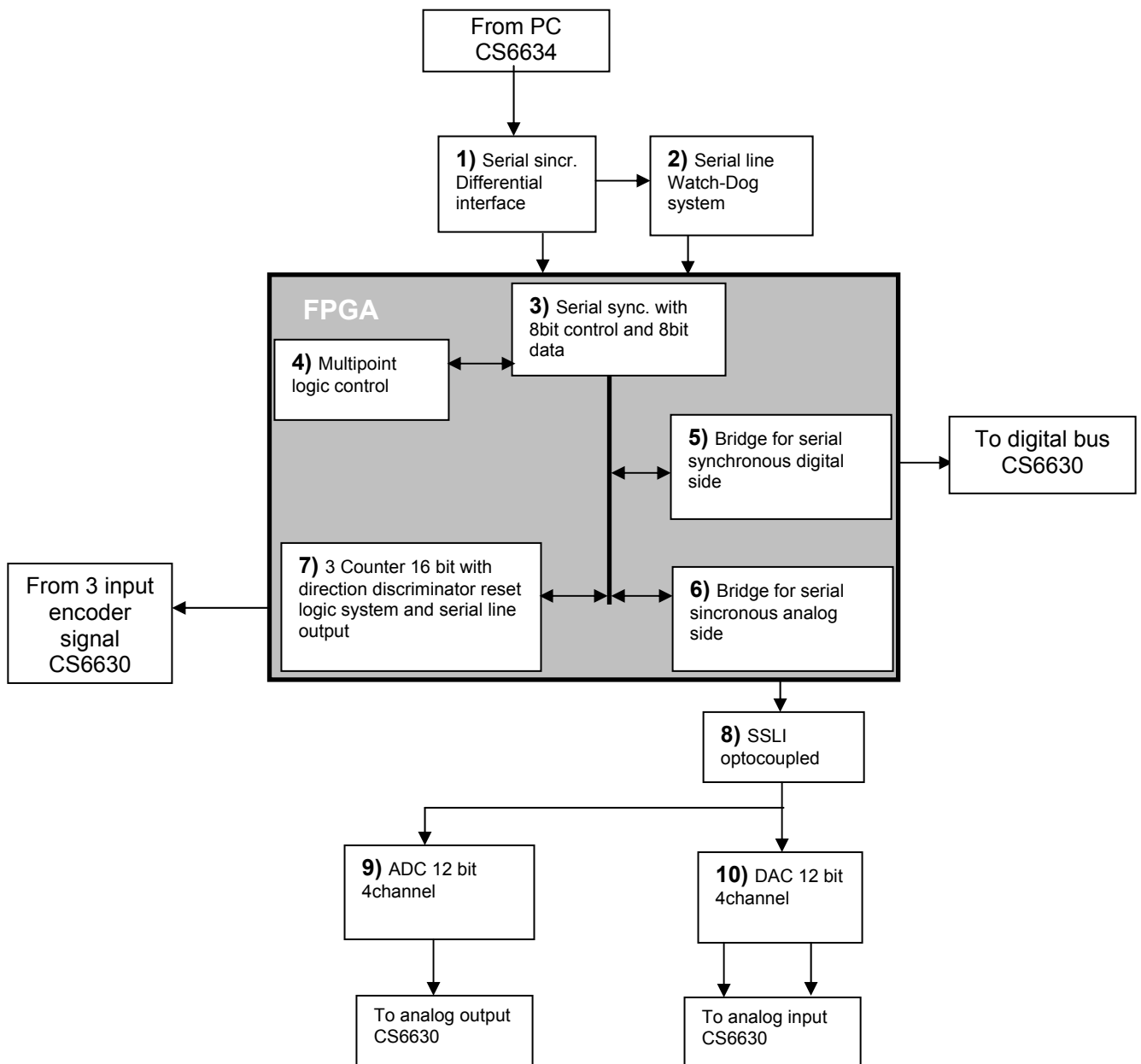


9. Block diagram CHS2002-I/O

The CHS2002-I/O consists of two basic boards and an optional one. The boards are:

- a) CS6633 –FPGA board with connection towards CHS2002-PC Ver.2.4
- b) CS6630 – interface board with the external I/O
- c) CS6631 – expansion board digital I/O

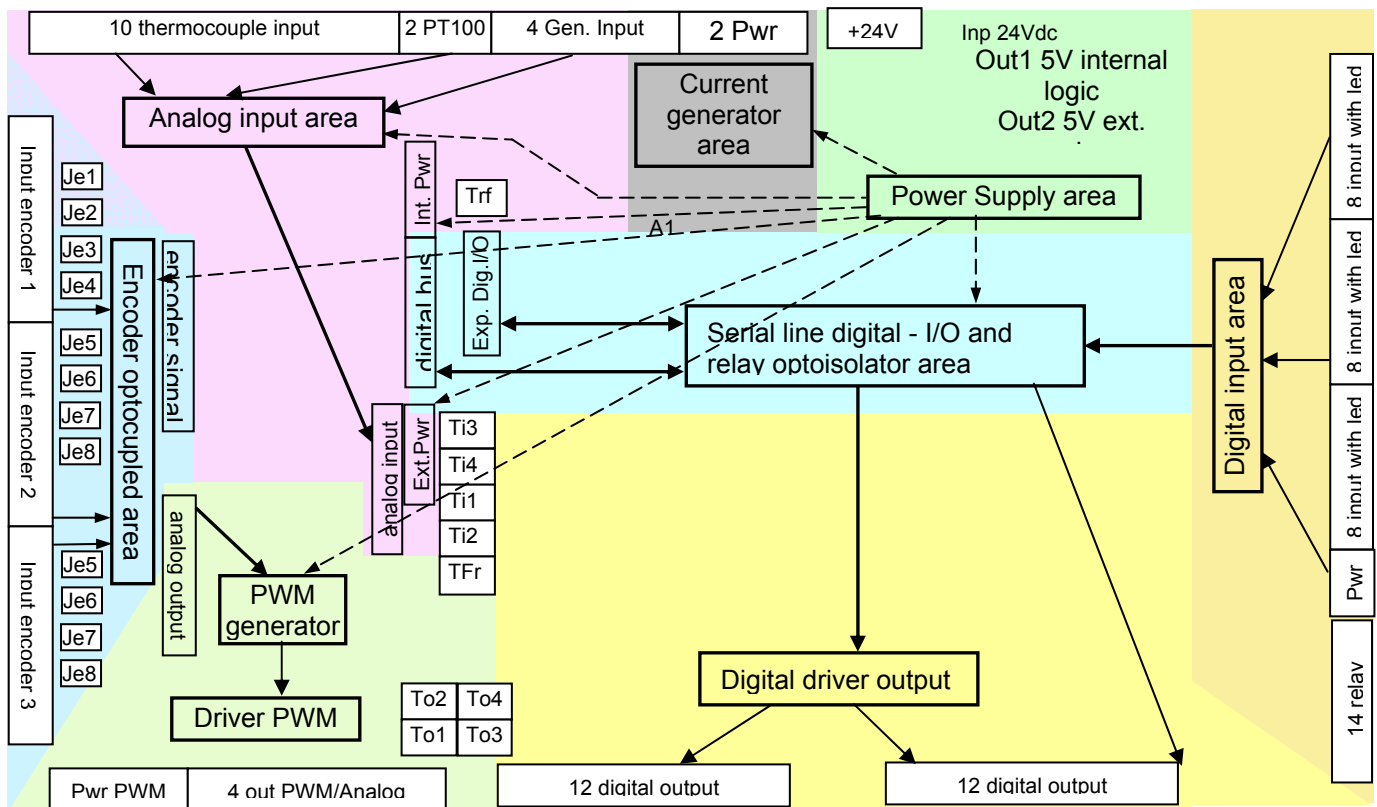
9.1. CS6633 – BLOCK DIAGRAM FPGA BOARD



- 1) Conversion circuit from differential coming from the CHS2002-PC with CMOS internal logic
- 2) Data movement control system on the serial. The system presents a monostable re-synchronised on the presence of the clock of the synchronous serial synchronous in the PC
- 3) The circuit includes a reception and transmission system for serial data through a data buffer, while through the control buffer it is possible to identify the driver to which the next communication is addressed. Inside the FPGA
- 4) Circuit to recognise whether the frame to be received is addressed to the board. The system makes sure that the package received contains the identification code (0-3) which is selected through the dip-switch present on the board (optional)
- 5) Conversion logic between the synchronous serial from the PC and the synchronous serial used for the management of the digital I/O present on the CS6630
- 6) Conversion logic between the synchronous serial from the PC and the synchronous serial used by the DAC and the ADC
- 7) Encoder reading group, for three encoders. Contains the logic for the recognition of the direction of the incremental encoders, the counter reset circuits, the 16 bit counters and finally the shift registers to send the counting to the PC
- 8) Optoisolators for the analog I/O
- 9) Analog/digital converter with four 12-bit channels. Manages also the selection of the analog multiplexers found on the CS6630 board
- 10) Digital/analog converter with four 12-bit channels. Used to drive at the same time the four analog outputs and the four PWM outputs

9.2. CS6630 - BLOCK DIAGRAM I/O BOARD

The board is divided into four areas:



- a) Board power supply
- b) Synchronous serial for digital I/O
- c) 24 digital inputs
- d) 24 digital outputs
- e) Analog inputs: 10 thermocouples, 2 PT100, 4 generic inputs
- f) 2 power generators for PT100
- g) 4 PWM or analog outputs
- h) 3 encoder Inputs

9.2.1. Power supply

As you will have noted, the connections between power supplies are represented with a discontinuous line and supply power only to some parts of the board, the other areas of the driver PWM type, digital inputs and outputs receive them from the appropriate connector. The power supply is of the switching fly-back type with 24Vdc+20% input and is able to provide four power supplies galvanically separated one from the other. The outgoing power supplies are:

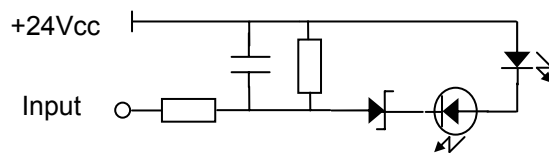
- 1) +5V internal: powers the digital synchronous serial part, the FPGA and the differential interface towards the PC. It provides a maximum of 0.5A
- 2) +12 e -12 external: powers the whole input, output analog part and the encoders and is able to supply max.0.2A per branch
- 3) +5V external: powers the DAC, the ADC and the optoisolators of the analog synchronous serial, providing a maximum of 0.2A

9.2.2. Digital I/O synchronous serial

The system consists of a series of output shift-registers in cascade one with the other and at the end there is the expansion connector before the closing of the ring with the input shift-registers. In this circuit there are also the optoisolators of the digital I/O. The cascade of the outputs is formed by three bytes for the 24V digital outputs and two bytes for the 14 relay outputs. The cascade of the inputs on the other hand consists of only three bytes. There is also a buffer for the expansion of the cascade and it is advisable not to mount more than one digital expansion board.

9.2.3. Digital inputs

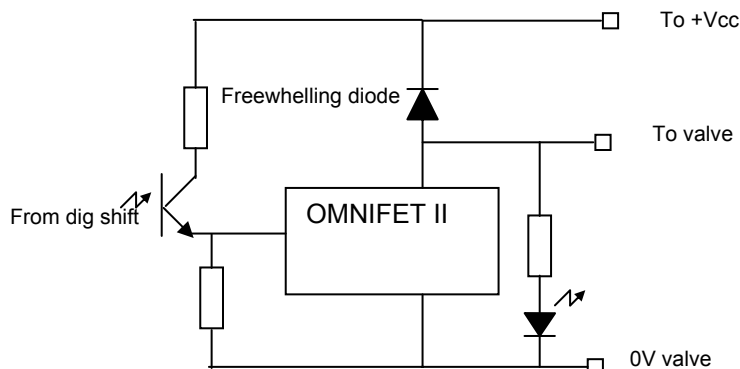
In the area indicated there are filters with about 1mSec. for each input and the display LED's. The input circuit is of the source type as shown in the diagram.



The +24Vdc is supplied only in one point on the Pwr Inp connector. Marked on the bottom right part of the block diagram.

9.2.4. Digital outputs

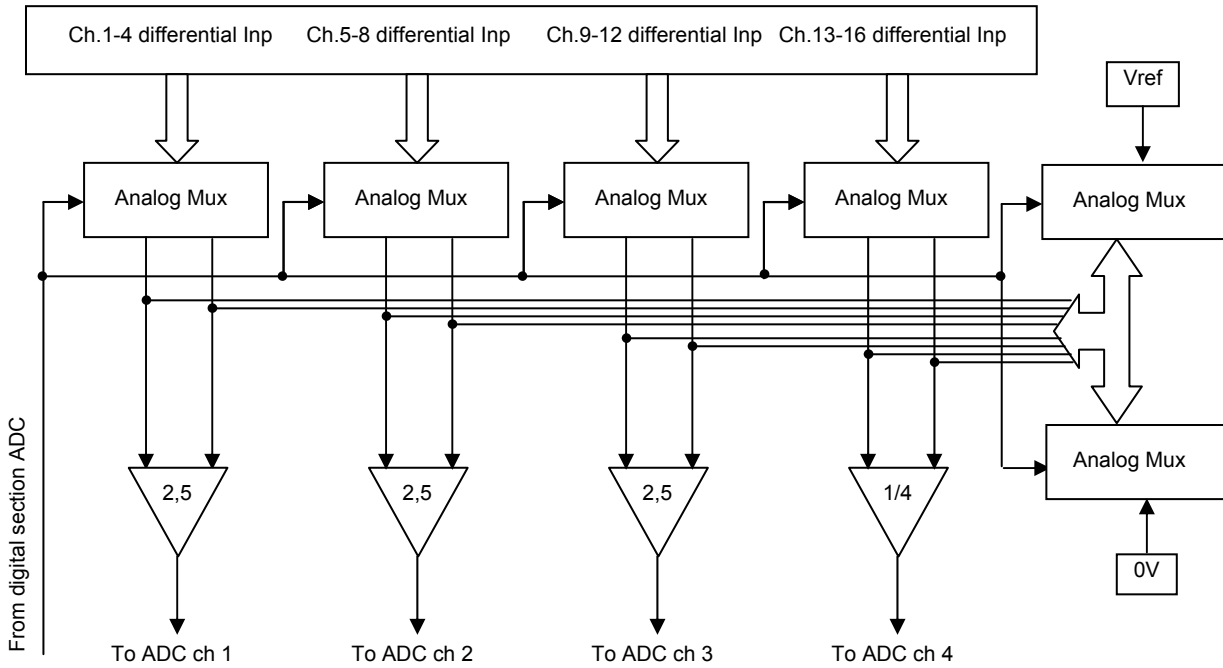
The output stages are of the sink type as shown in the diagram



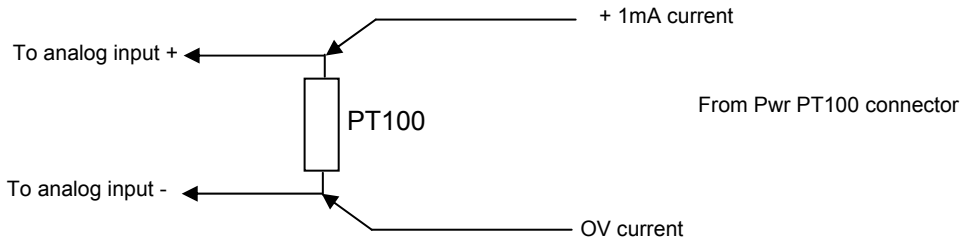
There are 24 outputs of which 6 with 5A and 18 with 2A, the first output of each of the four has 5A. The output driver has a power limitation device, overheating block, short-circuit protection and ESD protection.

9.2.5. Analog inputs

The board accepts up to 16 analog inputs of the differential type divided into four groups. Each group consists of an analog multiplexer and a differential amplifier.



By default the first three groups are set with a gain of ten and the last group with a gain of 1/4. The first ten inputs can be connected to thermocouples both of the J and K type with a full scale of 50mV. Inputs 11 and 12 are reserved to two PT100 which need to be connected as shown in the diagram.



The maximum applicable value to the input is 250mV corresponding to 250 ohm amounting to about 400 degrees.

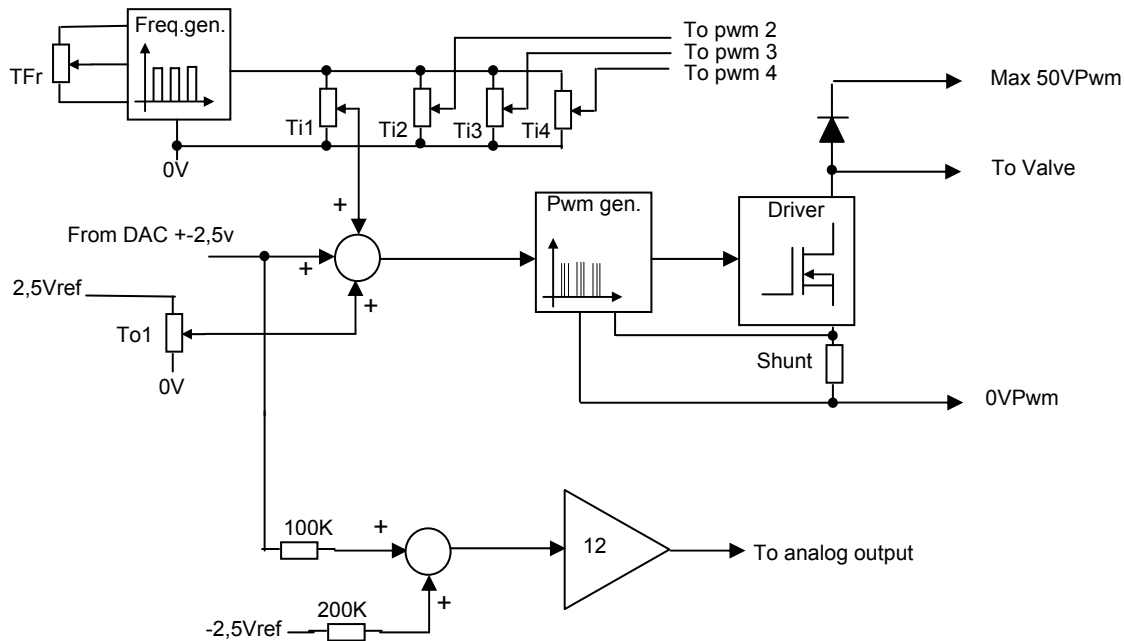
The last four differential inputs have a gain of 1/4 in order to reduce the signals from +-10V to +-2.5V which is the full scale of the ADC. They can be used for pressure measurement, potentiometers etc..

9.2.6. Power generators for PT100

In this area there are two 1mA precision power generators to power the two PT100 included.

9.2.7. PWM or analog outputs

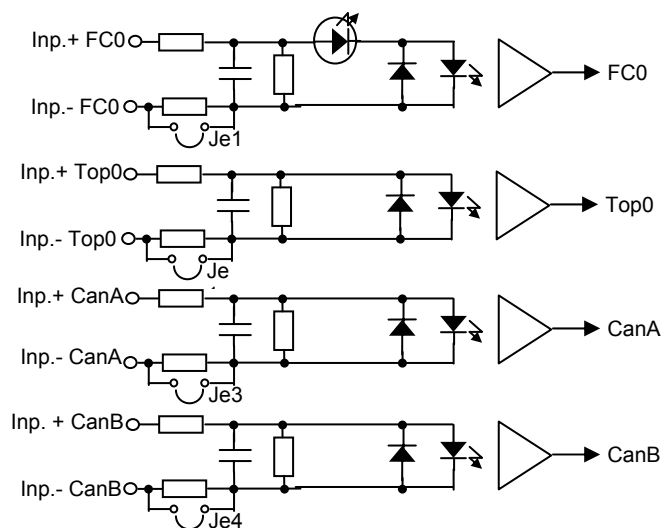
The analog output section can be represented as shown in the diagram:



The four analog outputs coming from the DAC of the CS6633, have a range of 0 +2.5V and are readapted to a range of +10V. The same signals from the DAC enter the PWM modulators and are sent to the respective power drivers that are able to supply up to 2A. The system is back activated by a shunt which allows for a good current linearity proportional to the value set by the DAC. The power output which we obtain depends on the power value introduced in the Pwr PWM connector. On the board there are two trimmers for each output which allow for the gauging of the offset PWM (To1-To4) and the hysteresis of the valve (Ti1-Ti4). The trimmer TFr adjusts the frequency of the 30-170Hz hysteresis recovery circuit to be adapted to the type of valve used.

9.2.8. Encoder inputs

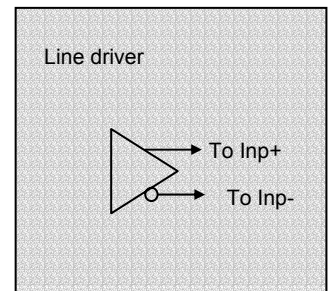
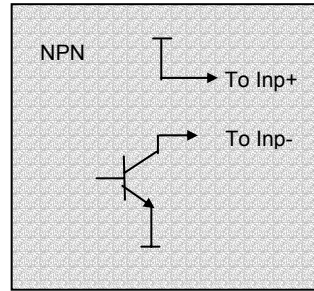
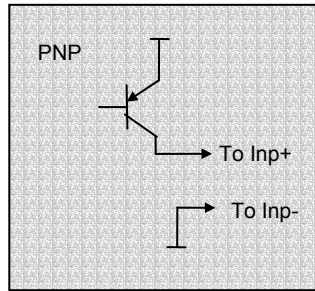
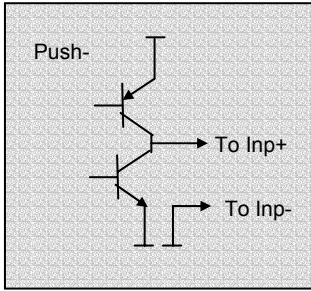
The board includes three encoder inputs. The input stage can be represented as illustrated in the block diagram below.



This type of circuit makes it possible to connect the following types of encoder:

- 1) Push-Pull
- 2) NPN
- 3) PNP
- 4) Line driver

The changing element is the connection mode. The diagram exemplifies the different connection types



On each connector, as indicated in the chapter on connections, there is a 12V supply to power the encoder. The maximum usable current is about 40mA. If you are using the line driver configuration with 5V you need to close the following jumpers Je2,Je3,Je4 for the first encoder, Je6-Je7,Je8 for the second and Je10,Je11 and Je12 for the third. The jumpers Je1, Je5, Je9 are used if the limit switch of the mechanical zero area provides to the board a 5V signal (otherwise this signal is 24V as in a digital input).

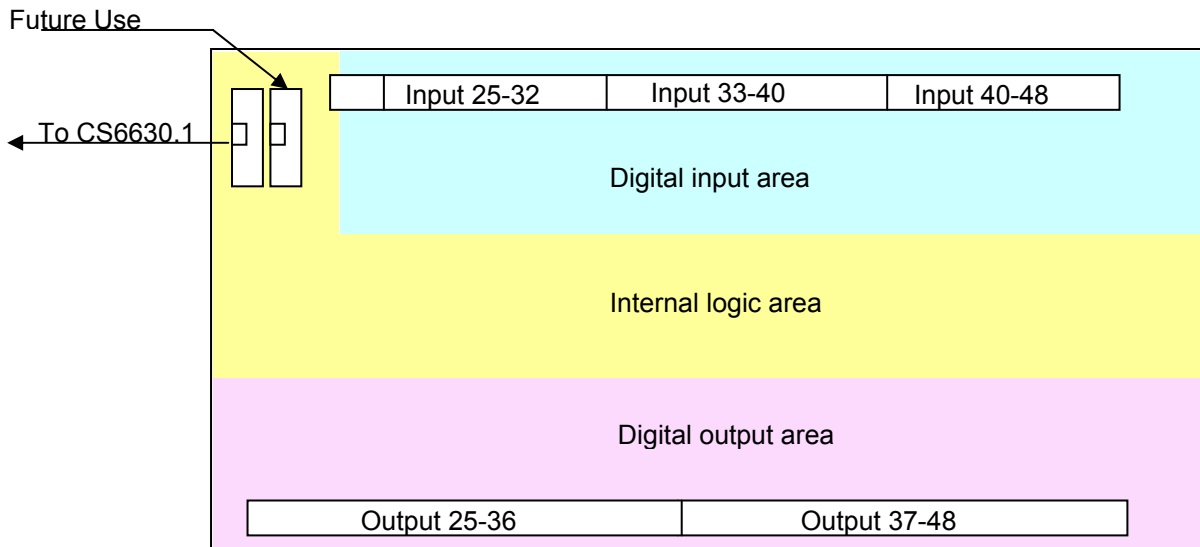
10. Digital I/O extension board

The extension board CS6631.0 is used to extend the digital I/O numbers of the CHS2002 system from 24I/24Out to 48I/48Out. The board is mounted on the CS CS6630.1 board through four metallic supports included in the kit. A 16 wires flat connects it to the board.

10.1. CS6631 – EXTENSION BOARD BLOCK DIAGRAMM

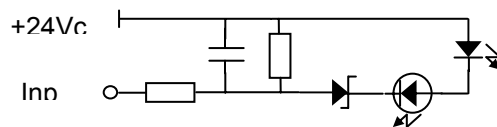
The board is divided into three areas:

- 1) Digital inputs
- 2) Internal logic area
- 3) Digital outputs



10.1.1. Digital inputs

In this area you find the filters (about 1mSec) for each input and the display leds. The input circuit is source type, as in the below fig.

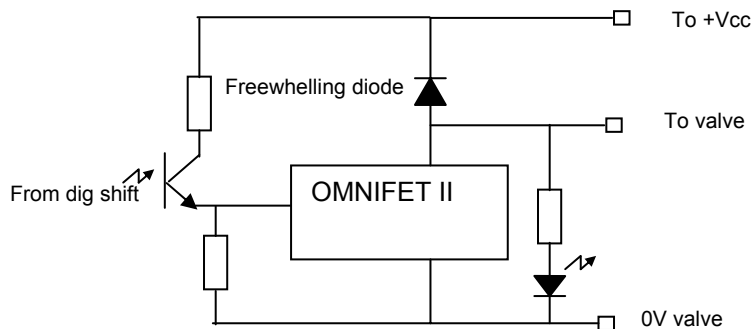


The connection +24Vdc is just to the connector Pwr Inp. See block diagramm below on the right.

10.1.2. Digital outputs

The outputs are sink type, as in the fig.

There are 24 outputs (2A). The output driver has a current limit control, an overtemperature protection, shortcircuits and ESD protections.



11. Troubleshooting annex

11.1. INTRODUCTION

In this chapter we will attempt to illustrate some operations useful to test the correct operation of the system. The purpose is not to identify the type of failure, but rather to give the user an instrument to test the correct operation of the system. We will refer to the block diagrams presented above and we expect that the tests are carried out by skilled technical staff.

CHS2002-PC failure table	
Impossible to turn on the CHS2002-PC	<ol style="list-style-type: none"> 1) Check that the +24V is correctly connected and is present with a max. tolerance of 20% 2) Check the power supply to the CS6635 card Jp2 connector. The power supplied must have a tolerance of +-10% 3) Connect on the monitor connector a VGA monitor to check the correct functioning of the CPU card
The LCD is on but not functioning correctly	<ol style="list-style-type: none"> 1) Check that the flat connection circuit and the LCD are correctly connected 2) Check that the flat side CPU is correctly inserted
The system can be turned on but LCD remains off	Check that the +12 LCD lamp powering is present from the Jp7 connector of the CS6634

CHS2002-I/O failure table	
All the LED's in the power supply are off	1) Check that the +24V is present on the XALI connector and make sure that it fits within the allowable range of +-20%
The LED on the CS6633 is off	No communication with the PC. <ol style="list-style-type: none"> 1) Check that the multipolar cable is connected between the PC and the I/O card 2) Check that the PC is in the communication mode 3) Check the power supplied to the connectors Ji3-Ji4-Ji6
The analog readings are not correct	Check -Vref=-2.5V and +Vref=2.5V on pin 1 and 2 of Ji1