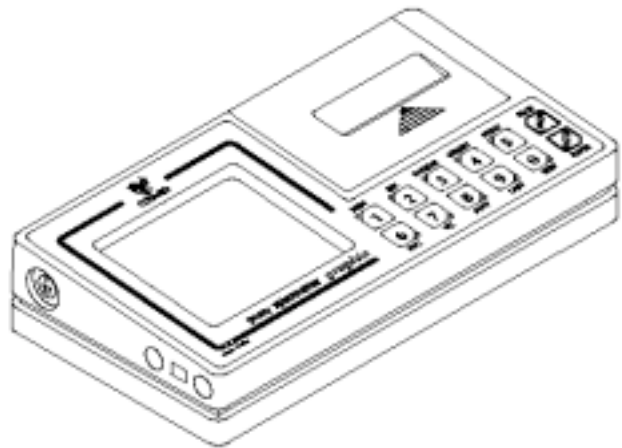


SERVICE MANUAL



Pony *graphic*



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Pony graphic service Manual

October 2001 II Edition

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COSMED Srl - Italy

Part No. C01414-01-91 Rev A.

WARNING

Do not use the equipment in presence of flammable gases or anesthetic mixtures.

Perform the service procedures described in this manual only if you are a trained and authorized COSMED service person.

Keep the equipment away from heat, flames, sparks, flammable liquid mixtures and explosive gases.

For using this equipment along with other medical ones, contact COSMED.

The following symbols are used into the equipment, in accordance of the actual standards:



Type B equipment (according to EN60601-1)



DANGER: high temperature



OFF



ON



Protective earth



AC

WARNING

Perform the service procedures described in this manual only if you are a trained and authorized COSMED service person. You must have a thorough knowledge and experience with medical electronic equipment.

Pay attention to the directions in this service manual, along with the warning and cautions that appear throughout this manual.

Read through each step in every procedure before beginning the repair. Always use the proper tools, test equipment and the most recent revision of this service manual.

Warning

If you deviate from the instructions and/or recommendations in this manual, you may cause the *Pony Graphic* to operate improperly or unsafely, and you may damage the *Pony Graphic* itself.

The *Pony Graphic User's Manual* is an integral companion to this manual. Familiarize yourself with it before operating and repairing the device.

Table Of Contents

1.	Introduction.....	1.2
1.1.	<i>Organisation of the manual</i>	<i>1.2</i>
1.2.	<i>Reference Documents.....</i>	<i>1.2</i>
1.3.	<i>Customer Communication.....</i>	<i>1.2</i>
1.4.	Technical Specifications.....	1.3
1.4.1.	Pony graphic Unit	1.3
1.4.2.	Flow meter.....	1.3
1.4.3.	Power supply:	1.3
1.4.4.	Battery charger	1.3
1.4.5.	Windows PC Software.....	1.3
1.4.6.	PC configuration required.....	1.3
1.4.7.	Safety and conformity.....	1.3
2.	Functional description	2.2
2.1.	General Overview.....	2.2
2.1.1.	Pony graphic Unit	2.2
2.1.2.	Flowmeter	2.2
2.1.3.	Battery Charger (AC /DC Adapter).....	2.2
2.1.4.	RS232 cable	2.2
3.	Part Description	3.2
3.1.	Pony graphic Unit.....	3.3
3.2.	Mother Board (C01350-01-15).....	3.3
3.2.1.	Function	3.3
3.2.2.	Description.....	3.3
3.2.3.	Adjustments & checks	3.4
3.2.4.	Assembly Drawing.....	3.4
3.2.5.	Warnings & Indications in Event of Failure.....	3.4
3.3.	Display Assembly (C01344-01-30).....	3.5
3.3.1.	Function	3.5
3.3.2.	Description.....	3.5
3.3.3.	Adjustments & checks	3.5
3.3.4.	Assembly Drawing.....	3.5
3.3.5.	Warnings & Indications in Event of Failure.....	3.5
3.4.	Keyboard Assembly (C01352-01-15).....	3.5
3.4.1.	Function	3.5
3.4.2.	Description.....	3.5
3.4.3.	Adjustments & Checks	3.5
3.4.4.	Assembly Drawing.....	3.6
3.4.5.	Warnings & Indications in Event of Failure.....	3.6
3.5.	Printer (C01386-01-08).....	3.6
3.5.1.	Function	3.6
3.5.2.	Description.....	3.6
3.5.3.	Adjustment & checks	3.6
3.5.4.	Assembly Drawing.....	3.7
3.5.5.	Warnings & Indications in Event of Failure.....	3.7

3.6. Opto Electronic Assembly(C00095-01-05)	3.7
3.6.1. Function	3.7
3.6.2. Description	3.7
3.6.3. Adjustment & checks	3.8
3.6.4. Assembly Drawing (Refer to Section: Schematics & Layouts)	3.8
3.6.5. Warnings & Indications in Event of Failure	3.8
3.7. Battery Charger (C00766-01-30) (C00767-01-30)	3.8
3.7.1. Function	3.8
3.7.2. Description	3.8
3.7.3. Adjustments & checks	3.8
3.7.4. Assembly Drawing	3.8
3.7.5. Warnings & Indications in Event of Failure	3.9
4. UNIT MAINTENANCE AND CONSUMABLE REPLACEMENT	4.2
4.1. Operator Maintenance Program	4.2
4.2. Replacement Schedule	4.2
4.3. Preventive Maintenance	4.4
4.3.1. Necessary tools	4.4
4.3.2. Charger cable A381-003-202:	4.4
4.3.3. RS232 serial cable C00032-01-12:	4.4
4.3.4. Turbine C00292-01-05:	4.4
4.3.5. Optoelectronic reader C00095-01-05:	4.4
4.3.6. Pony graphic unit	4.4
5. TROUBLESHOOTING	5.2
5.1. Careless mistakes during the use of the system	5.3
5.1.1. Warning	5.3
5.1.2. Tools	5.3
5.1.3. The system doesn't operate when switched on;	5.3
5.1.4. The printer doesn't work properly;	5.4
5.1.5. The Pony graphic is unable to measure properly flow and volume;	5.4
5.1.6. The Optoelectronic transducer doesn't work;	5.4
5.1.7. The batteries cannot be recharged or the green led remains off;	5.4
5.1.8. Serial Communication error	5.5
5.1.9. The keyboard doesn't work	5.5
5.1.10. The LCD Display back-light doesn't work	5.5
6. Service Procedures	6.2
6.1. Consumable Replacement	6.2
6.1.1. Disassembling the Pony graphic	6.2
6.1.2. Replacing the internal Rechargeable batteries	6.3
6.2. Electronics	6.3
6.2.1. Display contrast Adjustment	6.3
6.2.2. Flow measurement Check and Calibration	6.4
6.3. Auto Test Mode	6.4
6.3.1. Running the Auto-test program	6.4
6.3.2. Operating the interactive Diagnosis Program	6.5
6.4. Connecting to External Printer	6.5
6.4.1. External printer: features and connections	6.5
6.4.2. Main features of the test report	6.5
6.4.3. Configuration of the printer	6.6

6.4.4.	Configuration of the Pony Graphic	6.6
7.	SCHEMATICS AND LAYOUTS	7.2
7.1.1.	Motherboard (C01350-01-15).....	7.2
7.1.2.	Display (C01344-01-30)	7.2
7.1.3.	Key board PCB (C01352-01-15)	7.2
7.1.4.	Printer (C00551-01-08).....	7.2
7.1.5.	Optoelectronic Reader (C00095-01-05)	7.2
7.1.6.	Optoelectronic PCB (C00609-01-15)	7.2
7.1.7.	Adapter Plug for Car charging (C00297-01-12)	7.2
7.1.8.	Serial Cable (C00032-01-12).....	7.2
8.	Appendix A: Replaceable Part List	8.2

1.	Introduction.....	1.2
1.1.	<i>Organisation of the manual</i>	1.2
1.2.	<i>Reference Documents</i>	1.2
1.3.	<i>Customer Communication.....</i>	1.2
1.4.	<i>Technical Specifications.....</i>	1.3
1.4.1.	<i>Pony graphic Unit</i>	1.3
1.4.2.	<i>Flow meter</i>	1.3
1.4.3.	<i>Power supply:</i>	1.3
1.4.4.	<i>Battery charger</i>	1.3
1.4.5.	<i>Windows PC Software.....</i>	1.3
1.4.6.	<i>PC configuration required.....</i>	1.3
1.4.7.	<i>Safety and conformity.....</i>	1.3

1. Introduction

This manual provides the basic procedures for the maintenance and the technical support of the Pony Graphic. Perform the service procedures described in this manual only if you are a trained and authorized COSMED service person. You must have a through knowledge and experience with medical electronic equipment.

Pay attention to the directions in this service manual, along with the warning and cautions that appear throughout this manual.

Read through each step in every procedure before beginning the repair. Always use the proper tools, test equipment and the most recent revision of this service manual.

The Pony Graphic User's Manual is an integral companion to this manual. Familiarize yourself with it before operating and repairing the equipment.

1.1. Organisation of the manual

This manual is organized as follows:

Functional Description

Provides a general description of the device, the theory of operation and the main usage modes. This chapter is useful to use the device in the most complete and proper mode.

Part Description:

Provides a detailed description of the device and the theory of operation of the modules. This chapter is useful to identify cause for problems and to operate properly.

Maintenance

Provides general specifications for maintenance and calibration.

Trouble-shooting

Trouble-shooting guidelines for detecting problems and their respective solutions

Service Procedures:

Description of the adjustments and checks to carry out for a problem

Schematics & Layouts

A collection for drawing for disassembling of the parts, electric and pneumatic schematics, mounting planes and PCB Layouts

Appendix A

Technical information, replaceable part list, customer communication.

1.2. Reference Documents

The following document contains information that you may find useful for further reference as you read this manual:

Pony Graphic: User's Manual P/N: C00296-02-91.

1.3. Customer Communication

COSMED would like to receive your comments and suggestions on its products and manuals. We are interested in your application with our products, and we would like to help you if you have problems with them. To make it easier for you to contact us, this manual contains our address and a Technical Support Form in the Appendix

Our contact Address

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Voice +39 (6) 931 5492

Fax +39 (6) 931 4580

Internet Web site: <http://www.cosmed.it>

1.4. Technical Specifications

1.4.1. Pony graphic Unit

Graphic display	Backlight LCD 70x80 mm
Display	LCD 2 lines x 16 characters
Printer	Graphic, 24 char/lin, 2,5 lines/s
Keyboard	12 multifunction keys
Serial cable	RS 232, bi-directional, 4800 baud

Dimensions

Dimensions	237x127x46 mm
Weight	1.2 kg

1.4.2. Flow meter

Flow meter:	Digital bi-directional turbine
Flow range	0.03 -20 l/s
Volume range	10 l
Accuracy F/V	± 3% or ± 50 ml
Dynamic res at 12 l/s	<0.7 cm H ₂ O/l/s
Mouthpieces	Ø 31 and 22 mm

1.4.3. Power supply:

Ni-Cd Batteries, 5V, 1.2 AH, Rechargeable.
Battery Autonomy 200 tests including prints out

1.4.4. Battery charger

Power supply 120V - 240 V

1.4.5. Windows PC Software

The PC software, running on Windows™, allows the user to manage data stored in the Pony graphic Unit or transmitted to PC. Here following a list of the main features available:

- Test data management.
- Viewing data in table and graphic form
- Spirometry (FVC, VC, IVC, MVV).
- Adding parameters and predicted equations through the "Formula Editor" tool-kit.
- DDE with Microsoft Excel.
- Customizing software environments (colours, printed parameters...).
- on line Help.

1.4.6. PC configuration required

- Pentium 133 MHz. Or higher
- Windows 95, 98, NT.
- 16 MB RAM .
- 3.5 drive.
- VGA, SVGA monitor.
- Serial Port RS 232 available (two serial ports available in case of Ergometer control)
- Any Mouse and Printer compatible with the MS Windows™ operating system.
- PC conform to European Directive 89/336 EMC

1.4.7. Safety and conformity

SAFETY

IEC 601-1 (1988)/EN 60 601-1 (1990)

Below is reported the complete classification of the device:

- Class B "internally powered equipment" device
- IP00, ordinary equipment unprotected against water penetration;
- Non sterile device
- Device not suitable in the presence of flammable aesthetics;
- Continuous functioning equipment;

EMC

The system meets the EMC Directive 89/336
EN 60601-1-2, EN 55011 Class B (emission)
IEC 1000-4-2 (immunity ESD): 4KV CD, 8KV AD
IEC 1000-4-3 (immunity EM): 3 V/m
IEC 1000-4-4 (immunity Bursts): 1 KV

QUALITY ASSURANCE

UNI ISO EN 9001 (Reg 387 Cermet)

MEDICAL DEVICE DIRECTIVE (CE MARK)

MDD 93/42CEE (Notified Body 0476)
Class IIa.

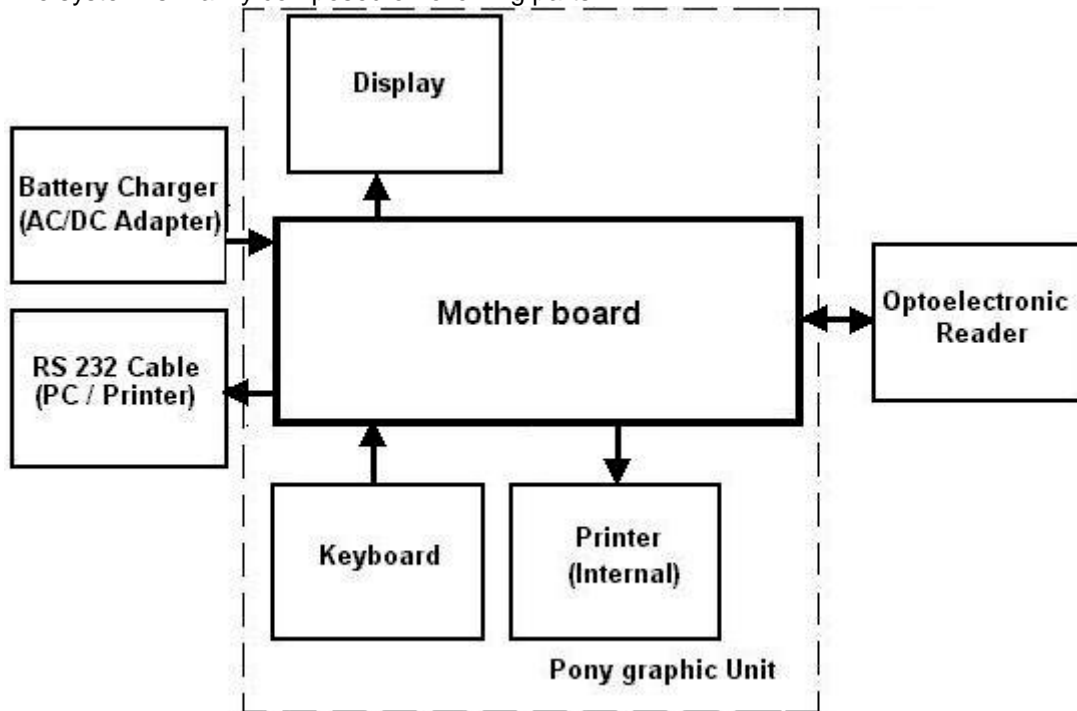
2.	Functional description	2.2
2.1.	General Overview.....	2.2
2.1.1.	<i>Pony graphic Unit</i>	<i>2.2</i>
2.1.2.	<i>Flowmeter</i>	<i>2.2</i>
2.1.3.	<i>Battery Charger (AC /DC Adapter)</i>	<i>2.2</i>
2.1.4.	<i>RS232 cable</i>	<i>2.2</i>

2. Functional description

2.1. General Overview

Pony graphic is a portable spirometer designed for carrying out the typical test of the screening spirometry: Forced Vital Capacity (Pre and Post), Slow Vital Capacity (Inspiratory and Expiratory) and Maximum Voluntary Ventilation.

The system is mainly composed of following parts



2.1.1. Pony graphic Unit

It is the core of the system; contains the microcontroller and the electronics necessary to operate the peripherals and to manage the different measurements. It can be operated either in stand alone mode using the internal rechargeable NiCd batteries or connected to the AC/DC adapter. It is connected to the Turbine flowmeter during the measurement. It can be connected to a PC compatible or an external printer by the RS232 interface for data management and direct printing.

2.1.2. Flowmeter

It is composed by the turbine and the Optoelectronic transducer; the air passing through the helical conveyors, makes a spiral motion which causes the rotation of the turbine rotor. The rolling blade interrupts the infrared light sources beamed by the diodes of the optoelectronic transducer. Every interruption represents half turn of the rotor, this allows to measure the number of turn in the time. There is a constant ratio between air passing through the turbine and number of turns. This allows to calculate an accurate measurement of volume and flows.

2.1.3. Battery Charger (AC /DC Adapter)

The battery charger (AC /Dc Adapter) can charge NiCd batteries of the Pony graphic unit at the same time battery pack inside the unit and also supply power to the unit. It can operate at both, 110 or 220V AC inputs. It is also possible to use the charger in car using cigar light adapter cable supplied with standard accessories.

The battery charge status is indicates by a flashing green Led and completely charged one with Non Flashing one on the top cover pony unit.

2.1.4. RS232 cable

It allows to download the data of the test to a PC compatible or to print the result with an external Printer (see the User's Manual for the printer specifications).

3.	Part Description	3.2
3.1.	Pony graphic Unit	3.3
3.2.	Mother Board (C01350-01-15).....	3.3
3.2.1.	Function	3.3
3.2.2.	Description.....	3.3
3.2.3.	Adjustments & checks	3.4
3.2.4.	Assembly Drawing.....	3.4
3.2.5.	Warnings & Indications in Event of Failure.....	3.4
3.3.	Display Assembly (C01344-01-30).....	3.5
3.3.1.	Function	3.5
3.3.2.	Description.....	3.5
3.3.3.	Adjustments & checks	3.5
3.3.4.	Assembly Drawing.....	3.5
3.3.5.	Warnings & Indications in Event of Failure.....	3.5
3.4.	Keyboard Assembly (C01352-01-15).....	3.5
3.4.1.	Function	3.5
3.4.2.	Description.....	3.5
3.4.3.	Adjustments & Checks	3.5
3.4.4.	Assembly Drawing.....	3.6
3.4.5.	Warnings & Indications in Event of Failure.....	3.6
3.5.	Printer (C01386-01-08).....	3.6
3.5.1.	Function	3.6
3.5.2.	Description.....	3.6
3.5.3.	Adjustment & checks	3.6
3.5.4.	Assembly Drawing.....	3.7
3.5.5.	Warnings & Indications in Event of Failure.....	3.7
3.6.	Opto Electronic Assembly(C00095-01-05)	3.7
3.6.1.	Function	3.7
3.6.2.	Description.....	3.7
3.6.3.	Adjustment & checks	3.8
3.6.4.	Assembly Drawing (Refer to Section: Schematics & Layouts).....	3.8
3.6.5.	Warnings & Indications in Event of Failure.....	3.8
3.7.	Battery Charger (C00766-01-30) (C00767-01-30).....	3.8
3.7.1.	Function	3.8
3.7.2.	Description.....	3.8
3.7.3.	Adjustments & checks	3.8
3.7.4.	Assembly Drawing.....	3.8
3.7.5.	Warnings & Indications in Event of Failure.....	3.9

3. Part Description

This section deals with the electronic circuits and their functions; it gives an overview regarding the general aspect of the PCB assembly, its electronic description and the possible errors and faults, which can occur due to malfunction in the component from that assembly. It provides the complete reference for the service personnel for diagnosis. The section consists of the following.

Pony graphic Unit

- | | |
|--------------------------|----------------|
| 1. Mother board Assembly | (C01350-01-15) |
| 2. Display Assembly | (C01344-01-30) |
| 3. Keyboard Assembly | (C01352-01-15) |
| 4. Printer unit Assembly | (C01386-01-08) |

Opto electronic Reader

- | | |
|-----------------------------|----------------|
| 5. Opto electronic Assembly | (C00095-01-05) |
|-----------------------------|----------------|

Battery Charger Unit

- | | |
|-----------------------------------|----------------|
| 6. Battery Charger Assembly(220V) | (C00766-01-30) |
| 7. Battery Charger Assembly(110V) | (C00767-01-30) |

The circuit diagrams and PCB Layouts are attached for ready reference

3.1. Pony graphic Unit

The Pony graphic Unit '96 version (P/N: C00307-0X-04), distributed since May 1996, is made of 4 different PCBs:

Mother Board P/N: C01350-01-15

Display: P/N: C01344-01-30

Keyboard: P/N: C01352-01-15

Printer: P/N: C01386-01-08

The physical structure of the Pony graphic Unit is described in the following block diagram:

The Unit contains most of the parts constituting the spirometer and can be interfaced to the, the turbine flow meter and with the User's PC or external printer via the serial cable. AC/DC adapter powers the unit.

3.2. Mother Board (C01350-01-15)

3.2.1. Function

The Mother Board carries the components shown in the above diagram, all the connection between them perform the following functions:

- Control of the all peripherals (display, internal printer, keyboard...) through the micro controller U1 (CDP6805);
- Data Acquisition and amplification of the pulses coming from the opto electronic reader.
- Serial communication management (RS232 unidirectional) and interface level regulation through U11 (MAX233);
- Battery voltage level detection;
- Battery charging management through U10 (TEA1100) of Power Supply Board PCB.

The mother Board layout is enclosed in the Appendix.

3.2.2. Description

(1) Micro controller (CPU) (U1)

The micro controller U1 (CDP6805E3) used in the Pony graphic is responsible for Data management through its address bus for control data transfer function in accordance with the firmware: stored in EPROM U4 (27C512 ,64KB)

(2) Clock

The frequency of the clock signal is controlled by the crystal X1 (4.194.304MHz) , Connected between pin 2 and pin 3 of the Real Timer Clock U2 (146818A).

The RTC (146818A) send the squared clock pulses to pin 39 of U1 (CPU) and generates the interrupt signal necessary to measure the turbine pulses width (pin 19 of 146818A).

(3) I/O control(U9)

The I/O control is carried out within the component FPGA (Field Programmable Gate Array) U9 (Actel A1010B). This IC compensates the Latches, Buffers, Logic Gates for control logic.

(4) Reset

The task of the Reset circuit is to boot the CPU program; when the reset signal (pin 1 of U1) toggles from Low to High, the CPU executes the bootstrap program.

(5) Power down (U13)

The Power Down circuit protects data stored in RAM in event of power failure. It disable the RAM access by toggling pin 20 and 22 of the RAM U3 (62256). To logic level High

(6) RAM (U3)

The IC (U3) 62256 is a 32KByte Random Access Memory used for saving the tests data and for temporary memory during calculations. A dedicated circuit supplies power to the IC even if the Pony graphic is switched off.

(7) RS232

The serial communication is completely managed by the CPU; the only external component is U11 (MAX233) which does the voltage level conversion from TTL (0-5V) to RS232 (-12+12V). The protocol used is the following:

Data bit:	8	Parity:	none
Baud rate:	4800	Handshake:	DTR Hardware

(8) Power Supply

The power supply to the Pony graphic Unit and the Optoelectronic transducer is done by 4 rechargeable NiCD batteries (1.2V, 1.2Ah). (they are packed in set of 2 ,each set containing two batteries)

The IC U14 (MAX761) regulates the supply Voltage of the digital components. It also detects the Low battery status when the battery voltage goes lower than 4.7 Volts.

The IC U12 (MAX635) generates a negative voltage of -18 Volts (pin 11) in order to power the LCD Display contrast.

The LCD back-light power supply is controlled by software (battery saving mode) and generated by an switching circuit composed by T1, C32, C33, R33, R34 and Q10; the supply voltage is about 90 VAC RMS.

The battery voltage directly powers the Optoelectronic Transducer and the Printer.

The IC U10 (TEA1100) performs the battery charging management. The NiCD batteries are charged with two different levels:

Fast charging: 800mA (front panel green led fix)

Slow charging: 15mA (green led blinking)

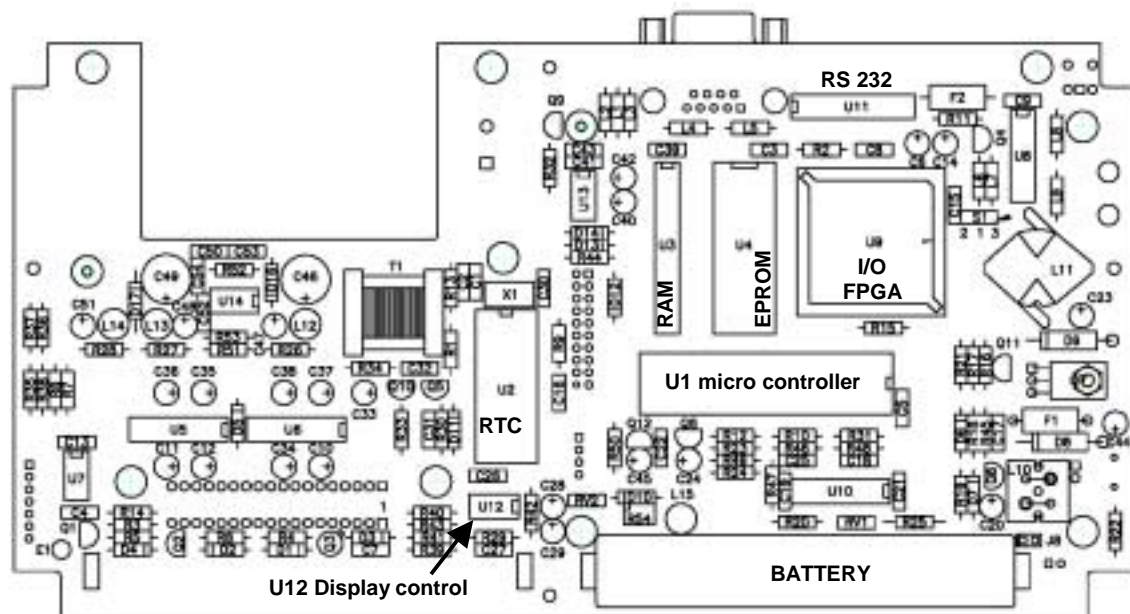
The circuit Switches from fast to slow charging when one of the following conditions is verified:

- Battery fully recharged (Voltage Decrement CutOff System; the battery voltage is continuously monitored by pin 7, when a decrement is detected TEA1100 switch to slow mode).
- Battery temperature higher than 45°C (the temperature is monitored by thermistor RV2)
- Battery voltage lower than prefixed threshold
- Battery Voltage higher than prefixed threshold
- Charging time higher than 2 hours.

3.2.3. Adjustments & checks

There are no adjustments to be performed on the motherboard.

3.2.4. Assembly Drawing



3.2.5. Warnings & Indications in Event of Failure.

- The system does not operate when switched on (refer to Troubleshooting section)
- Printer / serial communication does not work

3.3. Display Assembly (C01344-01-30)

3.3.1. Function

The display of pony graphic is the main interface for user to enter the patient details , to view the results and to print a particular test performed by the patient and for all the control functions to be performed.

3.3.2. Description

The LCD display is CPU controlled by means of the Data Bus (B0-B7) and powered with the following voltages (see the Display layout in Schematics and Layouts section):

3.3.3. Adjustments & checks

(1) Display contrast adjustment

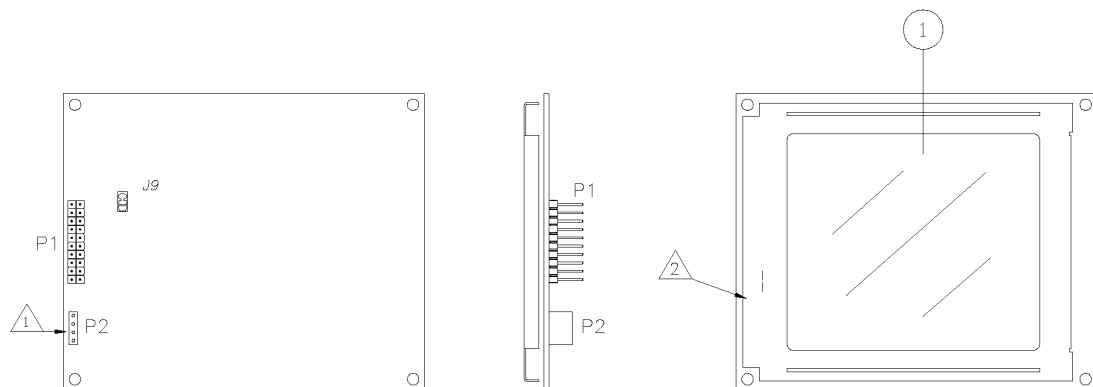
Adjustment VR	Test Point	Adjustment Item
VR54	Display	Display contrast

It is automatically compensated for temperature variations.

(2) Test Points

Pin 3 of P1	Digital Logic supply (VCC 5V)
Pin 5 of P1	LCD supply (VEE-18V)
Pin 4 of P1	Contrast level VDAJ(-15V)
Pin 1,2 of P1	back-light supply (VEL*90VAC)

3.3.4. Assembly Drawing



3.3.5. Warnings & Indications in Event of Failure.

- Display failure
- Backlight failure

3.4. Keyboard Assembly (C01352-01-15)

3.4.1. Function

The keyboard is the primary input device for the patient data and for executing the test it is passive device hardwired to the CPU.

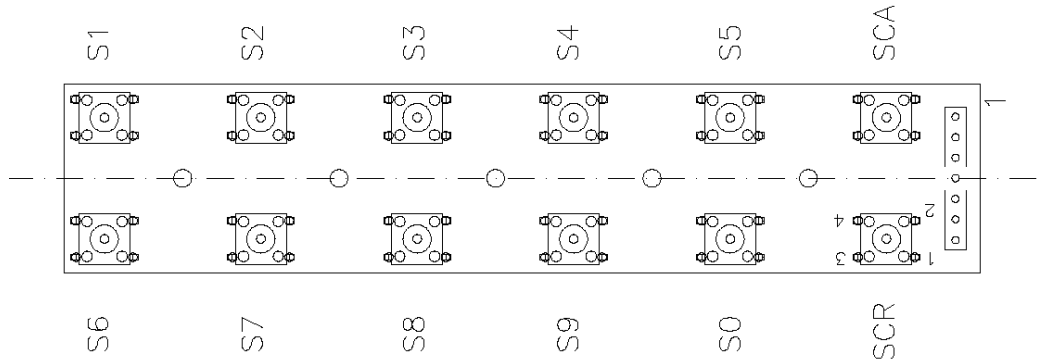
3.4.2. Description

The keyboard is directly interfaced with the I/O ports of the CPU by the connector JP7. Pins 12-13-14 of U1 are outputs while pins 33-34-35-36 Inputs.

3.4.3. Adjustments & Checks

There are no adjustments to be performed on this assembly.

3.4.4. Assembly Drawing



3.4.5. Warnings & Indications in Event of Failure.

- Key failure

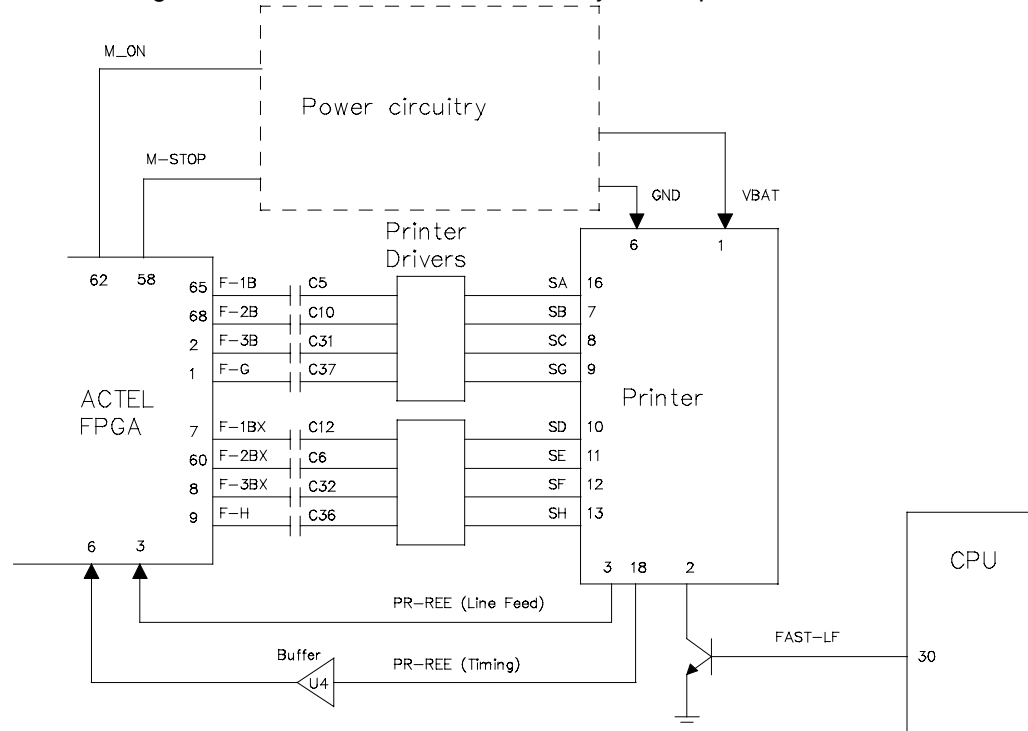
3.5. Printer (C01386-01-08)

3.5.1. Function

The printer used in the Pony graphic is the EPSON M190; it has 8 print solenoids horizontally placed. Each solenoid moves from left to right in order to print 18 dots so the total number of dots/line is 144.

3.5.2. Description

The following schematic shows the control circuitry for the printer.



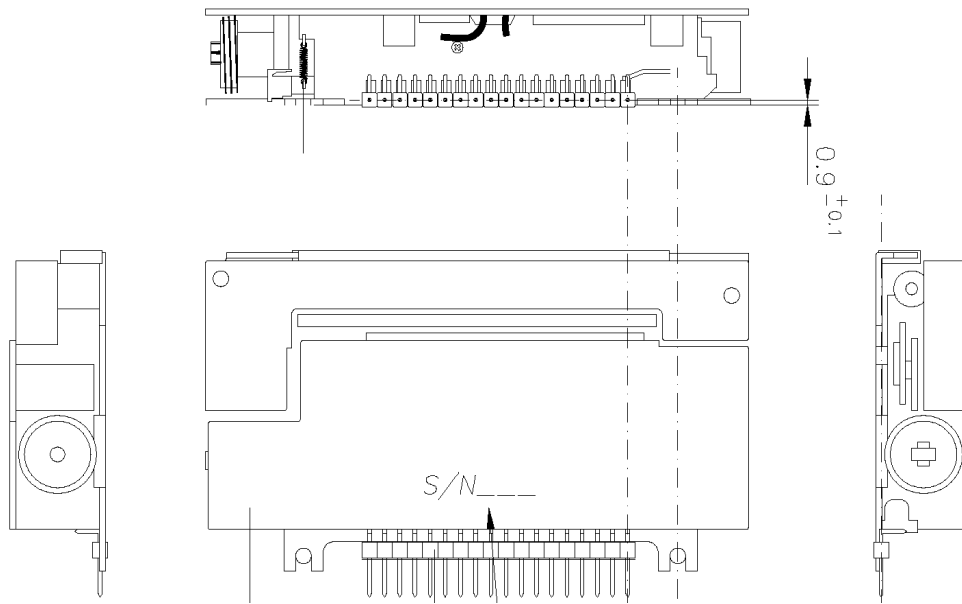
The Printer motor is activated and stopped by the two signals M_ON (Motor On) and M_OFF (Motor Off). The signal Fast Line Feed controls the paper feed and it is directly operated by the CPU (pin 30). The feedback signals coming from the Printer are monitored in order to detect the exact position of the solenoids.

The supply voltage comes directly from the Batteries and the peaks of the current can reach 10A.

3.5.3. Adjustment & checks

There is no adjustment on this assembly.

3.5.4. Assembly Drawing



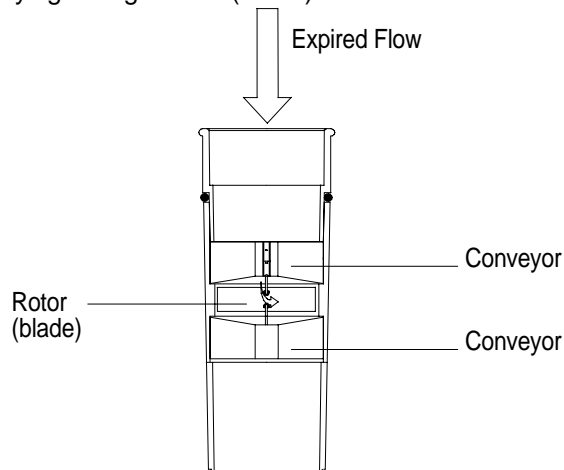
3.5.5. Warnings & Indications in Event of Failure.

- Printing Failure
- Paper jam during Printing
- No Printout

3.6. Opto Electronic Assembly(C00095-01-05)

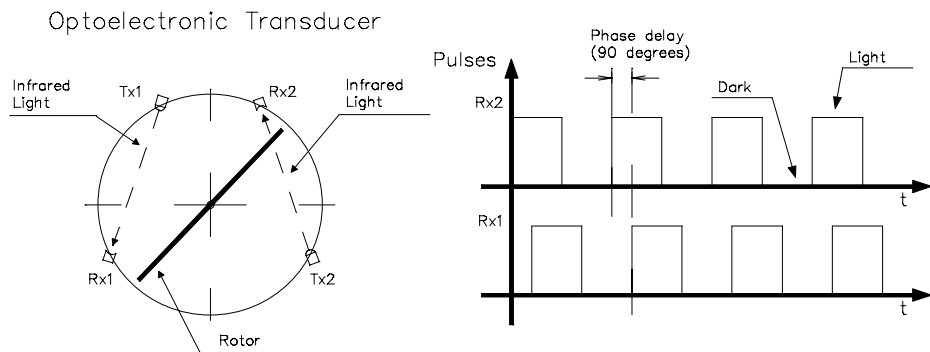
3.6.1. Function

The flow meter is composed by a Bi-directional turbine and an Optoelectronic transducer. The Turbine is made of (see figure) a transparent tube with two helical conveyors to which is fixed (rotating free) a very lightweight rotor (blade).



3.6.2. Description

The Optoelectronic transducer contains 2 couples of Infrared Emitter/Receiver diodes to detect the position of the rotor. The air passing through the helical conveyors, takes a spiral motion which causes the rotation of the turbine rotor. The rolling blade interrupts the infrared light beamed by the diodes of the optoelectronic reader, each interruption represents half turn of the rotor, this is used to measure the number of turn in the time. There is a constant ratio due to software linearization between air passing through the turbine and number of turns. This allows for an accurate measurement of volume and flows. Refeto the electrical diagram and layout of the output signals from the infrared receivers D4 (Rx1) and D3 (Rx2) as shown following figure.



The flow and volume measurement is carried out as follows:

Volume It is proportional to the number of pulses detected by the receiver diode during expiration (expired volume) or inspiration (inspiratory volume);

Flow the absolute value of the flow (positive for both expiration and inspiration) is proportional to the inverse of the pulse width detected by the receiver diode;

IN/EX The flow direction is detected by verifying which pulse (rx1, rx2) is received first. The turbine doesn't need to be calibrated daily as it is not affected by pressure, humidity and temperature. The turbine should be maintained with regular ordinary sterilization to move freely without friction, free of dust.

3.6.3. Adjustment & checks

There are no adjustments to be performed on this assembly.

3.6.4. Assembly Drawing (Refer to Section: Schematics & Layouts)

3.6.5. Warnings & Indications in Event of Failure.

- Flow and Volume errors

3.7. Battery Charger (C00766-01-30) (C00767-01-30)

3.7.1. Function

The Battery charger of the Pony graphic supplies power to the Battery charging circuit (see Mother Board).

Two models are available depending of the country where you purchased the system:

Pony graphic AC/DC adapter 220V 12V 1A P/N: C00766-01-30

Pony graphic AC/DC adapter 110V 12V 1A P/N: C00767-01-30

3.7.2. Description

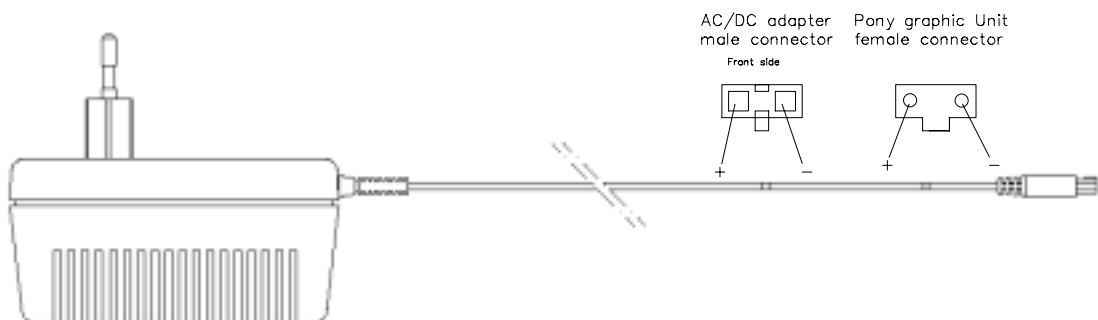
The battery charger is a classified Class II equipment according to "IEC 601-1: 1990: Safety of medical electrical equipment "General requirements"

The diagram in assembly drawing shows the polarity of the connections between the Pony graphic Unit and the AC/DC adapter.

3.7.3. Adjustments & checks

There is no adjustment to be performed on this assembly

3.7.4. Assembly Drawing



3.7.5. Warnings & Indications in Event of Failure.

- Power failure
- Battery charging failure.

4.	UNIT MAINTENANCE AND CONSUMABLE REPLACEMENT	4.2
4.1.	<i>Operator Maintenance Program</i>	4.2
4.2.	<i>Replacement Schedule</i>	4.2
4.3.	<i>Preventive Maintenance.....</i>	4.4
4.3.1.	<i>Necessary tools</i>	4.4
4.3.2.	<i>Charger cable A381-003-202:</i>	4.4
4.3.3.	<i>RS232 serial cable C00032-01-12:</i>	4.4
4.3.4.	<i>Turbine C00292-01-05:</i>	4.4
4.3.5.	<i>Optoelectronic reader C00095-01-05:</i>	4.4
4.3.6.	<i>Pony graphic unit.....</i>	4.4

4. UNIT MAINTENANCE AND CONSUMABLE REPLACEMENT

4.1. Operator Maintenance Program

The following log is recommended to be maintained by the user or by operator on daily /Weekly basis

General Precautions

- DO NOT autoclave, gas sterilize or immerse the electrical parts of the in liquid.
- The person operating the Pony graphic should not perform any servicing except as specifically stated in the Pony graphic User's Manual.
- If the Pony graphic fails to respond as described, DO NOT use it until you have corrected the situation. Refer to the trouble-shooting section of this manual for more detailed discussion.
- Always turn the PONY graphic off before cleaning or servicing.
- DO NOT immerse any electrical part (i.e. Optoelectronic transducer) in water or any liquid.
- DO NOT touch any exposed wiring or conductive surface while the cover is off and the system is running if using a grounding wrist strap.
- Use insulated tools when touching the components of the PCBs.
- Electrostatic Discharge through the PCBs will damage the components of the system. Handle all circuit boards (replacements and defectives) by their non conductive edges and use anti-static containers when transporting them. Before servicing the equipment, ground yourself and the tool to discharge any accumulated static charge by wearing a static control wrist strap.
- Check Power Supply Adapter voltage before connecting the AC main power.
- Replace fuses ONLY with the same type and rating ones.

THINGS TO DO	DAILY	WEEKLY	MONTHLY
General			
Clean & disinfect Turbine			√
Charge batteries	√		
Clean the Unit			√
(Follow Instructions in Users Manual for cleaning of the unit & Turbine. Refer the Pony graphic User's Manual for cleaning instructions)			
Checks			
Check display	√		
Check Display backlight	√		
Check Cables (power, flow meter)		√	
Check battery status using the charger	√		
Calibration			
Carry out Turbine calibration	√		

4.2. Replacement Schedule

The replacement of parts should be followed for smooth functioning of the system.

THINGS TO DO	DAILY	MONTHLY	HALF YEAR	YEARLY
Replace Internal Rechargeable batteries				(Every 2 years)
(For replacement of the batteries follow the service procedure section of this manual)				
Refer Users manual for details on maintenance.				
For any replacement of accessories please refer operators manual.				
For any procedure for replacement of consumables refer section on Service procedures				
Service Manual Ponygraphic	Chapter 4	Maintenance	4.2	

The part numbers are as given in the parts list section (Appendix A) of this manual.

4.3. Preventive Maintenance.

(Preventive maintenance is to be carried out by the COSMED authorized personnel only.)

Important note : the preventive maintenance procedure must be performed only using original parts of the standard packaging of each equipment

4.3.1. Necessary tools

Besides tools normally used by a technician, it is necessary to have:

Calibration syringe 3 L (C00243-01-06)

Voltmeter

Oscilloscope (20MHz Bandwidth)

The Engineer attending the preventive maintenance schedule must follow the guidelines given below

General checks.

4.3.2. Charger cable

A381-003-202:

Check the integrity of the cable especially on the plugs at the ends and verify with a voltmeter the absence of electrical short circuit on it.

4.3.3. RS232 serial cable

C00032-01-12:

Check the integrity of the cable especially on the plugs at the ends. Check electrically the cable by using a ohm meter for continuity check.

4.3.4. Turbine

C00292-01-05:

Check the integrity of the external transparent tube of the turbine. Verify that the rotor moves freely without friction and that the turbine is clean.

4.3.5. Optoelectronic reader

C00095-01-05:

Check for any physical damage to the turbine or surface. Check the integrity of the cable especially on the plug at the end.

4.3.6. Pony graphic unit

Check the batteries using voltmeter, for replacement follow service procedure section of this manual. Check the Display for proper brightness and contrast, if found faulty follow the service procedure section for replacement of the display. Check the printer for by carrying a test and then printing the data on the printer with flow and volume curves.

The above ensure the complete check of the unit

5.	TROUBLESHOOTING	5.2
5.1.	<i>Careless mistakes during the use of the system</i>	5.3
5.1.1.	<i>Warning</i>	5.3
5.1.2.	<i>Tools</i>	5.3
5.1.3.	<i>The system doesn't operate when switched on;</i>	5.3
5.1.4.	<i>The printer doesn't work properly;</i>	5.4
5.1.5.	<i>The Pony graphic is unable to measure properly flow and volume;.....</i>	5.4
5.1.6.	<i>The Optoelectronic transducer doesn't work;</i>	5.4
5.1.7.	<i>The batteries cannot be recharged or the green led remains off;</i>	5.4
5.1.8.	<i>Serial Communication error.....</i>	5.5
5.1.9.	<i>The keyboard doesn't work</i>	5.5
5.1.10.	<i>The LCD Display back-light doesn't work</i>	5.5

5. TROUBLESHOOTING

The following list is an extension of the troubleshooting section outlined in the operator's manual. The reader should familiarize with the setup, operation and troubleshooting sections of the operators manual before attempting to service the unit.

This section deals with the following problems and their recommended solutions

- The system does not operate when switched ON.
- The Printer does not work properly.
- The Pony graphic is unable to measure properly flow and volume.
- The optoelectronic transducer does not work.
- The batteries cannot be recharged or green LED remains OFF.
- Serial Communication Error.
- The Keyboard does not work
- The LCD Display backlight does not work.

Note:

It is very important while diagnosing problem to look at the non-instrumental aspects of troubleshooting. This will save time and efforts for reaching to the correct solution

Please ensure the following before opening the instrument.

- There are no operator level problems.
- There are no environmental problems.

GENERAL

5.1. Careless mistakes during the use of the system

Effects: malfunction of the equipment or unreliable measurements.

While doing a test, ensure that the right height and weight are entered for the subject and desired predicted values are selected. Ensure proper procedure for doing the test as instructed in the User manual.

5.1.1. Warning

This chapter contains the indications useful to find out and repair most of the possible troubles of the Pony graphic. Pay attention to the version of the Pony graphic Unit you are repairing before following the Trouble-shooting indications (see next paragraph).

Before implementing this chapter it is strongly recommended to read the "Functional Description" chapter of this manual.

Before trying to solve the trouble, be sure that the battery is charged and the system is in a steady condition. If the system indicates any malfunction or precautionary messages on the Display find out the source of error, rectify it and then only proceed with the test.

5.1.2. Tools

Besides the tools normally used by a technician, it is necessary to have:

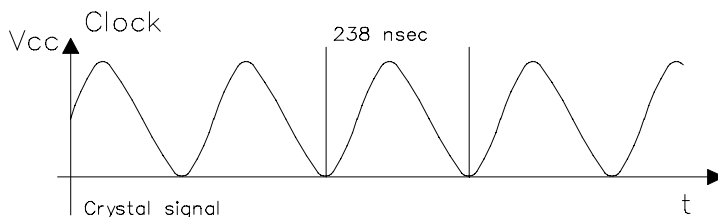
A Voltmeter to measure voltage.

A screwdriver with a thin point, to adjust the trimmer

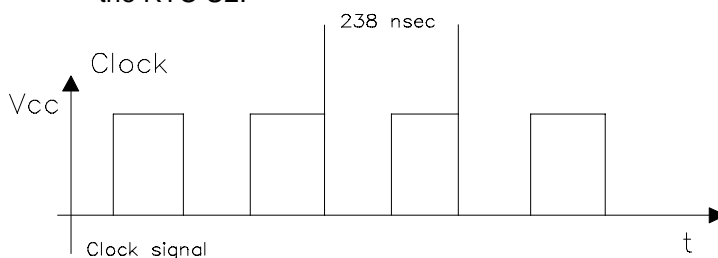
5.1.3. The system doesn't operate when switched on;

Reference Layouts: mother board P/N: C01350-01-15

1. Turn-off the instrument, connect the AC/DC adapter to the Pony graphic Unit and verify if the green led is on otherwise proceed from to "The batteries cannot be recharged or the green led is off" item.
2. Recharge completely the batteries and remove the rear panel.
3. Turn on the Pony graphic Unit and verify if the voltage of pin 1 of U1 is about 5 Volts, otherwise proceed from to "The batteries cannot be recharged or the green led is off" item.
4. Turn off the instrument and verify if voltage on pin 6 of U13 is about 5 Volt (RAM disabled) otherwise replace U13.5.
5. Verify if the signal on pin 3 of U2 is the same as the following figure



6. otherwise replace X1 (crystal 4.194.304 MHz).
7. Verify if the signal on pin 39 of U1 is the same as the following figure otherwise replace the RTC U2.



8. Verify if the frequency of the squared waveform on pin 3 of U1 is about 839 KHz otherwise replace U1.
9. Verify if after the replacement of the EPROM U4, the RAM U3 and the FPGA U9 the unit works otherwise contact COSMED.

5.1.4. The printer doesn't work properly;

Reference Layouts: mother board

P/N: C01350-01-15

1. Turn off the Pony graphic, remove the printer cover and verify that the paper is jam;
2. Verify if the batteries voltage is between 5.0 and 6.2 volt otherwise recharge the instrument.
3. Verify transistors Q1, Q2, Q3 and Q6 and eventually replace the broken ones.
4. Verify if after the replacement of the components U5, U6, U7 and U9 the unit works otherwise replace the printer.

5.1.5. The Pony graphic is unable to measure properly flow and volume;

Reference Layouts: mother board

P/N: C01350-01-15

1. Take off the turbine from the Optoelectronic Transducer and verify that the rolling blade is clean from dust, hairs or any external agent, otherwise refer to the "Pony graphic User's Manual" for cleaning procedures.
2. Blow gently into the turbine and verify if the rolling blade moves freely otherwise replace the turbine itself.
3. Verify that the turbine is inserted completely into the Optoelectronic transducer (an incomplete insertion doesn't allow the photo diodes to work properly).
4. Verify that the connector of the Optoelectronic Transducer is properly inserted in its plug.
5. Open the above-mentioned connector and verify the integrity of the contacts (See Appendix/Optoelectronic Transducer).
6. Perform any test (FVC, VC or MVV) and verify if the pin 10 of U1 is high (NOTE the enable signal remains high for only 5 seconds if no flow is detected), otherwise replace U1.
7. Perform any test and verify if pin 1 of the Optoelectronic Transducer connector J5 is about 5 Volts otherwise control L6, L7, L8 and Q4 (photo diodes power supply)
8. Perform any test and, blowing into the turbine flowmeter, verify if both signals on pin 2 and pin 3 of J5 are similar to the following figure: otherwise refer to the "The Optoelectronic transducer doesn't work" section below;

5.1.6. The Optoelectronic transducer doesn't work;

Reference Layouts: Optoelectronic Transducer Board

P/N: C00609-01-15;

1. Disassemble the Optoelectronic Transducer in order to access the internal PCB. Run the flow acquisition by pressing FVC, VC or MVV (NOTE the circuitry is powered for only 5 seconds if no flow is detected).
2. Verify if the voltage of pin E1 is about 5 Volt otherwise check the cable connections.
3. Verify if the voltage of the infrared emitters D1 and D2 is about 1.3 Volt and eventually replace the PCB.
4. Verify if voltage of the infrared emitter E2 and E3 (without turbine) is about 5 Volt or eventually replace optoelectronic reader (only PCB is not sold due to alignment problems)

5.1.7. The batteries cannot be recharged or the green led remains off;

Reference Layouts: mother board

P/N: C01350-01-15

1. Connect the AC/DC adapter to the main supply and verify if the output voltage is about 20 Volt DC otherwise verify the wire connection inside the adapter or replace it.
2. Connect the AC/DC adapter to the Pony graphic and verify if the green led is on
3. Open J8 on the mother board and connect (series) to its pins a multimeter in order to check the charging current (about 800 mA) (if the charging current is correct and the voltage of the batteries remains lower than 5 Volt, the batteries must be replaced).
4. Verify and eventually replace F1 (1.5 A).
5. Verify the contacts of the connections between the mother board and the power supply board.
6. Verify if the thermistor RV1 is properly soldered to the mother board;. Even if this is not visible, the impurities may reduce capacity of the sampling line to de-humid saturate the humidity elimination capacity.

5.1.8. Serial Communication error

Reference Layouts: mother board P/N: C01350-01-15.

1. Verify if the serial cable is connected to the port configured on the PC software.
2. Open the 2 connectors of the serial cable and verify if the wires are properly connected to the relative pins.
3. Replace iteratively the following components: U11, U1, U9

5.1.9. The keyboard doesn't work

1. Disassemble the Pony graphic Unit and verify if the keyboard PCB is properly connected to the mother board.
2. Replace U1.

5.1.10. The LCD Display back-light doesn't work

Reference Layouts: mother board

P/N: C01350-01-15

1. Note: the LCD back-light is automatically switched off during printing and one minute later last key is pressed.
2. Turn on the Pony graphic and verify if pin 11 of U1 is about 5 Volt otherwise replace U1.
3. Verify if the voltage between pin 2 and 3 of J3 is 90 VAC otherwise replace T1.

6. Service Procedures.....	6.2
6.1. Consumable Replacement.....	6.2
6.1.1. <i>Disassembling the Pony graphic</i>	6.2
6.1.2. <i>Replacing the internal Rechargeable batteries</i>	6.3
6.2. Electronics.....	6.3
6.2.1. <i>Display contrast Adjustment.....</i>	6.3
6.2.2. <i>Flow measurement Check and Calibration</i>	6.4
6.3. Auto Test Mode.....	6.4
6.3.1. <i>Running the Auto-test program</i>	6.4
6.3.2. <i>Operating the interactive Diagnosis Program.....</i>	6.5
6.4. Connecting to External Printer.....	6.5
6.4.1. <i>External printer: features and connections.....</i>	6.5
6.4.2. <i>Main features of the test report.....</i>	6.5
6.4.3. <i>Configuration of the printer.....</i>	6.6
6.4.4. <i>Configuration of the Pony Graphic</i>	6.6

6. Service Procedures.

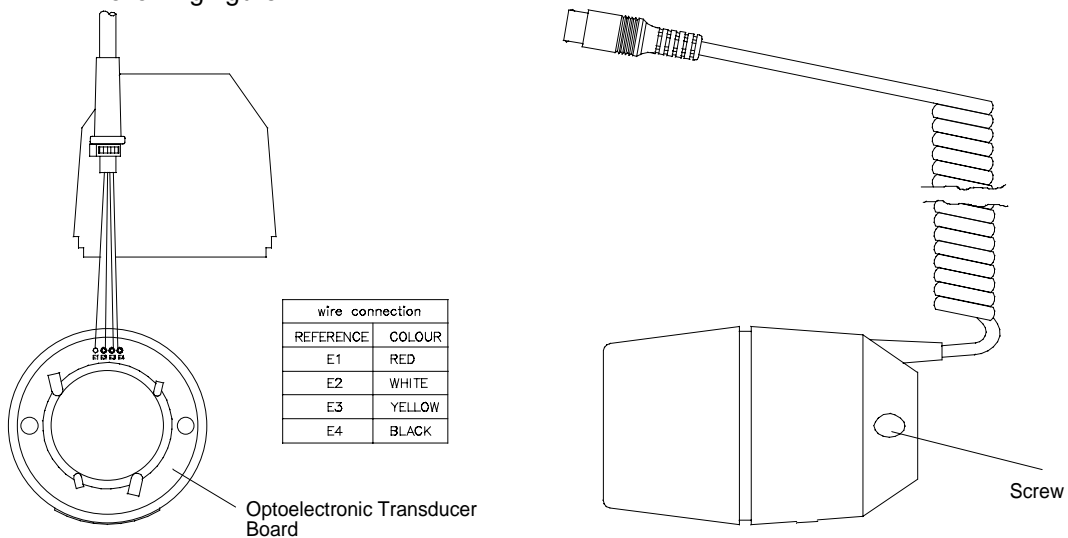
6.1. Consumable Replacement

6.1.1. Disassembling the Pony graphic

It is necessary to open the unit for repair and adjustment , the procedure described below deals with the disassembling of the pony graphic unit.

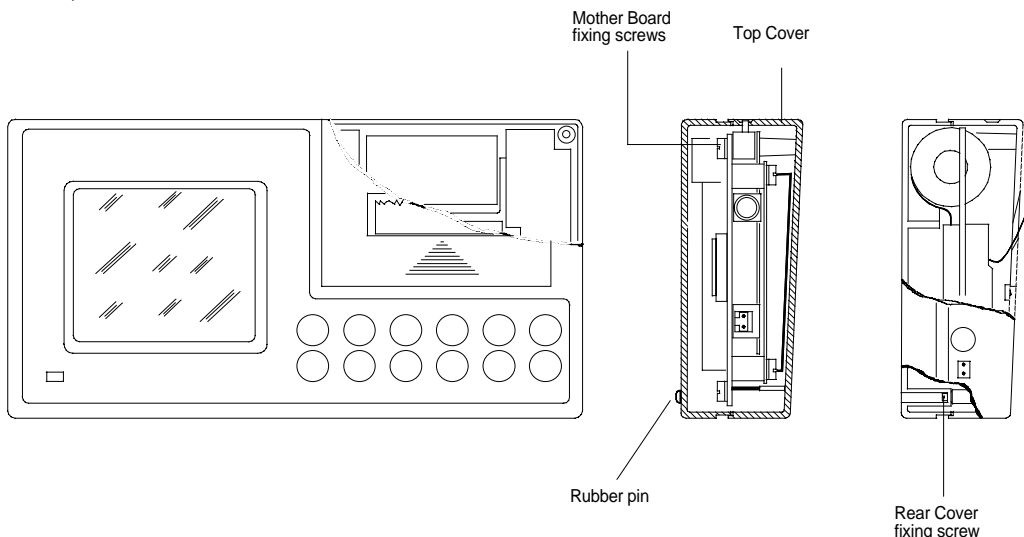
(1) Flow meter

1. Remove the Turbine from the Optoelectronic Transducer as described in the Pony graphic User's Manual.
2. Remove the 2 screws and open the cases to access the internal parts as shown in the following figure.



(2) Pony graphic unit

Remove the 4 rubber pins from the bottom of the Unit, take off the 4 screws and open the cover;



After removing the Rear cover you may remove the following sub-assemblies:

- Mother Board fixed with 4 screws to the top cover;
- Keyboard fixed with 2 screws to the top cover;
- [Power Supply Board fixed to the Mother Board];
- Printer fixed to the Mother Board;
- LCD Display fixed to the Mother Board

6.1.2. Replacing the internal Rechargeable batteries

The Pony graphic Unit is supplied by 2 rechargeable Nickel Cadmium Batteries (2.4 Volt, 1200 mAh), soldered to the mother board.

The life duration of the batteries depends strongly from how they are used (frequent charges and discharges stress the elements). When you verify that the autonomy of the system is unacceptably reduced (this can occur normally in 2 years), it is time to replace the batteries.

Procedure

1. Be sure that the Pony graphic is off.
2. Open the rear panel of the Pony graphic as the described in the chapter "Disassembling the Pony graphic - Pony graphic Unit".
3. Disassemble the Mother board from the front case (4 screws fixes the PCB to the plastic case).
4. Unsolder the terminals of the batteries from the PCB and pull them out gently.
5. Place the new batteries paying attention to fix the thermistor on the older battery as found before the replacement.
6. Solder the connections of the batteries on the PCB.
7. Reassemble the Pony graphic unit.

Parts required

For the mentioned procedure you need the following items:

P/N Description

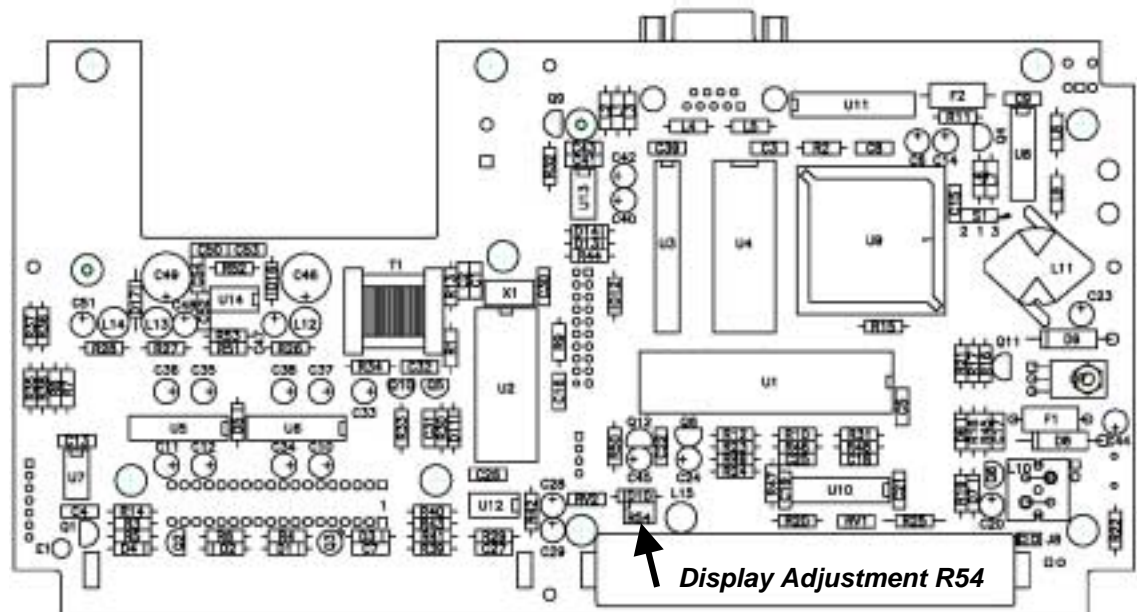
6.2. Electronics

6.2.1. Display contrast Adjustment

This is necessary when it is not possible to see any data on the display of pony graphic, one has to adjust the LCD contrast electronically.

Procedure

1. Switch off the Pony graphic and completely charge the batteries
2. Wait until the green led is blinking.
3. Wait for 20-30 minutes with the system off in order to bring the LCD display to the ambient temperature (the LCD contrast is compensated for the ambient temperature but, during recharging the sensor is affected by the heating of the batteries).
4. Open the rear panel of the Pony graphic as the described in the section "Disassembling the Pony graphic - Pony graphic Unit".

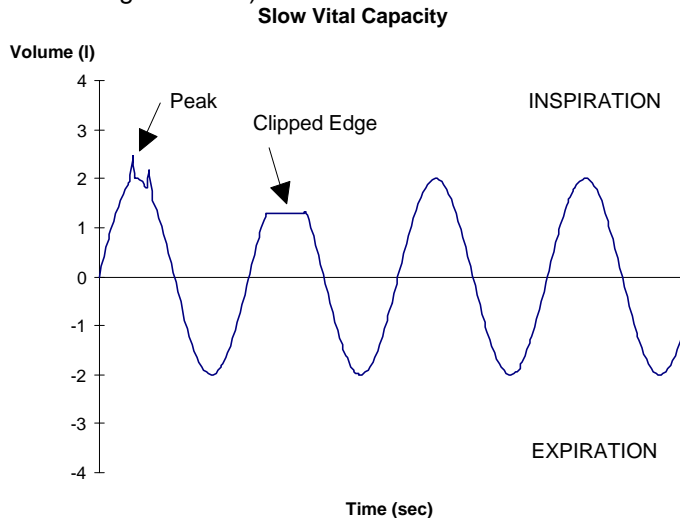


1. Turn on the Pony graphic and adjust the Contrast R54 trimmer until the contrast meets the requirement.
2. Reassemble the Pony graphic unit.

6.2.2. Flow measurement Check and Calibration

Carrying out a VC test and verifying the real-time curve displayed on the LCD screen can easily check the flow measurement. The flowmeter is working substantially properly if:

1. The volume/time curve follows the ventilatory pattern both during expiration (pixels drawn from up to down) and inspiration (pixels drawn from down to up).
2. The Volume/time curve is regular and doesn't present peaks or clipped edges (see figure below)



For further information Refer to the Pony graphic User's Manual on "turbine calibration."

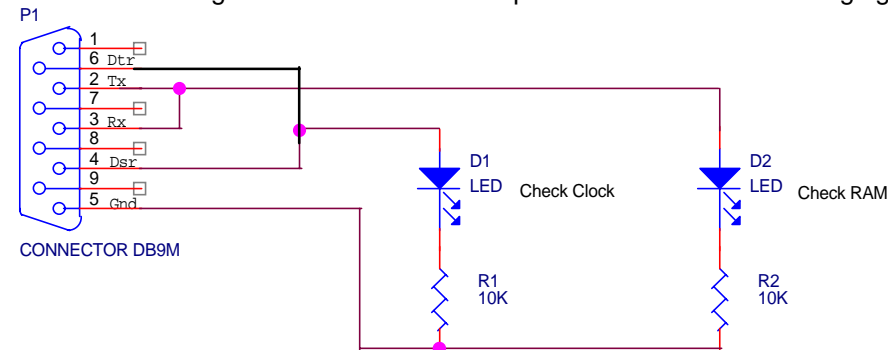
6.3. Auto Test Mode

Auto Test Mode

In the EPROM of the Pony graphic is stored an Auto-test program that is particularly useful to check eventual malfunctions of the main components.

The program can be activated by switching-on the Pony graphic Unit while a special adapter is connected to the RS232 port.

The electrical diagram of the Auto-test-adapter is shown in the following figure.



The adapter can be easily constructed or contact COSMED directly to procure it.

6.3.1. Running the Auto-test program

1. Switch off the Pony graphic Unit
2. Insert the Auto-test Adapter in the serial port of the instrument
3. Switch on the Pony graphic and verify the LEDs on the Auto-test adapter

The Pony graphic Unit runs a self-test routine in order to verify the integrity of the

- Serial Communication,
- RAM access and
- The clock function

The results of these tests are prompted with glowing of the 2 LEDs of the Auto-test Adapter (refer to the electrical diagram above reported):

D2 switched on Serial Communication OK

D2 is switched OFF RAM Access OK

Test menu is prompted on the display CLOCK Functions OK.

6.3.2. Operating the interactive Diagnosis Program

Once the automatic Self-test has been completed, the interactive diagnosis program is run. The display of the Pony graphic prompts the following items:

1. Keyboard
2. Printer
3. Display
4. Low-Battery
5. Turbine

(1) Keyboard Check

- From the Program menu select item 1 to run the Keyboard control
- Press all the keyboard buttons in the following order.
- 1, 2, 3, 4, 5, 6, 7, 8, 9, 0, Enter, Cancel.

Whenever a malfunction of the keyboard is detected, an error message will be prompted.

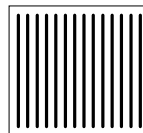
(2) Printer check

- From the Program menu select item 2 to run the Printer control
- Verify if the printout report is comparable with the following figure:



(3) Display Check

- From the Program menu select item 3 to run the Display control
- Verify if the image shown on the Display is comparable with the following figure with the back-light off:



Press any key and verify if the image shown on the Display is comparable with the above reported figure with the backlight on.

6.4. Connecting to External Printer

6.4.1. External printer: features and connections

The Pony Graphic version 3.0 (and higher) allows you to print the test report through the small dot matrix printer of the spirometer as well as through any printer (Laser or inkjet) which supports the HP PCL3 (or higher) language.

The data transmission passes through the serial port of the Pony Graphic using the same communication cable DB9M-DB9F supplied with the standard equipment (transmission data to PC) with the addition of an adapter (9M-25M non inverter).

If the printer does not have the serial interface, it is possible to use a common converter serial to-parallel or the Kit Serial to parallel converter for external printers P/N: C01391-01-11.

6.4.2. Main features of the test report

The test report shows the data (Forced Vital Capacity, Slow Expiratory Vital Capacity, Slow Inspiratory Vital Capacity, Maximum Voluntary Ventilation), curves Flow/volume and Volume/time relative to the Forced Vital Capacity.

All the information is printed on one sheet; the scales and the resolution of the graphs (F/V and V/t) are in compliance with the ATS 1987/1994 standards for the use "Validation & Hand Measurement".

Graphic F/V

	Flow (L/s)	Volume (L)
Range	-12*-120*8	
Resolution	5 mm/L/s	10 mm/L
Scale	2:1	1:2
Disposition	Upwards	Right

Graphic V/t

	Time (s)	Volume (L)
Range	0*8	0*8
Resolution	20 mm/s	10 mm/L
Disposition	Right	Upwards

6.4.3. Configuration of the printer

Attention: The Pony Graphic has to be configured correctly before connecting to the printer.

1. Check whether the printer supports the HP PCL3 (or Higher) language or following.
2. Use the user's manual of the printer in order to configure the following communication protocol:

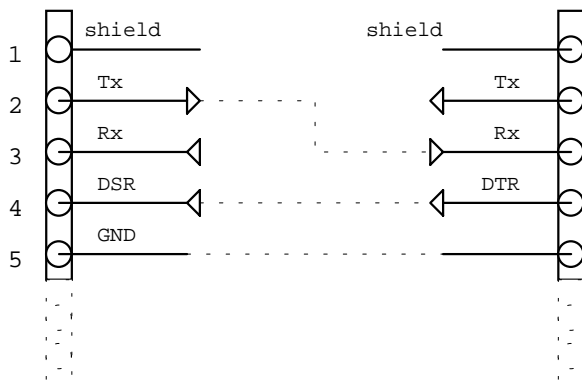
Number of bit	8
Parity	no
Rate (BAUD)	9600
Stop Bit	2
Handshake	DTR Hardware

Note : The paper size used should be European A4 (210 x 297 mm).

Pony-Printer connection

The electric diagram of the connection between the Pony Graphic and the printer is useful in case the printer has a serial connector which is not compatible with the adapter which is supplied with the equipment.

Pony Graphic (DB9F) Printer/Serial to parallel



6.4.4. Configuration of the Pony Graphic

1. Switch on the Pony Graphic and insert date
2. Choose "utility" (key 4)
3. Select "Configure" (key 6)
4. Select "PRINTER" (key 5) "PRINTER"
5. Make choice: 1 EXTERNAL, 2 INTERNAL

Note: the choice made remains memorized, also after the equipment has been switched off.

Printing procedure

The printing procedure is the same if one uses the internal conventional printer or the external printer; a detailed description of the print possibilities can be found in the user's manual

Before starting to print with the external printer it is necessary to check the following:

1. The communication cable and the adapter must both be connected correctly
2. The printer must be switched on

Before and during the process of data transmission, the Pony Graphic checks the correct connection with the printer, if the connection is not correct an error message will be prompted.

If you wish to interrupt the printing process press CANCEL.

Note: the external printer can only be used to print the test report; the other print-out (list test...) and possible messages (delete archive, calibration turbine...) can be printed only through the internal printer even if the external printer has been selected.

7.	SCHEMATICS AND LAYOUTS	7.2
7.1.1.	Motherboard (C01350-01-15).....	7.2
7.1.2.	Display (C01344-01-30)	7.2
7.1.3.	Key board PCB (C01352-01-15)	7.2
7.1.4.	Printer (C00551-01-08).....	7.2
7.1.5.	Optoelectronic Reader (C00095-01-05)	7.2
7.1.6.	Optoelectronic PCB (C00609-01-15)	7.2
7.1.7.	Adapter Plug for Car charging (C00297-01-12)	7.2
7.1.8.	Serial Cable (C00032-01-12).....	7.2

7. SCHEMATICS AND LAYOUTS

General

This Chapter provides the service personnel with information about the different Layouts, disassembling schematics and circuit diagrams of the Pony graphic.

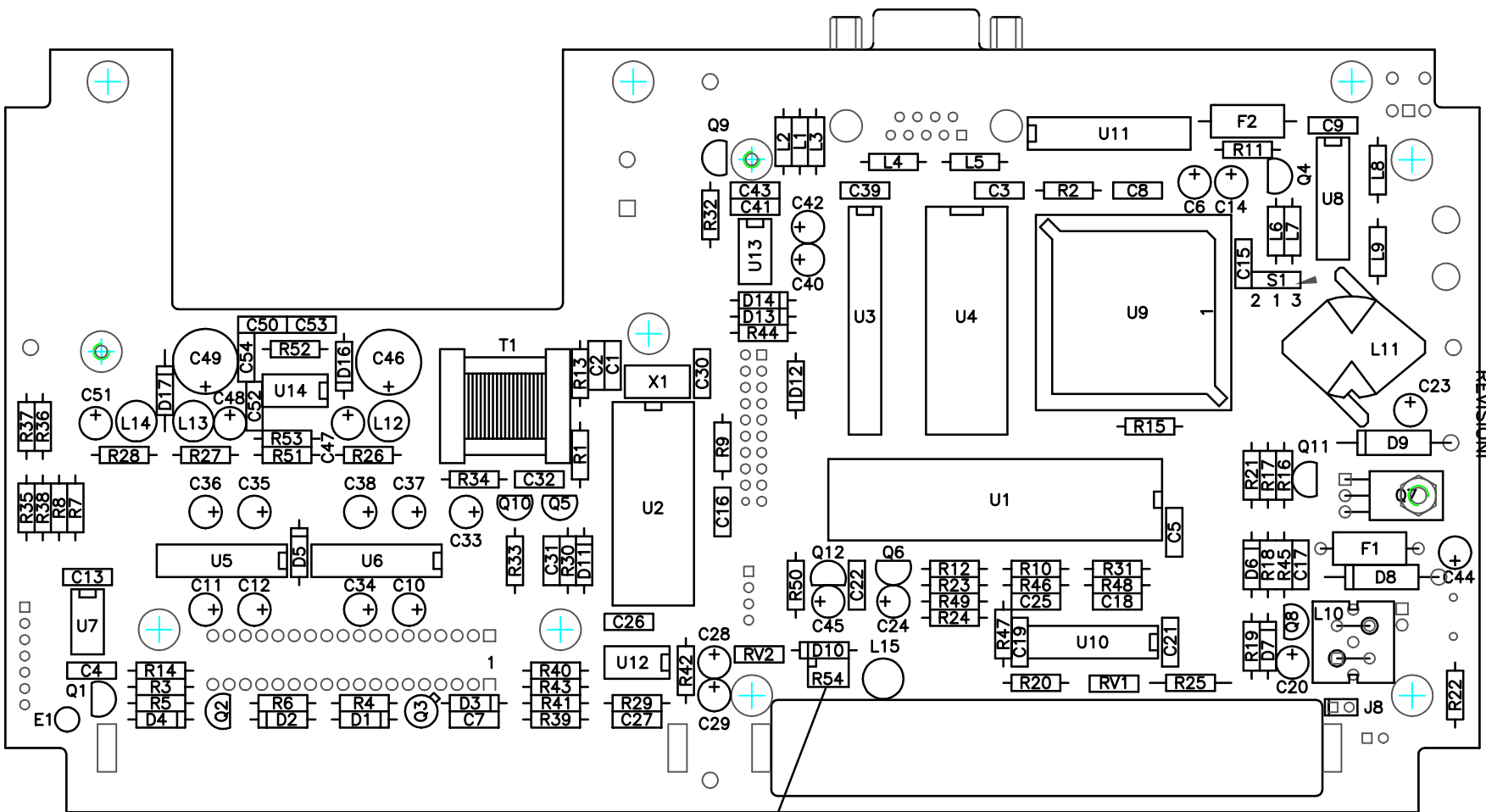
Before disassembling the unit please take care that all the transducers and cables are disconnected from the unit.

Remove the base cover by unscrewing the four screws at the base.

Schematic & Layouts

7.1.1. Motherboard	(C01350-01-15)
7.1.2. Display	(C01344-01-30)
7.1.3. Key board PCB	(C01352-01-15)
7.1.4. Printer	(C00551-01-08)
7.1.5. Optoelectronic Reader	(C00095-01-05)
7.1.6. Optoelectronic PCB	(C00609-01-15)
7.1.7. Adapter Plug for Car charging	(C00297-01-12)
7.1.8. Serial Cable	(C00032-01-12)

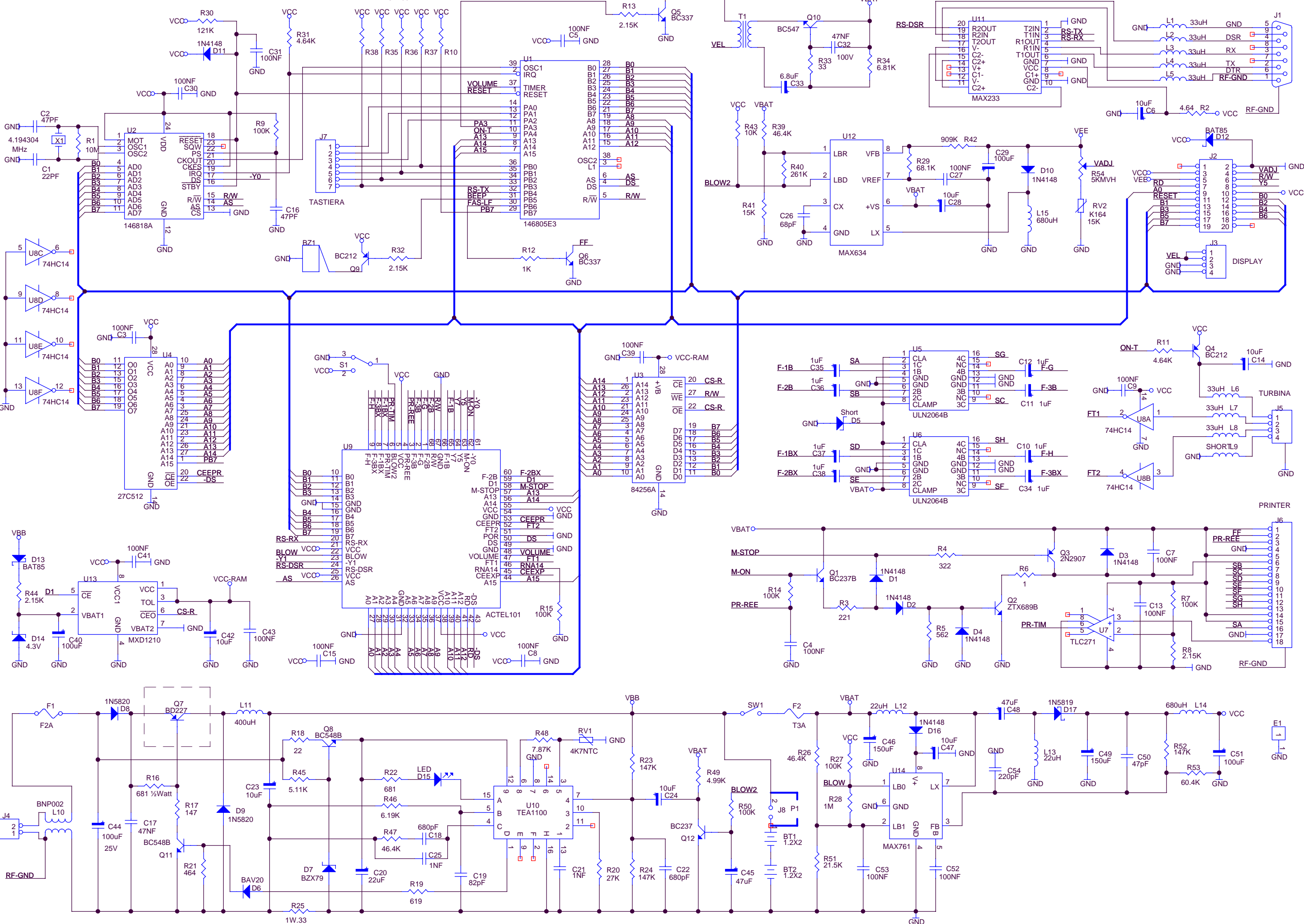
**IL PRESENTE DISEGNO E' DI PROPRIETA' DELLA SOC.
COSMED QUALSIASI SUO UTILIZZO DA PARTE DI
TERZI SENZA AUTORIZZAZIONE DELLA SOCIETA' SARA'
PERSEGUITO A TERMINI DI LEGGE.**

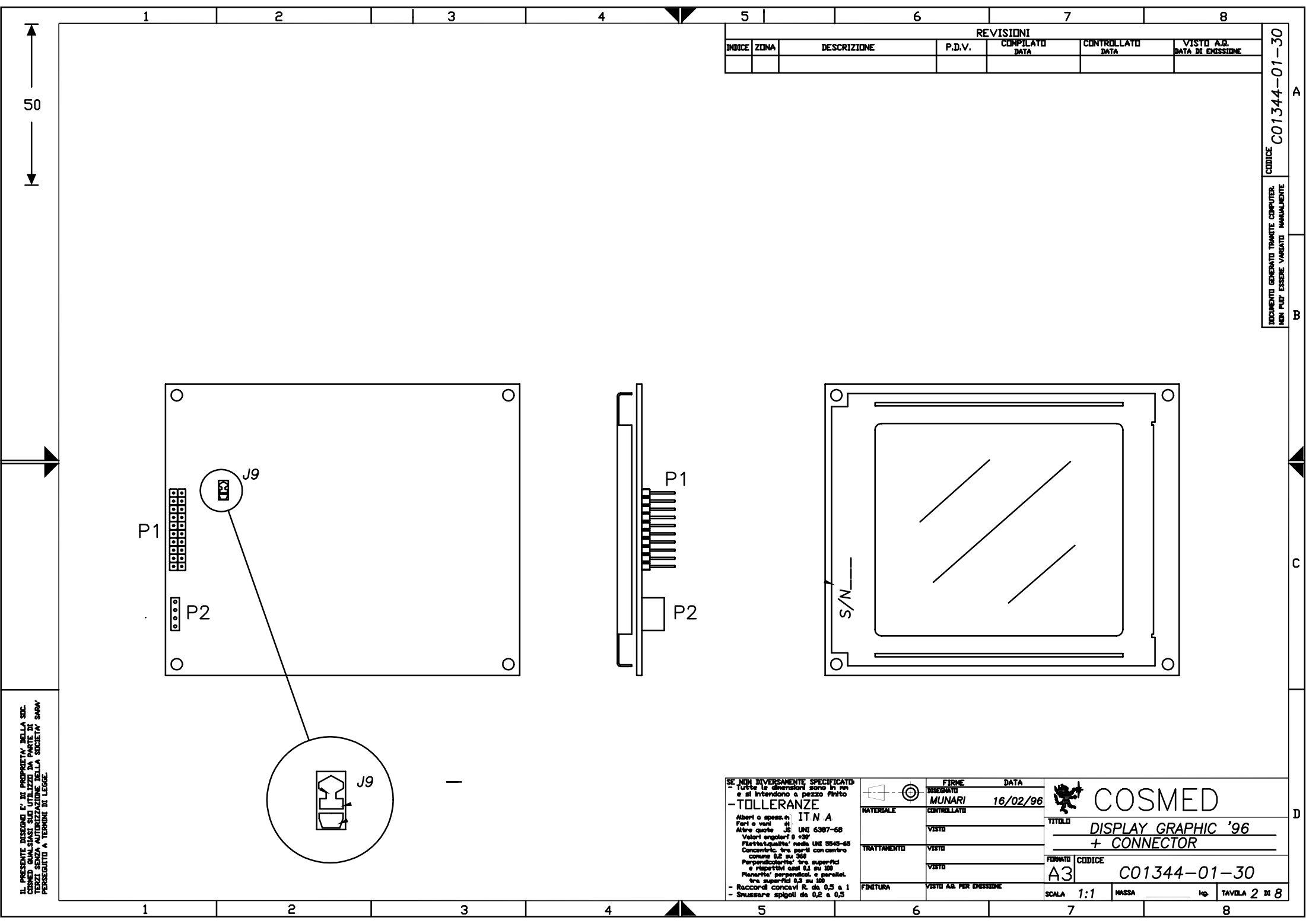


Display Adjustment R54

SE NON DIVERSAMENTE SPECIFICATO: - Tutte le dimensioni sono in mm - e si intendono a pezzo finito			
- TOLLERANZE			
Albeti o apesati: 3h IT Forti o veni 3H Altre quote JS UNI 6387-68 Voluti angolari 0° +30° Piatta, quella media UNI 5545-65 Conometrico, tra parti con centro comune 0,2 su 360° Perpendicolarità tra superfici e ipersuiciassi 0,1 su 100 Parallelismo tra superfici e ipersuiciassi 0,3 su 100 Tra superfici 0,3 su 100			
- Recordi concetti R ₁ da 0,5 a 1 - Smisurare spigoli da 0,2 a 0,5			
MATERIALI			
TRATTAMENTO		1 ^a EMISSIONE FIRME DATA	
VISTO		DISEGNATO	
ULTIMO SALVATAGGIO ESEGUITO DA:		CONTROLLATO	
FORMATO		CODICE	
A4		C01350-01-15	
SCALA 1:1		MASSA kg.	
TAVOLA 1		DI 8	

Tav.3 - Mother board: schematic






REVISIONI					
INDICE	ZONA	DESCRIZIONE	P.D.V.	COMPILATO DATA	CONTROLLATO DATA

CODICE C01344-01-30
DOCUMENTO GENERATO TRAMITE COMPUTER
NON PUO' ESSERE MODIFICATO MANUALMENTE

IL PRESENTE DISEGNO E' DI PROPRIETA' DELLA SOC.
COSMED QUALSIASI SUE UTILIZZI DA PARTE DI
TERZI SENZA AUTORIZZAZIONE DELLA SOCIETA' SARANNO
PERSEGUITI A TERMINI DI LEGGE.

SE NON DIVERSAMENTE SPECIFICATO
- Tutte le dimensioni sono in mm
e si intendono a pezzo finito
- TOLLERANZE
Alberi e spassi: IT N 6
Fori a viti: H7
Altre quote: JS
Valori angolari: 0 +30'
Finito/qualita' media UNE 3545-65
Concentricita' tra parti concentriche
comune 0,2 su 100
Perpendicolarita' tra superfici
e rispettivi assi 0,2 su 100
Parallelita' perpendicolarita' e parallelita'
tra superfici 0,2 su 100
- Raccordi concavi R da 0,5 a 1
- Smussare spigoli da 0,2 a 0,5

FIRMA	DATA
MUNARI	16/02/96
MATERIALE	
TRATTAMENTO	
FINITURA	

**COSMED**

TITOLO
DISPLAY GRAPHIC '96
+ CONNECTOR

FIRMA
A3

CODICE
C01344-01-30

SCALA
1:1

MASSA
kg

TAVOLA
2 di 8

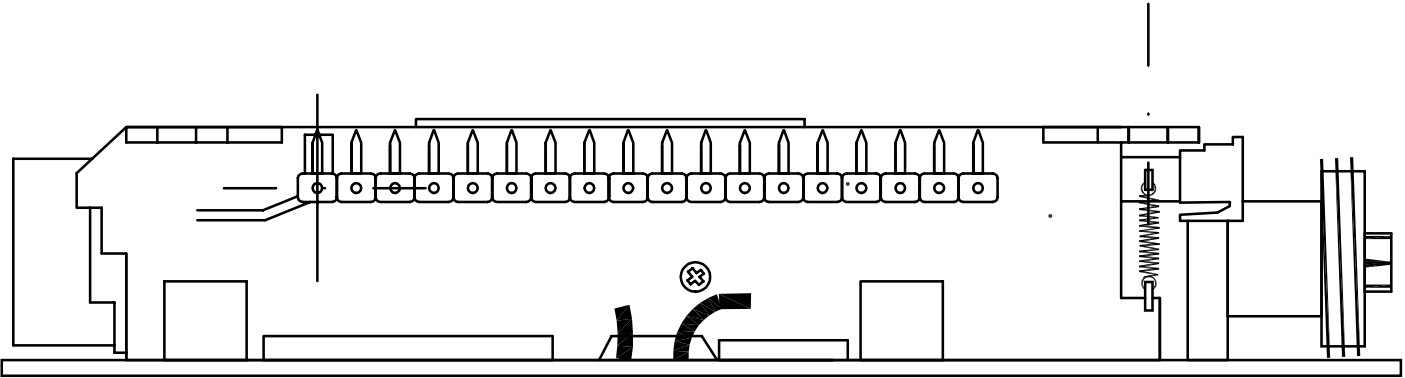
1		2		3		4	
INDICE		ZONA		DESCRIZIONE		P.D.V.	

REVISIONI			
COMPILATO	DATA	CONTROLLATO	DATA

VISTO A.G.	DATA DI EMISSIONE



50



DOCUMENTO GENERATO TRAMITE COMPUTER. NON PUO' ESSERE VARIATO MANUALMENTE	CODICE C00551-01-08
---	------------------------

IL PRESENTE DISEGNO E' DI PROPRIETA' DELLA SOC.
COSMED QUALSIASI SUO UTILIZZO DA PARTE DI
TERZI SENZA AUTORIZZAZIONE DELLA SOCIETA' SARA'
PERSEGUITO A TERMINI DI LEGGE.

SE NON DIVERSAMENTE SPECIFICATI,
tutte le dimensioni sono in mm
e si intendono a pezzo finito

- TOLLERANZE

- Alberti o spess. h1
- Fori o viti JS UNI 6387-68
- Altre quote JS UNI 6387-68
- Valori angolari 0 +30'
- Flettisqualita' media UNI 5945-65
- Concentric. tra parti con centro comune 0,2 su 360
- Perpendicolarita' tra superfici e rispettivi assi 0,1 su 100
- Planarita', perpendicol. e parallel.
- Raccordi concavi R. da 0,5 a 1
- Smussare spigoli da 0,2 a 0,5

FIRME	DATA
DISSEGNA MUNARI	10/04/95
CONTROLLATO	



COSMED

TITOLO
Printer Pony Graphic

FORMATO CODICE

A4

C00551-01-08

MATERIALE	TRATTAMENTO	FINITURA
	VISTO	VISTO A.G. PER EMISSIONE
	VISTO	

SCALA

2:1

MASSA

kg.

TAVOLA 4 DB

1

2

3

4

D

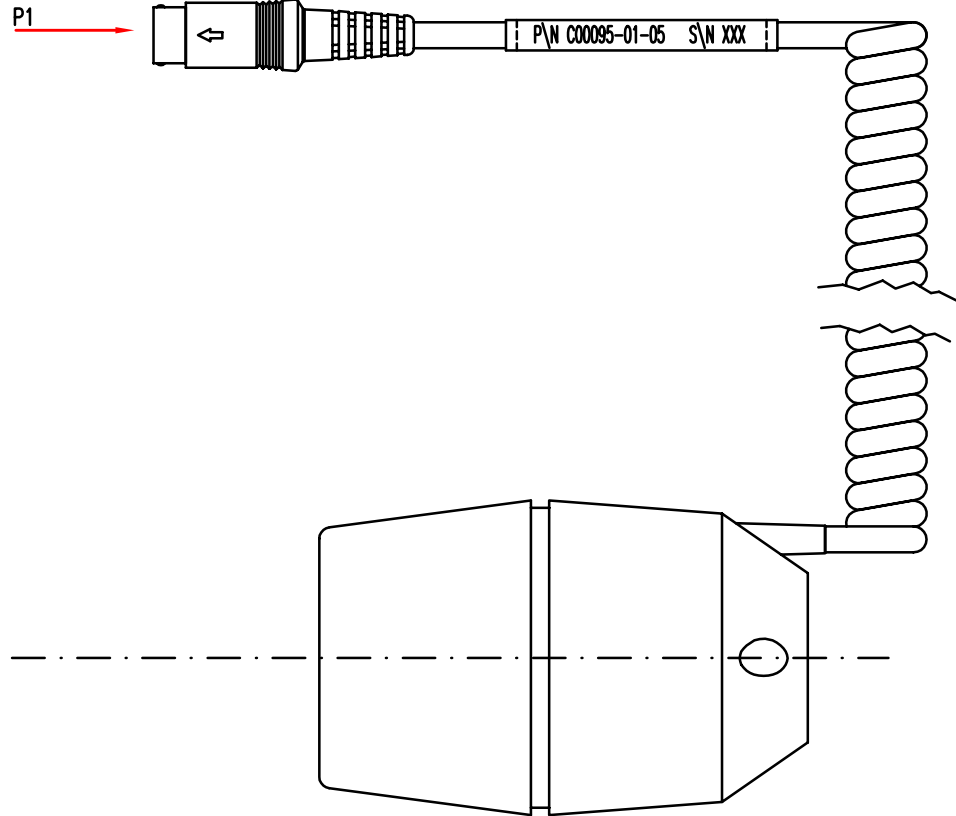
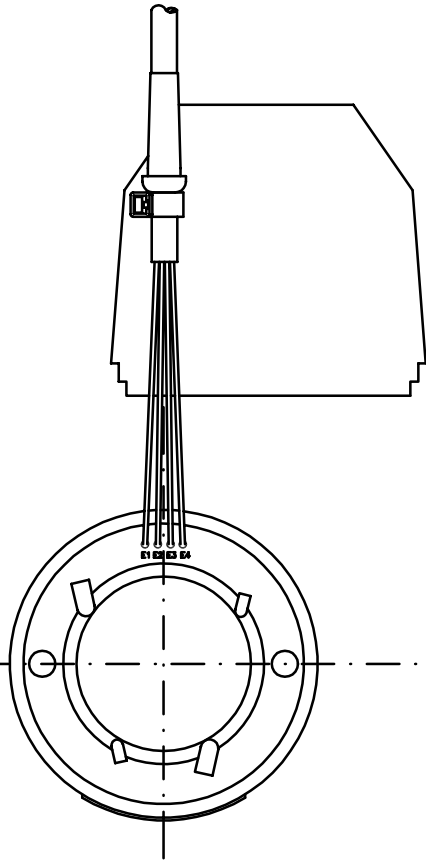
C

B

A

IL PRESENTE DISEGNO E' DI PROPRIETA' DELLA SOC
COSMED QUALSIASI SUO UTILIZZO DA PARTE DI
TERZI SENZA AUTORIZZAZIONE DELLA SOCIETA' SHAW
PESCHIERO A TERMINI DI LEGGE.

4	Black	E4
2	Yellow	E3
3	White	E2
1	Red	E1
P1	Color	Ref. 5
Legend		



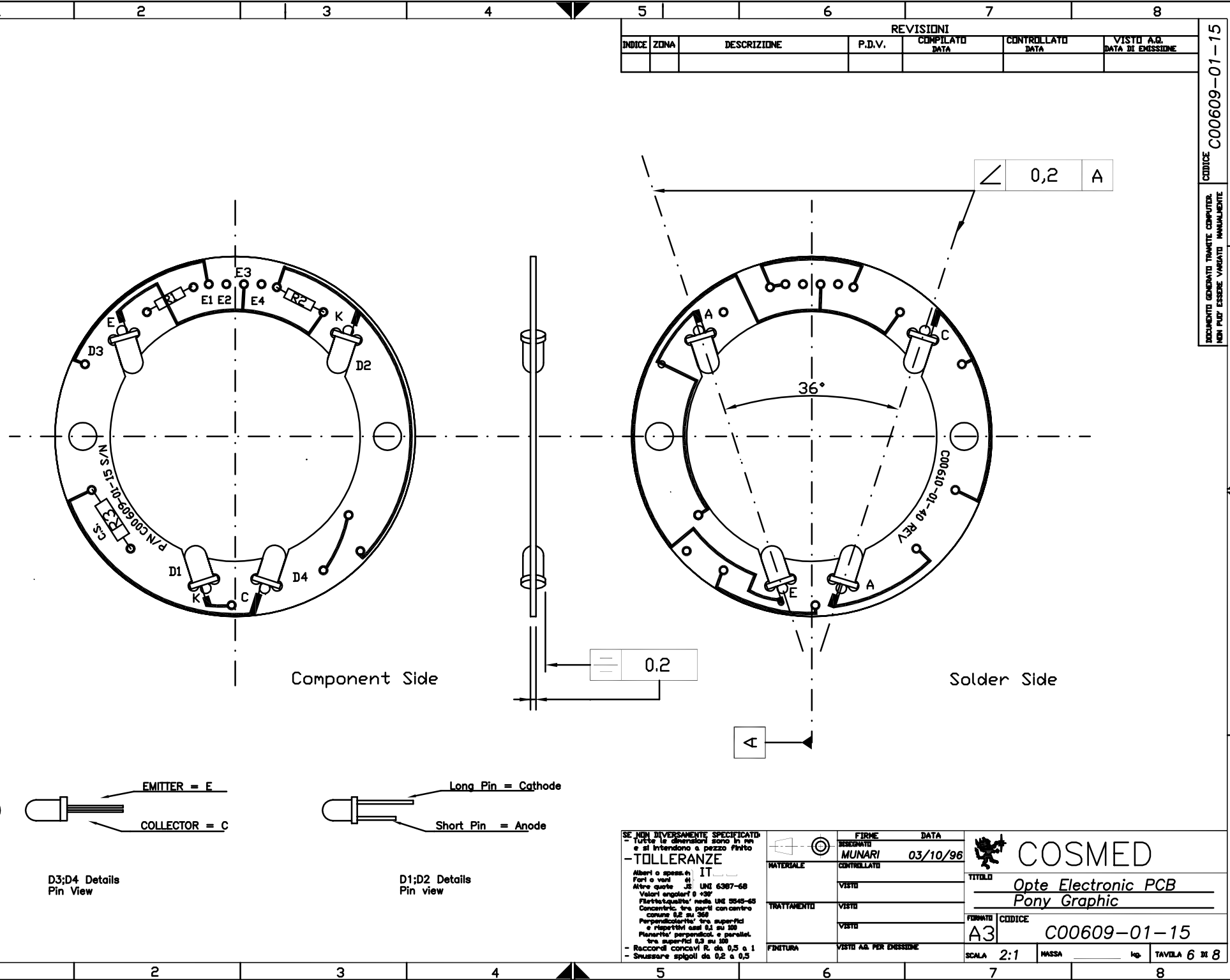
SE NON DIVERSAMENTE SPECIFICATO:
- tutte le dimensioni sono in mm
e si intendono a pezzo finito
- TOLLERANZE IT
Alberi e spassi: sh
Fori e viti: sh
Altre quote: sh UNI 6387-68
Valori angolari $\alpha \pm 30'$
Finitura: qualità media UNI 5545-65
Concentricità, tra parti con centro
comune 0,2 su 300
Perpendicolarità tra superfici
e rispettivi assi 0,1 su 100
Piani paralleli, e perpendi-
colari, tra superfici 0,3 su 100
- Raccordi concavi R. da 0,5 a 1
- Smussare spigoli da 0,2 a 0,5

	P EMISSIONE			TITOLO Optoelectronic Reader Pony Graphic			
	FIRME	DATA					
MATERIALE	DISEGNATO	30/01/98	C00095-01-05				
	CONTROLLATO						
TRATTAMENTO	VISTO	30/01/98	FORMATO CODICE				
	ULTIMO SALVATAGGIO ESEGUITO DA:						
FINITURA	CARMINE FINAMORE	07/07/98 11.11	A3 C00095-01-05				
	HOME FILE						
	C00095-01-05A	.DWG	SCALA	N A	MASSA		
			ing.		TAVOLA 5 DI 8		

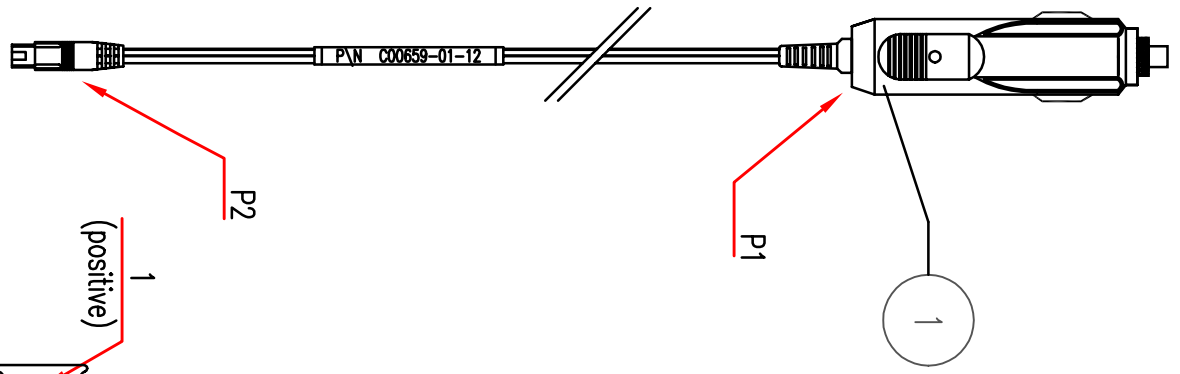
REVISIONI					
REV.	DESCRIZIONE	P.D.V.	DISEGNATO	DATA	CONTROLLATO
A	Spostata targhetta	840	Carmine Finamore	30/06/98	

CODICE C00095-01-05
DOCUMENTO GENERATO TRAMITE COMPUTER
NON PUO' ESSERE MODIFICATO MANUSCRITTO

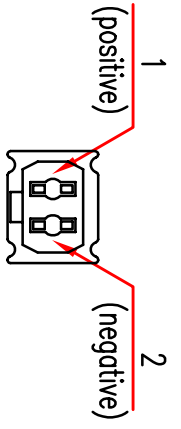
IL PRESENTE DISEGNO E' DI PROPRIETA' DELLA SOC.
COSMED ED E' SOTTO LICENZA D'USO. QUALSIASI
TERZO CHE UTILIZZI LA PARTE DI
QUESTO DISEGNO SENZA AUTORIZZAZIONE DELLA
COSMED SARANNO PERSEGUITI A TITOLO DI LEGGE.



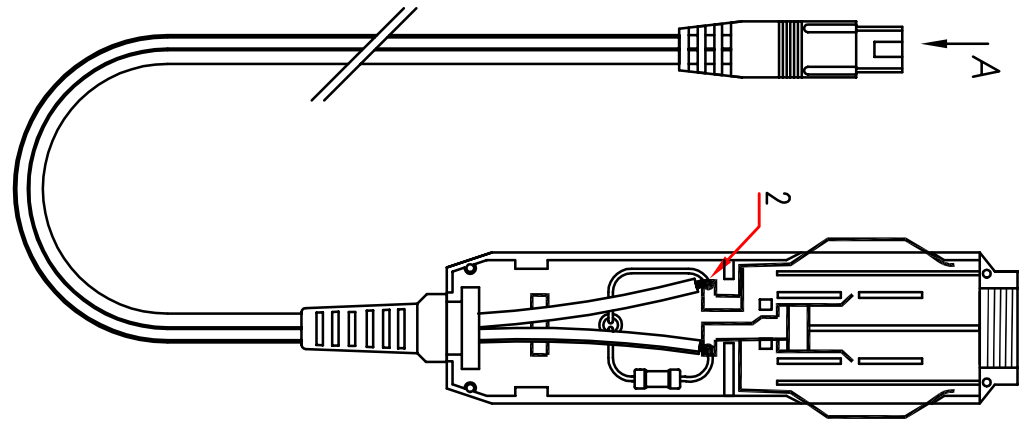
REVISIONI							
REV.	DESCRIZIONE	P.D.V.	DISEGNATO	DATA	CONTROLLATO	DATA	VISTO
/							



Scale 1:2



View A



DOCUMENTO GENERATO TRAMITE COMPUTER.
NON PUO' ESSERE VARIATO MANUALMENTE

CODICE C00659-01-12

2	Negative	2
1	Positive	1
P1	Signal	P2

Legend

SE NON DIMENSIONATE SPECIFICATO:
tutte le dimensioni sono in mm
e si intendono a pezzo finito

- TOLLERANZE
- Alberi o spere. in IT
- Fori o viti in UNI 6387-68
- Altre quote in UNI 5545-65
- Filettature in filetti con centro comune 0,2 su 360
- Perpendicolarita' tra superfici e rispettivi casi 0,1 su 100
- Planarita' perpendic. e parallel. tra superfici 0,3 su 100
- Raccordi concavi R. da 0,5 a 1
- Smussare spigoli da 0,2 a 0,5

MATERIALE	1° FIRME	EMMISSIONE	DATA
	DISEGNATO		
	CONTROLLATO		
	VISTO		
	ULTIMO SALVATAGGIO ESEGUITO DA:		

	TITOLO	
	Cigar Light Adapter	
	Pony Graphic	
	FORMATO	
	A4	
	CODICE	
	C00659-01-12	

	FINITURA		NOTE FILE		SCALA		MASSA		kg.		TAVOLA		DI	
1		2			3						4		7	8

IL PRESENTE DISEGNO E' DI PROPRIETA' DELLA SOC.
COSMED QUALSIASI SUO UTILIZZO DA PARTE DI
TERZI SENZA AUTORIZZAZIONE DELLA SOCIETA' SARA'
PERSEGUITO A TERMINI DI LEGGE.

REVISIONI						
REV.	DESCRIZIONE	P.D.V.	DISEGNATO	DATA	CONTROLLATO	DATA
				</		

8. **Appendix A: Replaceable Part List 8.2**

8. Appendix A: Replaceable Part List

P/N	Description
C01805-01-98	Adult Mouthpieces * 30 mm (500 pieces)
C01814-01-98	Pediatric mouthpieces * 22 mm (500 pieces)
C00214-01-20	Adapter for pediatric mouthpieces ID 22mm
C00063-01-20	Conic plastic mouthpiece
C00441-01-98	Nose clips (5 pieces)
A 666 905 001	Printer ribbon (5 pieces)
C00643-01-98	Printer paper (10 pieces)
C00600-01-11	Calibration syringe 3 liters
C00296-XX-91	Pony graphic User manual (XX:01=IT/02=EN/03=FR/ 04=ES/ 05=DE)
C00109-01-30	Carrying case Pony graphic
C00766-01-30	AC/DC adapter Pony graphic 220V
C00767-01-30	AC/DC adapter Pony graphic 110V
A 362 110 001	Plug + cable x AC/DC adapter Pony graphic
C00297-01-12	Adapter plug for car charging Pony graphic
A 388 010 002	RS232 adapter for external printer (serial interface available)
C00032-01-12	Serial cable (D9M-D9F)
C01391-01-11	Kit Serial to parallel converter for external printers
C00095-01-05	Optoelectronic transducer Pony graphic
C00213-01-12	Cable+plug x Optoelectronic transducer Pony graphic
C00121-XX-31	Eprom Pony graphic (XX: 01=IT, 02=EN, 03=FR, 04=ES, 05=DE)
C01339-XX-31	Eprom Spirotur 610 (XX: 02=EN, 03=FR, 04=ES, 05=DE)
C00187-XX-31	Eprom Discovery graphic (XX: 02=EN, 03=FR, 04=ES)
C00292-01-05	Turbine Pony graphic
C00086-01-30	Display Pony graphic (before may 1996 models)
C01344-01-30	Display Pony graphic (after may 1996 models)
C00096-01-20	Film safe x Pony graphic display
C00551-01-08	Printer Pony graphic (after may 1996 models)
C01350-01-15	Mother Board Pony graphic (after may 1996 models)
C00087-01-15	Keyboard Pony graphic (Till may 1996 models)
C01352-01-15	Keyboard Pony graphic (after may 1996 models)
C00609-01-15	Optoelectronic transducer (Pony graphic) board
C00126-01-20	Top cover Pony graphic
C00089-01-92	Keyboard panel Pony graphic
C01338-01-92	Keyboard panel Spirotur 610
C01572-01-92	Keyboard panel Discovery graphic
C00126-01-08	Bottom cover Pony graphic
A 256 210 001	Rubber feet x bottom cover Pony graphic
A 410 700 004	Pony graphic Ni Cd batteries (1 of 2)