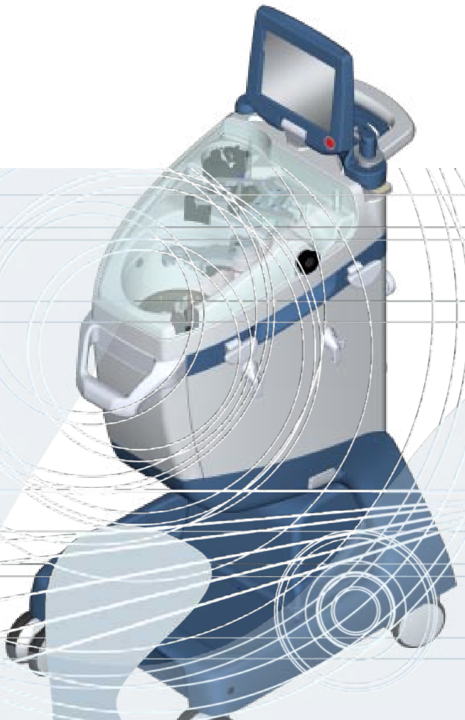
SORIN | XTRA®

Service Manual



Sorin|Xtra • Service Manual
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Strada Statale 12 Nord, 86
41037 Mirandola (MO)
Italy

Service Manual
Version 01/2010 - CODE 65600

1 INTRODUCTION rev.00

XTRA

Service Manual

Software Release 1.01

These instructions are intended for personnel responsible for repairs and/or maintenance of the SORIN GROUP XTRA Cell Separator for intra-operative auto-transfusion, and contain all the information necessary for this purpose.

WARNING! : **READ THE INSTRUCTIONS CAREFULLY PRIOR TO CARRYING OUT ANY MAINTENANCE AND/OR REPAIR OPERATION.**

Check on delivery that the unit outer container has not been damaged. If there are signs of deterioration, a formal complaint must be addressed to the transport agents at once. Check the unit carefully and ensure that there are no missing parts or visible signs of damage. Any complaint together with a detailed account of the problems discerned must be immediately communicated either to the local representative or directly to Sorin Group Italia, to the following address:

Sorin Group Italia s.r.l.
Via Statale 12 Nord, 86
41037 MIRANDOLA (MO) – Italy
Tel. +39/0535/29811 - Fax. +39/0535/25229

In this manual warnings and safety procedures have been highlighted as follows:

WARNING!: **IT INDICATES ANY KIND OF PRECAUTION TECHNICIAN MUST TAKE.**

1.1 Standards

XTRA complies with the following standards:

EMC Emission:
• EN 60601-1-2 : 2001 + A1: 2006
 – IEC 60601-1-2 : 2001 + A1: 2004

The standard above refers to the following basic standards:
• EN 61000-3-2 : 2006
 – IEC 61000-3-2 : 2005

Harmonic current emissions:
• EN 61000-3-3 : 1995 + A1: 2001 + A2: 2005
 – IEC 61000-3-3 : 1994 + A1: 2001 + A2: 2005

Voltage changes, voltage fluctuations and flicker:
• EN 55011 : 2007 + A2: 2007
• CISPR 11 (modified) : 2003 + A1: 2004 + A2: 2006
• VCCI V-3 : 2008
• CISPR 22 : 2006
• AS/NZS CISPR22 : 2006
• 47 CFR Part 15 Subpart B (FCC) : 2007
• ICES 003 :2 004

EMC Immunity:
• EN 60601-1-2 : 2001 + A1: 2006
 – IEC 60601-1-2 : 2001 + A1:2004

The standard above refers to the following basic standards:
• EN 61000-4-2 : 1995 + A1: 1998 + A2: 2001
 – IEC 61000-4-2 : 1995 + A1: 1998 + A2: 2000

Electrostatic discharge immunity test (ESD)
• EN61000-4-3 : 2006
 – IEC 610000-4-3 : 2006

Radiated, radio-frequency, electromagnetic field immunity test
• EN 61000-4-4 : 2004
 – IEC 61000-4-4 : 2004

Electrical fast transient/burst immunity test
• EN 61000-4-5 : 2006
 – IEC 61000-4-5 : 2005

Surge immunity test
• EN 61000-4-6 : 2007
 – IEC 61000-4-6 : 2006

Immunity to conducted disturbances, induced by radio-frequency fields
• EN 61000-4-8 : 1993 + A1: 2001

- IEC 61000-4-8 : 1993 + A1: 2000

Power frequency magnetic field immunity test
• EN 61000-4-11 : 2004
- IEC 61000-4-11 : 2004

Voltage clips, short interruptions and voltage variations immunity test

Electrical and Mechanical Safety Standards:
• IEC 60601-1 : 1988 + A1: 1991 + A2: 1995
• UL 60601-1 : 2003
• CAN/CSA-C22.2 No. 601.1-M90

Certification:
• C-US NRTL Certification

The Sorin Group Italia quality assurance system complies with the following standards:
• UNI - EN - ISO - 13485

Protection class: **I**

Electrical safety type: **B**

Drip proofing: **DRIP PROOF IPX1**

2 INDEX rev.00

Index rev.00

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3 GENERAL INSTRUCTIONS rev.00

Present Service Manual refers to:

- XTRA software rel. 1.01

It is structured in “cards”. Every card exhausts a subject about diagnostics, HW description, calibration procedure, etc.
It means that a card is a self-supporting unit and may be individually revised.

Each card has the following structure:

CARDNAME rev.00

the label *rev.00* indicates actual revision level for present card.

About this card

The purpose of this card is to describe the diagnostic’s functions ….
It is an “abstract” about present card.

Diagnostics

Diagnostics function allows the technician...
Here the card begins to treat of the subject.

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4 EQUIPMENT FEAUTURES

4.1 (FEAT_001) Technical Features Of The Equipment rev.00

4.1.1 About this card

The purpose of this card is to list technical features regarding XTRA.

4.1.2 Technical Features List

Equipment Dimensions:	Height = 660 mm (1055 mm*) – pole lowered; Height = 1585 mm (1980 mm*) – pole completely lifted; Height = 835 mm (1230 mm*) – display lifted; Width = 375 mm - including the eccentric rings; Width = 800 mm - with poles completely open; Depth = 500 mm - 680 mm including the front and rear handles. * = with cart.
Cart Dimensions:	Height = 500 mm; Width = 480 mm; Depth = 595 mm.
Unit weight:	37 Kg.
Cart weight:	22,5 Kg.
Display:	Type: graphic color LCD TFT 8.4” ; Dimensions: 172 mm x 130 mm (screen).
Keyboard:	1 STOP key; Touch screen keys.
Mains voltage (Power supply):	230 V~ or 100 ÷ 120 V~.
Frequency:	50 - 60 Hz.
Power absorption:	Maximum**:** 320VA (550VA w/ vacuum on Intra mode); Functioning: 160VA (390VA w/ vacuum on Intra mode).
Fuses:	2xT6.3 A.
Power cord:	Section = 3x1 mm^2 (3x18AWG); Length = 4 m.

(FEAT_001) Technical Features Of The Equipment rev.00

Cable / connection peripherals: Sorin Group Italia memory stick.

Socket on cords:	Type C13 (EN 60320/C13).
Plug on cords:	Type VII (CEE (7) VII); Type NEMA 5-15; Type BS89/10 (BS 1363/A); Type I/3 (CEI 23-16).
Unit electrical safety:	Class I, Type B (EN 60601-1);
Drip proofing:	IPX1.

4.2 (FEAT_002) Operating Features Of The Equipment rev.00

4.2.1 About this card

The purpose of this card is to list operating features regarding XTRA.

4.2.2 Operating Features List

Centrifuge speed:	Range: 1500 ÷ 5600 rpm (steps of 100 rpm); Accuracy: ± 50 rpm.
Peristaltic pump:	Range: 10 ÷100 ml/min (steps of 10 ml/min) and 25 ÷1000 ml/min (steps of 25 ml/min) – Preoperatively; 25 ÷1000 ml/min (steps 25 ml/min) – Intraoperatively and postoperatively. Accuracy: ± 8 ml/min at 150 ml/min.
Scale:	Capacity: 0 ÷ 5000 g; Accuracy: ± 5%.
HCT sensor:	Type: optical; Position: Inlet/Outlet line; Range: 0% - 70% mg/dl; Accuracy: ± 10%.
Air sensor:	Type: ultrasonic waves ON / OFF with auto-test; Position: between pump and bowl.
Waste line color sensor:	Type: optical; Position: waste line; Range: 0 – 3000 mg/dl; Accuracy: ± 10%.
Waste bag level:	Type: Software; Intervention Range: 7 - 10 l.
Buffy-Coat sensor:	Low: optical linear CCD; High: punctual optical.
Clamped empty line sensor:	Type: pressure sensor; Position: reinfusion line; Intervention: 1.5 – 3.0 bar.
Centrifuge fluid loss sensor:	Type: resistive; Position: centrifuge well.
Bar Code reader:	Type: optical; Position: top.
Vacuum Pump (optional):	Functioning range: from -50 to -300 mmHg [-6.6 to -40 kPa] (steps of 10 mmHg) – intraoperatively;

	from -10 to -100 mmHg [-1.3 to -13.3 kPa] (steps of 10 mmHg) – postoperatively. Accuracy: ± 20 mmHg (2.6 kPa) – intraoperative; ± 10 mmHg (1.3 kPa) – postoperative.
Data storage:	Type: not-rechargeable buffer battery; Duration: (10 year functioning).
Communication ports:	1 Ethernet; 3 RS232 serial; 3 USB; 1 RS422 serial.

5 UNIT

5.1 (UNIT_001) Description of the unit rev.00

5.1.1 About this card

The purpose of this chapter is to describe the XTRA unit.

5.1.2 General description

The system consists of an equipment unit (**XTRA**), a disposable, and a vacuum pump (**XVAC**):

- The equipment unit is a cellular separator;
- The disposable is a bowl pre-connected with a system of tubes, bags and a blood collection reservoir;
- The vacuum pump is an external module installed in the equipment that supplies an aspiration source.

The XTRA equipment, through actuators, sensors and control mechanisms, performs the procedures through the user interface.
The equipment is mounted on a cart, but they are detachable.
The cart contains the vacuum.
There is a button/power switch for the equipment, and a second one for the vacuum module (located on the vacuum module).

The XVAC vacuum provides a source of aspiration in order to capture the blood from the operating field in Intraoperative Blood Salvage (IBS, alias of Intraoperative Procedure) procedures and from the drainages in Post-operative (POST) procedures. The aspiration occurs when the reservoir is connected to the vacuum source, through a vacuum line, and to an aspiration line.
The power supply of the vacuum is supplied from the equipment through a cable. A serial line provides communication between the vacuum and the equipment.
The vacuum is separable from the equipment and may be operated in a stand-alone mode. The vacuum module contains an ON/OFF power switch, a means of controlling the vacuum level, and a display showing the vacuum level.

XTRA is composed of the following main elements:

- Display and Touch screen, including:
  - Display Housing;
  - Stop Button.

- Top, including:
  - Clamps;
  - Clamps latch;
  - Pump loop Eject;
  - Pump;
  - Centrifuge;
  - Bowl Retention (clutch and arm);
  - Bowl Arm Position Sensor;
  - Bowl Size Sensor (Kit sensor);
  - Centrifuge Fluid Loss Sensor;
  - Centrifuge Well Light;
  - Haematocrit Measurement (inlet and outlet);

- Air (Bubble) Sensor;
- RBC Indicator (high and low level);
- Waste Line Color Indicator;
- Clamped Empty Line Sensor;
- Centrifuge lid;
- Centrifuge lid position sensor;
- Centrifuge lid Lock;
- Centrifuge lid lock position sensor.

- Reservoir pole with holder including
  - Weight scale.

- I.V. Pole

- Rear Panel, including:
  - Printer;
  - RS232 ports;
  - Ethernet port;
  - USB ports;
  - Power switch;
  - External power connection.

- Side Panels, including:
  - Holders;
  - Front handles.

- Cart, including:
  - Wheels;
  - Braking mechanism.

- Inside the equipment, including:
  - Frame;
  - Electronics;
  - Liquid collection tank.

5.1.2.1 Display Group

The display incorporates a touch screen interface and displays the appropriate buttons for the operating condition of the system.
The display has a total rotation capability of 30 degrees (+/- 15 degrees) and a tilt capability from horizontal to 120 degrees above horizontal.

5.1.2.1.1 Physical description

The XTRA User Interface (NUI) uses a flat panel LCD display 800 x 600 pixels to give visual information to the user. It also uses a speaker to produce acoustic signals in case of Warnings and Alarms and to tell if a pressed button has been accepted.
A TFT 8,4 inches (Color LCD Display) is used and has:

- LVDS interface;
- High contrast with adjustment capability by the user;
- High viewing angle.

A touch screen is mounted to the display.

User Interface accept input by the user through a Touch Screen device and an hard button (Stop Button).
A printer, a USB port and an RS232 port is also managed in order to allow the user to export data from XTRA.

5.1.2.1.2 Functional description

Touch areas for each button on the screen are large enough to be controllable via a gloved finger.
All changes on screen although managed by NUI board, are controlled by NMC board except for changes negligible under the safety point of view. The same concept is applied to buttons management: all the button pressures are communicated and validated by NMC board except buttons negligible under the safety point of view.

Typical screen aspect is like this :

Fig. 5.1-1

Buttons or touchable parts of the screen have a 3D aspect while displayed information is flat on the screen.
The top of the screen is dedicated to operating messages.
Under this messages screen a status rectangle is shown on the most of the screens.
On the bottom of the screen is an area usually reserved to buttons.
On the central area operating data and parameters are shown togheter with related buttons if needed.
Close to updatable parameters two buttons appear in order to allow modification once the parameters are touched (they are displayed with 3D effect):

Fig. 5.1-2

Most of the screens show “Displet” elements. Displet is a medium blue square with a light blue “title bar” button across the top. The displet is meant to contain a related grouping of displays and controls for one portion of the system (one sensor or related sensor group, for example). The contents of the displet typically can be displayed or hidden by touching the title bar (when it is 3-dimensional).

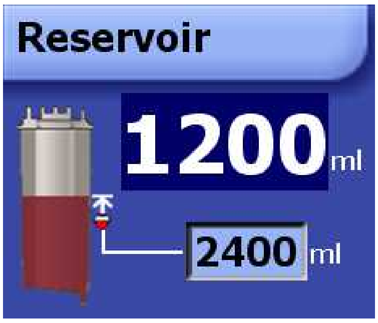

Fig. 5.1-3

A MENU button exists to access some grouped and functions.

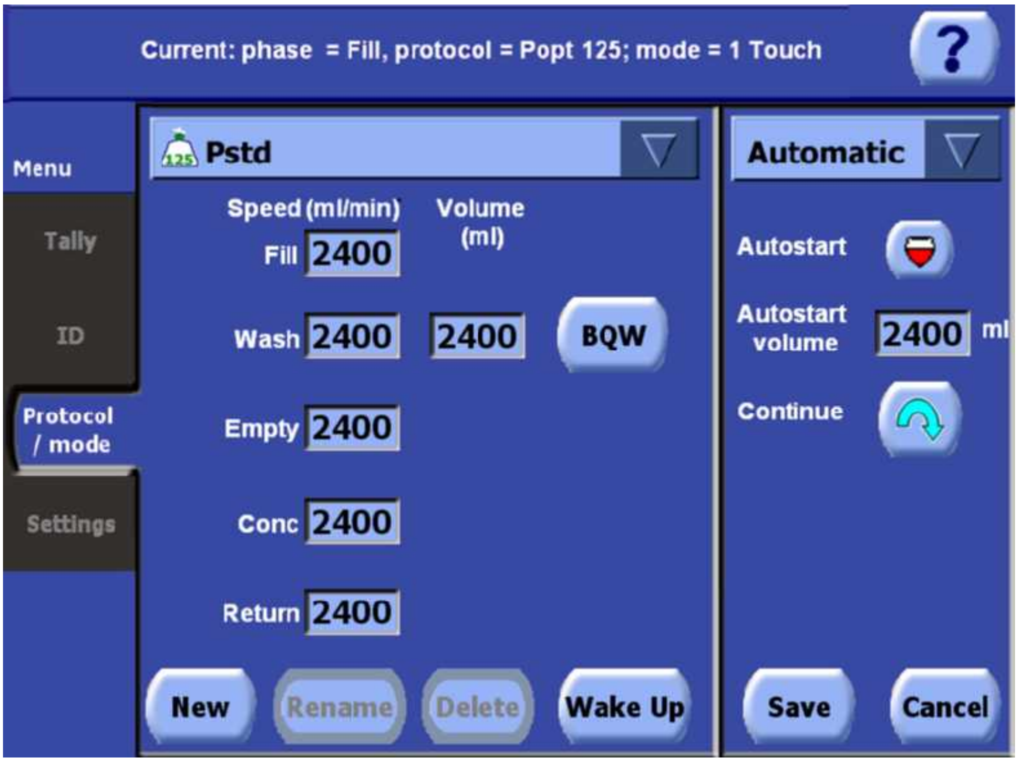

Fig. 5.1-4

5.1.2.2 Top Panel

The upper part of the unit contains a panel including:

5.1.2.2.1 The peristaltic pump

The processing pump moves fluids into and out of the centrifuge bowl while providing high flow rates with minimal hemolysis. In the autotransfusion protocols, the processing pump can be operated at rates of 25 to 1000 ml/min in 25 ml/min increments. In both the PPP and PRP protocols, the pump can be operated at rates of 10 to 100 ml/min in 10 ml/min increments..

5.1.2.2.2 Haematocrit Sensor

The haematocrit detector provides information on blood concentration in the inlet line (during the Fill phase) and in the outlet line (during the Empty phase). It comprises an infrared LED.

5.1.2.2.3 Air (Bubble) Sensor

The air detector is an ultrasonic device that detects air in the tubing from the pump to the centrifuge bowl. It is responsible for detecting the end point of the Empty phase and detecting when the collection reservoir or wash bag becomes empty.

5.1.2.2.4 Waste Line Color Sensor

The Waste Line Color detector provides information on the washing quality by measuring the color of the waste line, indicative of the residual waste products still present in the supernatant

5.1.2.2.5 Clamps group

The clamps group, in combination with the clamps latch and its locking lever, either fully stops, or allows full passage of the fluid through tubing as determined by the operational state of the machine. These clamps are activated by a stepping motor, whose different positions determine the open/close combinations. In addition to the clamps, there are sensors detecting the position of the driving shaft and of each clamp.

5.1.2.2.6 Centrifuge group

The centrifuge group is located in the front of the machine and includes the centrifuge arm, centrifuge plate, and centrifuge lid. The centrifuge plate rotates at 5600 rpm during processing and it is not operator adjustable during the autotransfusion protocols. This speed produces rapid separation of the red cells with minimal trauma. The centrifuge speed can be manually adjusted by the operator only during PPP and PRP protocols (from 5600 down to 2400 rpm).
The centrifuge group consists of:

1) The centrifuge housing, which contains possible leakages of fluids from the bowl;
2) The centrifuge arm and its position sensor, which senses the correct positioning and locking of
the bowl head;
3) The centrifuge housing light;
4) The fluid loss sensor, which detects fluid leakages in the centrifuge and stops the centrifuge and pump in case of a leak;
5) The two RBC sensors, high and multipoint, which sense when the red blood cells have reached a predetermined level within the centrifuge bowl;
6) The centrifuge lid that automatically latches and remains locked as a safety precaution until the
the centrifuge and pump come to a complete stop.

5.1.2.2.6.1 Centrifuge Well Light

To assist with the visual verification of the cellular separation of blood, the centrifuge well is lit.
There are 4 white LEDS, placed in a single point in the perimeter of the centrifuge well, at a height approximately at the top of the centrifuge. The LEDs used to illuminate the centrifuge well are lit whenever the machine is powered on.

5.1.2.2.6.2 Centrifuge lid

There is a centrifuge lid to provide the following functions:

- Structural and safety; it protects the operator in the event of a bowl breach, and from other moving parts
- Soundproofing: it reduces the noisiness of the centrifuge and other actuators
- Protection from contamination in case of loss of liquid from the bowl or the circuit

The centrifuge lid provide a writing surface size sufficient to allow placement of A4 and letter size paper. The centrifuge lid will be transparent, in order to allow seeing inside of the well and seeing the pump and clamps, with a surface which is resistant to scratching.
The centrifuge lid, in combination with the clamps latch, insures that the disposable is properly loaded into the machine and that the bowl outlet tube is correctly inserted in the WFT sensor.
A lock controlled by a sensor, and an additional sensor which monitors the open/closed position of the lid, are present.

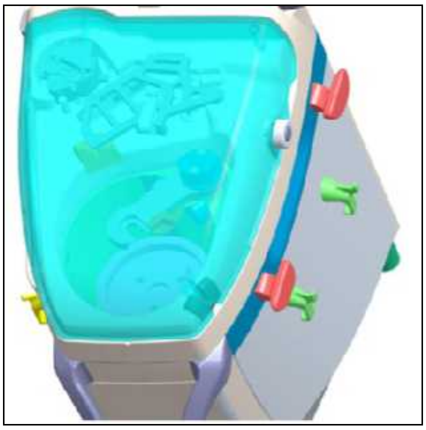

Fig. 5.1-5

The centrifuge lid lock mechanism is activated by a 30-volt power supply. This is activated only when the centrifuge lid is closed and locked under software control. This permits function of the actuators.

5.1.2.3 Rear Panel

5.1.2.3.1 Printer

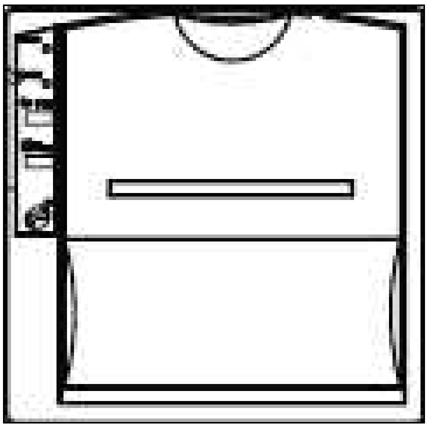

Fig. 5.1-6

There in an integrated printer; its characteristics are

- Speed: > 60 characters per minute;
- Paper that ensure long readable Output readable for many years.

The printer, situated inside the unit rear panel, is a dot matrix type. It contains a user replaceable ribbon and paper roll.

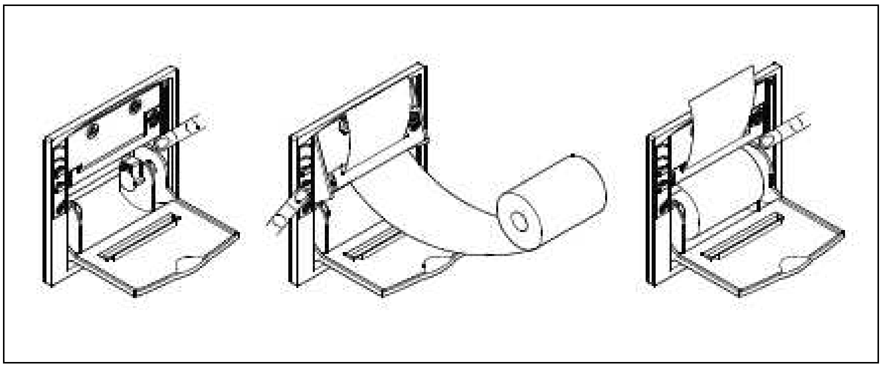

Fig. 5.1-7

The software controls the printer. When required, reports of procedures are sent to the printer.

5.1.2.3.2 RS232 ports

The device has three RS232 ports to provide capability/capacity for transmission of data/operating conditions or connection of accessories.
All RS232 ports are electrically isolated, placed on the rear panel, and labelled as to their use.

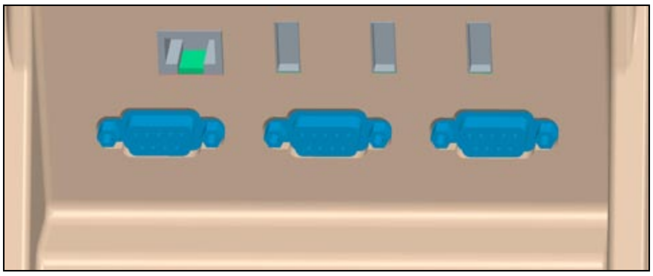

Fig. 5.1-8

The RS232 ports allow attachment of peripheral data collection devices, or a connection of a computer or peripheral accessories for the machine.

5.1.2.3.3 Ethernet port (not yet used)

There is a RJ45 port external to the machine for network connection (Ethernet).
The port is electrically isolated, placed on rear panel and with its description labelled.

Fig. 5.1-9

It provides software-controlled transfer of data to an FTP site and/or to a hospital network.

5.1.2.3.4 USB ports

There are three USB ports external to the machine for connection or data download.

These ports are not electrically isolated (no cables are allowed for connection to a device which takes power from an external plug device, i.e., it could be connected to a device powered by the XTRA machine or powered by a battery).

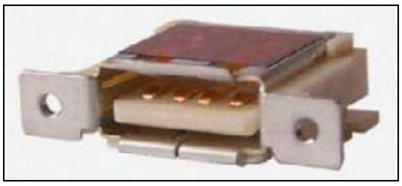

Fig. 5.1-10

The USB ports, placed on rear panel, permit the connection of data transfer devices, e.g., flash drive, or peripheral accessories for the XTRA system.

5.1.2.3.5 Reservoir Pole and Weight Scale

It is a device able to safely and steadily hold the reservoir. Further, this device allows reservoir position adjustment vertically and horizontally in order to allow it to be easily and clearly visible from any position around the equipment. It is made up by a sturdy structure having an open ring and a support pole. The open ring engages the reservoir. Onto the ring, a lock system made by an increasing-radius cam allows to retain the reservoir and avoids its accidental extraction. The open ring structure is attached to the pole, which can be vertically regulated in height and allows rotational adjustment too.
The open ring engages the reservoir allowing a protruding lip of its upper part to be inserted into a groove obtained into the open ring itself. The lock system, made by a spring actuated, increasing-radius cam, spontaneously opens when pushed by the reservoir lip, and automatically closes by the spring when the reservoir reaches its right position. Then, it safely secures the reservoir to the ring, since it tightens itself more and more if the reservoir is pulled outwards. The lock system has then to be disengaged by the operator's thumb in order to allow the reservoir to be removed from the ring.

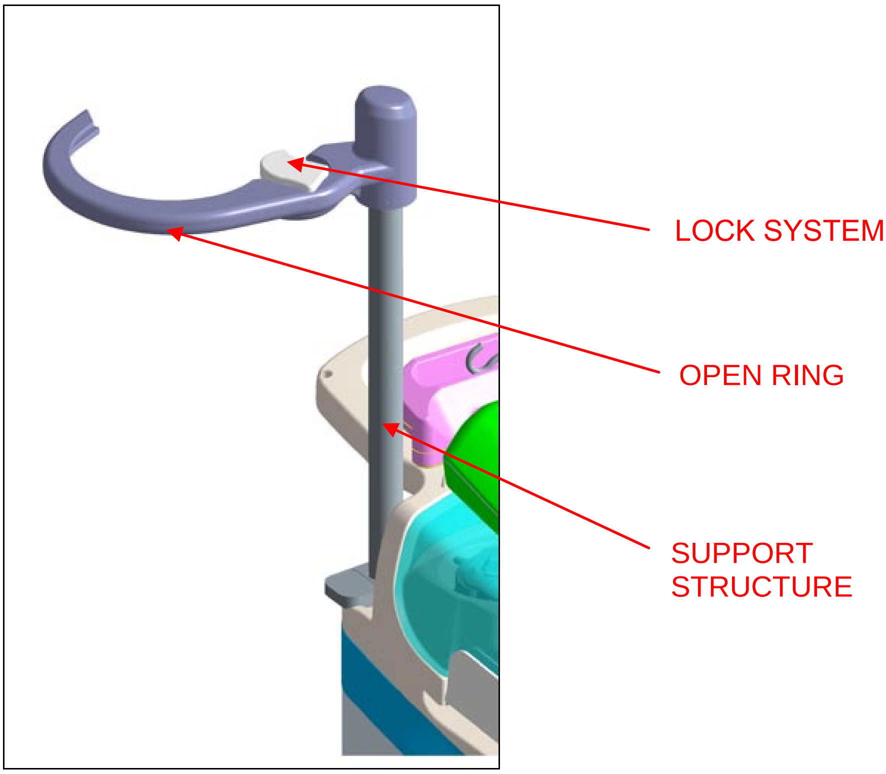

Fig. 5.1-11

5.1.2.3.6 I.V. Pole

The device has an I.V. Pole with:

- a maximum height: 198 cm (nominal);
- a minimum of two selectable heights at 198 and 155 cm;
- a mechanism to lock the pole in the selected position.

It will be divided into various main parts:

- upper and lower horizontal arms with related hooks and slots for suspension of bags;
- mast and locking devices, constituted from one structure of three two sections to support the weight of the bags.

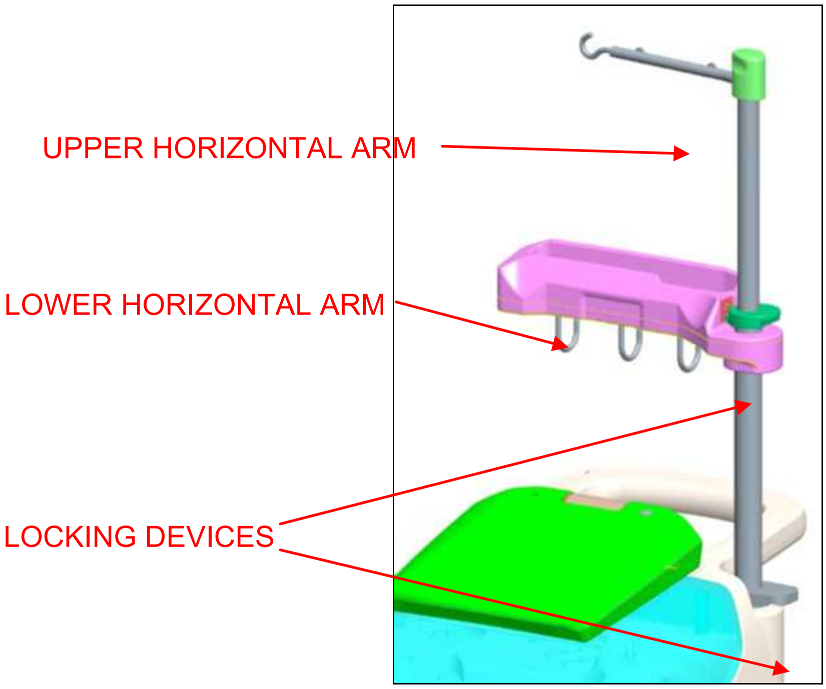

Fig. 5.1-12

This mechanism allows the hanging of the bags necessary for execution of procedures. It can also accommodate the hanging of additional reservoirs by using a bracket to attach it to the pole.

5.1.2.3.7 Handle for use in removing the machine body from the cart

The rear panel is designed to provide protection to the ports/printer on the panel from liquid spillage, by shielding the top portions of those components.

Fig. 5.1-13

The rear panel has the purpose of providing the rear surface of the machine and allows the mounting and positioning of multiple components of the machine.

5.1.2.4 Side Panels

The sides of the machine are protected by two lateral panels.
In the panels there are recesses that can be used as grip handles in order to make easy to move the machine when it rolls onto the cart, and hooks that allow to hang the waste bag (right side), saline or ACD bags or still packed trays (both sides).
Further, on the right panel there are two supports able to sustain in an ergonomic position the tray containing the disposable circuit that has to be used on the equipment.
The side panels are structurally sturdy enough to support the components to be attached.

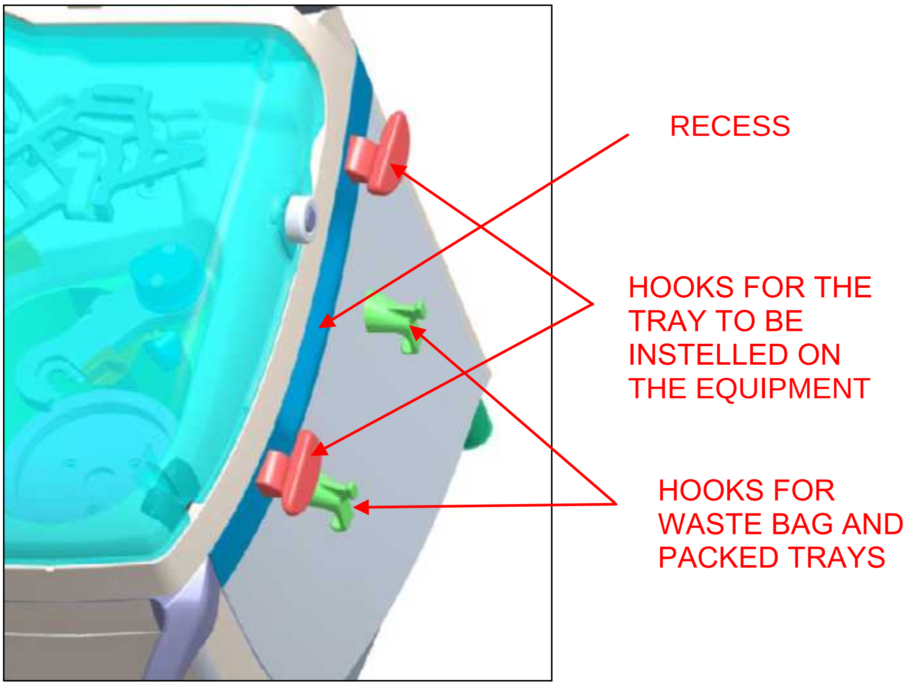

Fig. 5.1-14

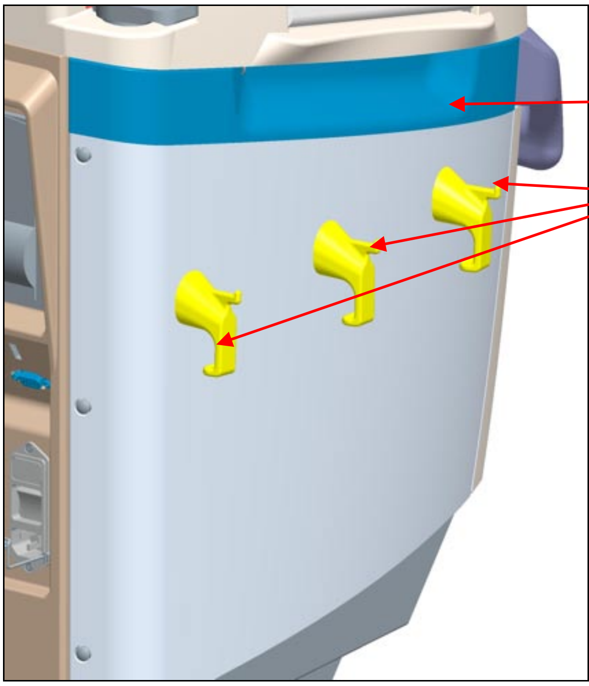

Fig. 5.1-15

The supports, able to sustain the tray containing the disposable circuit to be used on the equipment, position the tray itself in an ergonomic position on the same plane surface of the top, and allow a robust block of the tray, in order to avoid that it unintentionally disengages from the supports when the disposable components are moved from the tray to the top.
The hooks, allowing to store packed trays and bags, allow a safe and steady support, insensible to the movement due to machine transportation onto the cart.

5.1.2.4.1 Handles

The handles allow:

- to lift the machine body for its transportation;
- to move and steer the whole machine + cart, rolling onto the cart wheels.

The three handles are on the machine body:

- a handle located at the rear of the machine, directly connected to the machine top, which serves mainly for manoeuvring the machine when mounted onto the cart and rolling on wheels (driving in a straight direction, steering);

Fig. 5.1-16

- a handle at the rear of the machine, below the previous one, connected to the steel frame structure, which serves mainly for lifting the machine and also as a power cord wrap support;

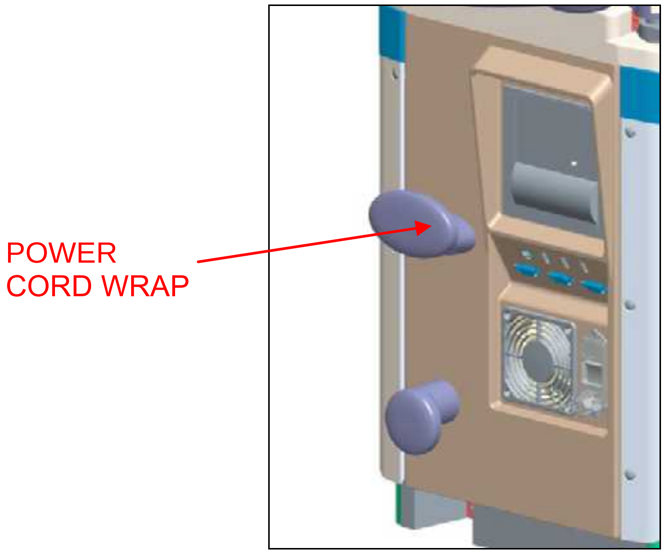

Fig. 5.1-17

- a handle located at the front of the machine, connected to the steel frame structure too, useful for both lifting and manoeuvring the machine when mounted onto the cart and rolling on wheels.

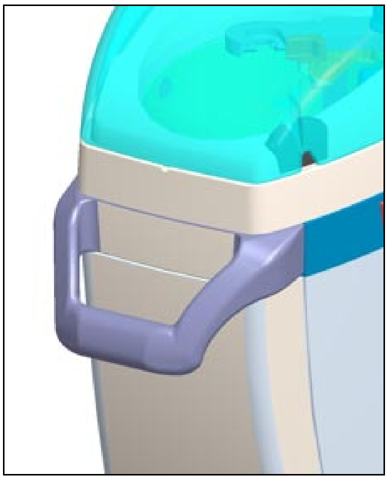

Fig. 5.1-18

5.1.2.5 Cart

The cart serves as the stand for the machine body, contains a location for attachment of the vacuum module, an area for storage of materials, it has an upper level mechanism for holding the machine, four wheels to facilitate moving of the system and a braking mechanism.

Fig. 5.1-19

5.1.2.5.1 Wheels

There are four 100 mm diameter caster wheels, able to easily roll over large power cords. They permit rotation and front/back/lateral movement of the machine without carrying it.

Fig. 5.1-20

5.1.2.5.2 Braking mechanism

There is a mechanism able to brake the cart and the equipment mounted on it. It is pedal-actuated and placed at the front side of the cart/equipment.
The pedal engages in the middle of its length an hexagonal cross-section bar, that is axially-rotated by the pedal itself when it is pushed downwards in locking position. The bar acts onto the locking mechanism of both the front wheels, preventing in the same time both front wheels rotation and rolling.

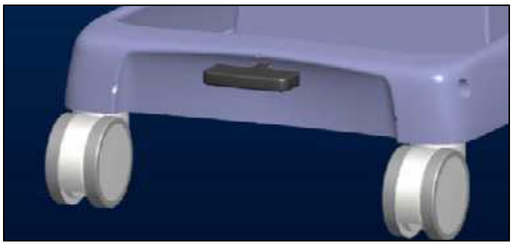

Fig. 5.1-21

There are two positions of the braking mechanism:

- all wheels will freely rotate and roll;
- the front wheels locked to prevent both rotation and rolling.

The pedal when pushed downwards locks both the front wheels. When lifted upwards, the pedal disengages both the front wheels making them free to rotate and roll.

5.1.2.6 Waste drainage tank

The equipment has an integrated centrifuge waste container of a minimum volume of 100 ml, which can be accessed and removed by the operator without special tools **(waste drainage tank).**
The waste drainage tank is a plastic container (bottle) that is connected by a screw connector and a tubing to the centrifuge well. It is located under the centrifuge assembly. A cone shaped

thermoplastic cover supports the connector and allows separation between the external environment and the internal part of the equipment.
It collects the liquid which could be spilled into the centrifuge well in the event of a catastrophic bowl break, or during washing of the centrifuge well. The lower part of the bottle is accessible by the external environment and can be unscrewed by the connector, empty, cleaned and mounted again by the users.

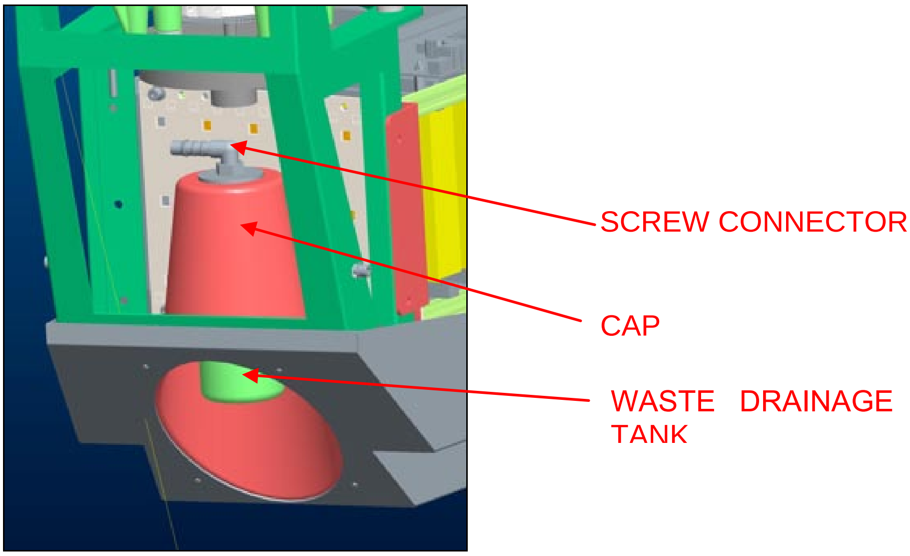

Fig. 5.1-22

5.1.2.7 XVAC Vacuum Module

Fig. 5.1-23

This XVAC system, which can work stand-alone or can be connected to XTRA machine, has to aspire the blood during an Intra-operative procedure and also during a Post-operative one.

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5.2 (UNIT_002) Use of the unit rev.00

5.2.1 About this card

The purpose of this chapter is to describe the **functionality** of the XTRA unit.

5.2.2 Disposable Circuit

Various disposables and accessories are available depending on the procedure in question:

- the **Bowl Set** – to be used directly connected to the unit;
- the **Collection Set,** for treatment of the blood collected from the operating field – to be used connected to the Bowl Set;
- the **Procedure Set** – A combination of Bowl Set and Collection Set
- the **Cardio Kit**, for processing the blood collected during Extra Corporal Circulation (ECC) – to be used connected to the **XRES Blood Collection Reservoir** and Bowl Set;
- the **Sequestration Set X,** for collection of **platelet poor plasma/platelet rich plasma** in one or two bags – to be used connected to the Bowl Set. Blood can be drawn from a whole blood bag.

The **Bowl Set** has a rotating separation cell, the **BOWL X/ml**, which is connected by means of tubing, on one side, to a waste bag and, on the other, to the **RBC (Red Blood Cells) bag**, to the washing solution inlet line and to the blood inlet line going into the bowl. The separation cell is a device into which the blood is unpacked into its components, allowing the concentration of the red cells.
The following are the bowl sizes available for each circuit: **55, 125, 175** and **225 ml**.

5.2.2.1 Circuit for auto-transfusion procedures

The overall configuration of a circuit for auto-transfusion comprises several components that, once connected to one another, constitute the circuit.
It consists of:

- a reservoir for blood collected from the operating field;
- a line connecting the reservoir to the vacuum pump;
- a line connecting the reservoir to the wash circuit;
- a connection to a bag containing additional liquids, when applicable;
- a pre-connected wash circuit composed of:
  - a “bowl” separation cell (different sizes);
  - a “cassette” whose function is to connect the tubes in order to allow a timely and proper positioning of the lines near the clamping group and the pump segment;
- an inlet line for the blood recovered from the operating field;
- a blood washing line to be connected to a saline a solution bag;
- a line for collection of processed blood, connected to a bag where the processed blood is collected prior to re-infusion;
- a bag for collection of waste fluids.

5.2.2.2 Collection Circuit

The circuit for collection of blood components comprises several elements that,once pre-connected to one another, constitute the circuit. It consists of:

- a collection circuit divided into:
  - a waste line;
  - a line for collection of platelet rich plasma;
  - a line for collection of platelet poor plasma;
  - two bags for collection of blood components, connected to the above-mentioned lines.

5.2.3 Applications

The XTRA system performs the following procedures:

- **Preoperative sequestration**, for separation of blood into red cells, plasma and concentrated platelets or platelet rich plasma:
    - **PPP** collection;
    - **PPP** and **PRP** collection into one bag;
    - **PPP** and **PRP** collection in two separate bags.
- **Intraoperative blood salvage**, for collection of red cells:
    - recovery of RBCs from the surgical field, washed from free plasma hemoglobin, anticoagulants and other debris and collected into RBC bag(s);
- **Postoperative blood recovery**, for collection of red cells:
    - the recovery and anticoagulation of blood from wound drainage subsequent to the surgery, washed from free plasma hemoglobin, anticoagulants and other debris and collected into RBC bag(s);

The system is <u>not invasive for any procedure</u> (preoperative procedures, intraoperative blood salvage procedures, and postoperative procedures). In these procedures, the blood to be processed is collected by another mean into a bag, aspirated from the surgical field, or recovered from wound drainage (postoperative).
The blood processed and collected in the bags is reinfused to the patient through gravity. The system does not provide any mechanical mean of product reinfusion.
The unit displays numeric values and percentages. These have not to be regarded as measured values, but only as a reference value for the user. If the values are relevant for the patient's treatment, it is always necessary to use a hospital standard method of measurement.

Two types of protocols are available: Factory-defined and User-defined.
User-defined protocols are able to be created,renamed and deleted by the user.
The unit has the ability to store current case data when power is removed from the machine, allowing continuation of the case when power is restored.

According to the different surgical requirements these procedures are divided into:

- **standard** blood salvage;
- **optimized** blood salvage;
- **emergency** blood salvage.

In **preoperative procedures** and by means of a specifically conceived circuit adapter, this system permits the separation of blood components, the subsequent collection of both platelet poor plasma (**PPP**) and platelet rich plasma (**PRP**) in separate bags, and the immediate re-infusion of concentrated RBC to the patient, not before the re-infusion bag is disconnected from the circuit.
In **intra-operative procedures**, the wash set is used in connection to a collection circuit. The anticoagulated blood that is recovered from the operating field during the procedures or that comes from the extra-corporal circulation circuit is filtered and collected aseptically in a specifically conceived container (reservoir for auto-transfusion) and then subjected to separation, concentration and washing processes through the unit. Eventually, the concentrated RBC's with high haematocrit level are re-infused to the patient.

5.2.3.1 Procedures

XTRA allows to choose between three types of procedures:

- **Preoperative**;

- **Intra-operative**
- **Post-operative.**

1) The **preoperative** procedures are:
- **PPP, PPP_User** (plasma collection);
- **PRP1, PRP1_User** (platelet rich plasma collection);
- **PRP2, PRP2_User** (plasma and platelets collection in separate bags).

(these names also indicate the parameters set that is to be used: **PPP, PRP1** and **PRP2** stored in SORIN GROUP database, **PPP_User, PRP1_User** and **PRP2_User** created by the user-USER).

2) The **intra-operative** procedures are:
- **Popt**, **Popt_User** (optimized blood salvage);
- **Pstd, Pstd_User** (standard blood salvage);
- **Emergency** (emergency blood salvage),

(these names also indicate the parameters set: **Popt, Pstd,** and **Emergency** - SORIN GROUP; **Popt_User, Pstd_User** - USER).

3) The **post-operative** procedures are:
- **Post-op, Post-op_User** (optimized blood salvage for post-operative).

(these names also indicate the parameters set: **Post-op,** - SORIN GROUP; **Post-op_User,** USER).

Note: The term "_User" can be modified by the user with a different term. (i.e. Popt_Doctor)

A set of values identifying the program is associated to the parameters of the procedure (flows, speed, volumes, etc.):
- type of procedure;
- type of bowl used;
- set of values to be associated with the parameters of the procedure with regard the type of bowl used.

5.2.3.2 Choosing the Program

A new program can be selected in the following situation:

1. Unit is in **SETUP** screen.
   a. Enter the MENU PAGE
   b. Enter the PROTOCOL TAB

   The following information are displayed on the **PROTOCOL TAB** page:
   a. The available protocols
   b. The wakeup protocol

   It is also possible to create a User defined protocol pressing on NEW button.

2. Unit is in **READY** screen.
   a. Enter the MENU PAGE
   b. Enter the PROTOCOL/MODE TAB

   The following information are displayed on the **PROTOCOL/MODE TAB** page:
   a. The available protocols
   b. The wakeup protocol

It is also possible to modify the values of the SORIN GROUP protocols or create a User defined protocol pressing on NEW button.

Both protocols with parameters containing SORIN GROUP default data and programs with parameters containing user data are available for all procedures according to the type of bowl used.

5.2.3.3 Programming

When in **PROTOCOL/MODE TAB** the user can select the protocol for the procedure. For each selected protocol, the user can:

- modify the pump flow, the centrifuge speed (for preoperative procedures only) and the volume of the **WASH/SPILL** phase;
- Create and rename a new protocol;
- set the automatic operating modes for the program;

The pump flow, centrifuge speed, wash/spill volumes and vacuum level can be modified also runtime when the specific phase screens appear.

A program can only be selected when XTRA is in stop, while its parameters can be modified any time during the procedure.
The type of bowl used is immediately detected by XTRA, through a bar code reading system.

5.2.3.4 Operating Modes

The operating modes of the unit are:

- **1 TOUCH;**
- **AUTOMATIC;**
- **MANUAL;**
- **EMERGENCY;**
- **Auto Start ;**
- **Continue;**
- **Better Quality Wash;**
- **Better Empty;**
- **Last Bowl**;
- **Purge;**
- **Prime IV.**

can be activated according to the following rules:

- **Better Quality Wash**: available for Intra-operative and post-operative procedures only, in all the operating modes;
- **Continue** : it can be activated for all Intra-operative procedures, but in the **AUTOMATIC** mode only;
- **Auto Start**: available for Intra-operative procedures only, it can be activated / deactivated in the **AUTOMATIC** mode.
- **Better Empty**: it can be activated manually for all procedures;
- **Last Bowl**: (for intra-operative and post-operative procedures only), is available only in **1 Touch** and in **Automatic** modes.

The operating **AUTOMATIC** and **MANUAL** modes are mutually exclusive and can be selected any time.

- **AUTOMATIC**

In this operating mode the equipment detects the end of the ongoing phase and automatically switch to the following one.

- **MANUAL**

Manual mode can be operated in different ways depending on the activated options.

1. **Manual mode – RBC DETECTOR and WASH/EMPTY not selected:** In this mode the unit does not recognizes the end of the Fill phase and Wash phase; the user has to decide when to proceed to the following phase.
2. **Manual mode – RBC DETECTOR selected and WASH/EMPTY not selected:** In this mode the unit recognizes the end of the Fill phase (as it reads the buffy coat level). The wash phase will proceed until the user manually skip to the Empty phase.
3. **Manual mode – RBC DETECTOR not selected and WASH/EMPTY selected:** In this mode the unit does not recognizes the end of the Fill phase and the user has to decide when to proceed to the Wash Phase. The machine recognize the end of the Wash Phase and proceeds automatically to the Empty phase.
4. **Manual mode – RBC DETECTOR and WASH/EMPTY selected:** In this mode the unit recognizes the end of the Fill phase (as it reads the buffy coat level) and Wash phase (as it reaches the preset wash level). The user needs only to press the WASH button once the Fill phase is complete.

- **EMRGENCY**

This mode can be activated in case of emergency. It is a fully automated blood processing at very high speed. It is enabled by means of direct activation through dedicated key on every screen.
By pressing the emergency key, the Emergency mode is automatically activated: the fastest protocol (Emergency) as well as the completely automatic processing (**1 Touch**). Good performances both in terms of Hct and wash-out are obtained also during the Emergency mode.

In case of massive bleeding/critical conditions, there are also two options that can be selected before activating the Emergency mode:

NO WASH: Once pressed the emergency button, select NO W WASH prior to press PLAY.
The unit will concentrate the blood without process it.
RAPID TRANSFER: Once pressed the emergency button, select RAPID TRANSFER prior to press PLAY. The unit will transfer the blood from the reservoir to the reinfusion bag without concentrating or washing it.

- **AUTOMATIC START**

Thanks to the load cell of the Reservoir holder, XTRA detects the blood quantity contained in the reservoir and activates the **Automatic Start** of the Fill phase. The quantity of blood varies depending on the bowl used and the preset volume. It can be activated in the **AUTOMATIC** mode and can be associated with the **Continue** function.

When the **Automatic Start** function is set, it will always be activated without the user having to press any key: once the set weight is reached, the display shows a 4-seconds operating message informing the user that the set weight is reached in the reservoir and the Prime phase is about to start. Within these 4 seconds the user may:

1) temporarily stop the automatic start of the **Fill** phase by pressing **Delay**;

2) deactivate the function by pressing **DISABLE AUTOSTART** button or **Stop** and thus definitively abort the automatic start (the function will be reactivated from the **PROTOCOL/MODE TAB** of the **MENU PAGE** only).

- **BETTER QUALITY WASH**

This function improves the washing quality by means of an acceleration/deceleration cycle, in which every xx ml of saline solution (the quantity may be set), the centrifuge decelerates to allow the red cells contained in the bowl to unpack, thus performing a better wash. It can be activated in the **AUTOMATIC**, and **MANUAL** modes. It can be associated with the **Automatic Start** and **Continue** functions.

- **CONTINUE**

This function causes consecutive cycles of the activated procedure to be automatically carried out; in other words, once the Empty phase is over, the unit, instead of switching to Stop, proceeds to a new Fill phase. It can be activated in the **AUTOMATIC** mode and in Intra-operative and post-operative procedures only by means of the **Continue** button in the **PROTOCOL/MODE TAB** of the **MENU PAGE** any time.

- **1 TOUCH**

This operating mode is the completely automatic processing, with automatic start, continuous processing and automatic stop. In other words it is simply the combination of three modes:
AUTOMATIC START+AUTOMATIC+CONTINUE.

- **LAST BOWL**

The **Last Bowl** function is intended to minimise the operator's interventions when deciding to conclude the case, by means of continuous cycles until reservoir is empty. Automatic concentration, wash and empty of bowl and RBC line are enabled.
The correspondent button is always available in the "RESERVOIR EMPTY.BOWL NOT FILLED" warning screen, if enabled in **Configuration mode**.

- **BETTER EMPTY FUNCTION**

The Better Empty Function may solve eventual problems of incomplete bowl emptying, activating automatically a further special empty phase. In case the volume of RBC recovered in the re-infusion bag is lower than expected for that size of bowl, the bowl is "stirred" by means of a double alternating acceleration of the centrifuge and a new empty phase is forced.

- **STAND-BY**

This function, when activated, stops:
- the deceleration of the centrifuge during the first stage of the Spill phase, or
- the pump in all the other cases

Activation of the Stand by is carried out:
- manually, by means of the corresponding **STAND-BY** button;
- automatically, during specific phases when the unit operates.

5.2.3.5 Switching on

When XTRA is switched on, the screen, after the system has booted, displays the **SETUP** screen where by means of the enabled button, it is possible to press:

- **Help button:** it shows the quick disposable installation guide
- **Load Pump button:** It starts the automatic pump loop loading

- **Menu button:** It shows the menu page.
- **Retain button (if the previous case was not closed by pressing the UNLOAD PUMP button):** It allows to retain the data of the previous case.
- **Reservoir Displet:** It allows to open or close the reservoir displet. Once open, it shows the blood volume inside the reservoir
- **Vacuum displet (only if XVAC is linked to XTRA): i**t allows to open or close the vacuum displet. Once open, it gives the possibility to turn on the vacuum pump and modify the vacuum level.

5.2.4 Functional Safety

The XTRA system entails the following phases:

- **Switching on**
- **Setup**
- **Procedure**

In all phases the unit carries out checks to monitor the status of the equipment.

5.2.4.1 Switching on

Upon switching on, XTRA carries out checks on the correct operation of the electronic components.
This test involve all the XTRA intelligent units (NMC, NAC, NSC, NUI).
Every intelligent unit contains an application software with a revision level (SWRL), that will be in general different from the SWRL of the others boards :purpose of this test is to verify that, for each board, its SWRL are functionally compatible with the SWRL of all other board. This is very useful for example after a software upgrade or after a substitution of a single board, to check if the operation left the XTRA into a correct configuration.
If the software releases compatibility verification fails, the NMC shall block the XTRA functioning and shall indicate to the operator a fatal error.
If the software releases compatibility verification fails, the diagnostic functionality of the XTRA should be accessible only if there is a compatibility between the NMC software release and the NUI software release.

- **Test on the RAM used by the unit.**

This test involve all the XTRA intelligent units (NMC, NAC, NSC, NUI).
The test is executed to check the correct functionality of all the RAM (internal and/or external to the microcontroller, not under battery) used by the microcontroller, in terms of correct reading and writing data.
If the test fails, the processor switches to the stop status.

- **Test on the Flash memory used by the unit.**

The test is carried out by all processors with the same algorithm (CRC calculation and control with a polynomial) to check the integrity of the board software, where for “board software” is intended all the executable code stored into the flash eprom internal and/or external to the microcontroller, code executed when the XTRA is in user and diagnostic mode.
In case of test failure, a stop instruction is performed.

- **Test of under battery RAM.**

This test involve only the NMC and it is executed to check the integrity of the data stored into the under battery RAM.
A CRC test is carried out on this area with a polynomial.

If the two CRC values match, the NMC also shall perform a range control on the data stored into under battery RAM, to see if the values contained are permitted.
If also the range check is OK, the whole Under battery Ram Test passes successfully.
If the test fails (the pre-calculated value differs from the CRC):

a) the NMC first executes a complete functionality test on the under battery RAM:
   - Data Bus Test;
   - Address Bus Test;
   - Device Test.

If at least one of those tests fails, the XTRA blocks and communicates to the user that a fatal error occurred (E27);

b) If all the tests at the previous point are executed successfully, all the data stored into the under battery RAM are filled with default data stored into the program flash eprom; after that, a CRC calculation is performed again, and the CRC value now is compared with a fixed CRC value stored (with a dedicated tool) directly into flash eprom, at board programming time: if the two values are equals, the user is warned that a under battery RAM initialization occurred. If the CRC test fails again, the XTRA blocks and communicates to the user that a fatal error occurred (E27);

NOTE: If a re-initialization of the under battery RAM occurs, those data that are also stored into the e2prom are filled with the data copy contained into e2prom (only after performing successfully the test of the e2prom).

- **E2PROM**

This concerns only the NMC and is executed to check the integrity of the data stored into the NMC E2prom.
If the e2prom test fails, the XTRA operates in two different manners, depending on the result of the under battery RAM test:
- If the under battery RAM test passed successfully, the XTRA communicates to the user that the e2prom is not functioning, then the XTRA can continue to operate normally;
- If a re-initialization of the under battery RAM was occurred, the XTRA blocks and communicates to the user that a fatal error occurred: in fact all the calibration data of the machine was lost.

- **Test on the opening of the cover lock.**

This test involves the NMC, the NAC and the NSC.
This test is performed in order to control if the actuator that mechanically locks the XTRA cover is able to open.
To make that, the lock actuator is commanded to open and the status of the actuator is controlled using the position sensor that is active when the lock opens.
If the sensor signals that the actuator is open, the test passes.
If the sensor don’t detect that the actuator is open, the XTRA communicates to the user a message that depends to the status of the cover, status determined by reading two hall sensors:
- o If the cover is closed, the XTRA communicates that the cover lock is not functioning properly, but doesn’t block the functioning of the machine;

- If the cover is open, the XTRA communicates that the cover is into a erroneous position, and blocks the centrifuge and the rolling pump actuation (until the cover is open).

- **30 V Switching off Test**

This test involves the NMC and it is performed in order to control if the NMC is able to switch on and off properly the 30 V used for powering all the actuators (centrifuge, pump, clamps,…) of the XTRA, so to test if the NMC can disable all the actuators when needed for safety (for example when the actuators are accessible by the user).

The NMC switches on the 30V power supply, and after a delay, necessary to the stabilization, it controls if the 30 V is present; then, the NMC disables the 30V, and after a delay, necessary to the stabilization, controls if the 30V is absent.

If the test fails, the XTRA blocks and communicates to the user that a fatal error occurred (E1).

5.2.4.2 Setup

The **Setup** phase consists mainly in the installation of the disposable kit on the unit prior to a treatment and in the detection and calibration functions (e.g. pressure offset of the pressure sensor and automatic calibration of the HCT sensor). As the Setup is a compulsory step to any treatment start-up, during this phase the unit carries out some tests on the proper functioning of its components.

- **Cover position verification**

This test involves the NMC, the NSC and the NAC boards.

This test controls if the cover is closed, to guarantee the safety of the user in respect to the actuators movement.

During the test, the NSC and the NAC boards send to the NMC board the state of the two hall sensors that monitor the closing of the cover: when the cover is closed, every sensor is activated.

The test passes only if the state of both sensors sent from both NAC and NSC to NMC is “sensor active”.

The XTRA blocks and communicates to the user that a error occurred; the user, after closing the cover, may repeat the test. The setup phase can prosecute only when (if) the test passes.

- **Arm position verification**

This test involves the NMC, the NSC and the NAC boards.

This test controls if the arm that blocks the bowl is properly positioned on the bowl.

During the test, the NSC and the NAC boards send to the NMC board the state of the sensors that monitor the position of the arm: when the arm is correctly positioned on the bowl, the sensor is activated.

The test passes only if the state of the sensor sent from both NAC and NSC to NMC is “sensor active”.

The XTRA blocks and communicates to the user that a error occurred; the user, after positioning the arm, may repeat the test. The setup phase can prosecute only when (if) the test passes.

- **Kit verification (barcode verification)**

This test involves the NMC and the NSC boards.

This test is made only when, at power up, the user choose to continue the previous treatment. In this case, the XTRA assumes that the bowl is yet inserted and unchanged.

To verify that, the NSC reads the bar code positioned on the bowl with the bar code reader, and sends the read code to the NMC, that contains into under battery RAM the code read at the last new patient startup.
If the code stored is equal to the code read, the test passes.
If the XTRA communicates to the user that a different (or wrong) bowl was detected; the user may:
- Continue the setup operations, accepting the treatment of the previous bowl;
- Exit to setup and choose a new treatment.

- **Lock close test**

This test involves the NMC and the NAC boards.
This test is performed in order to control if the actuator that mechanically locks the XTRA cover is able to close.
To make that, the lock actuator is commanded to close and the status of the actuator is controlled using the position sensor that is not active when the lock closes.
If the sensor signals that the actuator is closed, the test passes.
The XTRA blocks and communicates to the user that a error occurred; the user, after controlling the lock, may repeat the test. The setup phase can prosecute only when (if) the test passes.

- **Clamps Autotest**

This test involves the NMC, the NAC and the three CBN units.
Every one of the three clamps have to be open and closed in order to check the capability of the system to open/close them and to verify if each single clamps position sensor is working. In addition, at the end of the test all the clamps have to be put in their closed position (because this is not guaranteed at every machine switch-on).
The XTRA blocks and communicates to the user that a error occurred; the user, after controlling the clamps, may repeat the test. The setup phase can prosecute only when (if) the test passes.

- **Pump driver check**

This test involves the NMC and the NAC boards.
During the setup, only when the user choose to start a new procedure, the XTRA needs to perform the autoload of the tube using the roller pump. Anyway, also in case of restarting of an interrupted case (and then when autoload is not needed), the pump is commanded to shortly rotate in both directions when the user has to overcome the Setup phase after machine switch-on. During this phase, the NAC and NMC boards control if the driver of the pump motor, the direction feedback signals and the same motor are functioning well.
In case of test failure, warning messages or fatal errors interrupt the setup avoiding the process progression.

- **Check of the right direction of rotation of the pump**

This test involves the NMC and the NAC boards.
If the direction feedback signals test fails a fatal error blocks the machine (E52).
If rotation is prevented by obstacles a warning is issued.

- **Centrifuge test**

This test involves the NMC and the NAC boards.
This test is performed in order to control the right functioning of the centrifuge (driver and motor).
To make that, the NMC board command to the NAC board the actuation of the centrifuge at a fixed speed of 100 rpm; the NAC activates the centrifuge and calculate with the encoder connected to

the centrifuge motor the speed. Then NAC sends the speed to the NMC that controls if the value received is into the tolerance range, in this case the test passes.
The XTRA blocks and communicates to the user that a error occurred; the user, after controlling the centrifuge, may repeat the test. The setup phase can prosecute only when (if) the test passes.

- **Rotor Insertion control**

This test involves the NMC board.
During the phase of autoloading (only when a new treatment is initiated) and during the pump direction check, the NMC bord verifies if the rotor of the pump is correctly inserted by reading the hall sensors that detect the proximity of a magnet located into the rotor: if the rotor is inserted correctly, the magnet during the pump actuation passes in proximity of both the hall sensors.
The test passes only if both the hall sensors are activated by the magnet.
The XTRA blocks and communicates to the user that a error occurred; the user, after controlling the rotor, may repeat the test. The setup phase can prosecute only when (if) the test passes.

5.2.4.3 Procedure (Operation)

When the unit is operating, a number of controls on safety, reliability and performance are activated. These tests are carried out by the Master, which processes the signals transmitted by the slave units, along with those directly received through its own hardware. Should any anomaly arise, a number of safety measures are taken depending on both the anomaly and its priority level.

5.2.4.4 Temporary alarm muting

The user is able to silence only endless acoustic sequences (it is not possible to silence finite acoustic signals) when they are played, through a **Mute** button on the alarm/warning screen. The effect of this action is to temporarily stop acoustic sequence: if after 45 seconds from silencing, the alarm/warning remains active, then the acoustic sequence restarts (and the user is able to press again the **Mute** button if he wants).

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6 DIAGNOSTIC PAGES

6.1 (DIAG_001) Diagnostic Pages: Overview rev.00

6.1.1 About this card

The purpose of this chapter is to describe the **diagnostics functions**.

6.1.2 Working Environments

The XTRA SW supports two main Working Environments:

- the *"***Operational Environment***"*: to support the ATS (Operative) procedures;
- the *"***Service Environment***":* to support the machine maintenance, configuration and production.

A third environment, the **bootstrap**, is supported to manage the machine initializations at the power-up and the transition to one of the two main working environments.

6.1.2.1 Running Modes

The execution of the Operational and the Service environments is implemented in mutual exclusive running modes.

The Operational Environment is implemented with the **Normal Mode**.
The Service Environment is implemented with the **Diagnostic Mode**.

Once the XTRA is turned-on, the XTRA SW executes the *"bootstrap programs",* having the responsibility to bring the machine in one of the two main working environments according to the startup specifications.
The boostrap programs are implemented with the **Start-up Mode**.

So the **Start-up Mode** is the first program executed when a user switch-on the XTRA machine, the **Normal Mode** implements the functionalities of the ATS procedures, and the **Diagnostic Mode** manages the service functionalities.

The Diagnostic Mode runs two different levels according to the user permissions and choices:

- **Basic Diagnostic Mode**
- **Complete Diagnostic Mode**

The **Basic Diagnostic Mode** enables the user to perform diagnostic Tests and Checks. It cannot modify the sensor calibrations.
The **Complete Diagnostic Mode***,* accessible pushing the **"Factory Mode"** button, enables the user to perform diagnostics Tests and Checks, but also sensors calibrations.

6.1.2.2 Users and Permissions

The XTRA SW does not require any user permission to execute the bootstrap and the operational environment, but it supports a permission control to enable only the proper users to access the XTRA service environment.
The intended user of the operational environment is a **Normal User**.
The intended user of the service environment is a **Service User**.

6.1.2.3 Service Dongle

Each service user gets from Sorin Group a personal **Service Dongle**, storing the user's permissions.
In order to access the service environment, the XTRA SW requires to any service user to perform the following actions at power-up:

1. connect its own service dongle;
2. switch-on the machine while pressing and holding the XTRA **STOP** button (hard key).

Under these conditions the XTRA SW checks the data stored in the service dongle in order to identify the service user, it checks the permissions and restricts properly the accessible XTRA running modes.
The status of the **STOP** button gives to the machine the double confirmation that the user wants to access the service environment.
The XTRA uses as service dongle commercial USB Memory Sticks.
Each service dongle provides the permissions to launch only the set of the service modes that Sorin Group wants to enable to the addresse of the service dongle itself.
Each service dongle supports at least one of the following attributes, related to the service modes:

1. **basicDiagnosticsEN** attribute, allowing to access the Basic Diagnostic Mode;
2. **fullDiagnosticsEN** attribute, allowing to access the Complete Diagnostic Mode.

When more of one service mode is allowed by the dongle, the user is asked for a choice.
Each service dongle supports an optional **passwordEN** attribute that enables the XTRA SW to check the service user's personal password.

6.1.2.4 User Classification

The XTRA SW supports two main user classes:

- **Normal Users;**
- **Service Users,** users trained to work on the Service Environment. A Service User has got its own personal service dongle and uses it to access to the Service Environment.

The **Normal Users** are divided in:

- **Normal User,** a user trained to operate with the ATS procedures;
- **Supervisor User,** a subclass of Normal User that is allowed, through inserting the password **"41037"** when required, to change the settings of the ATS procedures.

Fig. 6.1-1

The **Service User** is the **Field Service Technician (FST),** a technician completely trained on the machine service features and allowed to calibrate the machine sensors. Each FSE technician user has a service dongle with the attributes:

- **fullDiagnosticsEN;**
- **passwordEN.**

6.1.3 Service Operating Mode

- **SPECIFICATION**

This operating mode is dedicated to:

- the service operator, for maintenance by the Field Service, like calibrations, controls and tests, updates etc.;
- manufacturing to produce the machine (assembly, calibrations, initializations, settings, test and final inspection equipment).

This service operating mode is in a protected area and is accessible through “hardware button” and then entering a password for each dedicated level.
For simplicity this operating mode is named the **Diagnostics site**.
From Diagnostics site it is possible to:

- initialize the machine data;
- verify the digital and analogic input of machine,
- control each of the actuators (pump, centrifuge, clamps, lock, pump loop eject, vacuum pump);
- examine and identify Hardware errors from their symptoms;
- memorize the machine serial number;
- verify the correct functioning of the machine through run and short test;
- verify the correct functioning of some component like a E2prom;
- read the machine actuators working time;
- characterize the **Waste Line Color** and **HCT indicator** functional parameters;

- verify the correct functioning of the sensors and calibrate them;
- verify the correct functioning of the printer, USB, serial port;
- adjust the **Popt** protocol parameter;
- verify the power supply of the machine;
- record the relevant data concerning the machine state.

- **PHYSICAL DESCRIPTION**

The access to the diagnostic or the normal operation is determined at the machine startup; with the diagnostic mode being selected by activating the **STOP** button when the machine is turned on, using specific tool connected to one of the electrical port of the machine and then entering the password **"2010"**.
Diagnostics is a particular unit operating mode. During diagnostics it is possible to update the software, to initialize the unit before delivering it to the user, to test and to calibrate individual components/groups or, in general, to collect information on the unit.
The Diagnostics is specific for testing, technical service personnel.
Access to diagnostics functions is password protected and requires a specific hardware tool.
The software update is also available like one of diagnostic functions.

- **FUNCTIONAL DESCRIPTION**

The behavior of the machine at startup is determined from the following elements:

- If a USB storage device with a software update flag is inserted, the machine activates WINDOWS CE without activating the XTRA functional operating mode. In this case it is possible update each unit software. The software update may also be accessed through the service diagnostic level.
- If the **STOP** button is pressed, the machine activates the diagnostics mode. In order to access diagnostics level, it is necessary to enter the password **"2010"**. Each level has the appropriate diagnostics functions.

Otherwise, the XTRA functional operating modes is accessed.

6.1.3.1 Entering Diagnostic Mode

The XTRA supports the following procedure to start the DM:

1. Insert a USB service key in XTRA machine;
2. Select and hold the **STOP** Button;
3. Power-on the machine;
4. After 2 seconds release the **STOP** Button, at this point the following page is shown:

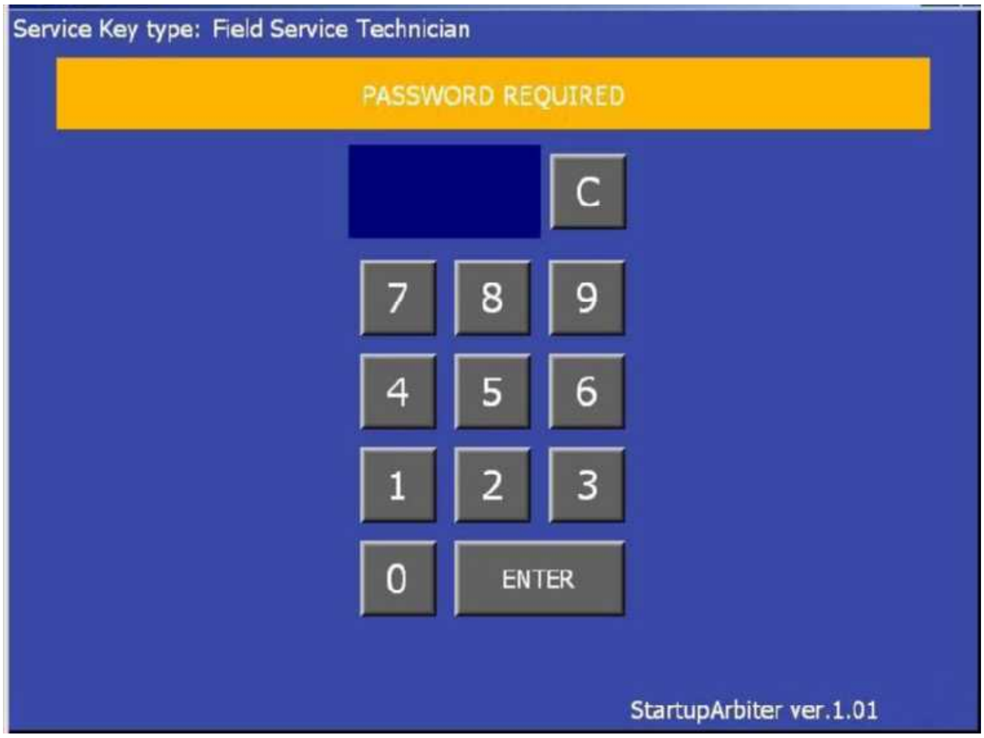

Fig. 6.1-2

5. Insert the password **"2010"**.
6. After inserting the password, the following page is displayed:

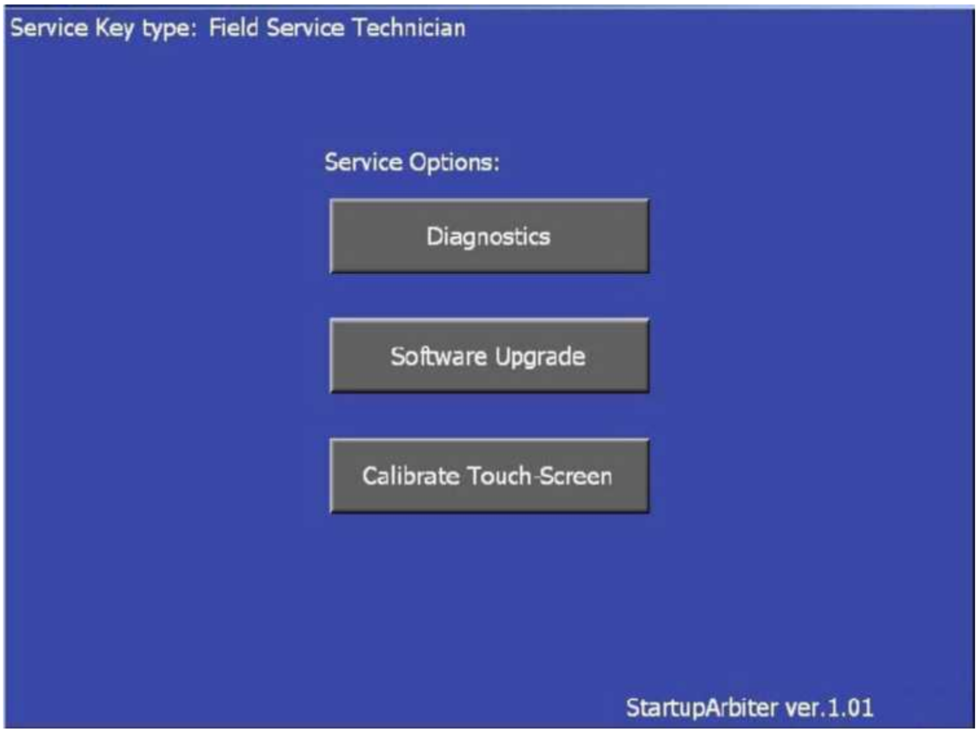

Fig. 6.1-3

Three service options are available:

- **Diagnostics**, to enter Diagnostic Mode;

- **Software Upgrade**, to enter SW upgrade procedure pages;
- **Calibrate Touch-Screen**, to enter Touch-Screen calibration procedure pages.

Below are described the **Diagnostics** pages.

6.1.4 Functions Group Classification

The DM entering is enabled only to authorized people and displays to the Graphical User Interface (GUI) only English language texts.
The DM delivers diagnostic functions classified according to the following groups:

- **Electronics:** functions to check low-level HW/SW components;
- **Actuators:** functions to test the machine actuators;
- **Sensors:** functions to test and calibrate the machine sensors;
- **Runtests:** automatic functional tests and related diagnostic alerts reporting;
- **Settings**: functions for setup the factory parameters;
- **Logs:** functions to display diagnostics logs.

The DM supports two permission levels: basic and complete. The DM allows users with complete level permission to access to any specified diagnostic function. The DM does not allow users with basic level permission to access the sensor calibration functions.

6.1.5 Supported Functions

XTRA supports diagnostic functions reported in the following table, according to the diagnostic functions classification.

Group	Functions
Electronics	- CPUs Status - Power Supply - A/D Converter References - Peripherals - Stop Button Check
Actuators	- Rolled Pump - Cell Separator Centrifuge - Line Clamps - Centrifuge Lid Lock - Cassette Ejector
Sensors	- HCT - HGB/FPH - Buffy Coat, Low and High levels - Reservoir Scale - Disposable Kit Reader - Air Bubble detector - RBC line overpressure - Bowl Arm position - Over Temperature - Blood loss
Settings	- Serial Number insertion - Data initialization

	- Wash Quality settings
Logs	- Fatal Erros - Working Times - Memory Failure
RunTests	- Raw test - Run test - Short test

Table 6.1-1

6.1.6 Functions Access

The DM lets the user to access the diagnostics functions according to a function group classification. The DM enables the user to access a specific function with no more of three screen selections: group, function and section.

6.1.7 Screens Structure

The DM displays on the top-left of each screens a title that identifies the group actually selected. The group title is an active part of the GUI giving access to the select list of the others groups.
The function title is an active part of the GUI giving access to the select list of accessible functions.
The DM uses displets to group the graphical element related to a same functionality.

6.1.8 Screens Navigation

The DM enables the user to move from one screen to another via the screen group and function title buttons.

6.1.9 Start-up Screen

The DM, on machine start-up, displays the function group list only. This starting screen is named **Normal Start-up Screen**.

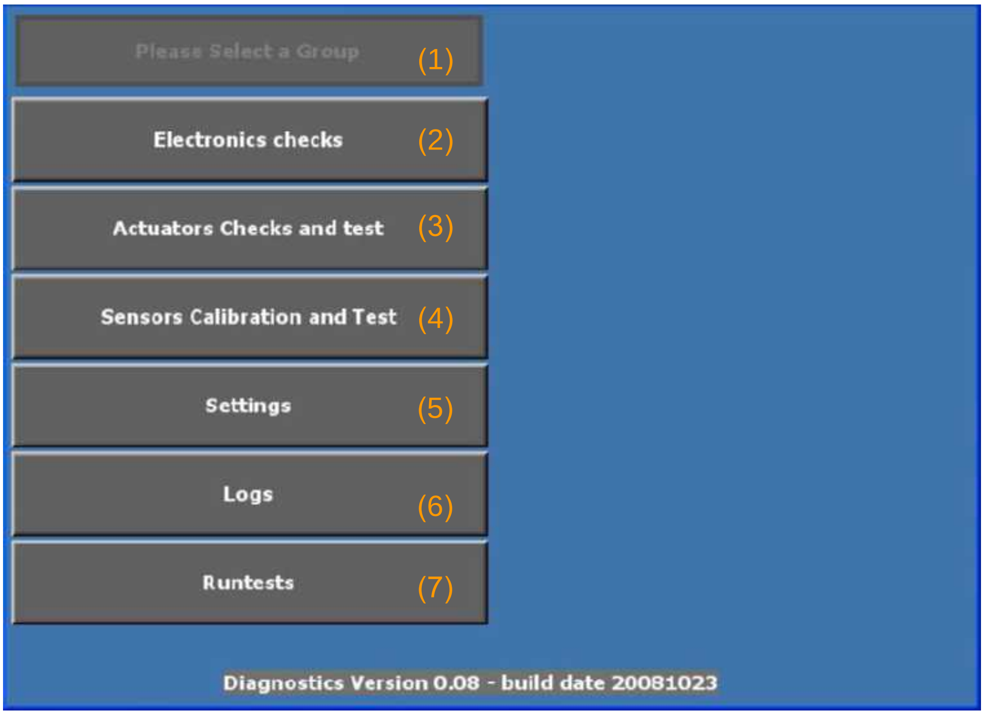

Fig. 6.1-4

Starting from a Normal Start-up Screen, the user can choice the function group from the proposed list.

	Label	Action on Button Selection
1	Please, select a group	Show the list of available function groups
2	Electronics check	Show the list of Electronic functions
3	Actuators check and test	Show the list of Actuator functions
4	Sensors Test and Calibration	Show the list of Sensor functions
5	Settings	Show the list of Setting functions
6	Logs	Show the list of Log functions
7	Run-tests	Show the list of Run-test functions

Table 6.1-2

6.1.10 Screen Navigation Example

The Fig. 6.1-5 shows an example of screen navigation; the user selects “Electronics checks” in group list and the DM displays the list of the Electronics functions (Fig. 6.1-6).

(DIAG_001) Diagnostic Pages: Overview rev.00

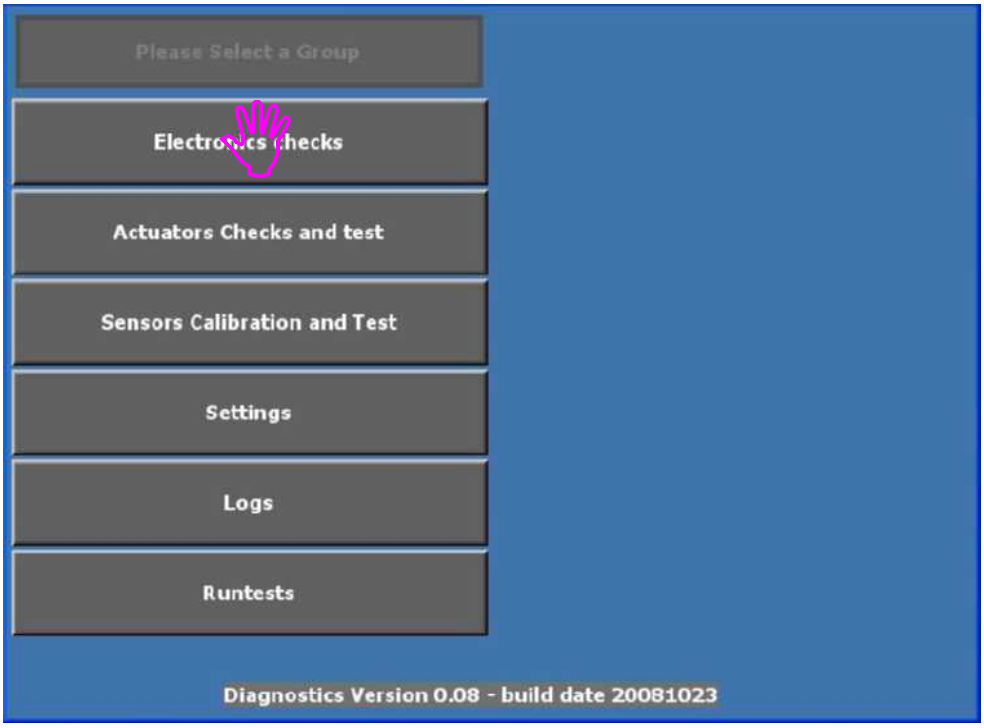

Fig. 6.1-5

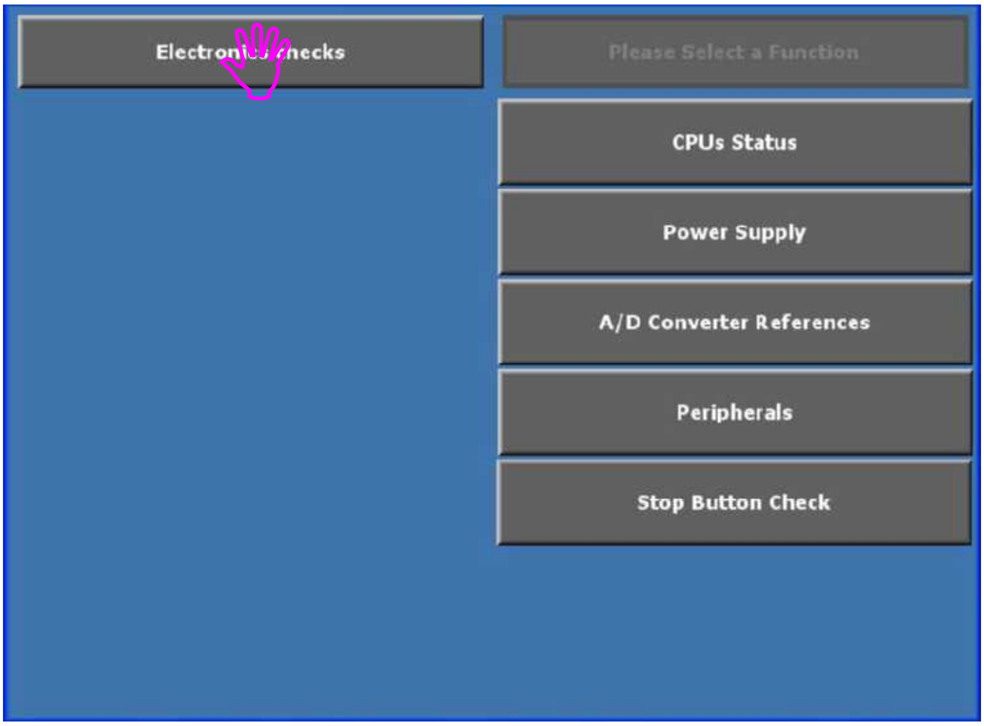

Fig. 6.1-6

The DM displays again the Functions Groups list if the user push on the Group Title button. In the example of Fig. 6.1-5, this button is labelled “Electronics checks” .
At this point the DM hides the Electronics functions list and displays the Function Group list. The user can select a different group from the list, for example “Actuators Check and Test” , and the DM displays the Actuators Functions list.

(DIAG_001) Diagnostic Pages: Overview rev.00

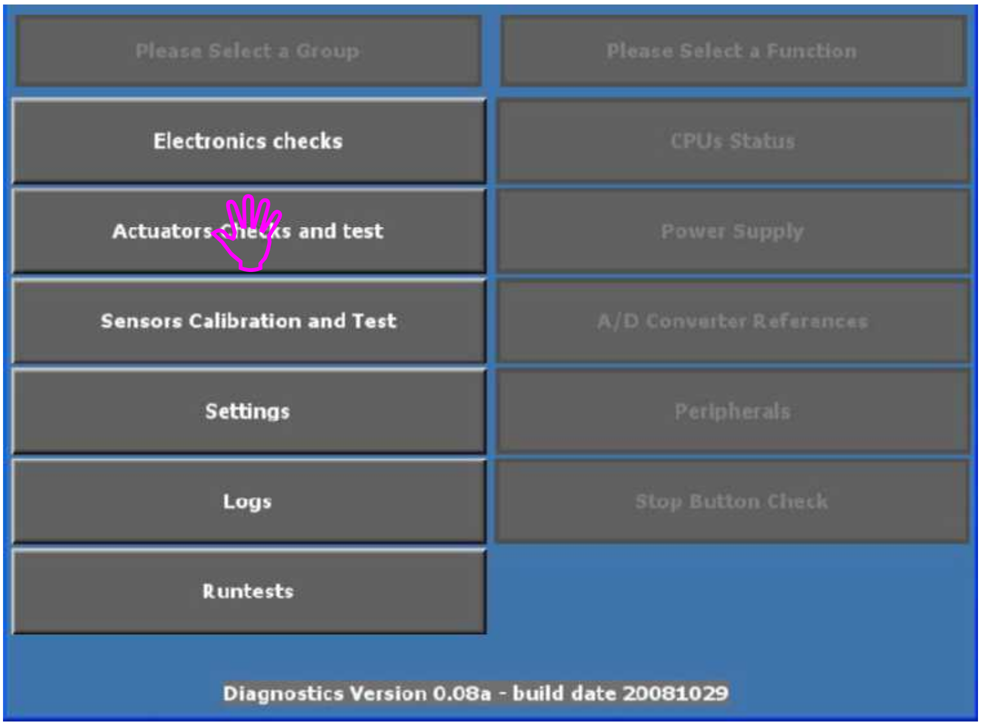

Fig. 6.1-7

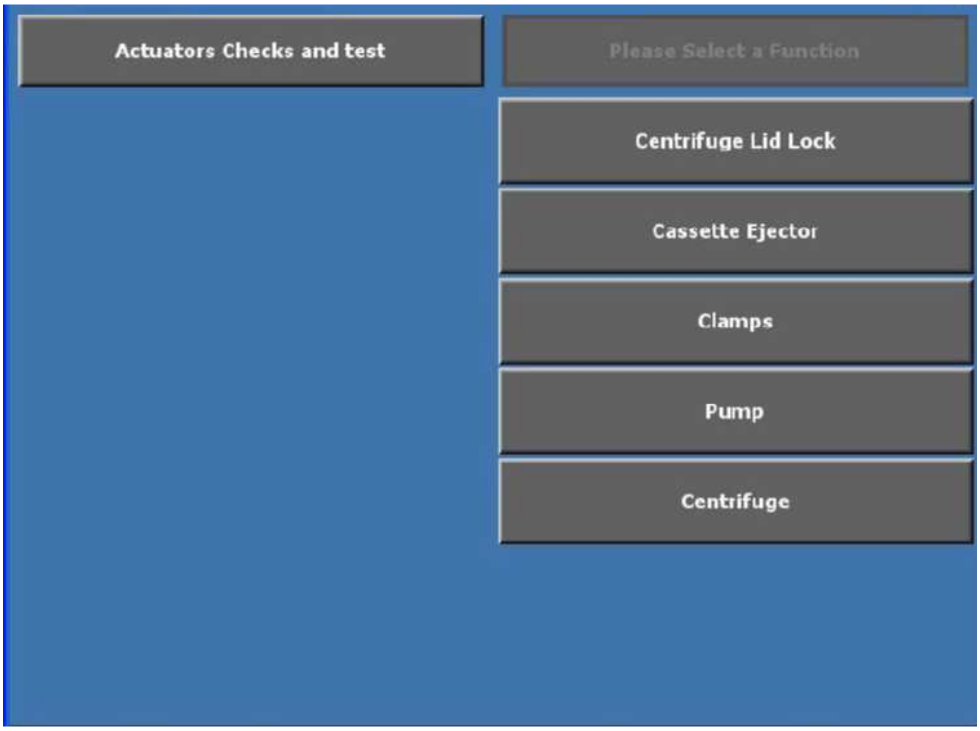

Fig. 6.1-8

6.2 (DIAG_002) Electronics Checks rev.00

6.2.1 About this card

The purpose of this chapter is to describe the **Electronics diagnostics functions**.

6.2.2 Electronics Main Screen

The Electronics Main Screen gives direct access to the diagnostic functions for the following electronics parts:

- CPUs status (ISC links, dip-switches, SW revision);
- Power Supply;
- A/D Converter References;
- Peripherals;
- Stop Button Check.

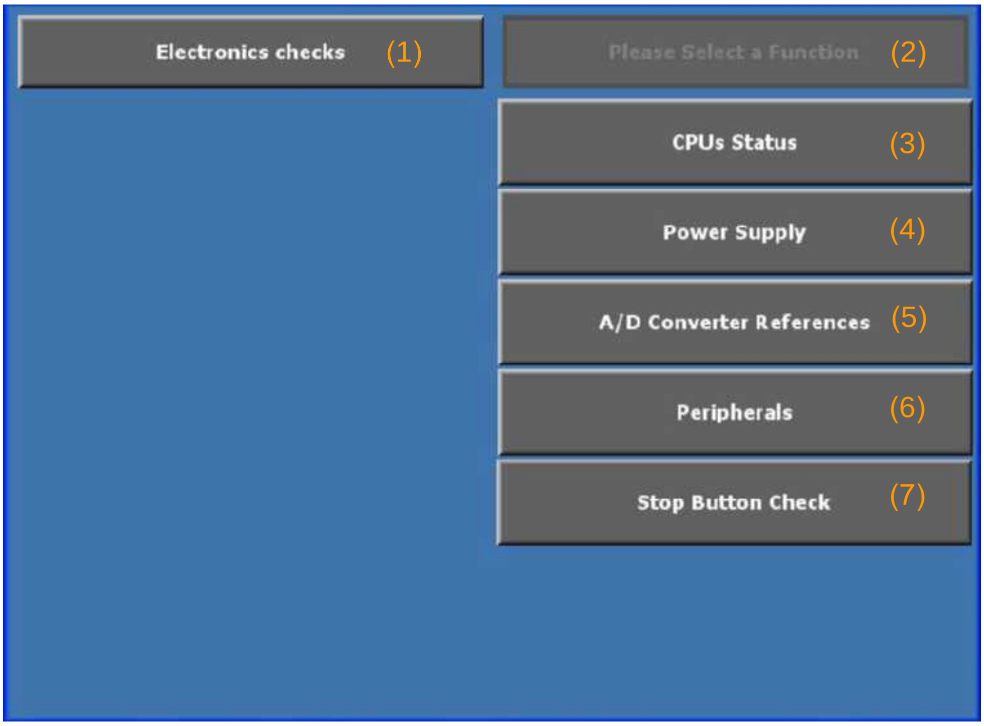

Fig. 6.2-1

In the following Table, it is described the function of each button:

	Label	Action on Button Selection
1	Electronics checks	The Electronics Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Depending of selected function: -Please Select a function -CPUs Status -Power Supply - A/D Converter References - Peripherals -Stop Button Check	Show the list of Electronics functions

3	CPUs Status	Show the screen CPUs Status
4	Power Supply	Show the screen Power Supply
5	A/D Converter References	Show the screen A/D Converter References
6	Peripherals	Show the screen Peripherals
7	Stop Button Check	Show the screen "Stop Button Check"

Table 6.2-1

6.2.2.1 CPUs Status function

The DM supports a CPUs Status function to check and show the status of the XTRA CPUs units. The DM:

- checks the Inter-processor Serial Communication (ISC) links that the CPU should establish;
- displays the SW revision running in each CPU;
- displays the status of the over-temperature detector of the NMC;
- displays the status of the dip-switches accessible to the CPUs.

6.2.2.1.1 CPUs Status Screen

According to the XTRA hardware architecture the following links are checked:

CPUs link	Description
Master, UserInterface	RS232 interface between NMC and NUI CPU
Master, Actuator	RS422 interface between NMC and NAC CPU
Master, Sensor	RS422 interface between NMC and NSC CPU1
Actuator, Vacuum	RS422 interface between NAC and Vacuum Module
Sensor, Buffy Coat Level	TTL serial interface, internal to NSC between its two CPUs, for Buffy Coat Level detection

Table 6.2-2

An active link is displayed as "**up**". A not-active link is displayed as "**down**".

The DM displays the status of the following dip-switches:

CPU board	*Name*	*Bits*
NAC	SW1 (bit1 – bit2)	2
NSC	SW3 (bit1- bit 2)	2
NMC	SW1 bit2, SW2 bit1	2
NUI	SW1	1

Table 6.2-3

6.2.2.1.2 Screen appearance

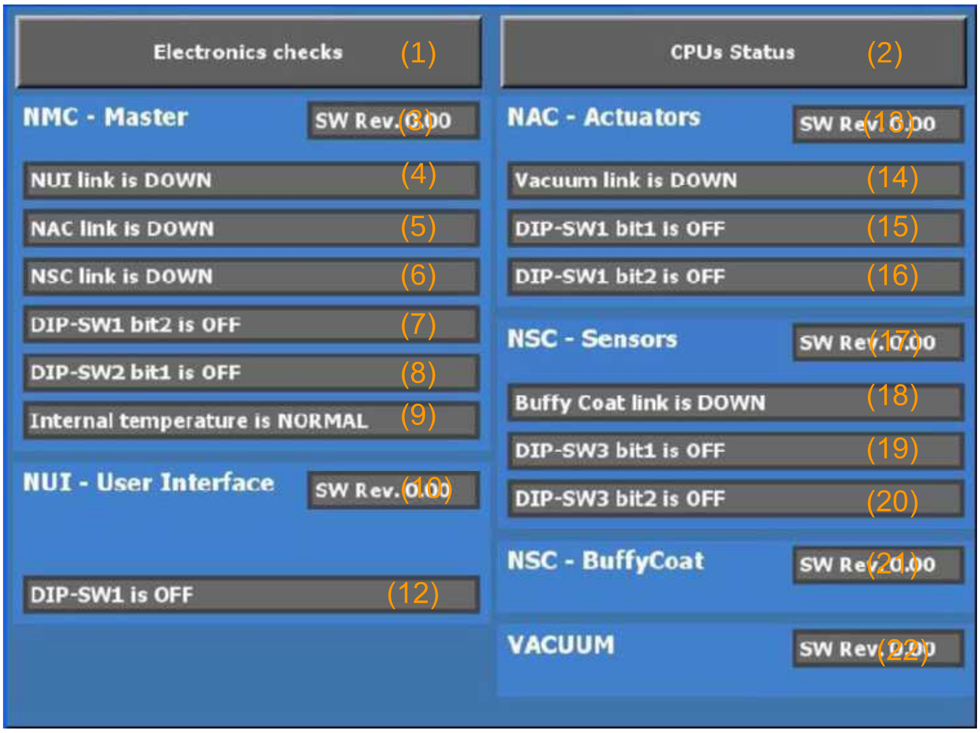

Fig. 6.2-2

ID	Label	Action on Button Selection
1	Electronics	The Electronics Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	CPUs Status	Show the list of Electronics functions

Table 6.2-4

ID	Description
3	NMC - SW revision
4	NMC – status of link with the NUI slave
5	NMC – status of link with the NAC slave
6	NMC – status of link with the NSC slave
7	NMC – status of dip-switch 1 bit 2
8	NMC – status of dip-switch 2 bit 1
9	NMC - Internal temperature sensed on NPS board
10	NUI - SW revision
12	NUI – status of dip-switch 1
13	NAC - SW revision
14	NAC - status of link with the Vacuum slave
15	NAC – status of dip-switch 1 bit 2
16	NAC – status of dip-switch 1 bit 2
17	NSC - SW revision
18	NSC - status of link with NSC-Buffy Coat slave

19	NAC – status of dip-switch 3 bit 1
20	NAC – status of dip-switch 3 bit 2
21	NSC BuffyCoat - SW revision
22	Vacuum - SW revision

Table 6.2-5

6.2.2.2 Power Supply function

The DM supports a function for Power Supply Testing Function (PSTF).
The PSTF:

- checks the main supply voltages, displaying the nominal values and the actual values;
- displays the internal temperature of the XTRA equipment expressed in Celsius degree [°C] as detected from the temperature sensor of the NPS.

6.2.2.2.1 Power Supply Screen

The Table 6.2-6 lists:

- the supply voltages that XTRA can check;
- the nominal value and its tolerance;
- the power supplier module involved;
- a description of how the supply voltage is used;
- the monitoring strategy allowed by the XTRA hardware.

Supply Voltage	Nominal value [V]	Tollerance [mV]	Power Supplier Module	Descriptions	Monitoring Strategy
+3.3_LCD	+3.3V	±200mV	First +5V module (+5VDC-12A)	It is the +3.3V-DC supplying the TFT display. This voltage is obtained with a DC-DC conversion from the +5V_NUI	The NUI shall check the status of its 3.3V regulator
+12V_analog	+12V	±200mV	First +12V module (+12VDC-10A)	It is the +12V-DC supplying the analog circuitries.	1) The NSC shall determine the actual value of the +12V_analog from its TEST-REF+12V signal 2) The NUI shall check the status the +12V_analog that should supply the LCD's inverter of the NUI
-12V_analog	-12V	±500mV	Second +12V module (+12VDC-6A)	It is the -12V-DC supplying the analog circuitries	The NSC shall determine the actual value of the -12V_analog from

					its TEST-REF-12V
+30V_power	+30V	±1000mV	Serial connection of First and Second +15V modules	It is the +30V-DC supplying the power to the actuators	1) The NAC shall detemine the actual value of the +30V_power from its AN_30V_MON. 2) The NMC shall check its 30FAIL-PS signal to determine if the +30V module is working or not 3) the NMC shall check its “30<7V” signal to determine if the +30V module doesn’t work propertly supplying a voltage lower than 7V. 4) the NMC is able to enable/disable the +30V_power through its /+30E-PS signal. 5) The NAC shall detect a main power failure thanks to its VTRAP-NAC signal

Table 6.2-6

The PSTF screen displays the information related to the supply voltages as reported in the followings Table 6.2-7 and Table 6.2-8.

Supply Voltage	Nominal output [V]	Tollerance [mV]	Displayed Informations	Monitoring CPU
+12V_analog	+12V	±200mV	Actual value	NSC
-12V_analog	-12V	±500mV	Actual value	NSC
+30V_power	+30V	±1000mV	Actual value	NSC

Table 6.2-7

Supply Voltage	Displayed Informations	Monitoring CPU	Description
+5V_NUI	OK / LOW	NMC	It is the status of the +5V_NUI as read by the NMC from the related monitor signal of the NPS: • OK means good voltage; • LOW bad voltage.
+30V_enable	ON / OFF	NMC	It is the NMC enable/disable command for the +30V power: • ON means enable; • OFF disable command.
+30V_onoff	ON / OFF	NMC	It is the status of the +30V power as read by the NMC from the related monitor signal of the NPS: • ON means the +30V module is on; • OFF that the module is off.
+30<7V	OK / LOW	NMC	It is the status of the monitor signal of the NPS that checks if the +30V module is malfunctioning: • OK means that the +30V power value is below 7V; • LOW in the opposite case.

Table 6.2-8

6.2.2.2.2 Screen Appearance

Fig. 6.2-3

ID	Label	Action on Button Selection
1	Electronics	The Electronics Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Power Supply	Show the list of Electronics functions
14	+30V Disable	Disable/Enable the +30V module

Table 6.2-9

ID	Description
5	Current Value of +12V analog supply voltage
6	Current Value of -12V analog supply voltage
7	Current Value of +30V power supply voltage
8	Status of +5V supply voltage for NUI
9	Status of enable command for +30V
10	Feedback on +30V current value
11	Status of +30<7V signal
12	Current Internal Temperature sensed on NPS board
14	Each changes re-enable the button “+30V Disable”

Table 6.2-10

6.2.2.3 A/D Converter References

The DM supports a function, called ADC Reference (ADCF), to detect failures in the A/D converters of the CPUs board of XTRA machine.

6.2.2.3.1 A/D Converter References Screen

The ADCF displays the ADC references specified in the Table 6.2-11.

CPU board	ADC reference	Nominal voltage [mV]	Tollerance [mV]
NMC	ADC_REF_4V	+4040	±200
	ADC_REF_2V	+1920	±100
	ADC_REF_1V	+960	±50
NAC	ADC_REF_4V	+4080	±200
	ADC_REF_2V	+2040	±100
	ADC_REF_1V	+1020	±50
NSC	ADC_REF_4V	+4120	±200
	ADC_REF_2V	+1960	±100
	ADC_REF_1V	+980	±50
NSC-BC	ADC_REF_4V	+4120	±200
	ADC_REF_2V	+1960	±100
	ADC_REF_1V	+980	±50

Table 6.2-11

6.2.2.3.2 Screen Appearance

Fig. 6.2-4

ID	Label	Action on Button Selection
1	Electronics	The Electronics Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	A/D Converter References	Show the list of Electronics functions

Table 6.2-12

ID	Description
3	Current Value of VREF1 acquired with NMC's A/D converter
4	Current Value of VREF2 acquired with NMC's A/D converter
5	Current Value of VREF3 acquired with NMC's A/D converter
6	Current Value of VREF1 acquired with NSC's A/D converter
7	Current Value of VREF2 acquired with NSC's A/D converter
8	Current Value of VREF3 acquired with NSC's A/D converter
9	Current Value of VREF1 acquired with NAC's A/D converter
10	Current Value of VREF2 acquired with NAC's A/D converter
11	Current Value of VREF3 acquired with NAC's A/D converter
12	Current Value of VREF1 acquired with NSC-Buffy Coat's A/D converter
13	Current Value of VREF2 acquired with NSC-Buffy Coat 's A/D converter
14	Current Value of VREF3 acquired with NSC-Buffy Coat 's A/D converter

Table 6.2-13

6.2.2.4 Peripherals

The DM supports a Peripherals Check Function (PCF) to check the peripherals connected to the XTRA machine.

6.2.2.4.1 Peripherals Screen

The PCF is able to check the communication link between the XTRA machine and its peripherals listed in the Table 6.2-14.

Peripheral	Link	Description
Printer	Embedded PC, Printer	RS232 interface between NUI and printer

Table 6.2-14

6.2.2.4.2 Screen appearance

The PCF supports a printer test, in which the PCF sends to the printer a prefixed text. The resulting printed page should enable the user to verify wherever the printer worked properly.

Fig. 6.2-5

ID	Label	Action on Button Selection
1	Electronics	The Electronics Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Peripherals	Show the list of Electronics functions
3	Printer Test	The NUI starts the Diagnostics Printer Test

Table 6.2-15

6.2.2.4.3 Printer Test Text

The NUI sends to the printer the following text:

```
1.PRINTER TEST
2.line
3.line
4.line
```

6.2.2.5 Stop Button Check function

The DM enables the user to check that the double acquisition, by the NMC and the NAC, of the Stop Button status works properly.

6.2.2.5.1 Screen Appearance

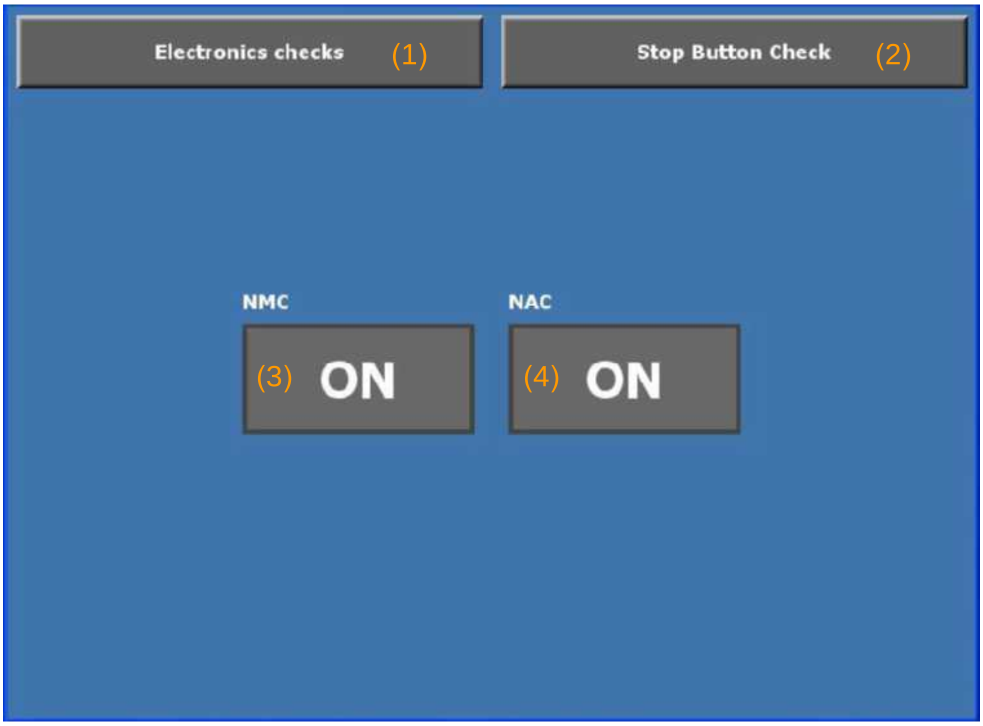

Fig. 6.2-6

ID	Label	Action on Button Selection
1	Electronics	The Electronics Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Stop Button Check	Show the list of Electronics functions

Table 6.2-16

ID	Label	Description
3	OFF/ON	Current Status of Stop Button acquired by NMC
4	OFF/ON	Current Status of Stop Button acquired by NAC

Table 6.2-17

6.3 (DIAG_003) Actuators Checks And Test rev.00

6.3.1 About this card

The purpose of this chapter is to describe the **Actuators diagnostics functions**

6.3.2 Actuators Main Screen

The Actuator Main Screen gives a direct access to the diagnostic functions for the following actuators:

- Centrifuge Lid Lock;
- Cassette Ejector;
- Clamps;
- Roller Pump;
- Separator Centrifuge.

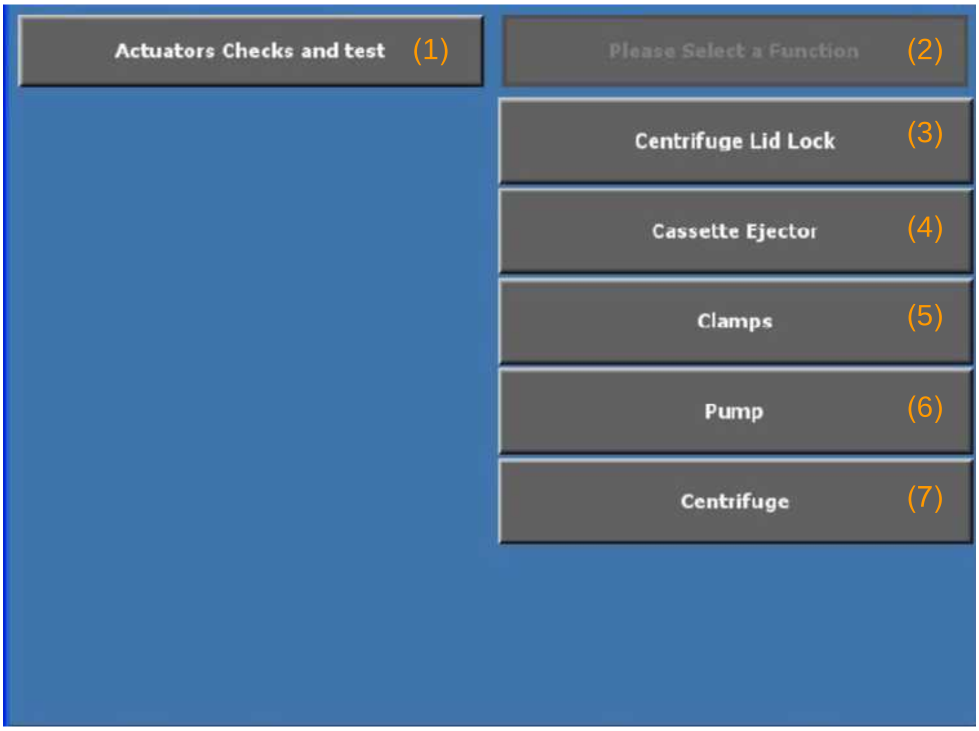

Fig. 6.3-1

In the following Table, it is described the function of each button:

ID	Label	Action on Button Selection
1	Actuators	The Actuators Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Please Select a Function	Show the list of Actuators functions
3	Centrifuge Lid Lock	Show the Centrifuge Lid Lock subScreen
4	Cassette Ejector	Show the Cassette Ejector subScreen
5	Clamps	Show the Clamps subScreen
6	Pump	Show the Pump subScreen
7	Centrifuge	Show the Centrifuge subScreen

Table 6.3-1

6.3.2.1 Centrifuge Lid Lock Test Function

The DM supports a Centrifuge Lid Lock Test Function to allow the user to test the Centrifuge Lid position sensors and the Centrifuge Lid lock system.
The DM:

- displays the actual position of Centrifuge Lid acquired by the related Hall sensor of the NAC and the one of the NSC;
- displays the actual position of the locking latch acquired by the related NSC's optical sensor;
- enables the user to control the Centrifuge Lid latch in both locked and unlocked positions;
- unlocks the Centrifuge Lid latch on entry or exit of the Centrifuge Lid Lock function.

6.3.2.1.1 Centrifuge Lid Lock Screen

Fig. 6.3-2

ID	Label	Action on Button Selection
1	Actuators	The Actuators Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Centrifuge Lid Lock	Show the list of Actuators functions
5	Lock	Activate/Deactivate the lock command

Tabella 6.3-1

ID	Label	Description
3	OPEN/CLOSED	Current position of Centrifuge Lid acquired by the NAC
4	OPEN/CLOSED	Current position of Centrifuge Lid acquired by the NSC
7	ON/OFF	Position of lock acquired by the NAC
6	ON/OFF	Command status received by the NAC
NA	NA	Enable/Disable the button Lock (ID=9)

Table 6.3-2

6.3.2.2 Ejector Test Function

The DM supports a Cassette Ejector Test Function.
The DM delivers the following automatic test function that is started by the user:

- To activate the ejector for 10 s;
- To deactivate the ejector and to inhibit its reactivation for 50s.

The DM deactivates the ejector on entry or exit of the Ejector Test function.

6.3.2.2.1 Ejector Screen

The DM checks the ejector status as detected from the NAC's current sensor of the cassette ejector system.

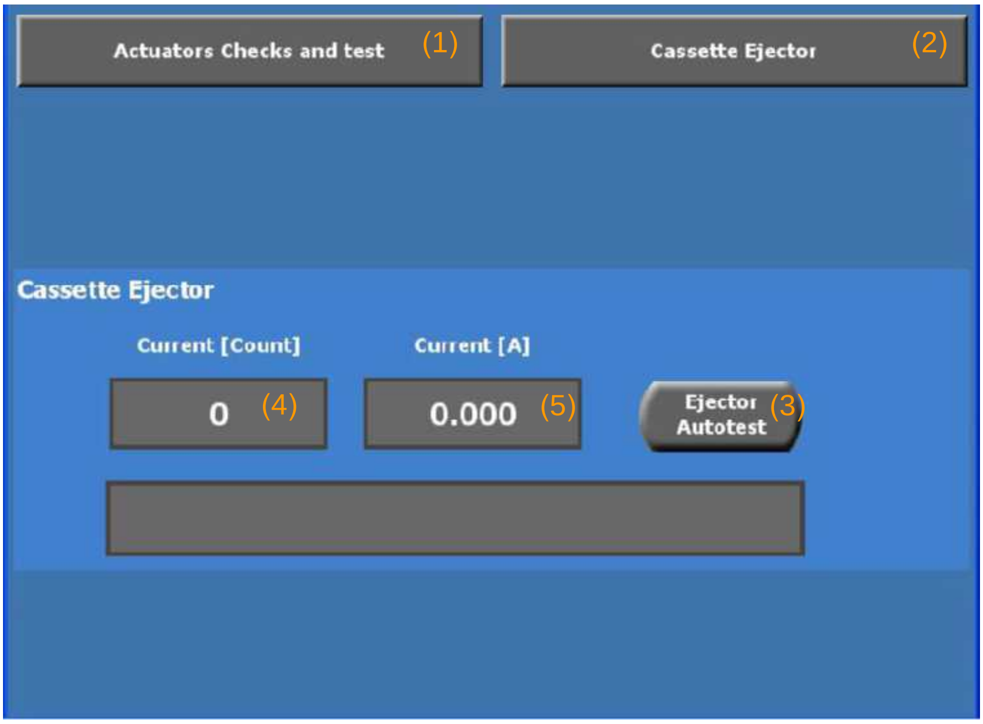

Fig. 6.3-3

ID	Label	Action on Button Selection
1	Actuators	The Actuators Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Cassette Ejector	Show the list of Actuators functions
3	Eject Autotest	Starts the automatic test of ejector

Table 6.3-3

ID	Label	Description
4	0-1023	Current consumption expressed in count
5	0-65535	Current consumption expressed in [A]x1000
NA	NA	Enable/disable the button Eject(ID=3)

Table 6.3-4

6.3.2.3 Clamps Test Function

The DM supports a Clamp Check Function to allow the user to test the clamps of prime, wash and empty separately. The Clamp Check function is available through the Actuators / Clamps Screen.

The CCF:

- enables the user to activate a Clamps Auto-Test that performs the same procedure implemented in clamps T1 Test;
- displays the actual position of each clamp acquired by the related Hall sensor of the NMC and the NAC;
- enables the user to command each clamp in opened or closed position;
- displays the result of the positioning command and the actual position of the clamp acquired by the related Hall sensor of the NAC.

6.3.2.3.1 Clamps Test Screen

The CCF enables the user to start the Clamp Auto-Test[1] command for each clamp and prevents the positioning of a clamp that has not completed successfully its Auto-Test command

Fig. 6.3-4

ID	Label	Action on Button Selection
1	Actuators	The Actuators Group has been selected. Selecting the button the DM shows again the list of available functions groups

[1] Each clamp cannot actuate an open/close command before performing its initialization procedure, called Clamps Autotest. It consists to put the clamp cam in rotation, count the cam encoder pulses between two consecutive open positions and stop the cam in the closed position.

2	Clamps	Show the list of Actuators functions
3	Open/Close	Open/Close the Prime clamp
6	Open/Close	Open/Close the Wash clamp
9	Open/Close	Open/Close the Empty clamp
12	Autotest	Starts the Autotest of Prime Clamp
13	Autotest	Starts the Autotest of Wash Clamp
14	Autotest	Starts the Autotest of Empty Clamp

Table 6.3-5

ID	Description
4 , 7 , 10	Position of Prime (4) , Wash (7) and Empty(10) clamps as acquired by the NAC. The DID1_DiagPosClamp is a byte-wide bitmap, coding the position of clamps and the status of the related positioning commands: 0x01 bit: Prime Clamp positioning status: 1 = OK, 0 = fail/running; 0x10 bit: Prime Clamp position: 1 = open, 0 = closed; 0x02 bit: Wash Clamp positioning status: 1 = OK, 0 = fail/running; 0x20 bit: Wash Clamp position: 1 = open, 0 = closed; 0x04 bit: Empty Clamp positioning status: 1 = OK, 0 = fail/running; 0x40 bit: Empty Clamp position: 1 = open, 0 = closed;
4, 5, 7	Each changes in DID1_DiagTestPosEnd requires an update in the position of Prime (4) , Wash (7) and Empty(10) clamps as acquired by the NAC.
5	Prime Clamp position acquired by NMC: 0 Open, 1 Closed
8	Wash Clamp position acquired by NMC: 0 Open, 1 Closed
11	Empty Clamp position acquired by NMC: 0 Open, 1 Closed
NA	1 means that the Prime Clamps autotest is running, 0 otherwise
NA	1 means that the Wash Clamps autotest is running, 0 otherwise
NA	1 means that the Empty Clamps autotest is running, 0 otherwise
NA	1 means that the Prime Clamps positioning command is running, 0 otherwise
NA	1 means that the Wash Clamps positioning command is running, 0 otherwise
NA	1 means that the Empty Clamps positioning command is running, 0 otherwise
NA	1 means that the Prime clamp is ready to receive a positioning command
NA	1 means that the Wash clamp is ready to receive a positioning command
NA	1 means that the Empty clamp is ready to receive a positioning command

Table 6.3-6

6.3.2.4 Pump Test Function

The DM supports a function for roller pump test (RPTF, Roller Pump Test Function). It enables the user to control the pump direction and speed and to switch on/off the pump motor.
The RPTF:

- displays the user settings and the actual values the machine runs;
- supports both ml/min and rpm pump set point, enabling the user to select the unit. It retains two independent set points for ml/min and rpm, this means that any conversion from ml/min to rpm or from rpm to ml/min is performed;
- enables the user to select a set point in the range of 10 to 1300 ml/min in steps of 10 ml/min, or in the rage of 5 to 150 rpm in steps of 5 rpm;

- enables the user to control the pump in both CW and CCW directions;
- displays the actual speed measured from the pump encoder. The maximum values of positive and negative speed differences (errors) between the set point and the actual speed is displayed. The displayed values are reset each time the pump is started and the speeds is expressed in *ml/min* units;
- displays the actual value of PWM count driving the pump motor;
- checks the pump speed only after a time well suitable to have a steady speed set;
- displays the direction acquired both from the pump encoder and from the motor low shaft.
- allows the user to set/reset the Master Enable and the Actuator Enable signals to switch on/off the pump motor;
- allows the user to enable/disable the over-current protection stop. It displays the current consumption of the pump motor. The current is expressed in *A* units with 3 decimal. It displays the status of the over-current protection, the displayed values are reset each time the pump is started;
- displays the status of the over-temperature digital sensor of the pump motor;
- displays the internal temperature of the XTRA equipment expressed in Celsius degree [°C] with one decimal digit, as detected from the temperature sensor of the NPS.

The RPTF defaults are:

- set point, 100 ml/min and 50 rpm (the set points are independent);
- direction, CCW;
- Master Enable, OFF;
- Actuator Enable, OFF;
- Over-current Protection, ON;
- Max pos. speed error, 0 ml/min;
- max neg. speed error, 0 ml/min.

The RPTF stops the pump when the DM ways out the RPTF itself.

6.3.2.4.1 Pump Test screen

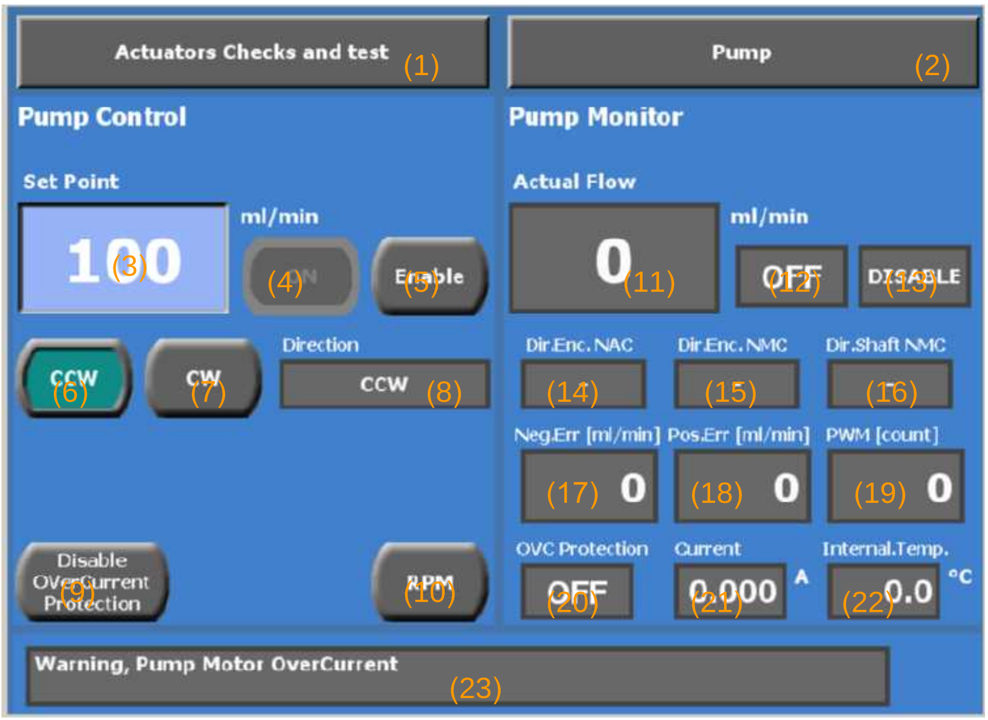

Fig. 6.3-5

(DIAG_003) Actuators Checks And Test rev.00

ID	Label	Action on Button Selection
1	Actuators	The Actuators Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Pump	Show the list of Actuators'functions
5	Enable	Enable/Disable the pump
4	ON	Turn ON/OFF the pump
6	CCW	Command the CCW direction
7	CW	Command the CW direction
9	DISABLE OVC	Each selection toggle the command enable/disable of the overcurrent protection

Tabella 6.3-2

ID	Label	Description
NA	-	Each new value re-enables the buttons Enable(ID4) and ON/OFF (ID7)
3	-	User modificable pump set point, expressed in ml/min or in rpm unit, according to set point unit command.
10	-	Command the pump set point unit: • 0 ml/min • 1 rpm
11	0 - 1300	Current pump speed as acquired by the NAC
12	-	• 0 OFF • 1 ON
13		• 0 Disable • 1 Enable
14	CCW / CW	Pump direction acquired with the encoder by the NAC: • 1, CCW • 0, CW
15	CCW / CW	Pump direction acquired with the encoder by the NMC: • 1, CCW • 0, CW
16	CCW / CW	Pump direction acquired with the low shaft by the NMC: • 1, CCW • 0, CW
17	-	Maximun of negative speed error
18	-	Maximum of positive speed error
19	0-10000	Current PWM count applied to the pump motor. • 10000 is the maximum
20	ON / OFF	overcurrent protection circuit: • 1, the overcurrent protection is ON • 0, the overcurrent protection is OFF
21	0 - 65553	Actual value of pump motor's current consumption
22		Internal temperature sensed on NPS acquired by the NMC
23	-	Display a message according to the DID value: • 1, warning about the Overtemperature of the Pump Motor • 0, remove any message
24	-	Display a message according to the DID value: • 1, warning about the OverCurrent of the Pump Motor • 0, remove any message

Tabella 6.3-3

6.3.2.5 Centrifuge Test Function

The DM supports a function for centrifuge test (CTF, Centrifuge Test Function). It enables the user to control the centrifuge direction and speed, and to switch on/off the centrifuge motor.
The CTF:

- displays the user settings and the actual values the machine runs;
- enables the user to select a set point in the range from 100 to 5600 rpm in steps of 100 rpm;
- displays the actual speed measured from the centrifuge encoder. The maximum values of positive and negative speed differences (errors) between the set point and the actual speed is displayed. The displayed values are reset each time the centrifuge is started and the speed errors are expressed in *rpm* units;
- displays the actual value of PWM count driving the centrifuge motor;
- checks the centrifuge speed only after a time well suitable to have a steady speed set[2];
- measures and displays the acceleration time that is the time the centrifuge brings to speed up to the set point starting from 0 rpm. The displayed acceleration time is kept until the centrifuge is newly restarted from 0 rpm and is expressed in *seconds* units, with 3 decimal digit;
- displays the centrifuge direction acquired from the motor encoder both from the Master and the Actuator;
- displays the current consumption of the centrifuge motor, expressed in *Ampere* units with 3 decimal digit;
- displays the status of the over-temperature digital sensor of the centrifuge motor;
- displays the status of the PWM failure digital signal;
- supports a function for testing that the centrifuge can be driven in CW direction (CW Test).

The CTF defaults are:

- setpoint, 2800 rpm;
- direction, CCW;
- on/off command, OFF;
- Max pos. speed error, 0 rpm;
- max neg. speed error, -0 rpm.

The CTF stops the centrifuge when the DM ways out the CTF itself.

[2] The CTF shall wait 6 s for setpoint in the range from 100 to 2700 rpm and from 2800 to 5600 rpm , 6 s more 3 s for each 700 rpm from 2800 rpm.

6.3.2.5.1 Centrifuge Screen

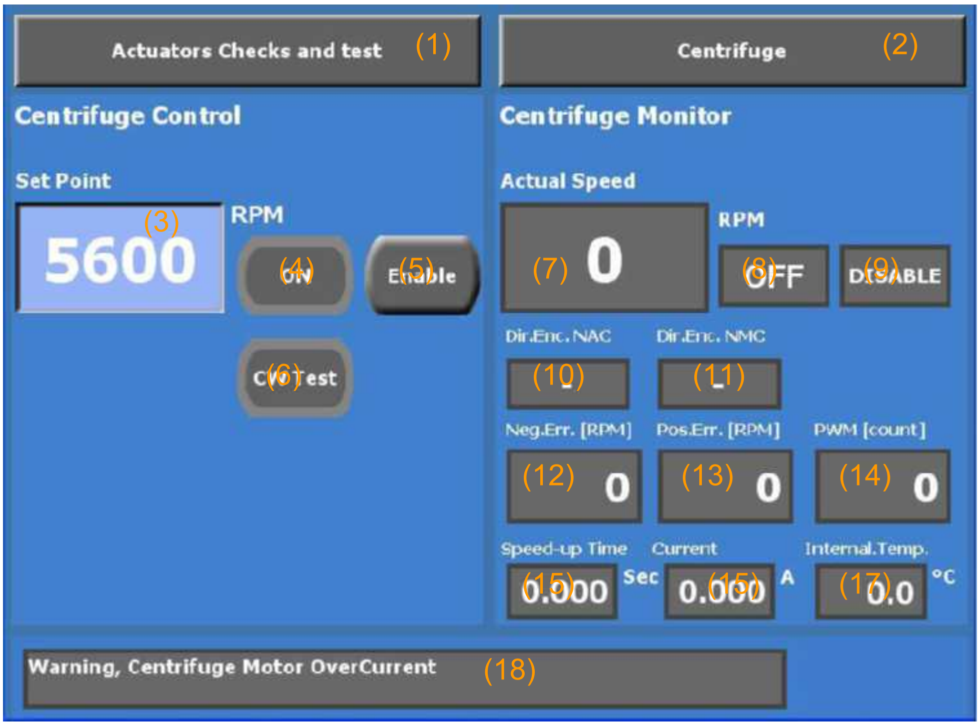

Fig. 6.3-6

ID	Label	Action on Button Selection
1	Actuators	The Actuators Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Centrifuge	Show the list of Actuators'functions
4	ON	Button to activate/deactivate the Actuator's on/off command for the centrifuge
5	Enable	Button to activate/deactivate the Master Enable of the centrifuge
6	CW Test	Starts the CW test

Table 6.3-7

ID	Label	Description
NA	-	1 re-enables the CW test button (ID6)
NA	-	Each changes in the value re-enables the Enable button (ID5)
3	0 - 5600	User modificable centrifuge set point
7	0 – 5600	Current centrifuge speed as acquired by the NAC in rpm
8	ON / OFF	Returs the status of the Actuator on/off command of the centrifuge
9	Enable / Disable	Returs the status of the Master Enable
10	CCW / CW	Centrifuge direction acquired with the encoder by the NAC: 1, CCW 0, CW

11	CCW / CW	Centrifuge direction acquired with the encoder by the NMC: 1, CCW 0, CW
12	-0 to -65535	Maximun of negative speed error
13	0 to 65535	Maximum of positive speed error
14	0 -1023	Current PWM count applied to the centrifuge motor
15	0.000 – 65.535	Display the speed up time
16	0.000 – 65.535	Actual value of centrifuge motor’s current consumption
17	0.0 – 6553.5	Internal temperature sensed on NPS acquired by the NMC
18	-	Display a message according to the DID value: 1, warning about the Overtemperature of the Centrifuge Motor 0, remove any message
18	-	Display a message according to the DID value: 1, warning about the OverCurrent of the Centrifuge Motor 0, remove any message

Table 6.3-8

6.4 (DIAG_004) Sensors Calibration And Test rev.00

6.4.1 About this card

The purpose of this chapter is to describe the **Sensors diagnostics functions.**

6.4.2 Sensors Main Screen

The Sensors Main Screen gives a direct access to the diagnostic functions for the following sensors:

- HCT;
- HGB/FPH;
- Buffy Coat;
- Reservoir Scale;
- Kit Reader.

The functions for the following sensors:

- Air Bubble Detector;
- Bowl Arm position;
- Blood Loss Detector;
- RBC Line Over-Pressure

are grouped in only one screen, named Others Sensors.

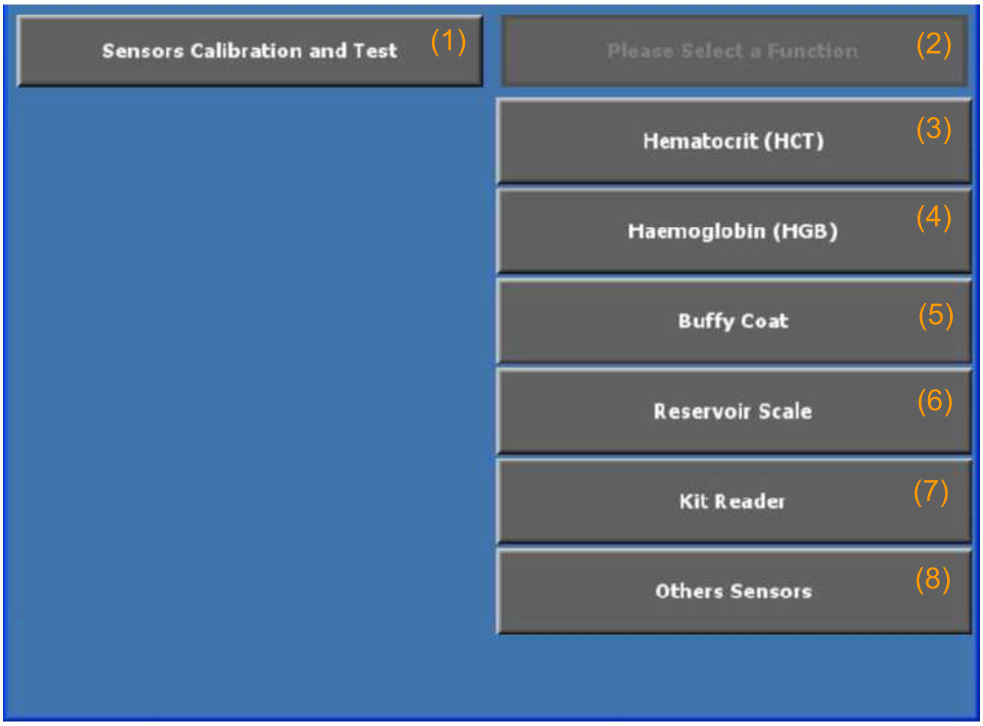

Fig. 6.4-1

In the following Table, it is described the function of each button:

ID	Label	Action on Button Selection
1	Sensors	The Sensors Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Please Selech a function	Show the list of Sensors'functions
3	ON	Show the HCT screen
4	Enable	Show the HGB screen
5	Buffy Coat	Show the Buffy Coat screen
6	Reservoir Scale	Show the Reservoir Scale screen
7	Kit Reader	Show the Kit Reader screen
8	Others	Show the Others screen

Table 6.4-1

6.4.3 HCT Indicator

The DM supports a function for HCT indicator calibration and test (HCTF).
The HCTF supports the configuration of the HCT indicator transmitting power (Tx) level from 0 to 255[3].
The HCTF:

- supports the configuration of the HCT indicator receiver sensitivity[4];
- controls the pre-amp gain in a range of 100 discrete levels (via the **Rx-Trim**) and the power-amp gain (**Rx-Factor**). It manages and displays the actual Rx-Factor that corresponds to the HCT indicator receiver power-amp gain with a 10x factor:
  - 10 for 1V/V power-amp gain;
  - 49 for 4.9 V/V;
  - 160 for 16 V/V;
  - 340 for 34 V/V;
  - 1938 for 193.8 V/V.
- displays the HCT indicator response as read by the 10 bit A/D Converter of the HCT sensor expressed in count (**Rx-Count**) in the range of 0 to 1023 counts;

It automatically adjusts the Rx-Factor to keep the Rx-Count in the range of [0, 1023] count, and it displays the normalized (**Norm-Count**) value of the Rx-Count.

- displays the HCT value, expressed in percent, associated to the actual HCT indicator response (NormCount);
- enables the user to select the type of anticoagulant;
- is able to access to the reference HCT maps[5], that are empirical tables, related to the selected anticoagulant;

[3] The HCT sensor trasmitter power (Tx Level) is controlled by the current through the 805nm LED. This current is controlled by the output voltage of a 8-bit DAC (TP12 of NSC board), so that the SW can be select 256 different Tx Levels.

[4] The HCT sensor receiver transduces the received signal from 805nm light to current, then into voltage. This voltage signal is finally amplified thought a three stage amp. The receiver pre-amp gain (1st stage) is SW configurable via a digital trimmer with 100 different values (0 minimum gain, 99 maximum gain). The receiver power-amp(2nd and 3rd stages) has 5 different SW configurable values of gain: x 1, x 4.9, x 16, x 34 and x 193.8.

The HCTF supports four HCT maps related to the anticoagulant types: heparin, ACD, CPD and custom.

The HCTF accesses the reference HCT map after converiting the actual HCT sensor response (NormCount) to the related reference extimation (**mqNCount**).

The HCTF:

- enables the zero-adjustment **(zeroAdj)** procedure, that the machine should perform each time a new disposable is loaded, to adjust the default TxLevel to compensate the different optical dispersion of each HCT cuvette installed inside the HCT holder. A fixed Rx count level is achieved (**RefRxCount935**, fixed reference , default 935);
- enables the user to manually (**Manual** button) change the actual values of TxLevel, RxTrim and RxFactor. Any manual changes of these values disables the automatic RxFactor adjustment;
- enables the user to input the reference Rx count level (**RefRxCount**, modificable reference, default 740) required for HCT sensor calibration;
- supports a calibration procedure (**ledCalib**) that automatically performs the calibration of the HCT sensor transmitter power (TxLevel) and pre-amp gain (RxTrim), well suitable to bring the HCT sensor response to a reference Rx count level (RefRxCount 2). This procedure ends within 10 s;
- supports a procedure to calibrate the HCT sensor response (**mqCalib**), adjusting the calibration coefficient through a linear regression algorithm that minimizes the response error respect to a reference HCT sensor;
- allows the user to force percentance variations on the machine reading of the HCT maps (**fineTune**), related to the supported anticoagulants. It allows the user to set different variations of the prefixed HCT ranges in the range of ± 80% with steps of 1%.
- prevents the user to start accidentally the procedures that can modify the default calibration settings of the HCT sensor.

[5] A reference HCT map contains samples of the HCT sensor's response of the reference machine (RefNormCount) associated to a significant set of HCT values.

6.4.3.1 HCT Main Screen

The HCT Indicator Main screen displays the "Factory mode button" that enables/disables the following buttons: ledCalib, mqCalib, Manual, and fineTune.

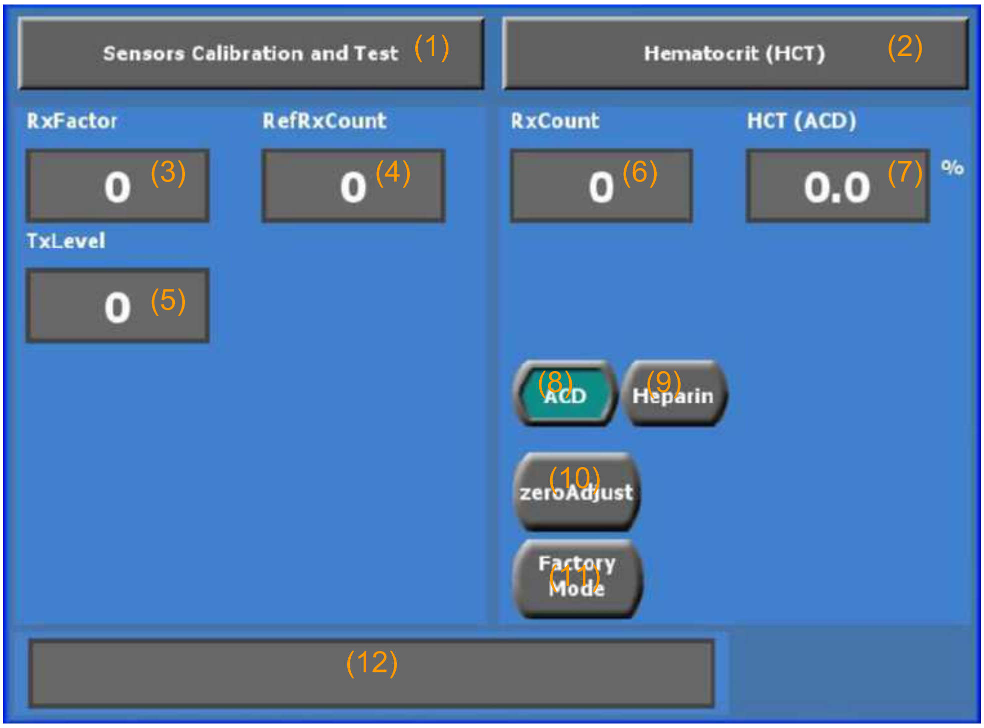

Fig. 6.4-2

ID	Action on Button Selection
1	The Sensors Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Show the list of Sensors'functions
8	Select the HCT table for anticoagulant ACD
9	Select the HCT table for anticoagulant heparin
10	Launch the zeroAdjust procedure
11	Access to the the factory mode. Display the buttons: - ledCalib (ID17) - mqCalib (ID18) - fineTune (ID19) Disable the button: - zeroAdjust (ID10)

Table 6.4-2

ID	Label	Description
3	10, 49, 160, 340, 1938	Return gain of RxFactor
4	0-1023	Return RefRxCount
5	0-255	Return TxLevel
6	0-1023	Return RxCount
7	0.0 to 100.0	Return AnIn HCT from Sensors board. This HCT value depends on selected calibration curve (ACD or Heparin), but it is not affected by mq corrections.

12		Return code of executed procedure: • 140, zeroAdjust completed successfully • 150, zeroAdjust failed

Table 6.4-3

6.4.3.1.1 HCT Factory Main Screen

Factory mode button selection enables the user to access the factory procedures. Therefore the following buttons are displayed: ledCalib, mqCalib, Manual and fineTune.

Once the factory button is selected, the RefRxCount = 935 is no more used. It takes place the calibration RefRxCount, which default is 740 count. This default can be modified inside the Manual subScreen.

Fig. 6.4-3

ID	Label	Action on Button Selection
1	Sensors	The Sensors Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	HCT	Show the list of Sensors'functions
8	ACD	Select the HCT table for anticoagulant ACD
9	HEP	Select the HCT table for anticoagulant heparin
10	zeroAdjust	Launch the zeroAdjust procedure
11	Factory Mode	Access to the the factory mode. Display the buttons: - ledCalib (ID17) - mqCalib (ID18) - fineTune (ID19)

		Disable the button: - zeroAdjust (ID10)
17	ledCalib	Display the ledCalib subScreen, and launch the ledCalib procedure.
18	mqCalib	Display the mqCalib subScreen, and launch the mqCalib procedure.
19	fineTune	Display the fineTune subScreen

Table 6.4-4

ID	Label	Description
3	10, 49, 160, 340, 1938	Return AnIn RxFactor
4	0-1023	Return RxCount reference
5	0-255	Return TxLevel
6	0-1023	Return AnIn RxCount
7	0.0 to 100.0	Return AnIn HCT
12		Return code of executed procedure: • 100, ledCalib is running • 110, LedCalib completed successfully • 120, LedCalib failded • 130, zeroAdjust is running • 140, zeroAdjust completed successfully • 150, zeroAdjust failed • 160, mqCalib is running • 170, mqCalib completed successfully • 180, mqCalib failed
20		Return RxTrim
13		Return mHCTAdv
14		Return aHCTAdv
15		Return HCT NormCount
16		Return HCT mqNormCount

Table 6.4-5

6.4.4 HGB / FPH Indicator

The DM supports a function for HGB indicator calibration and test (HGBF).

The HGBF:

- supports the configuration of the HGB indicator transmitting power (Tx) level from 0 to 255[6];
- supports the configuration of the HGB indicator receiver sensitivity[7];

[6] The HGB sensor trasmitter power (Tx Level) is controlled by the current through the 565nm LED. This current is controlled by the output voltage of a 8-bit DAC(TP15 of NSC board), so that the SW can be select 256 different Tx Levels.

[7] The HGB sensor receiver transduces the received signal from 565nm light to current, then into voltage. This voltage signal is finally amplified to a level well suitable to A/D conversion. The receiver gain is SW configurable via a digital trimmer with 100 different values (0 minimum gain, 99 maximum gain).

- controls the receiver gain in a range of 100 discrete levels (via the RxTrim);
- displays the HGB indicator response as read by the 10 bit ADC of the HGB indicator expressed in count (RxCount) in the range of 0 to 1023 counts;
- displays the estimation of the Free Plasma Hemoglobin(FPH), associated to the HGB indicator response via a store FPH map, expressed in mg/dl;
- enables the user to input a reference Rx Count level (RefRxCount) needed for HGB sensor test and calibration.

The HGBF enables the user to manually change the actual values of TxLevel, RxTrim, and to reset the actual values of TxLevel and RxTrim to their defaults, and it supports a calibration procedure (Calib) that automatically performs the calibration of the HGB sensor transmitter power (TxLevel) and receiver gain (RxTrim). This procedure ends within 10 s.

6.4.4.1 HGB/FPH Main Screen

The HGB/PFH main screen displays the “Factory mode button” that enables/disables the following buttons: ledCalib, and Manual.

Fig. 6.4-4

(DIAG_004) Sensors Calibration And Test rev.00

Fig. 6.4-5

Fig. 6.4-6

ID	Label	Action on Button Selection
1	Sensors	The Sensors Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Hemoglobin (HGB)	Show the list of Sensors'functions

8	Factory Mode	Enters in the factory mode, displays: • ledCalib button (ID 8) • TxLevel textbox (ID 4) • RxTrim textbox (ID 5)
9	ledCalib	Starts the ledCalib procedure
11	Store	Store the changes in HGB calibration parameters: - Txlevel - RxTrim
12	Cancel	Discards the changes in the HGB calibration parameters

Table 6.4-6

ID	Description
3	Display the reference RxCount
4	Display the current value of the TxLevel
5	Display the current value of the RxTrim
6	Display the count resulting from the A/D conversion of the received HGB signal
7	Display the estimated value of HGB
10	Return code of executed procedure: • 200, ledCalib is running • 210, LedCalib completed successfully • 220, LedCalib failed

Table 6.4-7

6.4.5 Buffy Coat

The DM supports a function (BCF) to calibrate and test the Low Buffy-Coat sensor[8] (BC-L) and to test the High Buffy-Coat sensor(BC-H).
The BCF:

- displays the BC-H level value expressed in the range of 0÷1023 counts;
- displays the BC-L Level[9]; the minimum BC-L level is defined as 800, and the maximum is defined as 950;

The BCF calibration procedures require the use of a proper Calibration Bowl.

The BCF allows the user to input the $RefV_{min}$ that characterizes a Calibration Bowl; displays the stored $RefV_{min}$ and allows the user to change it in the range specified below:

	Factory default	min	Max
$RefV_{min}$	**600 mV**	**500mV**	**900mV**

Table 6.4-8

The BCF displays the following parameters of the BC-L waveform[10]:

[8] The BC-L sensor receiver is made up of a 128 bit CCD array, a linear amplifier and a 10 bit ADC. The CCD pixels are outputted sequentially with a rate of 200 µs/pixel, therefore a complete CCD image acquisition takes at least 25.6ms. The ADC ratio is approximately 5 mV/count.

[9] This corresponds approximately to the distance from the bowl base and the position of the first CCD pixel with a voltage greater of 3,4 V, expressed in mm.

[10] The desiderable BC-L waveform for a calibration bowl is characterized by a starting step that corresponds to the time reference (Point 0), by four points at 3,5 V, P_{T1}, P_{T2}, P_{T3}, P_{T4} indentified by four times (T1, T2, T3 and T4), by two

parameter	default	min	Max
T1	**0**	**0ms**	**26.009ms**
T2	**0**	**0ms**	**26.009ms**
T3	**0**	**0ms**	**26.009ms**
T4	**0**	**0ms**	**26.009ms**
V_{max1}	**0**	**0mV**	**4000mV**
V_{max2}	**0**	**0mV**	**4000mV**
V_{min}	**0**	**0mV**	**4000mV**

Table 6.4-9

The BC-L sensor transmission level[11](TxLevel) and receiver sensitivity[12] (RxTrim) can change in the ranges specified below:

	Factory default	min	Max
TxLevel[13]	**204 count**	**0 count**	**1023 count**
RxTrim	**49 step**	**0 step**	**99 step**

Table 6.4-10

The BCF supports a three steps procedure that has to be performed with a proper calibration bowl:

1. IR1 calibration: it automatically pre-calibrates the BC-L sensor transmitter[14] and receiver. The TxLevel (IR1) found is used with bowl type X/225, X/175, X/55 only.
2. It edits manually (IR1) TxLevel.
3. IR2 calibration: it automatically adjusts the TxLevel used with the X/125 bowl (IR2 TxLevel), to compensate the minor reflectivity of that bowl.

The BCF allows the user to store the BC-L sensor TxLevel and RxTrim previously set by the user or by the machine with a Calib procedure, and it prevents the user to start accidentally the procedures that can modify the default calibration settings of the BC-L and BC-H sensors.

6.4.5.1 Buffy Coat Screen

The BC calibration screen displays the “Factory mode button” that enables/disables the following buttons: IR1 Calibrate, IR2 Calibrate, Manual, IR2 TxLevel.

maximums P_{Vmax1} and P_{Vmax1}, identified by V_{max1} and V_{max2}, and the minimum P_{Vmin} between the two maximums, indentified by V_{min}.

[11] The BC-L sensor’s transmitter is made up of a set of three IR Leds (880nm) whose bias current is SW controlled and selectable in the range of [0 – 1023] discrete steps(TxLevel).

[12] The receiver sensitivity is adjusted changing via SW the value of a digital trimmer(RxTrim), in the range of [0-99] discrete values.

[14] The TxLevel stored will be used with bowl type: BT225, BT175, BT55. When using a BT125 the machine will boost the TxLevel of a number of counts, that corresponds to a +100mV increment of the IR-LED’s bias voltage.

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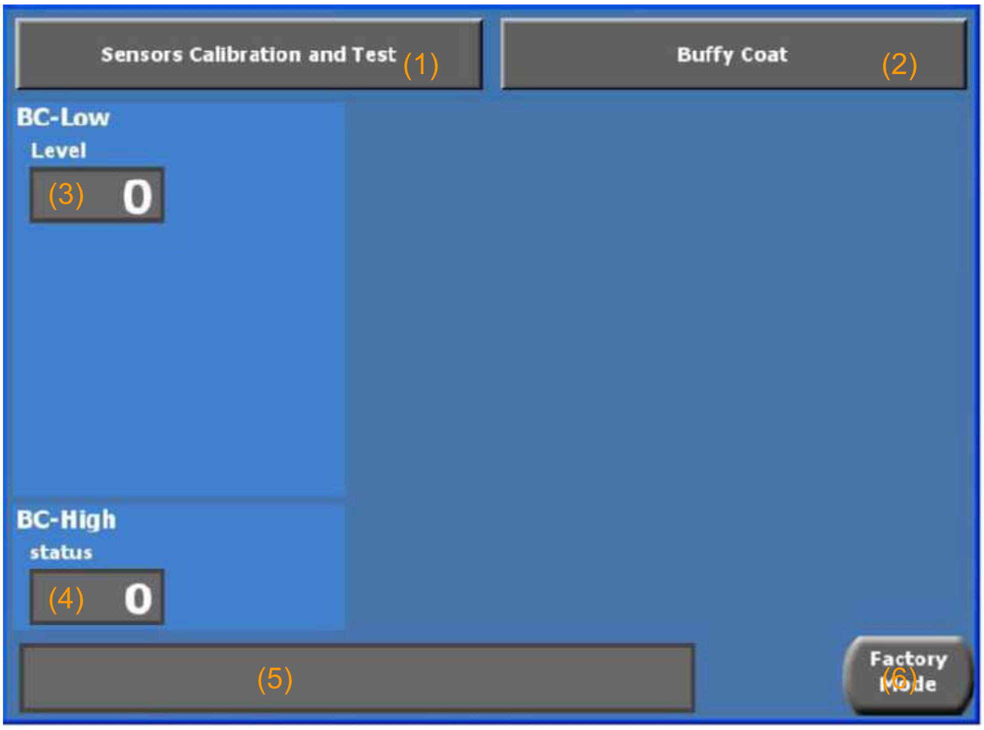

Fig. 6.4-7

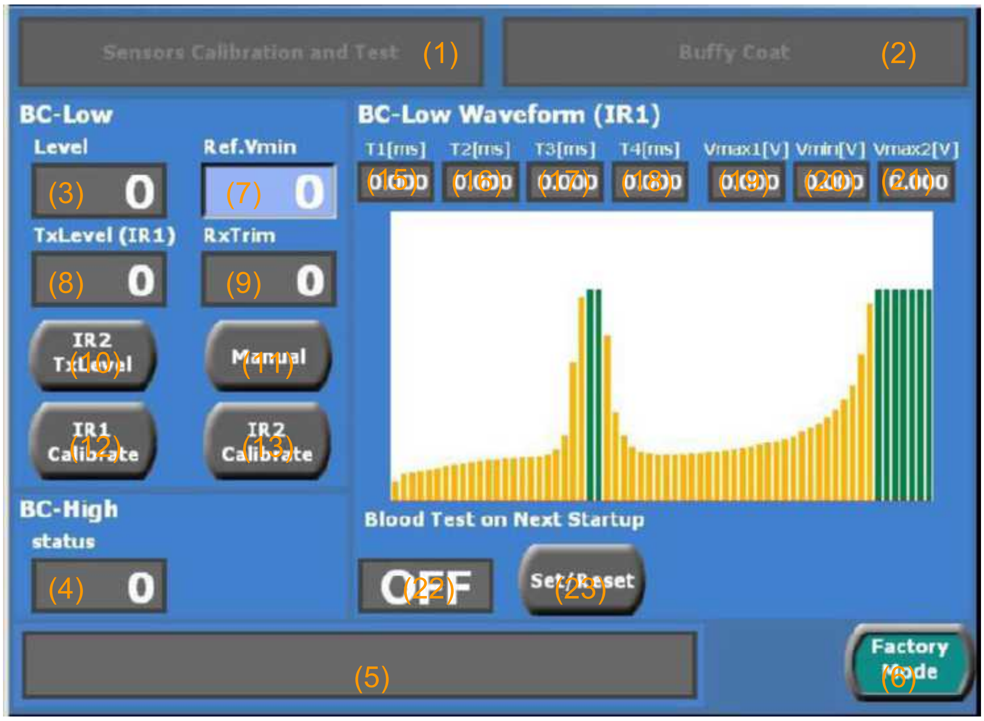

Fig. 6.4-8

ID	Label	Action on Button Selection
1	Sensors	The Sensors Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Buffy Coat	Shows the list of Sensors functions

6	Factory Mode	Enters the factory mode, it displays: • ledCalib button (ID 8) • TxLevel textbox (ID 4) • RxTrim textbox (ID 5)
10	IR2 TxLevel	Displays the TxLevel for IR2
11	Manual	Enables the manual edit of TxLevel for IR1
12	IR1 Calibrate	Starts the IR1 calibration procedure
13	IR2 Calibrate	Starts the IR2 calibration procedure
23	Set/Reset	Sets or resets the request of blood test procedure on the next startup. Since this procedure is performed only in Manufacturing, it is disabled in the FSE environment.
24	Store	Stores the changes in Buffy Coat calibration parameters:
25	Cancel	Discards the changes in the Buffy coat calibration parameters

Table 6.4-11

ID	Description
3	The current level of BC low expressed in count
4	The current level of BC high expressed in count
7	Returns minimum voltage reference
8	Returns TxLevel
8	Returns AnIn IR1
8	Returns AnIn IR2
9	Returns AnIn Rx trim count
5	Return code of executed procedure: • 200, IR1/IR2 calibration is running • 210, IR1/IR2 calibration completed successfully • 220, IR1/IR2 calibration failed
22	Returns BC level during Blood Test
15	Returns the T1 time
16	Returns the T2 time
17	Returns the T3 time
18	Returns the T4 time
19	Returns the Vmax1 value
20	Returns the Vmin value
21	Returns the Vmax2 value

Table 6.4-12

6.4.6 Reservoir Scale

The DM supports a function to test and calibrate the weight sensor of the Reservoir Scale (RSF). The RSF converts the weight sensor output into weight expressed in [g] according to the following correction formula:

weight = count* gain/1000 + offset/10

Where: “count” is the output of the weight sensor load cell digitally converted in a range of 0÷1023 counts, “gain” is a correction factor variable in the range of 0÷10000 and “offset” is a zero correction variable in the range of -20000÷0.
The RSF displays the weights inside the range of 0÷5000 [g]. The RSF alerts the user if the converted weight exceed the 5000 value.
The RSF supports a function, Calib, that automatically adjusts the correction parameters, offset and gain, after a calibration procedure.

The RSF enables the user to manually adjust gain and offset or access to the Calib function.

The RSF prevents the user to start accidentally the procedures that can modify the default calibration settings of the Reservoir Scale sensor.

6.4.6.1 Reservoir Scale Screen

The Reservoir Scale screen displays the “Factory mode button” that enables/disables the following buttons: Calib, Manual, and Store.

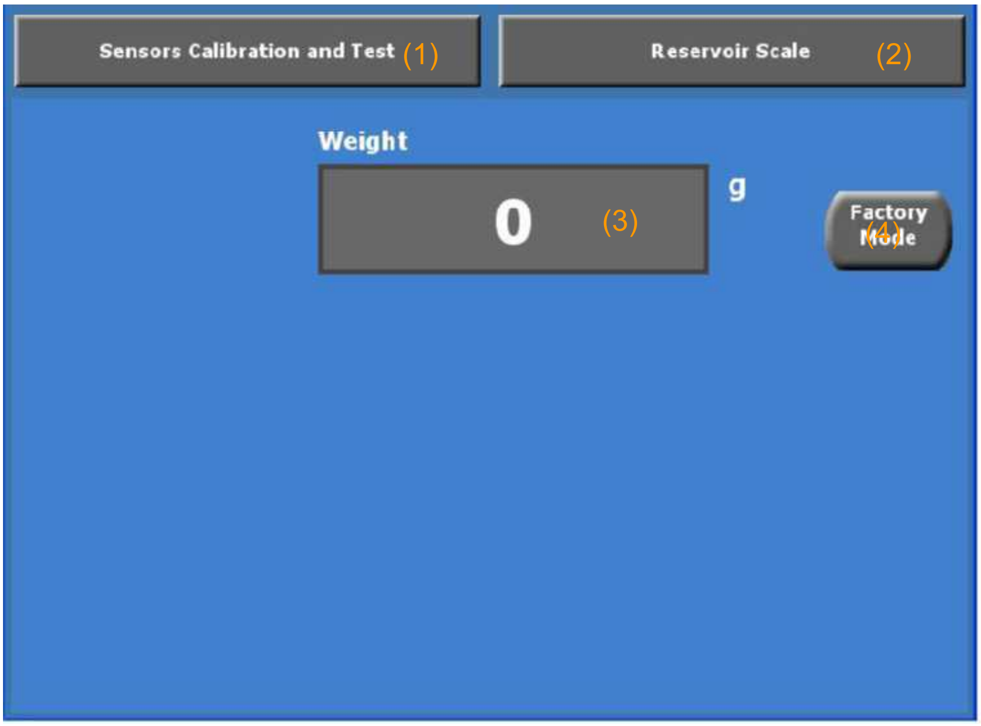

Fig. 6.4-9

(DIAG_004) Sensors Calibration And Test rev.00

Fig. 6.4-10

Fig. 6.4-11

(DIAG_004) Sensors Calibration And Test rev.00

Fig. 6.4-12

ID	Label	Action on Button Selection
1	Sensors	The Sensors Group was selected. Selecting the button the DM shows again the list of available functions groups
2	Reservoir Scale	Show the list of Sensors'functions
4	Factory Mode	Enters in the factory mode
8	Calib	Starts the Calibration procedure
11		Confirm that any weight is on the reservoir scale
12		
13	Store	Store the changes in reservoir scale's gain and offset
14	Cancel	Discards the changes in reservoir scale's gain and offset

Table 6.4-13

ID	Description
3	Returns AnIn Weight
5	Returns AnIn Weight count
6	Returns AnIn Weight gain
7	Returns AnIn Weight offset
9	200 running 210 completed successfully 220 failed
10	2nd poit weight, editable from 3000 to 5000 g

Table 6.4-14

6.4.7 Kit Reader

The DM supports a function (OKRF) to test and calibrate the Optical Kit Reader system for the disposable kit identification.
The OKRF displays the type of disposable kit installed as detected from the optical labels printed in the XTRA disposable cassette. The 3 labels are printed using the 3-bit codes showed in the following table:

	Label 1	Label 2	Label 3
X/55	0	0	1
X/125	0	1	0
X/175	1	0	1
X/225	1	1	0

Table 6.4-15

The OKRF:
- displays the status of all the three optical receivers;
- displays the actual gain of the optical receivers in a scale of 0÷99 steps;
- is able to automatically calibrate (Calib) the gain of each optical receiver, to achieve the detection of reflective or no-reflective optical-code labels put ahead the optical code readers;
- to manually change the optical receivers gain.

6.4.7.1 Kit Reader Screen

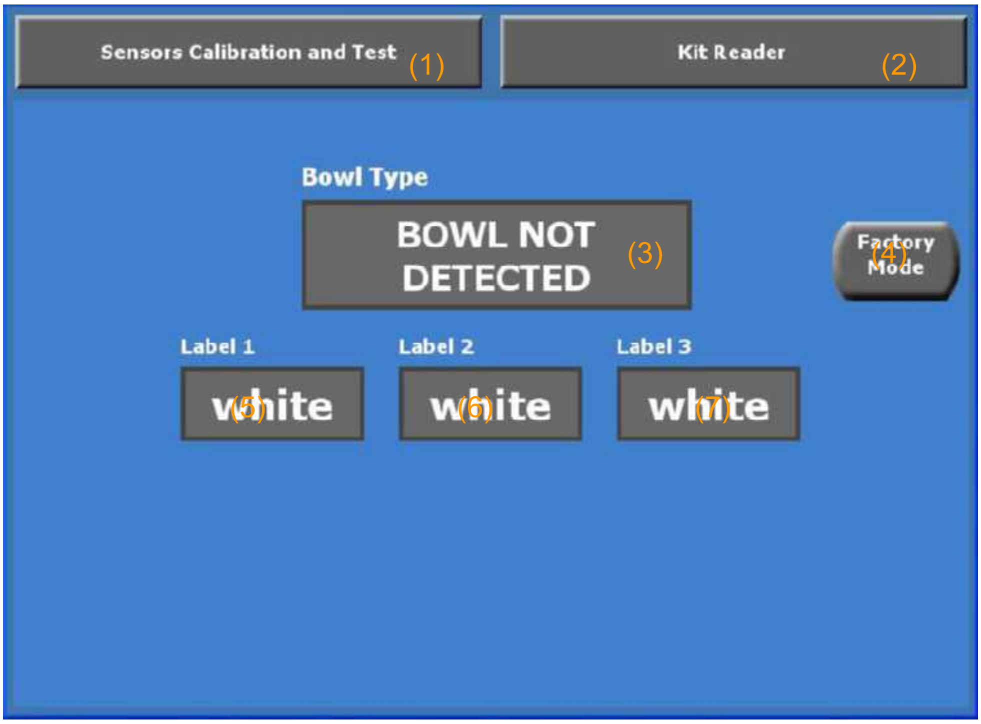

Fig. 6.4-13

(DIAG_004) Sensors Calibration And Test rev.00

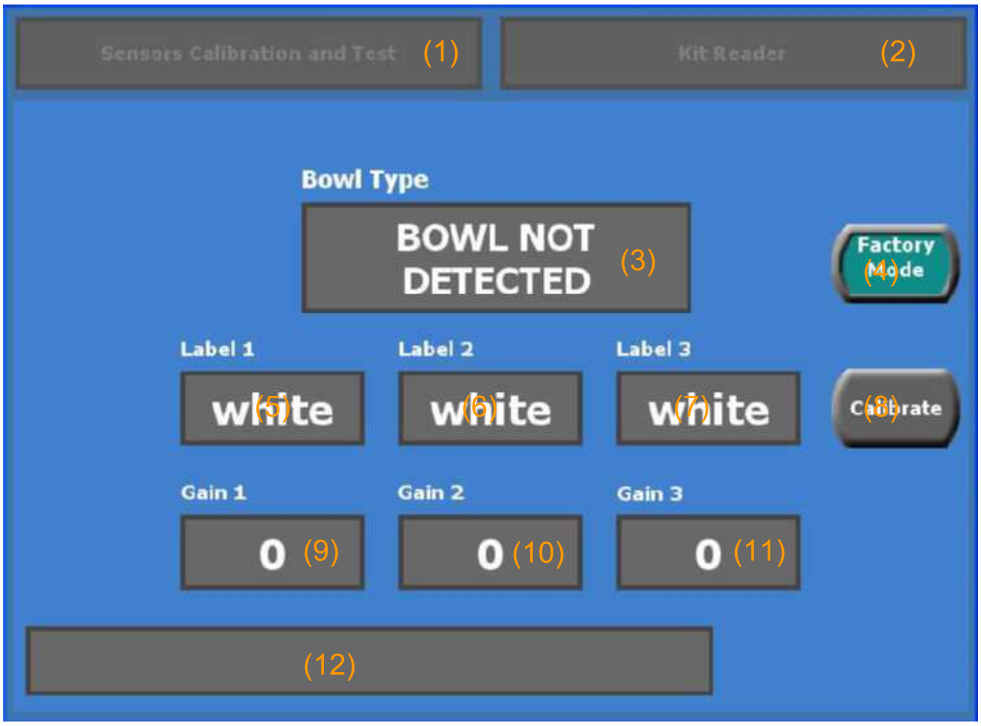

Fig. 6.4-14

ID	Label	Action on Button Selection
1	Sensors	The Sensors Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Kit Reader	Show the list of Sensors'functions
4	Factory Mode	Enters in the factory mode
8	Calibrate	Starts the kit reader calibration procedure

Table 6.4-16

ID	Label	Description
3		Display the kit type detected: • 1, displays "X/55" • 2, displays "X/125" • 3, displays "X/175" • 4, displays "X/225" • Others, displays "Bowl not detected"
4	Black/white	1, "black" 0, "white"
6	Black/white	1, "black" 0, "white"
7	Black/white	1, "black" 0, "white"
9	0-99	Returns Kit reader 1 Rx gain level
10	0-99	Returns Kit reader 2 Rx gain level
11	0-99	Returns Kit reader 3 Rx gain level
12		200, running 210, completed successfully 220, failed

Table 6.4-17

6.4.8 Others Sensors

The functions for the following sensors:

- Air Bubble Detector;
- Bowl Arm position;
- Blood Loss Detector;
- RBC Line Pressure.

can be grouped in only one screen, named **Others Sensors**.

6.4.8.1 Others Sensors screen

The "Others Sensors" screen displays:

- the status of the Bowl Arm read from the NMC and NAC;
- the blood loss detector status as read from the NSC sensor;
- the status of the Air Bubble Detector read from the NMC and NAC;
- the status of the RBC line pressure switch. The intervention of this switch is calibrated so that pressure overcomes 1800 mmHg.

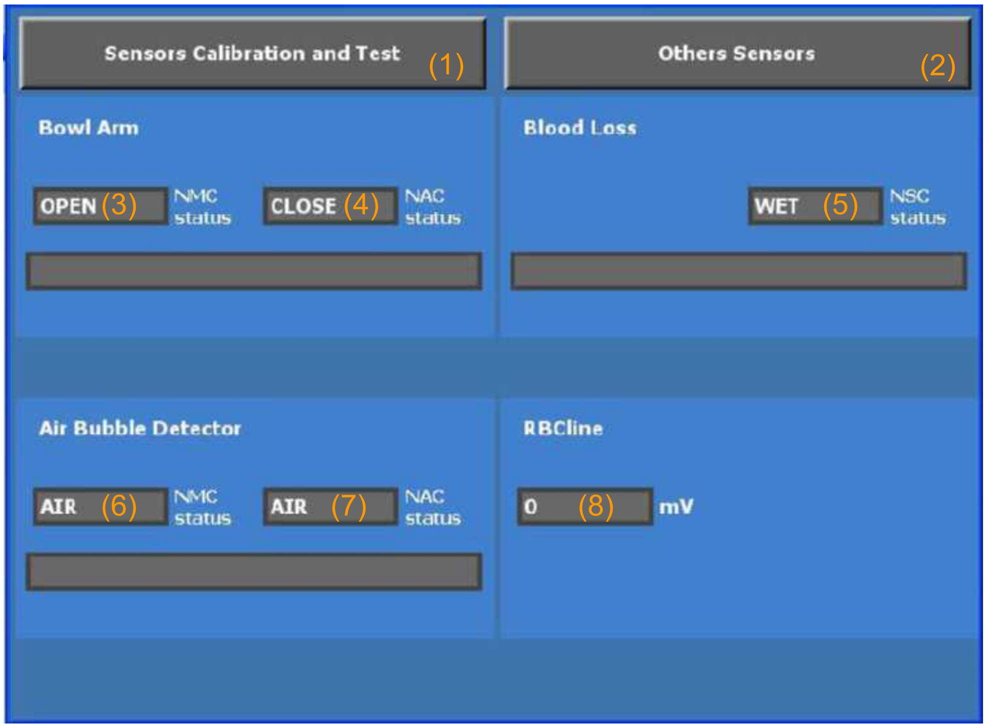

Fig. 6.4-15

ID	Label	Action on Button Selection
1	Sensors Calibration and Test	The Sensors Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Others Sensors	Show the list of Sensors'functions

Table 6.4-18

(DIAG_004) Sensors Calibration And Test rev.00

ID	Label	Description
3	OPEN/CLOSE	Bowl Arm position as acquired by the NMC: 1 CLOSE 0 OPEN
4	OPEN/CLOSE	Bowl Arm position as acquired by the NAC: 1 CLOSE 0 OPEN
5	DRY/WET	Blood loss detector acquired by the NSC: 1 DRY 0 WET
6	LIQUID/AIR	Air bubble detector as acquired by the NMC: 1 liquid 0 air
7	LIQUID/AIR	Air bubble detector as acquired by the NAC: 1 liquid 0 air
8	0 - 65535	RBC line pressure acquired by the NSC and expressed in [mV]

Table 6.4-19

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6.5 (DIAG_005) Settings rev.00

6.5.1 About this card

The purpose of this chapter is to describe the **Settings diagnostics functions**

6.5.2 Settings diagnostics functions

The Settings Main Screen gives direct access to the diagnostic functions for the following settings:

- Data initialization;
- Machine S/N Insertion;
- Wash Quality Setup.

6.5.3 Settings Main Screen

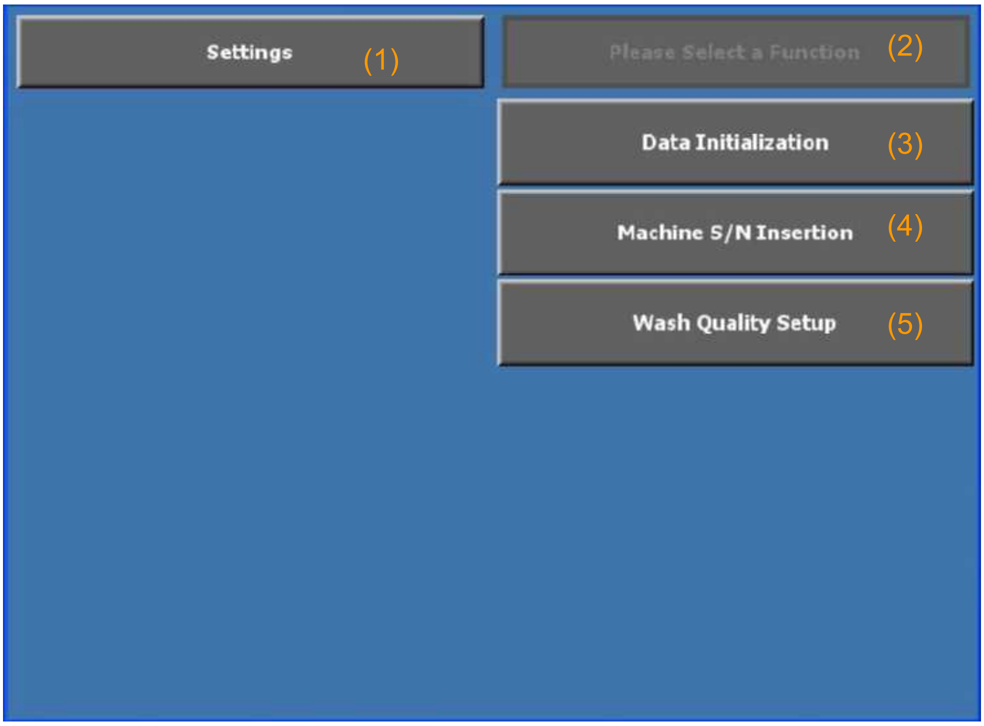

Fig. 6.5-1

In the following Table, it is described the function of each button:

ID	Label	Action on Button Selection
1	Settings	The Settings Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Please Select a Function	Show the list of Settings functions
3	Data Initialization	Show the Data Initialization subScreen
4	Machine S/N Insertion	Show the Machine S/N Insertion subScreen
5	Wash Quality Setup	Show the Wash Quality Setup subScreen

Table 6.5-1

6.5.3.1 S/N insertion

The specification of the format of XTRA machine serial number is described as following:

- 2 alphabetic digits: "BO", coding the city of production;
- 5 numeric digits: progressive number;
- 1 alphabetic digit, coding the month of production:

A	January	G	July
B	February	H	August
C	March	I	September
D	April	L	October
E	May	M	November
F	June	N	December

- 2 numeric digit, coding the year of production.

6.5.3.1.1 SN Insertion subScreen

Pushing the S/N Insertion the disply show the following S/N Insertion subscreen:

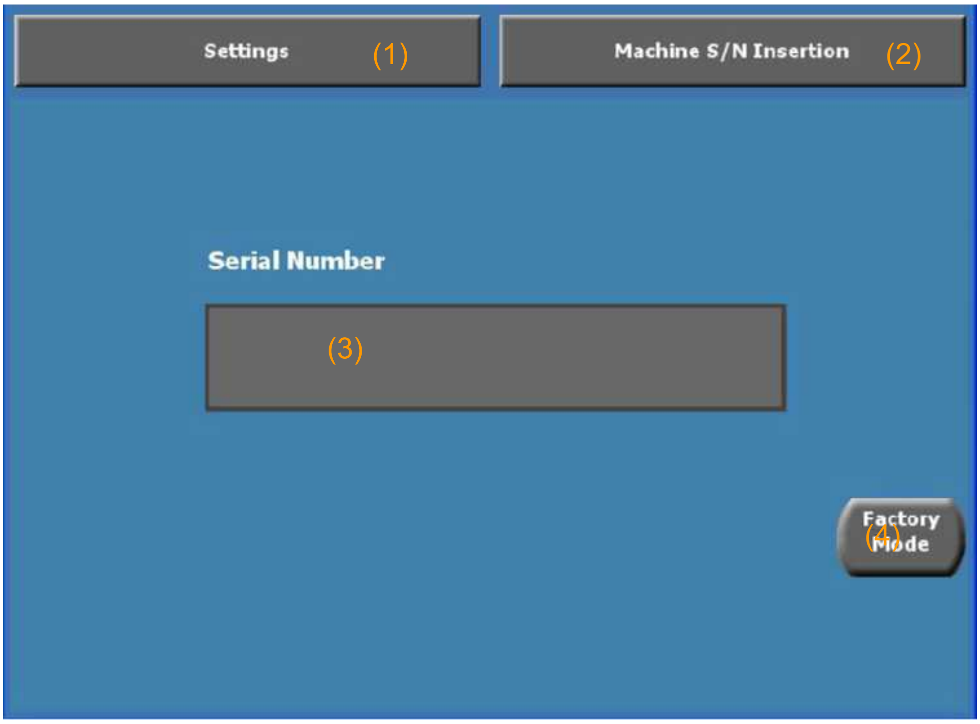

Fig. 6.5-2

Pushing the Factory Mode button, the following screen is displayed:

(DIAG_005) Settings rev.00

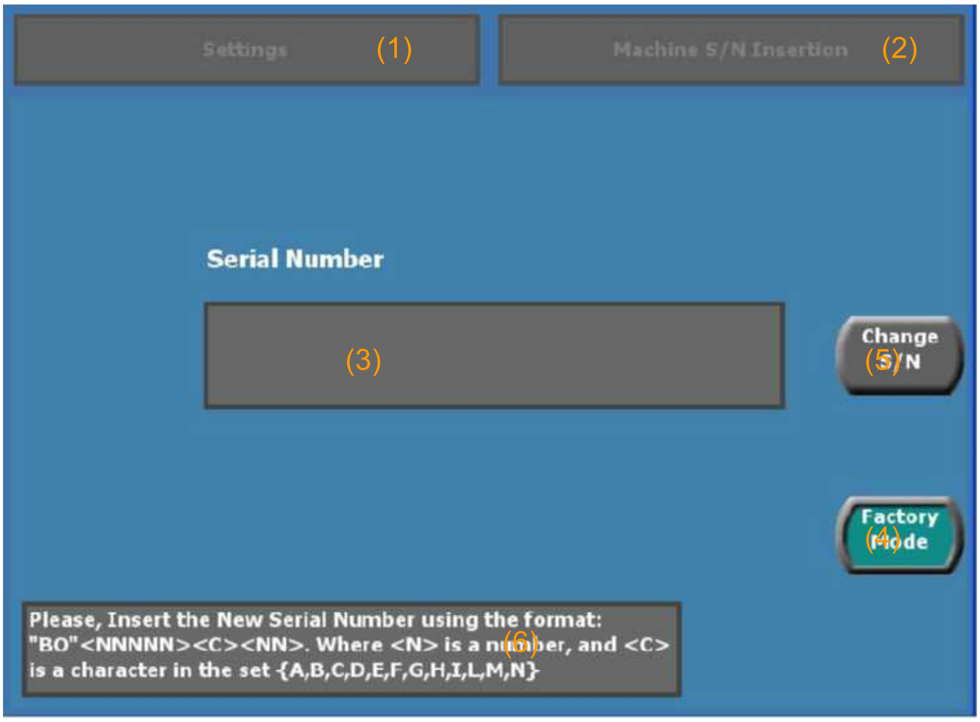

Fig. 6.5-3

ID	Label	Action on Button Selection
1	Settings	The Settings Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Machine S/N Insertion	Show the list of Settings'functions
4	Factory Mode	Enters in the factory mode
5	Edit S/N	Open the keyboard subScreen to edit the machine S/N

Table 6.5-2

ID	Description
3	Machine Serial Number, composed of 10 ASCII characters.

Table 6.5-3

Pressing on Change S/N button, the keybord subscreen to insert the serial number is open, with the possibility, touching the Caps & Numbers button to toggle the keyboard between showing capital letters and numbers (when the button is ON), to showing lower case letters and symbols, such as “!, @, and #” (when the button is OFF). When ON, the button appears inset and green.

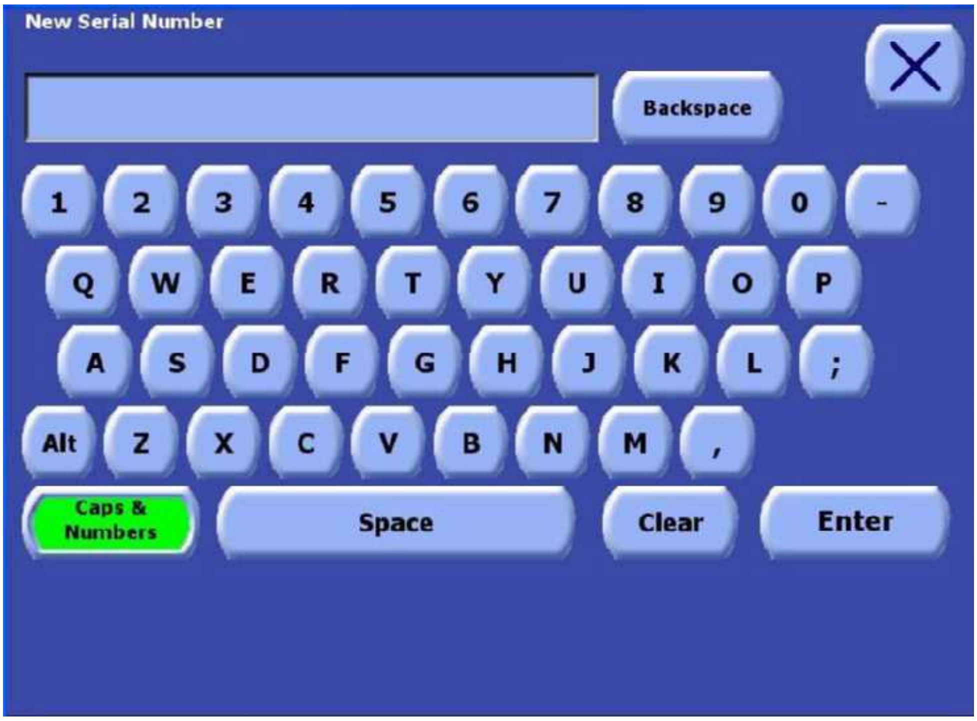

Fig. 6.5-4

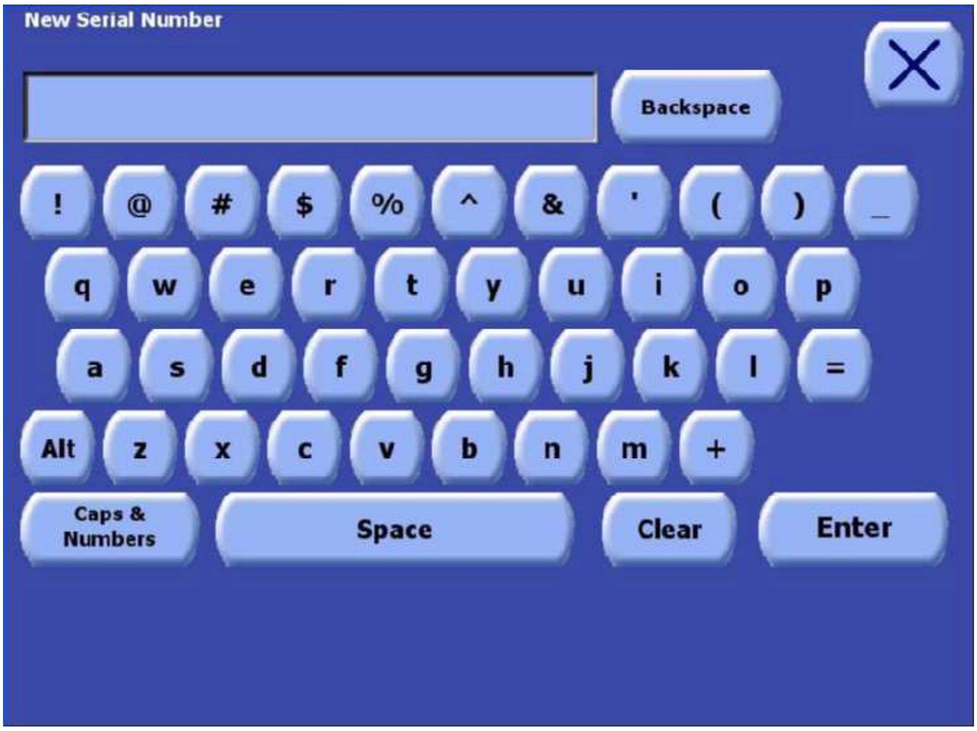

Fig. 6.5-5

6.5.3.2 Data Initialization

This page concerns with not-volatile memories installed on NMC boards:

- E2PROM: it stores calibration data and any other relevant; it is a backup copy;
- Battery backed-UP RAM (Dallas): it stores the same data of E2PROM and in addiction: user configurations and machine logs.

and with user data retained in the storage memory of NUI board (system Compact Flash).

6.5.3.2.1 E2PROM Control

E2PROM control functions.

- o E2PROM Reset: this function resets all the data stored in the E2PROM memory to FFh value.
- o E2PROM Recovery: this function recoveries (overwrites) all E2PROM data from DALLAS memory.

6.5.3.2.2 Battery Backuped RAM

Battery backed-UP RAM functions:

- o INIT: this function resets all data stored in Dallas (not volatile) memory to their default values;
- o INIT&RESTORE: it performs the same operations of INIT function. In addition, this function then recoveries (overwrites) all DALLAS data from E2PROM backup, while all other DALLAS data (that are not backed-up in E2PROM) remain to the default values.

6.5.3.2.3 Working Data Reset

The Working Data Reset function delete the following user data:

- Data Management records;
- User Protocol Names;
- ID Field Title and Contents.

6.5.3.2.4 Data Initialization Main Screen

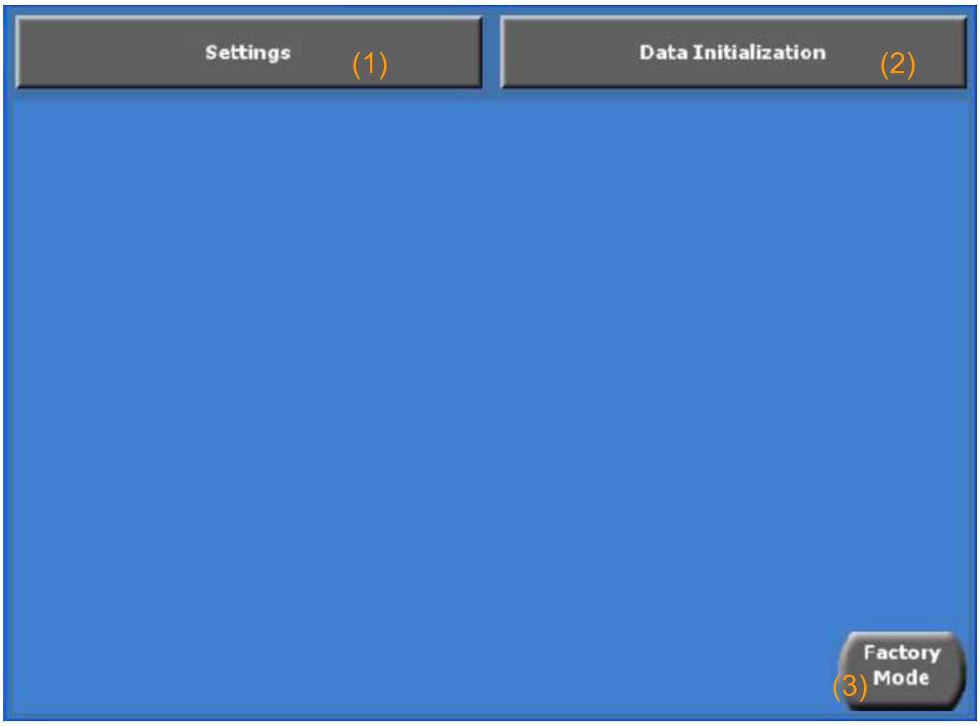

Fig. 6.5-6

Pushing on the Factory Mode button, the following Factory Mode screen appears:

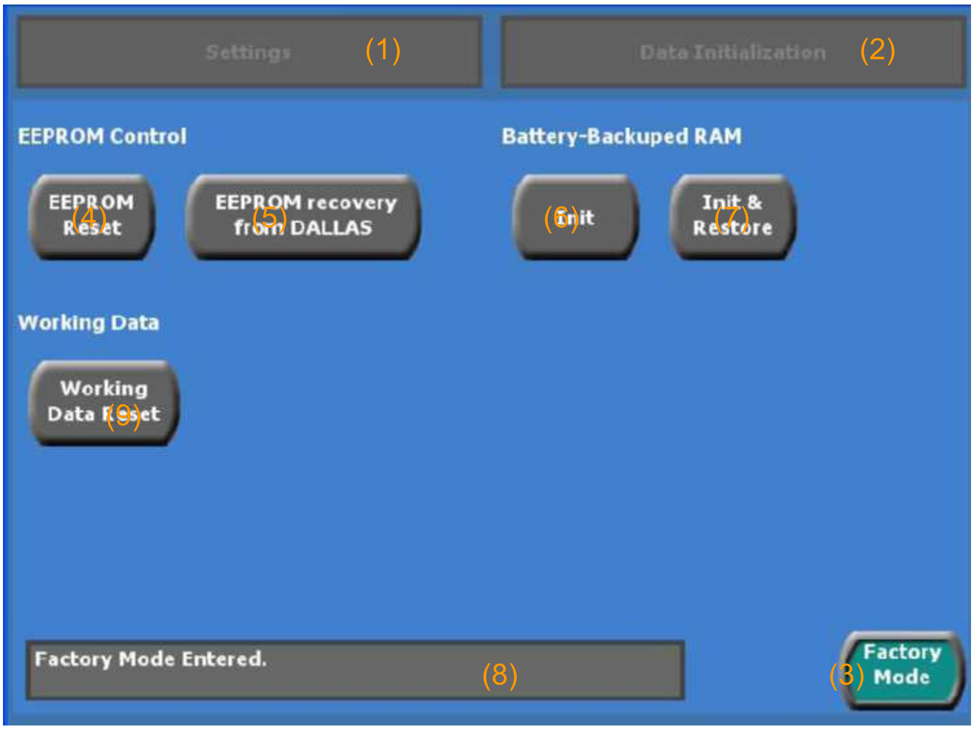

Fig. 6.5-7

ID	Label	Action on Button Selection
1	Settings	The Settings Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Data Initialization	Show the list of Settings functions
3	Factory Mode	Exit from the factory mode
4	E2PROM Reset	Show the E2PROM reset subScreen
5	E2PROM recovery from Dallas	Show the E2PROM recovery subScreen
6	Init	Show the Battery-Backupped RAM Init subScreen
7	Init & Restore	Show the Battery-Backupped RAM Init & Restore subScreen
9	Working Data Reset	Show the Working Data Reset subScreen

Table 6.5-4

ID	Label	Description
8	“Factory Mode Entered”	Message box, diplayes the message “Factory Mode Entered”

Table 6.5-5

6.5.3.2.5 E2PROM Reset subScreen

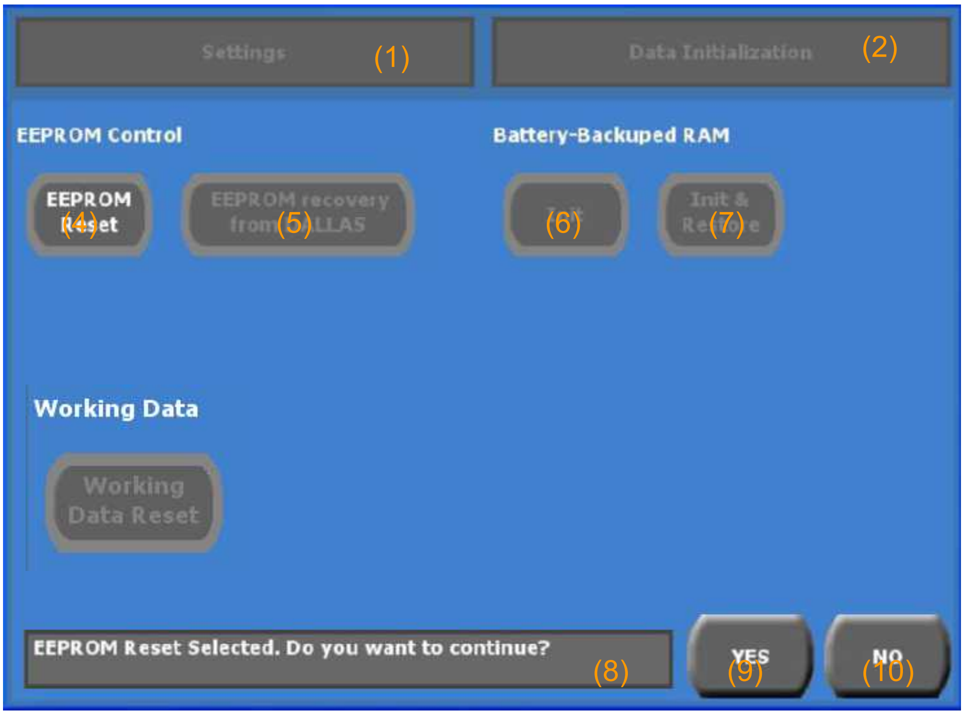

Fig. 6.5-8

ID	Label	Action on Button Selection
9	YES	Starts the E2PROM Reset procedure.
10	NO	Abort the E2PROM Reset procedure request.Display the Settings/Data Initialization/Factory subScreen

Table 6.5-6

ID	Description
8	Status of E2PROM Reset procedure from NMC: 7, e2prom reset running 8, e2prom reset completed successfully 9, e2prom reset failed

Table 6.5-7

6.5.3.2.6 E2PROM Recovery subScreen

Fig. 6.5-9

ID	Label	Action on Button Selection
9	YES	Starts the E2PROM Recovery procedure.
10	NO	Abort the E2PROM Recovery procedure request.Display the Settings/Data Initialization/Factory subScreen

Table 6.5-8

ID	Description
8	Status of E2PROM Recovery procedure from NMC: 10, e2prom recovery is running 11, e2prom recovery is completed successfully 12, e2prom recovery has failed

Table 6.5-9

6.5.3.2.7 Init subScreen

Fig. 6.5-10

ID	Label	Action on Button Selection
9	YES	Starts the Init procedure.
10	NO	Abort the Init procedure request.Display the Settings/Data Initialization/Factory subScreen

Table 6.5-10

ID	Description
8	Status of Init procedure from the NMC: 1, init running 2, Init completed successfully 3, init failed

Table 6.5-11

6.5.3.2.8 Init & Restore subScreen

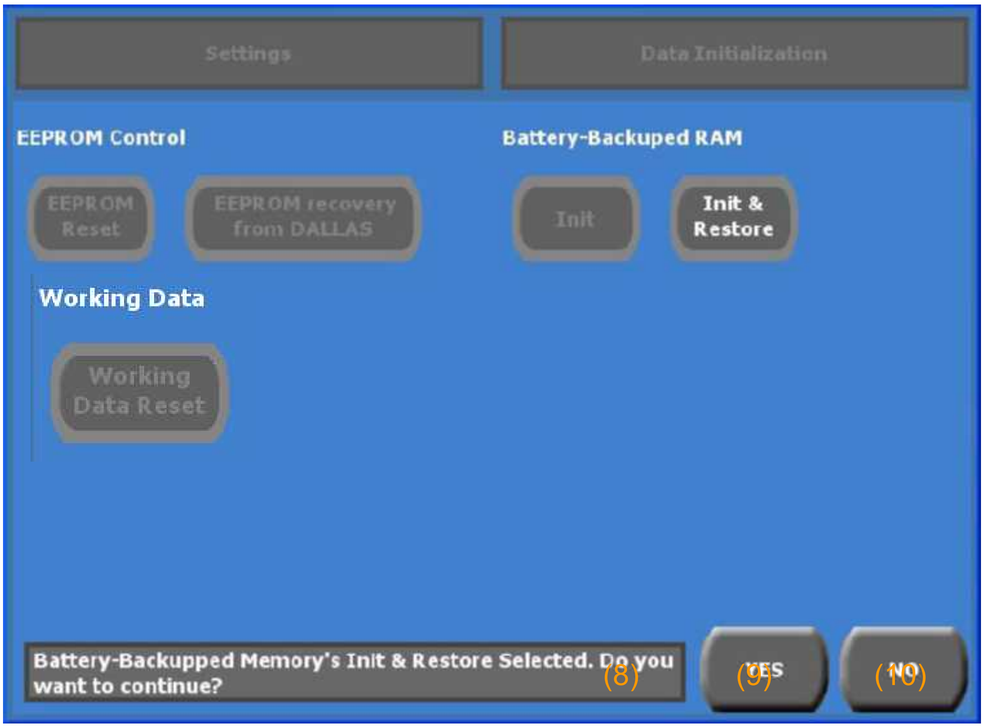

Fig. 6.5-11

ID	Label	Action on Button Selection
9	YES	Starts the Init&Restore procedure.
10	NO	Abort the Init&Restore procedure request.Display the Settings/Data Initialization/Factory subScreen

Table 6.5-12

ID	Description
8	Status of the Init&Restore procedure from NMC: 4 , init&restore running 5 , init&restore completed successfully 6,init&restore failed

Table 6.5-13

6.5.3.2.9 Working Data Reset subScreen

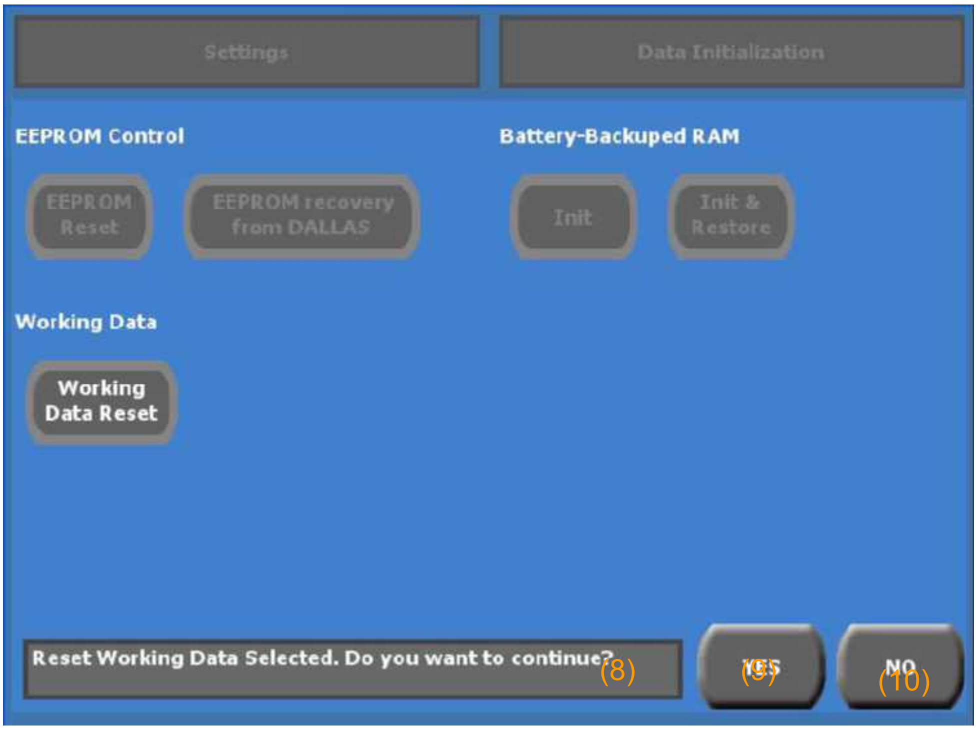

Fig. 6.5-12

ID	Label	Action on Button Selection
9	YES	Starts the Working Data Reset procedure.
10	NO	Abort Working Data Reset procedure request.Display the Settings/Data Initialization/Factory subScreen

Table 6.5-14

ID	Description
8	Message warning a confirm : “Reset Working Data Selected. Do you want to continue?”

Table 6.5-15

6.5.3.3 Wash Quality Setup

- FPH HIGH LEVEL (RED)
  - Range 0 ÷ 3000 mg/dl
  - step 1 mg/dl
  - default 200 mg/dl

- FPH LOW LEVEL (GREEN)
  - Range 0 ÷ 3000
  - step 1 mg/dl

    - default: 50 mg/dl
- Insufficient FPH Removal Percentage
    - Range 0 ÷ 100 %
    - step 1%
    - default: 60%.

- Good FPH Removal Percentage
    - Range 0 ÷ 100 %
    - step 1%
    - default: 90%.

6.5.3.3.1 Wash Quality Screen

Fig. 6.5-13

ID	Label	Action on Button Selection
1	Settings	The Settings Group was selected. Selecting the button the DM shows again the list of available functions groups.
2	Wash Quality Setup	Show the list of Settings'functions
3	Factory Mode	Enter/Exit the factory mode. In factory Mode the Wash Quality parameters: High level, Low Level, Bad PFH removal, and Good FPH removal are editable.

Table 6.5-16

ID	Label	Description
4	High level	FPH HIGH LEVEL
5	Low level	FPH LOW LEVEL
6	Bad FPH removal	Insufficient FPH Removal Percentage
7	Good FPH removal	Good FPH Removal Percentage

Table 6.5-17

6.6 (DIAG_006) Logs rev.00

XTRA DM shall support the following logs functions:

- Fatal Errors

6.6.1 Logs Main Screen

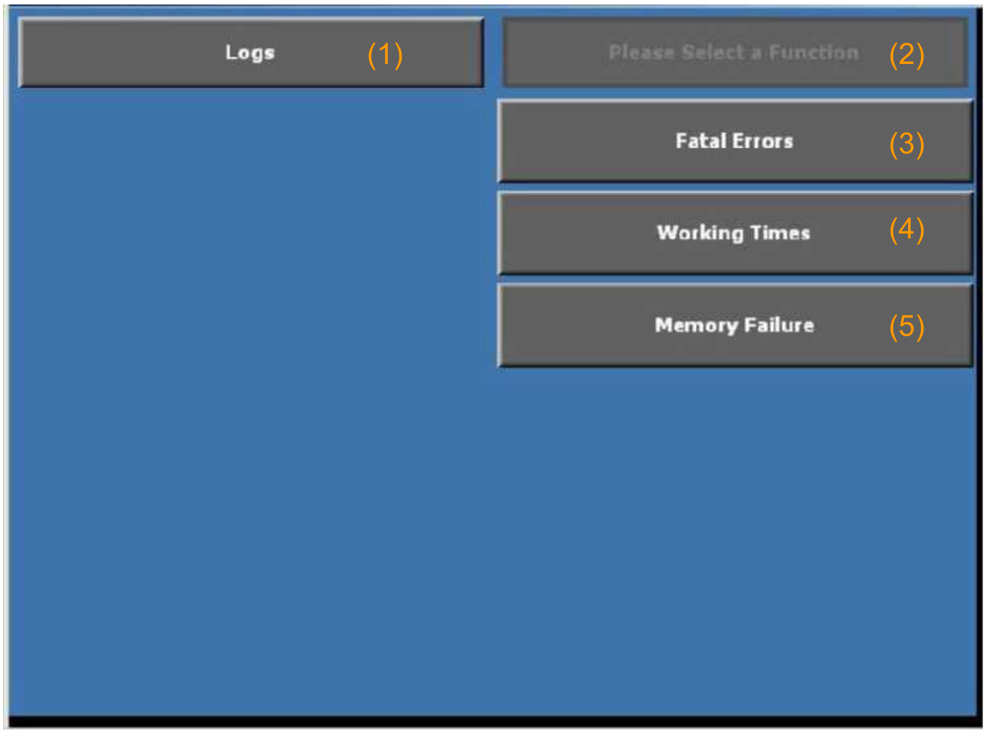

Fig. 6.6-1

In the following Table, it is described the function of each button:

ID	Label	Action on Button Selection
1	Logs	The Logs Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Please Select a Function	Show the list of Logs functions
3	Fatal Errors	Show the Fatal Erros subScreen
4	Working Times	Show the Working Times subScreen
5	Memory Failure	Show the Memory Failure subScreen

Table 6.6-1

6.6.1.1 Fatal Errors subScreen

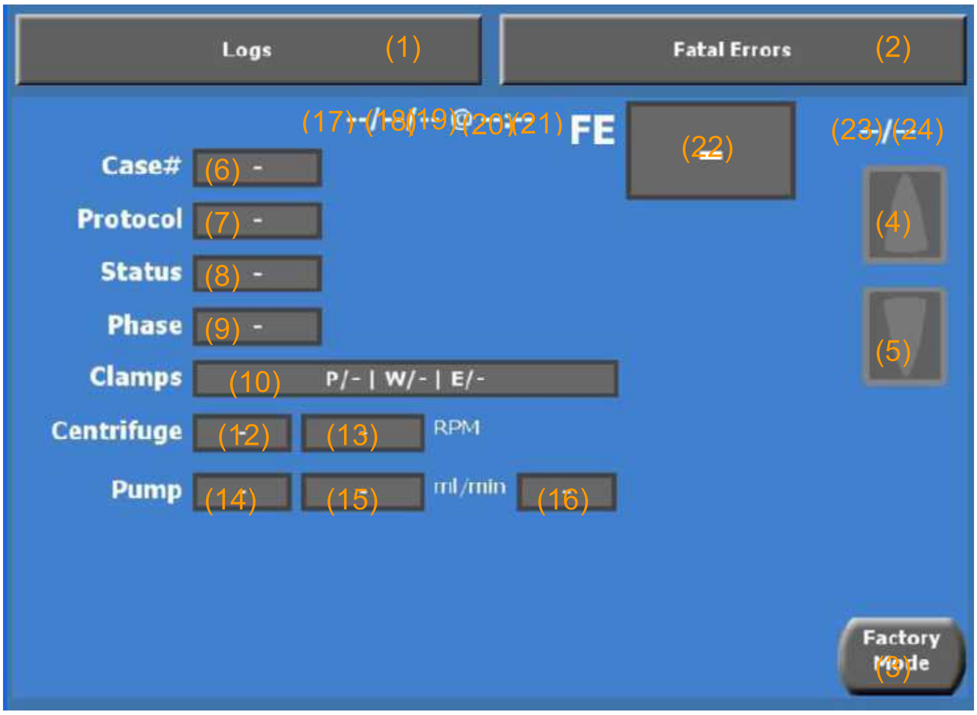

Fig. 6.6-2

ID	Label	Action on Button Selection
1	Logs	The Logs Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Fatal Errors	Show the list of Logs'functions
3	Factory Mode	Enter/Exit the factory mode. In factory Mode the History of Fatal Errors can be deleted.
4	up	Display the data of next Fatal Error occurred
5	down	Display the data of previous Fatal Error occurred

Table 6.6-2

ID	Label	Description
6	0-65535	Number of case that was running when occurred the fatal error currently displayed.
7	0-65535	Protocol that was running when occurred the fatal error currently displayed.
8	0-255	Debug code: Status
9	0-255	Debug code: Phrase
10	"P/ x | W / x | E / x-" Where, P stays form Prime clamp, W for Wash, and E for Empty; and "x" described the position with one of the following symbol:	Clamps position coding: -1, STOP_POS -2, PRIME_CLAMP -3, WASH_CLAMP -4, EMPTY_CLAMP -5, PRIME_WASH_CLAMP -6, PRIME_EMPTY_CLAMP -7, TEST_CLAMP -8, WASH_EMPTY_CLAMP

	"-": undefined "O": opened "C": closed	-9, PRIME_WASH_EMPTY_CLAMP
12	0-65535	Centrifuge command status coding: - 0, OFF - not 0, ON
13	0-65535	Centrifuge set point expressed in rpm
14	ON / OFF	Pump command status: - 0, OFF - not 0, ON
15	0-65535	Pump set point expressed in ml/min.
16	IN_BOWL / OUT_BOWL	Pump direction coding: - 0, OUT-BOWL - Not 0, IN-BOWL
17	0-255	The year when occurred the FE displayed (from 2000 to 2255)
18	1-12	The ordinal of the mouth when occurred the FE displayed
19	1-31	The ordinal of the day in when occurred the FE displayed
20	0-23	The hour when occurred the FE displayed
21	0-59	The minute when occurred the FE displayed
22	0-65535	Code of Fatal error occurred
23	0-255	Ordinal of fatal error currently displayed
24	0-255	Total number of fatal errors recorded

Table 6.6-3

6.6.1.1.1 Fatal Errors / Factory Mode subScreen

Fig. 6.6-3

ID	Label	Action on Button Selection
26	Clear All	Starts the "Clear All Fatal Errors History" procedure.
3	Factory Mode	Exit the factory mode.

Table 6.6-4

ID	Description
25	Warning message: "Factory Mode Entered"

Table 6.6-5

6.6.1.1.1.1 Fatal Errors Clear All subScreen

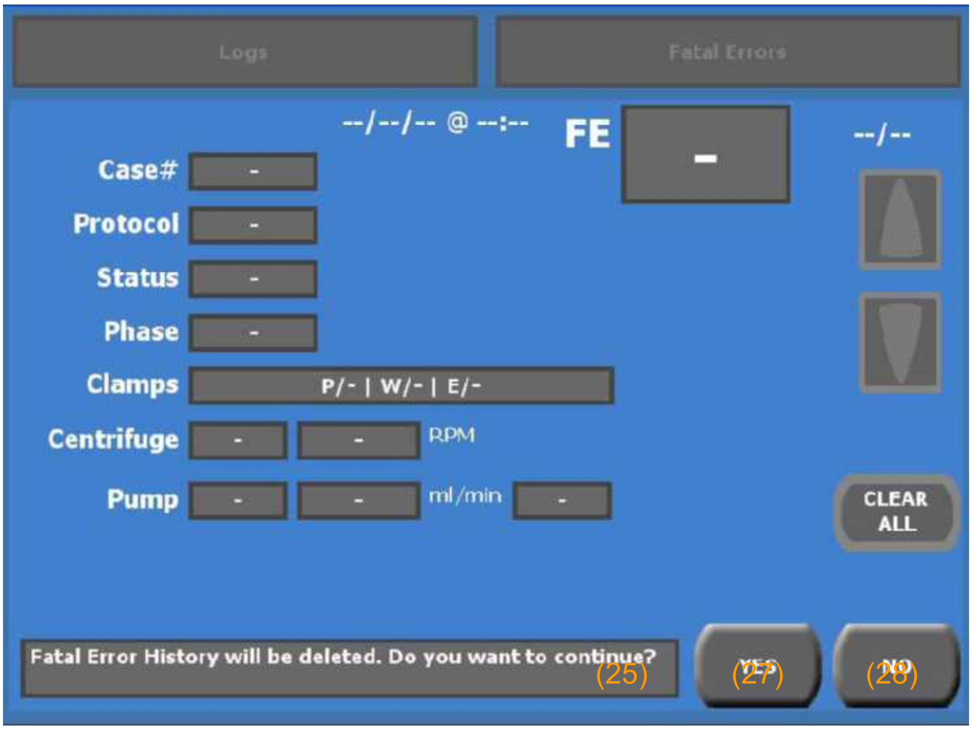

Fig. 6.6-4

ID	Label	Action on Button Selection
27	YES	Executes the "Clear All Fatal Errors' History" procedure.
28	NO	Abort the "Clear All" procedure. Display the Logs/Fatal Errors/Factory subScreen

Table 6.6-6

ID	Label	Description
25	Fatal Error Histoty will be deleted. Do you want to continue?	When "Clear All" is selected the following warning message is displayed; "Fatal Error Histoty will be deleted. Do you want to continue?" Once the Clear All Fatal Errors Histroy procedure is actually executed (selecting YES) the result is received in

		the specified DID with the coding: - 0, "Fatal Error History deletion failed." - Not 0, "Fatal Error History deleted successfully."

Table 6.6-7

6.6.1.2 Working Times subScreen

Fig. 6.6-5

ID	Label	Action on Button Selection
1	Logs	The Logs Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Warking Times	Show the list of Logs functions
3	Factory Mode	Enter/Exit the factory mode. In factory Mode the History of Warking Times can be reset.

Table 6.6-8

ID	Label	Description
4	0-65535	Number of working hours of the XTRA equipment
5	0-65535	Number of working hours of the centrifuge motor
6	0-65535	Number of working minutes of the ejector actuator
7	0-65535	Number of working minutes of the lock system
8	0-65535	Number of working hours of the pump motor
9	0-65535	Number of working minutes of the Fill clamp motor
10	0-65535	Number of working minutes of the Wash clamp motor
11	0-65535	Number of working minutes of the Empty clamp motor

Table 6.6-9

6.6.1.2.1 Working Times / Factory subScreen

Fig. 6.6-6

ID	Label	Action on Button Selection
1	Logs	The Logs Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Warking Times	Show the list of Logs functions
3	Factory Mode	Enter/Exit the factory mode. In factory Mode the History of Warking Times can be reset.
4	XTRA	Enable/Disable the displet to change/reset the XTRA equipment working time
5	Centrifuge	Enable/Disable the displet to change/reset the centrifuge motor working time
6	Ejector	Enable/Disable the displet to change/reset the ejector actuator working time
7	Lock	Enable/Disable the displet to change/reset the lock system working time
8	Pump	Enable/Disable the displet to change/reset the pump motor working time
9	Clamp F	Enable/Disable the displet to change/reset the Fill clamp working time
10	Clamp W	Enable/Disable the displet to change/reset the Wash clamp working time
11	Clamp E	Enable/Disable the displet to change/reset the Empty clamp working time

Table 6.6-10

6.6.1.3 Memory Failure subScreen

By selecting it, it is shown a screen where last occurrence of the memory alarm is visible with its date, time and numerical code of occurrence:

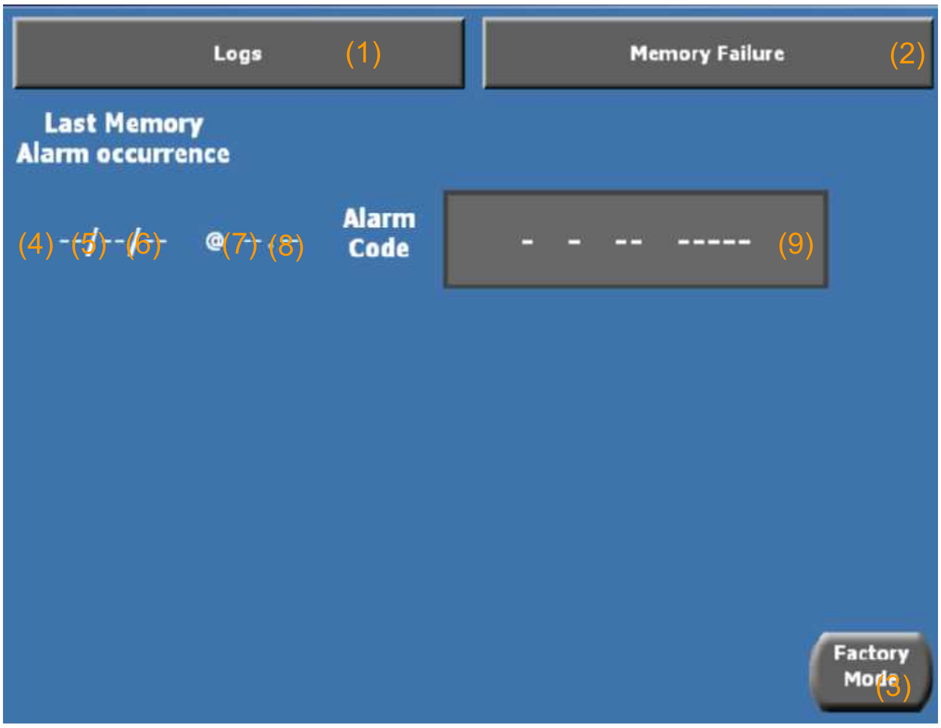

Fig. 6.6-7

ID	Label	Action on Button Selection
1	Logs	The Logs Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Memory Failure	Show the list of Logs functions
3	Factory Mode	Enter/Exit the factory mode. In factory Mode the History of Warking Times can be reset.

Table 6.6-11

ID	Label	Description
4	0-255	The year when the Memory Failure occurred (from 2000 to 2255)
5	1-12	The ordinal of the mouth when the Memory Failure occurred
6	1-31	The ordinal of the day in when the Memory Failure occurred
7	0-23	The hour when the Memory Failure occurred
8	0-59	The minute when the Memory Failure occurred
9	0-65535	Alarm Code of the Memory Failure occurred

Table 6.6-12

6.6.1.3.1 Memory Faiulure / Factory subScreen

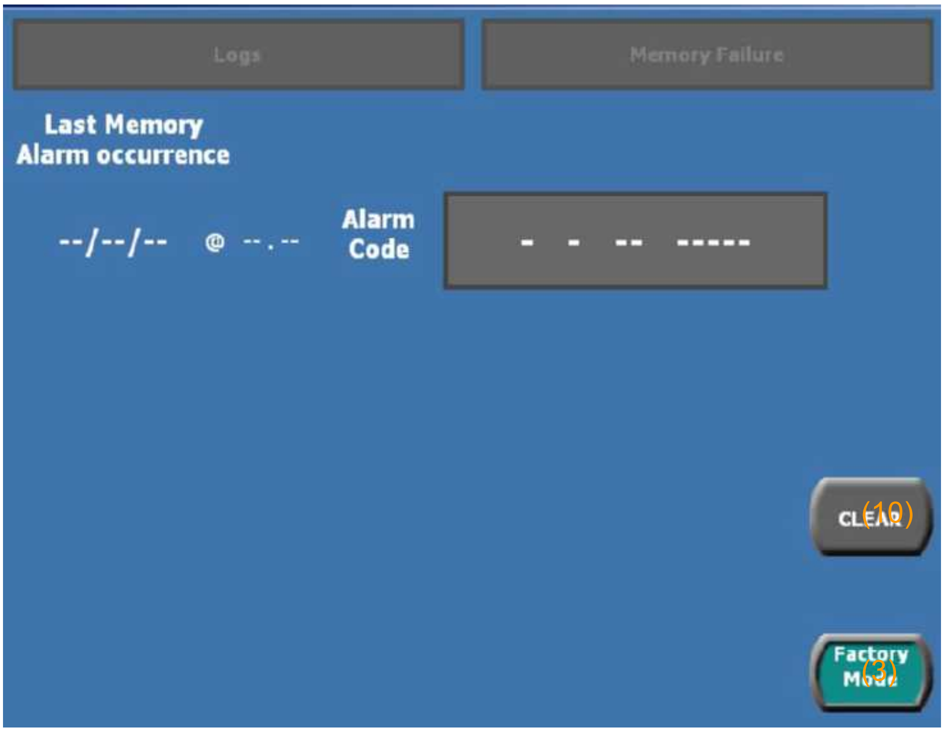

Fig. 6.6-8

ID	Label	Action on Button Selection
3	Factory Mode	Exit the factory mode.
10	Clear	Starts the “Clear of data related to the memory alarm occurrence” procedure

Table 6.6-13

6.6.1.3.1.1 Fatal Errors Clear subScreen

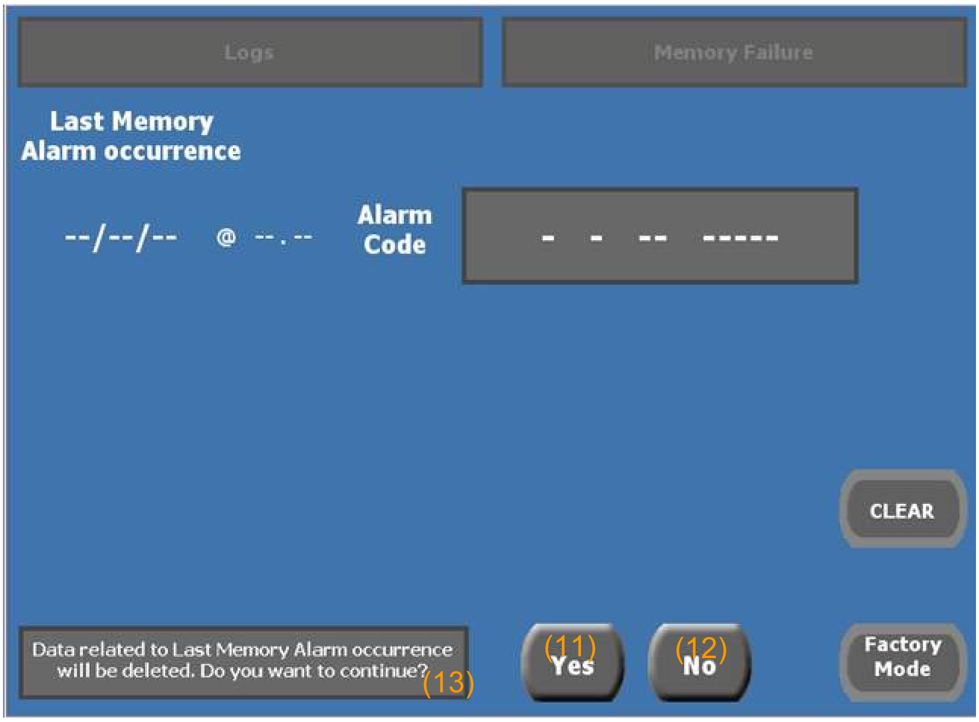

Fig. 6.6-9

ID	Label	Action on Button Selection
11	YES	Executes the "Clear of data related to the memory alarm occurrence" procedure
12	NO	Abort the "Clear" procedure. Display the Logs/Memory Failure/Factory subScreen

Table 6.6-14

ID	Label	Description
13	Data related to Last Memory Alarm occurrence will be delated. Do you want to continue?	When "Clear" is selected, the following warning message is displayed: "Data related to Last Memory Alarm occurrence will be delated. Do you want to continue?" Once the Clear procedure is actually executed (selecting YES) the result is received in the specified DID.

Table 6.6-15

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6.7 (DIAG_007) Runtests rev.00

6.7.1 About this card

The purpose of this chapter is to describe the **Runtests diagnostics functions**

6.7.2 Runtests diagnostics functions

XTRA DM supports the following run-test functions:

- Raw test;
- Run test;
- Short test.

6.7.3 Runtests Main Screen

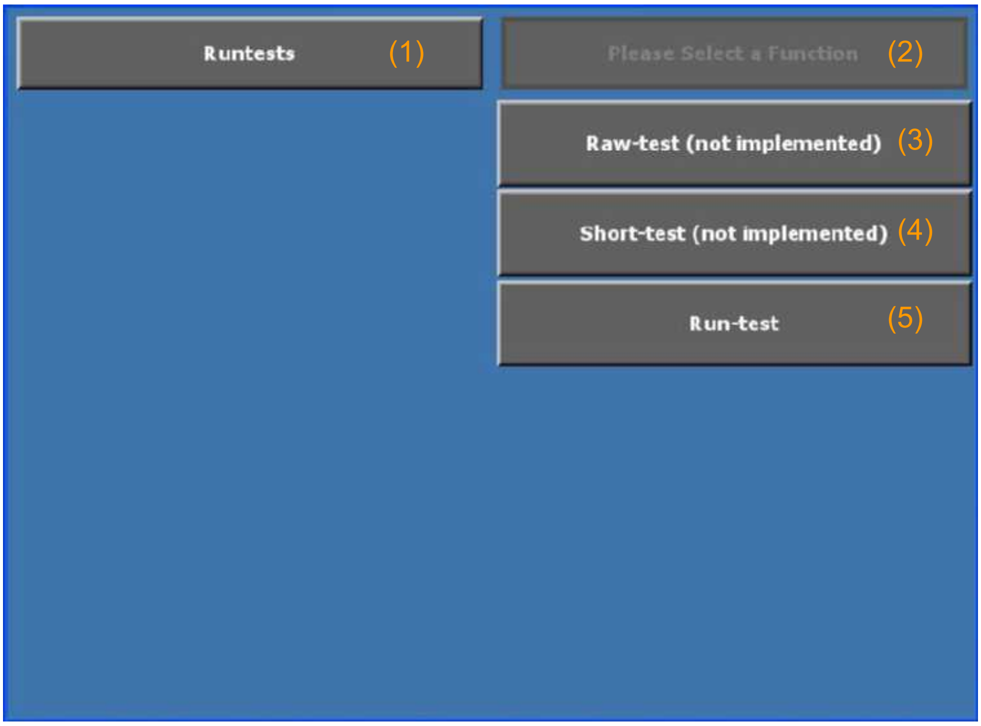

Fig. 6.7-1

ID	Label	Action on Button Selection
1	Runtests	The Runtests Group has been selected. Selecting the button the DM shows again the list of available functions groups
2	Please Select a Function	Show the list of Runtests functions
3	Raw-test	Show the RawTest subScreen
4	Short-test	Show the ShortTest subScreen
5	Run-test	Show the Run-Test subScreen

Table 6.7-1

6.7.4 Run test

When activated from diagnostic, this function allows a simulated session of machine functioning. This simulation indefinitely last: it has only to be interrupted:

- by operator manual stop intervention or;
- due to system anomalies occurred during run test.

To perform Run Test, operator has to follow this sequence:

- Access to RUN TEST function diagnostic menu;
- Enable execution of one Run Test session.
- Switch machine off;
- Remove USB service key;
- Turn machine on in Normal Mode;
- After boot, the Setup screen appears providing a “MENU” button and a “RUN SETUP” button, like these:

“MENU” button: 

“RUN SETUP” button: 

- Operator inserts a liquid filled tube into air sensor holder avoiding loading balance with weights;
- From Setup screen, Operator presses MENU button, and then “Settings”;
- From Settings, the Configuration Mode button allows settings of some options;
- From here, after numerical password input, operator can access to Features where some “features” can be enabled/disabled: here, he sets as enabled the only following ones:
    - HCT;
    - Manual;
    - RBC Detector Disabling Option.
- From Configuration Mode menu, by selecting the option “Protocol Set, operator sets Pstd protocol option as the only available one, i.e. he disables the others;
- Leaving from Configuration Mode and from Settings, operator comes back to Setup screen. Here he presses RUN SETUP button, when a bowl identification message is displayed and operator has to input BT125 bowl size by mean of a button; then, the Setup phase takes place. During Setup, a waiting screen is displayed.
- After this sequence, operator is allowed to access to MENU again, using the same  MENU button. Then, he selects “Protocol/Mode” tab;
- From “Protocol/Mode”, operator has to enable “Manual Mode”; then he disables both “RBC Detector” and “Wash-Empty” options; then he confirms and leaves screen by MENU button.
- On screen displayed after confirm, an “RBC’s” displet is visible containing “111%” value, as confirmation of RUN TEST activation:

- On the same screen, operator starts a continue execution automatic actions performed by actuators (centrifuge, clamps and pump), divided into three phases named “Fill”, “Wash” and “Empty”, performed in this sequence and showed on display with these names. In particular, each phase transition is performed in an automatic and undefined repeated way. All Fill-Wash-Empty cycles is performed in the same identical way, until operator presses Stop button or an interruption occurs . Fill phase lasts 2 minutes, Wash phase lasts 2 minutes and also Empty phase lasst 2 minutes.
- During RUN TEST execution, operator has to:
  - activate BQW2x;
  - modify pump flow parameter for Fill, Wash and Empty phases;
  - temporary interrupt current phase by PAUSE button (another PAUSE push will re-activate current phase and RUN TEST);
  - interrupt Run Test by STOP button (another PLAY push will re-activate current phase and RUN TEST);
- Run Test is interrupted also by MODE change or by “RBC Detector” option activation or by “Wash/Empty” option activation; this condition is confirmed by removal of “111%” value from “RBC’s” displet. To re-activate Run Test, operator has to perform following sequence:
  - set MODE to Manual;
  - set RBC detector to OFF;
  - set Wash/Empty to OFF;
  - press STOP;
  - press PLAY.
- A sequence different from Fill-Wash-Empty must not be performed. If Conc or Return phases are activated, Run Test will not be performed.
- Run Test diagnostic function is disabled if:
  - machine is switched off or;
  - Setup is performed with a bowl size different from BT125.
- In these cases, from next machine power on, machine gives up above described behavior and, Run Test function in Diagnostic access is showed as disabled.

6.7.4.1 Screen Appearance

Fig. 6.7-2

ID	Label	Action on Button Selection
1	Runtests	The Runtests Group was selected. Selecting the button the DM shows again the list of available functions groups
2	Run-test	Show the list of Runtests'functions
3	Factory Mode	Enter in the Factory Mode

Table 6.7-2

(DIAG_007) Runtests rev.00

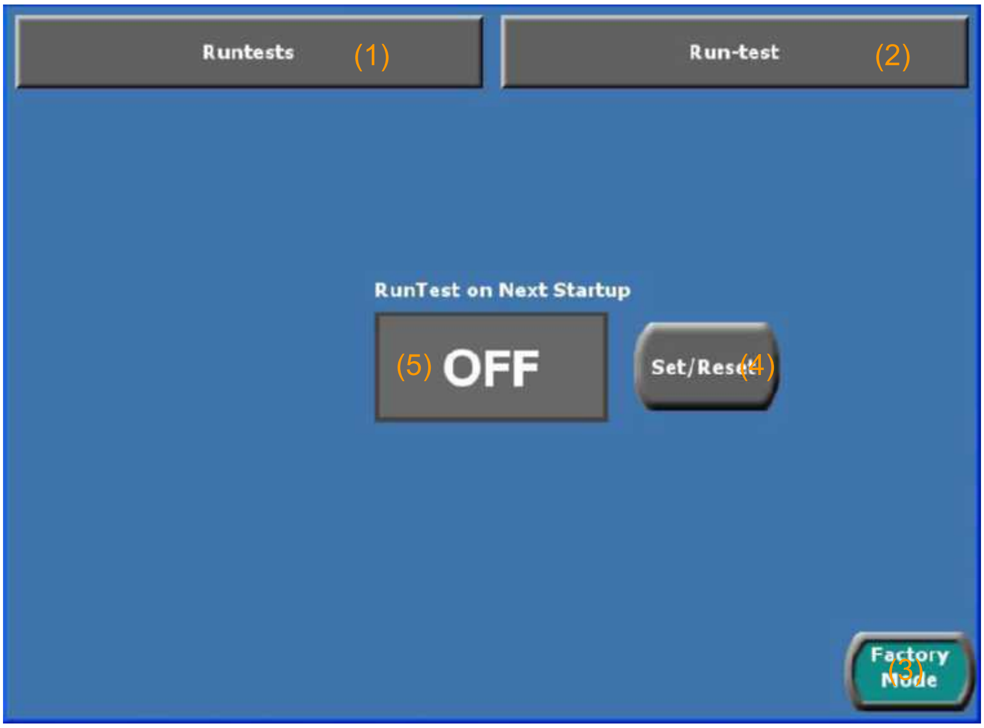

Fig. 6.7-3

ID	Label	Action on Button Selection
1	Runtests	The Runtests Group was selected. Selecting the button the DM shows again the list of available functions groups
2	Run-test	Show the list of Runtests'functions
3	Factory Mode	Exit from the Factory Mode
4	Set/Reset	Set/reset the request of runtest on next machine power-on

Table 6.7-3

ID	Label	Description
5	ON/OFF	Status of RunTest on next power-on request: 1 ON 0 OFF

Table 6.7-4

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6.8 (DIAG_007) Store Errors rev.00

6.8.1 About this card

The purpose of this chapter is to describe the **Store Errors diagnostics functions**

6.8.2 Store Errors diagnostics functions

The DM checks result of the storing operations.
The user is warned and asked for a confirm, in the following cases:

1. read/write errors in E2PROM device;
2. read/write errors in Battery-Back upped RAM (Dallas) device;
3. read/write errors in both E2PROM and Battery-Back upped RAM devices.

6.8.3 Store Errors Screens

6.8.3.1 Battery-Backupped RAM fault

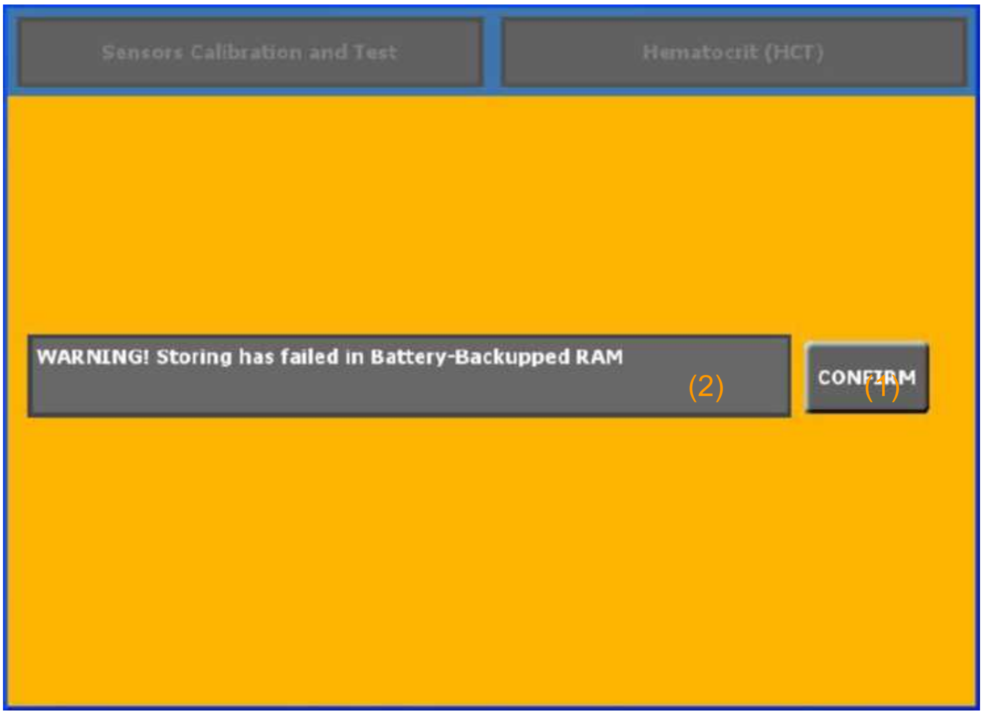

Fig. 6.8-1

6.8.3.2 E2PROM fault

Fig. 6.8-2

6.8.3.3 Both E2PROM and Battery-Backupped RAM fault

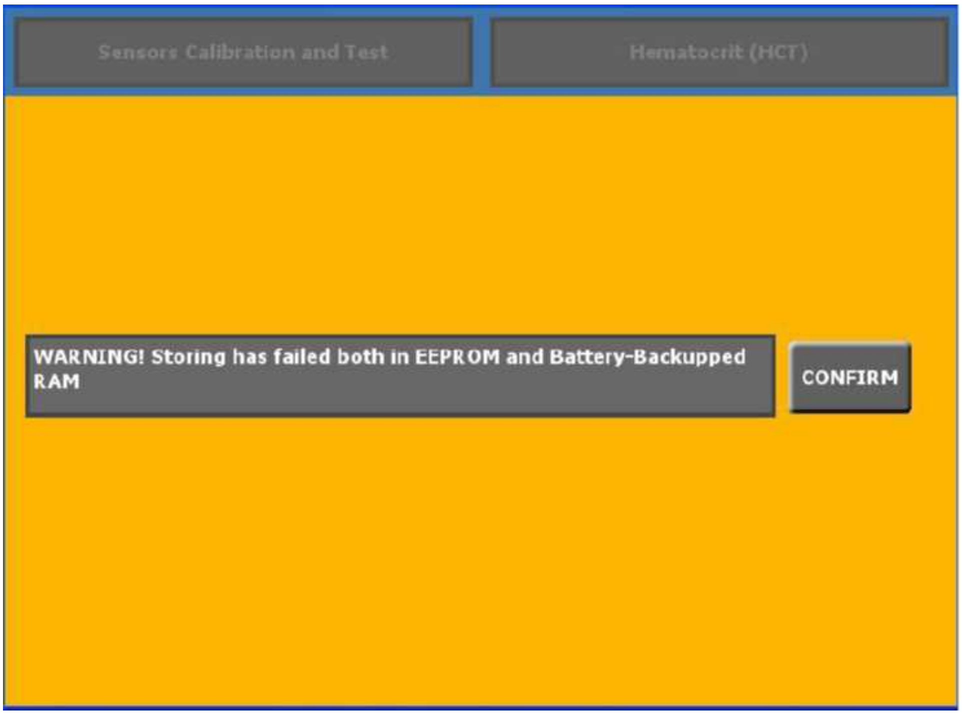

Fig. 6.8-3

(DIAG_008) Store Errors rev.00

ID	Label	Action on Button Selection
1	Confirm	The machine receive a confim that the warning message was read by the use and re-enable the screen navigation

Table 6.8-1

ID	Description
2	0, no message 1, Dallas error 2, E2PROM error 3 E2PROM and Dallas error

Table 6.8-2

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7 SOFTWARE UPGRADE rev.00

7.1 About this card

The purpose of this chapter is to describe the **software upgrade** of the XTRA equipment.

7.2 Tools

The software upgrade of the XTRA equipment is possible by using a USB key containing the new SW version, connected to the USB port of the machine. A simple user interface is requested. All the SW programs of the machine (Master, Actuators, Sensors, User Interface) and the XVAC vacuum module (if connected) are updatable in this way.

7.3 Procedure

- Connect USB dongle with Field Service access-rights to one of USB ports of the machine;
- Switch-on the XTRA machine while pressing STOP button for a few seconds;
- If present, switch-on the XVAC module, making sure it is properly connected to the XTRA equipment;
- Wait for boot conclusion to have this screen shown:

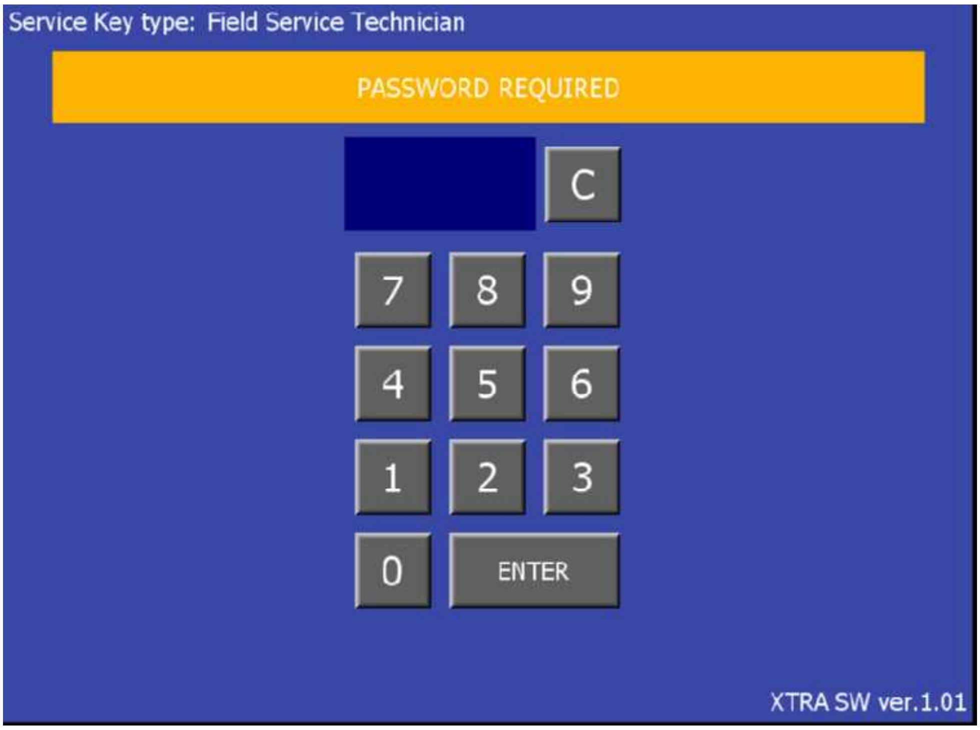


Fig. 7.3-1

- Insert the Field Service Technician 's password **“2010”** to have following menu available:

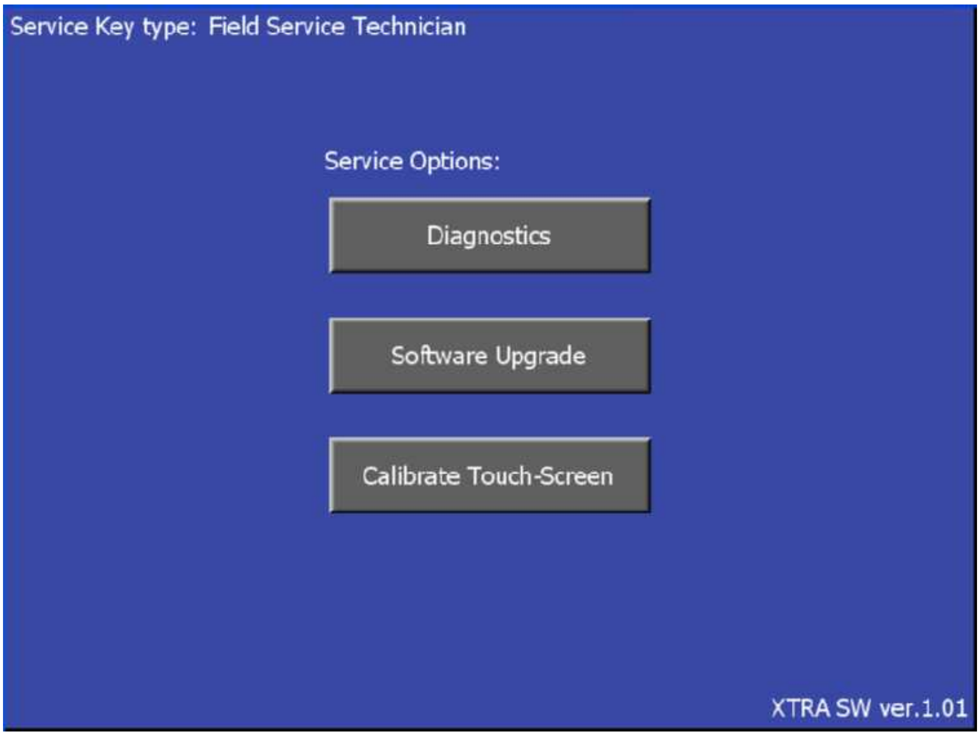


Fig. 7.3-2

- In case of problem with serial link between NUI and NMC the screen shows an Error Message "ISC ERROR: No Serial Link between NUI and NMC.", the "Diagnostics" and "Software Upgrade" button are disabled:

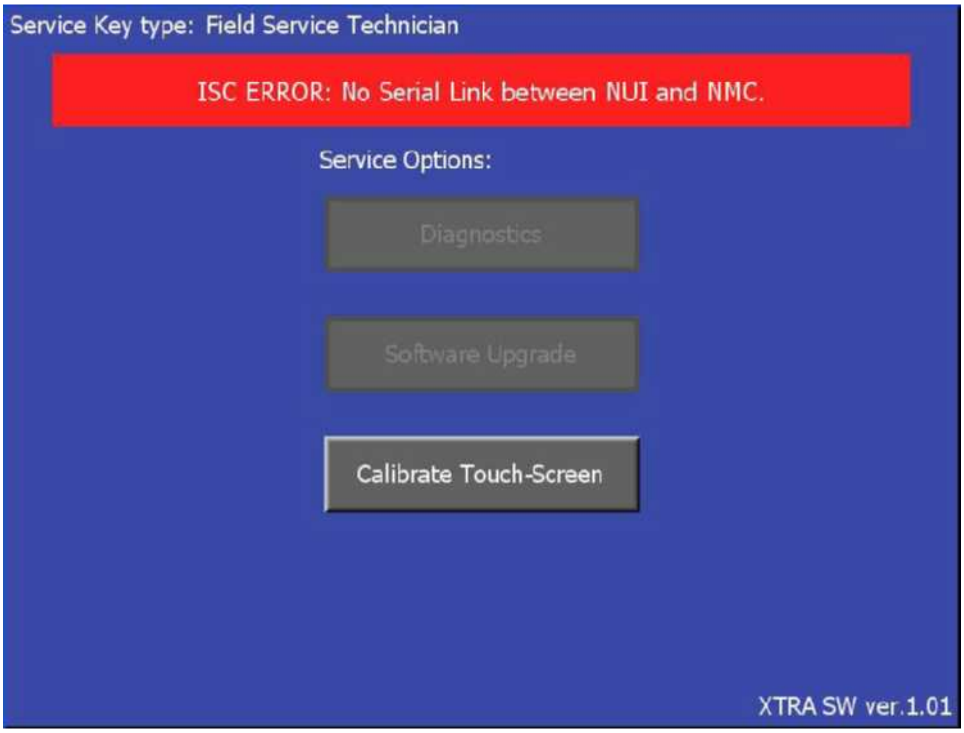


Fig. 7.3-3

- Touching the SOFTWARE UPGRADE button causes the SW Upgrade application, checking for the presence of expected repositories with upgrade packages on the USB key. If at least one of these repositories exists, a similar screen becomes visible:

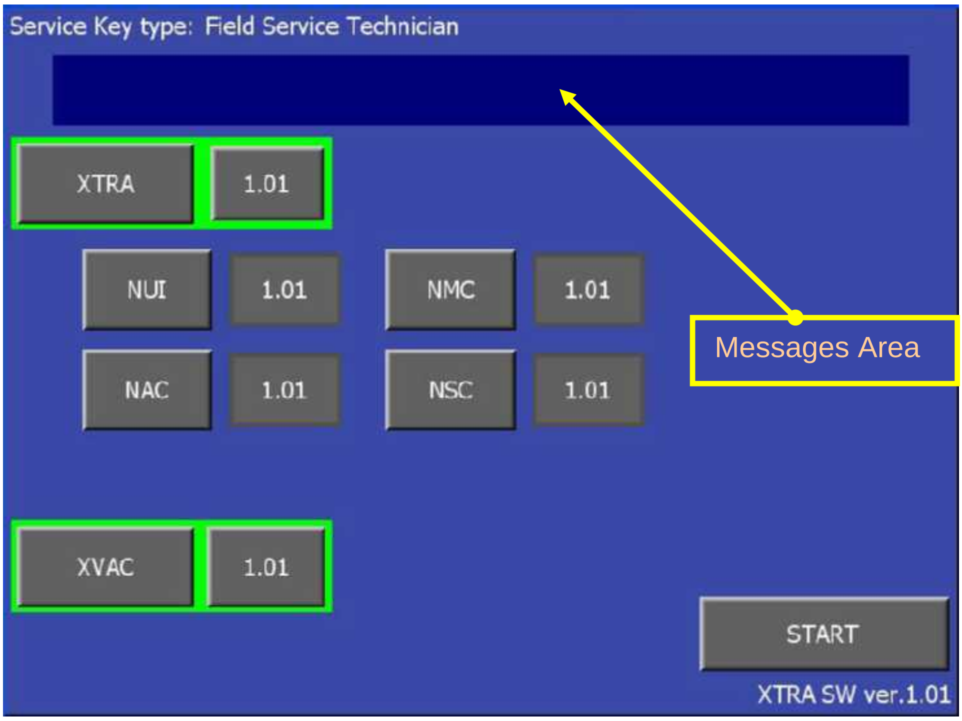


Fig. 7.3-4

- The grey boxes sited on the right of XTRA and XVAC rectangles/buttons show the last version of SW for XTRA and XVAC present on the reserved directories of the USB Key.
- The two buttons XTRA and XVAC are in their highlighted status meaning both upgrades are present and can be launched by simply pressing START. Only one of the XTRA and XVAC box couples and respective button is enabled if just one of the two kinds of Upgrade is present on the USB key. For example if only XVAC upgrade is present:

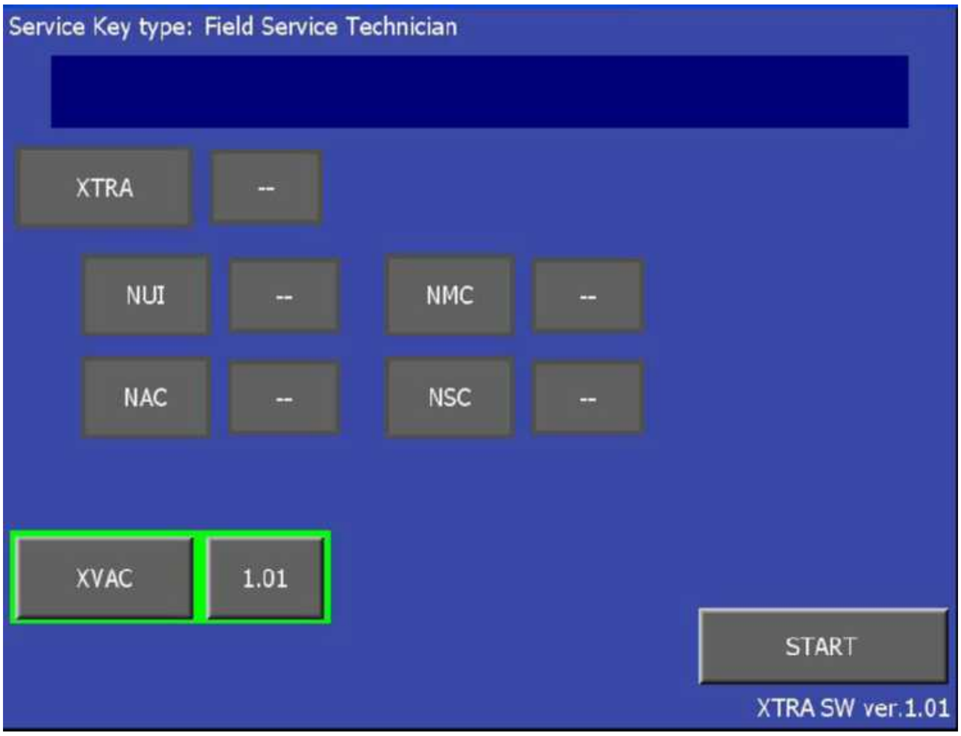


Fig. 7.3-5

- When XTRA or XVAC are selected and more than 1 upgrade version is available on the UPGRADE KEY, by pressing the "version" button beside the board/device name it is possible to select an altenative version for the SW upgrading, among the version available on the USB key listed on a pulldown list (on the following example the button close to XTRA has been pressed and the available versions 1.01 and 1.02 are listed with a button aspect; it is possible to select the desired XTRA SW version by pressing the desired "version button" of the pulldown list):

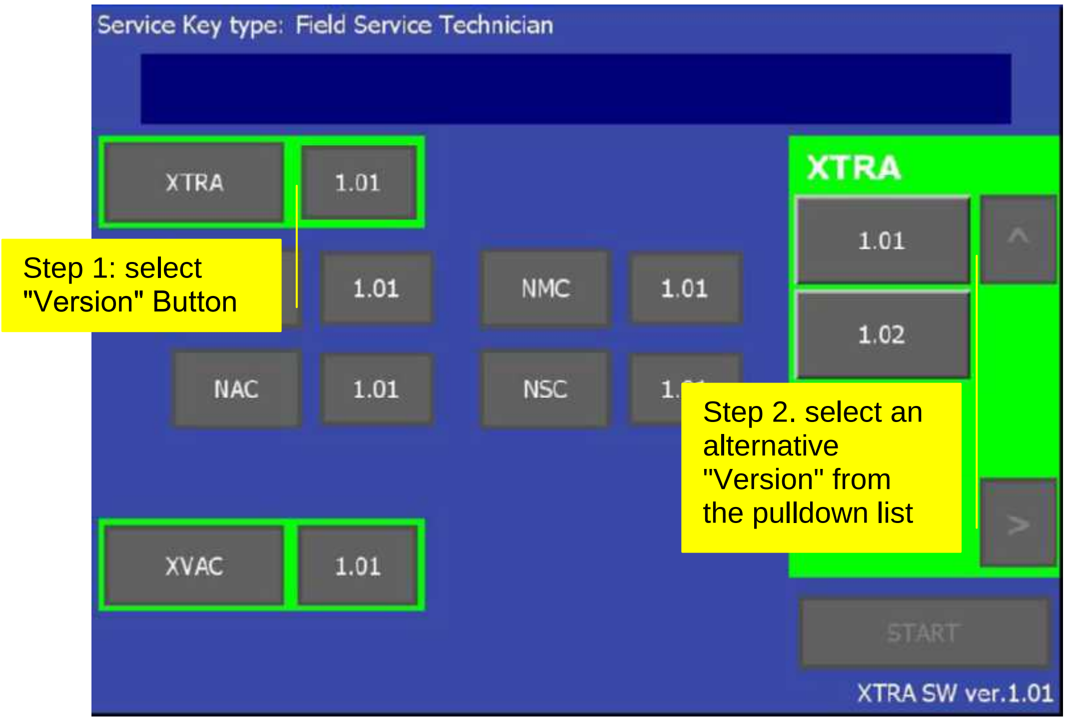


Fig. 7.3-6

- It is possible to selectively upgrade just some of the units of the machine (NUI, NAC, NMC, NSC) by de-selecting XTRA first and then selecting the desired unit/units and (eventually) its/their desired version. On the example only NUI unit and XVAC module are upgraded with their respective 1.02 SW version:

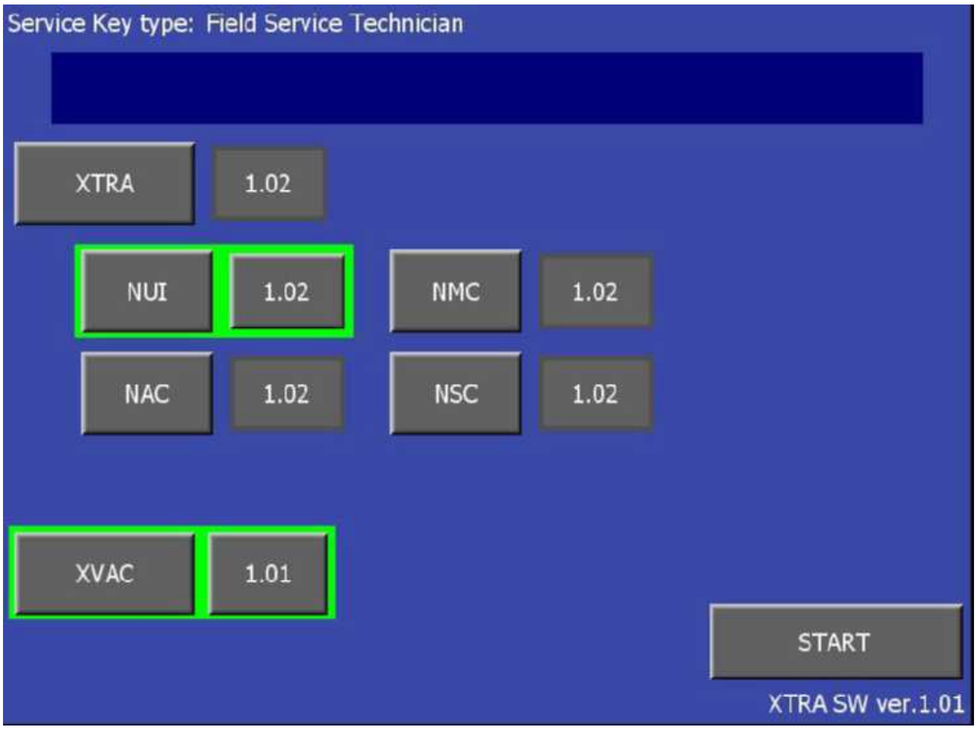


Fig. 7.3-7

- In case no repository with SW Upgrade is found on the key, just a message is shown ("UPGRADE ERROR: No SW Upgrade available on USB Key") and a button to come back to initial screen:

Fig. 7.3-8

- By acting on XTRA and XVAC toggle buttons (when enabled) it is possible to select if both of them or just one of the devices needs to be programmed (on following example just XTRA SW is upgraded by pressing START):

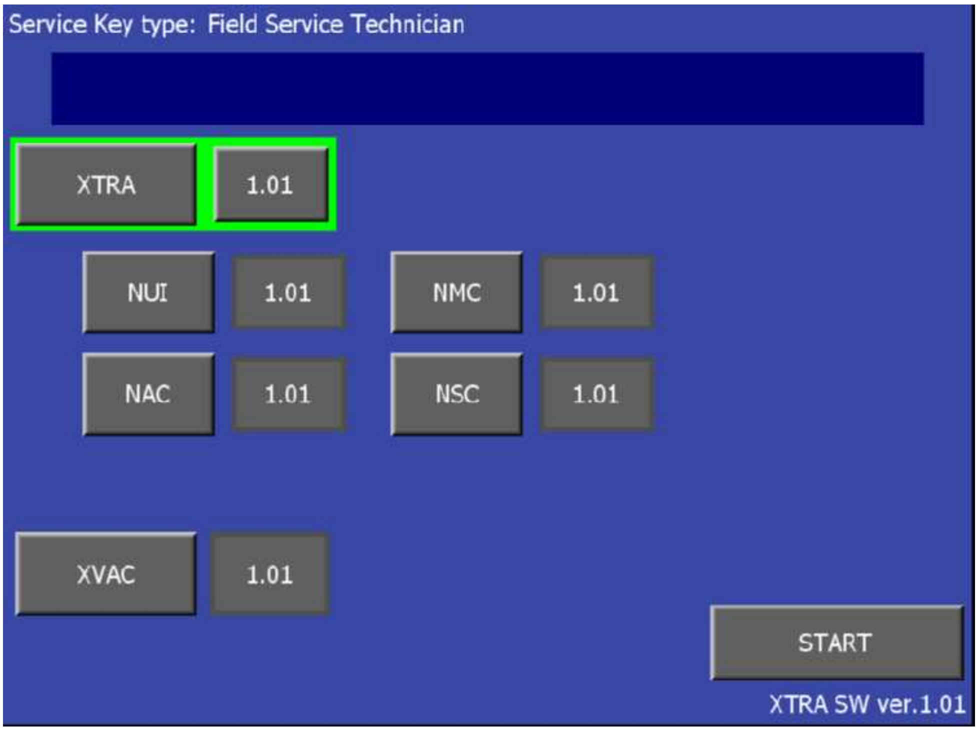


Fig. 7.3-9

- Touching the START button starts the automatic upgrade of the SW of the selected parts of the machine (XVAC first if its upgrade is present and selected, then XTRA if its upgrade is present and selected).
- When the Automatic Upgrade starts the required files are copied from the USB key to XTRA memory (NUI's CF) and a message, "Copying SW Upgrades from USB key. Don't switch off the machine, please wait…", is shown on the MESSAGE AREA of the screen. In the same time all the buttons are disabled.

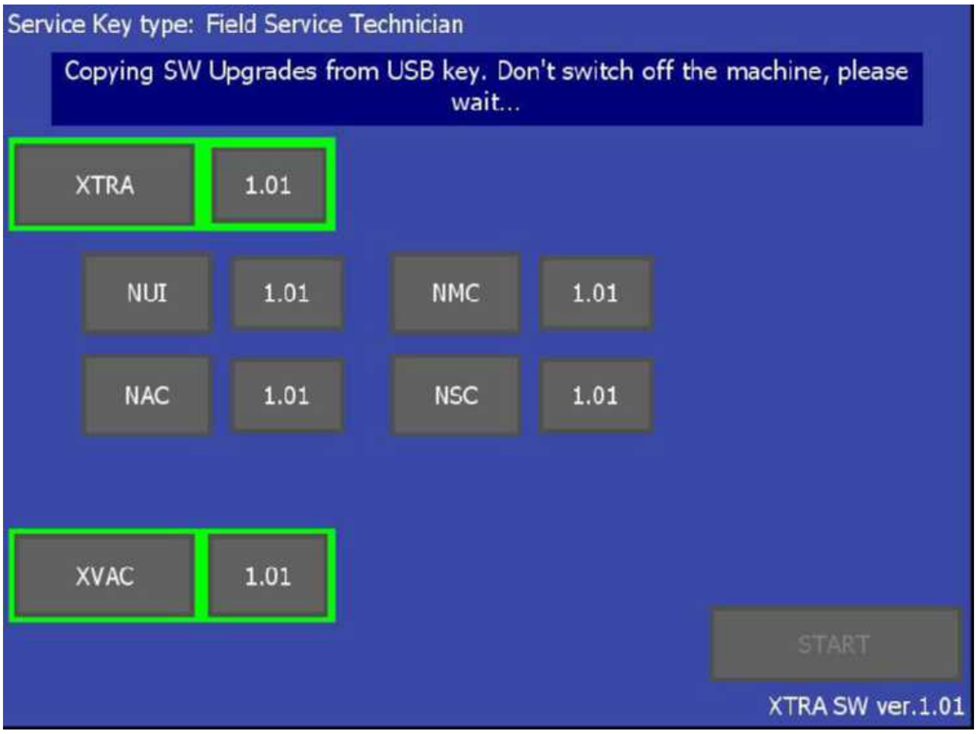


Fig. 7.3-10

- When the SW Upgrades are locally copied on XTRA, a check of integrity of selected upgrades is performed and a message, " Checking SW Upgrades. Don't switch off the machine, please wait... " is shown on the MESSAGE AREA of the screen.

Fig. 7.3-11

- As soon as the check passes, the programming phases start and new messages like “Upgrading XVAC. Don't switch off the machine, please wait…", “Upgrading NAC. Don't switch off the machine, please wait…", “Upgrading NSC. Don't switch off the machine, please wait…", “Upgrading NMC. Don't switch off the machine, please wait…", “Upgrading NUI. Don't switch off the machine, please wait…" are shown in sequence on the MESSAGE AREA.

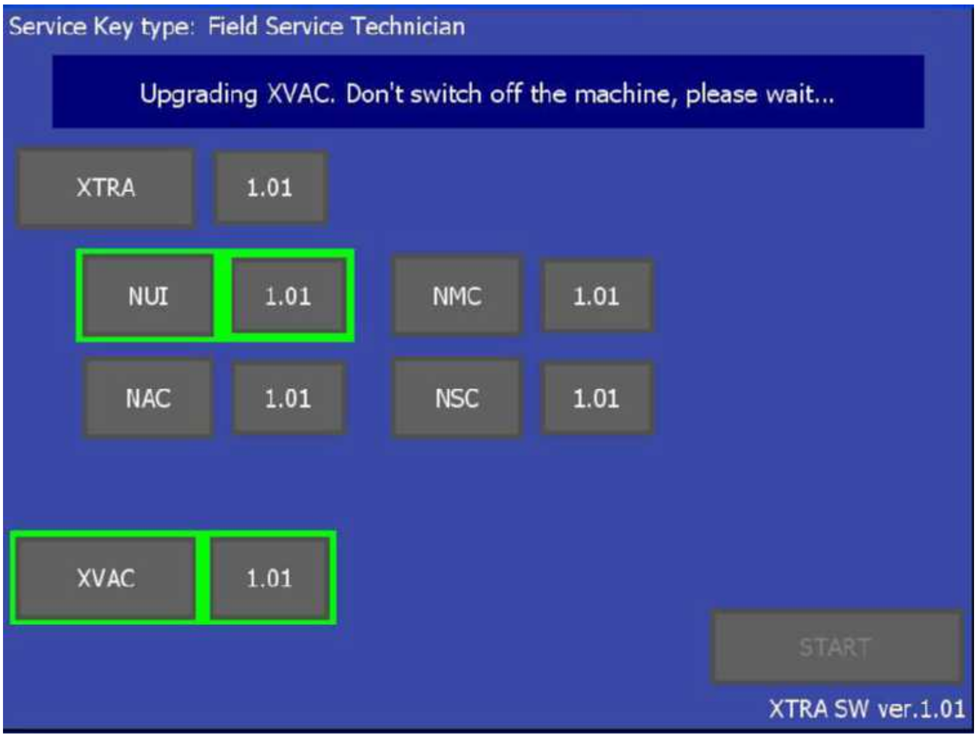


Fig. 7.3-12

- If SW Upgrade ends without problems a message appears on the screen telling “SW Upgrade Completed Successfully. Now is Safe to Switch-off the machine.”

Fig. 7.3-13

- If problems are encountered during Upgrading process, Error messages appear on the screen like:
    a. "UPGRADE ERROR: No SW Upgrade available on USB Key.",
    b. "UPGRADE ERROR: some files on USB Key are missing or corrupted.",

c. "UPGRADE ERROR: Serial Link Error."
d. "UPGRADE ERROR: XVAC upgrade failed.”,
e. "UPGRADE ERROR: NAC upgrade failed.”,
f. "UPGRADE ERROR: NSC upgrade failed.”,
g. "UPGRADE ERROR: NMC upgrade failed.”,
h. "UPGRADE ERROR: NUI upgrade failed.”

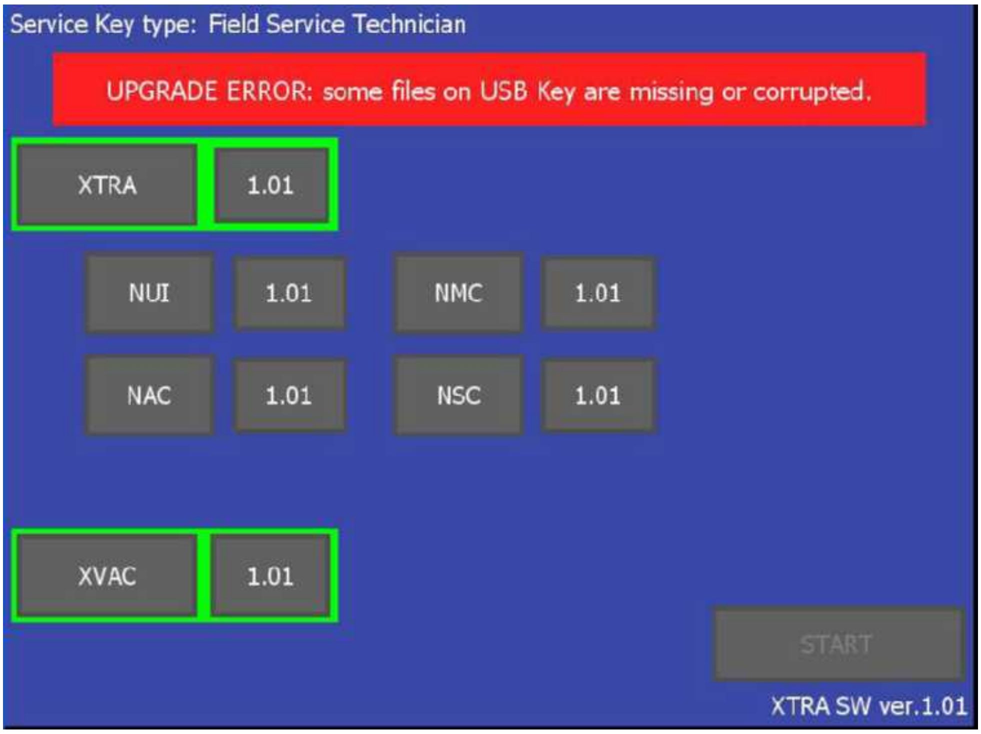


Fig. 7.3-14

- In these cases the machine must be switched off and the process must be repeated from the beginning. In general, it is possible to resume Upgrading interrupted due to problems or power fails. In these cases the MESSAGE AREA shows the Error message: "UPGRADE ERROR: please run again previous SW Upgrade":

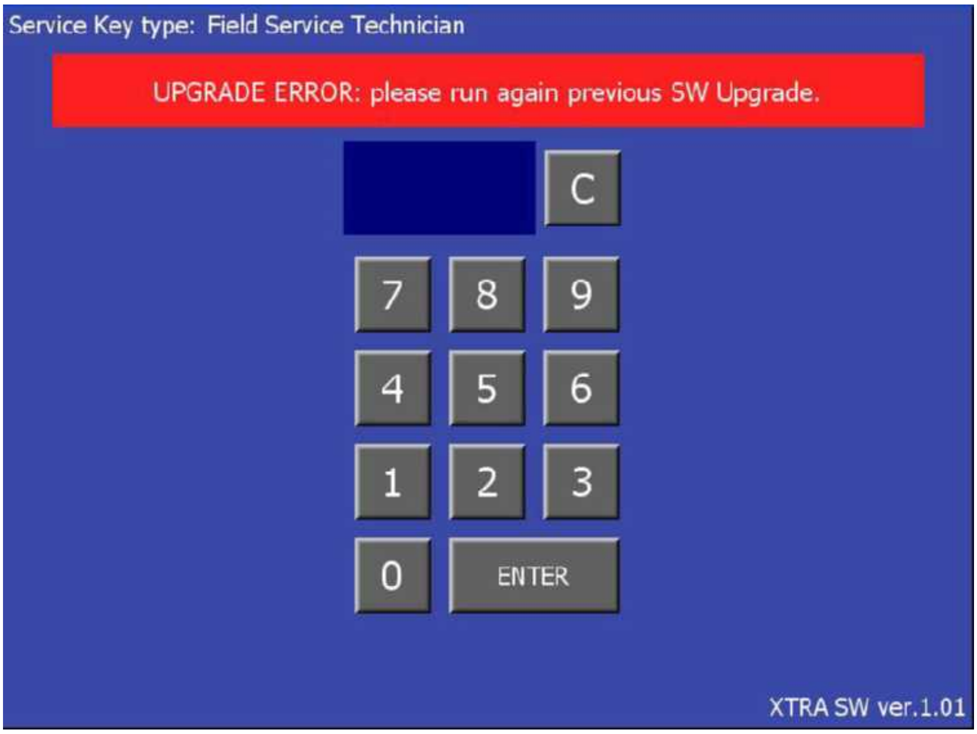

Service Key type: Field Service Technician
UPGRADE ERROR: please run again previous SW Upgrade.
C
7 8 9
4 5 6
1 2 3
0 ENTER
XTRA SW ver.1.01

Fig. 7.3-15

8 ACTUATOR DESCRIPTION

8.1 (ACT_001) Actuator Overview rev.00

8.1.1 About this card

The purpose of this card is to give a general description of XTRA **actuators**.

8.1.2 Actuator overview

XTRA can be structurally divided into five main groups according to the actuators, which determine their operation. Each group is composed of: -actuator -driver -controller –sensor.

The five groups are:

1) Clamping group;
2) Centrifuge group;
3) Peristaltic / Roller pump group;
4) Locking group (cover lock);
5) Vacuum module.

The following are the groups with respective microcontroller:

Actuator	Running µController
Pump group	NAC board
Centrifuge group	NAC board
Cover Lock group	NAC board
Clamping group	CBN board
Vacuum module	XVAC Control board

Table 8.1-1

8.2 (ACT_002) Clamp group rev.00

8.2.1 About this card

The purpose of this card is to give an HW description of the XTRA **clamps group**. This group is mounted below the XTRA top and acts as line selector among whole blood, saline solution and concentrated blood.

8.2.2 Specification

The clamps group, in combination with the clamps latch and its locking lever, either fully stops, or allows full passage of the fluid in 4,3 x 6,8 mm tubing as determined by the operational state of the machine.
It is made up by three independently actuated clamps. Only one clamp is allowed to be open at a single point in time, during rotation of the pump in a CCW direction.
The position “open / close” of the clamp is checked redundantly.
At the beginning of each treatment, the clamp stepper motors perform a self-test.

8.2.3 Physical Description

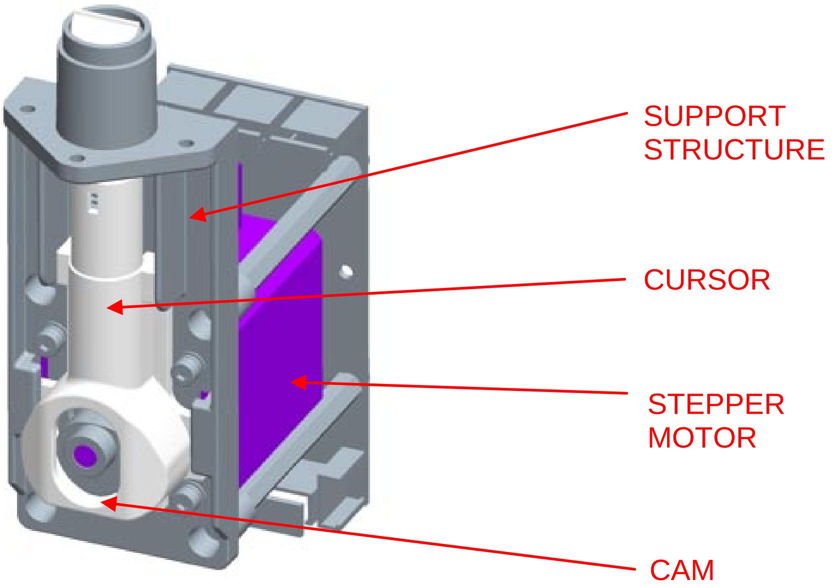
There are three independent clamps, one each for the Fill, Wash and Empty lines. Three stepper motors move them. They have the rigidity to close the line and maintain its closure.
They consist of:

- Support structure, made by thermoplastic injection moulded;
- Clamping cursor, made by thermoplastic injection moulded;
- Cam, made in low friction material machined;
- Stepper motor;
- Two channel position sensors for each clamp;
- Stepper motor driver circuit.

8.2.4 Functional Description

The cam is fixed to the stepper motor. By stepper motor rotation, the cam rotates and moves alternatively up and down the clamping cursor, that is driven by a couple of low friction guides on the support structure. At the tip of the clamping cursor, a knife profile allows the soft PVC tubing to be clamped between the knife profile and the latch surface. Knife profile has to be properly rounded in order to clamp but not to damage the soft PVC tubing. Pushed by a spring, clamping cursor tends to be normally in up position, and in this position the clamping of the tubing occurs. The cam rotation moves the clamp bulge in order to drive the cursor in down position, and so the soft PVC tubing opening occurs.
They stop or pass the fluid in the Fill line, Wash line and Empty Line as appropriate according to each phase of the procedure.

Clamp Group rev.00



8.3 (ACT_003) Clamp Latch rev.00

8.3.1 About this card

The purpose of this card is to give an HW description of the XTRA **clamp latch**.

8.3.2 Specification

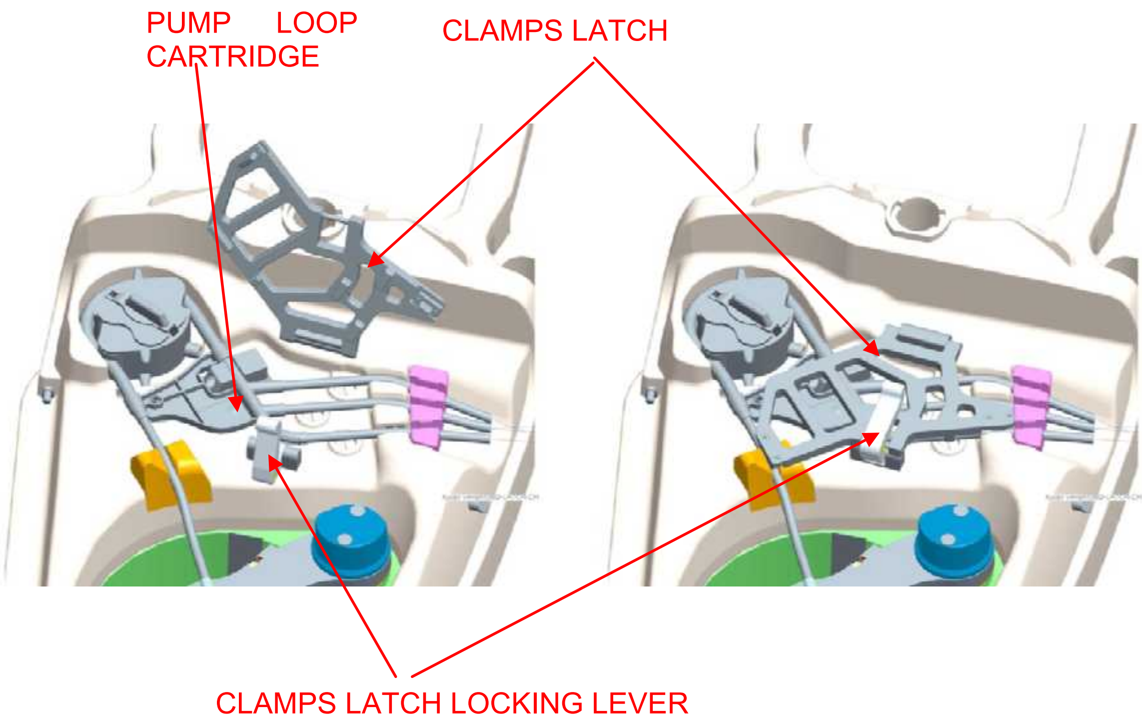
The device has mechanisms (mechanical) to connect and facilitate setup of the disposable. The clamps latch places the tubing onto/into the clamps, the HCT sensor, the air bubble sensor and the empty line clamped sensor.
The device, in combination with the clamps and the clamps latch locking lever, insures that the tubing is fully occluded (closed) when the clamp is in the closed position.
The device in combination with the centrifuge lid insures that clamp and sensor disposable elements are appropriately loaded into the machine.

8.3.3 Physical Description

The clamps latch is a rigid, hinged structure with mechanical elements which assist in the positioning of the tubing in the appropriate locations, and provide stability to those tubing sections or pump loop cartridge portions which are within sensor.

8.3.4 Functional Description

During the disposable setup, the clamps latch closes over the pump loop cartridge and the tubing. Mechanisms drive the disposable elements into the respective sensors, and provide stability to those elements within the sensors during system operation.



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8.4 (ACT_004) Clamp Latch Locking Lever rev.00

8.4.1 About this card

The purpose of this card is to give an HW description of the XTRA **clamps latch locking lever**.

8.4.2 Specification

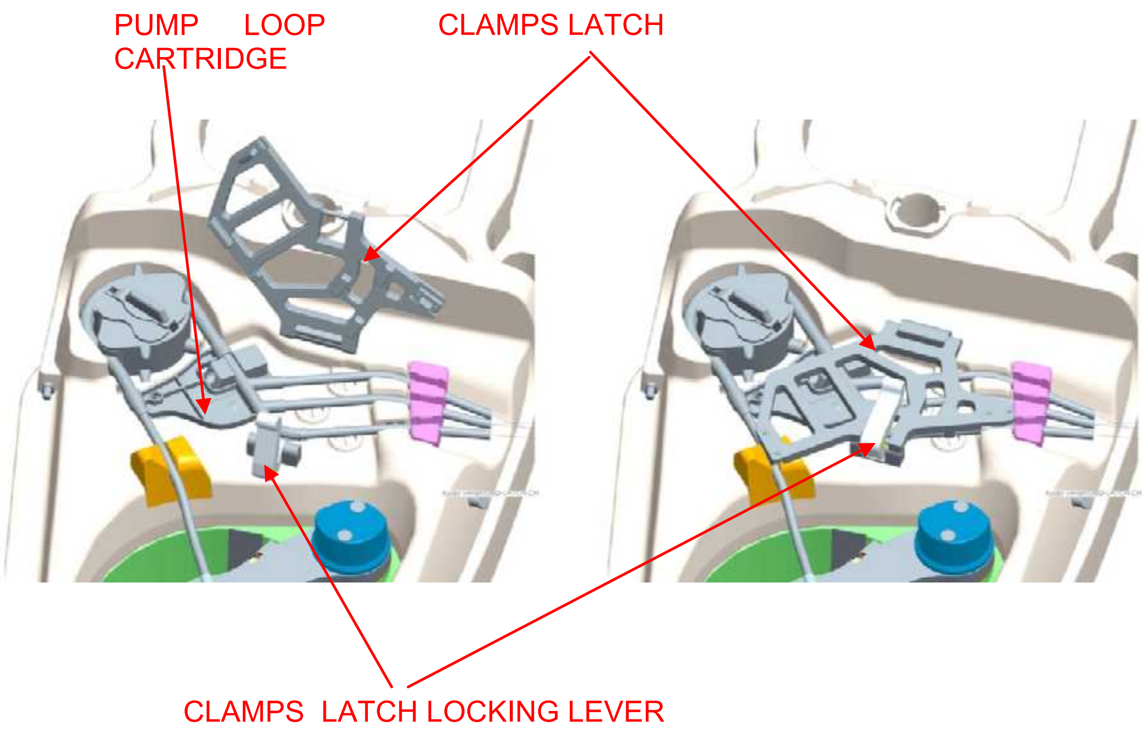
It allows the steady and safe positioning of the Clamps Latch when it closes over the pump loop cartridge and the tubing. When it does not engage the Clamps Latch, its own shape does not allow the Centrifuge Lid to be completely closed onto the top (no signal of correctly closed Centrifuge Lid) and so the procedure can't start (by SW).

8.4.3 Physical Description

It is a stout and rigid lever, hinged onto the top.

8.4.4 Functional Description

The Clamps Latch Locking Lever can be completely closed only if the Clamps Latch is completely lowered. The Clamps Latch can be completely lowered only if the pump loop cartridge and tubing are correctly inserted.
The particular shape of the Clamps Latch Locking Lever, that has a protruding appendix, interferes with the Centrifuge Lid if the Clamps Latch Locking Lever itself is not completely closed. So, only if the pump loop cartridge is completely inserted the Centrifuge Lid can be completely closed (signal of correctly closed Lid) and the procedure can start (by SW permission).



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8.5 (ACT_005) Centrifuge Group rev.00

8.5.1 About this card

The purpose of this card is to give an HW description of the XTRA **centrifuge group.**

8.5.2 Specification

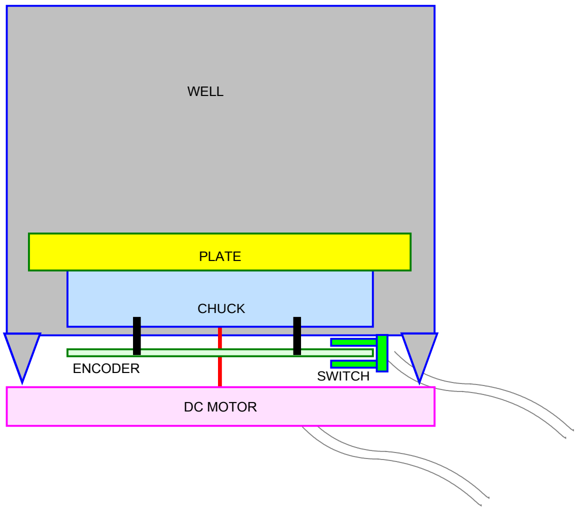
The centrifuge has an attachment plate on which the bowl is mounted.
The centrifuge has the following characteristics:

- the possible range of selectable speeds to be 1500 to 5600 rpm in 100 rpm steps;
- the lowest speed that can be maintained to be 100 rpm;
- deceleration ramps;
- only one acceleration ramp;
- the acceleration and deceleration (for braking only) times must be as low as possible;
- bidirectional movement;
- the direction and speed are monitored;
- provides the capability to be de-energized under software control during fault conditions;
- an over-temperature signal when the centrifuge motor driver temperature exceeds 75°C.

8.5.3 Physical Description

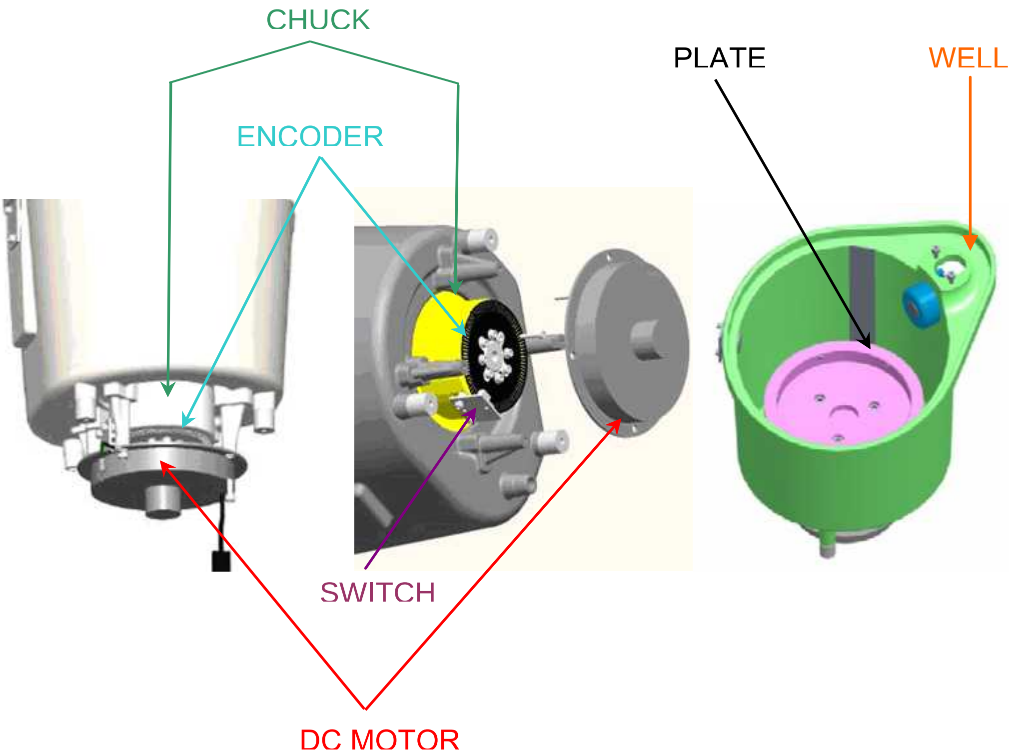
The centrifuge group is made by the following principal elements:

- DC motor;
- Disk encoder;
- Encoder switches;
- Chuck;
- Plate.



The centrifuge group is positioned in a centrifuge well.
The bowl is positioned on the plate. The plate is designed to facilitate setup of the bowl.
The chuck supports the plate and the encoder; it fastens to the shaft of the DC motor. The encoder is a perforated wheel, composed of 90 holes, coupled to the centrifuge motor. A double-channel optical sensor reads the holes of the encoder and provides pulses for each revolution. The encoder is used to control the centrifuge speed and direction.

There is also a temperature sensor on the electronic centrifuge motor driver.
The DC motor is controlled and powered by an electronic board.



8.5.4 Functional Description

Normally, the rotation is counter-clockwise except for the function called Better Empty, in which the bowls are “shaken” (alternating clockwise / counter-clockwise).
The DC motor is controlled and powered by an electronic board; the current to be supplied is generated by the motor driver and is calculated based on the pulse width modulation (PWM) principle.
The motor rotation speed is constantly monitored through signals transmitted by the encoder. A double-throw optical switch reads the 90 holes of the encoder and provides 180 pulses per revolution; it is connected to the microprocessor which counts on both clock fronts, thus obtaining 360 pulses per revolution in either direction.
There is a temperature sensor on the electronic centrifuge motor driver; it provides a digital over-temperature signal when the temperature threshold of 75 °C is exceeded inside the driver.
The microprocessor is able to detect faults in the rotation of the motor by means of the feedback signal transmitted by the encoder, the PWM algorithm, and the over-temperature indication.

8.6 (ACT_006) Bowl Retention (clutch and arm) rev.00

8.6.1 About this card

The purpose of this card is to give an HW description of the XTRA **bowl retention** system**.**

8.6.2 Specification

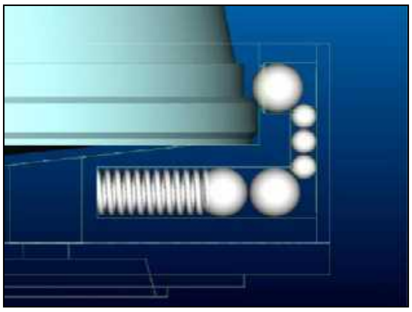
Bowl mounting is designed to allow mounting with the bowl bottom situated in any 360-degree horizontal relational position. The mounting is secure in order to retain the bowl during its rotation, and orients the bowl inlet and outlet ports in their appropriate locations.

8.6.3 Physical Description

The system that retains the bowl is made by the following principal elements:

- Mechanism on the plate that locks to the bottom of the bowl;
- Arm that locks to the top of the bowl.

The plate mechanism consists of a metal base, utilizing sets of balls and springs which interact with the bowl bottom and secure it to the plate.
The arm interacts with the bowl stator, holding the inlet and outlet ports in the appropriate locations. A latch/button mechanism releases the arm when the bowl is intended to be removed from the system.



8.6.4 Functional Description

The system attaches to the bowl at both the bottom and top of the bowl, retaining it during rotation, and positioning the inlet and outlet ports of the bowl in their appropriate locations. The arm latches into position when properly positioned on the bowl. The latch mechanism can be disengaged by the operator by activating a latch/button mechanism on the arm. The arm moves into the latched (locked) position without activating the button.

(ACT_006) Bowl Retention (clutch and arm) rev.00

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8.7 (ACT_007) Pump Group rev.00

8.7.1 About this card

The purpose of this card is to give an HW description of the XTRA **pump group**.

8.7.2 Specification

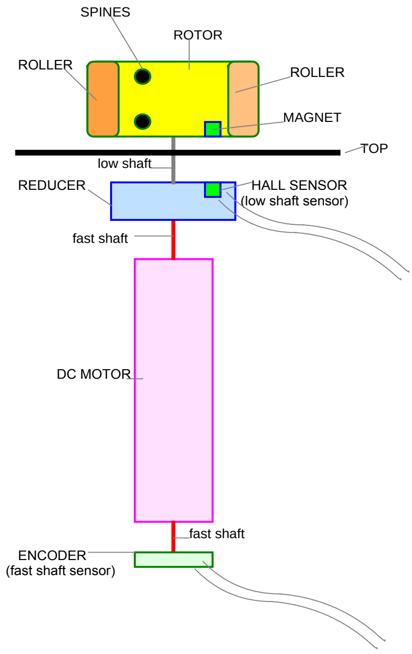
The pump is a dedicated actuator for transferring the fluid inside the tubing of the disposable.
The pump and associated circuitry provides the following operating characteristics:

- maximum speed capability of ≥1000 ml/min;
- minimum speed capability of ≤10 ml/min;
- acceleration or deceleration without ramping;
- bidirectional movement;
- the speed is monitored;
- the pump direction is monitored redundantly;
- a self-test of the direction sensors is performed;
- self-loading and self-unloading for the pump loop tubing;
- provides the capability to be de-energized under software control during fault conditions;
- an over-temperature signal when the pump motor driver temperature exceeds 145°C (inside the driver component);
- adjustment capability in 10 ml steps (minimum step increment).

8.7.3 Physical Description

The pump group is made by the following principal elements:

- Encoder (Fast shaft sensor);
- DC motor;
- Mechanical reducer;
- Rotor;
- Low shaft sensor.



The mechanical reducer gears down the pump motor rpm by a factor of 1:23.04.
The DC motor is situated under the "top" and it is connected with a mechanical reducer and an encoder. The maximum speed of the motor is 173 rpm (1150 ml/min with ¼" tubing). The encoder provides 500 pulses for each revolution and is used to control the pump speed (flow rates) and volumes.
The rotor is made with two rollers and four spines and is moved by the low shaft of the reducer. The spines enable the self-load of the "pump loop".
There is a second speed sensor – the low shaft encoder. It is constructed of a magnet mounted on the rotor, and a Hall sensor. It provides a clockwise or counter-clockwise digital signal when the pump is rotating.
There is a temperature sensor on the electronic pump motor driver that provides a digital over-temperature signal when the temperature threshold of 145 °C is exceeded within the driver.

8.7.4 Functional Description

During movement, the rollers occlude the "pump loop" and transfer the liquids present in the pump loop.
Direction and speed are constantly monitored by mean of signals coming from two channels (encoder and low shaft sensor) connected to the motor rotor. Different microprocessors monitor each channel. The first microprocessor controls the power for the pump motor, the second, in case of a fault in the first microprocessor, is able to stop the pump motor by activating a safety switch on the power supply of the motor.

8.8 (ACT_008) Pump Loop Eject Mechanism rev.00

8.8.1 About this card

The purpose of this card is to give an HW description of the XTRA **pump loop eject mechanism**.

8.8.2 Specification

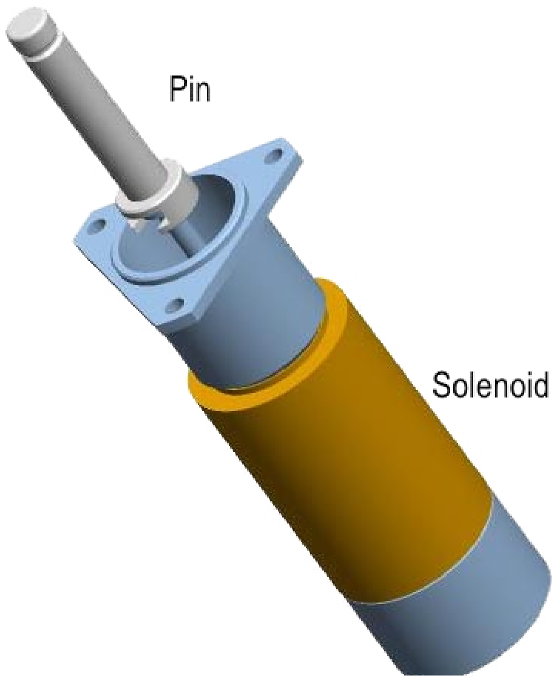
The device has a user-selectable function which disengages the "pump loop" portion of the disposable pump loop cartridge from the process pump, enabling the user to remove the "pump loop" without manually rotating the pump.

8.8.3 Physical Description

A mechanical mechanism lift the "pump loop". The ejector "finger" is moved by a monostable solenoid located under the top of machine.

8.8.4 Functional Description

At the end of procedure, the user presses a soft button that begins a pump loop eject phase which positions the rotor pump and then lift a "finger". The pump then rotates, unloading the tubing from the pump raceway.



(ACT_008) Pump Loop Eject Mechanism rev.00

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8.9 (ACT_011) Stop Button rev.00

8.9.1 About this card

The purpose of this card is to give an HW description of the XTRA **stop button**.

8.9.2 Specification

There is a Stop button. It is a hard key and it implements the stop of a procedure when activated. For safety concerns, it is hardwired to two separate microprocessors. It is labeled per Standards requirements.

8.9.3 Physical Description

The stop button is a hard button, with labelling, which is mounted on the display housing and is electrically connected to the microprocessors.

8.9.4 Functional Description

When the Stop button is pressed the machine proceeds to the safe state and the screen is the Ready Screen.

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8.10 (ACT_013) XVAC Vacuum System rev.00

8.10.1 About this card

The purpose of this card is to give an HW description of the **XVAC Vacuum System.**

8.10.2 Specification

This system has to aspire the blood during a Intra operative procedure and also during the Post operative one. This module can work stand-alone or can be connected to XTRA machine.

This module is able to work on two different modes:

- Intra Operative mode;
- Post Operative mode.

It also uses two different set-points and two different set point ranges.

- Post Operative mode: providing a negative pressure in the range -10 mmHg ÷ -100 mmHg;
- Intra Operative mode: providing a negative pressure in the range -50 mmHg ÷ -300 mmHg.

For both modes the increasing/decreasing step is 10 mmHg.

Vacuum performances measured with single suction line, with water elevation height of minus 0,3 meters are at least:

- 1,5 l/min of water with vacuum regulated to 300 mmHg;
- 0,9 l/min of water with vacuum regulated to 150 mmHg.

The XVAC has capacity to deliver fluid flow values greater than, but not directly proportional to, those listed above, with two suction lines attached to the reservoir and both submerged into the fluid source.

Atmospheric pressure is obtained whatever is the selected mode and set point when Vacuum is in its OFF status.

8.10.3 Physical Description

The XVAC module is a physical unit separable from the rest of the equipment: it is easily transportable, by means of an ergonomic upper handle, and it weighs 14 Kg.

The XVAC is able to be inserted and secured into the equipment cart compartment, without the use of special tools, by means of a screw, handled by a knob and fixed at the cart bottom, screwing into a threaded hole at the bottom of the XVAC base.
When used independently from the machine as a stand-alone device, with its own control panel and power connection, XVAC can be laid on any horizontal flat surface of sufficient dimensions.
The body is made into three part, a base and a front, tightly connected each other, and a cover.
The shape of the body matches the shape of the cart, in such a way that, when installed onto the cart, the surface of the vacuum body (front) matches exactly the rear surface of the cart legs.
The XVAC has a reusable fluid receptacle which, said “water-trap”, that protects the internal part of the equipment from the unwanted access of blood or other liquids. It can be removed without special tools.
Another device, a replaceable hydrophobic filter, is placed inside the body with the same aim of protecting the equipment from unwanted liquids access.

The module includes the following units:

- High Voltage Power Adaptor, made by:
  - Electrical Network Filter;
  - Toroidal transformer;
  - TRD adaptor board.

- Intra Operative Aspiration Block (EV1 + P1), made by:
  - Vacuum Pump 230 VAC o 115VAC(P1);
  - Proportional Electrovalve(EV1).

- Post Operative Aspiration Block (P2), made by:
  - Vacuum Pump 6 VDC;

- Control Board (with safety micro) + Power Board, made by:
  - Main microcontroller Freescale 56F8146;
  - Safety microcontroller Freescale 56F8122;
  - Intra-Operative pressure sensor Honeywell 26PCCFA2G (S1);
  - Post-operative pressure sensor Maxim MPXM2053GS (S2);

- DC to DC regulators(for 5V and 3.3V);
- LCD driving circuit;
- LED driving circuit;
- TTL to RS422 transceiver circuit;
- Keyboard reading circuit;
- Power Board:
  - Intra Pump driver(opto-triac TLP3064 4Kv)
  - 230V cut off Safety Relay(GSB-1114P-US 5VDC)

- User Interface

8.10.4 Functional Description

The module can work either in Stand-alone or in Remote mode. The system decides automatically the running mode. If a XTRA system in connected on its serial interface, module works in remote configuration otherwise, if no system is connected the module runs in stand alone. While XTRA system is booting, XVAC must operate in stand-alone and switches its operative mode to remote only when boot phase is over. If the presence of the vacuum module XVAC is detected by the machine, after the power on, specific handshake messages have to be exchanged through the dedicated serial connection for this purpose. When boot is over the user is able to drive the module by using XTRA NUI user interface while, on the module is just display the symbol indicating that connection have been established, while its own keyboard is disabled.

The switch from remote mode to linked mode must not change the type of operative procedure (INTRA or POST) chosen during the boot phase. This means for example, if the vacuum pump has been started using module keyboard before the machine boot ends, when machine takes the vacuum control, the pump has to remain running; if the vacuum set point has been changed using module keyboard before the machine boot ends, when the machine takes the vacuum control, the pump set point has to remain that one selected through module keyboard and so on. In order to allow this behavior, after Vacuum module startup handshaking , Vacuum module has to send to the machine through serial line:

- Its current operating Mode (INTRA or POST);
- Its current status(ON or OFF);
- Its current set-point

In remote mode, the choice of surgical program to perform determines operative condition. For example, if the user choose a *Popt* program, XVAC operative mode becomes POST with a set point equal to the default value provided in XTRA.

A wake up features is provided for the system. XTRA provides the possibility to set a Wake Up protocol. As a Wake up protocol exists, there is also a wake up aspiration mode and also a wake up set point.

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8.11 (ACT_014) Centrifuge Lid Lock rev.00

8.11.1 About this card

The purpose of this card is to give an HW description of the XTRA **centrifuge lid lock.**

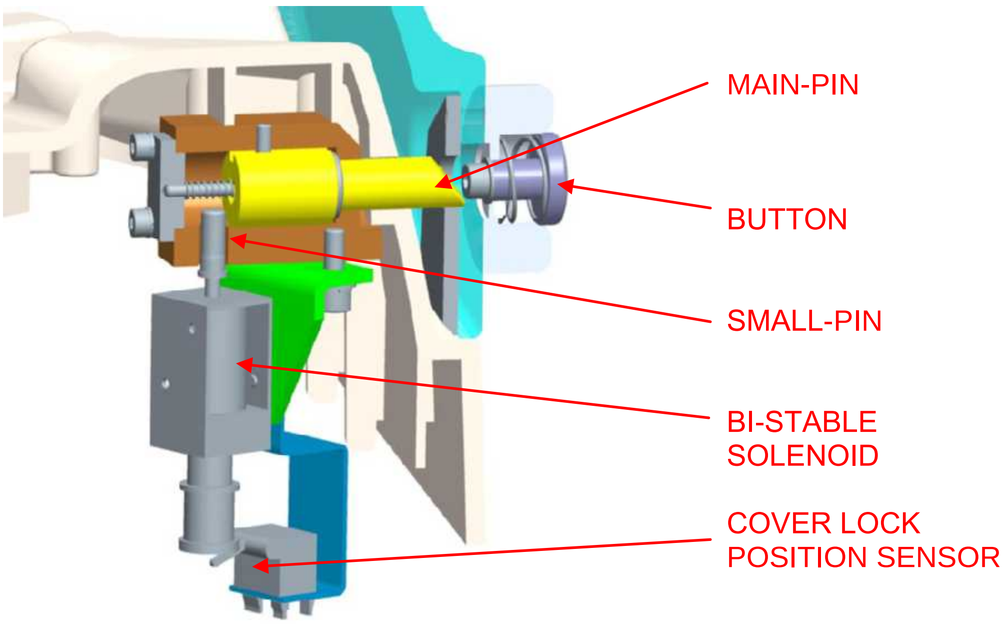
8.11.2 Specification

The Centrifuge lid Lock system locks the centrifuge lid in the closed position. The driver includes also a supplementary circuit for delaying the opening for a time period between 50 seconds and 1 minute 10 seconds, after equipment switch-off or power loss. This avoids danger when the main supply is turned-off while the pump and centrifuge still have inertial rotation. When the lock is open, the 30-volt supply is not available to power the actuators (pump, clamps and centrifuge).

8.11.3 Physical Description

The Centrifuge lid Lock is made up by:

- a spring-driven main-pin, mounted into the top, that engages into a hole of the centrifuge lid. Because of the sloped flat surface of its tip, the main-pin is automatically engaged into the centrifuge lid hole when the centrifuge lid is lowered and pushed downwards;
- a spring-driven button, mounted onto the centrifuge lid, that allows the main-pin to be disengaged from the centrifuge lid hole;
- a bi-stable solenoid, moving a small-pin having two positions: the first position (up-position) locks the main-pin in the position in which it is engaged into the centrifuge lid hole, the second position (down-position) allows the button to disengage the main-pin from the centrifuge lid hole. The solenoid is acted by a bi-directional driver circuit.



The supplementary circuit for delaying the opening is powered by two capacitors and the time is regulated by means of a resistor for RC discharge.

8.11.4 Functional Description

The Centrifuge lid Lock is closed, with the main-pin locked into the centrifuge lid hole by the small-pin driven in up-position, only if the centrifuge lid is physically closed; this position of the centrifuge lid is recognized through the “centrifuge lid position sensor” signal.
The Centrifuge lid Lock is open when the small-pin is driven by the bi-stable solenoid in down position. This allows the button to move the main-pin and disengage the centrifuge lid from the main-pin itself.
The SW:

- locks the Centrifuge lid Lock in closed position before moving the centrifuge and the pump;
- unlocks the Centrifuge lid Lock in open position in order to allow the centrifuge lid to be physically open, in the Stop state, when the centrifuge and the pump are completely stopped.

9 SENSOR DESCRIPTION

9.1 (SEN_001) Sensor Overview rev.00

9.1.1 About this card

The purpose of this card is to give a general description of XTRA **sensors**.

9.1.2 Sensors Management Summary

Below is provided the list of XTRA sensors managed by Sensor Group. For each of them is showed if it is analogic or digital (final elaboration), the PCB board involved in the signal control and the microprocessor in charge of acquisition of the signal.

Sensor	**Type**	**μP**	**μP**
Blood Loss	Digital	NSA	H8S/2633
Bar code reader	Digital	NSA	H8S/2633
Buffy-coat Low	Analog	NSC	PIC18F252
Buffy-coat High	Digital	NSC	PIC18F252
Hct (led λ = 805 nm)	Analog	NSC & HHR	H8S/2633
Hgb (led λ = 565 nm)	Analog	NSC & HHR	H8S/2633
Burst prevention into RBC line	Analog	NSA	H8S/2633
Status of the Centrifuge Cover	Digital	NSA	H8S/2633
Air bubble Sensor	Digital	NSA	To Master
+12V & -12V Under Voltage	Digital	NSA	H8S/2633
+12V & -12V Over Voltage	Digital	NSA	H8S/2633
Power Supply Voltage Acq.	Analog	NSA	H8S/2633
Load Cell	Analog	NSA	H8S/2633
Status of the Latch Cover	Ana. or Dig.	NSA	H8S/2633

Table 9.1-1

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9.2 (SEN_002) Centrifuge Fluid Loss Sensor rev.00

9.2.1 About this card

The purpose of this card is to give a general description of XTRA **centrifuge fluid loss sensor**.

9.2.2 Specification

The centrifuge fluid loss sensor detects unintended fluid present into the centrifuge well (assuming that the liquid comes from a leak in the bowl). The system detects a quantity of fluid which spans a dimension of 3 mm.

9.2.3 Physical Description

This sensor provides a digital signal of "Loss / No-Loss" bowl leak detection.
It is made up by a copper grid on a PCB placed inside the centrifuge well; at a level approximating the rotating seal area of the bowl; the copper is short-circuited as soon as a quantity of liquid corresponding to a 3 mm width is present in the centrifuge well.

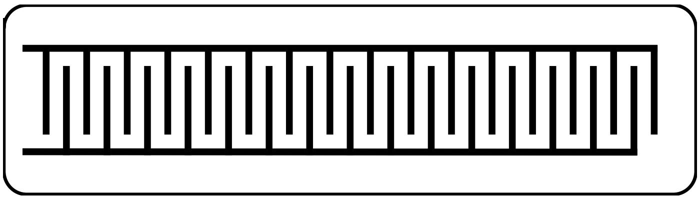

Fig. 9.2-1

9.2.4 Functional Description

To insure function, an electrical circuit provides the simulation of the presence of liquid for a short time (100 ms) at fixed intervals (every 5 s) during system use. This provides a continuous software functional verification of the sensor. The software is able to discriminate between the simulated liquid signal and the real presence of liquids; the discriminating factor is that during testing the signal is present for a shorter time than that expected for the case of actual liquid.

The transmitter is based on a 1KHz timing circuit that supplies one side of the copper grid PCB.
If a short-circuit happens the receiver stage is able to manage the received signal and it provides the alarm status. The receiver stage is based on: amplifier, filter and comparator blocks.
An autonomous transmitter provides a simulated short-circuit to test automatically this sensor.

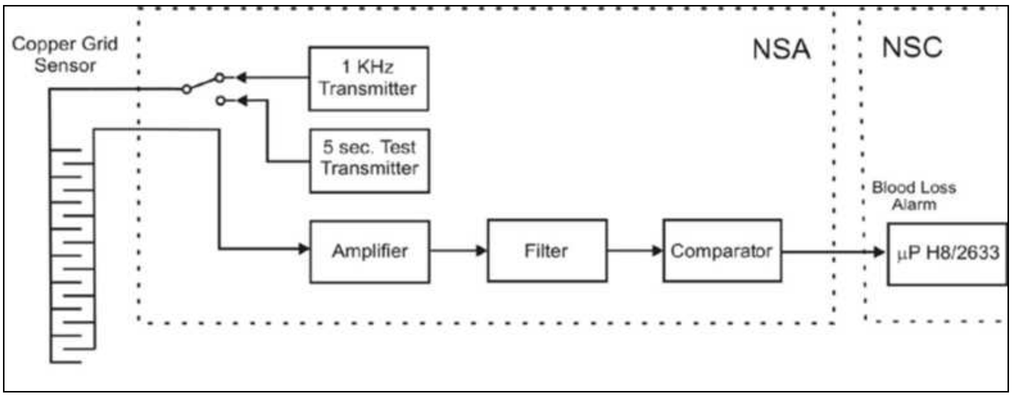

Fig. 9.2-2

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9.3 (SEN_003) Kit Sensor rev.00

9.3.1 About this card

The purpose of this card is to give a general description of XTRA **bowl kit sensor**.

9.3.2 Specification

The device has automated bowl size recognition for the four bowl sizes available. If the sensor is unable to read the size, it is possible to manually enter the bowl size.

9.3.3 Physical Description

The size of the bowls (55, 125, 175 and 225 ml) is read using a bar code label. The Label is applied to the pump loop cartridge.

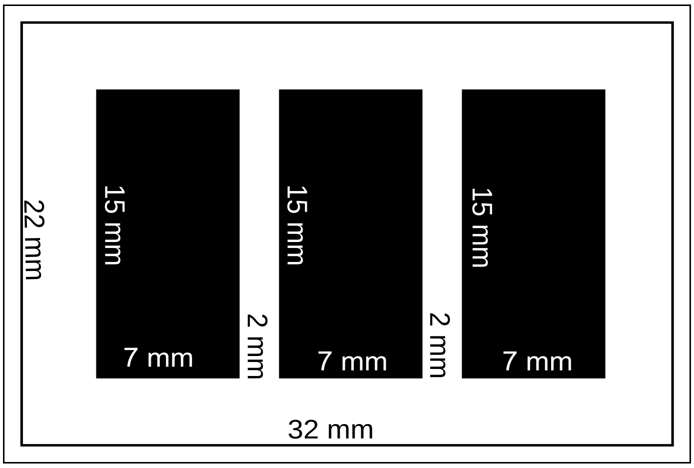

Fig. 9.3-1

The labels can indicate up to six different types (a label with all the bars, without bars, or no label present, is considered an error). An optical sensor fixed on the equipment reads the bars on the label.
Three contact Reflective Object Sensors constitutes this optical sensor, placed on the machine top.

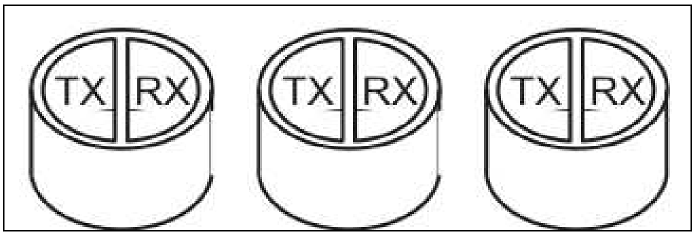

Fig. 9.3-2

The three optical sensors are managed by the same transmitter pulses generator but independent receivers are used to allow SW trimming.
In each receiver side a first gain-controlled amplifier stage is introduced. The gain is managed by the NSC H8S controller that allows an automatic SW trimming.
A filter stage is present to reduce the visible-light dependence. Last stage converts the analog signal to a digital level with the white-bar or black-bar relative meaning.

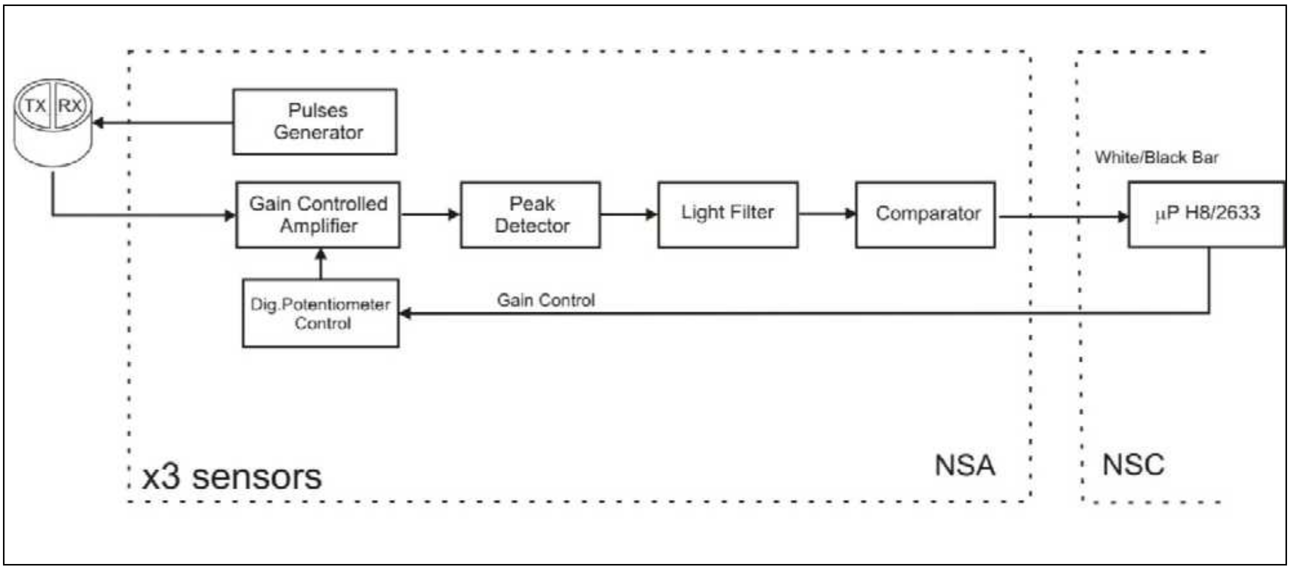

Fig. 9.3-3

9.3.4 Functional Description

During a Setup phase, the system reads the bars of the label, converts the reading to the bowl size, and sets the appropriate processing parameters for that bowl size. A label without bars, or the lack of a label, is considered an error. In a dedicated screen of the display, it is possible for the operator to insert the bowl size.

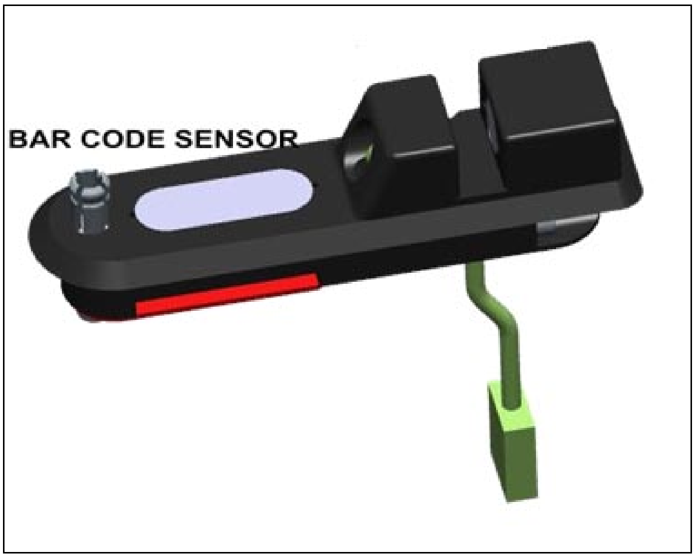

Fig. 9.3-4

9.4 (SEN_004) RBC Detectors rev.00

9.4.1 About this card

The purpose of this card is to give a general description of XTRA **RBC Detectors**.

9.4.2 Specification

There are two sensors, termed: RBC sensor High Level and RBC sensor Low Level. They provide information on the RBC levels reached in the bowl. They detect when the bowl is determined to be properly filled in order to change phases of processing.
Both RBC sensors work correctly even in case of haemolysis $\leq$ 2000 mg/dl of FPH (when using bovine blood).

Fig. 9.4-1

9.4.3 Physical Description

The RBC (B.C.) High Level Sensor and the illuminator for the RBC Low Level Sensor is located under the bowl arm that locks to the top of the bowl.
The RBC Low Level Sensor is placed in the centrifuge well.

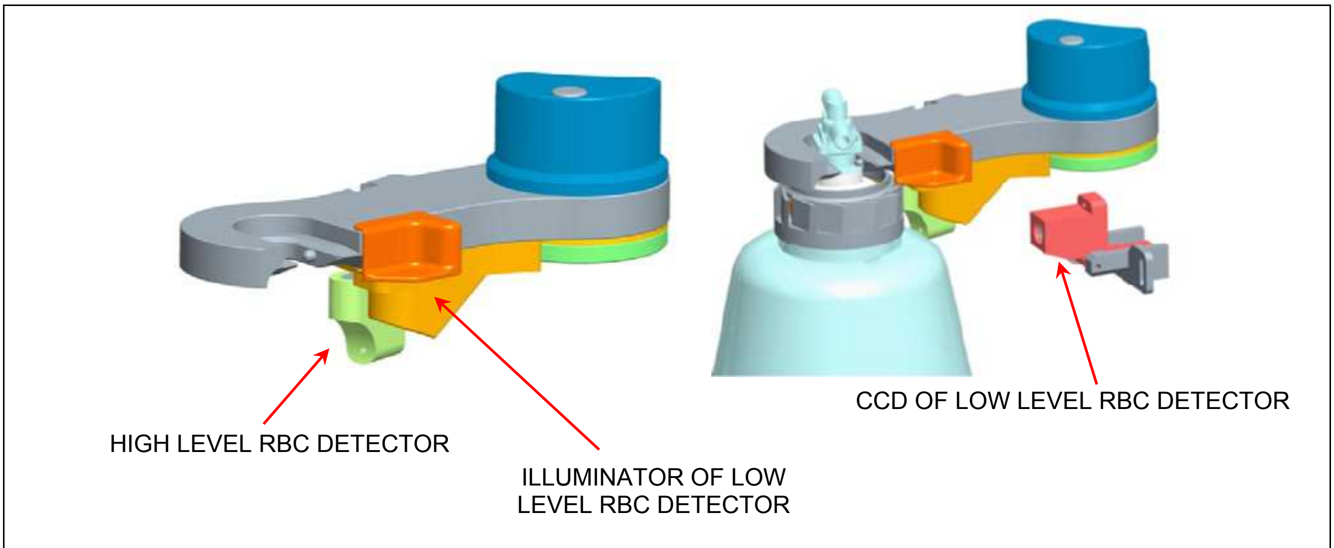

Fig. 9.4-2

- **RBC HIGH LEVEL SENSOR**

This sensor provides a reading of the light reflectance of the fluid in the top part of the bowl.
A LED, with an emitter wavelength of 870nm, is used to illuminate the bowl with an infrared impulse, and a corresponding photodiode (receiver) reads the energy that is not absorbed by the bowl.
The transmitter is based on an 11 KHz timing circuit that supplies the Tx LED.
A PIC governs the transmitter for a correct synchronization with “RBC low level lighting”.
The received signal detected by the Rx Led is amplified by a selective stage, it is followed by processing and filtering stages, at the end of which the comparator stage provides the information of level reached. The comparator threshold is SW managed by the PIC controller for auto-trimming features.

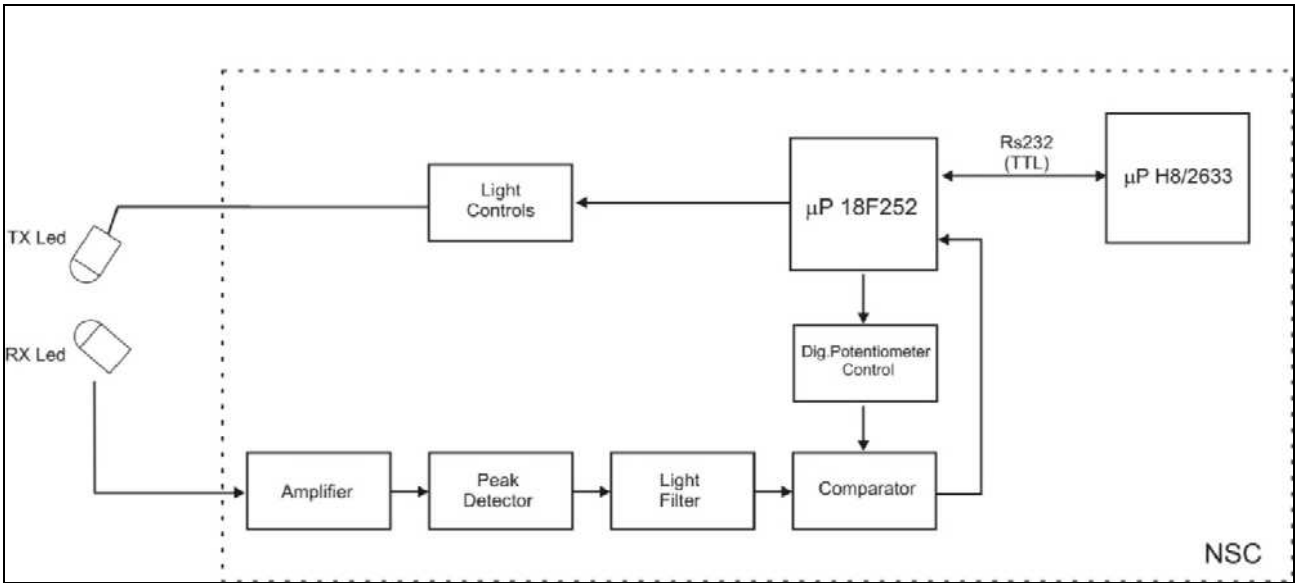

Fig. 9.4-3

- **RBC LOW LEVEL SENSOR**

This sensor provides the RBC low level reached into the bowl.
The sensor is constituted by:

- a battery of LEDs placed under the blocking arm of the bowl, such LEDs illuminate with infra-red technology, a site area of about 2 cm of the bowl,
- a CCD with 128 pixels that reads the reflected infra-red (resolution: 1,7 cm / 128 pixel ≈ 0,0133 mm)

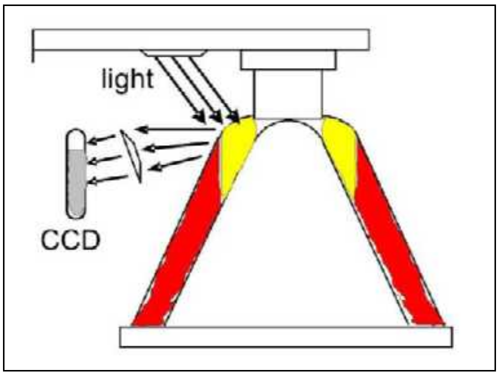

Fig. 9.4-4

The LEDs under the bowl arm are controlled by a PIC. The PIC program varies the transmitted light intensity via a D/A port using a PWM scheme. In this way, it is possible to adapt the intensity of the light to the type of bowl. The readout of the CCD (degree of lighting of the 128 pixels) is connected to an analog channel of a microprocessor.

This signal is before amplified by means of a gain controlled amplifier. The gain control is done by SW for trimming functions.

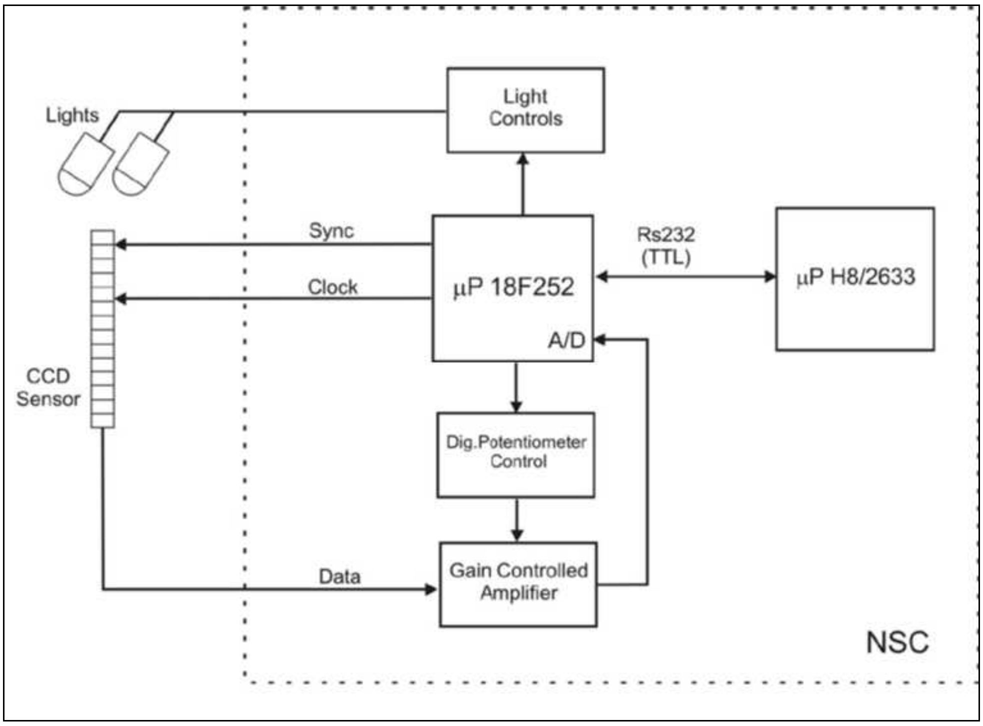

Fig. 9.4-5

9.4.4 Functional Description

The sensor design is based on the fact that concentrated RBCs do not reflect infra-red rays (or at least the intensity is very low) but the remaining fluids (plasma, platelets, white blood cells) and the empty bowl reflect such rays.
The buffy-coat low is established through analysis of the digitized and filtered signal. The sensors has the capability to discriminate the real RBC even in case of massive hemolysis (2000 mg/dl maximum) of blood in the bowl.

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9.5 (SEN_005) Air Sensor rev.00

9.5.1 About this card

The purpose of this card is to give a general description of XTRA **air sensor**.

9.5.2 Specification

This sensor detects when air is present in the cross sectional area of the sensor. Additional filtering SW is used. The minimum bubble to be detected is 50µl at 1000 ml/min fluid flow rate.

The sensor is used to detect when the

- reservoir is empty (or a bag is empty in the concentration phase or preoperative procedure);
- wash bags are empty;
- bowl is empty;
- bubbles of air are passing through the line (in order to evaluate the correct volumes of liquid passing through the line)

9.5.3 Physical Description

This sensor is composed of two ceramic transceivers. It is located between the pump motor and the bowl.

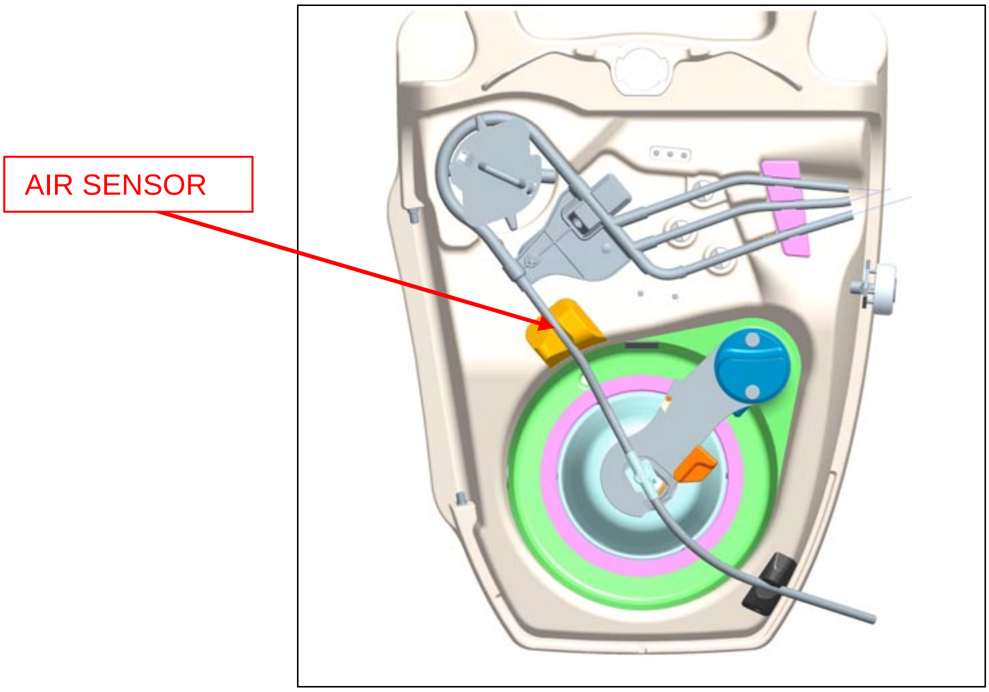

Fig. 9.5-1

The sensor will use ceramic transceivers to distinguish between liquid and air. The piezoelectric ceramic transmitter is energized by a burst of electric pulses whose energy is converted into ultrasound in the ceramic material and transmitted via the liquid. Air interrupts the propagation, which allows the sensor to detect its presence.
The ultrasound signal detected by the ceramic receiver is amplified by two selective stages in cascade, so that the signal/noise ratio can be increased; it is followed by processing and filtering, at the end of which the sensor provides the information on air/liquid with the corresponding led signal.

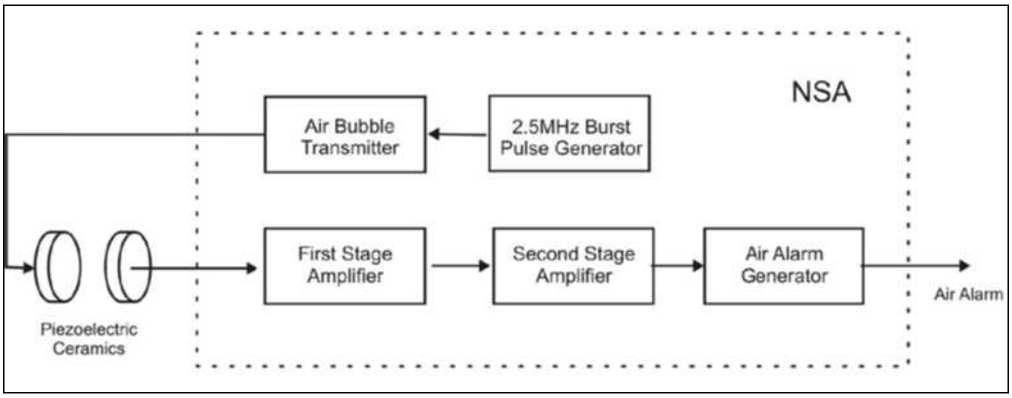

Fig. 9.5-2

9.5.4 Functional Description

The function of this sensor is to distinguish between air and liquid presence through the blood line, by means of two ceramic transceivers.
This sensor will provide a signal for the contents of the tubing: air or liquid.
The presence of air is not sufficient to activate the alarm: the software activates the alarm, depending on the unit’s operating conditions.

9.6 (SEN_006) Haematocrit Indicator rev.00

9.6.1 About this card

The purpose of this card is to give a general description of XTRA **haematocrit indicator**.

9.6.2 Specification

There is an integrated non-invasive HCT sensor with following features:

Inlet HCT (as blood pumps into the bowl):

- Range: 5 to 40 HCT %;
- Accuracy is ± 3 HCT % of the reading over range of 5 to 30 HCT %, and ±10 % of the reading in the remaining range as compared to a Coulter Counter (when blood is collected with Heparin, CPD, or ACD-A, per AABB recommended anticoagulant/blood ratios).

Outlet HCT (as blood products pump out from the bowl):

- Range: 30 to 65 HCT %;
- Accuracy: ± 10 % compared to a Coulter Counter (when blood is collected with Heparin, CPD, or ACD-A, per AABB recommended anticoagulant/ blood ratios).

9.6.3 Physical Description

The sensor is placed under the Clamps Latch on the top surface of the machine.

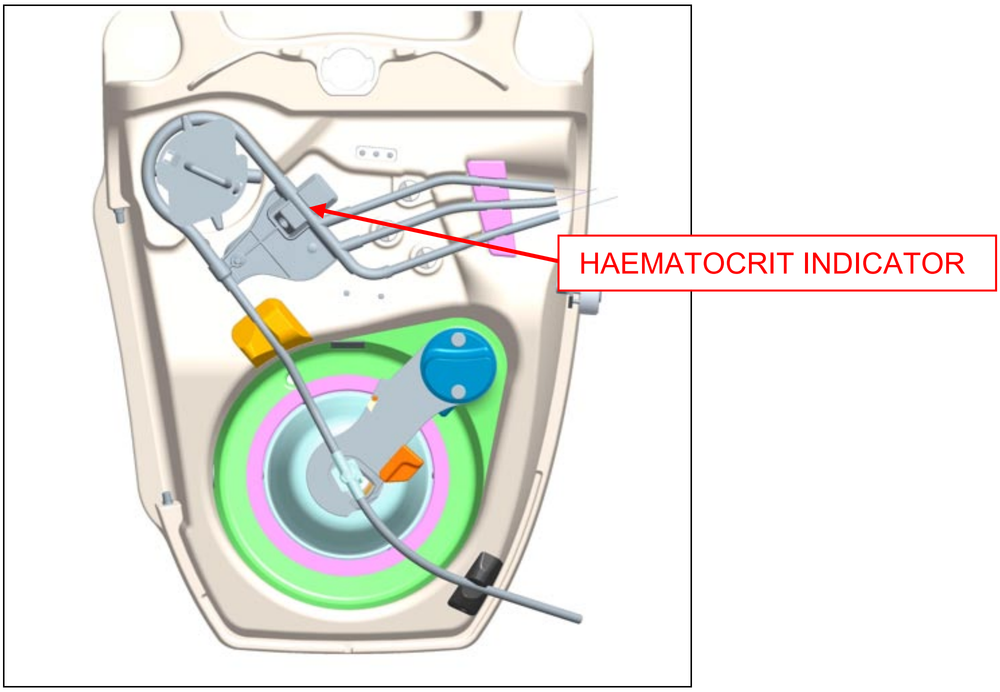

Fig. 9.6-1

A LED, with an emitter wavelength of 805 nm, is used to illuminate the disposable area with an infrared impulse, and a corresponding photodiode (receiver) reads the energy that is not absorbed while passing through the tube.

9.6.4 Functional Description

The functionality of the HCT sensor is described below:

(SEN_006) Haematocrit Indicator rev.00

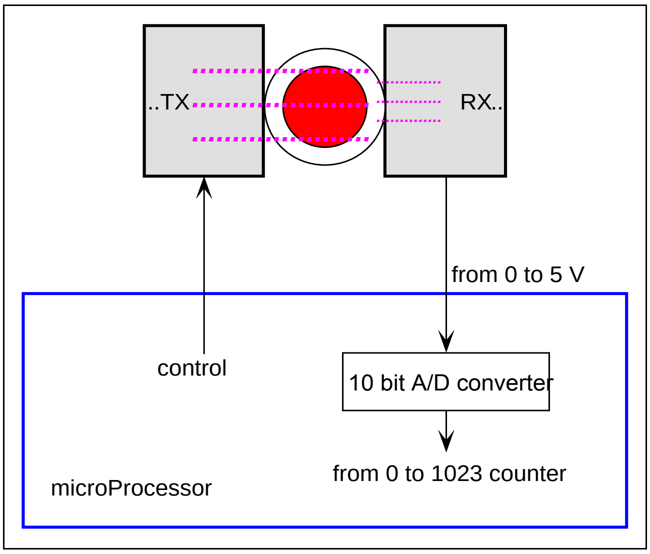

Fig. 9.6-2

Pulsed signals are used to detect and remove the effect of ambient light. The analog signal supplied by the photodiode is amplified by a first step with coefficients of 1, 4, 9, 16,0, 34,0 and by a second step with coefficients 1 or 5,7. The value is then read by an A/D converter and transformed into an haematocrit percentage value by a microprocessor using empirically-derived conversion tables.

The Hitachi controller, with own PWM channel, provides TX pulses that are multiplied with the analog value managed by the Digital to Analog converter. Thanks to this multiplication it is possible to modify the pulses widht. These pulses are SW enabled to syncronize the HCT acquisition with the other analog channels.
The receiver signal is modified by the HHR board. This receiver board convert the Current characteristic of this received signal to a Voltage type. So a first signal amplification is done by a filtered gain amplifier that also reduce the visible-light dependence.
After that, the NSC board allows a three stage amplification. The first one is used for SW trimming thanks to a digitally controlled potentiometer. The last two stages are SW controlled via analog switches and allow the correct Light to HCT conversion management.

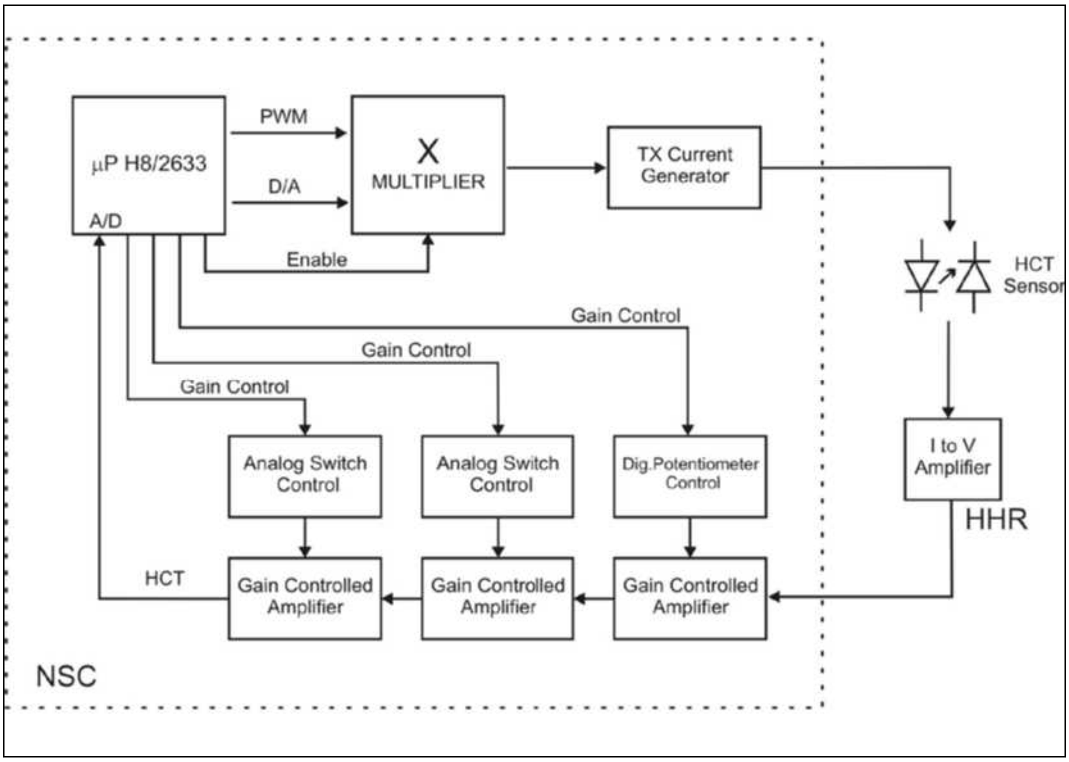

Fig. 9.6-3

During the setup phase, after each insertion of a new pump loop cartridge, and in the presence of saline solution, the equipment performs a self-calibration and zeroing of the HCT sensor.

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9.7 (SEN_007) Waste Line Color Indicator rev.00

9.7.1 About this card

The purpose of this card is to give a general description of XTRA **waste line color indicator**.

9.7.2 Specification

The system has the capability to determine the transparency of the waste line. This information is provided to the operator, and can be used, together with additional information, in order to provide an automatic warning in correspondence to a certain volume of wash solution used for that bowl.
The Waste Fluid Transparency detection level range and accuracy is:

- Range: 15 to 800 mg/dl;
- Accuracy: ± 15 mg/dl from 15 to 200 mg/dl;
  ± 200 mg/dl at 800 mg/dl.

The system has a method to insure proper placement of the tubing into the sensor.

9.7.3 Physical Description

This sensor is located on the top perimeter of the centrifuge well.
By means of an LED (wavelength: infrared, 565 nm.) the section of the tubing connecting the bowl and the waste bag is illuminated. Using a photodiode situated in front of the LED, but on the other side of the tubing, the light passing through the tubing is measured.

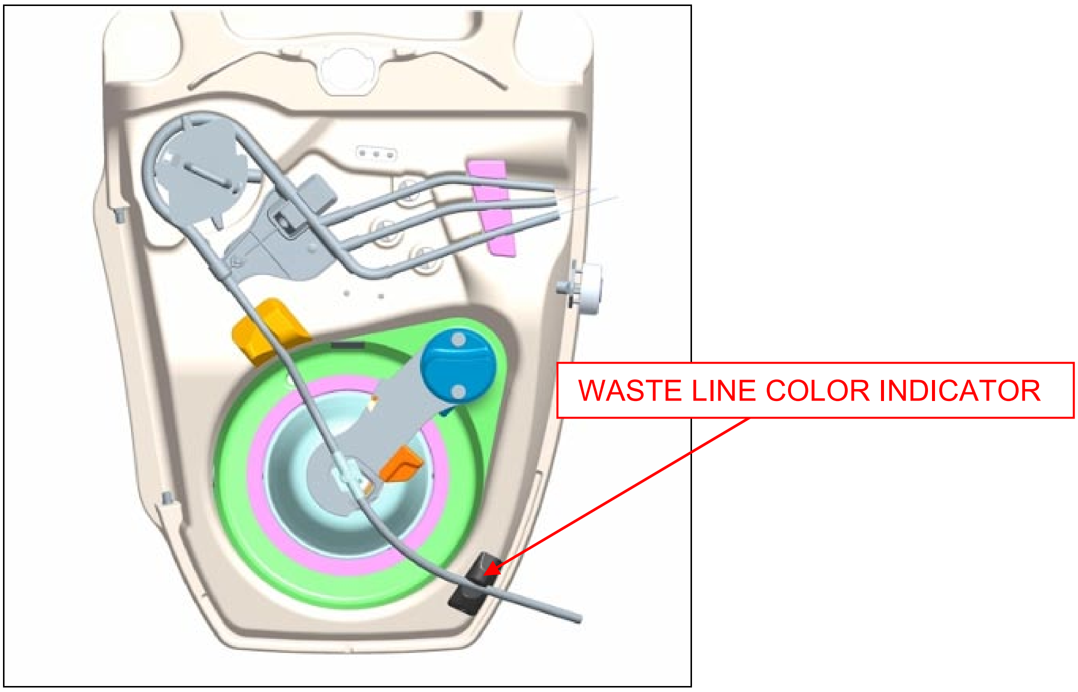

Fig. 9.7-1

The analog signal provided by the photodiode is converted into a measure of free hemoglobin concentration.
The functional blocks of the Waste Fluid Transparency sensor management are generally the same as the Haematocrit ones. The difference is in the receiver stages. Only a “SW controlled amplification stage” for trimming is used.

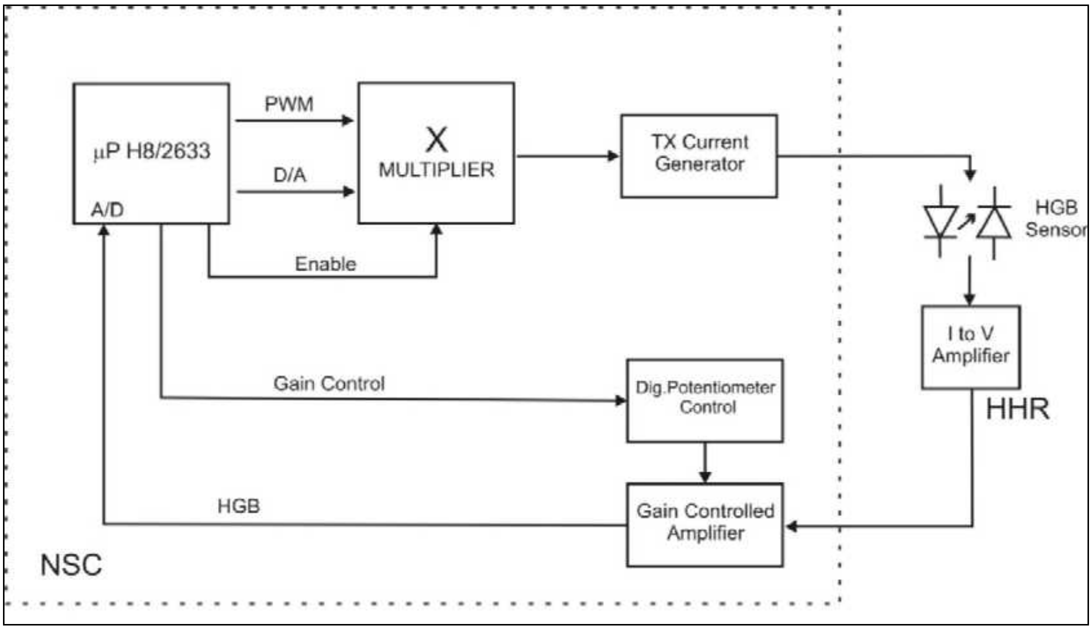

Fig. 9.7-2

9.7.4 Functional Description

This sensor provides information about the transparency of the liquids flowing into the waste bag. During the Wash phase, the microprocessor software indicates the transparency of the waste line and provides information to the operator of the wash quality.

9.8 (SEN_008) Reservoir Load Cell rev.00

9.8.1 About this card

The purpose of this card is to give a general description of XTRA **reservoir load cell**.

9.8.2 Specification

The reservoir holder has a weight scale. The measurable range for the weight scale is 0 to 6 Kg with 100 g of precision (relating to increments of 100 ml of fluid).

9.8.3 Physical Description

The weight sensor is a load cell, which is placed inside the reservoir holder.
This transducer provides an analog signal, proportional to the applied weight, tuned by a three-stage amplifier. The first one is a differential amplifier that amplifies the voltage difference between the two inputs. The second stage is proper to remove offset values from this acquisition channel and the last one is used to adjust the correct gain respect the weight-voltage transfer characteristic.
Differences between load cells or mechanical support will be compensated via SW auto-range 2-steps functions.

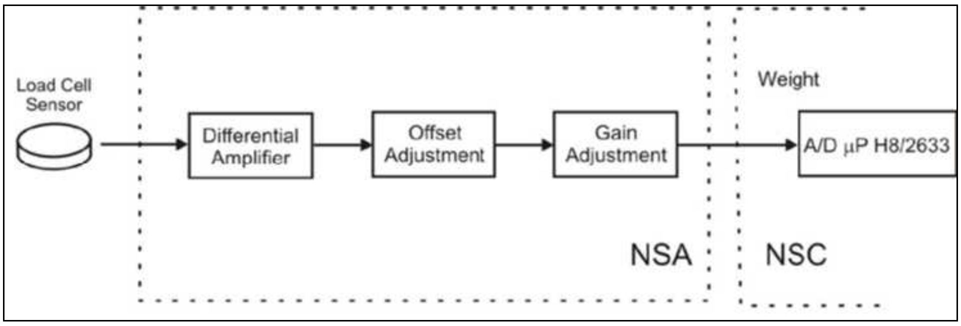

Fig. 9.8-1

9.8.4 Functional Description

The weight scale circuitry provides an analog signal, proportional to the weight applied.
The analog signal is read by a microprocessor. The weight of reservoir is used to estimate the quantity of fluid/blood inside the reservoir and this value can be used to initiate processing or to activate an alarm.

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9.9 (SEN_009) Clamped Empty Line Sensor rev.00

9.9.1 About this card

The purpose of this card is to give a general description of XTRA **clamped empty line sensor**.

9.9.2 Specification

The empty line clamped sensor detects if the empty line is obstructed when pumping blood to the bags. The force value is 1.6 to 3.5 bar, using a tubing of 4,3 x 6,8 mm.

9.9.3 Physical Description

This pressure sensor is based on force detection and consists of an element sensitive to the deformation (piezo-resistive effect) of the tube inserted in a mechanical fork. It is arranged inside the lid near the clamp of the empty line.

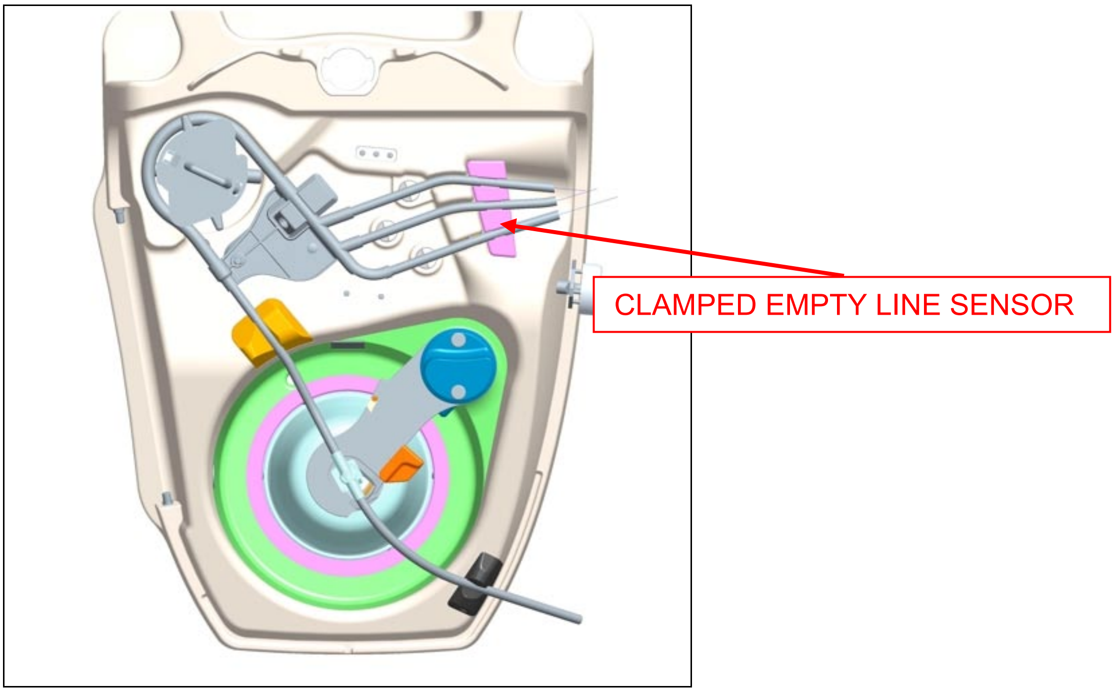

Fig. 9.9-1

If the line becomes occluded, it unbalances a Wheatstone bridge generating a signal of pressure (tension) proportional to the tube deformation. The tension that is caused is analyzed by a two stage amplifier.

The first stage is an instrumentation amplifier that amplifies the voltage difference between the two inputs. The second stage is a fixed gain amplifier. In this way, the amplified analog signal of pressure, proportional to the tube deformation, is read by the NSC µP analog to digital converter.

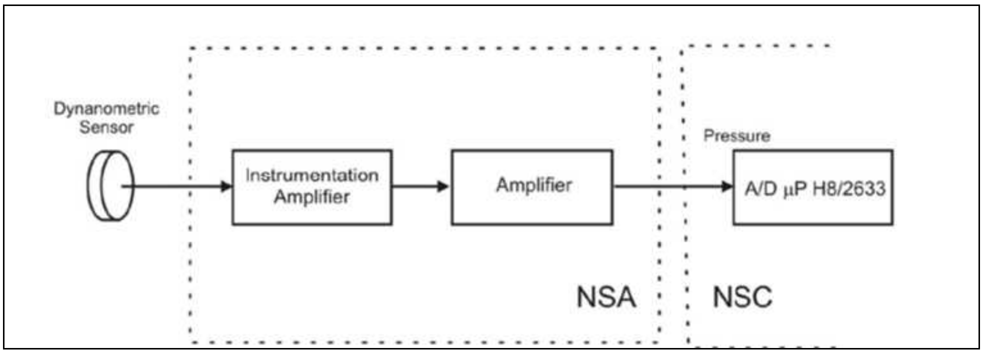

Fig. 9.9-2

9.9.4 Functional Description

At the end of Setup, before the procedure is started, the pressure value is sampled to obtain a reference value (theoretic zero) that is added to the pressure delta that corresponds to an anomalous condition (i.e., tubing occlusion).

9.10 (SEN_010) Centrifuge Lid Position Sensor rev.00

9.10.1 About this card

The purpose of this card is to give a general description of XTRA **centrifuge lid position sensor**.

9.10.2 Specification

The OPEN/CLOSED position of the centrifuge lid is detected by a dedicated sensor.

9.10.3 Physical Description

This sensor is located on the top perimeter of the centrifuge well. It is a Hall-effect sensor.
Sensing is possible by means of a magnet glued inside the centrifuge lid. The magnetic field axis is aligned with the sensor.
The Hall-effect sensor provides an analogical voltage signal that is proportional to the magnetic applied field. This voltage signal is amplified and compared with a value-controlled comparator and converted to a digital status (Open / Close). The compared value is managed by the NSC H8S controller that allows an automatic SW trimming.

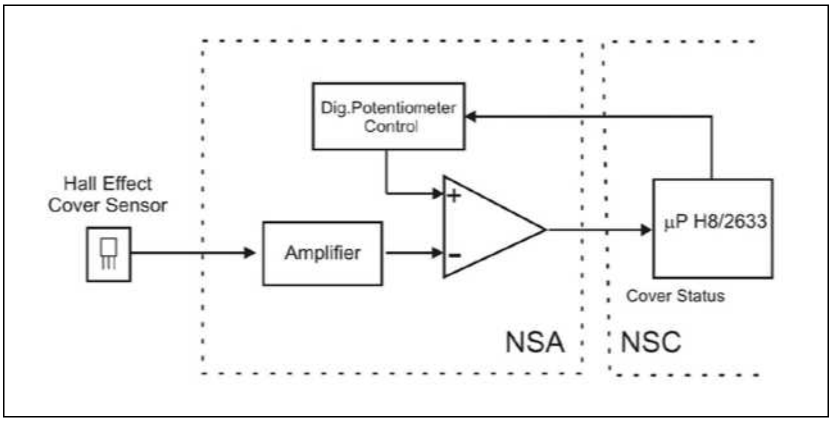

Fig. 9.10-1

9.10.4 Functional Description

The Hall-effect sensor provides a digital output that indicates either “centrifuge lid open” or “centrifuge lid closed”.
The SW closes the lock only when the centrifuge lid is closed.

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9.11 (SEN_011) Bowl Arm Position Sensor rev.00

9.11.1 About this card

The purpose of this card is to give a general description of XTRA **bowl arm position sensor**.

9.11.2 Specification

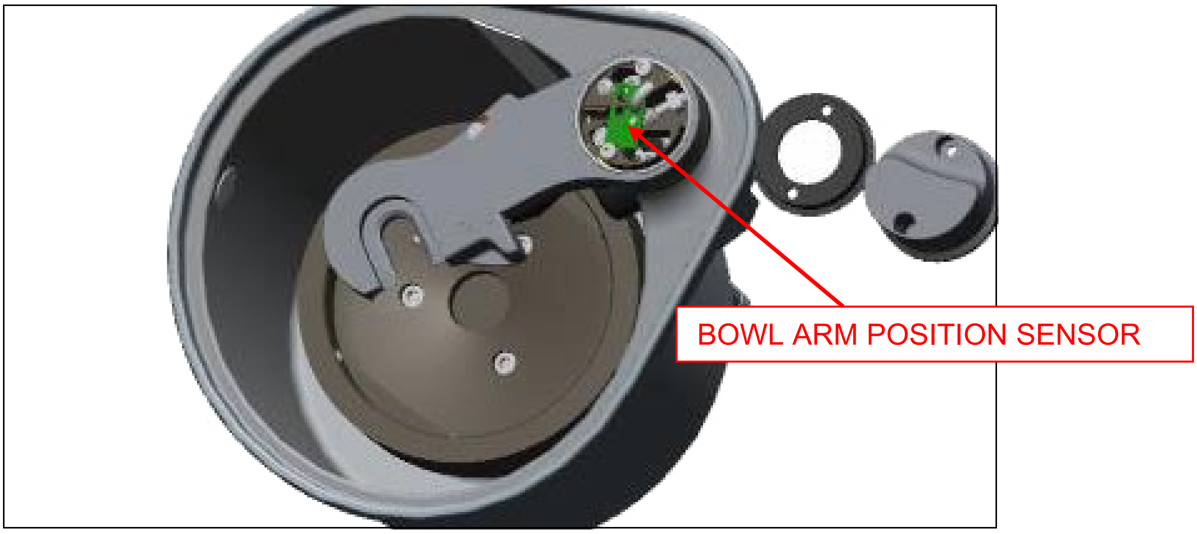
The position of the arm that locks to the top of the bowl is checked by two signals coming from two independent sensors. Both signals have to agree that the arm is in the closed position in order to enable the pump, centrifuge and clamps.

9.11.3 Physical Description

The sensors uses the “hall effect”, and are connected to two independent microprocessors. They supply the digital information of: **Arm Open** or **Arm Closed**.

9.11.4 Functional Description

Two microprocessors monitor the signals. The first microprocessor reads its signal and sends it to the second microprocessor. The second microprocessor reads its signal and compares the two signals. Both signals have to indicate “Arm Closed” to enable the pump, centrifuge and clamps. If the two signals are different, the system issues an alarm.



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9.12 (SEN_012) Centrifuge Lid Lock Position Sensor rev.00

9.12.1 About this card

The purpose of this card is to give a general description of XTRA **centrifuge lid lock position sensor**.

9.12.2 Specification

It is a sensor detecting if the Centrifuge Lid Lock position is “Closed” or “Open”.

9.12.3 Physical Description

It is an optical sensor, positioned at the bottom of the bi-stable solenoid, able to detect if the small-pin driven by the bi-stable solenoid is in “up-position” (locking the main-pin into the centrifuge lid hole) or in “down-position” (allowing the main-pin to be pushed by the button in order to physically open the centrifuge lid).
Failure of the sensor indicates that the Centrifuge Lid Lock is in Open position, in order to prevent the operation of the actuators pump and centrifuge.

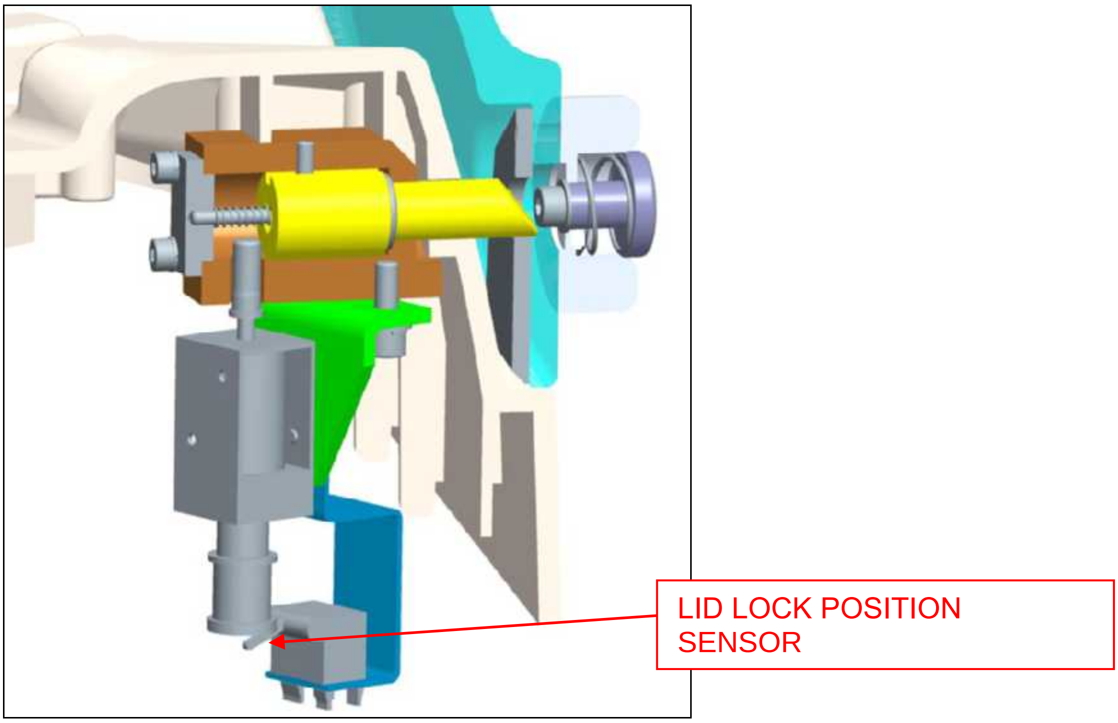

Fig. 9.12-1

9.12.4 Functional Description

The microprocessor recognizes the position of the small-pin. Only when:

1) the small-pin is in up position (that means that the main-pin is engaged into the centrifuge lid hole and it is not possible to disengage it by the button) and
2) the “centrifuge lid position sensors” recognize that the centrifuge lid is physically closed

the SW then allows the start of the actuators pump and centrifuge.

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10 BOARD DESCRIPTION

10.1 (BOARD_001) Board overview rev.00

10.1.1 About this card

The purpose of this card is to give a general description of XTRA main boards:

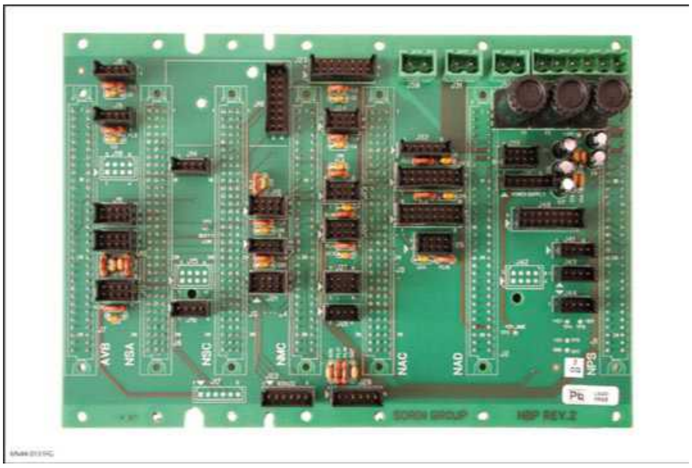
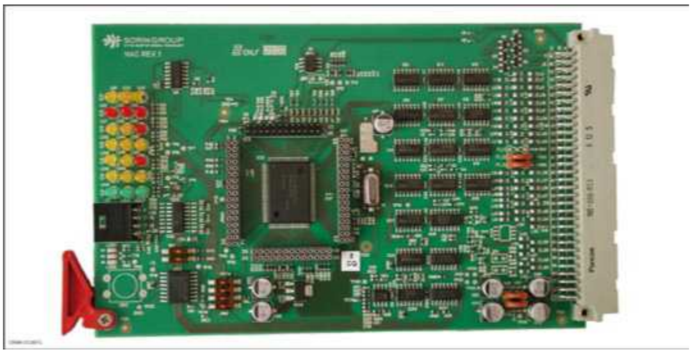
- **NMC** XTRA Master board;
- **NBB** XTRA Base board;
- **NBP** XTRA Back Plane board;
- **NAC** XTRA Actuator CPU board;
- **NAD** XTRA Actuator Driver board;
- **MFN** XTRA Main Filter board;
- **HIR** XTRA Usb Hub board;
- **CBN** XTRA Clamps board;
- **NPS** XTRA Power Supply board;
- **SIR** XTRA Serial Interface board;
- **NSA** XTRA Sensor Analog board;
- **NSC** XTRA Sensor CPU board;
- **HHR** XTRA HGB and HCT receivers board;
- **NBC** XTRA Bar Code interface board.

10.1.2 Board Overview

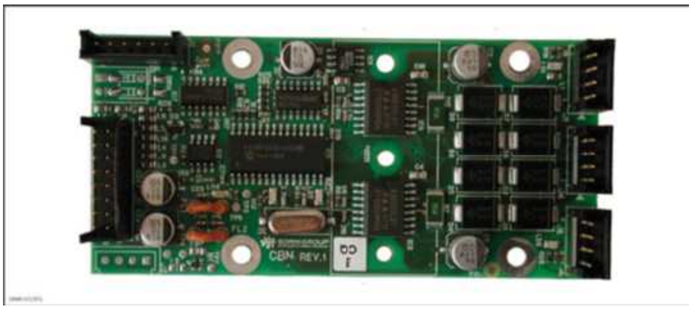
The following is the list of XTRA main boards, which have a functional description card in present collection.

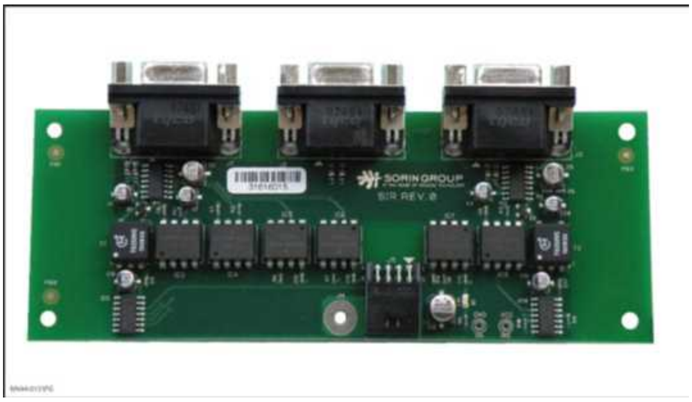
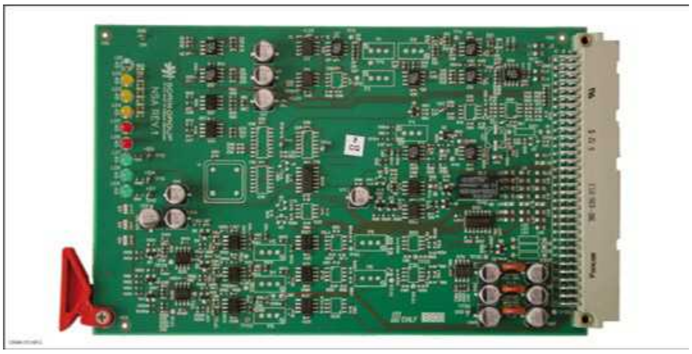
Name	Function	µP Hitachi H8S/2633 presence	Board view
NMC	Equipment coordination and data storage	1 on board	
NBB	Providing a platform for the ETX computer	No presence	

(BOARD_001) Board overview rev.00

NBP	Board connection managing	No presence	
NAC	Actuator/motor control	1 on board	
NAD	Actuator/motor control	No presence	

(BOARD_001) Board overview rev.00

MFN	Power supply filtering	No presence	
HIR	USB and Ethernet ports managing	No presence	
CBN	Clamp managing	No presence	

NPS	Power supply managing	No presence	
SIR	Serial interface managing	No presence	
NSA	Sensor managing	No presence	

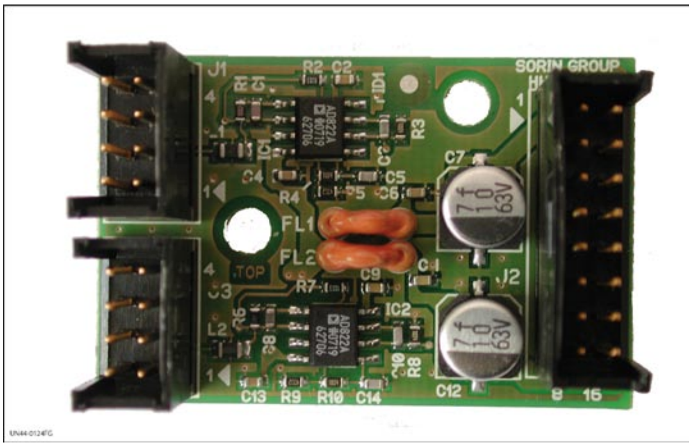
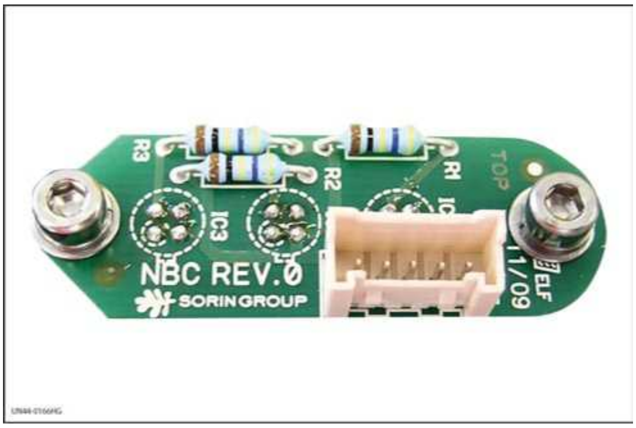
NSC	Sensor managing	1 on board	
HHR	HCT and HGB indicator managing	No presence	
NBC	RBC indicator managing	No presence	

Table 10.1-1

(BOARD_001) Board overview rev.00

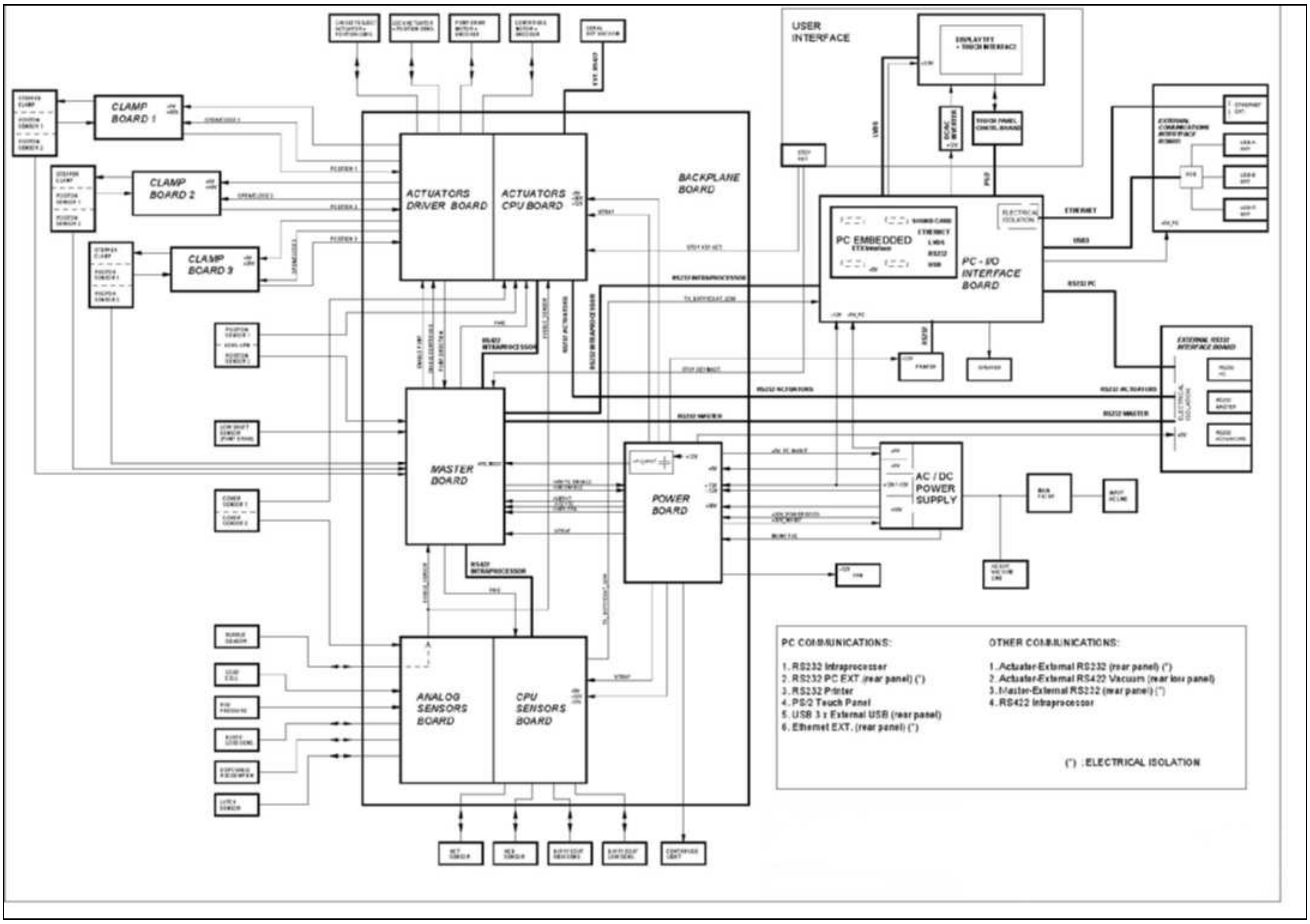


Fig. 10.1-1

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10.2 (BOARD_002) CBN – Clamps p.c. Board rev.00

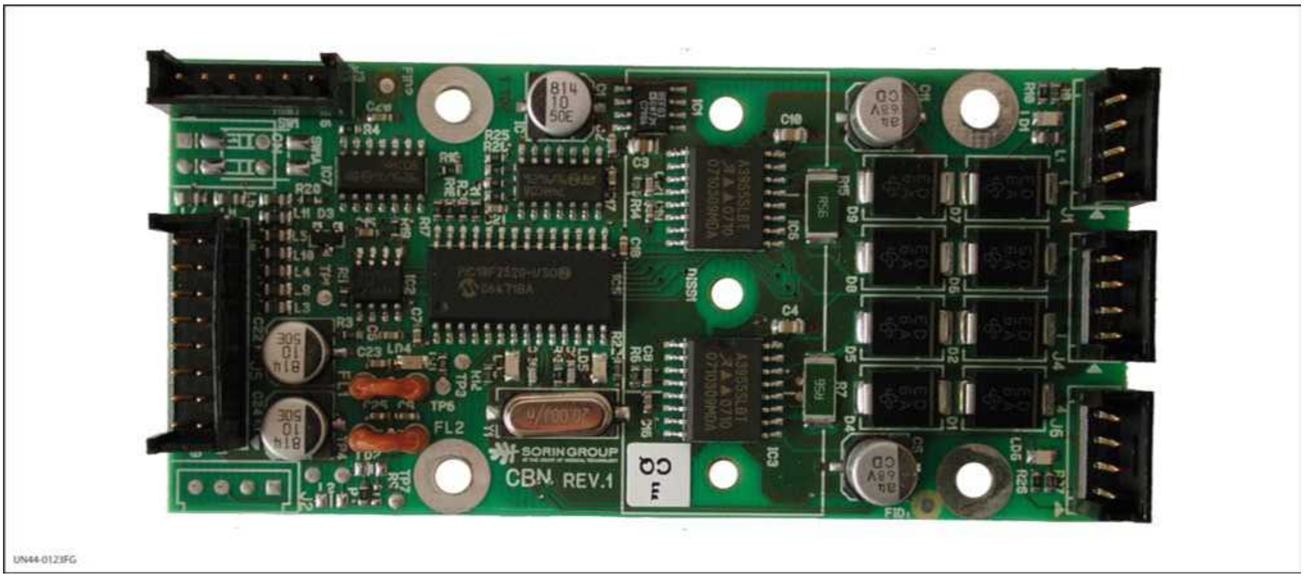

Fig. 10.2-1

10.2.1 Functional Description

Three CBN boards are mounted on the XTRA, each CBN is the driver for a single clamp group.
Three independent and identical groups realize the final clamp group machine.
Each CBN drives one 200 steps Stepper Motor.
This board is based on a Microchip PIC16F876 (or PIC18F2520) micro controller with internal Flash and internal Ram
The PIC Controller commands the stepper motor via full-bridge drivers, to open and close the clamp thanks to a cam/pinching system. A full-step motor driving system is selected and a close-position hall sensor is used to check the correct functionality. A double-control hall sensor checks the same close-position and this information is read by the Master CPU Board directly

The Clamp Interface is managed by the Actuator Board. No serial communication is used and only electrical signals are used as handshake.
The PIC Controller receives digital commands (from Actuator CPU) to open and close the clamp.
The PIC Controller reads its hall sensor and sends this status to the Actuator CPU.
The Actuator CPU could send this last information to the Master CPU (via intraprocessor communication) for checking correct working.

(BOARD_002) CBN – Clamps p.c. Board rev.00

10.2.2 Board Architecture

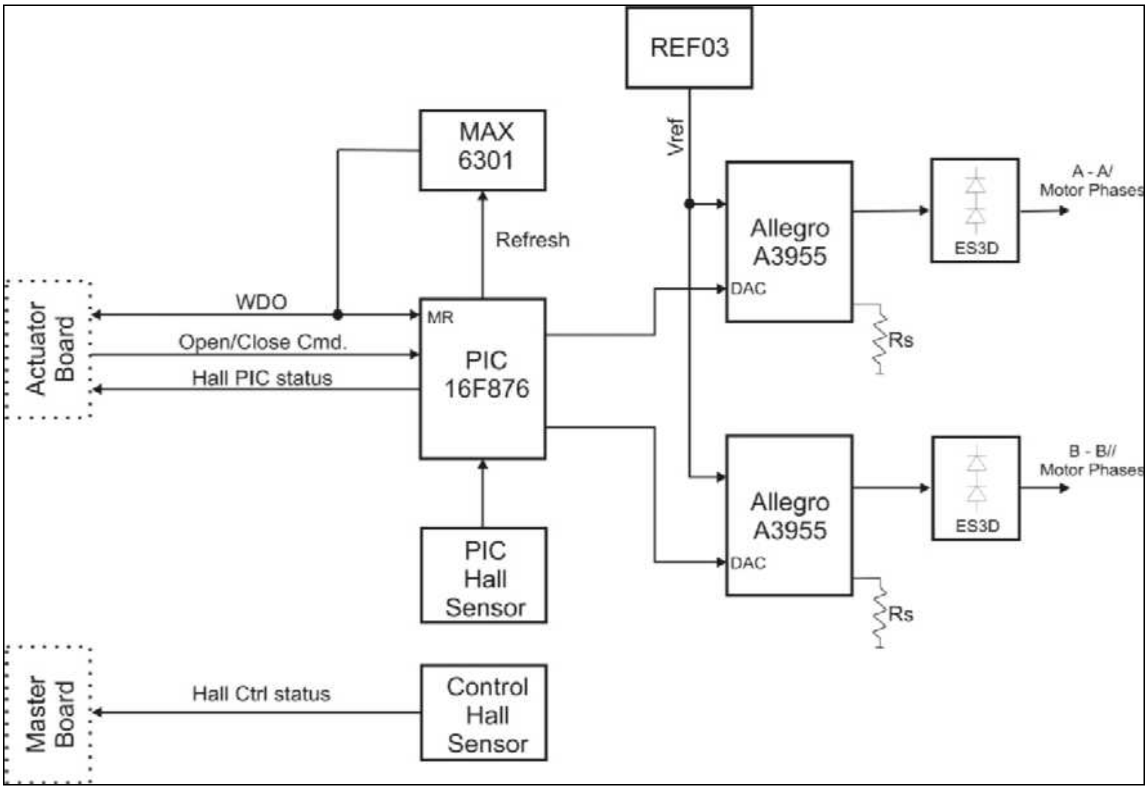

Fig. 10.2-2

10.2.3 Board Features

The CBN board components are supplied with a filtered +5V while +30V is used to drive the stepper motor.

A Maxim Max6301 supervisor takes care of correct operations and prevents code-execution errors. The features include Under Voltage, Power Fail and Watchdog controls.

The Analog Device REF03 precision voltage reference provides a stable +2.5 V output with minimal change for variations in supply voltage, ambient temperature or loading conditions.

This voltage, along with Sense Resistors value, sets the peak output current to the motor.

Two A3955 full-bridge motor drivers are needed to drive the windings of a bipolar stepper motor. The peak motor current is 1.05A. The A3955 stepper driver has an over-temperature internal protection at 150°C.

This board provides two Hall sensor management for the positioning of the clamp:

1. One hall Sensor read directly from PIC Controller;
2. A second hall Sensor used as double-control of the first oneby the Master.

10.2.4 External Connections Availability

J1 Connector – Hall Sensor

1	Vcc	+5V Power Supply
2	Gnd	Ground
3	Input	Hall Sensors Signal to PIC Controller
4	---	Not connected

(BOARD_002) CBN – Clamps p.c. Board rev.00

J2 Connector – Available Hall Sensor (Not Used)

1	Vcc	+5V Power Supply
2	Gnd	Ground
3	Input	Hall Sensors Signal to PIC Controller
4	---	Not connected

J3 Connector – PIC Controller Programming Port

1	PGC	Programming Clock
2	PGD	Programming Data
3	Gnd	Ground
4	Vcc	+5V Power Supply
5	Vpp	External Programming Power Supply
6	Gnd	Ground

J4 Connector – Stepper Motor Driving

1	Output	Phase A
2	Output	Phase A/
3	Output	Phase B
4	Output	Phase B/

J5 Connector – Cabling versus Rack Back Plane

1	VCC	External +5V Power Supply
2	Gnd	Ground
3	VBB	External +30V Power Supply
4	Gnd	Ground
5	Output	TX PIC Uart line
6	Input	RX PIC Uart line
7	Output	PIC Failure Signal
8	Input	PIC Input Line
9	Input	PIC Input Line
10	Input	PIC Input Line
11	*connection*	To Control Hall Sensor as Power Supply
12	*connection*	To Control Hall Sensor as Ground
13	*connection*	From Control Hall Sensor as status
14	Output	Pic Output Line
15	Output	Pic Output Line
16	Gnd	Ground

J6 Connector – Double-control Hall Sensor

1	*connection*	From Master Board as Power Supply
2	*connection*	From Master Board as Ground
3	*connection*	To Master Board as status
4	---	Not connected

J2 and J3 connectors are normally not used in the assembled machine.

10.2.5 Leds

Led 1	Yellow	Hall Sensor Status (vs. PIC Controller)
Led 3	Yellow	Run Led

(BOARD_002) CBN – Clamps p.c. Board rev.00

Led 4	Green	+30V Power Supply Presence
Led 5	Green	+5V Power Supply Presence
Led 6	Yellow	Double Control Hall Sensor Status

10.3 (BOARD_003) HIR – USB HUB Board rev.00

Fig. 10.3-1

10.3.1 Functional Description

The HIR (HUB Interface Rear panel) is an HUB Application for USB ports fully compliant with the USB2.0 specification.

10.3.2 Board Features

1) The USB2503 HUB component works with an external power supply locally generated thanks a +3.3V regulator (Self-Powered mode);
2) This HUB allows three USB ports availability (Downstream) on the rear panel of XTRA system coming from one PC-ETX USB port (Upstream);
3) Resettable fuses are introduced on each Downstream USB port. If an over-current happens, the resettable fuse is automatically opened and a status signal is received by the PC-ETX.
4) In this board it is introduced also the Ethernet connector (line coming from the PC-ETX). A 4KV isolation on the Ethernet line is introduced into the NBB Baseboard,

10.3.3 External Connections Availability

J1, J2, J3 Connectors – USB Downstream – Standard USB connector

1	Vcc	+5V
2	D-	Data -
3	D+	Data +
4	Ground	Ground

J4 Connector – Ethernet

1	XMT+	Transmission positive line
2	XMT-	Transmission negative line
3	RCV+	Receiving positive line
4	NC	Not connected
5	NC	Not connected
6	RCV6	Receiving negative line
7	NC	Not connected
8	NC	Not connected

J5 Connector vs. NBB Baseboard

1	Ground	Ground
2	USB_MON2	Monitor signal on Downstream Port2 – Short line on fuse
3	+5V	+5V Power Supply
4	D+_UP	Upstream Data+ line
5	USB_MON1	Monitor signal on Downstream Port1 – Short line on fuse
6	USB_MON3	Monitor signal on Downstream Port3 – Short line on fuse
7	D-_UP	Upstream Data- line
8	Ground	Ground

10.3.4 Leds

LD1	Green	+5V Power Supply

10.4 (BOARD_004) MFN – Main Filter XTRA board rev.00

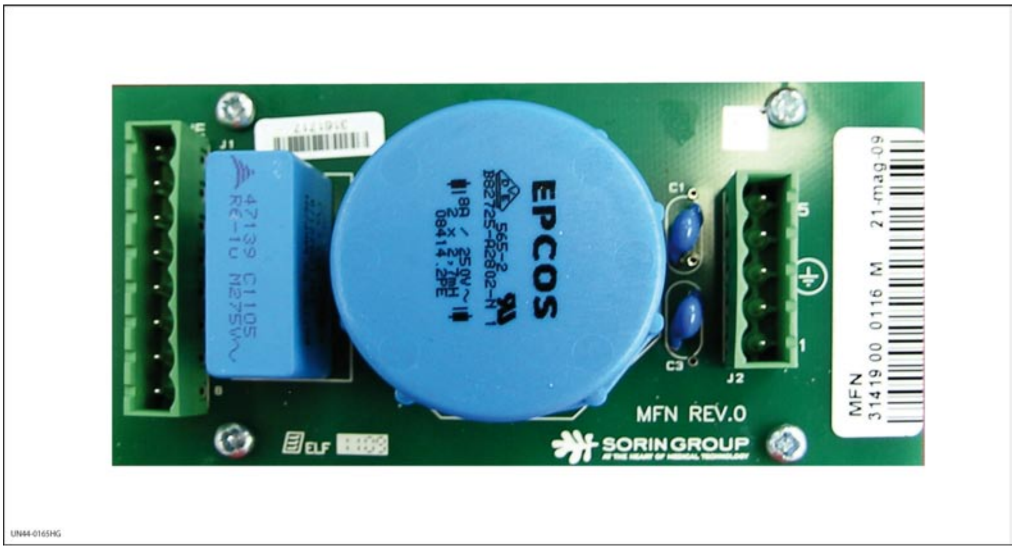

Fig. 10.4-1

10.4.1 Functional Description

The MFN board is used to reduce conductive emissions on the power cable according to EN60601-1-2.

10.4.2 Board Features

The MFN board is based on a “X” Capacitor, Inductor and two “Y” capacitors. A dedicated resistor “R” is introduced to discharge the “X” Capacitor to a voltage according to EN60601-1. It is located between the Power Supply unit and the inlet switch power connector.

10.4.3 External Connections Availability

J1 Phoenix MSTBVA 2,5/8-G-5,08

1	IN Neutral (N)
2	IN Neutral (N)
3	Not Connected
4	Not Connected
5	Not Connected
6	Not Connected
7	IN Line (L)
8	IN Line (L)

J2 Phoenix MSTBVA 2,5/5-G-5,08

1	OUT Line (L)
2	Not Connected
3	Ground (E)
4	Not Connected
5	OUT Neutral (N)

(BOARD_004) MFN – Main Filter XTRA board rev.00

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10.5 (BOARD_005) NAC & NAD - Actuator Boards rev. 00

10.5.1 Functional Description

The Actuator Group introduced in XTRA system is composed by two boards:

- **NAC** - **XTRA A**CTUATOR **C**PU
- **NAD** - **XTRA A**CTUATOR **D**RIVER

10.5.1.1 NAC Actuator CPU board

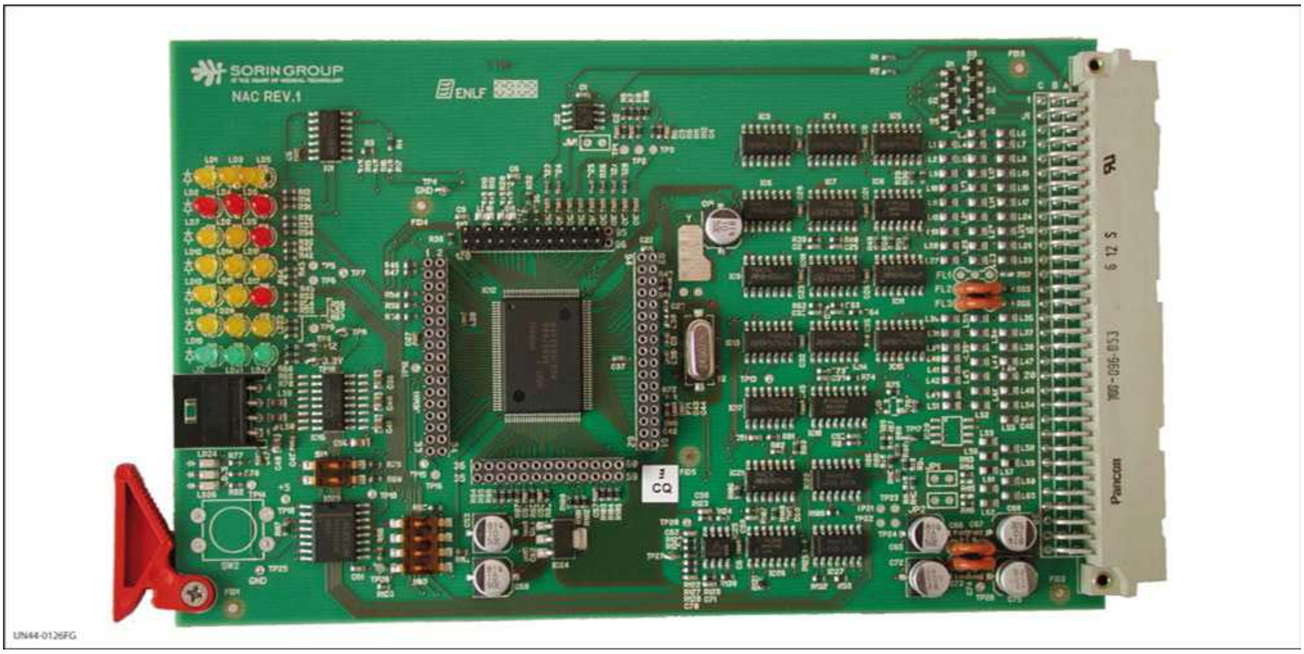

Fig. 10.5-1

The **NAC Actuator CPU** board is inserted into the rack and contains the following:

- Microcontroller:
  - Hitachi H8S/2633 microcontroller;
  - 256 KByte internal Flash memory availability;
  - 16 KByte internal Ram;

- Microcontroller circuits:
  - Supervisory circuit;
  - Stand-by circuit;
  - Program mode circuit;
  - 3.3V CPU Voltage monitor.

- Analog/Digital inputs:
  - Input signals from on/off board feedbacks.

- Other circuits:
  - +3,3V monitor circuit;
  - Centrifuge and Pump encoders interface;

- Clamps control.

- Communication interfaces:
  - RS422 intra-processor communication;
  - RS422 vacuum control (external);
  - RS232 available on-board for development and debugging;
  - RS232 TTL level for future applications (external).

10.5.1.2 NAD Actuator Driver board

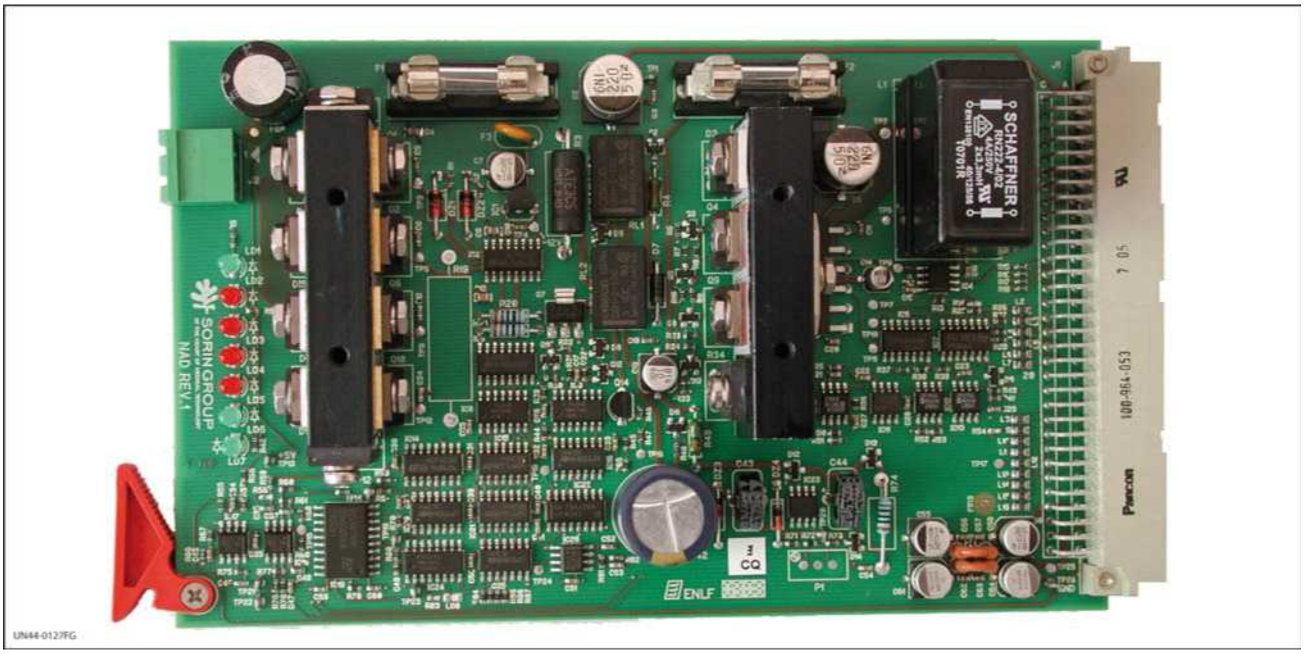

Fig. 10.5-2

The **NAD Actuator Driver** board is inserted into the rack and controls the following actuators:

- Power drivers:
  - Draw pump driver;
  - Centrifuge driver (the Centrifuge Connector is on-board and NOT in the backplane);
  - Eject solenoid driver;
  - Cover Lock driver.

- Other features:
  - +30V Test;
  - PCB Board Temperature Sensor.

(BOARD_005) NAC & NAD - Actuator Boards rev. 00

10.5.2 Boards Architecture

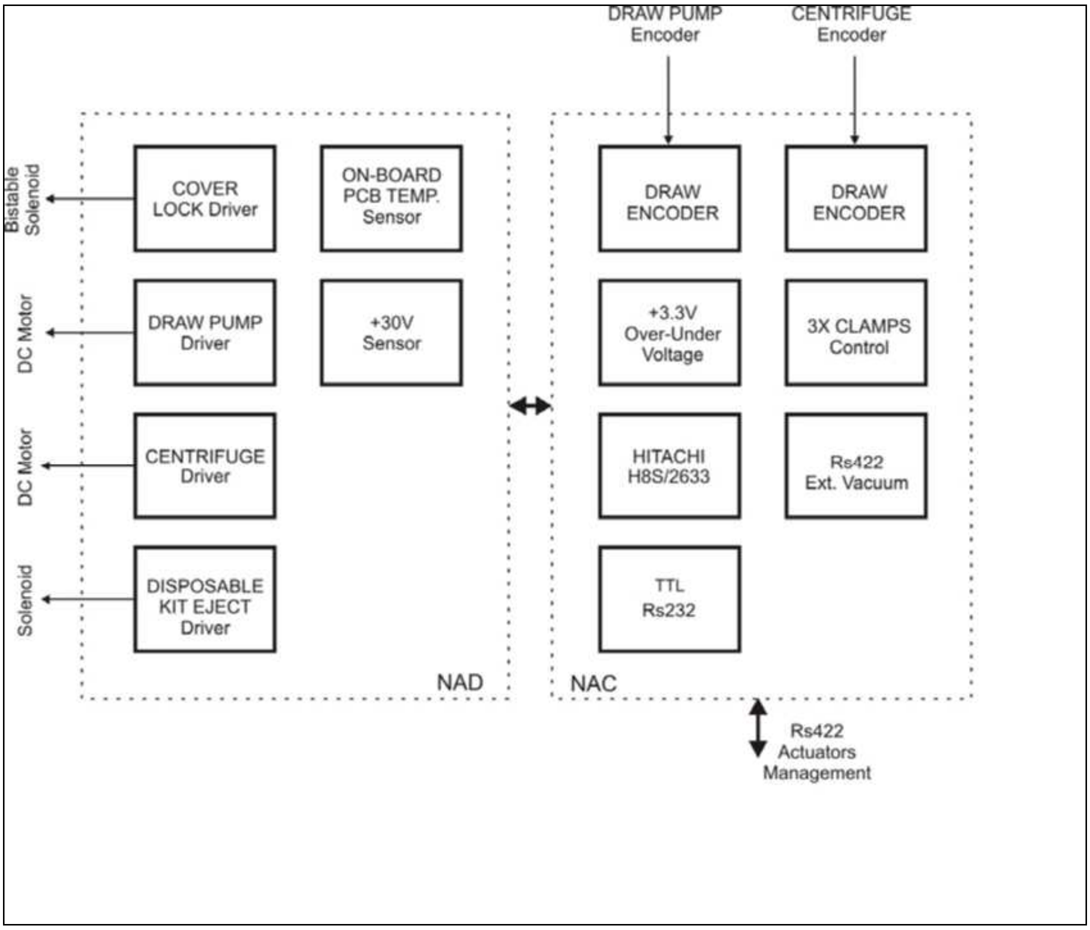

Fig. 10.5-3

10.5.3 Boards Features

The NAD Actuator Driver board is supplied by:

+5V for analog/digital circuits;
+30V for actuator power drive;
+12V for both analog/power application.

The NAC Actuator CPU board is supplied by:

+5V for analog/digital circuits;
+12V for analog applications;
+3,3V voltage is on-board generated for microcontroller core feeding.

The digital on-board components are supplied by a filtered +5V while the +12V is used by analog components. The +30V is used to power integrated/discrete drivers.

10.5.3.1 H8S Microcontroller

The Hitachi H8S-2633 has an internal 32-bit architecture, it is provided with sixteen 16-bit general register.
It works at 24MHz clock rate. In this application it is used in “on-chip” stand alone mode, without external Ram or Flash.

Its memory feature is 256K-Byte internal Flash and 16K-Byte internal Ram.

10.5.3.2 Clamps Control

This CPU controls the three Clamps Groups via TTL logic signals.
A digital interface composed by 3 Output signals, 2 Input signals and the Clamp PIC Watch Dog alarm is available for each Clamp to allow the correct control.

10.5.3.3 Cover Lock Driver

This circuit, with the driver located on the NAD board, allows driving a bi-stable solenoid device to lock/unlock the top cover (ON mode circuit). Bidirectional driver is realized to achieve it.
This driver includes also a supplementary circuit (OFF mode circuit) for cover delayed opening if the unit is switched off during a cover-locked phase. It is necessary to avoid danger, when main supply goes down and motors are in inertial rotation. This circuit is supplied by Cs capacitors and time is adjusted by means a resistor (Rs) for RC discharge

Electrical characteristics:
Rs is choosen to have a delayed opening time in 60”/80” range

Power Supply Voltage	+30V
Max Load Voltage@400mA	+24V (OFF mode circuit)
	+26V (ON mode circuit)
Max Current in continuous mode	500mA
Peak Current	2,9A

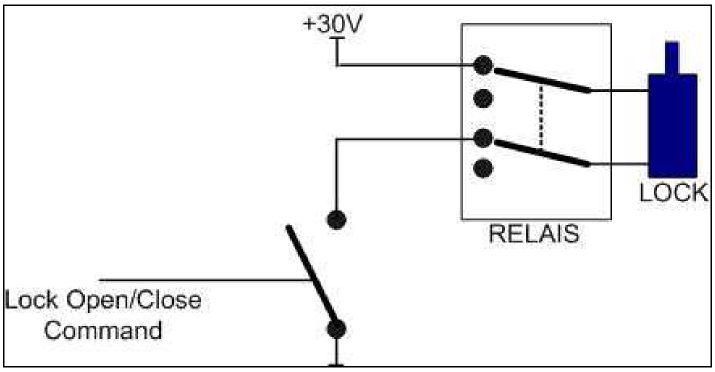

Fig. 10.5-4

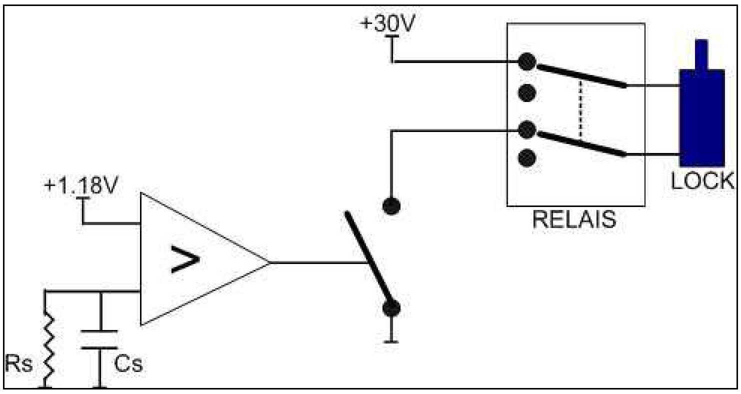

Fig. 10.5-5

10.5.3.4 Draw Driver

This circuit, with the driver located on the NAD board, allows to drive a DC motor in both directions. It means a bidirectional full bridge integrated in a single chip driver with current sensing and brake function. Load is driven changing average voltage by PWM regulation.

<u>Electrical characteristics:</u>

Power Supply Voltage	+30V
Max Load Voltage	+30V
Max Current in continuous mode	3A
Peak Current	6A (200ms)

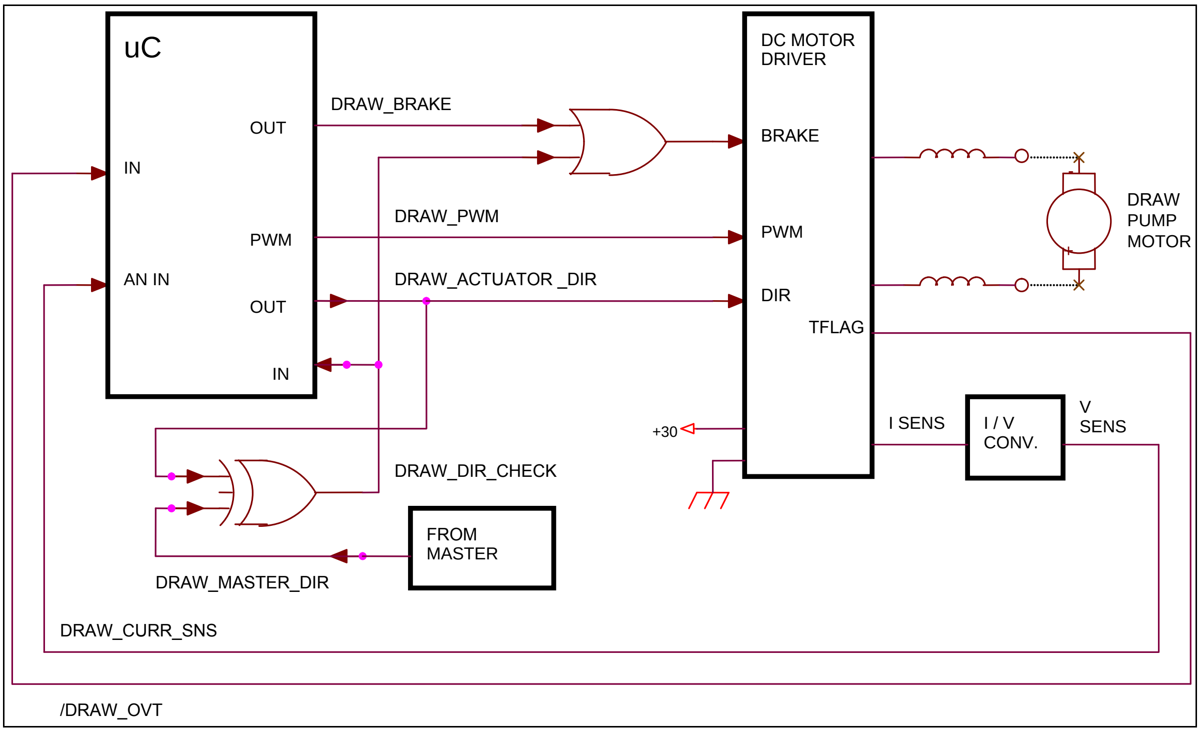

Fig. 10.5-6

10.5.3.5 Centrifuge Driver

This circuit with the power driver located in the NAD board and the digital controls in the NAC one, allows driving a DC motor in both directions. It means a discrete bidirectional full bridge. Load is driven changing current by analog reference signal regulation. Fast accelerating and braking are allowed. A current automatic adjust circuit is included.

<u>Electrical characteristics:</u>

Power Supply Voltage	+30V
Max Load Voltage	+30V
Max Current in continuous mode	2,2A
Peak Current	10,4A (10s)

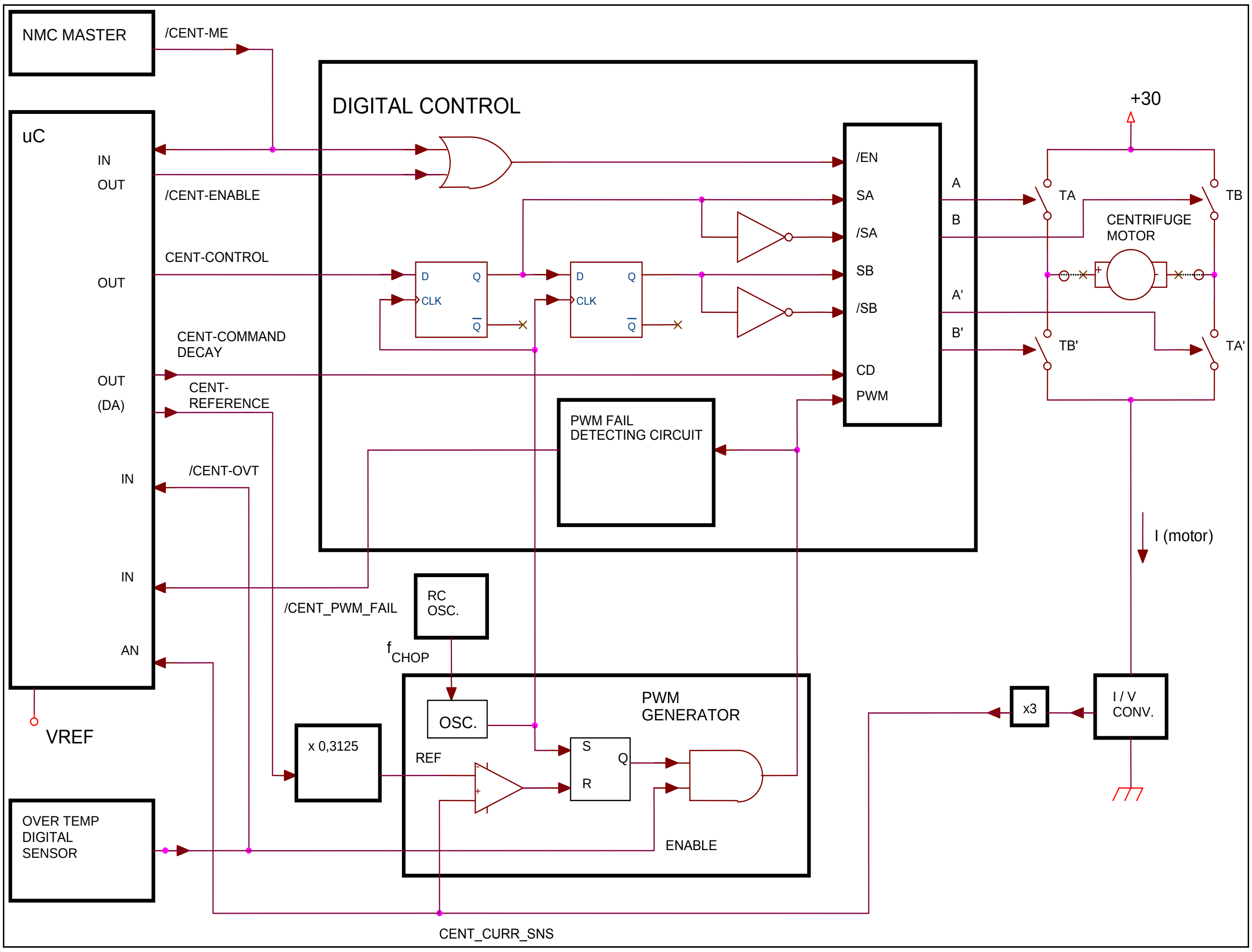

Fig. 10.5-7

Due to high current request the Centrifuge connector is on-board and NOT in the backplane.

10.5.3.6 Eject solenoid

This circuit, located in the NAD board, is a generic inductive load driver. A feedback signal informs the uP if power is applied or not to the load. A digital control is introduced: if the EJECT COMMAND is ON for up then 50 sec the solenoid is automatically de-energized.

<u>Electrical characteristics:</u>

Power Supply Voltage	+30V
Max Load Voltage	+30V
Max Current in continuous mode	17A (@ Tcase=25°C)
	12A (@ Tcase=100°C)

(BOARD_005) NAC & NAD - Actuator Boards rev. 00

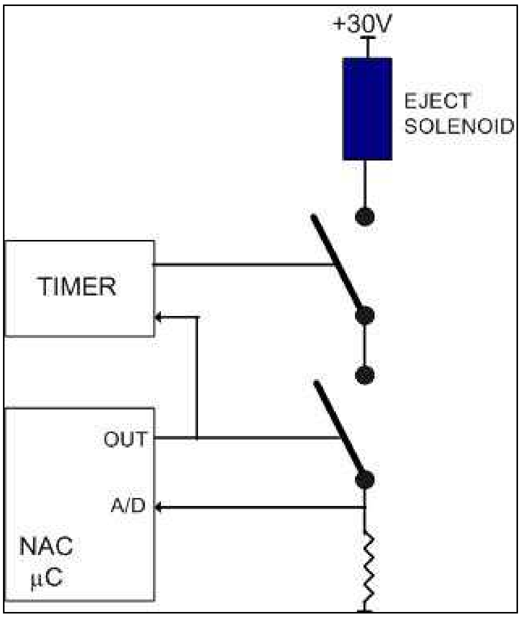

Fig. 10.5-8

10.5.3.7 Analog/Digital Inputs

The microcontroller located in the NAC board receives analog signals from three types of sources:

1) External system signals;
2) On board reference signals generation for the A/D conversion efficiency;
3) On board driver monitoring. These are current sensing signals from pump/centrifuge drivers, and then current to voltage conversion and dedicated filtering are necessary.

The microcontroller receives digital signals from two types of sources:

1) External sensors: signals from state sensors supplied by the NAC board itself.
2) External intelligent units: are doubled sensor lines or failure signals managed by other boards.

10.5.3.8 +3,3V Monitor Circuit

A monitor circuit is integrated on board to check the level of +3,3V supply for microcontroller core. This feature is realized without micro functions. There is a simple independent comparative circuit to measure +3,3V level and to send failure (over/under voltage) information outside of the board. It means that if +3,3V generation is KO, some external units can isolate micro and/or to switch off power line to avoid actuators out of control state.

10.5.3.9 Communications Interfaces

NAC is equipped with two RS422 interfaces. One for the intra-processor communication and the other for external vacuum control.

This actuator board is equipped with:

- RS232 interface for point to point connection (development and debugging) available on-board,

- external RS232 for future applications, TTL connected to SIR board.

10.5.4 External Connections Availability

10.5.4.1 NAD external Connections Availability

J2 NAD Connector – Centrifuge Motor

1	Cent-Mot+	Centrifuge + power line
2	Cent-Mot-	Centrifuge – power line

10.5.4.2 NAC external Connections Availability

J2 NAC Connector – Isolated 4KV RS232

1	--	--
2	Rx	H8S-2633 Rx line
3	Tx	H8S-2633 Tx line
4	I-Gnd	Isolated Ground

J3 NAC Connector – Available RS232 (debugging only)

1	Vcc	+5V Power Supply
2	Rx	H8S-2633 Rx line
3	Tx	H8S-2633 Tx line
4	Gnd	Ground

10.5.5 Test Points & Leds

10.5.5.1 NAD Test Points

TP 1	+30V
TP 13	+5V (filtered)
TP 14	+12V
TP 19	Centr. CLK PWM
TP 20	Lock Charge Capacit.
TP 21	Centr. Ref. (D/A)
TP 22	Ground
TP 23	Centr. OUT PWM
TP 13	+5V (filtered)
TP 26	Ground

10.5.5.2 NAD Leds

Led 1	Green	+30V
Led 2	Red	Centr. Temperature
Led 3	Red	Pump Draw Temperat.
Led 4	Red	Pump Draw Direction
Led 5	Red	Centr. PWM Fail

Led 6	Green	+12V
Led 7	Green	+5V

10.5.5.3 NAC Test Points

TP 1	ADC_REF_2V
TP 4	Ground
TP 9	+12V
TP 10	+3.3V
TP 11	EN_TXD3_422
TP 17	+5V
TP 26	Ground
TP 27	VTRAP

10.5.5.4 NAC Leds

Led 1	Yellow	Run Led
Led 2	Red	Program Mode
Led 3	Yellow	RXD4_232
Led 4	Red	Stand By
Led 5	Yellow	TXD4_232
Led 6	Red	Reset
Led 7	Yellow	DRAW_DIRECTION
Led 8	Yellow	CENT_ENC_DIR
Led 9	Red	/VMON3.3
Led 12	Yellow	Cover_Sns_Status
Led 13	Yellow	RXD3_422
Led 14	Yellow	Arm_Sns_Status
Led 15	Yellow	TXD3_422
Led 16	Yellow	Lock_Sns_Status
Led 17	Red	/WDO
Led 18	Yellow	RXD2_422
Led 19	Green	+5V
Led 20	Yellow	TXD2_422
Led 21	Green	+3.3V
Led 22	Yellow	ENABLE RS422i
Led 23	Green	+12V
Led 24	Yellow	EN_TXD3_422
Led 25	Yellow	DIAGN-OUT-1
Led 26	Red	LOW-L (Max691)

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10.6 (BOARD_006) NBB – XTRA Base Board rev.00

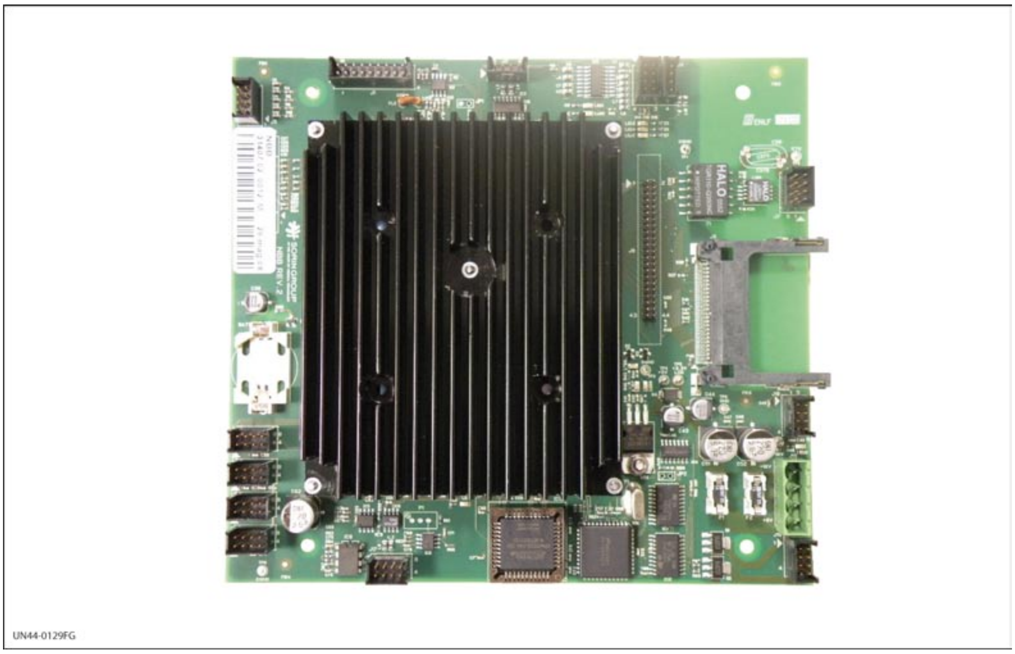


Fig. 10.6-1

10.6.1 General Characteristics

The NBB Board is a custom system baseboard for ETX single board computer. The NBB provides a platform for ETX functions to be physically implemented.
The ETX computer is connected to 4 receptacles located on the NBB.

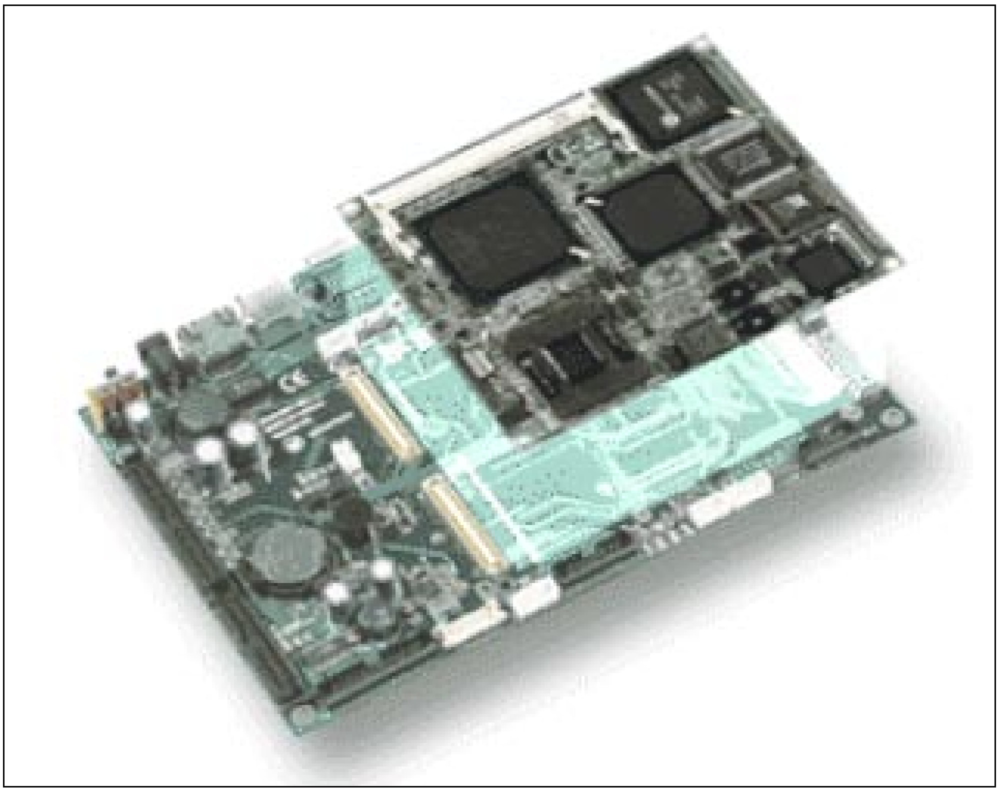


Fig. 10.6-2

ETX computer and Baseboard

The power requirements for the NBB are:

- +5V: this supply voltage is used both by ETX computer and NBB. The supply is protected by a fuse on the NBB;
  +5V is monitored by the NMC Master board to detect any failure. The monitor signal is sent to the Hitachi µP A/D acquisition circuitry (see J3 pin6);
- +12V: this supply voltage is used by the Display Backlight Inverter and Speaker Amplifiers located on the NBB. The supply is protected by a fuse on the NBB, and a local monitor circuit is directly read by the ETX board;
- +3.3V: this supply is derived from the NBB +5V by a local Voltage Regulator. It is used only by the LCD Display and a local monitor circuit is directly read by the ETX board.

J13 – NBB Power Input:

1	+5V	+12V Power Supply
2	GND	Ground
3	GND	Ground
4	+12V	+5V Power Supply

10.6.2 Connectors with ETX board

The connection between NBB and ETX computer is made using four connectors. Signal from all connectors are described and shown below:

X1 Connector: PCI Bus, 4xUSB, Audio interface;
X2 Connector: ISA Bus;
X3 Connector Analog Video (VGA) Output, LVDS Video Output, 2xCOM, Printer/Floppy, IrDA, Mouse, Keyboard;
X4 Connector Ethernet, 2xIDE Ports, Miscellaneous.

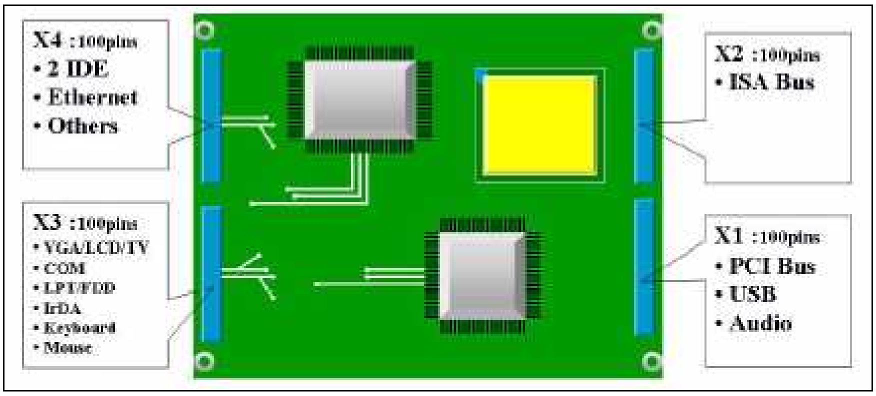


Fig. 10.6-3

ETX Connector Locations

10.6.2.1 ETX - X1 Connector Description:

– **PCI Bus**: PCI devices are not implemented, therefore the PCI bus is not used.

(BOARD_006) NBB – XTRA Base Board rev.00

- **USB** : Four USB ports are available, only one port is used that is connected to the HUB board to share three external USB ports. An over-current protection is implemented on the external USB port : it is based on resettable fuse, that opens the circuit where up to 900mA are recognized.

J11 ETX-USB0 AMP MODU II:

1	+5V	5	Ground
2	USB0-	6	Ground
3	USB0+	7	NC
4	Ground	8	NC

J12 ETX-USB1 AMP MODU II *(Availability for Internal Bluetooth Port- NOT USED)*:

1	+5V	5	Ground
2	USB1-	6	+3.3V
3	USB1+	7	Enable (TTL)
4	Ground	8	+3.3V

J15 ETX-USB2 AMP MODU II (*Touch Screen Controller - NOT USED)*:

1	+5V	5	Ground
2	USB2-	6	Ground
3	USB2+	7	NC
4	Ground	8	+3.3V

J14 ETX-USB3 AMP MODU II *(HUB HIR Board)*:

1	+3.3V	5	Port-a Monitor
2	Port-b Monitor	6	Port-c Monitor
3	+5V	7	USB3-
4	USB3+	8	Ground

- **Audio:** A mono amplifier circuit is introduced on the NBB using audio power amplifier with voltage gain of 10. One 8Ω speaker is mounted for alarms and warnings management. Line In/Out and microphone signals are available on the NBB but not used.

J17 AMP MODU II:

1	Right Speaker -	5	Ground
2	Right Speaker +	6	Ground
3	Line In Right (not used)	7	Ground
4	Microphone (not used)	8	Ground

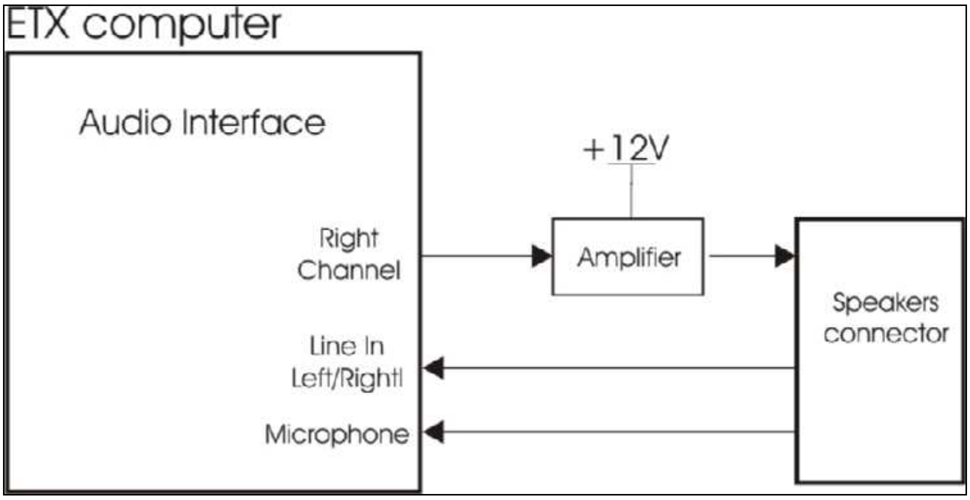


Fig. 10.6-4

10.6.2.2 ETX-X2 Connector Description:

ISA: The Industry Standard Architecture (ISA) Bus is used.

- The standard ETX Board has two on-board RS-232 Com Ports that goes into the X3 connector, while 4 RS-232 Ports are required for XTRA to manage:

- printer communication;
- NMC master communication;
- External communication;
- Communication with PIC for buffy-coat reading out.

Therefore A Dual-Channel asynchronous communications element (PC16552DV) is introduced to add two serial ports. The use of the added COM Port will be discussed in more detail below.

- Voltage Monitor circuits introduced for safety reasons:

- +3.3V$_{LCD}$: This voltage is generated by an on-board voltage regulator. The monitor detects a regulator failure that will cause the LCD Display to turn off;
- +12V$_{LCD}$: This monitor indicates that the LCD Inverter supply has failed;
- +5V-USB$_{EXT}$: This monitor checks the status of the +5V-USB voltage available at the external connector located on the User Interface;
- +5V-USB a,b,c : These monitors check the +5V-USB voltages for external ports located on the rear panel in the HIR board.

- Inverter Brightness Control: commands are described in detail below.

- (A Programmable Logic Device (PLD) is used to generate interface signals such as Chip Selects or dedicated commands.

ISA I/O Address:

I/O Decoder	Function
2E8H-2EFH	COM4 Com Port – Internal Printer
3E8H-3EFH	COM3 Com Port – External Bar Code Reader
300H – 301H	DIP-Switch, NMC-Input Line, Voltage Monitors Chip Select
302H – 303H	TFT Brightness Chip Select *Command*
304H – 305H	TFT Brightness Inc *Command*

306H – 307H	TFT Brightness U/D *Command*
308H – 309H	LED On/Off used as Run led
30AH – 30BH	Light Alarm On/Off
30CH – 30DH	Wireless enable Command
30EH – 30FH	NMC-Output Line

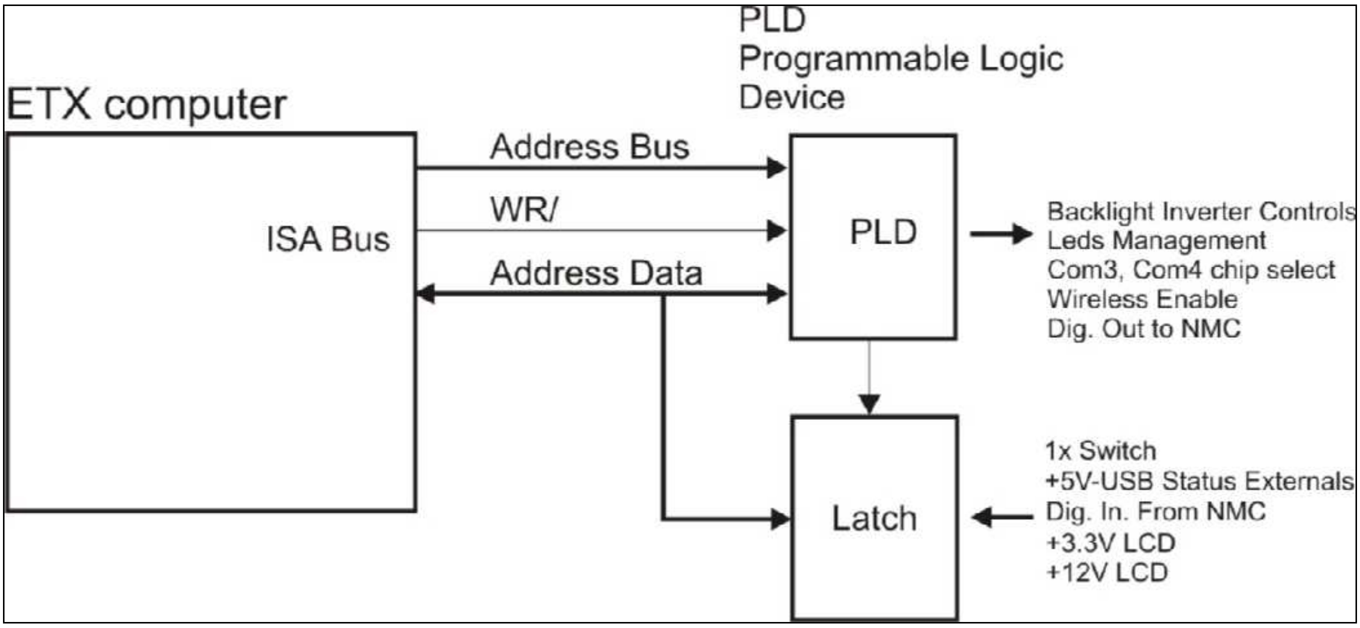


Fig. 10.6-5

10.6.2.3 ETX-X3 Connector Description:

LVDS: The TFT Display in the XTRA uses an LVDS data interface.
Connection to the TFT display is made using a twisted pair, shielded cable.

J1 AMP MODUII:

1	TXCLK+
2	TXCLK-
3	TXOUT2+
4	TXOUT2-
5	TXOUT1+
6	TXOUT1-
7	TXOUT0+
8	TXOUT0-
9	+3.3V-
10	Ground
11	+3.3V
12	+3.3V
17	Ground
18	Ground

(BOARD_006) NBB – XTRA Base Board rev.00

- **TFT Brightness control:**
  Display brightness control is managed by the PC-ETX software, and the intensity value is stored in a solid-state potentiometer with non-volatile memory. The desired intensity is set at XTRA turn on.

  J10 AMP MODU *(Inverter Connector)*:

1	+12V Inverter Supply		5	+5V Available
2	+12V Inverter Supply		6	Brightness Control
3	Ground		7	Ground
4	Ground		8	+5V Available

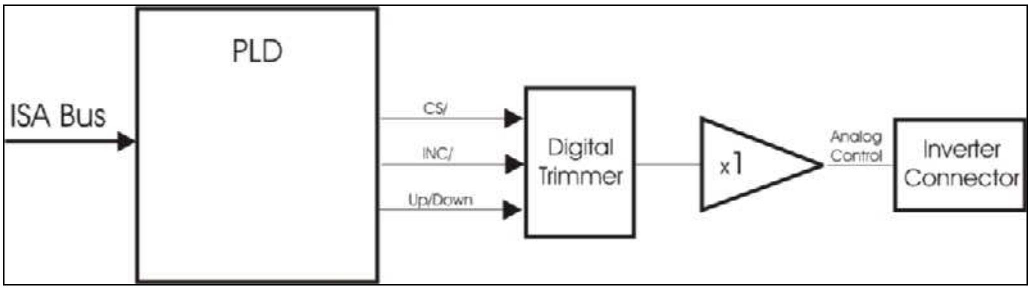


Fig. 10.6-6

- **2xCom Ports (ETX-X3 Connector) & added Com Ports on ISA Bus:**
  The ETX computer provides 2 serial communication ports, the NBB provides an additional 2 serial ports. Transceivers located on the NBB COM Ports comply with the RS-232 electrical standard.
  The External RS232 Port (COM1) is required to be electrically isolated to be compliant with EN-60601 safety standard for medical devices. This isolation driver is located on the SIR Board located on the equipment rear side. This External Isolated Com Port has a Tx-Rx interface only and no Hw handshake.

  AMP MODU II:

J2 COM1	
1	Not Connected
2	RX (TTL level)
3	TX (TTL level)
4	Isolated Ground

J4 COM4	
1	Not Connected
2	RX
3	TX
4	Ground

  J3 AMP MODU II

COM2-COM3				
1	RX (COM2)		5	Free Input
2	TX (COM2)		6	+2.5V TO A/D NMC
3	TO-NMC-DATA		7	TX TTL BUFFY LOW
4	FROM-NMC-DATA		8	RX TTL BUFFY LOW

  The J3 connector allows a connection between NBB Baseboard and NMC board through the Backplane Board. Other signals are shared: single bit I/O data lines and +5V Baseboard voltage for NMC A/D acquisition and monitoring.

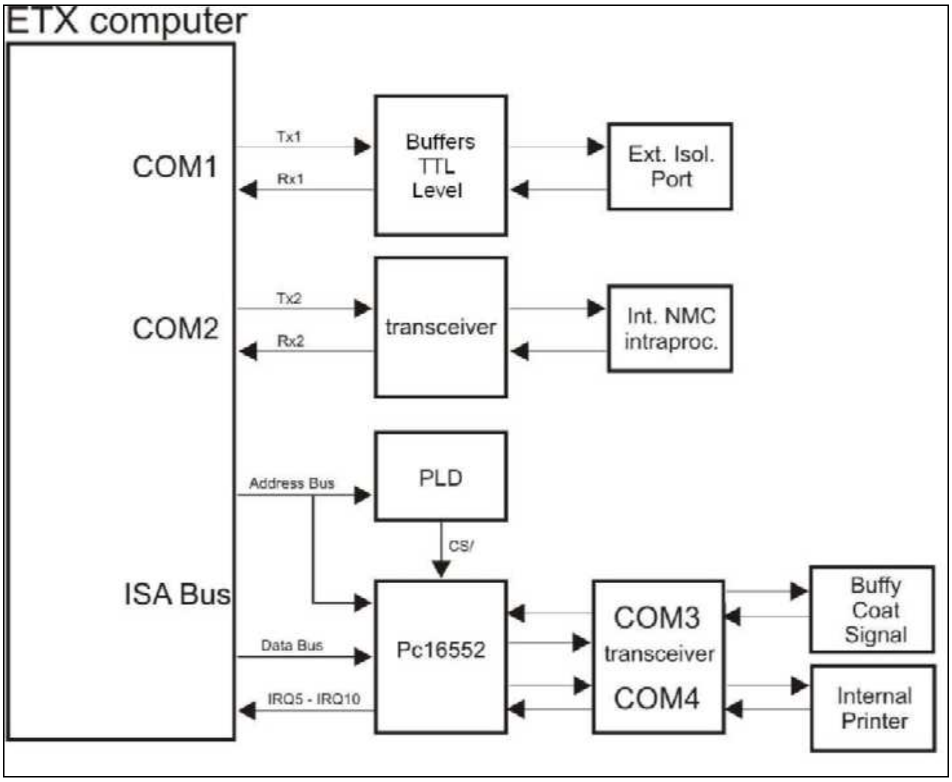


Fig. 10.6-7

- **PS/2 (ETX-X3 Connector)**
  The PS/2 connector is used as Touch Panel Controller interface.

10.6.2.4 ETX-X4 Connector Description:

- **Ethernet:**
  Ethernet network connection is available at the XTRA chassis back panel from a standard RJ-45. This port is actually not used.

10.6.3 Leds and Test Points

10.6.3.1 Leds

LD1	Yellow Led	RS232 intra-processor RX activity
LD2	Yellow Led	RS232 intra-processor TX activity
LD3	Green Led	Ethernet Link Integrity
LD4	Green Led	Ethernet Activity
LD5	Green Led	Ethernet Speed 10/100 Mbps
LD6	Yellow Led	Compact Flash Active
LD7	Green Led	+5V Power Supply Active
LD8	Green Led	+3.3V Power Supply Active
LD9	Green Led	+12V Power Supply Active
LD10	Yellow Led	PLD Output (Run Led)

10.6.3.2 Test Points

TP1	Ground
TP4	+5V
TP5	+3.3V
TP6	Ground
TP7	+12V
TP8	Ground

10.7 (BOARD_007) NBP – XTRA Back Plane rev.00

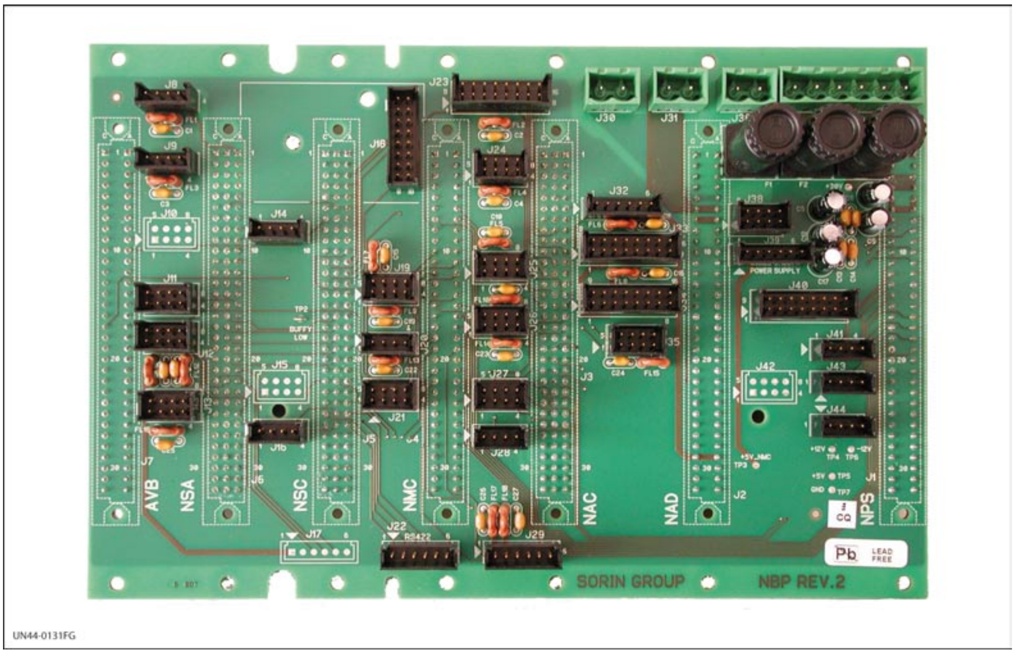


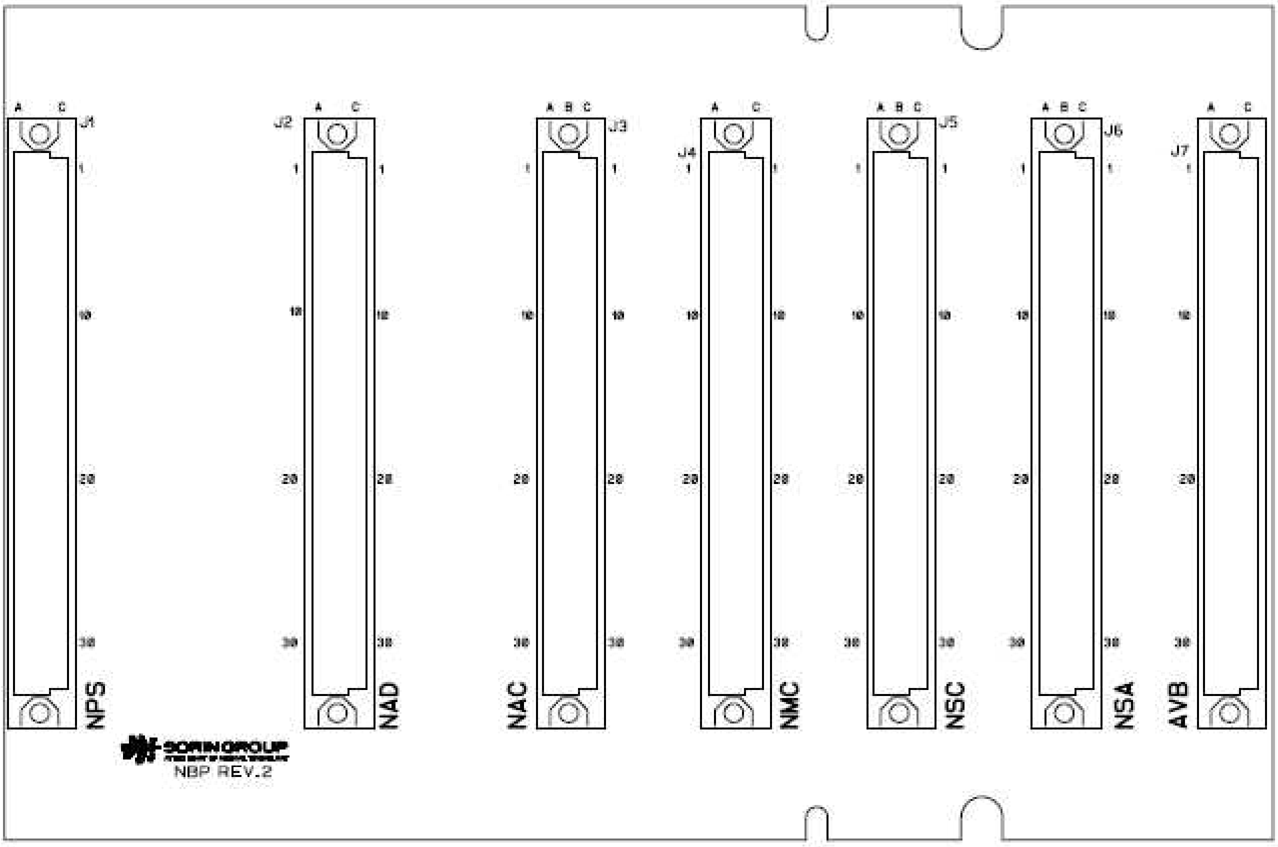
Fig. 10.7-1

10.7.1 Functional Description

The NBP Board introduced in XTRA system is the BACK PLANE Rack Board. It is inserted back to the rack, it allows the insertion of standard *single Europe size* boards.
It measures 194,94mm x 129,50mm.

(BOARD_007) NBP – XTRA Back Plane rev.00

- **Back Plane Board – Card Insertion Side**



J1 – NPS Power Supply
J2 – NAD Actuator Driver
J3 – NAC Actuator CPU
J4 – NMC Master CPU
J5 – NSC Sensor CPU
J6 – NSA Sensor Analog
J7 – AVB Available

Fig. 10.7-2

- **Back Plane Board – Cabling Connectors Side**

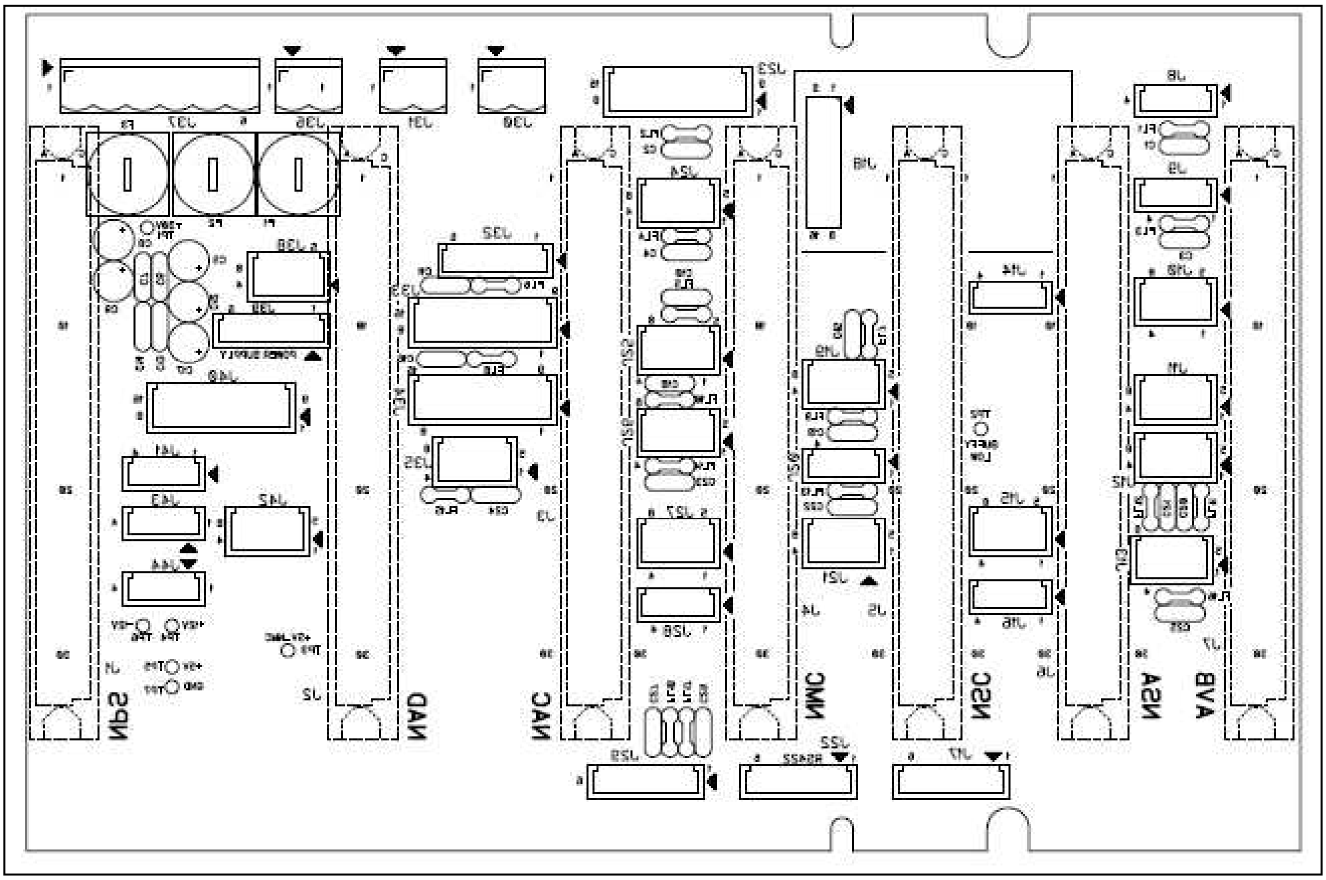


Fig. 10.7-3

10.7.2 External Connections Availability

10.7.2.1 Power Supply unit (Lambda, model Vega450)

The Power Supply unit is connected to the Back Plane board throw two connectors:

- J37 is the Power Connector, with +30V, +/-12V and +5V power supplies. The Lambda unit has another +5V output that supply the embedded PC directly;
- J40 is the logic interface between Power Supply and the machine.

Two fuses are present on the +5V and +30V power supply.

10.7.2.2 NPS Power Supply Board

It manages the Lambda unit through five connectors:

- J36 Printer power supply, with fuse;
- J39 POWER SUPPLY is an available connector with all the power supplies, useful for debug and testing;
- J41 is the Fan connector;
- J43 is the Centrifuge Well light connector;
- J44 is the Buffy Coat Low Level illuminator. Used only during development (connector not mounted).

10.7.2.3 NAD Actuator Driver

The NAD board manages the actuator drivers supplied by the +30V. The connectors located on the back plane are:

- J30 Kit Eject system;
- J31 Pump Draw motor;
- J38 Cover Lock system (driver and control).

The Centrifuge pump connector is located on the NAD board.

10.7.2.4 NAC Actuator CPU

The NAC board manages the actuators controls. The connectors located on the back plane are:

- J25 Centrifuge motor encoders;
- J27 Vacuum RS422 interface;
- J32 Available I/O Signals (Not Used);
- J34, J23 and J33 respectively to the Prime, Wash and Empty Clamp Boards;
- J35 Pump Draw motor encoders.

10.7.2.5 NMC Master CPU

The NMC board manages the high level machine software. The connectors located on the back plane are:

- J10 Air sensor interface;
- J26 Arm control system (first channel NMC, second channel to NAC via backplane);
- J21 RS232 and digitals vs. embedded PC;
- J22 RS422 Debug intra-processor channel connector;
- J28 Stop Key keyboard interface (managed also by the NAC Actuator CPU);
- J29 Second Control – Low Shaft Pump Draw motor;

The isolated RS232 connector is located on the board.

10.7.2.6 NSC Sensor CPU

The NSC board manages sensors throw the following:

- J14 Buffy Coat High Receiver;
- J16 Buffy Coat High Transmission;
- J18 HCT and HGB signals to HHR board;
- J19 Buffy Coat low level CCD and Light management.

10.7.2.7 NSA Analog Board

The NSA board manages sensors throw the followings:

- J8 Load Cell interface;
- J9 RBC Line pressure sensor;
- J11 Blood Loss sensor;
- J12 Machine Cover position sensor;

- J13 Bar Code Kit Reader to NBC Board;
- J17 Kit Cover (Latch) position sensor (not used).

10.7.2.8 Available Slot

An available slot is present for future development.

10.7.3 Test Points:

TP 2	Buffy Coat Low
TP7	Ground

(BOARD_007) NBP – XTRA Back Plane rev.00

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10.8 (BOARD_008) NMC – XTRA Master CPU rev.00

Fig. 10.8-1

10.8.1 Functional Description

The NMC Board introduced in XTRA system is the MASTER CPU Board.

10.8.2 Board Architecture

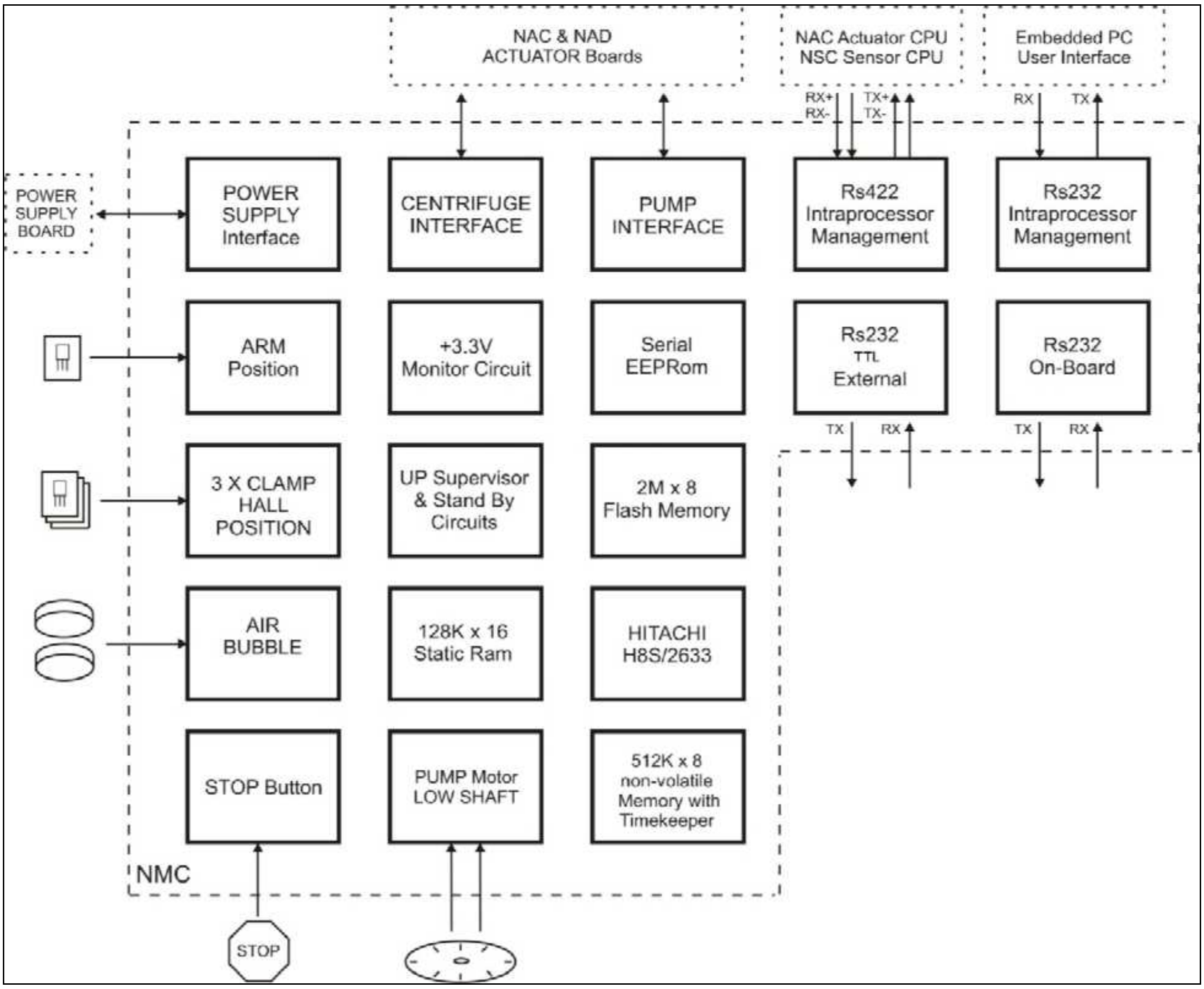


Fig. 10.8-2

10.8.3 Board Features

It is inserted into the rack and manages/contains the following parts:

- H8S-2633 Hitachi controller, with an internal 32-bit architecture, and working at 24MHz clock rate;
- Supervisory Circuit, which takes care of correct operations and prevents code-execution timeout errors. Its features are: Under Voltage, Power Fail and Watchdog controls. It generates a reset impulse or a voltage trap signal towards the micro;
- Stand By Circuit, to put micro in stand by mode to use an emulator pod present on board for SW debug.
- Ram and Flash Memory;
- +3.3V Monitor Circuit integrated on board to check the level of +3.3V supply for microcontroller core. This feature is realized without micro functions. There is an independent comparative circuit to measure +3.3V level and send failure (over/under voltage) information outside of the board to switch off power line to avoid actuators out of control state;
- Temperature Sensor mounted on-board and it signals to the microprocessor the 55°C over temperature;

- RS232 External TTL Channel which goes to the SIR board via backplane connection where isolated driver is located. This serial line could be used for general application. In this application only TX/RX lines are available for communication.
- RS232 On-Board Channel used for SW debug.

The microcontroller receives digital signals from following sources:

1. Pump low shaft for speed and direction control;
2. 3 x Hall sensors status from Clamp Groups (as Close Position double control);
3. Stop button from User Interface;
4. Air bubble sensor status directly from the integrated sensor;
5. Arm Hall sensor position as double control.

It manages and controls the following:

6. Power Supply interface;
7. Centrifuge motor enabling and feedback;
8. Pump motor direction and feedback;
9. Auxiliary inputs/outputs are available for future developments;

The NMC board is supplied by only a dedicated +5V generated in the NPS Power Supply Board.

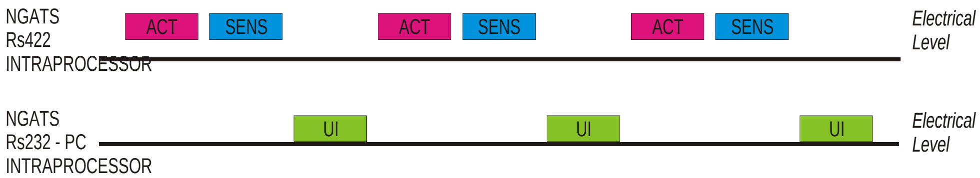
10.8.4 External Connections Availability

10.8.4.1 RS422 Intraprocessor Channel (vs. Actuator and Sensor CPUs)

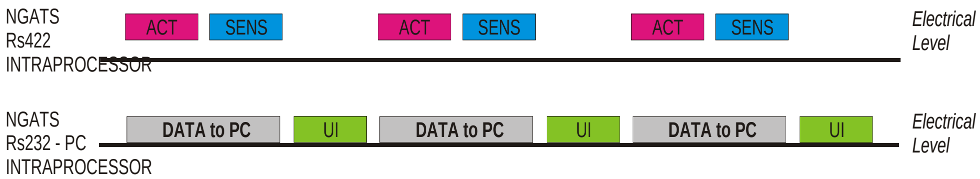
This is the serial interface used in the intraprocessor communication versus NAC Actuator CPU board and NSC Sensor CPU Board. In this application the NMC CPU is always the *master* of the communication and Actuator/Sensor CPUs are always the *slaves*.
This intraprocessor communication is based on "time division mode", in this way the *master* cyclic interrogates the two *slaves*.

10.8.4.2 RS232 Intraprocessor Channel (vs. embedded PC)

This is the serial interface used in the intraprocessor communication versus the embedded PC. This a point-to-point communication and only TX/RX lines are used.
This intraprocessor communication is based on the same "time division mode" used with the other slaves and it is synchronous with the RS422 communication.



Due to the amount of data that *master* needs to send to the embedded PC, the RS232 intraprocessor channel extension is:



(BOARD_008) NMC – XTRA Master CPU rev.00

The extra data to PC concern Information Technology data because of the PC is the manager of Printer, USB ...

ACT Actuator SENS Sensor UI User Interface (PC Communication)

DATA to PC User Interface (PC Extra Data)

J2 Connector – Available RS232 (debugging only)

1	Vcc	+5V Power Supply
2	Rx	H8S-2633 Rx line
3	Tx	H8S-2633 Tx line
4	Gnd	Ground

10.8.5 Test Points and Leds

10.8.5.1 Test Points

TP 1	Isolated GND RS232
TP 6	TST3
TP 9	/+12E (not used)
TP 10	/+0E
TP 12	DRAW-SH1
TP 19	+5VNMC-BP
TP 20	GND
TP26	TX+422m

10.8.5.2 Leds

Led 1	Yellow	MST-PUMP-CENTRIF
Led 3	Yellow	HL-PR-CLAMP
Led 5	Yellow	HL-WA-CLAMP
Led 7	Yellow	TST4
Led 9	Yellow	Arm Status
Led 11	Yellow	TST3
Led 13	Yellow	Air Bubble Status
Led 15	Yellow	RXD1 EXT.
Led 17	Yellow	TXD0 PC
Led 19	Red	TOver
Led 21	Red	Reset/
Led 23	Yellow	Draw-Sh2

Led 2	Yellow	MST-PUMP-DRAW
Led 4	Red	Stand By/
Led 6	Yellow	HL-EM-CLAMP
Led 8	Yellow	TST5
Led 10	Yellow	RXD0 PC
Led 12	Yellow	TXD4 RS422
Led 14	Yellow	RXD4 RS422
Led 16	Yellow	RXD1 EXT.
Led 18	Green	+5V
Led 20	Green	+3.3V
Led 22	Red	+3.3V over/under
Led 24	Yellow	Draw-Sh1

10.9 (BOARD_009) NPS - XTRA Power Supply Board rev.00

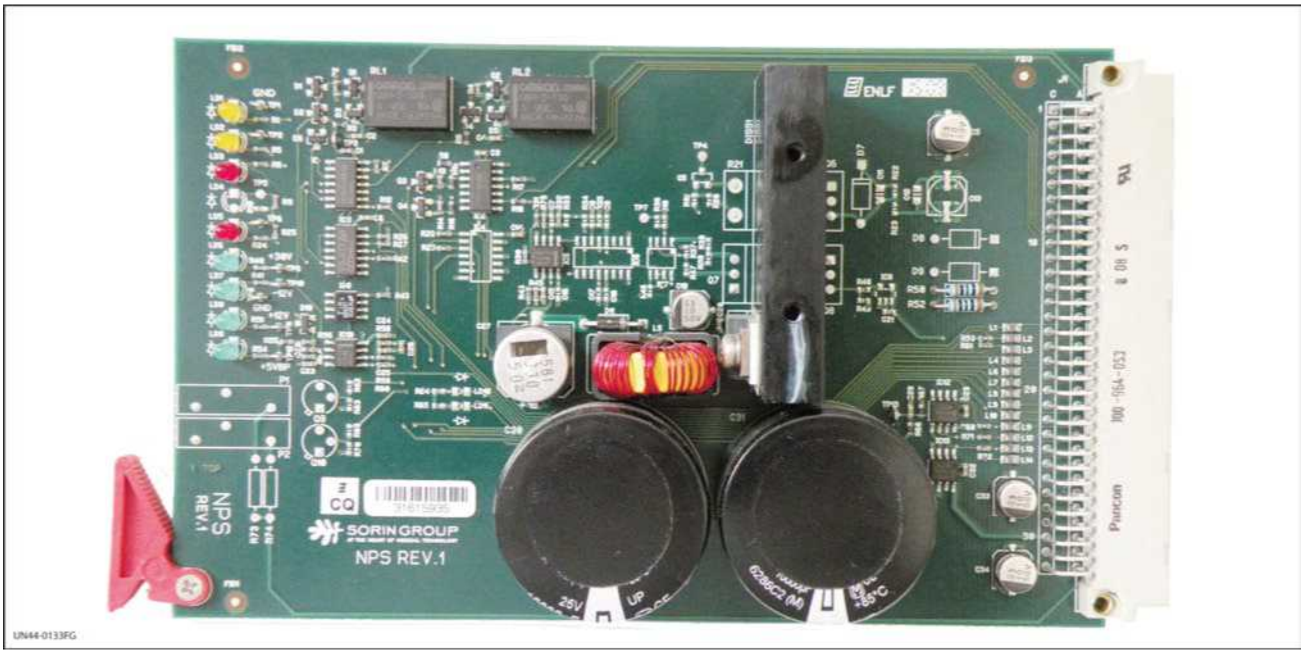


Fig. 10.9-1

10.9.1 Functional Description

The NPS board is used to control and enable voltages used by XTRA boards. The NPS board is inserted into the rack.

- **Mains Fail Signal, Vtrap Generation And Distribution**

The Lambda power supply unit generates a MAINS-FAIL opto-isolated signal which provides a minimum of 5ms warning before loss of output power due to either loss of AC or over temperature of the converter.
This signal is used:
- to generate the VTRAP signal to bring to all µP boards at the PFI input of the RESET supervisors (MAX691) present in the boards. The supervisor generates the NMI (not maskable interrupt signal) to its µP;
- to inhibit the +30VDC and the +5VDC-PC. This is done to save energy and have more time between NMI and RESET to execute the CRC function and store important data. In this way, when the Mains-Fail arrives, all the actuators, the embedded PC and the TFT display immediately going off.

(BOARD_009) NPS - XTRA Power Supply Board rev.00

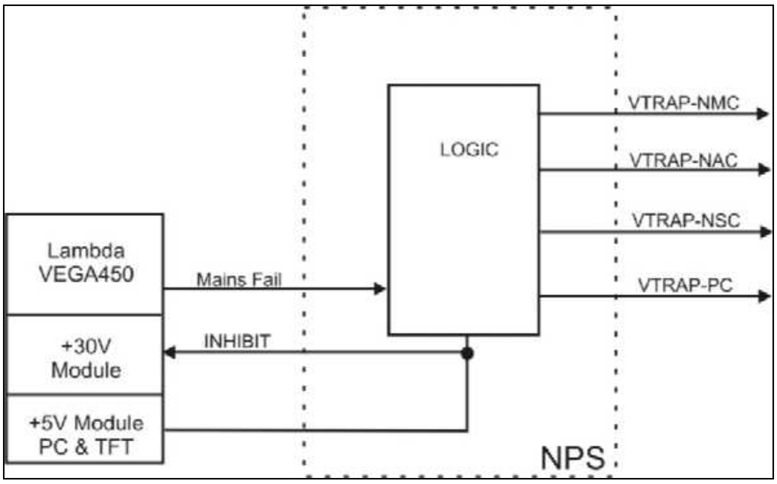


Fig. 10.9-2

The VTRAP signal informs all µP that the power supply will loss converter control after 5ms.

- **+5V Overvoltage Monitor**

The function of this monitor is to detect over-voltage on the +5VDC that can damage the µP's. Following this detection, +30VDC is disabled for safety. Actuators go in the safe state, centrifuge and pump stop, clamps are closed. There is also the possibility to check that the monitor is working properly at start-up from the master unit.

- **+30 Fail Signal From Power Supply**

The power supply unit generates +30Vdc with two +15Vdc modules connected in series. Each module has a power good signal (MGC1 and MGC2). These two signals are combined to generate the +30FAIL signal that is read by the master unit which performs the appropriate action.

- **Undervoltage +30**

Power +30Vdc is monitored on the board for a minimum value of 7Vdc. This is done to check that the fuse is OK. This signal +30<7 is read by the master unit which performs the appropriate action.

- **Vcc (+5vdc) Generation For The Master Unit**

This circuit is used to obtain a hold-up time of at least 100 ms more to that guaranteed by the power supply. To do this a dc-dc converter is used to generate the Vcc (+5Vdc) from the +12Vdc. Two big reservoir capacitor (till 22000 µF size) are available on the +12Vdc; these guarantees more than 7Vdc at the input of the dc-dc converter for a time necessary to generate at least 100ms of supplementary hold-up time for the master µP to store all important data and execute CRC SW function. Thanks to the INHIBIT signal, that disconnect the +30VDC actuators supplying and the +5VDC used for embedded PC and TFT supplying, this time could be allowed.

- **Power +30 Enable**

This voltage is enabled by five signals; two from the master unit (+30Enable and VMON3.3), one from the actuator unit (VMON3.3), one from the Lambda power supply (Mains Fail), and one from the +5V overvoltage circuit. Only if all these signals are active (absence of anomalies) the +30V is enabled (INHIBIT is not active). This is done to guarantee safe operations.

(BOARD_009) NPS - XTRA Power Supply Board rev.00

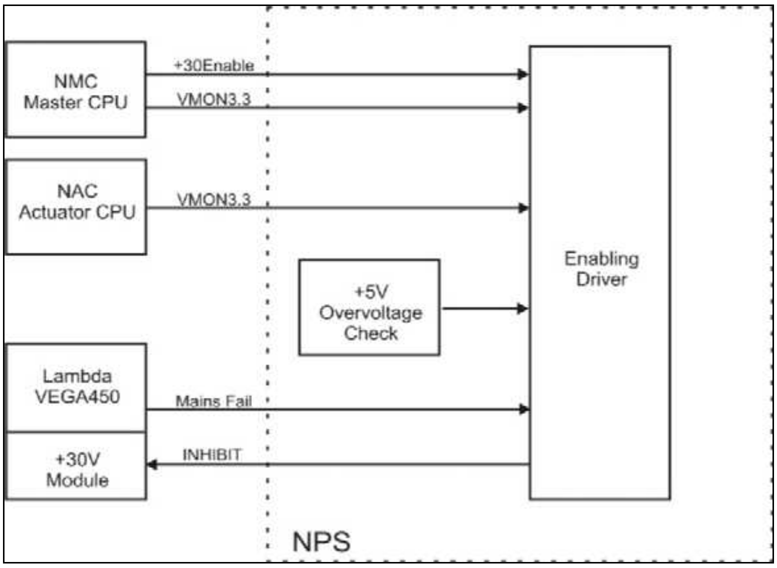


Fig. 10.9-3

- **Fan Control**

There are three independent options allowed:

a) Fan at max speed as soon as XTRA is powered on (fan supplied via Back-Plane without control);
b) Fan at max speed as soon as the temperature inside XTRA reaches 45°C (a temperature sensor is present in NPS board that controls the fan);
c) Fan at variable speed controlled by a temperature sensor in the range from 30°C to 50°C (less noise). Thanks to a sensor located in the NAD (Actuator Driver) board, the speed can be controlled by the NAC (Actuator CPU). If this HW controller fails, the fan runs at the maximum speed.

Only one option can be selected.

- **Low Buffy Coat Infrared Led Drive**

A manual trimmed circuit is available to drive the infrared leds of the Low Buffy Coat sensor.

- **Alarm Signal Generator**

Two alarm signals are generated: one under-voltage alarm on the +30V voltage and one power failure alarm on the +30V. Both of them are read by the NMC Master unit. These alarms are activated under the following conditions: +30V< 7V and +30FAIL if at least one of the two +15V modules on the power supply fails.

10.9.2 Board Features

The NPS board is supplied with +30VDC, +5VDC, +12VDC and –12VDC voltages coming from the power supply unit, filtered through EMI suppression filters and fused for protection. These EMI filters and fuses are located in the Back Plane PCB board.
The Power Supply unit used in the machine is the Lambda, model *Vega 450*.

(BOARD_009) NPS - XTRA Power Supply Board rev.00

It is composed by 3 power modules:

a) +5VDC – 12A ; +5VDC – 8A, twin outputs, single slot;
The first output is used for embedded PC and TFT display supplying. Other voltages necessary in the User Interface group (+3.3V TFT for example) need to be created locally (in the PC Carrier board).
The second output is used for Actuator and Sensor Boards supplying.

b) +30VDC – 18A single output, double slot;
This voltage is used for centrifuge, pump, clamps and all the actuators supply.

c) +12VDC – 10A ; +12VDC – 6A twin outputs, single slot (used for +12/-12VDC);
These voltage are used in two different way:
- supplying of analog components (+12/-12VDC)
- from the +12VDC it is created the +5VDC-MASTER_BOARD. Using a Step Down regulator and a big size capacitor there is the availability of a long TSAVE time during the machine power off.

The interfaces with the XTRA boards are:

- **NMC Master Board**
  Power Supply:
  VCC_MB (5V) board power supply (from the +12VDC);
  VTRAP-NMC: detects mains power failure.
  Interface:
  Enable +30VDC via Master controller;
  Disable +30VDC if +3.3V Core Controller Supply fails;
  Check minimum level of +30VDC(<7VDC);
  Check the +30VDC status (Module Good);

- **NAC Actuator CPU Board**
  Power Supply:
  VTRAP-NAC: detects mains power failure
  Interface:
  Disable +30VDC if +3.3V Core Controller Supply fails;
- **NSC Sensor CPU Board**
  Power Supply:
  VTRAP-NSC: detects main power failure;

- **UI Group (embedded PC, Carrier Board and TFT Display)**
  Power Supply:
  VTRAP-PC: detects main power failure;

10.9.3 Test Points and Leds

10.9.3.1 NPS Leds

Led 1	Yellow	Mains-Fail
Led 2	Yellow	+30V Enable
Led 3	Red	/+30FAIL

(BOARD_009) NPS - XTRA Power Supply Board rev.00

Led 5	Red	+30<7V
Led 6	Green	+30V
Led 7	Green	-12V
Led 8	Green	+12V
Led 9	Green	+5V

10.9.3.2 NPS Test Points

TP 1	Ground
TP 2	+30V Enable
TP 3	+30V Inhibit
TP 6	+30<7V
TP 8	Ground
TP 9	+30V
TP 10	-12V
TP 11	+12V
TP 12	+5V
TP 13	VTRAP

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10.10 (BOARD_010) Sensor Group – Xtra Sensor Interfaces rev.00

10.10.1 Functional Description

The Sensor Group is composed mainly by four boards:

- NSA Sensor Analog;
- NSC Sensor CPU;
- HHR Hgb and Hct receivers;
- NBC Bar Code interface.

The NSA Sensor Analog board is inserted into the rack and manages the followings sensors:

- Kit identification interface (bar code label);
- Load cell interface;
- Centrifuge blood loss sensor;
- Cover position sensor;
- RBC line pressure sensor;
- +12V/-12V over-voltage and under-voltage controls;
- +5V, +12V and –12V voltages acquisition (diagnostic checks).

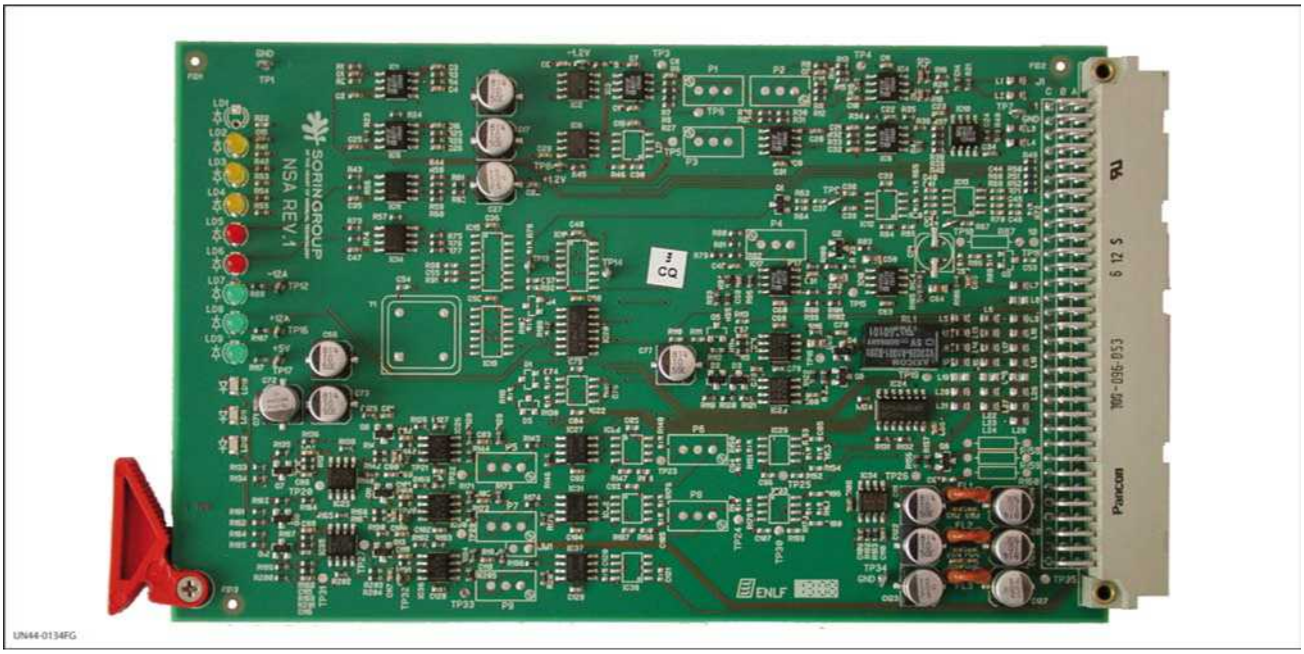

Fig. 10.10-1

The NSC Sensor CPU board is inserted into the rack and manages the followings sensors:

- Buffy Coat low level;
- Buffy Coat high level;
- HCT sensor (via HHR board);
- HGB sensor (via HHR board);
- NSA signals final acquisition.

In this board are present the Hitachi H8S/2633 and Microchip PIC18F2520/PIC18F252 controllers.

(BOARD_010) Sensor Group – Xtra Sensor Interfaces rev.00

Fig. 10.10-2

The HHR Hgb and Hct receiver is little board inserted bottom the top panel of the equipment.

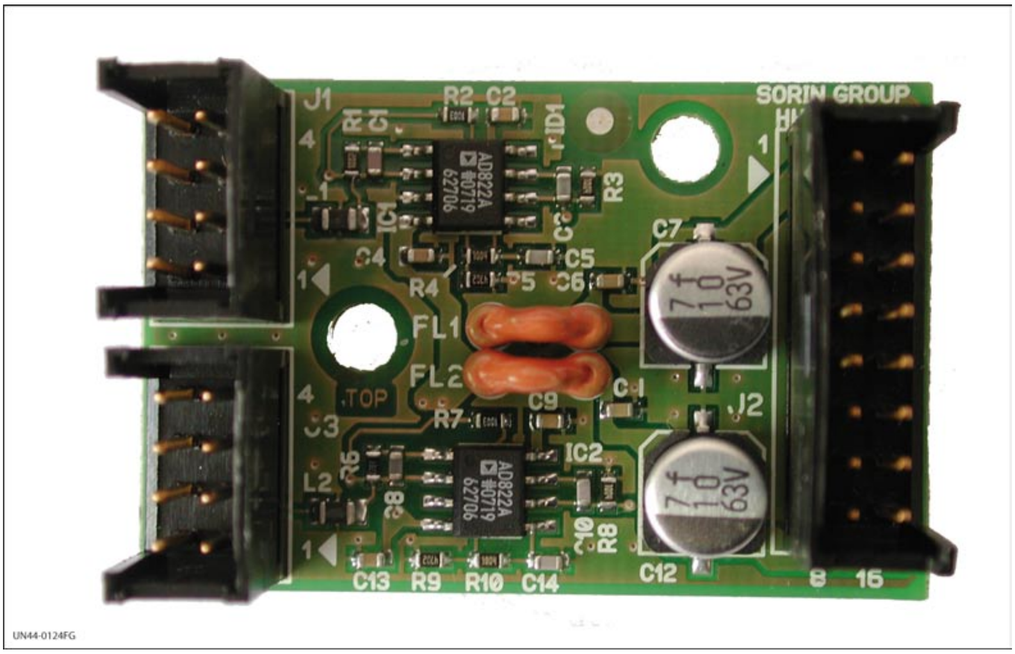

Fig. 10.10-3

The NBC board is a little board used only as support for the three reflective sensors used in this bar code application.

(BOARD_010) Sensor Group – Xtra Sensor Interfaces rev.00

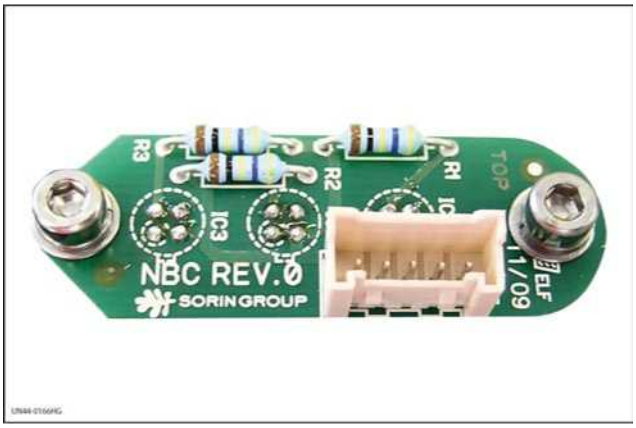

Fig. 10.10-4

10.10.2 Boards Architecture

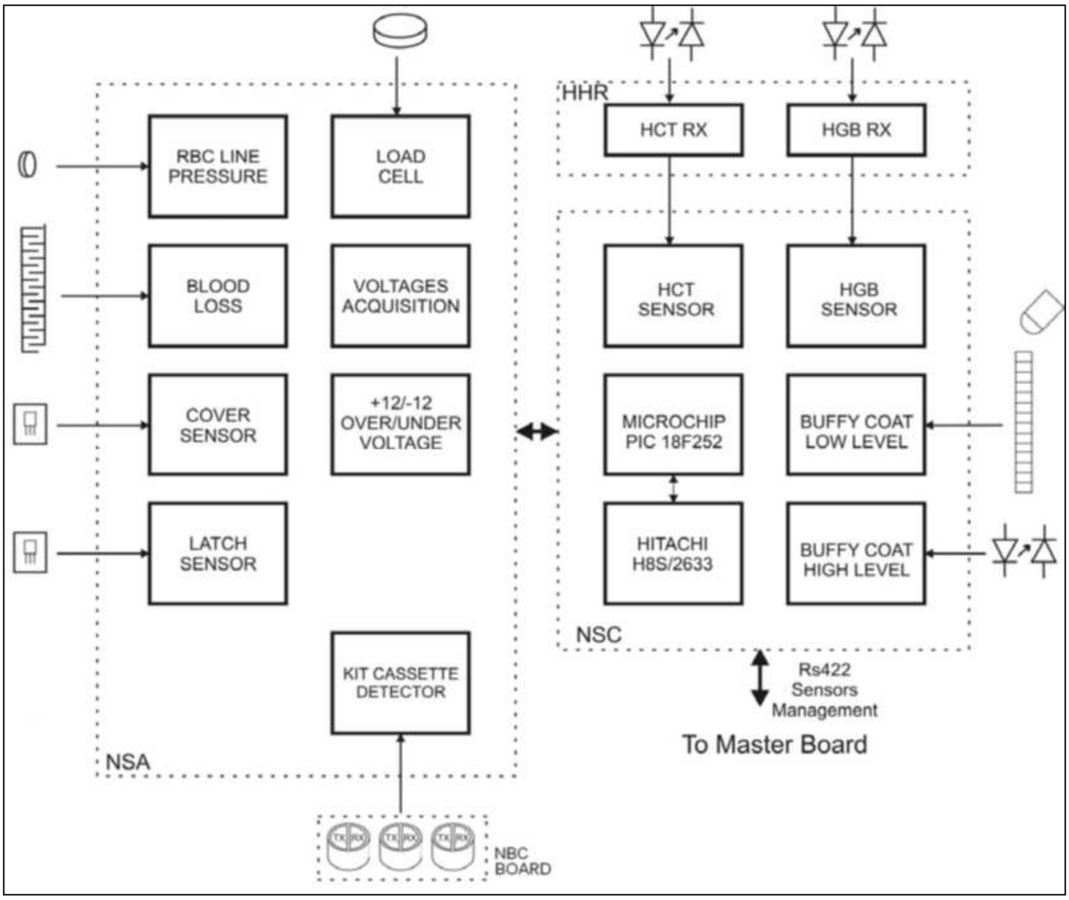

Fig. 10.10-5

10.10.3 Boards Features

These boards are supplied with +5V, +12V and -12V through back plane connectors.

The digital on-board components are supplied by a filtered +5V while the filtered +12V/-12V are used by analog components. Local +1.2V and –1.2V are generated in the NSA board for sensors trimming. The +3.3V is locally generated for H8S-2633 core feeding.

(BOARD_010) Sensor Group – Xtra Sensor Interfaces rev.00

The NSA board tests the +12V and –12V used to supply analog components. The over-voltage and under-voltage alarm signals are provided if these voltages go outside the allowed windows.

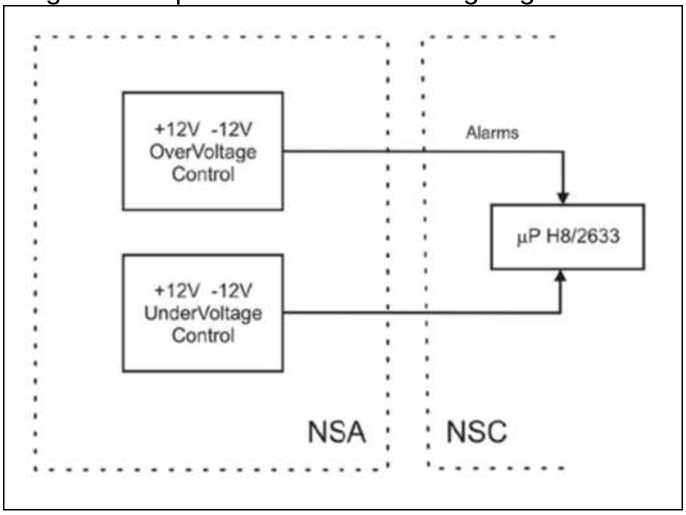

Fig. 10.10-6

The three voltages +5V, +12V and –12V used for components supplying are converted to a 0V ÷ +5V range. These signals are read by the µP NSC A/D converters for analogical acquisition.

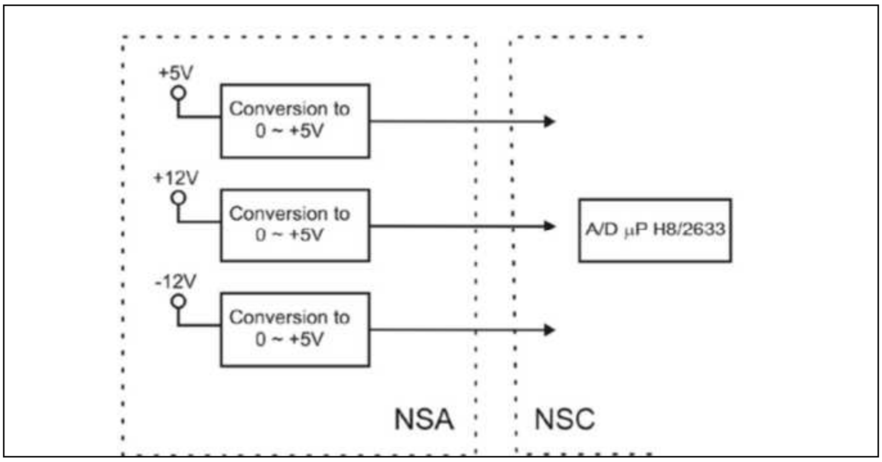

Fig. 10.10-7

The Hitachi H8S-2633 has an internal 32-bit architecture, it is provided with sixteen 16-bit general register and an instruction set designed for high speed operation.
It works at 24MHz clock rate. In this application it is used in stand alone mode, without external Ram or Flash. Its memory feature is 256K-Byte internal Flash and 16K-Byte internal Ram.
Thanks to its Analog to Digital 12-channels and Digital to Analog 4-channels it could manage the monitor sensors.

The Maxim Max693 supervisor take care of correct operations and prevents code-execution errors. The features include Under Voltage, Power Fail and Watchdog controls. It generates a reset impulse or a voltage VTRAP signal towards the micro H8S-2633.

An emulator pod used for SW Hitachi debug is present on board. In emulating mode it is necessary to put the micro in stand by mode. For this reason, a circuit for stand by mode driving is included with a manual switch for enabling it.

(BOARD_010) Sensor Group – Xtra Sensor Interfaces rev.00

On board SW Hitachi upgrade is possible by means of program mode circuit. This system allows to put this micro in programming mode. This function may be enabled by manual switch or by direct line from external (Master) microcontroller. Thanks to this last feature, the Sensor SW can be downloaded from external machine ports.

This Microchip PIC18F2520 microcontroller is used to manage the low and high Buffy Coat level sensors. Its memory characteristics are 32K-Byte Flash and 1532-Byte Ram. It communicates to the H8S-2633 via TTL UART to exchange data concerning buffy coat information.

A TTL UART communication is used to allow data exchange between the two microcontrollers present on the NSC board.
The Hitachi H8S-2633 controller is connected with the intra-processor machine communication via RS422 differential bus.
An available RS232 line is present on the accessible side of the board for development and debugging.

Below is provided the list of XTRA sensors managed by Sensor Group. For each of them is showed if it is analogic or digital (final elaboration), the PCB board involved in the signal control and the microprocessor in charge of acquisition of the signal.

Sensor	Type	µP	µP
Blood Loss	Digital	NSA	H8S/2633
Bar code reader	Digital	NSA	H8S/2633
Buffy-coat Low	Analog	NSC	PIC18F252
Buffy-coat High	Digital	NSC	PIC18F252
Hct (led λ = 805 nm)	Analog	NSC & HHR	H8S/2633
Hgb (led λ = 565 nm)	Analog	NSC & HHR	H8S/2633
Burst prevention into RBC line	Analog	NSA	H8S/2633
Status of the Centrifuge Cover	Digital	NSA	H8S/2633
Air bubble Sensor	Digital	NSA	To Master
+12V & -12V Under Voltage	Digital	NSA	H8S/2633
+12V & -12V Over Voltage	Digital	NSA	H8S/2633
Power Supply Voltage Acq.	Analog	NSA	H8S/2633
Load Cell	Analog	NSA	H8S/2633
Status of the Latch Cover	Ana. or Dig.	NSA	H8S/2633

Fig. 10.10-8

10.10.4 External Connections Availability

NSC J2 Connector – Available RS232 (debugging only)

1	Vcc	+5V Power Supply
2	Rx	H8S-2633 Rx line
3	Tx	H8S-2633 Tx line
4	Gnd	Ground

10.10.5 Test Points and Leds

10.10.5.1 NSA Test point

TP 1	Ground
TP 2	-1.2V
TP 7	Ground
TP 8	+1.2V
TP 9	Air Bubble RX II stage
TP 10	Air Bubble RX I stage
TP 12	-12V
TP 13	Air Bubble Ctrl.
TP 14	/Air-Alarm
TP 16	+12V
TP 17	+5V filtered
TP 19	Blood-Loss control
TP 20	RX-COV-EM3-compar
TP 34	Ground

10.10.5.2 NSA Leds

Led 3	Yellow	Cover Status
Led 5	Red	+12V Over Voltage
Led 7	Green	-12V
Led 9	Green	+5V
Led 11	Yellow	LABEL-ST2 (Bar Code)

Led 2	Yellow	Blood Loss
Led 4	Yellow	Latch Status
Led 6	Red	-12V Over Voltage
Led 8	Green	+12V
Led 10	Yellow	LABEL-ST3 (Bar Code)
Led 12	Yellow	LABEL-ST1 (Bar Code)

10.10.5.3 NSC Test Points

TP 1	Ground
TP 3	Ground
TP 5	HGB READ
TP 6	HCT READ
TP 8	HCT I stage (trim.)
TP 9	Buffy C. High compare
TP 10	Buffy C. High sens
TP 11	Buffy C. High amplified
TP 13	HCT TX Level
TP 16	HGB TX Level
TP 18	-12V
TP 19	+12V
TP 20	+5V filtered
TP 22	+3.3V
TP 25	Buffy C. read

TP 26	Buffy C. Low RX
TP 28	Buffy C. Low Synch
TP 29	Buffy C. Low Clock
TP 30	RX+422i
TP 31	RX-422i
TP 32	Ground
TP 33	TX+422i
TP 34	TX-422i

10.10.5.4 NSC Leds

Led 2	Yellow	TST2
Led 3	Red	H8S Stand By Mode
Led 4	Red	H8S Program Mode
Led 6	Yellow	Microchip Pic Run Led
Led 7	Yellow	/WDO
Led 8	Yellow	H8S Run Led
Led 9	Yellow	TXD2 intraprocessor
Led 10	Red	H8S Reset
Led 11	Yellow	RXD2 intraprocessor
Led 12	Green	-12V
Led 13	Green	+5V
Led 14	Green	+12V
Led 15	Green	+3.3V

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10.11(BOARD_011) SIR – Serial Interface Board rev.00

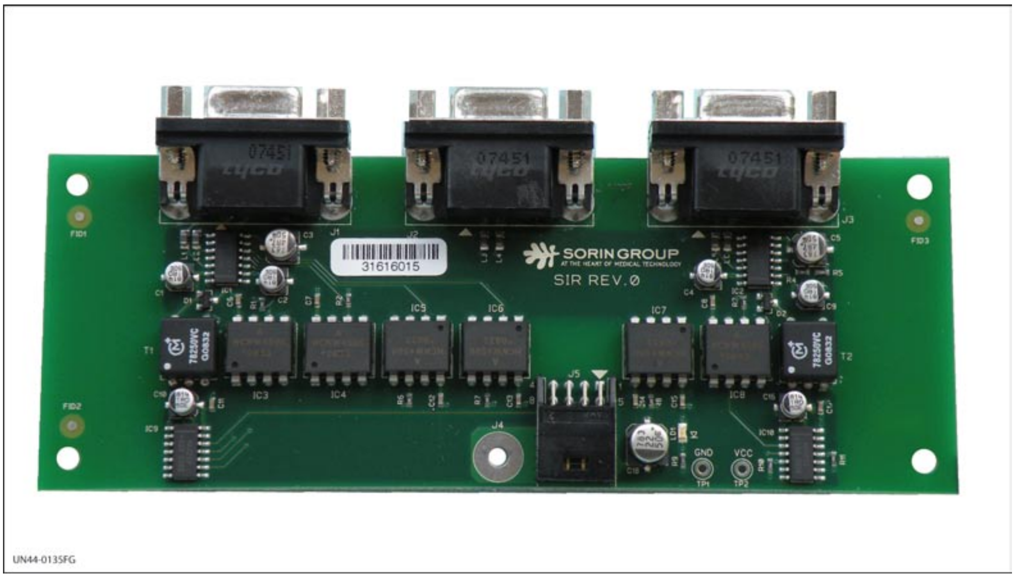

Fig. 10.11-1

10.11.1 Functional Description

The SIR (Serial Interface Rear panel) is an application that introduces 4KV isolation on the external serials available in the XTRA rear panel. This board is based on MAX250-MAX251 Maxim application. The PCB is 147,0mm x 55,0mm.
The MAX250 and MAX251 chipset form the heart of a complete, electrically isolated, RS232 dual transmitter/receiver. Because this board implements a three isolated serial application, it is necessary the use of two MAX250/MAX251 chipsets.
In addition to these chipsets, high speed optocouplers and a transformer complete the application.
The MAX250 connects the non-isolated side of the interface, translating the logic signals to and from the optocouplers, while the MAX251 resides on the isolated side, translating data between optocouplers and RS232 line drivers and receivers.

10.11.2 Board Architecture

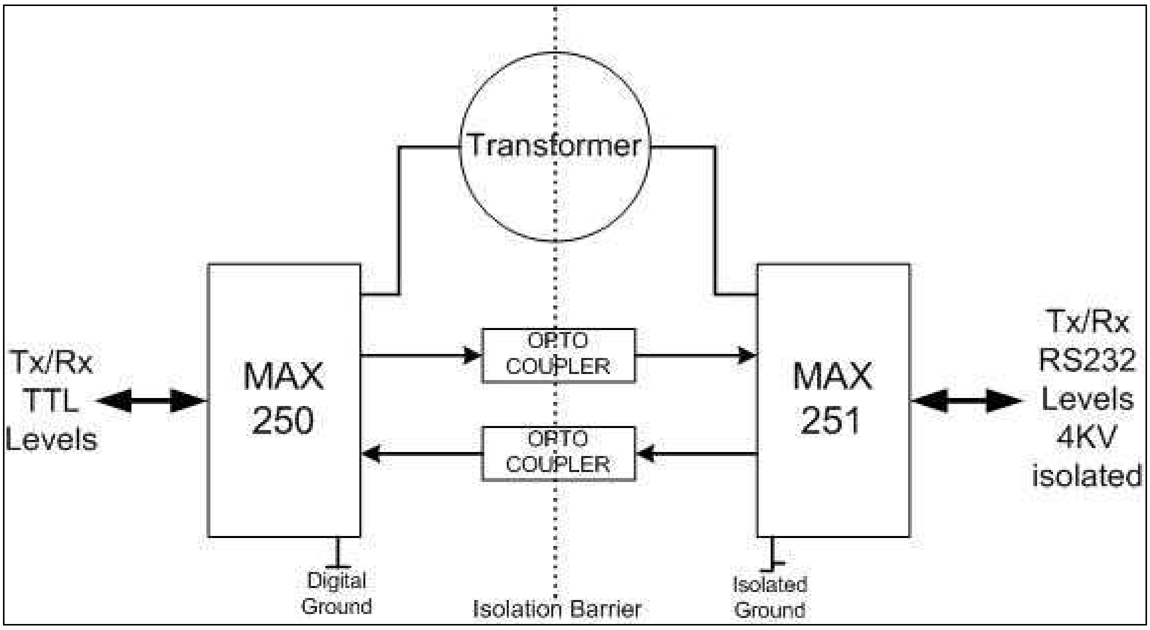

Fig. 10.11-2

SMSC USB2503 architecture

10.11.3 External Connections Availability

J1, J2, J3 Connectors – RS232 – Standard DB9 connector

1	NC	Not Connected
2	TX	TX Isolated Data Line
3	RX	RX Isolated Data Line
4	NC	Not Connected
5	IGND	Isolated Ground
6	NC	Not Connected
7	NC	Not Connected
8	NC	Not Connected
9	NC	Not Connected

J4 Connector – Metalized hole for ground cable.

J5 Connector – AMP MODUII

1	VCC	+5V Power Supply
2	TX3	Input TX1 TTL Level (to J3)
3	TX2	Input TX2 TTL Level (to J2)
4	TX1	Input TX3 TTL Level (to J1)
5	GND	Digital Ground
6	RX3	Output RX1 TTL Level (to J3)
7	RX2	Output RX2 TTL Level (to J2)
8	RX1	Output RX3 TTL Level (to J1)

Leds

1	LD1	Green	+5V Power Supply

11 TROUBLE MANAGEMENT

11.1 (TROUBLE_001) Trouble overview rev.00

11.1.1 About this card

The purpose of this card is to introduce and give instructions about SM cards relative to trouble situation possible in XTRA using.
Troubles are classified in two types: **Hardware Error** and **Alarm**/**Warning**.
Each type of trouble is organized in table-form and included in a single card. Every table collects all cases known for relative trouble type. See following table for details:

Table name	Meaning	Card Name
Hardware Error Table	All types of Hardware Error that may be declared by Electa Concept SW. In this case a clear message is always displayed and any procedure is interrupted (e.g. “E32 PLEASE REFER TO TECHNICAL SERVICE”)	**(TROUBLE_002)** **Hardware Errors** card
Alarm/Warning Table	All type of Alarm/Warning that may be declared by XTRA SW. In this case a clear message is always displayed (e.g. “ALARM: BLOOD LOSS IN CENTRIFUGE” or “WARNING: RESERVOIR IS FILLING UP. PLEASE PROCESS BLOOD”), but user has the possibility of resuming by pressing a button. Present type is intended as a trouble case only if message is present, but the expected cause seems not to be present.	**(TROUBLE_003)** **Alarms & Warnings** card

Table 11.1-1

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11.2 (TROUBLE_002) Hardware errors rev.00

11.2.1 Introduction

This chapter contains specifications about all the hardware anomalies that have to cause the stop of the machine.
All these anomalies are called "fatal error" and have to bring the machine in its out of order status in order to avoid any risk in using it.
To recovery a machine in fatal error is required a technical intervention.

11.2.2 Definition of fatal error

During each functioning phase a certain number of controls referring to the safety and reliability of the equipment is active. If any hardware anomaly is detected, some safety measures are activated in order to stop the use of the equipment until the hardware anomaly is eliminated: the anomaly that causes the stop of the machine is called FATAL ERROR.
When a fatal error occurs stopping a machine, the only action possible for sure remains switching off of the power.
Depending on condition of User Interface, that means if causes of fatal error don't affect directly User Interface, other functionalities remain available :
- it is possible to stop acoustic sequence;
- it is possible to access Tally's functionalities.

After the occurrence of a fatal error a technical intervention is needed.

11.2.3 Actions following a fatal error

The different microprocessors units detect the anomalies. When one unit detects an error it operates as follows:

a) Send the information to the NMC unit via serial link;
b) If the fault does not cause any risk to the patient/user or if the slave unit does not have enough information to decide about the severity of the event no further operations are executed;
c) If the fault could cause any risk to the patient/user, the slave unit stops the actuators under its own control and activate a 0.5 seconds timer. At the end of such timing it puts anyway itself in the stop status.

If the fault is recognized before the serial communication with the NMC unit is set up, fatal error operations is delayed until the serial link is established.
When the NMC unit recognizes a fault or receives from a slave the information of a recognized error via the serial link, it executes the following procedure (except if expressly indicated in the following pages):

a) Disable the current 30 Volt used for feeding actuators;
b) Disable the centrifuge functioning (at the switch on the centrifuge needs of a specific order ruled by the NMC unit);
c) Modify the phase and the active status switching to the phase devoted to alarms (in this way the automatic features ruling the correct functioning of the equipment cannot proceed);
d) Get the number referring to the error appeared;

e) Order to the NUI, via a serial link, to activate the page referring to the fatal error with the code of the error appeared;
f) Store into buffered ram memory the number referring to the fatal error, when it appeared (day, month, year, hour and minute) and the number of the procedure running;
g) Activate a 400 ms. timer. This time expired, it puts itself into a blocked status.

Each fatal error is associated with a code number that uniquely identifies it so that each fatal error is identified with an “E” followed by a progressive number : Ex.
In the next pages are listed all the fatal errors and their code number.
For each of them the code sent to UI, the ID and a description about the causes are provided.
Each of them are also included into a specific family, depending on the primary cause that determines the error.
Each fatal error is checked one time at every main cycle except if written otherwise. Checking interrupt after that any one of the anomalies herewith described appears.

11.2.4 Visualization of fatal errors

With exception of Fatal Errors detected by User Interface, Master unit sends to UI a code, before stopping communication. This code identifies the Fatal Error and it belongs to a special range of alarm codes (FE range).
Assuming occurred Fatal Error doesn’t affected UI performances, UI manages FE code as follows.
Thank to belonging of received alarm code to FE range, UI uses it to start a FE endless acoustic sequence and it acts on screen in this way :

- On message box (red background) there is a specific message (depending on FE code) telling both FE number, and a general description of kind of problem (that is FE family description) and the Help button;
- The centre of the screen could remain showing the status of the phase that was running before the fatal error but buttons on this area do not work anymore;
- on buttons bar always there is:
    - a MUTE button (as a fixed and continuous acoustic sequence is started, MUTE button is managed by UI with the effect to permanently mute the speaker);
    - a Menu button allowing the user to access the Tally data.
- All the reporting capabilities of the Tally system can still be used by the operator, to produce user or diagnostic reports of any kind. Such reports of course includes the details of the fatal error as well (as the last item in the report). This allows the operator to produce some sort of documentation for the failed run;
- The “base screen” (ATS screen) remains on Fatal Error (for example, if Menu is exited). There is no navigation out of this screen, so there is no possibility for the user to go to Setup, Fill, etc. screens.

UI handles the same way Fatal Errors detected by itself, after communication of detected anomaly to master (if possible).

(TROUBLE_002) Hardware errors rev.00

Following an example of FE screen :

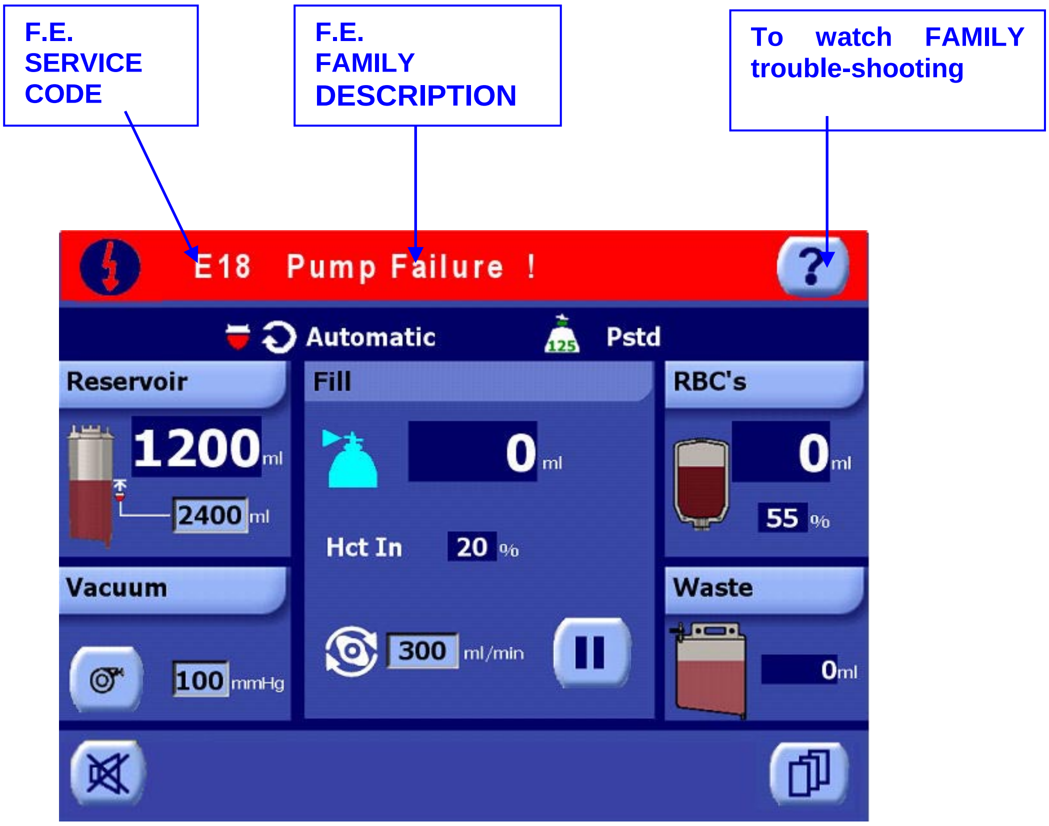

Fig. 11.2-1

11.2.5 Fatal Errors List and Description

SERVICE CODE	IDENTIFICATION	DESCRIPTION
E1	Switch off 30V failed (*DETECTED BY THE* NMC)	This fatal error appears when the deactivation of the 30 Volt power supply of the equipment hasn't been executed (it should be executed by the NMC microprocessor via software every time that the cover lock is deactivated. The NMC unit acts on the switch that interrupts the 30 volts power supply to the equipment that is placed on the NMC board by means of a bit (bit 0) of the latch at the address 490000h. The operation of interrupting the power every time the cover locking system is deactivated is due for safety reasons in order to guarantee that the actuators cannot start when they are accessible to the user. After the action on the switch the microprocessor waits for 300 ms than it checks for a feedback digital signal about the status of the 30 Volt power supply (30 Volt < 7 Volt) indicating whether such power is present or not. If the signal indicates that the 30 Volt current is still present and that, therefore, the switch has not acted in the proper way, then the abnormal condition is detected. The feedback signal is a digital signal which must stay constant (in the same status) for at least 40 ms to be accepted.
E3	SW Configuration not correct or not received (*DETECTED BY THE* NMC)	It may happen in two different events • <u>At the switch on</u> The release of the programs into the equipment (NMC, NUI, NSC and NAC) does not correspond to the one foreseen for the equipment release. This mean that every new SW release is constituted by the combination of the 4 SW which can be at different releases (e.g. the release 5.0 could be constituted by a NMC release 5.0, a NUI release 4.3, a NSC release 4.2, a NAC release 4.2). The NMC unit, , after the switch on, checks that the releases of the different SW (including its own SW) is consistent with the equipment release. To do that it receives from each slave the information about their own release and the configuration in which each slave is capable to work properly. From this information it extracts the highest level which become the level of the SW of the equipment. This SW is used as a reference to check that all of the programs answer to such configuration. • <u>After 45 seconds from the switch on</u> In this event it hasn't received the SW release from one or more Slave units.

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SERVICE CODE	IDENTIFICATION	DESCRIPTION
E4	Time-out the serial communications between NMC and NUI (*DETECTED BY THE* NMC)	The NMC unit does not receive any answer from the NUI when it questions such unit - For more than 38 seconds (approx.) after the switch on - or, further on, if there is an interruption in the serial link longer than 70 ms. (about twice of the time window devoted for such link). In both the events (failure of linking at the start up and interruption of the link) is displayed **E32** but in the trace of the Fatal Error is stored into memory E4**.**
E5	Time-out the serial communications between NMC and NSC (*DETECTED BY THE* NMC)	The NMC unit does not receive any answer from the NSC when it questions such unit - For more than 38 seconds (approx.) after the switch on (the failure of linking at the start up is displayed as **E32**, but in the trace of the Fatal Error is stored into memory E5) - or, further on, if there is an interruption in the serial link longer than 56 ms. (about twice of the time window devoted for such link). (in this event is displayed and stored into memory in the trace of the Fatal Error the code E5)
E6	Time-out of the serial communications between NMC and NAC (*DETECTED BY THE* NMC)	The NMC unit does not receive any answer from the unit NAC when it questions such unit - For more than 38 seconds (approx.) after the switch on (the failure of linking at the start up is displayed as **E32**, but in the trace of the Fatal Error is stored into memory E6) - or, further on, if there is an interruption in the serial link longer than 52 ms. (about twice of the time window devoted for such link). (in this event is displayed and stored into memory in the trace of the Fatal Error the code E6).
E8	Serial error on the line NMC -NUI (*DETECTED BY THE* NMC)	Overrun error, framing o checksum (CRC) on the line NMC-NUI. The NMC has found two consecutive errors on the serial communication for the line NMC-NUI.
E9	Serial error on the line NMC - NSC (*DETECTED BY THE* NMC)	Overrun error, framing o checksum (CRC) on the line NMC - NSC. The NMC has found two consecutive errors on the serial communication for the line NMC - NSC.

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SERVICE CODE	IDENTIFICATION	DESCRIPTION
E10	Serial error on the line NMC -NAC *(DETECTED BY THE* NMC*)*	Overrun error, framing o checksum (CRC) on the line NMC -NAC. The NMC has found two consecutive errors on the serial communication for the line NMC –NAC
E12	Filling of the transmission tails on the line NMC - NUI *(DETECTED BY THE* NMC)	The NMC unit has detected the need to send an information to the NUI when all the room in the memory devoted to store such requests is occupied by messages waiting for dispatching (the transmission waiting to be dispatched can be a maximum of six).
E13	Filling of the transmission tails on the line NMC - NSC *(DETECTED BY THE* NMC*)*	The NMC unit has detected the need to send an information to the NSC when all the room in the memory devoted to store such requests is occupied by messages waiting for dispatching (the transmission waiting to be dispatched can be a maximum of six).
E14	Filling of the transmission tails on the line NMC - NAC *(DETECTED BY THE MASTER UNIT*	The NMC unit has detected the need to send an information to the unit NAC when all the room in the memory devoted to store such requests is occupied by messages waiting for dispatching (the transmission waiting to be dispatched can be a maximum of six).
E16	NMC CRC Flash KO *(DETECTED BY THE* NMC*)* *and* *(DETECTED BY THE UNIT NUI)*	At the switch on the NMC unit calculates the CRC of the flash memory and compares it with the one stored into memory. Such value has been calculated and installed into memory during the SW development. Any difference between these two values indicates that the SW program of the NMC unit is corrupted: the hardware memory on which is installed the software is damaged. In this event the NMC, on the contrary to what stated in the introduction, activates the following procedure: 1. gets the code referring to the error happened 2. disables the current of 30 and12 Volt used for functioning of the actuators 3. disables the functioning of the centrifuge (to work properly the centrifuge needs of an OK at the switch on given by the NMC unit) 4. puts itself into a block status. Of course, the execution of 1. 2. 3. e 4. Is not guaranteed. This Fatal Error can also be detected by NUI.

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SERVICE CODE	IDENTIFICATION	DESCRIPTION
E17	Centrifuge lid open and lock closed (*DETECTED BY THE NMC*)	An anomalous status on lid sensors, or on lid lock, or on lid lock sensor. is detected when: • Inter-processor communication started since at least **500** ms • Centrifuge lid lock status(1) results closed and centrifuge lid status(2) results open since at least 200 ms These conditions tell that a failure occurs as SW will command lock closure only after lid is closed. (1) Lid lock status is read by Actuators unit and then sent to Master unit via serial line (2) 2 signals are used to check centrifuge lid status : • one read by Actuators unit and then sent to Master unit via serial line • one read by Sensors unit and then sent to Master unit via serial line

E18	Differences between the pump flow ordered and pump flow communicated to NMC unit.
	
	(*DETECTED BY THE* NMC)
		This is a check of the NMC unit on the unit NAC. As NAC is responsible for executing the commands referring to the pump, it receives such commands (on/off, set point) and executes them checking the motor by mean of an encoder used as a feedback. The encoder is also used by NAC to calculate the pump speed. The speed information is sent to the NMC unit via serial link. NMC compares the flow obtained from the speed it receives from the serial link with the commands it gave (pump status and set point) with the following limits :
		• Checking does not happen during and at the end of the setup till 2 s.
		• Checking does not happen when the cover is open.
		
		The NMC recognise a fatal error if one of the following happens:
		• If the flow stays for more than 3 s. equal to 0 (pump stopped)
		  – after 3 s since the command pump ON with a standard gradient (not parabolic)
		  – after 5 s since the command pump ON with a parabolic gradient

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SERVICE CODE	IDENTIFICATION	DESCRIPTION
		• if, after 2 s since the command of pump ON – the flow is greater than 9 with respect of a given setpoint lower than 100 ml/min – the flow is greater than 9% with respect of a given setpoint >= 100 ml/min • if, after the command OFF to the pump, the flow is greater than the following values in the following conditions: OFF command ⇩ *0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16* | | | | | seconds **3 4 5 6 8** flow detected >70 >50 >30 >20 >0 (after the command OFF the control is not active for the first 3 s; from 3 to 4 s if the flow is greater than 70 shows the fatal error; from 4 to 5 s if the flow is greater than 50 shows the fatal error; from 5 to 6 s if the flow is greater than 30 shows the fatal error; from 6 to 8 s if the flow is greater than 20 shows the fatal error; after 8 s if the flow is greater than 0 shows the fatal error) • if, after that the “stable flow” has been reached, the flows remains for more than 3 s exceeding – ± 9 if the programmed setpoint is lower than 100 ml/min 9% if the programmed setpoint is greater than >= 100 ml/min –

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SERVICE CODE	IDENTIFICATION	DESCRIPTION
		"stable flow" is defined when the value of the flow stays for at least 3 s within ± 5 of the programmed setpoint. This is achieved by restarting the timer of the 3 s every time that the flow exceeds ± 5 the programmed setpoint at the end of the gradients (3 s for standard gradients, 5 s for parabolic ones) after every passage of the pump from OFF to ON and after every variation ordered by the setpoint. When the flow is stable it'd no more necessary to restart the 3 ss timer, if the flow doesn't stabilise (it means that the pump is probably overriding) then enters the check on the flow > of the setpoint as previously explained. Generally, when the pump is ON every change of direction and every variation of the setpoint are considered as transitions from OFF to ON: the timers are restarted.
E19	Pump direction different from the one ordered *(DETECTED BY THE NMC)*	The NMC unit checks that the programmed direction is the same of the one showed by a specific sensor of the rotation direction placed on the pump rotating tree. This signal must be maintained constant (in the same status) for at least 100 ms. to be accepted. The check is done according to the following rules : • it is not done during the setup phase (it is done but not to check a fatal error, if fails it signal an appropriate SETUP WARNING) • it is not done when the cover is open • it is not done when the pump speed, programmed ON, is lower than 5 rpm (about 33 ml/min) • is executed only after that two pump rotations have been completed after every command of start or of change direction (to make reliable the direction signal based on the sensor placed on the pump motor tree which provides an updating of the information at every rotation) • in the above mentioned conditions is showed the error if the inconsistency is maintained for a further rotation and half of the pump.
E20	Wrong rotation direction of the centrifuge *(DETECTED BY THE NMC)*	Disabled.

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SERVICE CODE	IDENTIFICATION	DESCRIPTION
E21	Differences between the ordered clamps status and the status as detected by sensors at Hall effect *(DETECTED BY THE* NMC*)*	The NMC unit detects an inconsistency between the status of the clamp as programmed and the one actually found by the sensors at Hall effect. The error is detected according to the following rules : • The check is not performed when the cover is open • it is not done during the setup phase (it is done but not to check a fatal error, if fails it signal an appropriate SETUP WARNING) • The check is performed only after 3 seconds since the command of clamps position is sent to the slave NAC which has the task to execute such command • The error is showed in the above mentioned conditions if the inconsistency between the signal status of position and the programmed position is maintained for at least 2 seconds (the position signal is got by examining the three digital signals referring to the three clamps under a SW filter of 40 ms).
E22	Power Good failed *(DETECTED BY THE* NMC*)*	The Power Good signal as given by the power supply indicates a malfunctioning on the nominal current of 30 Volt as it is provided (the current exceeds the 34 Volt or is lower than 26 Volt). The reading of the signal is done by the NMC unit which filters it for 40 ms (every change in the status of the signal must be maintained for at least 40 ms to be accepted). The abnormal condition is considered a malfunctioning only when the switch which interrupts the flow of the 30 Volt is closed (30 Volt enabled) since at least 400 ms.
E23	Overheating of the board MBE *(DETECTED BY THE* NMC*)*	The temperature sensor on the board MBE (NMC) indicates that the temperature of 45°C has been reached. The correspondent digital signal is acquired by the microprocessor NMC which filters it for at least 40 ms. The error is showed if this condition stays for at least 2 seconds.

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SERVICE CODE	IDENTIFICATION	DESCRIPTION
E25	Fuse of the current V30 broken *(DETECTED BY THE* NMC)	The enabling of the 30 Volt power current of the equipment is executed: • At the switch on, via hardware • Further on via software by the NMC µP every time that the locking command is give to the cover lock (as a pre-condition for the command the arm and the cover must be closed). In both the event the NMC unit checks (300 ms after the switch on and 400 ms after the software command) a feedback signal about the status of the 30 Volt power current (30 Volt < 7 Volt) in order to verify whether such power supplying is present or not. If the signal indicates that the 30 Volt nominal current is actually lower than 7 volt the error is displayed. The feedback signal is a digital signal which must stay constant (in the same status) for at least 40 ms to be accepted.
E26	NMC Watch Dog *(DETECTED BY THE* NMC)	The component Max691, that is present on the NMC board, has sent a reset to the microprocessor of the NMC unit. This may happen when, after the switch on, the component is not "refreshed" with the time foreseen. At every startup (switch on, reset of the micro) the NMC checks whether the content of a ram vector contains the keyword REALWD; if so it shows the fatal error. At the switch on the ram vector for sure does not contain the keyword (the content of such vector is random); after the initialisations the vector is written with the keyword. When the routine NMI (switch off) is activated the keyword is "cancelled" from the vector; if the Max691 sends a reset between the switch on and the switch off (the vector still contains the keyword) the NMC recognise the condition of fatal error.
E27	Failure of the buffered Ram *(DETECTED BY THE* NMC)	At the switch on, if the CRC of the buffered ram is different from the one stored into memory at the switch off the buffered ram is re-initialised with the default values and the CRC is recalculated. If this CRC is different from the one in default, which has been calculated during the release with an emulator, the component is failed and the fatal error is immediately showed.

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SERVICE CODE	IDENTIFICATION	DESCRIPTION
E28	A/D Conversion fail on board NMC *(DETECTED BY THE* NMC*)*	The check on the converter A/D of the board NMC is failed. The check is executed by the NMC with the following rules: • 3 analogic fixed signals are selected on the channels AN10, AN11 and AN12: 4,04 Volt (±0.2V) on AN10, 1,92 Volt (±0.1V) on AN11 and 0.96 Volt (±0.05V) on AN12. • If one of the signals differs from the nominal value that is expected for more than 10%, then the failure is showed
E30	Failure of the calibration data re-initialisation from E2PROM after buffered Ram failure *(DETECTED BY THE* NMC*)*	At the switch on, if the CRC of the buffered ram is different from the one stored into memory at the switch off, the buffered ram is re-initialised with the default values and the CRC is recalculated. If this CRC is congruent with the one in default, calibration data stored on E2PROM have to be downloaded: if the CRC of these data is different from the one stored into E2PROM memory, the component is failed and the fatal error is immediately showed
E31	Key not confirmed *(DETECTED BY THE UNIT NUI)*	The unit UI has not received from the NMC the confirmation after a key has been pressed, within 5 seconds. The architecture of the correct functioning for the NUI forecast that at every key pressed must follow, before to continue in accepting more keys, a confirmation from the NMC the code of the pressed key has been received.
E32	Time-out serial link between NMC - NUI *(DETECTED BY THE UNIT NUI)*	This advice is given by the NUI when it does not receive requests from the NMC for more than 10 s after the switch on or further on for any interruption of the communication longer than 500 ms. To analyse this fatal error it is necessary to verify trough diagnostics what has been stored into memory from the NMC. When an E32 is present is possible to find in diagnostics an **E26** (see) NMC Watch Dog or an **E4** (see) Time-out serial link; in both the events the NMC was not able to send the code of fatal error because it has been re-set (E26) or because the serial link was not available (E4).

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SERVICE CODE	IDENTIFICATION	DESCRIPTION
E36	A/D Conversion fail on board NSC *(DETECTED BY THE* NSC*)*	The check on the converter A/D of the board NSC is failed. The check is executed by the NSC with the following rules: • 3 analogic fixed signals are selected on the channels AN0, AN1 and AN2: 4.12 Volt (±0.2V) on AN0, 1.96 Volt (±0.1V) on AN1 and 0.98 Volt (±0.05V) on AN2. • If one of the signals differs from the nominal value that is expected for more than 10%, then the failure is showed • The signals used are obtained as arithmetic average of the last 10 conversions (1 conversion at each query of the NMC via serial link every 100 ms. approximately).
E37	Blood loss sensor test Failed *(DETECTED BY THE* NSC*)*	The test in T0 of the blood loss sensor failed. This test, executed by the NSC, allows to verify that the blood loss signal, duly filtered (every variation must stay for at least 10 ms continuously to be accepted), is active time by time with a frequency not higher than 7.5 seconds. A dedicated autotest circuit is used.
E39	Time-out serial link between NSC - BC Sensors *(DETECTED BY THE* NSC*)*	This advice is given by the NSC when it does not receive any answer from the BUFFY COAT for more than 10 s after the switch on or further on for any interruption of the communication longer than 70 ms or in case of two consecutive errors (overrun, framing or checksum (CRC)) on the serial communication for the line NSC –BUFFY COAT.
E40	A/D Conversion fail on NSC - BC Sensors	The check on the converter A/D of the board NSC-Buffy Coat is failed. The check is executed by the PIC 18F252 with 3 analogic fixed signals are selected on the channels AN2, AN3 and AN4.
E42	+/-12 V Power Supply Failure *(DETECTED BY THE* NSC*)*	The check is executed by the NSC by means of OVERV-12, UNDERV-12 digital signals: it can possible to detect under-voltage or overvoltage conditions of +12V Power Supply (range valid is [9.9V:15V]) and -12V Power Supply (range valid is [-10.3V: -15V]) : if Power Supply is out of these ranges, the corresponding OVERV-12 or UNDERV-12 signals are activated and the failure is showed

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SERVICE CODE	IDENTIFICATION	DESCRIPTION
E51	Wrong pump speed: check from the unit NAC *(DETECTED BY THE UNIT ACT)*	The check executed by the unit NAC on the pump speed has detected a failure. The check is done according to the following: • No checking when the cover is open • When the pump is programmed off the error status is showed if the speed get by the encoder is >0 for more than 7 seconds • When the pump is programmed off the error status is showed if the speed get by the encoder is >153 rpm (1000 ml') for more than 1 seconds • The pump speed measured with the encoder is greater than 173 rpm (about 1147 ml/min) since at least 3 seconds • The pump speed get by the encoder is = 0 rpm for 2 seconds continuously after at least 3 seconds since the pump started; this control brings to just a warning if it happens in the setup during the phases of autotest and self-loading of the pump. • During the phases of the pump acceleration (see the duration as foreseen in table A) the speed got by the encoder exceeds the set point (see the tolerances on the speed in table B) for at least 1.5 s. • Other than in the phases of acceleration/ deceleration the pump speed as got from the encoder differs (+/-) from the setpoint of a fixed amount depending on the setpoint itself (see table B) for more than 3 seconds continuously. In table A are indicated the times for which this check is not active after a setpoint variation or in the transition of the pump from off status to on status. This check brings to just a warning if it happens in the setup during the autotest and self-loading phases of the pump.
E52	Wrong rotation direction of the pump motor *DETECTED BY THE NAC)*	The error is showed if the rotation direction of the pump motor as found by the unit NAC with the related sensor is inconsistent with the direction programmed for a volume moved by the pump greater than 3.5 ml (it's about half a rotation of the pump) with the pump speed higher than 4 rpm. The status modifications of the digital signal of pump direction are accepted only if they are confirmed for at least 10 ms.

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SERVICE CODE	IDENTIFICATION	DESCRIPTION
E53	Overheating of the Pump Motor driver *(DETECTED BY THE NAC)*	If the unit NAC find active the overheating sensor (T>145°C) for at least 2 seconds continuously, then the fatal error is showed.
E54	Overcurrent of the Pump Motor *((DETECTED BY THE NAC)*	This error is showed if the unit NAC detects that the piloting of the pump motor requested a current as great as the one of saturation (foreseen of 2 A) for a time greater than the 83% of the last 30 seconds (the piloting signal is sampled every 100 ms and compared with the saturation value foreseen). This error occurs also if the analog draw current sensing signal (pin P4.3) is over 4800 (2,82 A) for at least 900 ms.
E55	Wrong centrifuge speed *(DETECTED BY THE NAC)*	The check executed by the unit NAC on the centrifuge speed (encoder) has detected a failure. The check is done according to the following: • No checking when the cover is open • When the centrifuge is programmed off (at the end of the active stopping phase that ends at 208 rpm) the error status is showed if the speed get by the encoder is >100 rpm for more than 15 seconds • When the centrifuge is programmed off (at the end of the active stopping phase that ends at 208 rpm) the error status is showed if the speed get by the encoder is >200 rpm for more than 5 seconds • The centrifuge speed measured with the encoder is greater than 5700 rpm since at least 5 seconds or is greater than 5900 rpm • The centrifuge speed get by the encoder is = 0 rpm for 2 seconds continuously after at least 5 seconds since the centrifuge started • Other than in the phases of acceleration/deceleration the centrifuge speed as got from the encoder ,when it is ON, differs from the setpoint more than 150 rpm for more than 5 seconds continuously In table C are indicated the times for which the last check described is not active after a setpoint variation or in the transition of the centrifuge from off status to on status
E56	Wrong rotation direction of the Centrifuge Motor *(DETECTED BY THE NAC)*	Disabled

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SERVICE CODE	IDENTIFICATION	DESCRIPTION
E57	Overheating of the Centrifuge motor *(DETECTED BY THE NAC)*	If the unit NAC find active the overheating sensor on the centrifuge motor (T>75°C on the dissipater of the power MOSFET) for at least 200 ms. continuously, then the fatal error is showed
E58	Overcurrent of the Centrifuge Motor *(DETECTED BY THE NAC)*	This error is showed if the unit NAC detects that the power supply of the centrifuge requested the maximum of the power allowed for a time greater than the 98% of the last 30 seconds sampling the piloting power every 100 ms.
E59	Anomalous signal PWM of centrifuge piloting *(DETECTED BY THE NAC)*	The control circuit on the centrifuge piloting signal PWM acquired by the unit NAC indicates an anomaly on this signal (when the piloting is active the actuator connected to it is powered by mean of a PWM monitored outlet. Any lack of transitions of the PWM signal for more than 0.5 ms is communicated to the microprocessor trough the status (low) of the PWM signal Fault). The digital signal of “PWM fault” is read with a filter which passes only the status transitions which stays for at least 3 s continuously This control is active only when the centrifuge is piloting active..
E60	Failure of the centrifuge lid locking system *(DETECTED BY THE NAC)*	An anomalous status of the cover locking system (command circuit and sensor of position) is detected when there’s the following situation: • Cover closed AND • Pump programmed ON, OR • Centrifuge speed >= 10 rpm and, at the same time, • Lock ordered in closure since at least 1 second and • The sensor of locking status indicates open for at least 3 seconds

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SERVICE CODE	IDENTIFICATION	DESCRIPTION
E61	Anomalous functioning of the NMC unit (<u>DETECTED BY THE NAC</u>)	The unit NAC detects an anomalous behaviour of the NMC in the following events: 1. NMC check presence failure: • The keyword (see Table D) from the NMC that should be sent to NAC within 6 seconds since the switch on is not received (at the end of this document is showed the content of the keyword) ***OR*** • After the first receiving of the keyword from the NMC passes more than 1.5 seconds between two further receipts One of the anomalous status described below is communicated to the unit NAC for at least three times consecutively (to allow the stabilisation of the signal): 2. NMC forbidden phase transition: • From Setup to another phase different than Stop • From Stop to Spill phases • From Empty to Spill phases • From Unload to another phase different than Stop or Setup • See Table E: the phases forbidden, depending on protocol selected, are reported 3. NMC forbidden Clamps position or pump direction: • Setup phase: the programmed clamps status is not one of the allowed status: autotest, stop, empty (offset pressure sensor), wash (calib. HCT) or none. • Stop phase: the programmed clamps status is not one of the allowed status: stop or none ***OR*** during the stop phase the programmed pump status is ON On the following phase, with pump programmed ON: • Fill phase: If Protocol is *Pstd/Popt/Post*: Empty clamp open ***OR*** Wash clamp open ***OR*** pump clockwise rotation

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SERVICE CODE	IDENTIFICATION	DESCRIPTION
		If Protocol is *PPP/PRP1/PRP2*: Wash clamp open ***OR*** pump clockwise rotation (Empty clamp can be open if Concentrate function is enabled) • Return phase: Empty clamp open ***OR*** Wash clamp open ***OR*** pump counter-clockwise rotation • Wash phase: the status is neither one of the two allowed which are: pump clockwise rotation ***AND*** Fill clamp open ***OR*** Empty clamp open ***OR*** pump counter-clockwise rotation ***AND*** Wash clamp opened • Empty phase: If Protocol is *Pstd/Popt/Post:* Pump counter-clockwise rotation ***OR*** Rapid Transfer enabled ***AND*** Fill clamp is open ***OR*** Wash clamp open If Protocol is *PPP/PRP1/PRP2*: Fill clamp is open ***OR*** Wash clamp open ***OR*** pump counter-clockwise rotation • Concentrate phase (activated from Stop or during Fill phase or during Spill phase) : Fill clamp open ***OR*** Wash clamp open ***OR*** pump clockwise rotation • Spill phase: Wash clamp open ***OR*** pump clockwise rotation (Empty clamp can be open if Concentrate function is enabled) • Purge phase: Fill clamp is open ***OR*** Wash clamp open ***OR*** pump clockwise rotation • Prime IV phase: the status is neither one of the two allowed which are: pump counter-clockwise rotation ***AND*** Wash clamp open ***OR*** pump clockwise rotation ***AND*** Empty clamp opened

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SERVICE CODE	IDENTIFICATION	DESCRIPTION
		4. Unload phase: Wash clamp is open ***OR*** pump counter-clockwise rotation NMC not allowed Vacuum operation settings: • Protocol selected is Post (Factory or User) ***AND*** vacuum operation mode is INTRA • Protocol selected is PPP, PRP1, PRP2, Pstd or Popt (Factory or User) ***AND*** vacuum operation mode is POST • Vacuum operation mode set-point is INTRA ***AND*** range aspiration set-point is out of –50 ÷ –300 mmHg • Vacuum operation mode set-point is POST ***AND*** range aspiration set-point is out of –10 ÷ –100 mmHg
E68	Programmed position of the clamps not reached *(DETECTED BY THE NAC)*	The NAC unit detects an inconsistency between the status of the clamps as programmed and the one actually found by the sensors at Hall effect when are verified the following conditions: • During the setup has been executed at least one time the initial phase of autotest of the clamps group. • At least 800 ms have been passed since the command of clamps position change is received from NMC
E87	A/D Conversion fail on board NAC *(DETECTED BY THE NAC)*	The check on the converter A/D of the board NSC is failed. The check is executed by the NSC with the following rules: • 3 analogic fixed signals are selected on the channels AN0, AN5 and AN6: 1.2 Volt (±0.05V) on AN0, 4.08 Volt (±0.2V) on AN5 and 2.04 Volt (±0.1V) on AN6. • If one of the signals differs from the nominal value that is expected for more than 10%, then the failure is showed
E120	Fill Clamp board Watch Dog *(DETECTED BY THE NAC)*	The component Max6301, that is present on the Fill Clamp board, has sent a reset to the microprocessor of the Fill Clamp unit. This may happen when, after the switch on, the component is not “refreshed” with the time foreseen. This watchdog signal is a digital signal received by NAC, that can check this condition of fatal error

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SERVICE CODE	IDENTIFICATION	DESCRIPTION
E121	Wash Clamp board Watch Dog *(DETECTED BY THE NAC)*	The component Max6301, that is present on the Wash Clamp board, has sent a reset to the microprocessor of the Wash Clamp unit. This may happen when, after the switch on, the component is not “refreshed” with the time foreseen. This watchdog signal is a digital signal received by NAC, that can check this condition of fatal error
E122	Empty Clamp board Watch Dog *(DETECTED BY THE NAC)*	The component Max6301, that is present on the Empty Clamp board, has sent a reset to the microprocessor of the Empty Clamp unit. This may happen when, after the switch on, the component is not “refreshed” with the time foreseen. This watchdog signal is a digital signal received by NAC, that can check this condition of fatal error
E123	Overcurrent of pump loop ejector *(DETECTED BY THE NAC)*	This error is showed if the unit NAC detects an analog current sensing value greater than 3800 mA for at least 500 ms when the ejector is activated or greater than 200 mA when the ejector is deactivated
E124	Fill Clamp board Handshake failure *(DETECTED BY THE NAC)*	On power-on NAC sends to “FIll clamp board" a sequence of signals. If NAC does not receive the correct answers from clamp board, NAC declares fatal error preventing the use of the machine.
E125	Wash Clamp board Handshake failure *(DETECTED BY THE NAC)*	On power-on NAC sends to “Wash clamp board" a sequence of signals. If NAC does not receive the correct answers from clamp board, NAC declares fatal error preventing the use of the machine.
E126	Empty Clamp board Handshake failure *(DETECTED BY THE NAC)*	On power-on NAC sends to “Empty clamp board" a sequence of signals. If NAC does not receive the correct answers from clamp board, NAC declares fatal error preventing the use of the machine.
E135	Failure of UI: wrong key code (detected by the NMC)	If NMC has received from the unit UI a key code not valid regarding the current context, then the fatal error is showed.

(TROUBLE_002) Hardware errors rev.00

SERVICE CODE	IDENTIFICATION	DESCRIPTION
E136	Failure of Stop button (detected by the NMC)	An anomalous status on Stop button is detected when: • Inter-processor communication started since at least 500 ms AND • Stop button configurations (1) are in opposite status since at least 500 ms (1) 2 signals are used to check Stop status: • one read by Actuators unit and then sent to Master unit via serial line • one read directly by Master

Table 11.2-1

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11.3 (TROUBLE_003) Alarms & Warnings rev.00

11.3.1 Contents

All during working time of the XTRA system many controls are active to detect particular operative conditions requiring automatic intervention by the system and/or information to be shown on the screen.
Software of Master unit superintends these controls also using other units and machine sensors for this task. In case a particular operative condition is detected, different measures are applied depending on the kind of condition detected.

Depending of criticality of detected conditions they can be grouped in 2 general categories:

- **Warnings;**
- **Alarms.**

An additional category exists related to events which are symptomatic of troubles able to bring the system in a state of “out of control”. This category is named Fatal Errors.
A further division of Warnings and Alarms can be defined considering the moment when they can occur.
A first group is related to checks performed only once before execution of a case or, in any case, at every machine switch-on: they are called **T1 tests**.

11.3.2 Generalities

In order to allow management of concomitant detection of alarm or warning conditions a priority is assigned to each particular condition.
Only one alarm/warning at once can be the *active* one (meaning also the visible on) among all the possible alarms/warnings.
If conditions for 2 alarm / warning are true in the same time, both of them assume the *entering* status*.* Then an alarm management task declares the highest priority one as the *active* alarm/warning while the other one remains hidden in his *entering* status.
When a condition for an alarm/warning is detected while a lower priority alarm/warning is active, the higher priority alarm becomes the *active* alarm and the previous *active* alarm becomes an hidden *entering* alarm.
When a condition for an alarm/warning is detected while an higher priority alarm/warning is *active*, the higher priority alarm remains the *active* alarm and the new alarm becomes an hidden *entering* alarm.
When an alarm becomes active the *current status* of the machine is saved on a dedicated alarm memory area (phase automata status, pump status, centrifuge status, Clamps status and Vacuum status when alarm condition is detected) by Master unit in order to be able to restore it when the alarm exits.
On exit of an *active* alarm, depending on the user choice (Resume or Stop can be possible user actions) the saved *current status* can be retrieved and restored or not.
As soon as an active alarm is exited if *entering* (hidden) alarms/warnings exist the higher priority among them becomes the new active one.
Following rules are applied, in general, by Master unit, every time an operative condition related to an alarm or a warning is detected:

a. A special state in the state-transition diagram of Master software exists that is called “dummy state” where normal execution flow is drift. This causes a stop of the normal state evolution of software automata;
b. Pump stops (if not yet still);
c. Other commands for other actuators can be sent depending on the particular detected condition;

d. Information is sent to NUI telling an associated alarm code;
e. NUI
    - it changes the screen present when the alarm/warning occurs (in case of alarms/warnings occurring as a consequence of a button pressed this means the screen where the button is pressed) according to the received alarm code:
        - If a Menu or an Help screen is present it disappears : exiting the Menu/Help screen takes the system to the current underlying ATS screen;
        - A message appears on the top area of the screen instead of the original one;
        - Yellow colour highlights parts of the screen if detected condition belongs to Warning category while red colour is used in case detected condition belongs to Alarms;
        - Special graphical information could be shown;
        - Dedicated buttons are proposed instead of original ones.
    - an acoustic signal is activated.
f. This state persists till user intervention or an higher priority alarm occurs;
g. Alarms, stopping the pump, occurring when the process is already interrupted by PAUSE button, clear the pause : this means that when the process is resumed after the alarm, PAUSE button has to be manually pressed by the user if needed.
h. After Resume of an alarm the control related to it is enabled again.

11.3.3 Alarms and Warnings disabling

Only two ways exist allowing the user to disable monitoring of a few alarm/warning conditions:

a. Through Settings – Configuration – Warnings screen it is possible to disable two volumetric checks:
   i. RBC BAG FULL check;
   ii. WASTE BAG FULL check.

In case one of these checks is disabled a confirmation screen appears whenever the system is switched on or the user want start a new case after a disposable unload. Re-enabling of one of this check is only possible through the same Settings – Configuration Mode – Warnings screen.

b. Once following alarms are declared, from their same alarm screen it is possible to disable monitoring of their condition for the session of use in progress only (checks are automatically re-enabled at the beginning of next case or if the machine is switched-off):
   i. Blood loss in centrifuge;
   ii. Empty line clamped.

This possibility (alarm override) allows the user to conclude a case in progress excluding one or the both of these checks. This possibility could be necessary in case of fail of related detector (s). A confirmation is requested to the user whenever he wants disable each one of these 2 alarms.

When one of these four alarm checks (a.i., a.ii., b.i., b.ii.) at least is disabled, a warning symbol (the same regardless the check that has been disabled) appears on each operative screen during all machine functioning.

11.3.4 Alarms and Warnings - Acoustic signals

An acoustic signal is emitted every time a warning/alarm becomes the active one.
As a general rule, alarms/warnings related to checks of conditions performed immediately after a button pressure have a short and finite acoustic signal. On the contrary, alarms/warnings that can occur when the user is not close to the machine have an endless acoustic sequence.
The user is able to silence only endless acoustic sequences (it is not possible to silence finite acoustic signals) when they are played, through a Mute button on the alarm/warning screen. The effect of this action is to temporarily stop acoustic sequence: if after 45 seconds from silencing, the alarm/warning remains the *active* alarm/warning, then the acoustic sequence restart (and the user is able to press again the Mute button if he wants).

Through Settings – Configuration – Warnings screen, it is possible to select the kind of endless acoustic sequence between two options.
Once selected, this sequence is associated to all alarms/warnings that require an endless acoustic sequence.
Alarms/warnings that require a finite acoustic sequence always are associated to a fixed acoustic signal composed by 3 short beeps separated by short intervals of silence for total time of the whole sequence of 2 seconds.

For a few alarms/warnings that are associated by default to endless acoustic sequences the user is able to decide to have the finite sequence associated. These alarms/warnings are:

- *AIR IN LINE/RESERVOIR EMPTY Acoustic Signal* - Standard/Reduced
- *STANDBY TOO LONG Acoustic Signal* - Standard/Reduced
- *BOWL NOT EMPTIED Acoustic Signal* - Standard/Reduced
- *VOL DRAWN FROM BOWL Acoustic Signal* - Standard/Reduced
- *LAST BOWL : RBC BAG EMPTY Acoustic Signal* - Standard/Reduced
- *WEIGHT NOT RELIABLE Acoustic Signal* - Standard/Reduced

This possibility is available on Settings – Configuration – Warnings screen.

When at least one of these alarm/warning sequences is changed, a warning symbol (the same regardless the alarm/warnings that has been disabled and the same that is shown when an alarm/warning is disabled) appears on each operative screen during all machine functioning. In addition, on the same confirmation screen appearing whenever the system is switched on or the user want start a new case after a disposable unload with an alarm/warning disabled, the list of alarm with acoustic sequence changed appear too.

Acoustic volume of warnings is also selectable from Settings – Configuration – Warnings screen among 3 possibilities:

- High: define level;
- Medium: define level;
- Low: define level.

Default volume is High volume for all acoustic sequences.
Volume for Alarms is High and it is not changeable.

11.3.5 Alarms and Warnings – Stop button

Stop button is always available regardless the alarm/warning.
Pressure of Stop button during an alarm/warning brings the system in the Ready screen clearing the *active* alarm and the *entering* alarms too if any.
As pressure of Stop button during process usually disables Auto Start automation (temporarily), exiting an alarm/warning by Stop button has the same effect.

11.3.6 Alarms and Warnings – List and description

Following the complete list of Alarms and Warnings if XTRA.
Each one is described through two parts:

<u>Generalities</u>**:**

- Conditions;
- Priority;
- Alarm/Warning code: Data IDentifier value (ALARM) sent to NUI by NMC;
- Safety measures: actions to be performed on actuators when the Alarm/Warning occurs;
- Exit mode;
- Options available: Override, exclusion, acoustic sequence reduction.

<u>Effect on UI</u>**:**

- Title: the message shown on the area on the top of the Alarm/Warning screen (1);
- Colour (Red or Yellow);
- Buttons: effect on the buttons available on the Alarm/Warning screen divided in:
  - Buttons on the area on the top of the Alarm/Warning screen (2);
  - Buttons on the area on the centre of the Alarm/Warning screen (3);
  - Buttons on the area on the bottom of the Alarm/Warning screen (4)
- Displet bordered (5);
- Acoustic signal (Endless, finite);
- Notes: including specific graphic effects or other details.
-

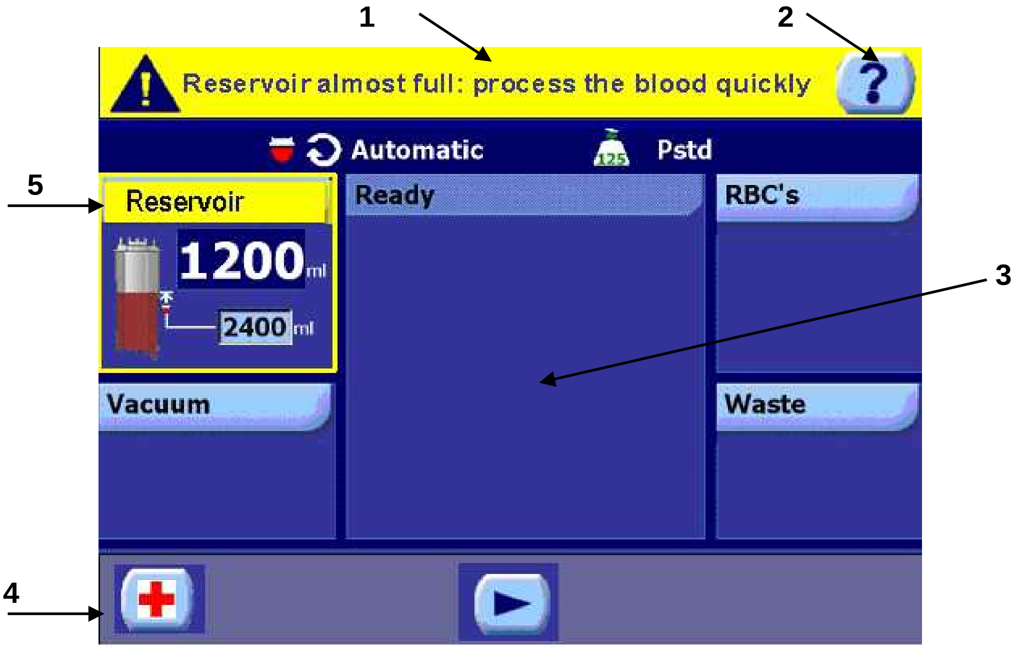

Fig. 11.3-11.3-1

Common characteristics of each alarm/warning like availability of Stop button and presence of  or  symbol by side of the warning or alarm title are not repeated in the following description: only exceptions to this general rule are described.

As a general rule related to UI management in case of Alarm/Warning, the screen present when an alarm/warning code is received by UI changes following these actions :
- Screens belonging to Menu Screens group are automatically closed;
- Screens belonging to Help Screens group are automatically closed;
- Warning Triangle in case of warning or circle symbol in case of alarm appears on the left side of the message box of the screen (top);
- Background colour of message box of the screen (top) changes assuming Background colour of specific alarm/warning;
- Message on the message box of the screen (top) changes assuming title of specific alarm/warning;

- Status area does not change in general;
- One of 5 displets identified by Reservoir, Vacuum, RBCs, Waste (or PPP PRP), Central could be bordered (see picture up here) using background colour of alarm/warning;
- Displets status (open/close) remains unchanged;
- Buttons on message box (top) become buttons defined for each specific alarm/warnings (in general help button appears on the right side of the message box);
- Buttons on Reservoir, Vacuum and central displets (centre) change according to requirements of each specific alarm/warning (generally only Play/Pause button disappears);
- Buttons on the buttons bar (bottom) change according to requirements of each specific alarm/warning (generally all existing buttons are substituted by new buttons);
- The acoustic sequence related to the alarm/warning starts.

This general rule can be applied on screens having the layout described on picture up here. Due to possibility of having alarms/warnings on screens with different layout, exceptions are necessary:

- In case of alarms/warnings occurring when a confirmation or access screen is present (Auto Start Activating, Emergency Activation, Last Bowl activation) UI applies general rule on screen active before the confirmation or access screen. To allow this, Master unit restores it (the screen active before the confirmation or access screen) before sending alarm/warning code to UI (or better with the same message if possible).
- Alarms/warnings whose occurrence can be possible both on standard screens or on End Case screens have a different alarm/warning code when occurring on standard screens or on End Case screens (usually when an alarm/warning occurring on End Case screens a different management is also needed in terms of buttons present)

Number	Alarm/Warning	Cause
1	**Fluid loss in centrifuge: Biohazard risk**	The centrifuge fluid loss sensor detects a liquid presence on centrifuge wall. Two bonds of surface conductivity sensor are short circuited
2	**On-board vacuum pump out of order**	There are several causes for this alarm, detected by Actuators unit and then transmitted via serial line to Master unit: • VACUUM_INTRA_PRESSURE_FAIL: Mismatch detected between INTRA OPERATIVE pressure value read by 2 microcontrollers on Vacuum Unit; • VACUUM_POST_PRESSURE_FAIL: Mismatch detected between POST OPERATIVE pressure value read by 2 microcontrollers on Vacuum Unit; • VACUUM_INTRA_PRESSURE_T1TEST_FAIL: T1 test performed on INTRA OPERATIVE pressure sensor failed; • VACUUM_POST_PRESSURE_T1TEST_FAIL: T1 test performed on POST OPERATIVE pressure sensor failed; • VACUUM_INTRA_OVERPRESSURE: Negative pressure measured by Vacuum unit through INTRA pressure sensor overcame -320 mmHg threshold; • VACUUM_POST_OVERPRESSURE: Negative pressure measured by Vacuum unit through POST pressure sensor overcame -120 mmHg threshold; • VACUUM_OVER_TEMP_ERROR: Temperature measured on Vacuum unit overcomes 50 °C; • VACUUM_OVER_TEMP_SENSOR_T1TEST_FAIL: T1 test of temperature sensor fail (Sensor SPI communication fail); • MAIN_SAFETY_SWITCH_T1TEST_FAIL: T1 test of safety switch controlled by main microcontroller failed;

		• SECOND_SAFETY_SWITCH_T1TEST_FAIL: T1 test of safety switch controlled by second (monitor) microcontroller failed; • INTERNAL_INTERPROC_COMM_TO: Time-out on serial communication between main microcontroller and second (monitor) microcontroller; • INTERNAL_INTERPROC_COMM_ERROR: Checksum/Framing/Overrun error on serial communication between main microcontroller and second (monitor) microcontroller.OM_COMM_ERROR Detected by Vacuum unit transmitted via serial line to Actuators unit and then to Master unit. Access to E2PROM failed; • E2PROM_T1TEST_READ_FAIL: Reading T1 test on E2PROM failed; • E2PROM_T1TEST_WRITE_FAIL: Writing T1 test on E2PROM failed; • TIMEOUT_COMM_VACUUM_FAIL: Communication time-out on Actuators-Vacuum serial line; • VACUUM_SER_COM_FAIL: Double serial error on the same communication window on Actuators-Vacuum serial line.
3	**Empty line occluded**	Sensor unit detects an excessive pressure exerted by RBC line on pressure sensor integrated in the clamp group. This check is active in EMPTY, EXTRA EMPTY and I.V.PRIME phase.
4	**Bowl not filled / not washed**	This message is displayed when the user presses the Empty button before the Wash phase is not concluded yet.(1) (1) Wash phase is considered non concluded for the cycle in progress if for the cycle in progress : • 90% or more of programmed Wash volume has not been used during the cycle in progress;

		• "Minimum wash quality might be already reached" has not been occurred during cycle in progress; • Mode of Operation was not manual and WASH-EMPTY function was not OFF during last part of wash phase of the cycle in progress and the user manually selects Empty.
5	**Bowl not filled / not washed *(from End Case)***	This message is displayed when the user presses from the "End Case" screen the Empty button before the Wash phase is not concluded yet.
6	**Emptying again will send air into the rbc bag**	This operation may send air into the RBC bag. This alarm appears when the user presses Empty button on "End of case" screen and he has already pressed Empty button on "End of case" screen at least once during the current case or Last bowl function was completely performed at least once during the current case.
7	**Bowl washed. Blood should not be returned**	Master Unit outputs this message when the user wants to return some washed blood to reservoir, pressing the Return button (from Special), and the Wash phase has already been concluded for the cycle in progress(1).
8	**Bowl not filled**	The bowl is not completely filled. This alarm appears when the mode of operation is 1Touch or Automatic and the user presses the Wash button (passing from Pause status) during Fill or Concentrate before the bowl is filled up.
9	**Blood not sufficient to concentrate automatically**	The blood contained in the RBC bag and/or the level of blood inside the bowl is not sufficient to start the concentration phase.
10	**RBC bag empty. Bowl not filled**	The volume inside the RBC bag is not sufficient to properly fill the bowl during a "Concentrate" phase(2) (included during Last Bowl); (2) At least one among these condition is true: • At least a total amount of 10 ml of air has been detected during last 20 ml moved by the pump; • A counter increased by 1 when 1 ml of air is detected and decreased by 1 when 1 ml of liquid is detected, reached 5 (lower limit of the counter being 0).
11	**Waste bag full. Empty or replace it.**	Master Unit outputs this message when the volume withdrawn to WASTE bag is over the limit (9,5l). To determine liquid volume, air sensor and pump encoder are used.

<table>
<tr><td>12</td><td>PPP bag full. Empty or replace it.</td><td>Master Unit outputs this message when the volume withdrawn to PPP bag is over the limit. To determine liquid volume, air sensor and pump encoder are used.
<table>
<tr><td>bowl</td><td>threshold (ml)</td></tr>
<tr><td>BT 55</td><td>875</td></tr>
<tr><td>BT 125</td><td>932</td></tr>
<tr><td>BT 175</td><td>971</td></tr>
<tr><td>BT 225</td><td>1049</td></tr>
</table></td></tr>
<tr><td>13</td><td>PRP bag full. Empty or replace it.</td><td>Master Unit outputs this message when the volume withdrawn to PRP bag is over the limit. To determine liquid volume, air sensor and pump encoder are used.
<table>
<tr><td>bowl</td><td>threshold (ml)</td></tr>
<tr><td>BT 55</td><td>875</td></tr>
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<tr><td>BT 175</td><td>971</td></tr>
<tr><td>BT 225</td><td>1049</td></tr>
</table></td></tr>
<tr><td>14</td><td>RBC bag full. Empty or replace it.</td><td>Master Unit outputs this message when the volume withdrawn to RBC bag is over the limit (0,8l). To determine liquid volume, air sensor and pump encoder are used.</td></tr>
<tr><td>15</td><td>Check centrifuge arm closure</td><td>Master Unit entering in a procedure active phase, detetcts that arm is not in locked position on bowl head.
Master Unit receives informations about bowl arm position by direct sensing and by serial line from Actuators unit. Sensor is doubled.</td></tr>
<tr><td>16</td><td>Centrifuge lid open</td><td>Master Unit receives by serial line informations about the lid from Actuator and Sensor units via serial line. The centrifuge cover status switches from closed to open but remains open for 2 seconds or more.</td></tr>
<tr><td>17</td><td>Check centrifuge lid lock</td><td>Actuator unit detects lock open position after two locking attempts commanded from the Master Unit.</td></tr>
<tr><td>18</td><td>Centrifuge lid lock blocked in closed position</td><td>Master Unit sent Centrifuge lid lock open command but after 2 seconds Centrifuge lid lock status resulted still closed (1)
(1) Lid lock status is read by Actuator unit and then sent to Master unit via serial line.</td></tr>
<tr><td>19</td><td>Weight not reliable. Autostart temporarily</td><td>The weight, measured by Sensors unit and sent to Master unit via serial line, is unstable on reservoir holder, that is to say, there is a positive or negative variation greater than 800 g in 2 s.</td></tr>
</table>

	disabled. ***(pre condition)***	
20	**Make sure the reservoir weight is reliable before proceeding**	"Weight not reliable (Pre condition)" warning is active since more than 10 seconds
21	**Abnormally long fill cycle** ***(Intra or Post)***	The RBC detector used to detect next filling threshold see no RBCs, so that more than default fill volume has been pumped into the bowl. This condition could be an evidence of RBC detectors failure.
22	**Bowl should be empty**	The Air Sensor could be faulty. The volume emptied from the bowl is higher than expected.
23	**Bowl did not empty completely**	The bowl did not empty completely. Processed liquid volume during Empty phase is lower than expected.
24	**Whole blood bag empty.**	The Air Sensor is detecting air in the fill line.
25	**RBC bag empty. Bowl not filled**	During a Fill-Concentrate or a Spill-Concentrate of a Pre-operative protocol, the Air Sensor is detecting air in line.
26	**Wash bag empty**	The Air Sensor is detecting air in the wash line when the voolume of washing solution used during current cycle doesn't exceed 90% of programmed washing solution
27	**Reservoir empty. Bowl not filled**	With AUTO or 1TOUCH Operating mode set, the Air Sensor is detecting air while a Fill phase is running
28	**Disconnect the patient from the machine**	User selects an intra-operative or a preoperative protocol when a postoperative protocol is in progress
29	**Stand-by too long:** ***"alarm name"***	The pump is still while centrifuge is running due to intervention of a warning/alarm and this condition persists for more than 5 minutes
30	**Stand-by too long**	The pump is still while centrifuge is running due to pump paused by the user and this condition persists for more than 5 minutes.
31	**Minimum wash quality might be already reached**	Sensor Unit detetcs a good transparency of waste line by Waste Line Color Indicator
32	**Minimum wash quality might not be reached yet**	Sensor Unit detetcs a quite low transparency of waste line by Waste Line Color Indicator
33	**Process quickly to avoid vacuum**	The volume of blood inside the reservoir has reached the preset safety level. Measured weight overcomes warning threshold continuously for more than 5 s.

	deactivation	
34	**RBCs detected during Purge**	The sensor detects more than 3 ml of RBCs returning into the bowl when the pump is running during Purge.
35	**Reservoir full: on-board vacuum pump disabled**	Sensor Unit detects that reservoir is full of blood. It is a necessary warning to avoid whole blood loss for reservoir damaging. Vacuum pump is disabled, during weight emergency activation
36	**Unload limit reached**	User presses Unload button more than ten time within a ten minute period
37	**Abnormally long fill cycle *(Seq)***	More than default fill volume has been pumped into the bowl, but the RBC detector, used to detect the filling threshold, is telling “no blood”. This condition could be an evidence of B.C. sensors failure
38	**Bowl did not empty completely: do not start the new cycle before emptying the bowl**	Master Unit detects air presence throught the Air Sensor during an EMPTY phase before the expected value is withdrawn out of bowl.
39	**Inconsistent vacuum mode**	The stand-alone vacuum pump is set on a different mode respect the one required by the wake up protocol
40	**Memory not functioning. Part of the data has been lost.**	Memory might have lost user protocol names and/or user protocol parameters. The CRC check of under battery memory performed by Master unit, or of data related to protocols (protocol names) performed by User Interface unit, at power on failed.
41	**Backup memory failure**	Check of integrity of data stored on E2PROM memory performed by Master Unit at power on failed.
42	**Bowl not washed**	Master Unit outputs this message when the user wants to empty the bowl without performing/ending the wash phase.
43	**Reservoir empty. Bowl not filled *(post)***	The Air Sensor detects air while the Fill phase is running during a Post-operative protocol in AUTO or 1TOUCH mode.
44	**Reservoir empty. Bowl not filled *(post) (No action)***	No action performed for 3 minutes when “Reservoir empty. Bowl not filled” warning (# 43) is active
45	**Reservoir empty. Bowl not filled (*manual)***	The Air Sensor detects air while the Fill phase is running during an Intra-operative protocol in MANUAL mode.
46	**Reservoir empty.**	No action performed for 3 minutes when “Reservoir empty. Bowl

	Bowl not filled (*manual) (No action)*	not filled” warning (# 45) is active
47	**Reservoir empty. Bowl not filled (*Post*) (*manual)***	The Air Sensor detects air while the Fill phase is running during a Post-operative protocol in MANUAL mode.
48	**Reservoir empty. Bowl not filled (*manual) (No action)***	No action performed for 3 minutes when “Reservoir empty. Bowl not filled” warning (# 47) is active
49	**Blood not sufficient to concentrate automatically *(post)***	The blood contained in the RBC bag and/or the level of blood inside the bowl are not sufficient to start the concentration phase.

Table 11.3-1

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12 DISMANTLING

12.1 (DISM_001) Opening the Unit rev.00

12.1.1 About this card

The purpose of this card is to describe how to remove the XTRA panels.

12.1.2 Procedure

For this equipment it is possible to remove separately the left and right panel and the front one, without removing the XTRA from the cart.

12.1.2.1 Left and right panels

- Remove the screw caps placed on the rear part of the equipment on the 6 screws (3 for each side panel);
- Unscrew the 6 screw TCCE M 5x12 (3 for each panel);
- Draw the left panel out pushing it toward the back;
- To remove the right panel push it just a little toward the back and slide it outside;
  Be careful not to damage the conductive gasket that puts the right panel on the ground.

12.1.2.2 Front Panel

- Remove the four screws TCCE M 4x12 (two per each side) which fix the front panel to the frame;
- Disconnect the SPEAKER AMP connector;
- Remove the front panel.

(DISM_001) Opening the Unit rev.00

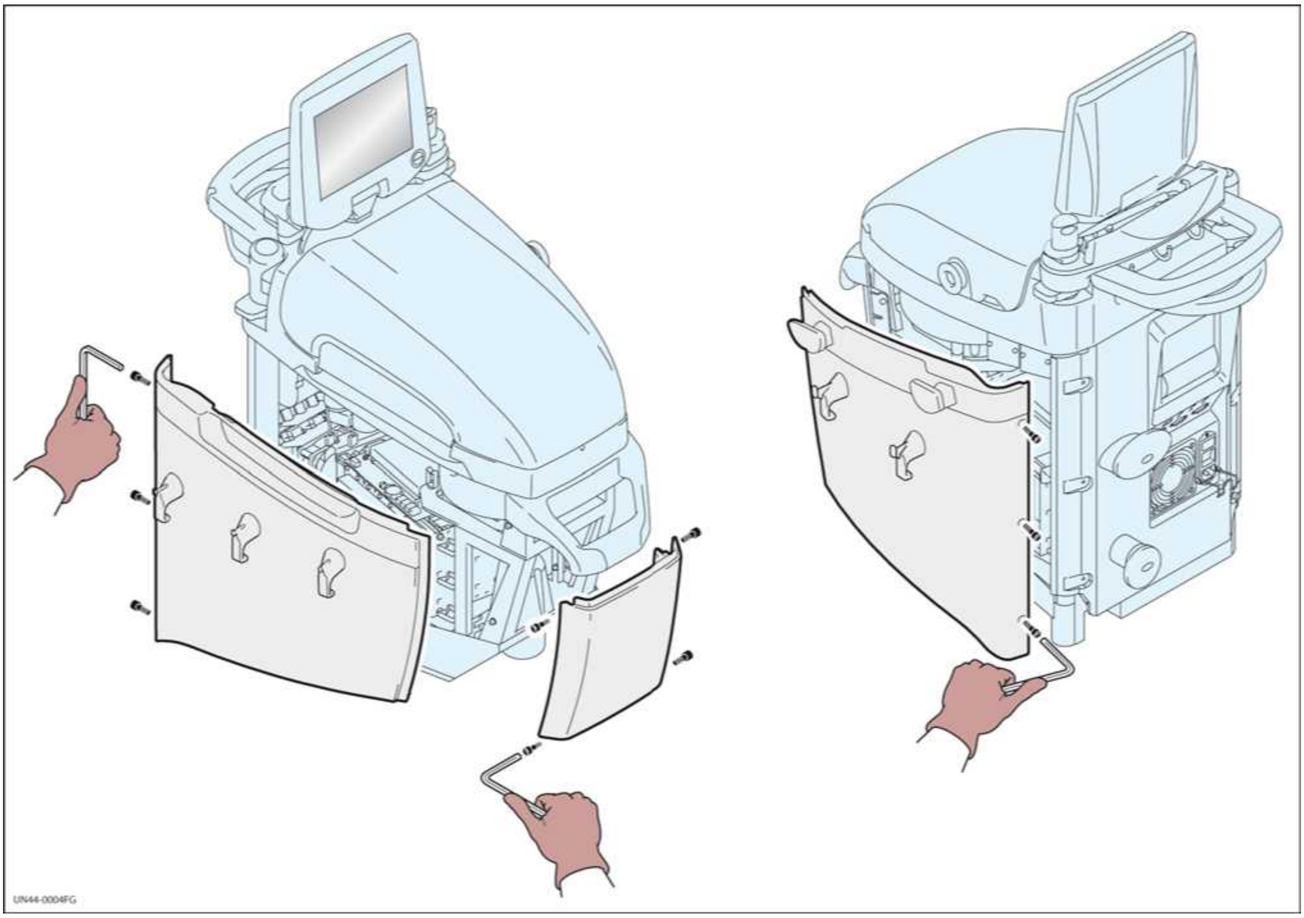

Fig. 12.1-1

12.2 (DISM_002) Locating the parts rev.00

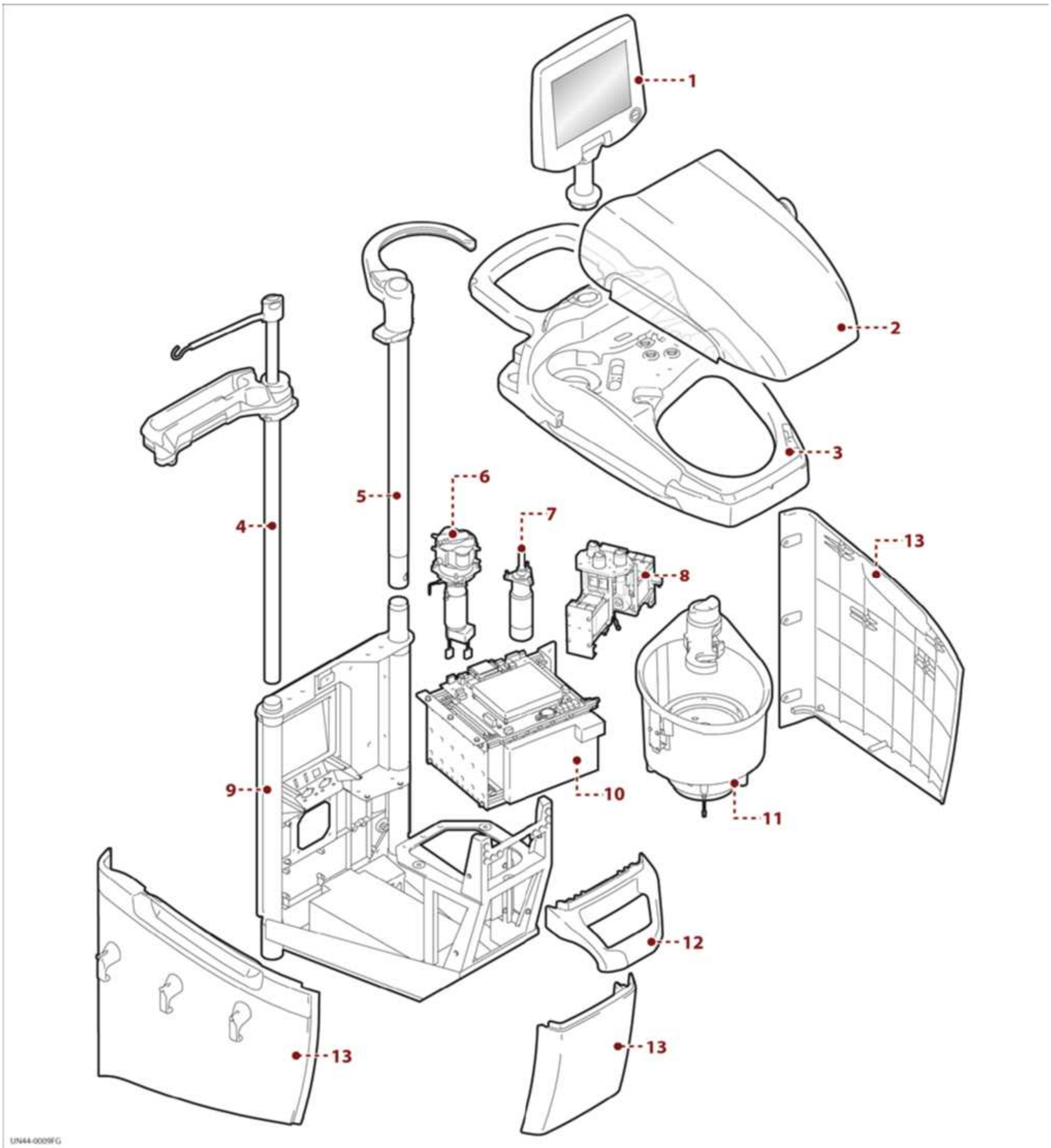

Fig. 12.2-1

(DISM_002) Locating the parts rev.00

1) Display Group;
2) Cover;
3) Top;
4) Bags I.V. Pole;
5) Reservoir I.V. Pole;
6) Roller Pump group;
7) Disposable Ejector;
8) Clamp Group;
9) Equipment Frame;
10) Rack Group;
11) Centrifuge Group;
12) Handle;
13) Side and Front Panels.

12.3 (DISM_003) Functional Verification Test rev.00

- Switch the XTRA on in Diagnostic Mode;
- Press “Electronics checks” and then “CPUs Status”;
- Check there the link between micro processors as following:
  - NMC-Master:
    - NUI-link is UP
    - NAC link is UP
    - NSC link is UP
- Check there the link indication in the NAC-Actuators Vacuum section (microP link test):
  If Vacuum pump is present check “vacuum link is UP”
  If vacuum is not present check “Vacuum link is DONW”

- Press CPU Status and then Power Supply and check that (voltages test):
  - a) the ON status is displayed at the +30V EN command and +30V_On/Off status functions;
  - b) the OK status is displayed at the +30<7V and +5V NUI status functions.
- Press Electronic Checks;
- Press Actuators Checks and test;
- Press Centrifuge Lid Lock;
- Open and close the cover and check the status change in Lid Position NAC;
- Through pressing the Lock button, check the opening and closing of the lock and the relative visualizations Lid Lock Command and Status functions (OFF lock open, ON lock closed);
- Press Centrifuge Lid Lock and then Cassette Ejector;
- Press Ejector Autotest and check the ejector correct functioning by moving it up and back down if some seconds;
- Press Cassette Ejector and then Clamps;
- Press Autotest buttons in Prime Clamp and wait till the completion of the test at the end the CLOSED status will shown in NAC and NMC functions;
- Press Autotest buttons in Wash Clamp and wait till the completion of the test at the end the CLOSED status will shown in NAC and NMC functions;
- Press Autotest buttons in Empty Clamp and wait till the completion of the test at the end the CLOSED status will shown in NAC and NMC functions;
- Press Clamps and then Pump;
- Press Enable and then ON: check the pump rotates counterclockwise;
- Press ON, the pump stops;
- Press Pump and then Centrifuge;
- Press Enable and then ON: check the centrifuge rotates counterclockwise;
- Press ON, the centrifuge stops;
- Press Actuators Checks and test;
- Press Sensors Calibration and test;
- Press Haematocrit (HCT);
- Insert an opaque body in the HCT sensor (It is sufficient to insert a sheet of paper);
- Check the RxFactor and RxCount value increase:
- Press Haematocrit (HCT);
- Press Haemoglobin (HGB);
- Insert an opaque body in the HGB sensor (It is sufficient to insert a sheet of paper);
- Check the RxCount value decreases;
- Press Haemoglobin (HGB);
- Press Buffy Coat;

- Insert the cod. 63044 tool bowl in the centrifuge with the Test Side in front of the Buffy-Coat Low Level sensor;
- Check at the BC-Low Level function there is a value in the range 840÷860;
- Check at the BC-High Status function there is a value higher than 619;
- Cover the Buffy-Coat High Level sensor (it is sufficient a sheet of paper between the bowl and the sensor) and check the displayed value is lower than 599;
- Press Buffy Coat;
- Press Reservoir scale;
- Check the values displayed in Weight fucntion is 0
- Press on the cardiotomy arm and check the Weight value increases;
- Press Reservoir scale;
- Press Kit Reader;
- Insert tool 63045 in the bar code reader and check the correct reading of the sensor;
- Press Kit Reader;
- Press Other Sensors;
- Open and close the bowl arm and check the status change in both NMC and NAC displets in the Bowl Arm section;
- Wet the Blood Loss sensor and check the status change into WET in the NSC displet in the Blood Loss section;
- Dry the Blood Loss sensor with a clean cloth and check the status change into DRY in the NSC displet;
- Insert the cod.63047 air sensor tool in the air sensor and check the status changes from Air to Liquid in both NMC and NAC displets in the Air Bubble Detector section;
- Press on the RBC Line with the tool 63053 (Clamped Empty Line Sensor tool) and check the displayed voltage (mV) concerning this pressure sensor increases;
- Press Sensor Calibration and test and remove the cod.63047 air sensor tool from the air sensor;
- Turn the XTRA off.

12.4 (DISM_004) cod. 65604 Air Sensor rev.00

12.4.1 About this card

The purpose of this card is to describe the **air sensor** replacement, code **65604**.

12.4.2 Procedure

12.4.2.1 Tools

- Set of screwdrivers;
- Allen keys 2,5 mm.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.4.2.2 Disassembly

- Remove the left panel, see the **(DISM_001) Opening the Unit** card;
- Disconnect the BUBBLE AMP flying connector;
- Unscrew the four TCCE M 3x10 screws with the flat and split washers which fix the air sensor to the top;

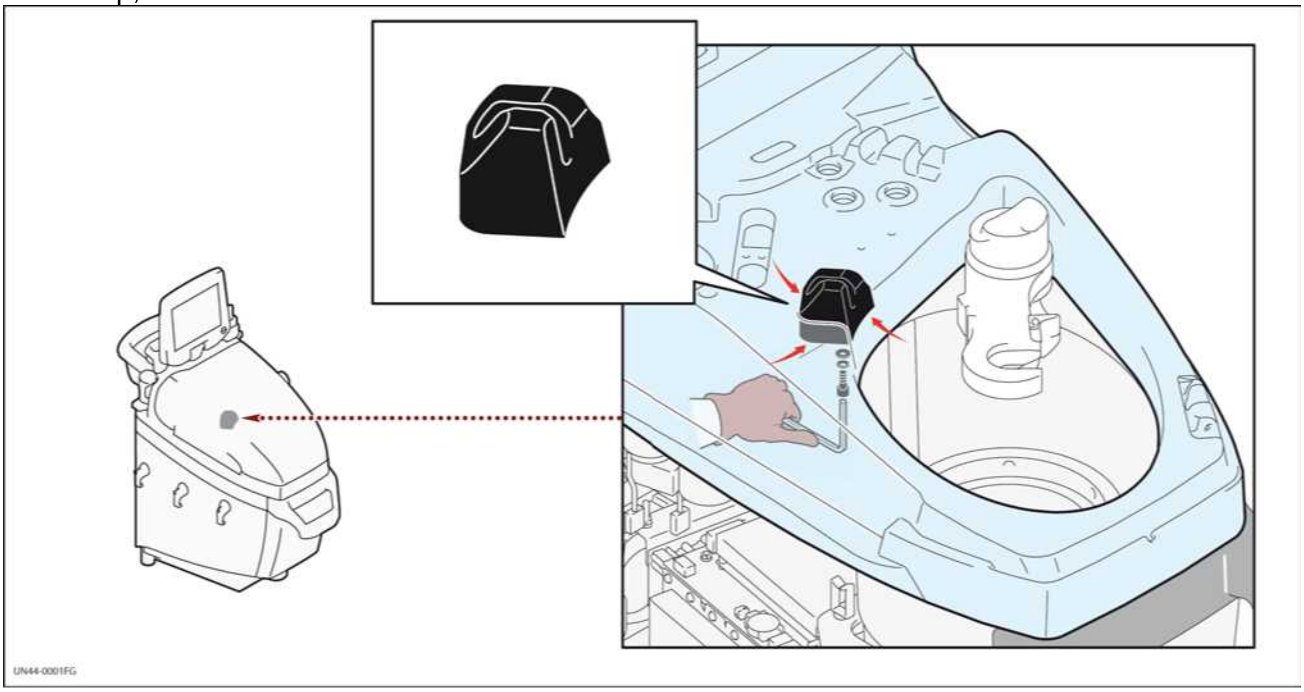

Fig. 12.4-1

- Remove air sensor with its cable from the top.

12.4.2.3 Reassembly

- Insert the new air sensor with its cable in its hole on the top;
- Fix the air sensor to the top screwing the four TCCE M 3x10 screws with the flat and split washers;
- Connect the BUBBLE AMP flying connector;

12.4.3 Functional test

Perform the **Air Sensor Test** described in the **(TEST_005)** card.
Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.5 (DISM_005) cod. 65605 Centrifuge Motor rev.00

12.5.1 About this card

The purpose of this card is to describe the **centrifuge motor** replacement, code **65605**.

12.5.2 Procedure

12.5.2.1 Tools

- Screwdriver set;
- Allen key 3 mm.

12.5.2.2 Disassembly

- Open all the XTRA panels, see the **(DISM_001) Opening the Unit** card;
- Remove the liquid collection tank group, see the **(DISM_076) cod.65695 Liquid Collecion Tank Group** card;
- Disconnect the J2 connector from the NAD board;
- Unscrew the four TCCE M 4x12 screws on the centrifuge motor and remove them with their split washers and the ground cable fixed to the front left screw. Pay attention to the plastic joint connecting the motor to the chuck;
- Remove the centrifuge motor;

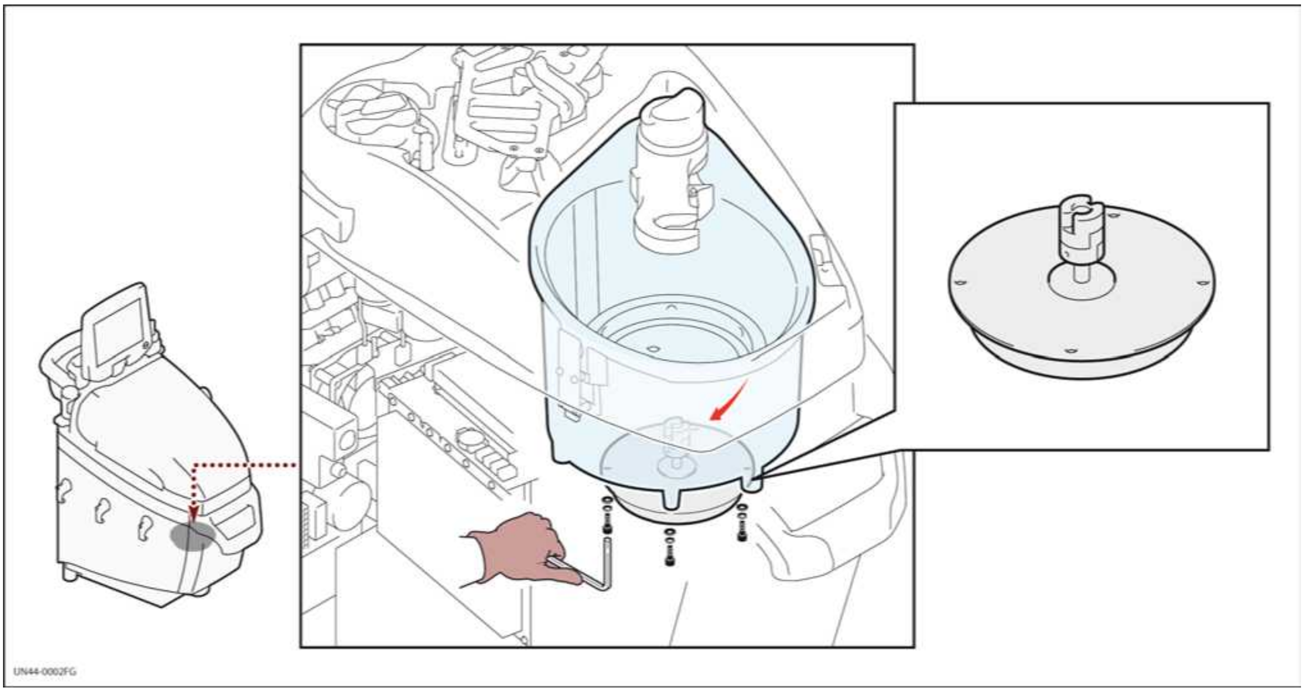

Fig. 12.5-1

12.5.2.3 Reassembly

- Insert the metallic joint aligning it to the top of the motor pivot, and fix it with the set screw;
- Insert the plastic joint;

- Insert the new centrifuge motor in the correct position by aligning the motor shaft to the shaft of the chuck;
- Screw the ground cable on the front left screw and the 4 screws M4X12 without tighten them;
- Connect the motor cable J2 to the NAD board;
- Put the Liquid Collection Tank Group back on the frame, see the **(DISM_076) cod.65695 Liquid Collecion Tank Group** card.

12.5.3 Calibration

The centrifuge motor needs to be aligned to the chuck to avoid noises problem coming from the assembled group. Proceed as following:

- Switch on XTRA in **Diagnostics mode \Actuators Checks and test\Centrifuge;**
- Run the centrifuge at slow speed (max 1500 rpm);
- Wait the assessment of the centrifuge to the chuck shaft;
- With the centrifuge running tighten the screws on the centrifuge motor paying attention that the centrifuge group noises are not increasing;
- In case it could be necessary to rotate the centrifuge motor and aligned it to the chuck shaft in a different position. This must be done rotating the motor and inserting it into the chuck shaft in the opposite side, to change the position of the plastic joint which makes the coupling between the two shafts (Fig.12.5-2).

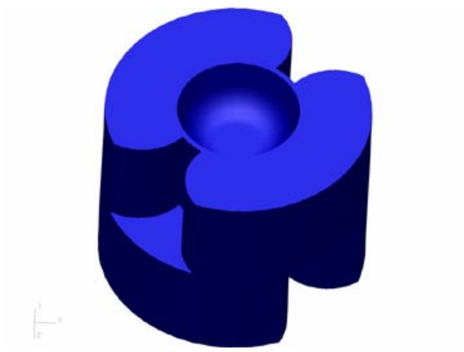

Fig. 12.5-2

12.5.4 Functional test

Perform the **Centrifuge Test** described in the **(TEST_003)** card.
Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

Reset the **Working Time** of centrifuge in **Diagnostic Mode/Logs/Working Times** page.

12.6 (DISM_006) cod. 65606 XTRA Clamp rev.00

12.6.1 About this card

The purpose of this card is to describe the **clamp** replacement, code **65606**

12.6.2 Procedure

12.6.2.1 Tools

- Set of screwdrivers;
- Allen keys 2,5 and 3 mm.

12.6.2.2 Disassembly

- Remove the right panel, see the **(DISM_001) Opening the Unit** card;
- Disconnect the three J5 CBN (PRI,WAS,EMP) and J3 HHR flying connectors;
- Unscrew the four TCCE M4X12 screws which fix the clamp group metallic support to the top, paying attention not to lose the relative washers;
- Drow the clamp group down, paying attention to the cables (note the ground cables are still on);
- Unscrew the three TCCE M3x10 screws which fix the ground cables to the clamps, paying attention not to lose the relative washers;

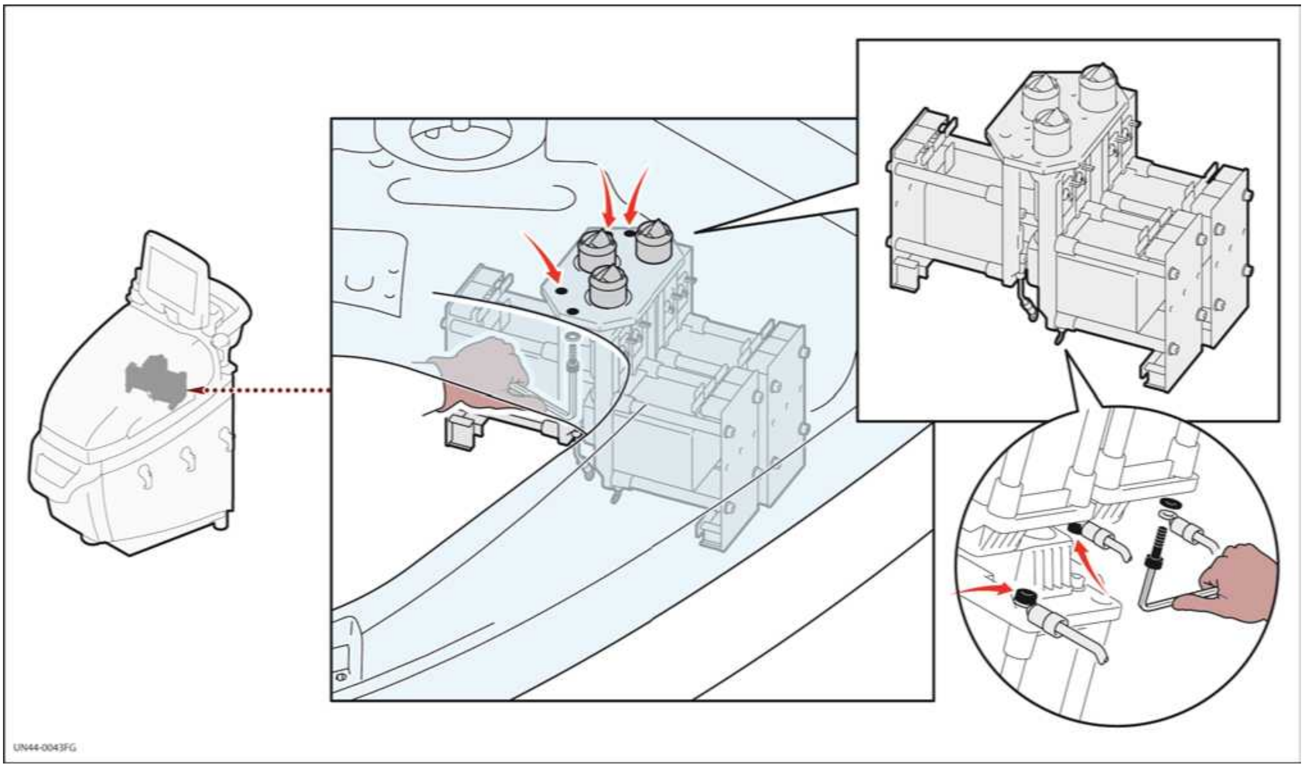

Fig. 12.6-1

- Remove the out of order clamp OR ring;
- Remove the out of order clamp from the metallic support, unscrewing the three TCCE M3x10 screws with the related flat and split washers.

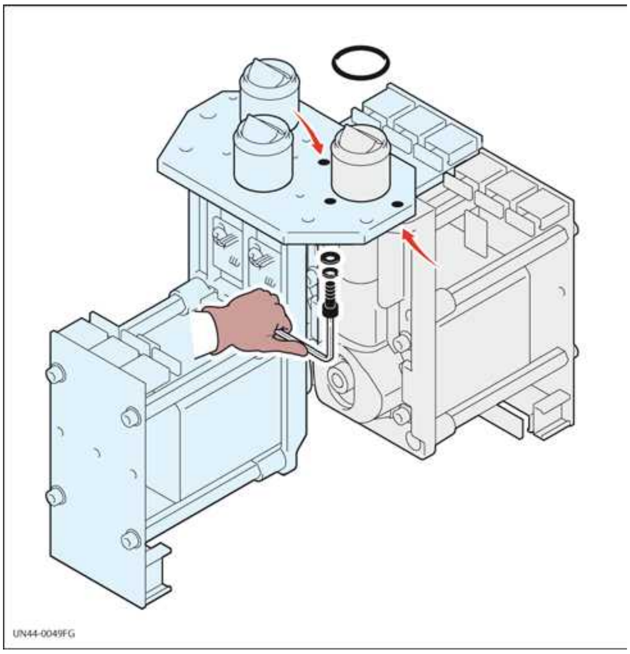

Fig. 12.6-2

12.6.2.3 Reassembly

- Put the new clamp on the metallic support, screwing the three TCCE M3x10 screws with the related flat and split washers, to do this:
  - Put at first the inner screw in its hole on the plastic support, then rotate the clamp inword and finally screw it;
  - Screw the other two screws;
- Insert the OR ring from the upper part of the clamp;
- Connect the ground cables back to the clamp group, screwing the three TCCE M3x10 screws with the related washers;
- Put the clamp group back under the top, fixing it with the four TCCE M4X12 screws and the relative washers;

Connect the three J5 CBN (PRI,WAS,EMP) and the J3 HHR flying connectors.

12.6.3 Functional test

Perform the **Clamp Test** described in the **(TEST_005)** card.
Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

Reset the **Working Time** of the replaced clamp in **Diagnostic Mode/Logs/Working Times** page.

12.7 (DISM_007) cod. 65607 Clamped Empty Line Sensor rev.00

12.7.1 About this card

The purpose of this card is to describe the **clamped empty line sensor** replacement, code **65607.**

12.7.2 Procedure

12.7.2.1 Tools

- Set of screwdrivers;
- Allen keys 2,5 and 3 mm.

12.7.2.2 Disassembly

- Remove the right panel, see the **(DISM_001) Opening the Unit** card;
- Remove the Clamp Group, see the **(DISM_006) cod. 65606 XTRA Clamp** card;
- Disconnect the RED PRESS AMP flying connector;
- Unscrew the two KA 40x16 screws, with the related flat washers, which fix the pressure sensor support to the top.

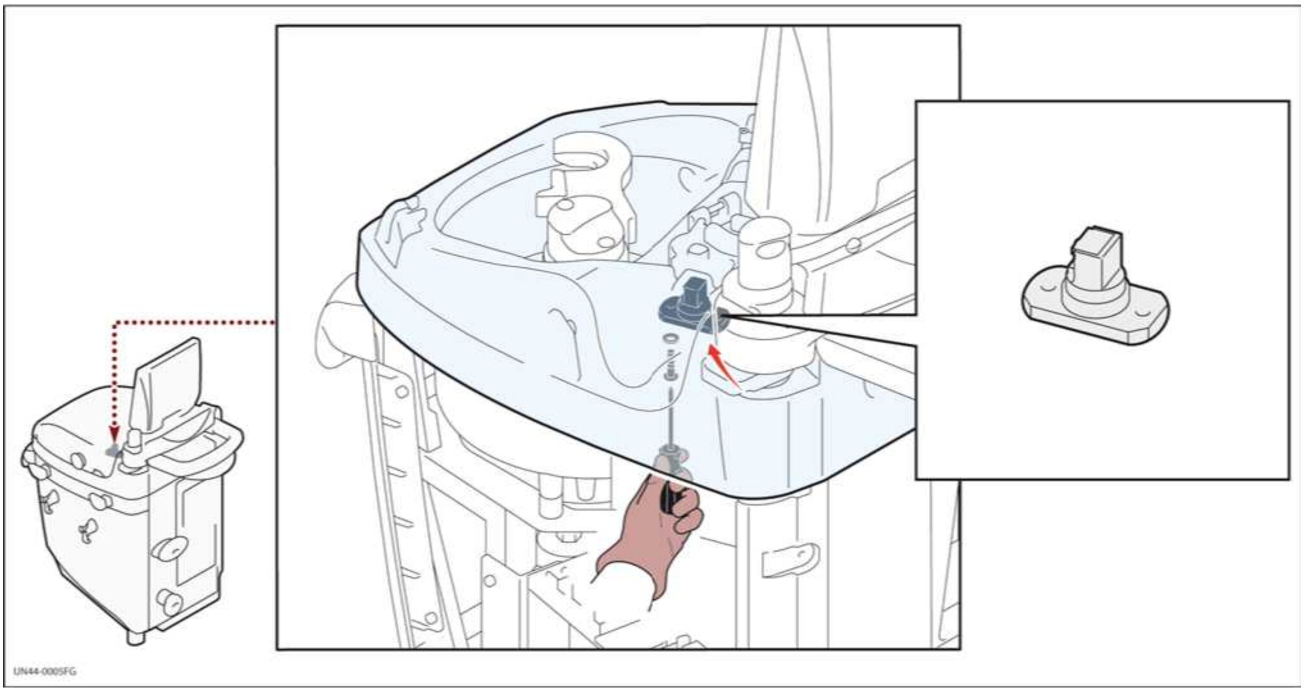

Fig. 12.7-1

12.7.2.3 Reassembly

- Fix the new pressure sensor with its support under the top, screwing the two KA 40x16 screws, with the related washers;
- Put the Clamp Group back under the top, see the **(DISM_006) cod. 65606 XTRA Clamp** card;
- Connect the RED PRESS AMP flying connector.

12.7.3 Functional test

Perform the **Clamped Empty Line Sensor Test** described in the **(TEST_006)** card.

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.8 (DISM_008) cod. 65608 XTRA Display Cover rev.00

12.8.1 About this card

The purpose of this card is to describe the **XTRA display cover** replacement, code **65608**.

12.8.2 Procedure

12.8.2.1 Tools

- Set of screwdrivers;
- Allen keys 2,5 mm.

12.8.2.2 Disassembly

- Remove the two black screw caps on the display group rear cover;
- Unscrew the two KA 40x10 screws which fix the rear cover to the front one;
- Remove the rear cover;
- Disconnect the CN1 INVERTER and the display illumination power cable connectors from the display inverter;
- Unscrew the two TCCE 3x6 screws with the related flat washers which fix the inverter to its white support, paying attention not to lose to the two plastic washers between the inverter and the support itself;
- Remove the display inverter;
- Disconnect the CN2 TOUCH C and the touch panel cable connectors from the touch screen control board;
- Unscrew the four TCCE 4x6 screws with the related flat washers which fix the touch screen control board to its white support;
- Remove the touch screen control board;

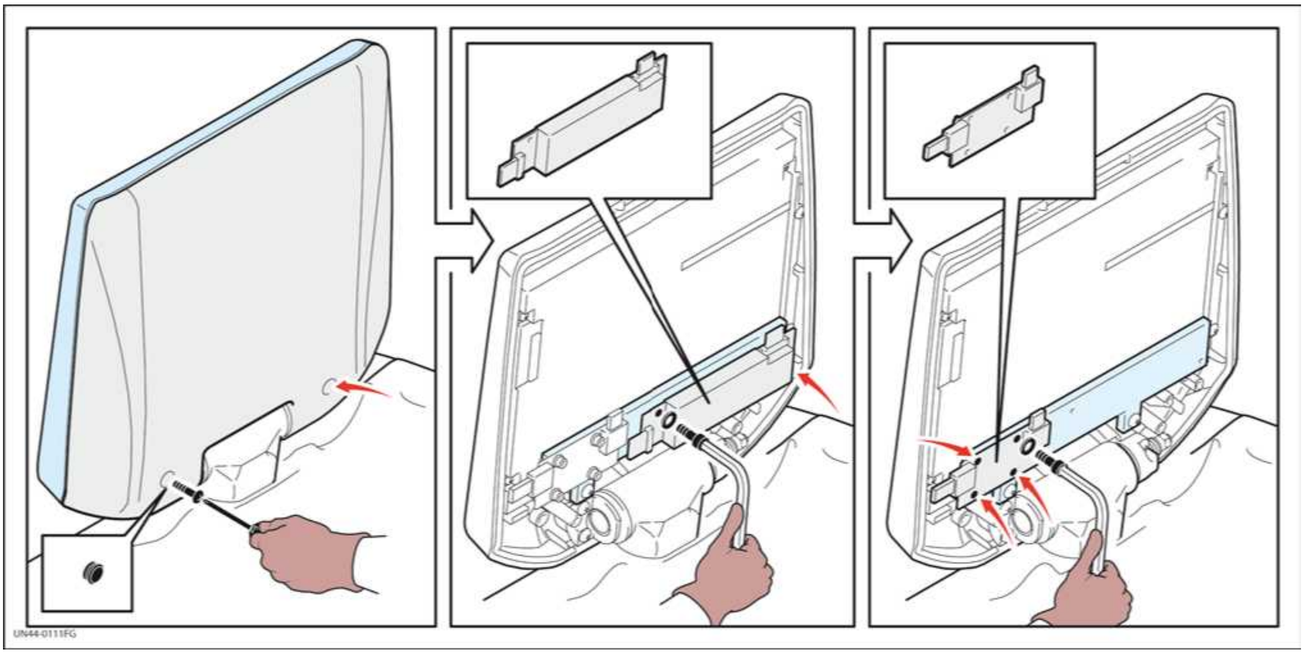

Fig. 12.8-1

- Remove the two TCCE 40x16 screws which fix the white support to the display group front cover;

- Remove the white support;
- Unscrew the ground cable of the display;
- Disconnect the display flat serial cable;
- Unscrew the four TCC 2,5x6 screws with the related flat and split washers, which fix the display and the touch screen to the display group front cover;
- Cut the wrap tie of the touch panel cable;
- Disconnect the two touch panel cable AMP connectors from the touch screen flat cable and from the touch screen control board;
- Remove the display together with the touch panel from the display front cover;

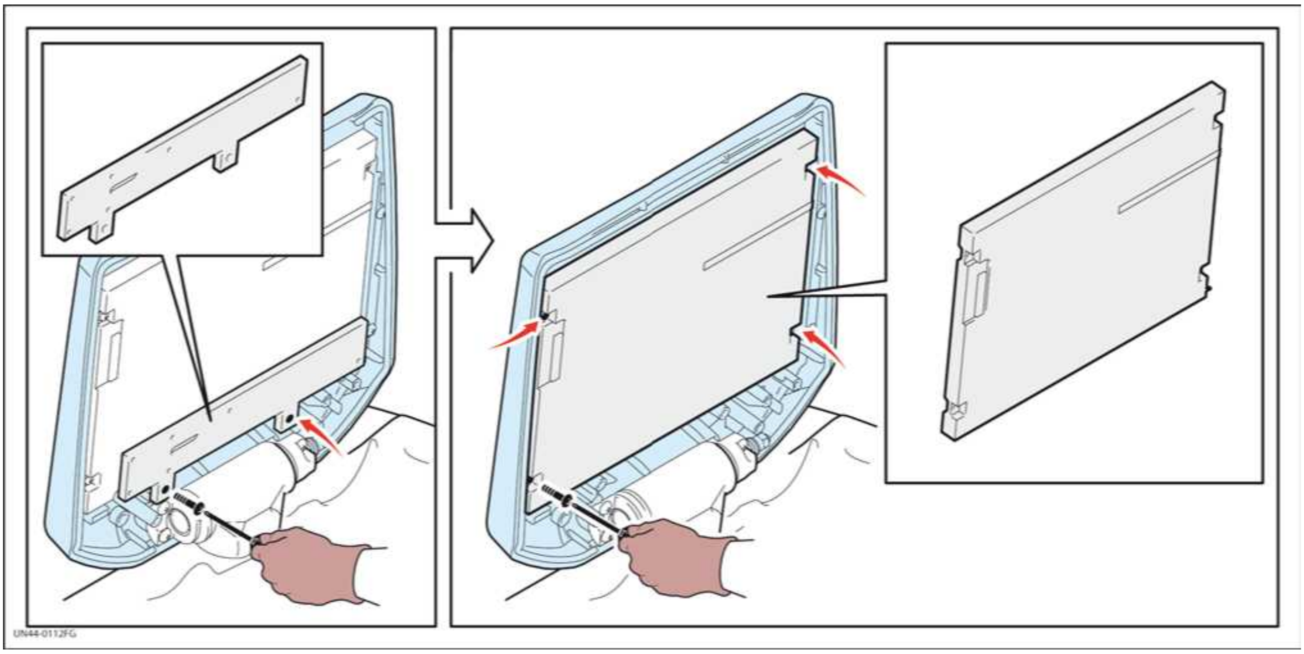

Fig. 12.8-2

- Disconnect the STOP AMP connector;
- Unscrew the four KA 40X16 screws which fix the display group hinge to the front cover;
- Remove the front cover;
- Unscrew the four KA 35X10 screws which fix the two side stirrups to the front cover.

(DISM_008) cod. 65608 XTRA Display Cover rev.00

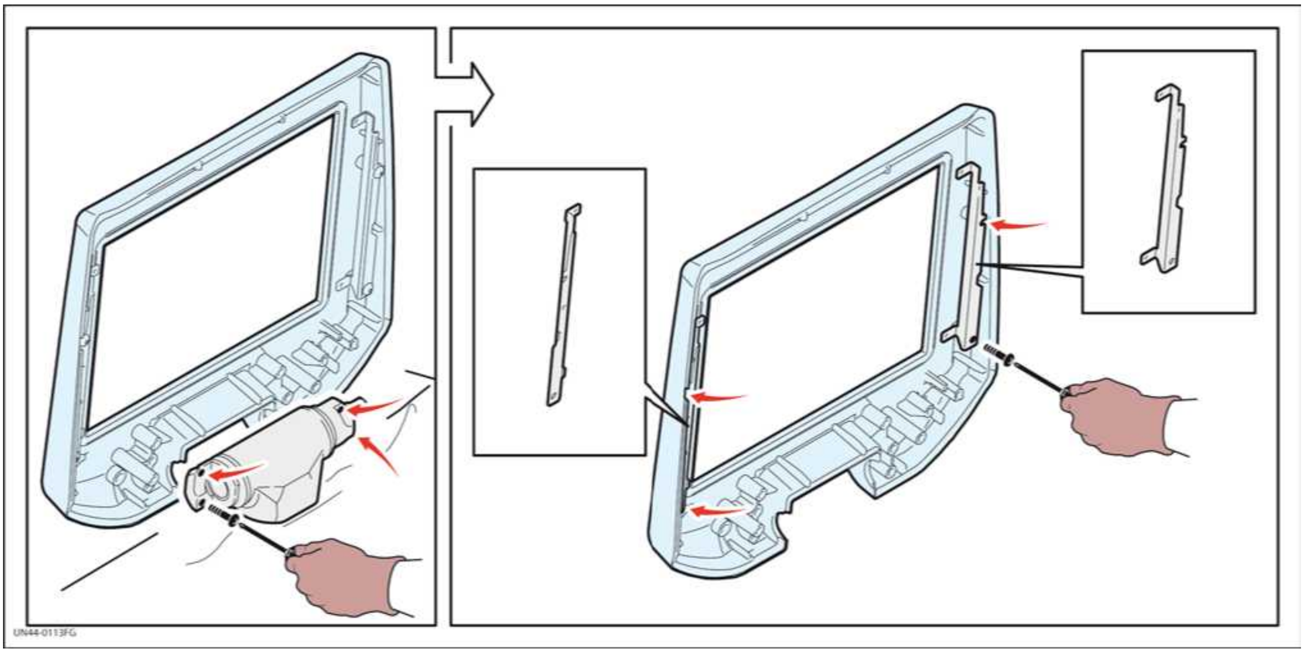

Fig. 12.8-3

12.8.2.3 Reassembly

- Put the two side stirrups on the new front cover, screwing the four KA 35X10 screws;
- Fix the new front cover in its position on the display group hinge, screwing the four KA 40X16 screws;

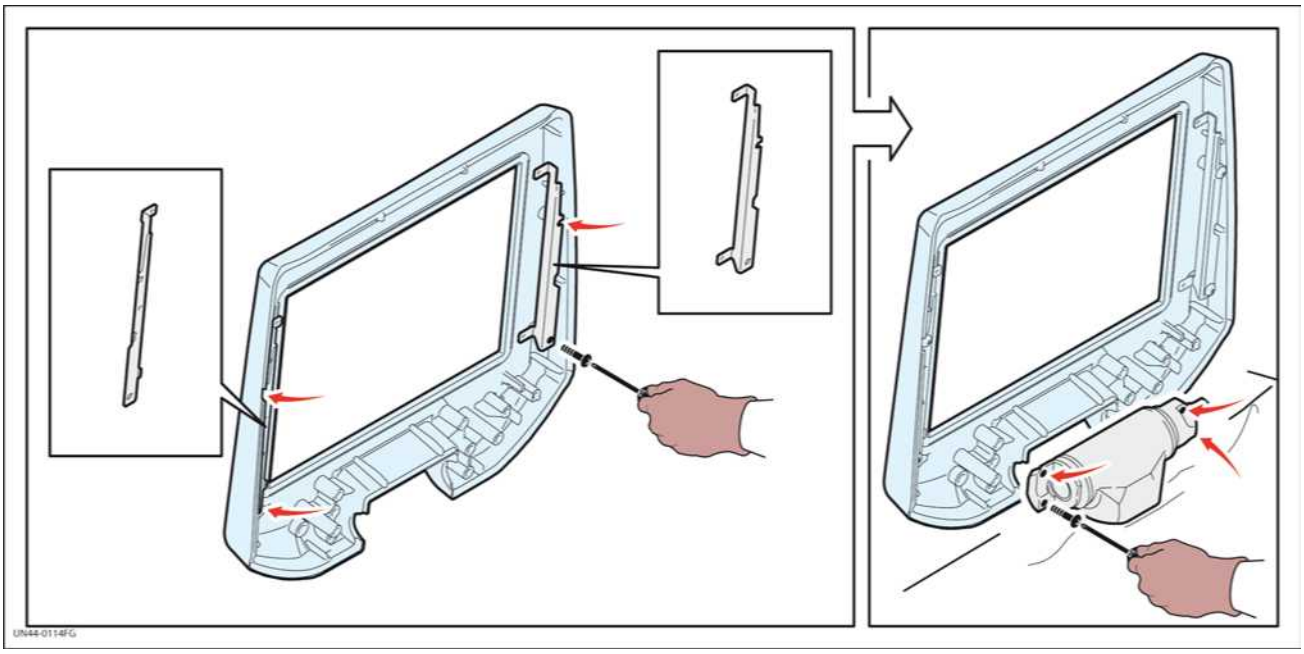

Fig. 12.8-4

- Put the display together with the touch screen in its seat on the front cover;
- Fix the display to the display front cover screwing the four TCC 2,5x6 screws, with the related flat and split washers;
- Connect the display flat serial cable;

- Connect the two touch panel cable AMP connectors to the touch screen flat cable and to the touch screen control board;
- Fix the touch screen cable to the adhesive tie holder on the display with a wrap tie;
- Screw the ground cable in its seat on the left stirrup;
- Put the white support back on its seat on the front cover, fixing it with the two TCCE 40x16 screws;

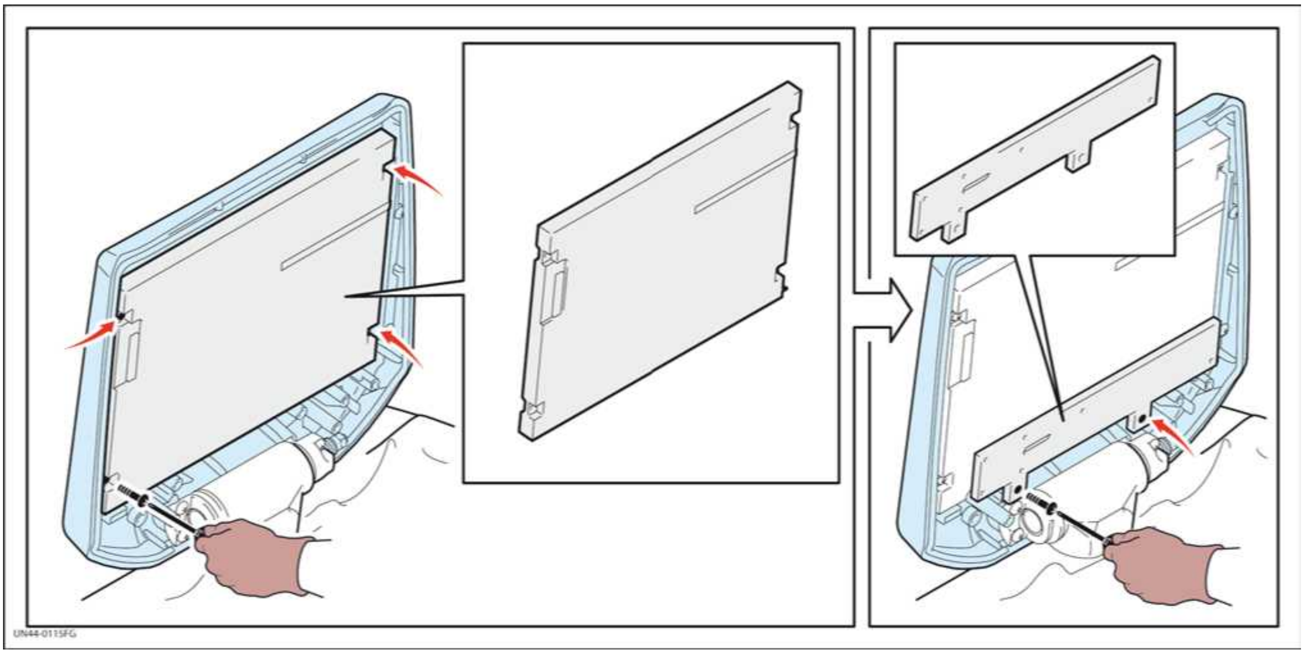

Fig. 12.8-5

- Put the touch screen control board back on the white support and fix it screwing the TCCE 4x6 screws with the related flat washers;
- Connect the CN2 TOUCH C and the touch panel cable connectors to the touch screen control board;
- Put the inverter back in its position on the white support and fix it screwing the two TCCE 3x6 screws with the related flat washers, paying attention to insert the two plastic washers between the inverter and the support itself;
- Connect the CN1 INVERTER and the display illumination power cable connectors to the display inverter;
- Connect the STOP AMP connector;
- Put the display rear cover in its position on the front one and screw the two KA 40x10 screws;
- Put the two black screw caps back on the display group rear cover.

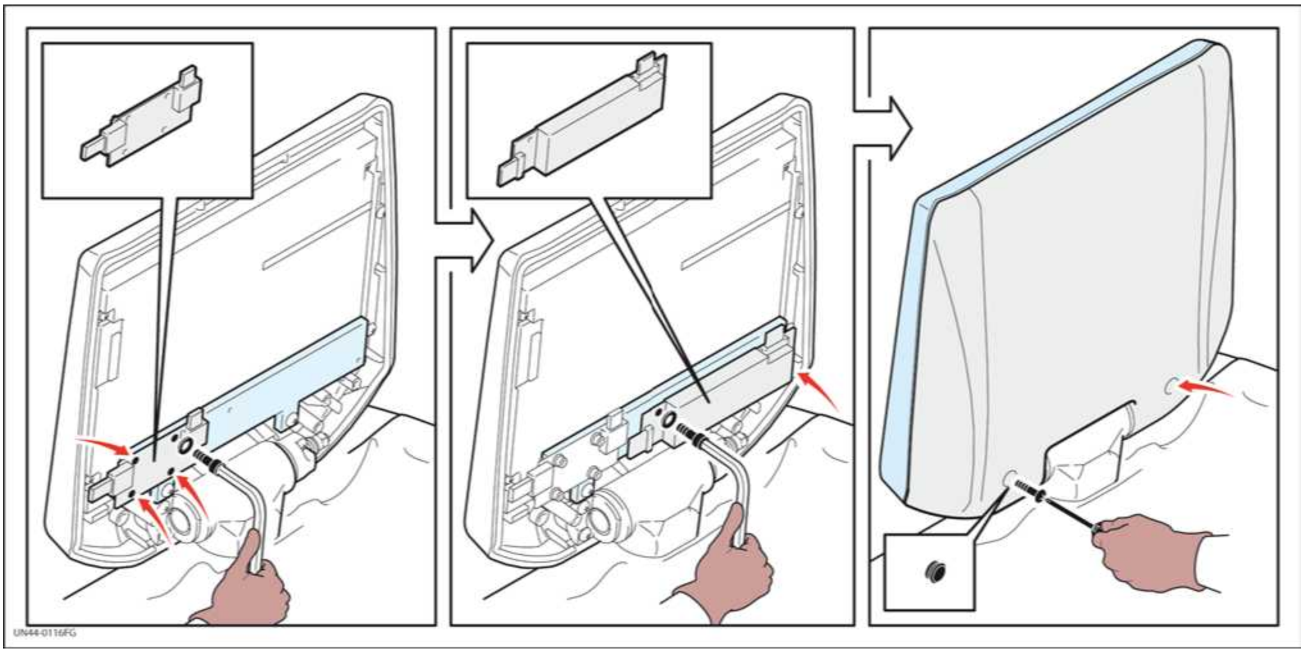

Fig. 12.8-6

12.8.3 Calibration

Only if necessary, perform the **Touch Screen Calibration** described in the **(CALIBR_008)** card.

12.8.4 Functional test

Perform the **Functional Verification test** described in the **(DISM_003)** card.

(DISM_008) cod. 65608 XTRA Display Cover rev.00

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12.9 (DISM_009) cod. 65609 Cover Locking System rev.00

12.9.1 About this card

The purpose of this card is to describe the **cover locking system** replacement, code **65609.**

12.9.2 Procedure

12.9.2.1 Tools

- Set of screwdrivers;
- Allen keys 3 mm.

12.9.2.2 Disassembly

- Remove the right panel, see the **(DISM_001) Opening the Unit** card;
- Disconnect the LOCK AMP flying connector;
- Remove the cover locking system unscrewing the two TCCE 4x12 screws, with the related flat and split washers, which fix the metallic locking system support to the white cover lock pivot support.

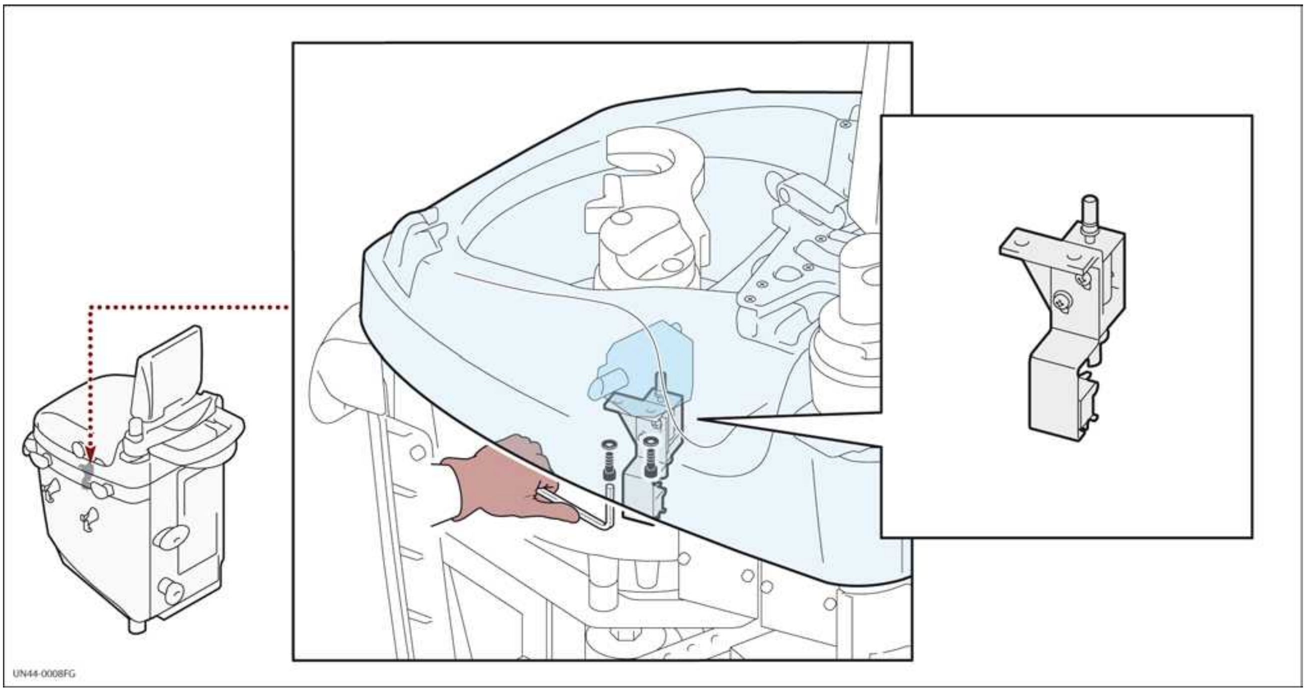

Fig. 12.9-1

12.9.2.3 Reassembly

- Put the new cover locking system under the white cover lock pivot support, fixing it with the two TCCE 4x12 screws with the related washers;
- Connect the LOCK AMP flying connector.

12.9.3 Functional test

Perform the **Cover Lock Test** described in the **(TEST_010)** card.

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.10(DISM_010) cod. 65610 Cover Magnet rev.00

12.10.1 About this card

The purpose of this card is to describe the **XTRA cover magnet** replacement, code **65610**, in case it comes unstuck.

12.10.2 Procedure

12.10.2.1 Tools

- Transparent Epossidic Glue.

12.10.2.2 Reassembly

- Apply a bit of transparent epossidic glue in the magnet seat in the XTRA cover;
- Insert the magnet in its seat;
- Let the glue dry;
- Close the cover.

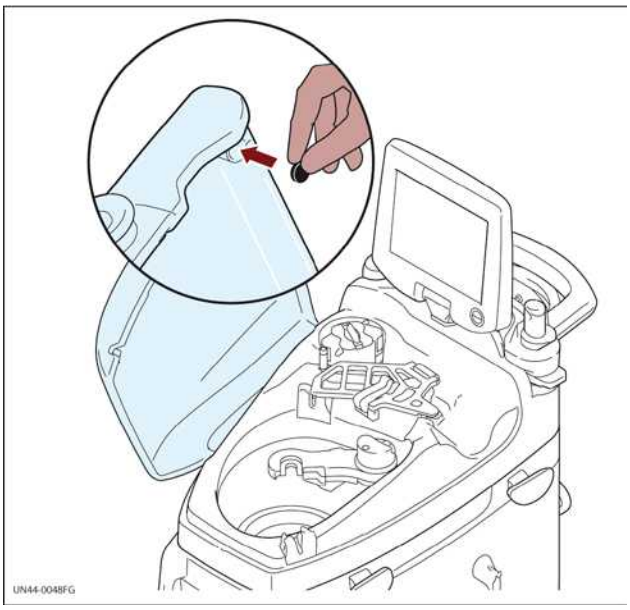

Fig. 12.10-1

12.10.3 Functional test

Perform the **Cover Sensor Test** described in the **(TEST_009)** card

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12.11(DISM_011) cod. 65611 XTRA Display rev.00

12.11.1 About this card

The purpose of this card is to describe the **XTRA display** replacement code **65611**.

12.11.2 Procedure

12.11.2.1 Tools

- Set of screwdrivers;
- Allen key 2,5 mm.

12.11.2.2 Disassembly

- Remove the two black screw caps on the display group rear cover;
- Unscrew the two KA 40x10 screws which fix the rear cover to the front one;
- Remove the rear cover;
- Disconnect the CN1 INVERTER and the display illumination power cable connectors from the display inverter;
- Unscrew the two TCCE 3x6 screws with the related flat washers which fix the inverter to its white support, paying attention not to lose to the two plastic washers between the inverter and the support itself;
- Remove the display inverter;
- Disconnect the CN2 TOUCH C and the touch panel cable connectors from the touch screen control board;
- Unscrew the four TCCE 4x6 screws with the related flat washers which fix the touch screen control board to its white support;
- Remove the touch screen control board;

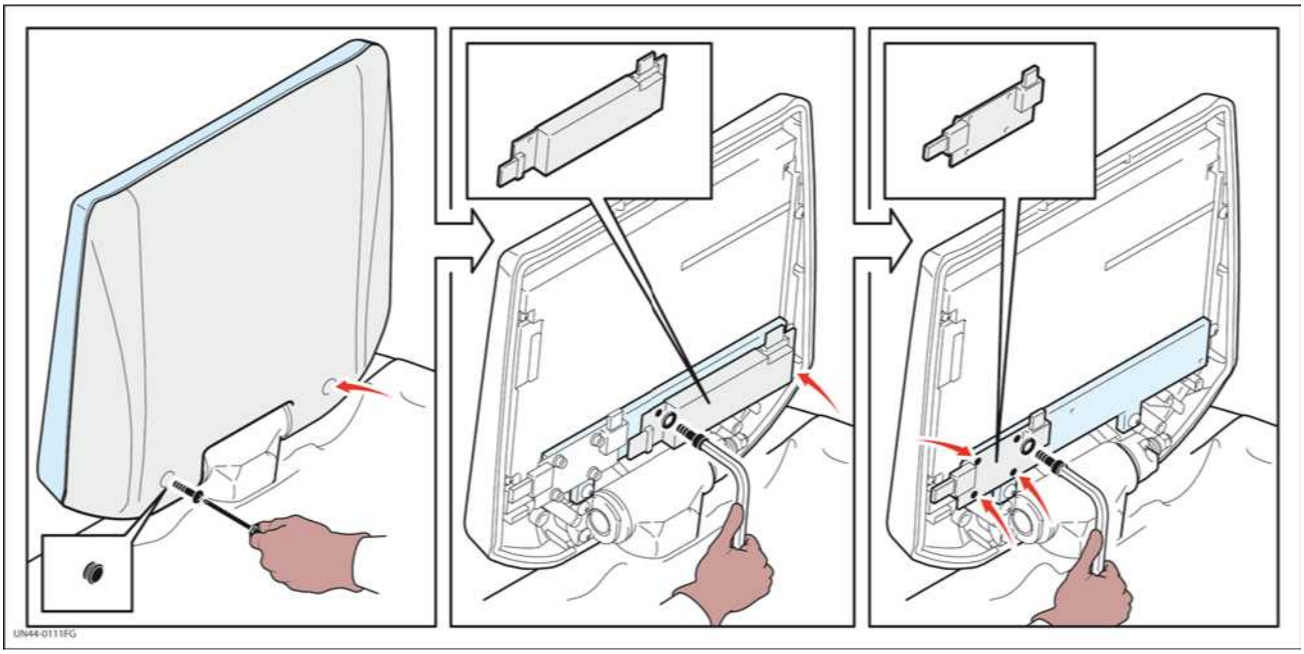

Fig. 12.11-1

- Remove the two TCCE 40 x 16 screws which fix the white support to the display group front cover;
- Remove the white support;
- Unscrew the ground cable of the display;

- Disconnect the display flat serial cable;
- Unscrew the four TCC 2,5x6 screws with the related flat and split washers, which fix the display and the touch screen to the display group front cover;
- Cut the wrap tie of the touch panel cable;
- Disconnect the two touch panel cable AMP connectors from the touch screen flat cable and from the touch screen control board;
- Remove the display together with the touch panel from the display front cover;

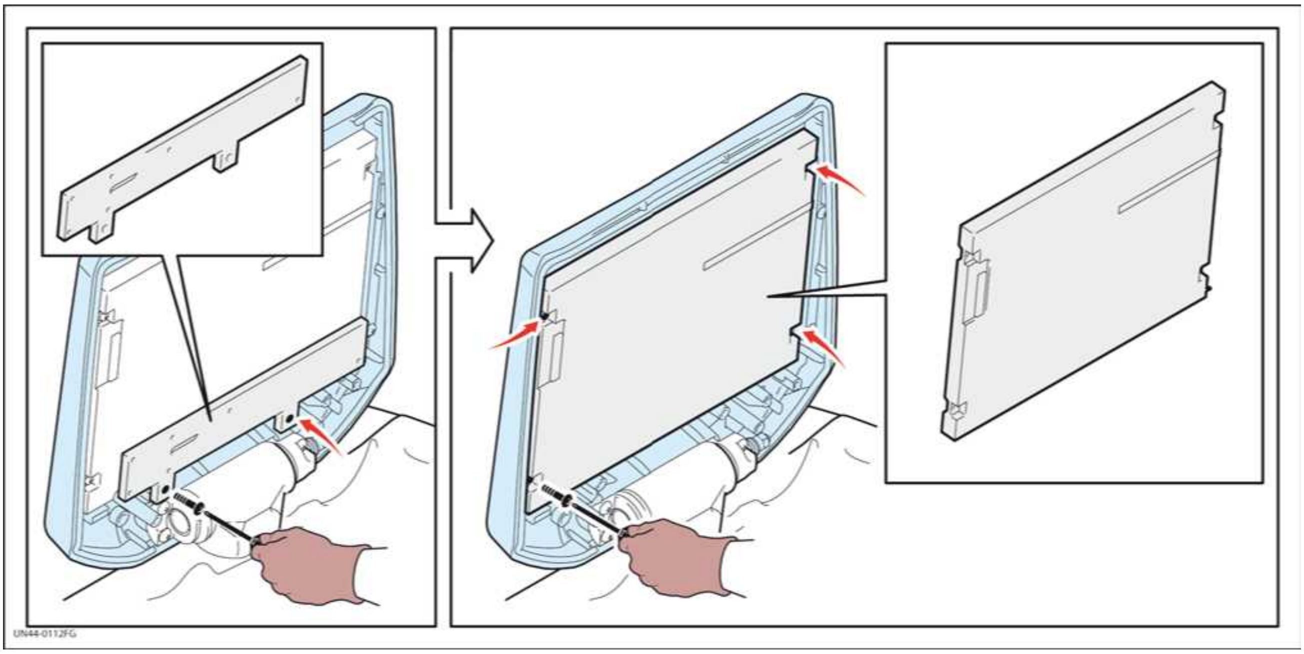

Fig. 12.11-2

12.11.2.3 Reassembly

- Put the new display together with the new touch screen in its seat on the front cover;
- Fix the display to the display front cover screwing the four TCC 2,5x6 screws, with the related flat and split washers;
- Connect the display flat serial cable;
- Connect the two touch panel cable AMP connectors to the touch screen flat cable and to the touch screen control board;
- Fix the touch screen cable to the adhesive dek on the display with a wrap tie;
- Screw the ground cable in its seat on the left stirrup;
- Put the white support back on its seat on the front cover, fixing it with the two TCCE 40x16 screws;

(DISM_011) cod. 65611 XTRA Display rev.00

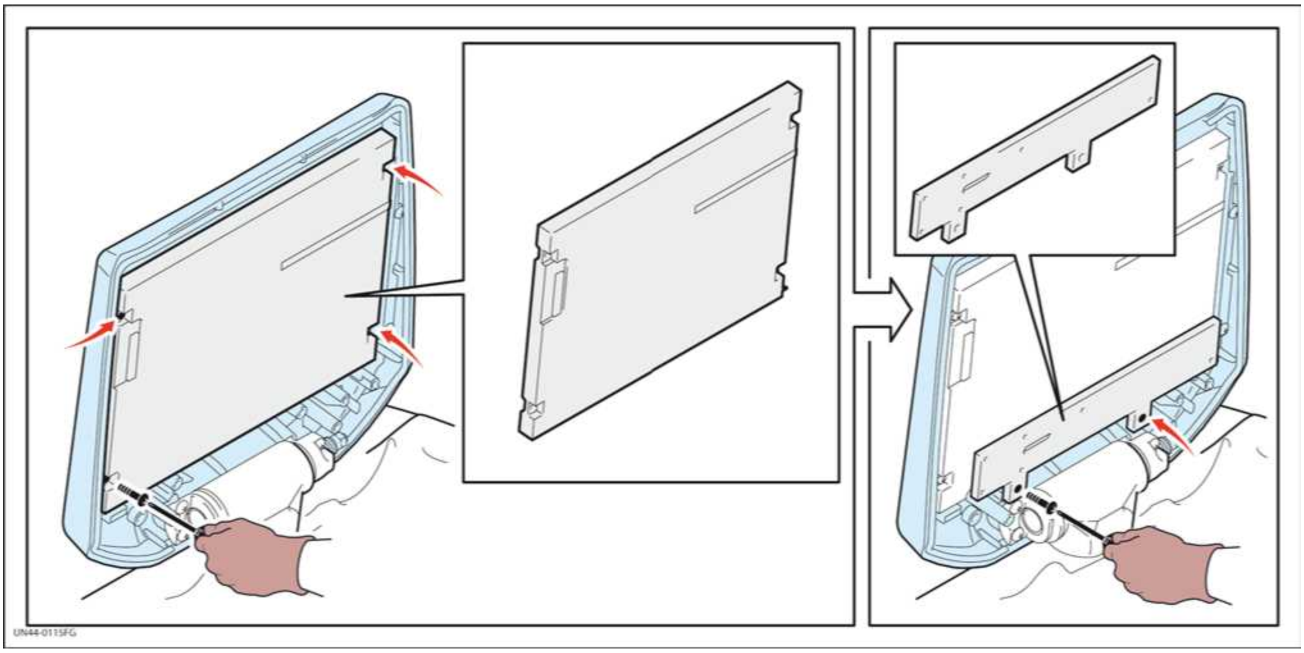

Fig. 12.11-3

- Put the touch screen control board back on the white support and fix it screwing the TCCE 4x6 screws with the related flat washers;
- Connect the CN2 TOUCH C and the touch panel cable connectors to the touch screen control board;
- Put the inverter back in its position on the white support and fix it screwing the two TCCE 3x6 screws with the related flat washers, paying attention to insert the two plastic washers between the inverter and the support itself;
- Connect the CN1 INVERTER and the display illumination power cable connectors to the display inverter;
- Put the display rear cover in its position on the front one and screw the two KA 40x10 screws;
- Put the two black screw caps back on the display group rear cover.

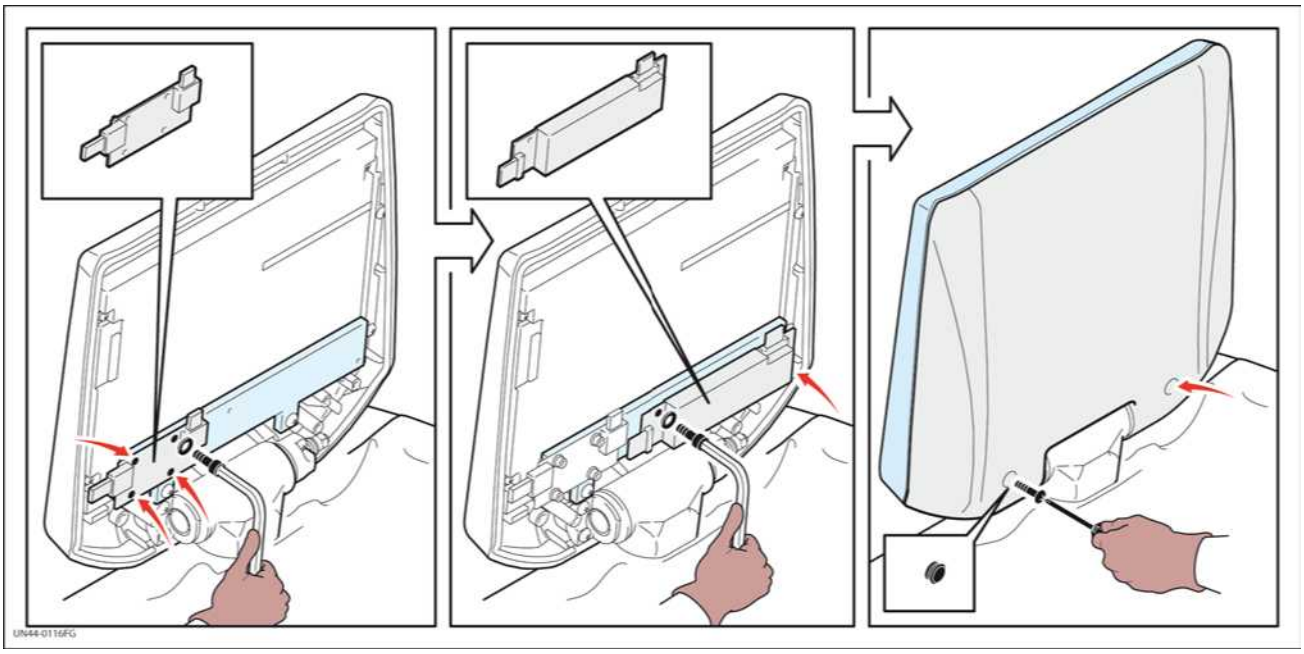

Fig. 12.11-4

12.11.3 Calibration

Perform the **Touch Screen Calibration** described in the **(CALIBR_008)** card.

12.11.4 Functional test

Perform the **Functional Verification test** described in the **(DISM_003)** card.

12.12(DISM_012) cod. 65612 Display Inverter rev.00

12.12.1 About this card

The purpose of this card is to describe the **XTRA display inverter** replacement, code **65612**.

12.12.2 Procedure

12.12.2.1 Tools

- Set of screwdrivers.

12.12.2.2 Disassembly

- Remove the two black screw caps on the display group rear cover;
- Unscrew the two KA 40x10 screws which fix the rear cover to the front one;
- Remove the rear cover;
- Disconnect the CN1 INVERTER and the display illumination power cable connectors from the display inverter;
- Unscrew the two TCCE 3x6 screws with the related flat washers which fix the inverter to its white support, paying attention not to lose to the two plastic washers between the inverter and the support itself.

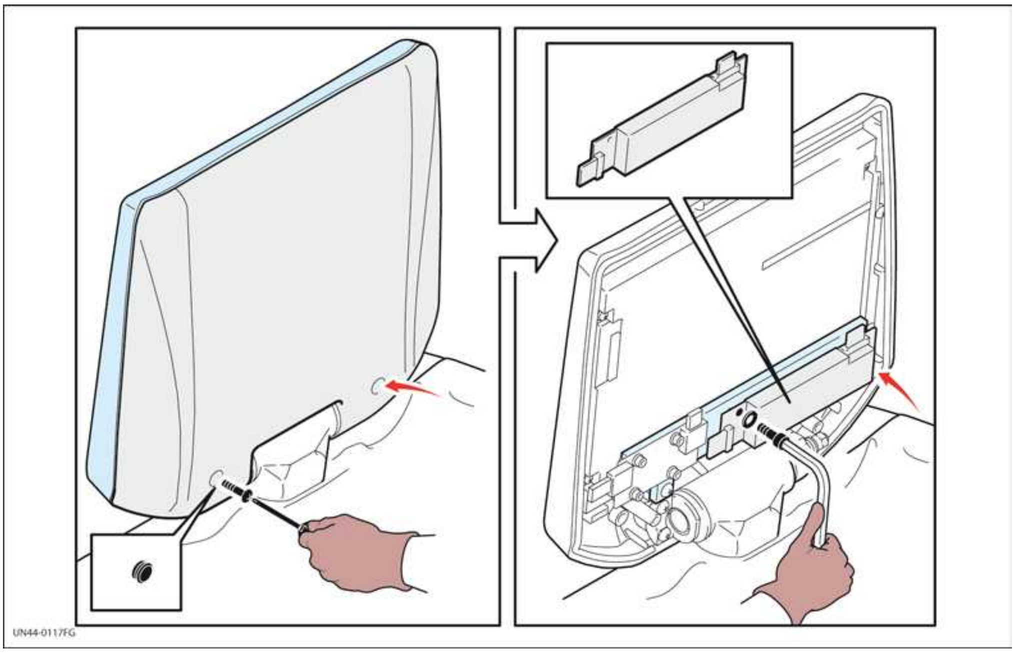

Fig. 12.12-1

12.12.2.3 Reassembly

- Put the new inverter in its position on the white support and fix it screwing the two TCCE 3x6 screws with the related flat washers, paying attention to insert the two plastic washers between the inverter and the support itself;
- Connect the CN1 INVERTER and the display illumination power cable connectors to the display inverter;
- Put the display rear cover in its position on the front one and screw the two KA 40x10 screws;
- Put the two black screw caps back on the display group rear cover.

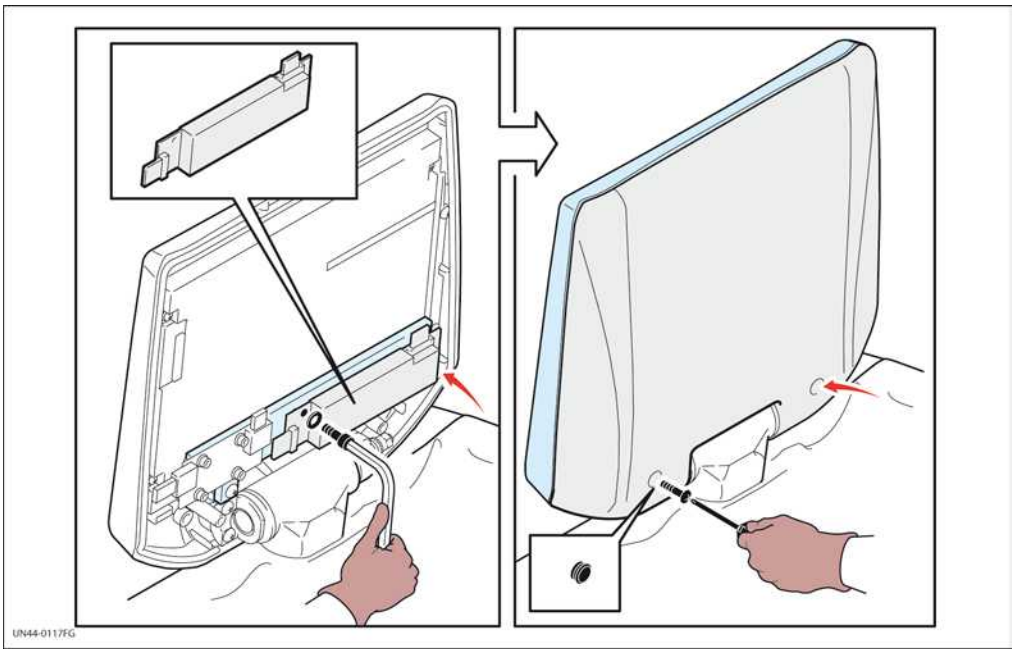

Fig. 12.12-2

12.12.3 Calibration

No calibration required

12.12.4 Functional test

Perform the **Functional Verification test** described in the **(DISM_003)** card.

12.13(DISM_013) cod. 65613 Disposable Ejector rev.00

12.13.1 About this card

The purpose of this card is to describe the **disposable ejector** replacement, code **65613**.

12.13.2 Procedure

12.13.2.1 Tools

- Set of screwdrivers.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.13.2.2 Disassembly

- Remove the left panel, see the **(DISM_001) Opening the Unit** card;
- Disconnect the J30 connector from the NBP p.c. board;
- Push the ejector up and manually remove the little OR ring from the tip of the ejector itself;
- Unscrew the three KA 40x16 screws with the flat washers which fix the ejector group support to the top;

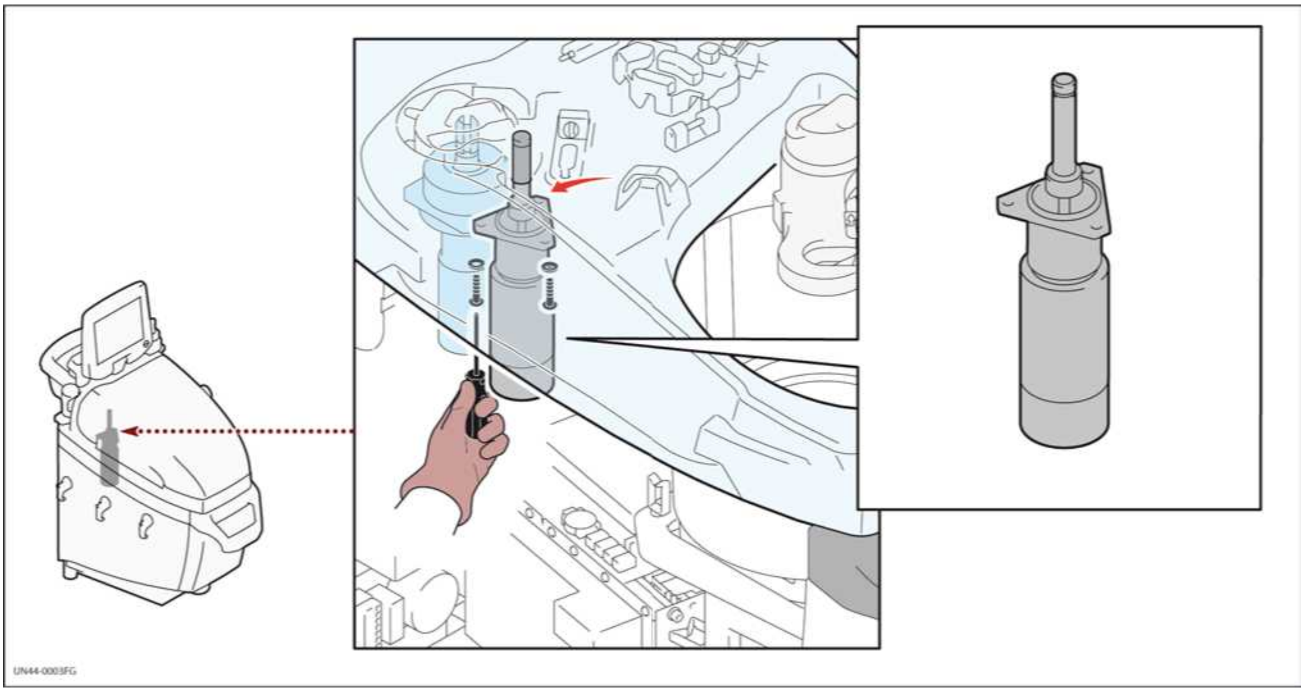

Fig. 12.13-1

- At this point the ejector group falls down.

12.13.2.3 Reassembly

- Fix the ejector group to the top screwing the three KA 40x16 screws with the flat washers;
- Push the ejector up and manually put the little OR ring back on the tip of the ejector itself;
- Connect the J30 connector from the NBP p.c. board.

12.13.3 Functional test

Perform the **Ejector Test** described in the **(TEST_008)** card.
Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card

12.14(DISM_014) cod. 65614 ENC Centrifuge Encoder Switch rev.00

12.14.1 About this card

The purpose of this card is to describe the **ENC centrifuge encoder switch** replacement, code **65614**.

12.14.2 Procedure

12.14.2.1 Tools

- Screwdrivers set;
- Allen key 3 mm.

12.14.2.2 Disassembly

- Open the left XTRA panels, see the **(DISM_001) Opening the Unit** card;
- Disconnect the ENC connector from the ENC board;
- Unscrew the two TCCE M 3x12 screws from the centrifuge chuck;
- Remove the ENC encoder switch together with the screws, the flat and split washers and the plastic spacers.

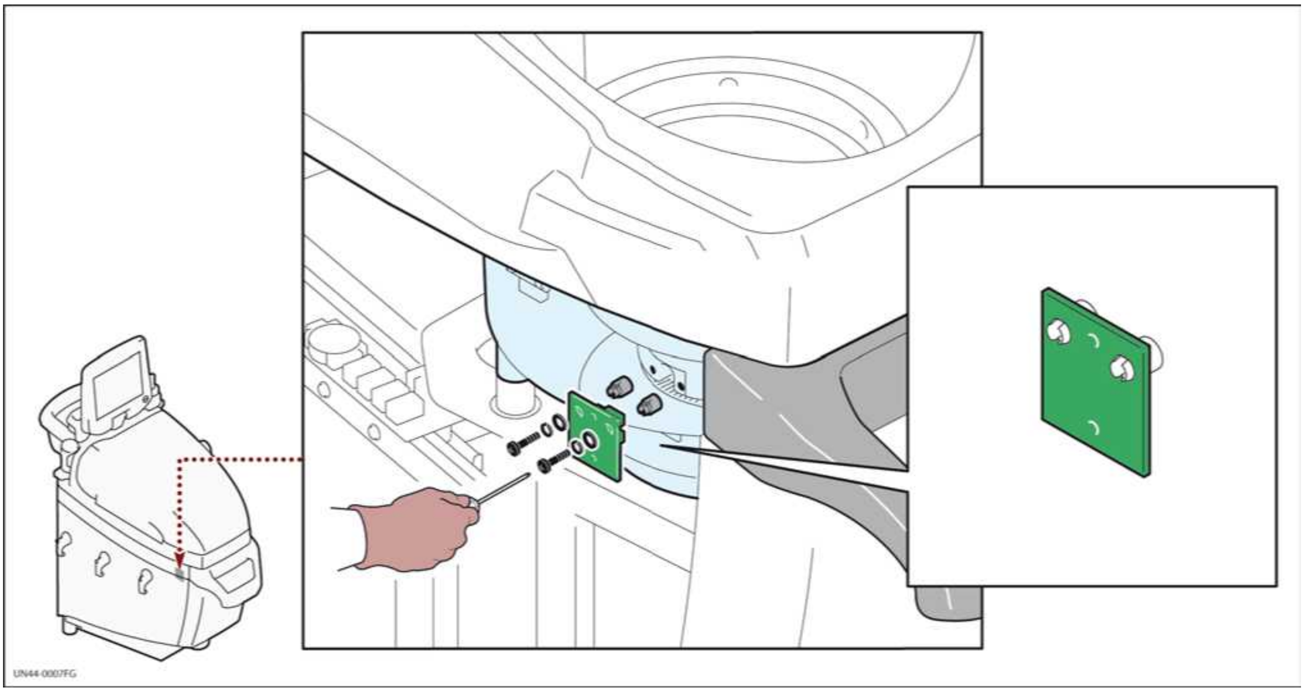

Fig. 12.14-1

12.14.2.3 Reassembly

- Screw the two TCCE M 3x12 screws with the split and flat washers on the encoder switch;
- Screw the encoder switch with its plastic spacers on the centrifuge chuck;
- Connect the ENC connector to the encoder switch.

12.14.3 Functional test

Enter **Diagnostics mode \Actuators Checks and test\Centrifuge;**
Verify the good functionality of the encoder running the centrifuge at 5600 rpm and verifying the **Actual Speed** is in the range (5600 ± 50);
Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.15(DISM_015) cod. 65615 Fuses rev.00

12.15.1 About this card

The purpose of this card is to describe the **XTRA fuses** replacement, code **65615**.

12.15.2 Procedure

12.15.2.1 Tools

- Set of screwdrivers.

12.15.2.2 Disassembly

- Push softly with the screwdriver the lever placed beside the switch and remove the fuses holder;
- Remove the fuses from the holder.

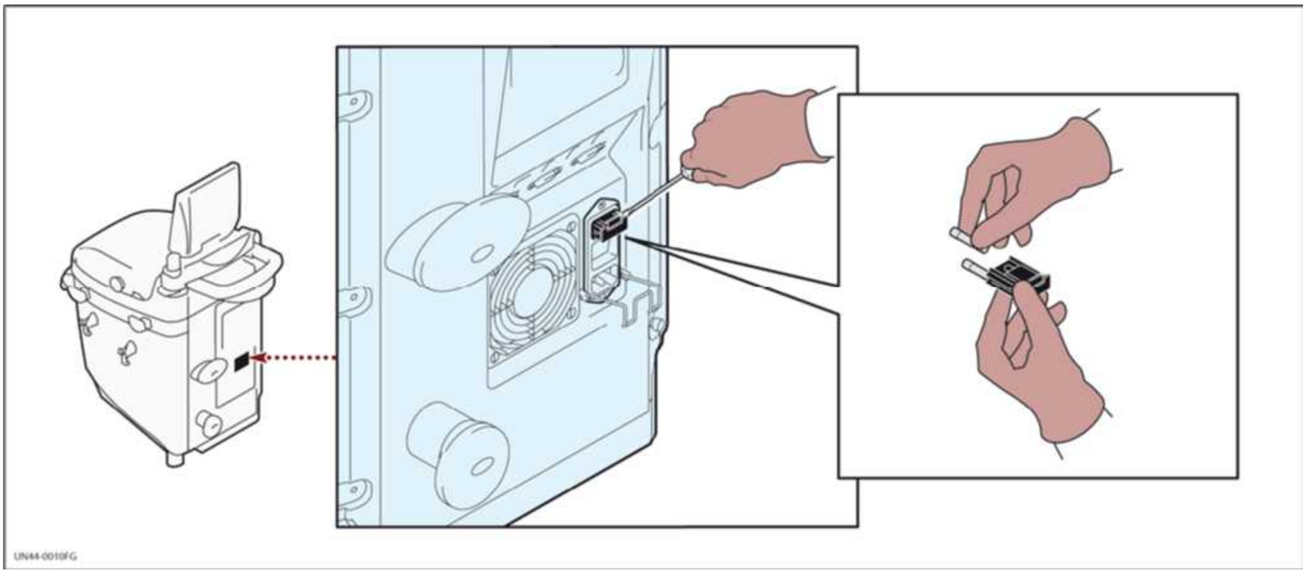

Fig. 12.15-1

12.15.2.3 Reassembly

- Insert the new fuses in the fuses holder;
- Re-insert the fuses holder till the complete insertion.

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12.16(DISM_016) cod. 65616 Fuses Holder rev.00

12.16.1 About this card

The purpose of this card is to describe the **XTRA fuses holder** replacement, code **65616**.

12.16.2 Procedure

12.16.2.1 Tools

- Set of screwdrivers.

12.16.2.2 Disassembly

- Push softly with the screwdriver the lever placed beside the switch and remove the fuses holder;
- Remove the fuses.

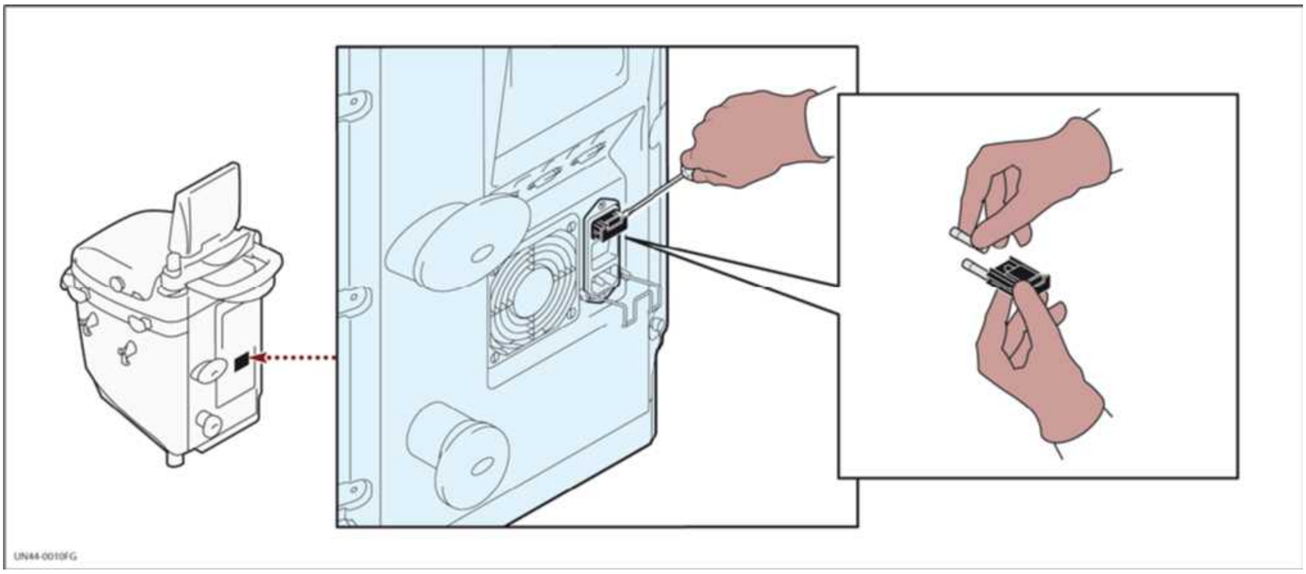

Fig. 12.16-1

12.16.2.3 Reassembly

- Insert the fuses in the new fuses holder;
- Re-insert the fuses holder till the complete insertion.

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12.17(DISM_017) cod. 65617 HHR p.c. board rev.00

12.17.1 About this card

The purpose of this card is to describe the **HHR p.c. board** replacement, code **65617**.

12.17.2 Procedure

12.17.2.1 Tools

- Set of screwdrivers.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.17.2.2 Disassembly

- Remove the right panel, see the **(DISM_001) Opening the Unit** card;
- Disconnect the J1, J2, and J3 connectors from the HHR p.c. board;
- Unscrew the two KA M 30x10 screws with the plastic washers which fix the HHR p.c. board to the top;
- Draw the HHR p.c. board away.

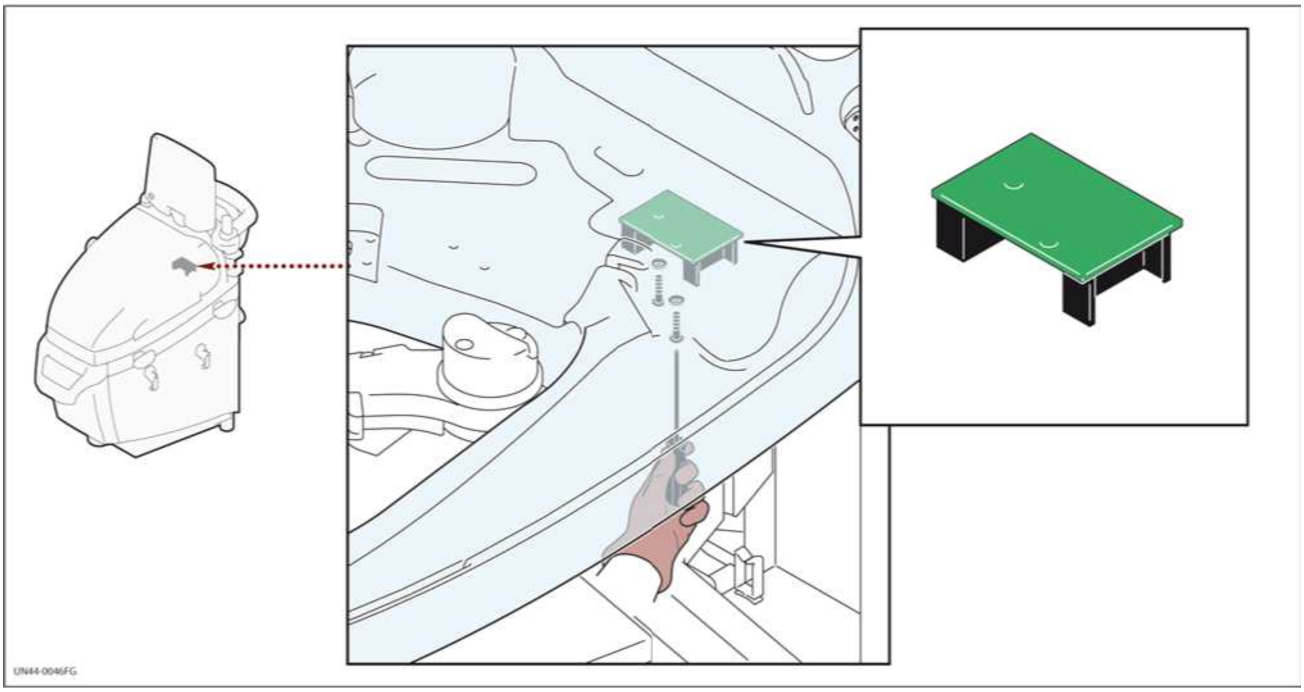

Fig. 12.17-1

12.17.2.3 Reassembly

- Insert the new HHR p.c. board on the top;
- Fix the HHR p.c. board to the top screwing the two KA M 30x10 screws with the plastic washers;
- Connect the J1, J2, J3 connectors to the HHR p.c. board.

12.17.3 Functional test

12.17.3.1 Waste Line Color Indicator test

- Push **Sensors Calibration and Test** , then **Haemoglobin (HGB)** and then **Factory Mode**;
- Insert the tool 63048 filled with saline solution in the **Waste Line Color Indicator**, making you sure no air bubbles are present;
- Perform different insertions and wait the assessment of the tube inside the support;
- Verify that the **HGB RxCount** reading is **935** (range from 870 to 1000).

If not perform the **Waste Line Color Indicator Calibration** described in the **(CALIBR_004)** card.

12.17.3.2 Haematocrit Indicator test

Perform the Testing procedure described in the **Haematocrit Indicator Calibration (CALIBR_005)** card.

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.18(DISM_018) cod. 65618 High Level RBC Detector rev.00

12.18.1 About this card

The purpose of this card is to describe the **High Level RBC Detector** replacement, code **65618**.

12.18.2 Procedure

12.18.2.1 Tools

- Set of screwdrivers;
- Allen key 2 and 3 mm;
- Wire cutter;
- Wire ties;
- Torque wrench 3 Nm.

12.18.2.2 Disassembly

- Open the side panels, see the **(DISM_001) Opening the Unit** card;
- Remove the bowl arm, see the procedure described in the **(DISM_058) cod. 65677 Bowl Arm** card;
- Loosen the horizontal set screw;
- Unscrew the vertical setscrew, paying attention to the inner cylinder;
- Unscrew the TSPC 3x10 and the TSPC 3x16 screws which fix the Low Level RBC Detector Illuminator to the bowl arm;
- Disconnect the J14 and J16 AMP connector from the NBP p.c. board;
- Cut the wrap ties around the J14 NBP and J16 NBP cables;
- Disconnect the cabling from the two AMP connectors to allow the cables to cross the hole in the illuminator**;**
- Draw the High Level RBC Detector up from the Low Level RBC Illuminator passing the cables through the hole of the illuminator.

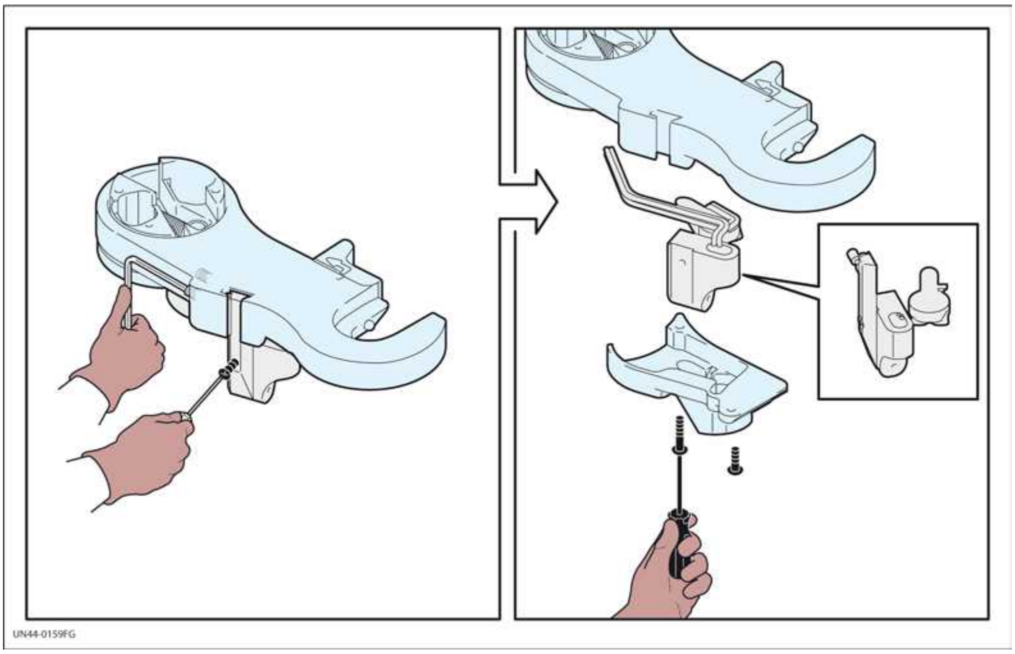

Fig. 12.18-1

12.18.3 Reassembly

- Disconnect the cabling from the J14 and J16 AMP connectors of the new spare part, to allow the cables to cross the hole in the illuminator;
- Put the new High Level RBC Detector on the Low Level RBC Detector Illuminator, passing the cables through the hole of the illuminator;
- Pass the cables through the hole under the bowl arm cap together with the other cables;
- Keep the High Level RBC detector just a little (about 1,5 cm) distant from the illuminator support;
- Put a new wrap tie around the High Level RBC detector and Low Level RBC Illuminator cables, making sure the wrap tie is inside the border of the illuminator support;
- Put the illuminator support on the bowl arm, fixing it with the TSPC 3x10 and the TSPC 3x16 screws, passing the HS-A sensor through the hole on the bowl arm and paying attention the cables are in their groove under the bowl arm;
- Insert the inner cylinder in its seat;
- Insert the metallic swallow tail together with the vertical set screw, screwing the latter;
- Screw the horizontal set screw without tightening it;
- Reassembly the Bowl Arm and adjust it, see **(DISM_058) cod. 65677 Bowl Arm** card.

12.18.4 Calibration

- Perform the High Level RBC Detector mechanical calibration, screwing the vertical set screw until the metallic swallow tail is at 1,15 mm to the bowl arm upper surface;
- Tighten the horizontal set screw;
- Perform the **High Level RBC Detector Calibration** described in the **(CALIBR_007)** card;
- Perform the **RBC Detector Calibration** described in the **(CALIBR_007)** card.

12.18.5 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.19(DISM_019) cod. 65619 HIR p.c. Board rev.00

12.19.1 About this card

The purpose of this card is to describe the **HIR p.c. board** replacement, code **65619**

12.19.2 Procedure

12.19.2.1 Tools

- Set of screwdrivers;

NOTE: ESD protective measures must be taken while removing the p.c. board

12.19.2.2 Disassembly

- Remove the left panel, see the **(DISM_001) Opening the Unit** card;
- Disconnect the J31 and J30 connectors from the NBP board, in order to have an easier access to the HIR board;
- Disconnect the J5 and J6 connectors from the HIR board;
- Unscrew the two screws which fix the HIR board to the rear panel;
- Remove the HIR board.

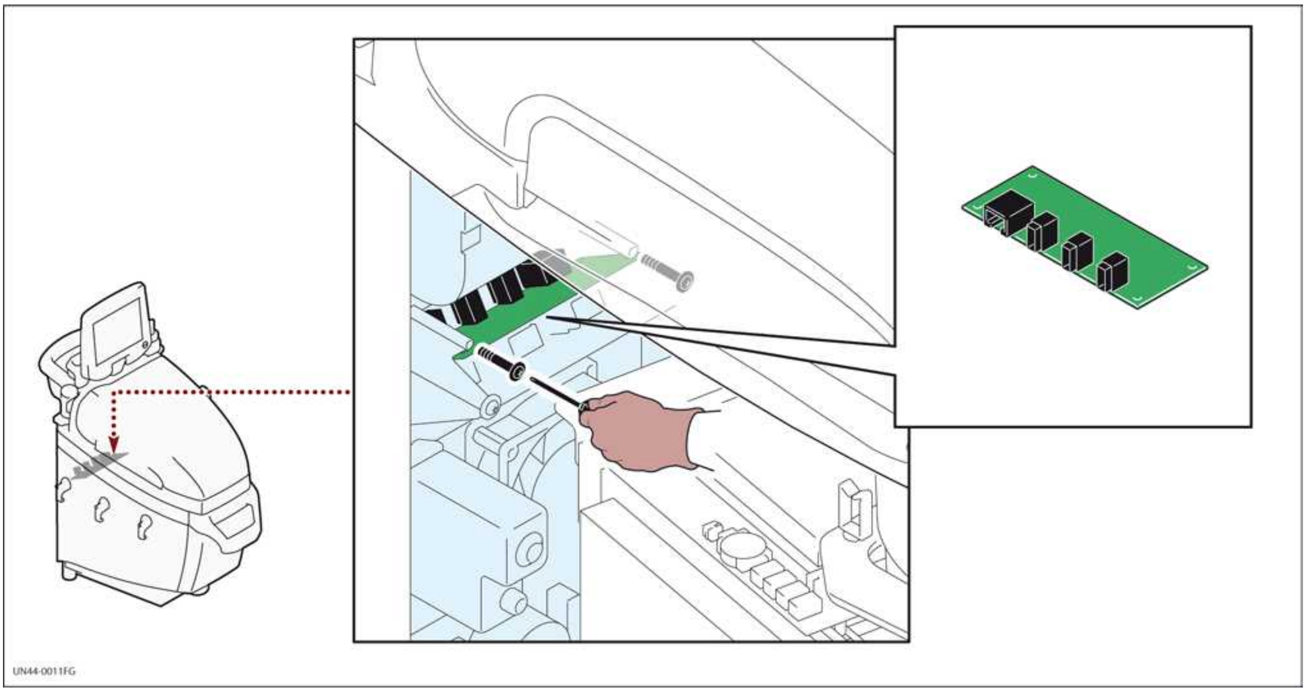

Fig. 12.19-1

12.19.2.3 Reassembly

- Put the new HIR board on the rear panel, paying attention to the USB and Ethernet connectors;
- Screw the two screws which fix the HIR board to the rear panel;
- Connect the J5 and J6 connectors to the HIR board;

- Connect the J31 and J30 connectors to the NBP board.

12.19.3 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.20(DISM_020) cod. 65620 HS-A Bowl Arm Sensor rev.00

12.20.1 About this card

The purpose of this card is to describe the **HS-A bowl arm hall sensor** replacement, code **65620**.

12.20.2 Procedure

12.20.2.1 Tools

- Set of screwdrivers;
- Allen key 3mm;
- Wire cutter;
- Wrap ties;
- Torque wrench 3 Nm.

12.20.2.2 Disassembly

- Open the right side panel, see the **(DISM_001) Opening the Unit** card;
- Cut the two wrap ties around the HS-A sensor cables;
- Open the centrifuge cover;
- Remove the bowl arm cover, removing first the two black caps and then unscrewing the two TCCE M 4x12 screws;

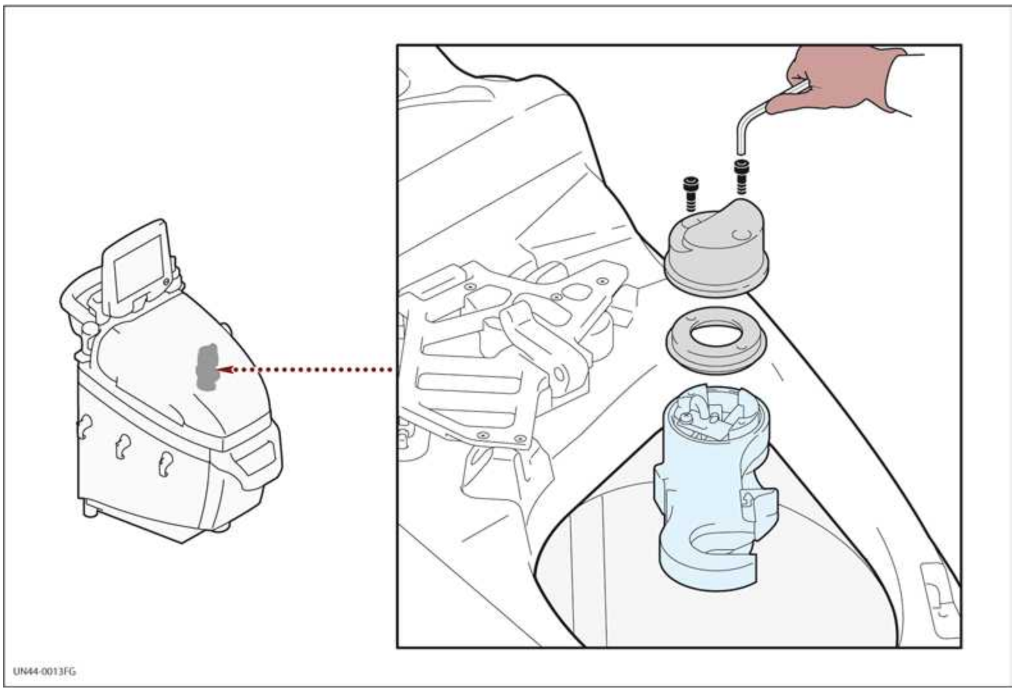

Fig. 12.20-1

- Disconnect the HS-A connector;
- Unscrew the TCC M 3x10 screw (with the split and flat washers) which keeps the HS-A sensor in its seat;

(DISM_020) cod. 65620 HS-A Bowl Arm Sensor rev.00

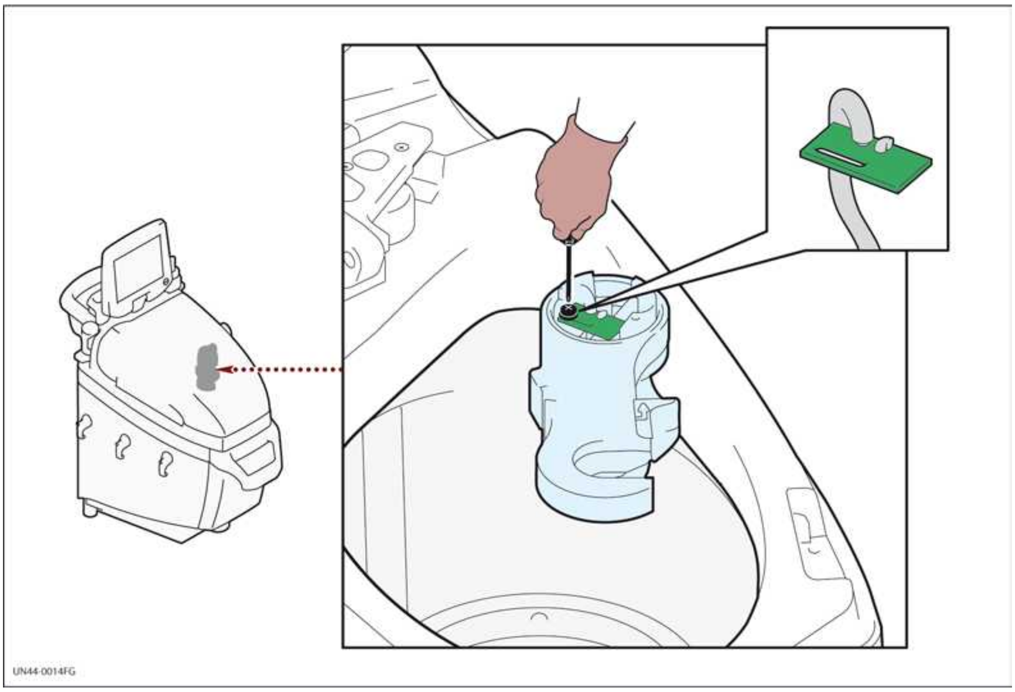

Fig. 12.20-2

- Remove the HS-A p.c. board passing the cabling through the hole of the arm.

12.20.2.3 Reassembly

- Insert the HS-A p.c. board passing the cabling through the arm hole;
- Place the HS-A circuit in its stop limit as shown in Fig.12.20-2:
- Screw the TCC M 3x10 screw (with the split and flat washers) which keeps the HS-A sensor in its seat;
- Connect the HS-A connector;
- Put the bowl arm cover back on the bowl arm screwing the TCCE M 4x12 screws;
- Put the two black caps back.

12.20.3 Functional test

Perform the **Bowl Arm Sensor Test** described in the **(TEST_007)** card.
Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.21(DISM_021) cod. 65621 HS-C Clamp Sensor rev.00

12.21.1 About this card

The purpose of this card is to describe the **HS-C clamp hall sensor** replacement, code **60621.**

12.21.2 Procedure

12.21.2.1 Tools

- Set of screwdrivers;
- Allen keys 2,5 and 3 mm;
- HSC Calibration tool, cod. 63050.

12.21.2.2 Disassembly

- Remove the right panel, see the **(DISM_001) Opening the Unit** card;
- Disconnect the three J5 CBN (PRI,WAS,EMP) and the J3 HHR flying connectors;
- Unscrew the four TCCE M4X12 screws which fix the clamp group metallic support to the top, paying attention not to lose the relative washers;
- Drow the clamp group down, paying attention to the cables (note the ground cables are still on);
- Unscrew the three TCCE M3x10 screws which fix the ground cables to the clamps, paying attention not to lose the related washers;

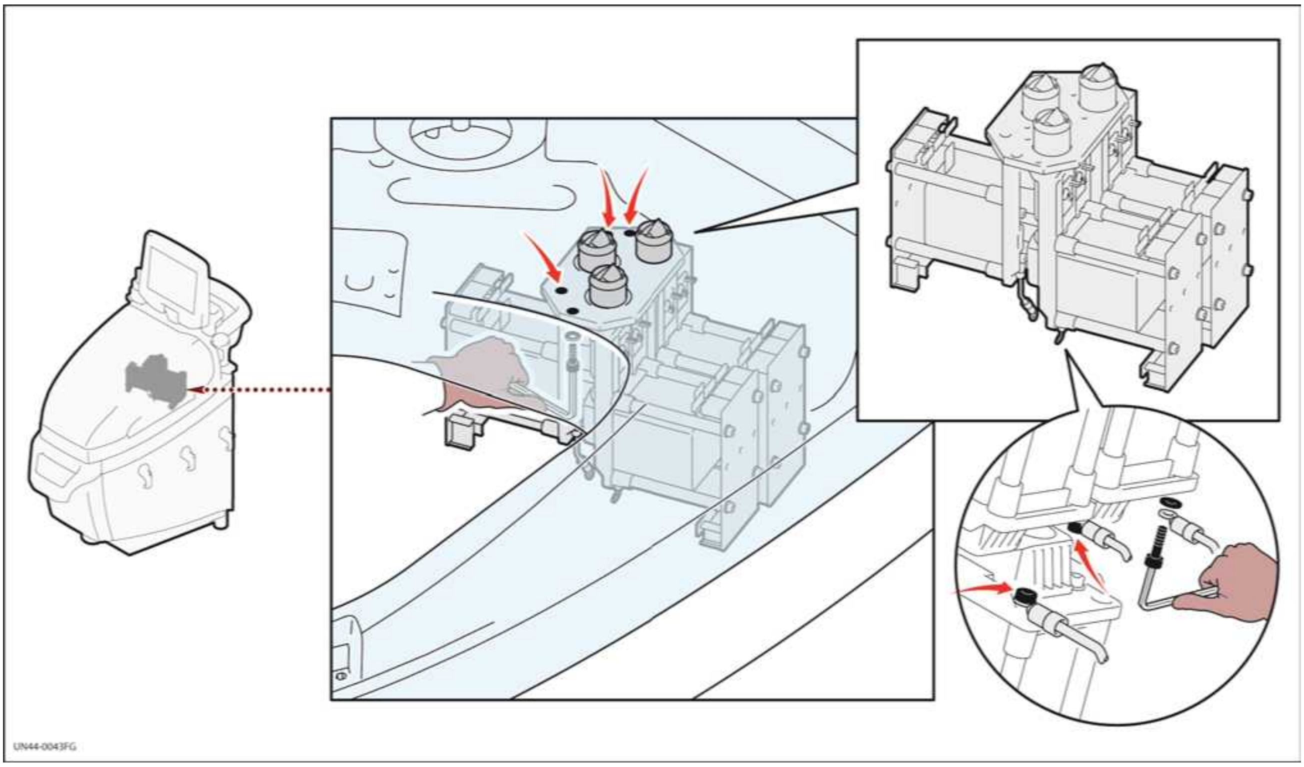

Fig. 12.21-1

- Remove the OR ring from the clamp on which is mounted the out of order HS-C sensor;
- Remove clamp from the metallic support, unscrewing the three TCCE M3x10 screws with the related flat and split washers;
- Disconnect the J1 and J6 CBN connectors regarding the out of order HS-C little board (J6 to the Master, J1 to the Actuator);

(DISM_021) cod. 65621 HS-C Clamp Sensor rev.00

- Unscrew the KA 30x8 screw, with the related flat washer, which fixes the HS-C board to the clamp plastic support;
- Remove the HS-C board.

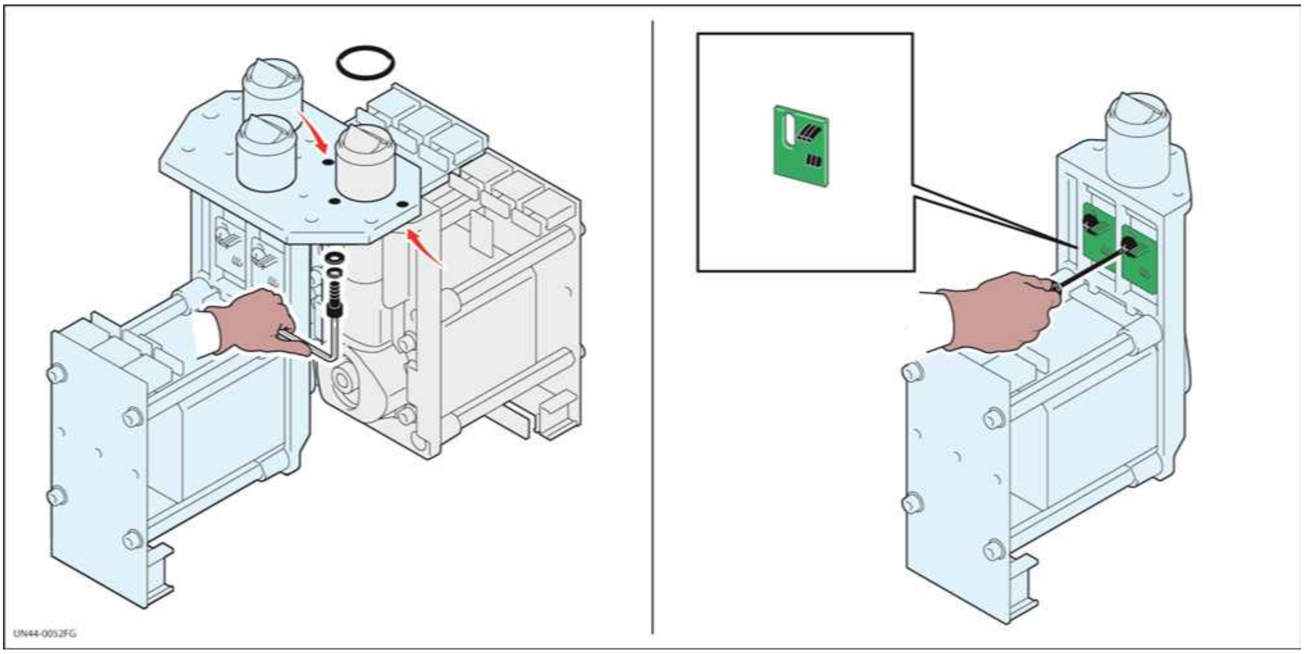

Fig. 12.21-2

12.21.2.3 Reassembly

- Put the new HS-C board on the clamp plastic support, screwing, without tightening it, the KA 30x8 screw with its flat washer;
- To find its correct position, put the tool 63050 in vertical position on the above edge of the HS-C board seat on the clamp plastic support and push the HS-C board close to it, then tighten the KA 30x8 screw;

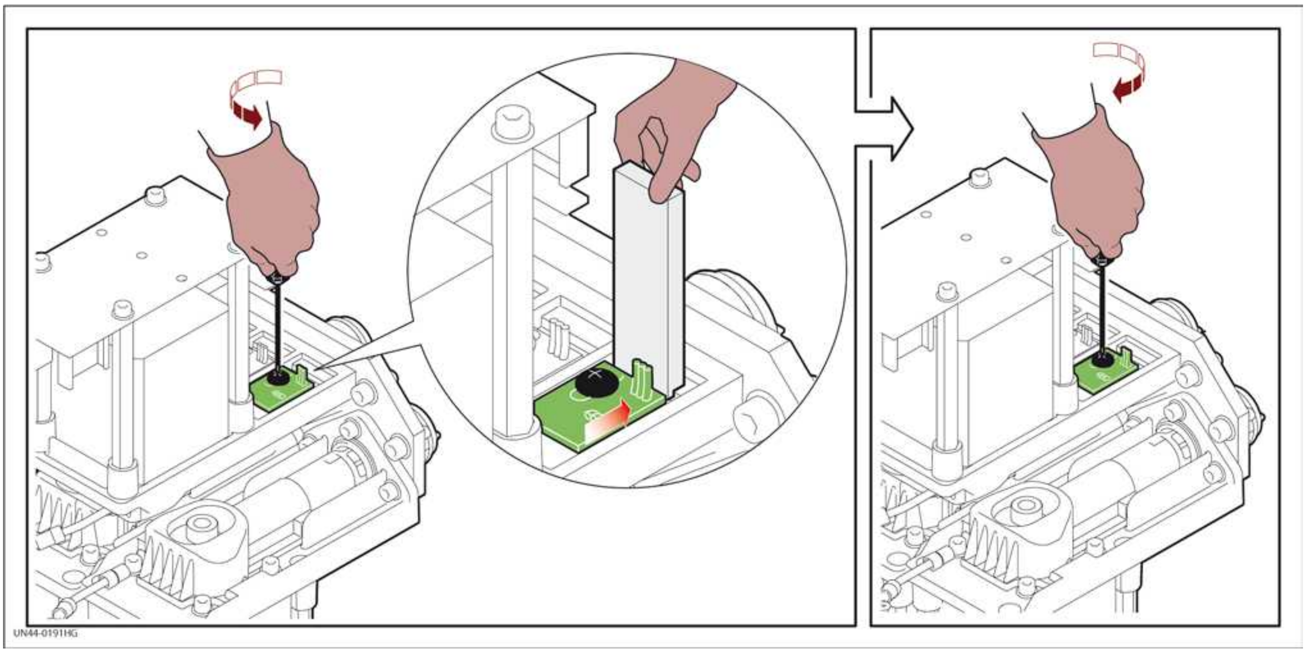

Fig. 12.21-3

- Connect the J1 and J6 CBN AMP connector to the CBN board;
- Put the new clamp on the metallic support, screwing the three TCCE M3x10 screws with the related flat and split washers, to do this:
    - Put at first the inner screw in its hole on the plastic support, then rotate the clamp inward and finally screw it;
    - Screw the other two screws;
- Insert the OR ring from the upper part of the clamp;
- Connect the ground cables back to the clamp group, screwing the three TCCE M3x10 screws with the related washers;
- Put the clamp group back under the top, fixing it with the four TCCE M4X12 screws and the relative washers;
- Connect the three J5 CBN (PRI,WAS,EMP) and the J3 HHR flying connectors.

12.21.3 Functional test

Perform the **Clamp Sensor Test** described in the **(TEST_014)** card.
Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

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12.22(DISM_022) cod. 65622 HS-P Pump Sensor rev.00

12.22.1 About this card

The purpose of this card is to describe the **HS-P pump hall sensor** replacement, code **65622**.

12.22.2 Procedure

12.22.2.1 Tools

- Set of screwdrivers;
- Allen key 4 mm.

12.22.2.2 Disassembly

- Open the side panels, see the **(DISM_001) Opening the Unit** card;
- Disconnect the HS-P AMP flying connector;
- Unscrew the TCC M3x10 screw, with the related flat and split washers, which fixes the HS-P board to the pump group and remove it, paying attention not to lose the spacer placed between the HS-P sensor and the pump.

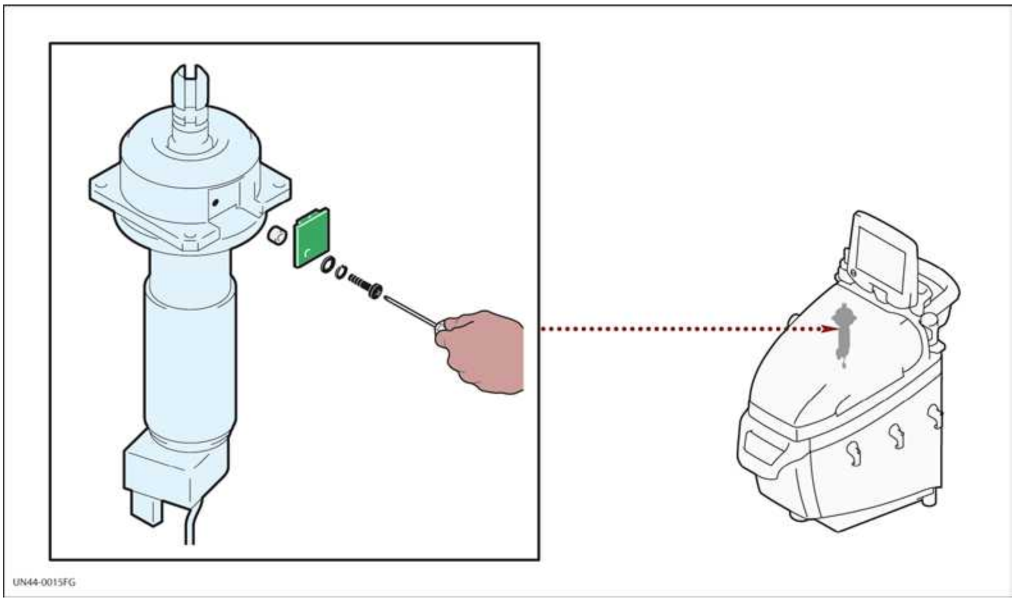


Fig. 12.22-1

12.22.2.3 Reassembly

- Put the new HS-P pump sensor in its seat on the pump group, inserting the spacer between them;
- Fix it screwing the TCC M3x10 screw with the related flat and split washers;
- Connect the HS-P AMP flying connector.

12.22.3 Functional test

Perform the **Pump Test** described in the **(TEST_002)** card.
Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.23(DISM_023) cod. 65623 Bar-code Holder and HCT Sensor rev.00

12.23.1 About this card

The purpose of this card is to describe the **Bar-code holder and HCT sensor** replacement, code **65623**.

12.23.2 Procedure

12.23.2.1 Tools

- Set of screwdrivers;
- Allen keys 5 and 3 mm.

12.23.2.2 Disassembly

- Open the left side panel, see the **(DISM_001) Opening the Unit** card;
- Unscrew the two TCCE M 4x12 screws with the split and flat washers which fix the bar-code holder and HCT sensor to the top;
- Disconnect the J1 connector from the NBC board and the J1 connector from the HHR board;
- Open the centrifuge cover;
- Open the latch;
- Pull the bar-code holder and HCT sensor together with the NBC board up;
- Remove the OR ring and the NBC board from the HCT sensor, unscrewing the two TCCE M 3x10 screws.

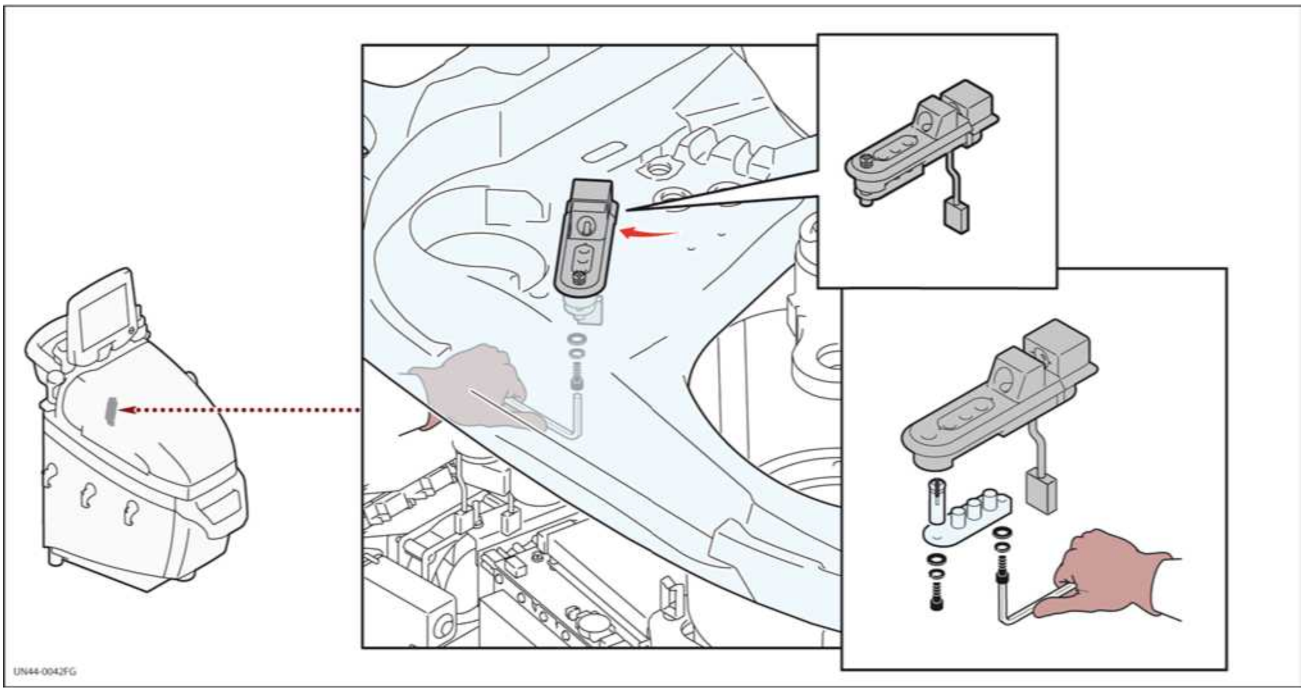


Fig. 12.23-1

12.23.2.3 Reassembly

- Put the OR ring and the NBC board on the new bar-code holder and HCT sensor, screwing the two TCCE M 3x10 screws;

(DISM_023) cod. 65623 Bar-code Holder and HCT Sensor rev.00

- Put the bar-code holder and HCT sensor on the top, allowing the cables to cross the hole on the top;
- Fix the bar-code holder and HCT sensor to the top, screwing the two TCCE M 4x12 screws with the split and flat washers;
- Connect the J1 connector to the NBC board and the J1 connector to the HHR board;
- Close the latch;
- Close the centrifuge cover.

12.23.3 Calibration

Perform the **Haematocrit Indicator Calibration** described in the **(CALIBR_005)** card and the **Kit Sensor Calibration** described in the **(CALIBR_006)** card**.**

12.23.4 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

.

12.24(DISM_024) cod. 65624 Load Cell rev.00

12.24.1 About this card

The purpose of this card is to describe the **load cell** replacement, code **65624**.

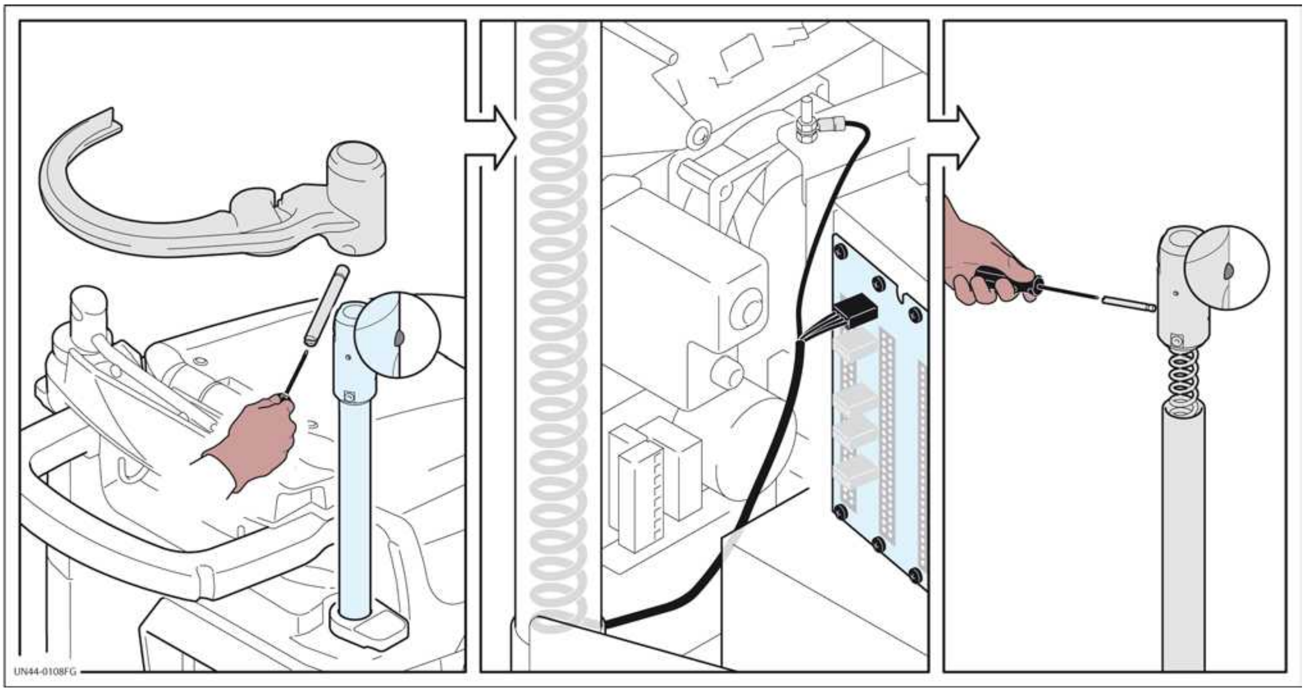
12.24.2 Procedure

12.24.2.1 Tools

- Set of screwdrivers;
- Pliers.

12.24.2.2 Disassembly

- Remove the left panel, see the **(DISM_001) Opening the Unit** card;
- Lift a little bit the cardiotomy mast till the cardiotomy support can rotate;
- Unscrew the pin in the cardiotomy support; to avoid damages to the support, pay attention to the pin direction (see fig.12.24-1), since the hole in which the pin thread is screwed is smallest than the hole through which the pin is to be inserted;
- Pay attention to the inside ball;
- Remove carefully the cardiotomy support pulling it up;
- Unscrew the inner pin;
- Unscrew the load cell coil cable shield (see fig.12.24-1);
- Disconnect the J8 AMP connector from the NBP board;
- Insert the coil cable inside the cardiotomy mast;
- Pull the load cell block up with its coil cable.



12.24-1

WARNING ! *Pay attention not to lose the load cell ball.*

12.24.2.3 Reassembly

- Put the new load cell on the cardiotomy mast, drawing the coil cable down through the mast; during reassembly pay attention to the load cell cable in order to avoid wires disconnection or damages;
- Screw the inner pin in the right direction;
- Re-connect the J8 AMP connector to the NBP board;
- Screw the load cell coil cable shield in its point (see fig.12.24-1);
- Put a little bit grease against the small ball to keep it in its place;
- Put the cardiotomy support back on the mast ,paying attention that the cardiotomy support is opposite to the ball, in order that the weight applied pushes the ball toward the load cell (see fig.12.24-1);
- Screw the external pin;
- Verify if the mast slides properly without going beyond the bush stop position.

12.24.3 Calibration

Perform the **Load Cell Calibration** described in the **(CALIBR_003)** card.

12.24.4 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.
.

12.25(DISM_025) cod. 65625 Low level RBC Detector rev.00

12.25.1 About this card

The purpose of this card is to describe the **XTRA display cover** replacement, code **65625**.

12.25.2 Procedure

12.25.2.1 Tools

- Allen key 3 and 4 mm.

12.25.2.2 Disassembly

- Open the right panel, see the **(DISM_001) Opening the Unit** card;
- Disconnect the LOCK SENS, J3 HHR and CCD flying connectors;
- Cut the wrap tie around the CCD cable,
- Unscrew the two TCCE M 4x12 screws, with the related split washers, which fix the Low Level RBC Detector to the centrifuge well;
- Remove the Low Level RBC Detector.

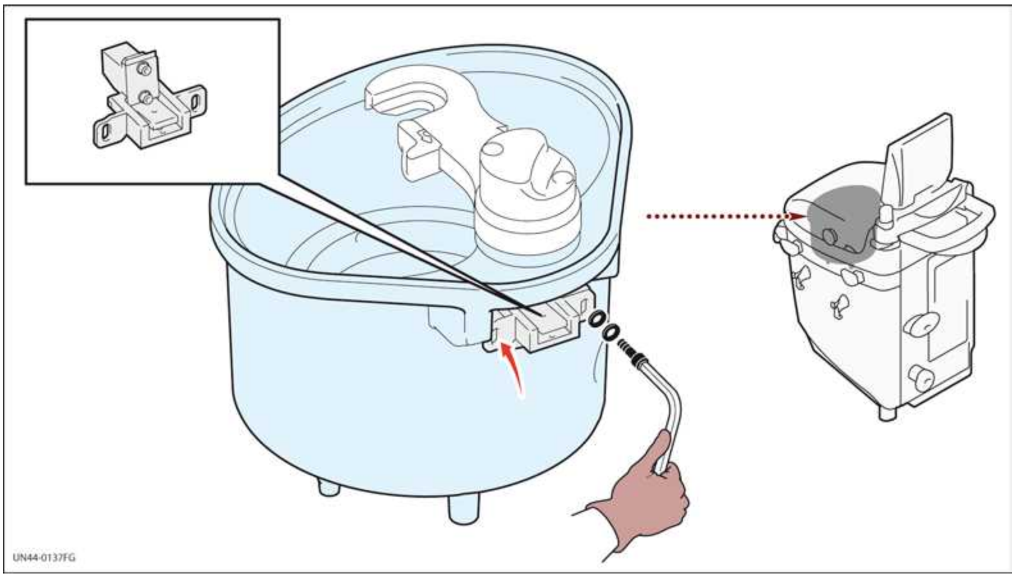


Fig. 12.25-1

12.25.2.3 Reassembly

- Put the new Low Level RBC Detector in its position on the centrifuge well;
- Fix it screwing the two TCCE M 4x12 screws, with the related split washers;
- Connect the LOCK SENS, J3 HHR and CCD flying connectors;
- Put a new tie around the cables.

12.25.3 Calibration

- Perform the **RBC Detector Calibration** described in the **(CALIBR_007)** card.

12.25.4 Functional test

Close the XTRA panels and perform the **(DISM_003) Functional Verification test** #card.

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12.26(DISM_026) cod. 65626 Low level RBC Detector Illuminator rev.00

12.26.1 About this card

The purpose of this card is to describe the **Low level RBC Detector Illuminator** replacement, code **65626**.

12.26.2 Procedure

12.26.2.1 Tools

- Set of screwdrivers;
- Allen key 2 and 3 mm;
- Wire cutter;
- Wire ties;
- Torque wrench 3 Nm.

12.26.2.2 Disassembly

- Remove the High Level RBC Detector, see the **(DISM_018) cod.65618 High Level RBC Detector** card;
- Disconnect the ILLUMIN AMP flying connector;
- Draw the Illuminator away.

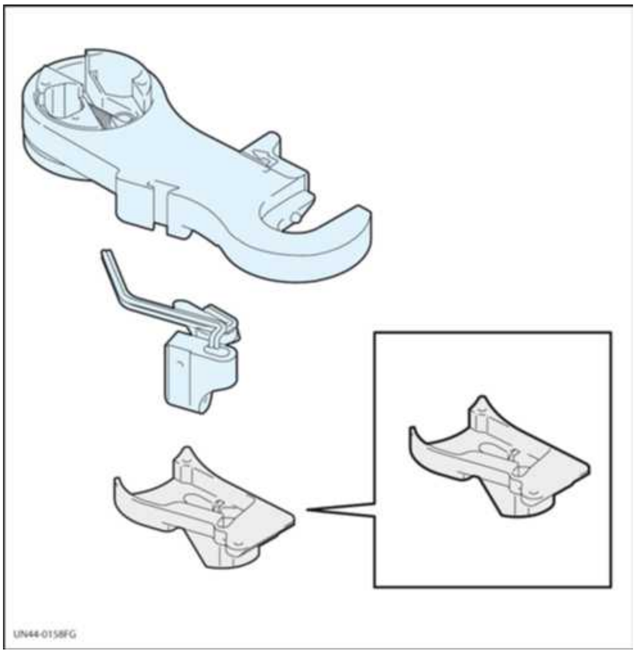


Fig. 12.26-1

12.26.2.3 Reassembly

- Put the High Level RBC Detector on the Low Level RBC Detector Illuminator, passing the cables through the hole of the new illuminator support;
- Pass the High Level RBC Detector and the Low Level RBC Detector Illuminator cables through the hole under the bowl arm cap;
- Connect the ILLUMIN AMP flying connector;
- Keep the High Level RBC detector just a little (about 1,5 cm) distant from the illuminator support;

(DISM_026) cod. 65626 Low level RBC Detector Illuminator rev.00

- Put a new wrap tie around the High Level RBC Detector and Low Level RBC Detector Illuminator cables, making sure the wrap tie is inside the border of the illuminator support;
- Put the illuminator support on the bowl arm, fixing it with the TSPC 3x10 and the TSPC 3x16 screws, passing the HS-A sensor through the hole on the bowl arm and paying attention the cables are in their groove under the bowl arm;
- Insert the cylinder in its seat;
- Insert the metallic swallow tail together with the vertical set screw, screwing the latter;
- Screw the horizontal set screw without tightening it;
- Reassembly the Bowl Arm, see **(DISM_058) cod. 65677 Bowl Arm** card.

12.26.3 Calibration

- Perform the **RBC Detector Calibration** described in the **(CALIBR_007)** card.

12.26.4 Functional test

Close the XTRA panels and perform the **(DISM_003) Functional Verification test** #card.

12.27(DISM_027) cod. 65627 MFN p.c. Board rev.00

12.27.1 About this card

The purpose of this card is to describe the **MFN p.c. board** replacement, code **65627**.

12.27.2 Procedure

12.27.2.1 Tools

- Set of screwdrivers;
- Set of keys.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.27.2.2 Disassembly

- Remove the side panels, see the **(DISM_001) Opening the Unit** card;
- Disconnect the J2 connector from the NAD board;
- Disconnect the J13, J10, J7, J4, J3, J2, J1connectors from the NBB board;
- Disconnect the J5, J14, J17 connectors from the NBB board;
- Unscrew the load cell nut, paying attention not to lose its spilt washer;
- Disconnect the J8, J9, J11, J12, J13 connectors from the NBP board;
- Disconnect the J14, J16 connectors from the NBP board;
- Disconnect the J18, J19, J20, J21 connectors from the NBP board;
- Disconnect the J23, J24, J25, J26, J27, J28 connectors from the NBP board;
- Disconnect the J29, J30, J31, J33, J34, J35 connectors from the NBP board;
- Disconnect the J36, J37, J38, J40, J41, J43 connectors from the NBP board;
- Unscrew the four TCCE M 4x12 screws which fix the rack to the frame;

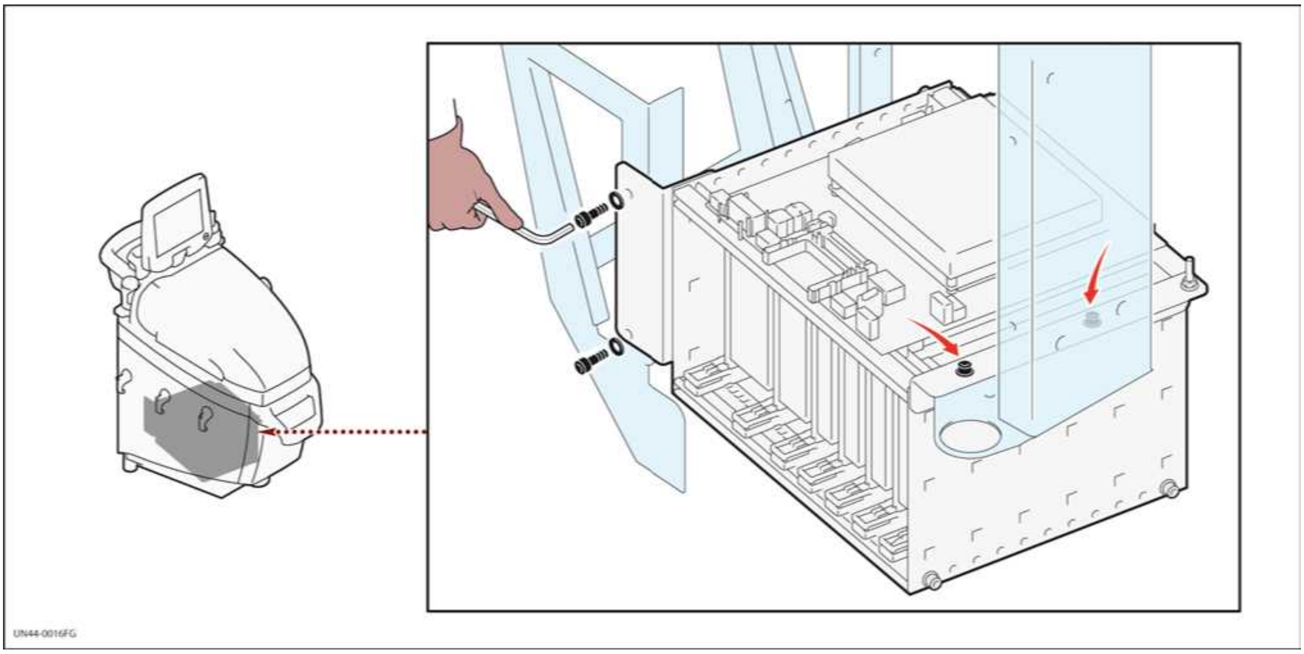


Fig. 12.27-1

- Remove the rack;

- Disconnect the J1 and J2 connectors from the MFN board;
- Unscrew the four KA 35x10 cross screws which fix the MFN board to the rear panel;
- Remove the MFN board.

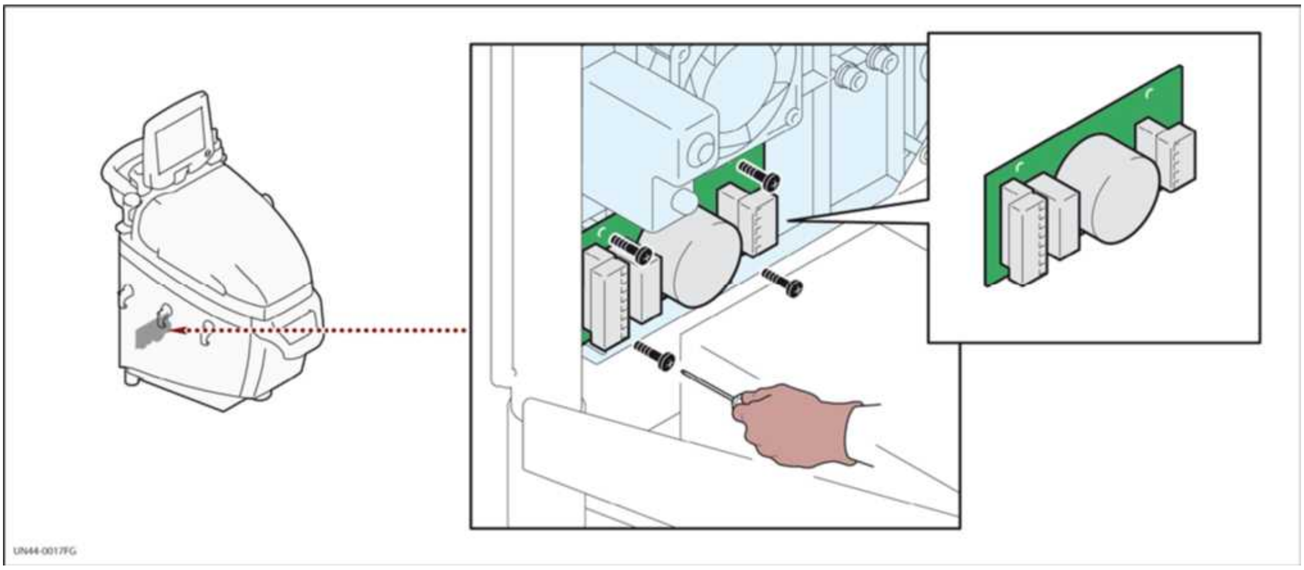


Fig. 12.27-2

12.27.2.3 Reassembly

- Put the new MFN board on the rear panel fixing it with the four KA 35x10 cross screws;
- Connect the J1 and J2 connectors to the MFN board;
- Put the rack on, screwing the 4 TCCE M 4x12 screws which fix it to the frame;
- Put the J13 NBB and J37 NBP cables into their wire saddles
- Connect the J8, J9, J11, J12, J13 connectors to the NBP board;
- Connect the J14, J16 connectors to the NBP board;
- Connect the J18, J19, J20, J21 connectors to the NBP board;
- Connect the J23, J24, J25, J26, J27, J28 connectors to the NBP board;
- Connect the J29, J30, J31, J33, J34, J35 connectors to the NBP board;
- Connect the J36, J37, J38, J40, J41, J43 connectors to the NBP board;
- Connect the J2 connector to the NAD board;
- Connect the J13, J10, J7, J4, J3, J2, J1connectors to the NBB board;
- Connect the J5, J14, J17 connectors to the NBB board;
- Screw the load cell nut, paying attention to insert its spilt washer.

12.27.3 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.28(DISM_028) cod. 65628 NAC p.c. Board rev.00

12.28.1 About this card

The purpose of this card is to describe the **NAC p.c. board** replacement, code **65628**.

12.28.2 Procedure

12.28.2.1 Tools

- Set of screwdrivers.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.28.2.2 Disassembly

- Open the XTRA right side panel, see the **(DISM_001) Opening the Unit** card;
- Bring the NAC board red lever down in the board rack;
- Remove the NAC board catching it for its lever;

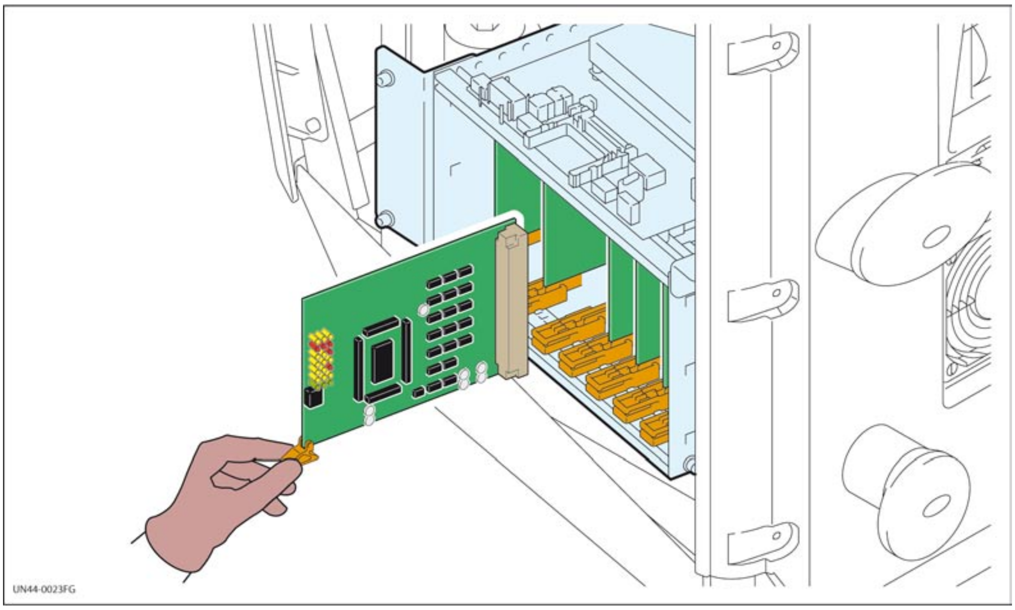


Fig. 12.28-1

12.28.2.3 Reassembly

- Insert all the way the NAC board on its red guide in the rack pushing on its lifted red lever.

12.28.3 Calibration

Perform the download of the software on the NAC p.c. board following the procedure for the NAC board described in the **7 Software Upgrade** card.

12.28.4 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.29(DISM_029) cod. 65629 NAD p.c. Board rev.00

12.29.1 About this card

The purpose of this card is to describe the **NAD p.c. board** replacement, code **65629**.

12.29.2 Procedure

12.29.2.1 Tools

- Set of screwdrivers.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.29.2.2 Disassembly

- Open the XTRA right side panel, see the **(DISM_001) Opening the Unit** card;
- Disconnect the J2 NAD connector from the NAD board;
- Bring the NAD board red lever down in the board rack;
- Remove the NAD board catching it for its lever.

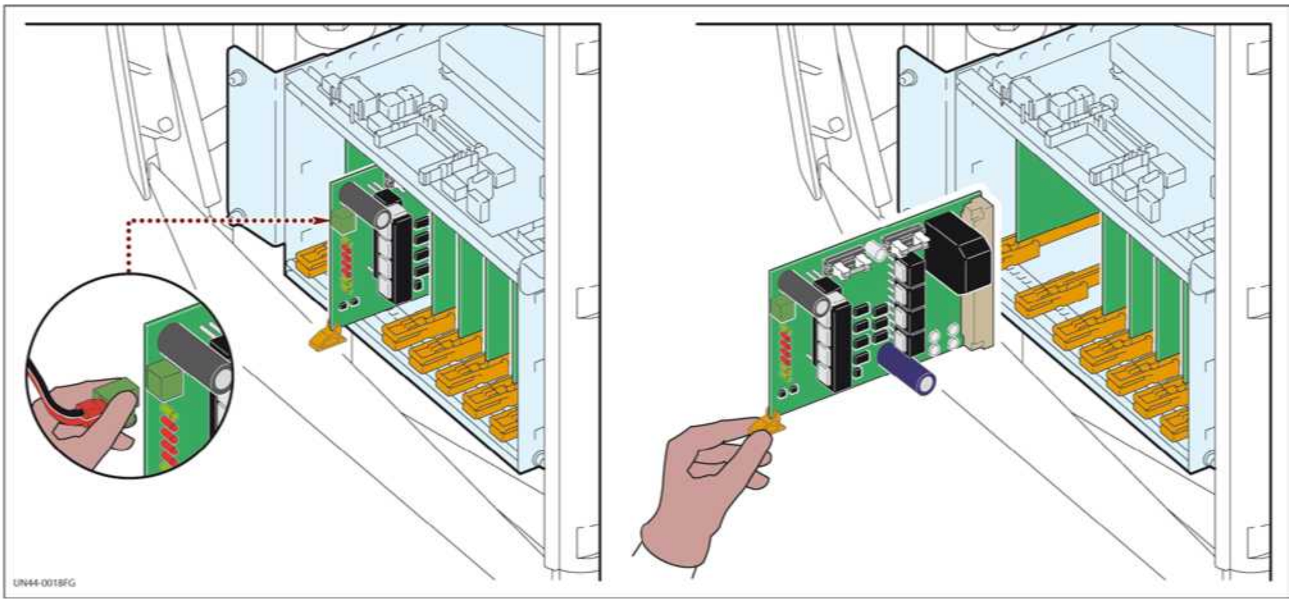


Fig. 12.29-1

12.29.2.3 Reassembly

- Insert all the way the NAD board on its red guide in the rack, pushing on its lifted red lever;
- Re-connect the J2 NAD connector to the board.

12.29.3 Functional test

Perform the **Pump Test** described in the **(TEST_002)** card.
Perform the **Centrifuge Test** described in the **(TEST_003)** card.
Perform the **Ejector Test** described in the **(TEST_008)** card.

Perform the **Cover Lock Test** described in the **(TEST_010)** card.

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.30(DISM_030) cod. 65630 NSC PIC rev.00

12.30.1 About this card

The purpose of this card is to describe the **NSC PIC** replacement, code **65630**.

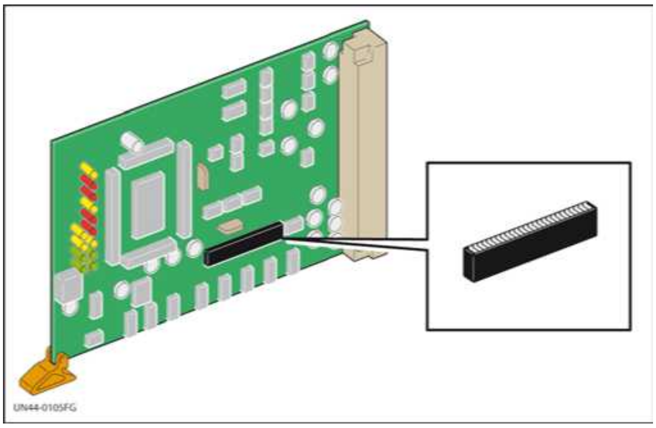
12.30.2 Procedure

12.30.2.1 Tools

- Allen Key 4 mm;
- 28 pins DIP extractor.

12.30.2.2 Disassembly

- Open the right panel;
- Remove the NSC p.c. board, see **(DISM_041) cod.65641 NSC p.c. board** card;
- Remove the NSC PIC from the board using a 28 pins DIP extractor.



12.30-1

12.30.2.3 Reassembly

- Insert the new PIC in its seat on the NSC board;
- Put the NSC board back into to the rack, see (DISM_041) cod.65641 NSC p.c. board card.

12.30.3 Functional test

- Turn on the equipment in **Diagnostic Mode** and enter **Settings/Data Initialization**,
- Press **Factory Mode/Restore Buffy Coat Low/YES**.
- At the end press **Factory Mode** and perform the testing procedure described in the **(CALIBR_007) RBC Detector Calibration** card.
- Close the XTRA panels and perform the **(DISM_003) Functional Verification test** #card.

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12.31(DISM_031) cod. 65631 NBB p.c. Board rev.00

12.31.1 About this card

The purpose of this card is to describe the **NBB** p.c. board replacement, code **65631**.

12.31.2 Procedure

12.31.2.1 Tools

- Set of screwdrivers;
- Set of socket wrenches.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.31.2.2 Disassembly

- Open the XTRA side panels, see the **(DISM_001) Opening the Unit** card;
- Disconnect the J1, J2, J3, J4, J5, J7, J10, J13, J14, J17 connectors from the NBB board;
- Unscrew the four M3 nuts which fix the NBB board to the rack, with their flat and split washers;

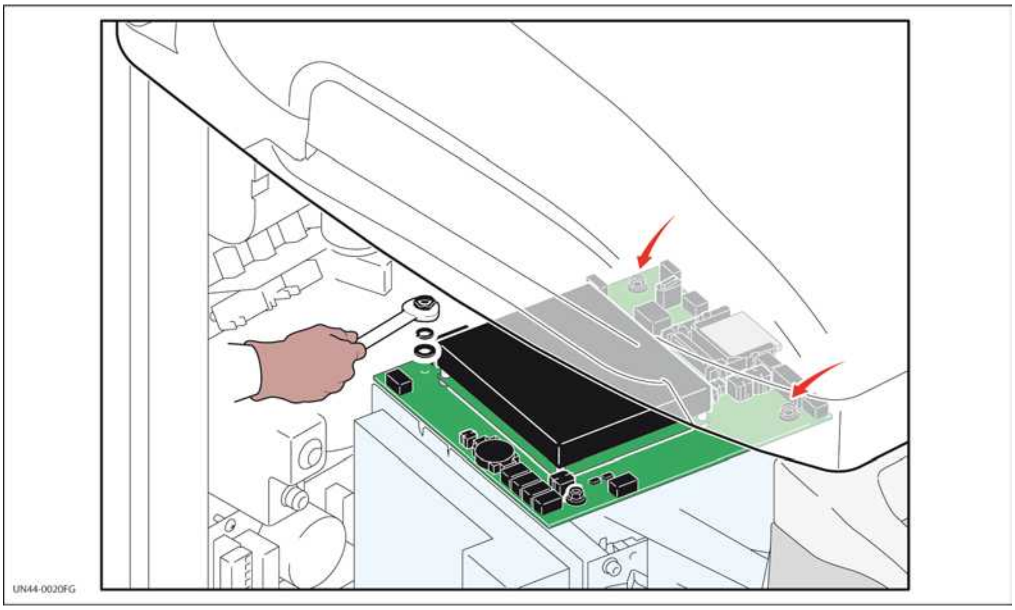

Fig. 12.31-1

- Draw the NBB board together with the PC away;
- Remove the PC from the NBB board unscrewing the 4 TCC M 2.5x16 screws with their flat washers;

(DISM_031) cod. 65631 NBB p.c. Board rev.00

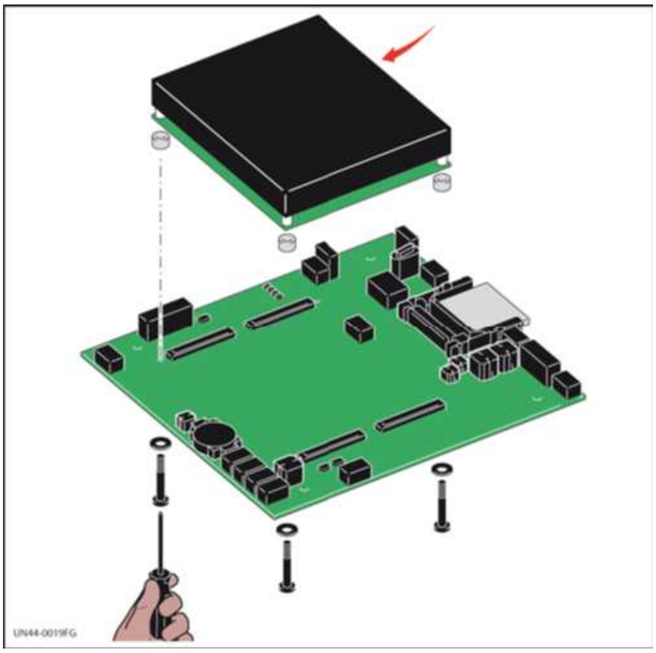

Fig. 12.31-2

- Remove the four spacers which separate the PC from the board.

12.31.2.3 Reassembly

- Put the PC on the new NBB board inserting the four spacers between them, paying attention to the correct direction of the PC (see Fig.12.31-2);
- Fix the PC on the board screwing the four screws with their flat washers;
- Put the NBB board with the PC on the rack, screwing the 4 nuts with their flat and split washers;
- Re-connect the J1, J2, J3, J4, J5, J7, J10, J13, J14, J17 connectors to the NBB board.

12.31.3 Functional test

It could be necessary to perform the display contrast adjustment. To do this, in the **Setup** page in **Normal Mode** enter **Menu/Settings/Configuration Mode/Display**.
Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.32(DISM_032) cod. 65632 NBC p.c. Board rev.00

12.32.1 About this card

The purpose of this card is to describe the **NBC p.c. board** replacement, code **65632**.

12.32.2 Procedure

12.32.2.1 Tools

- Set of screwdrivers;
- Allen keys 5 and 3 mm.

12.32.2.2 Disassembly

- Open the left side panel, see the **(DISM_001) Opening the Unit** card;
- Unscrew the two TCCE M 4x12 screws with the split and flat washers which fix the HCT sensor and bar-code holder to the top;
- Disconnect the J1 connector from the NBC board and the J1 connector from the HHR board;
- Open the centrifuge cover;
- Open the latch;
- Pull the HCT sensor together with the NBC board up;
- Remove the NBC board from the HCT sensor, unscrewing the two TCCE M 3x10 screws.

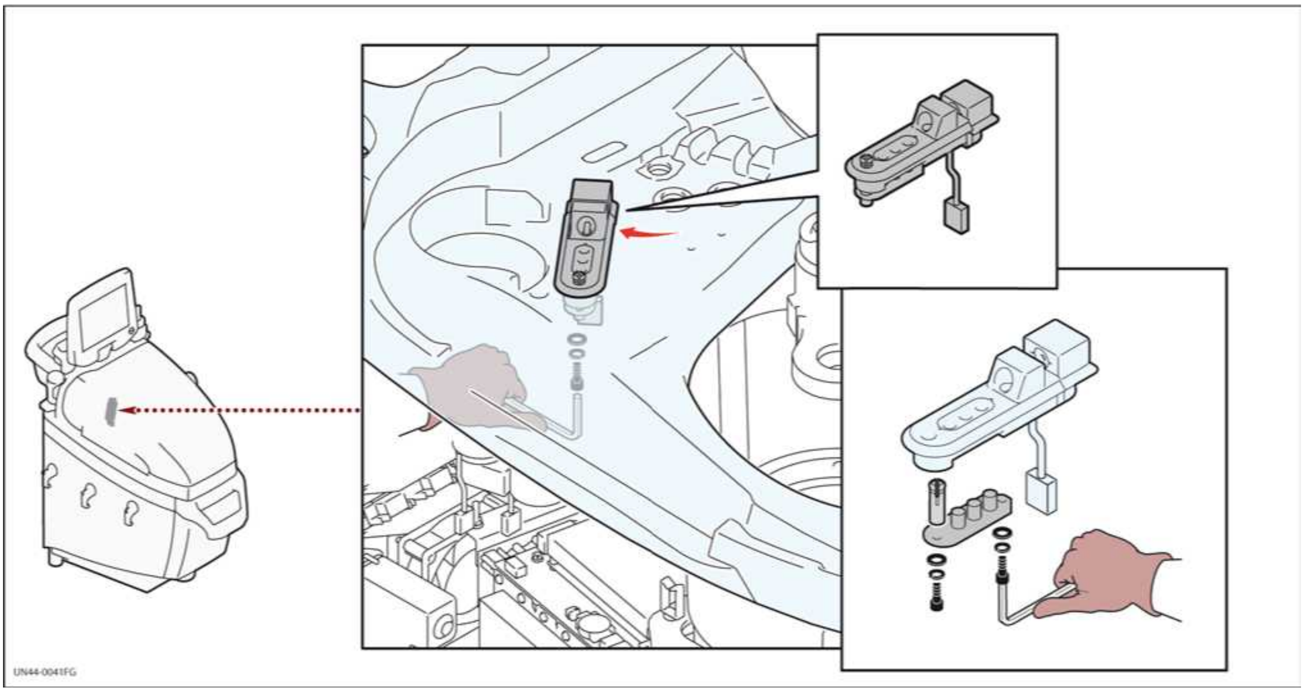

Fig. 12.32-1

12.32.2.3 Reassembly

- Put the new NBC board on the HCT sensor, screwing the two TCCE M 3x10 screws;
- Put the HCT sensor on the top, allowing the cables to cross the hole on the top;
- Fix the HCT sensor to the top, screwing the two TCCE M 4x12 screws with the split and flat washers;

- Connect the J1 connector to the NBC board and the J1 connector to the HHR board;
- Close the latch;
- Close the centrifuge cover.

12.32.3 Calibration

Perform the **Kit Sensor Calibration** described in the **(CALIBR_006)** card.

12.32.4 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.33(DISM_033) cod.65633 NBLS Fluid Loss Sensor rev.00

12.33.1 About this card

The purpose of this card is to describe the **NBLS fluid loss sensor** replacement, code **65633**.

12.33.2 Procedure

12.33.2.1 Tools

- Set of screwdrivers;

12.33.2.2 Disassembly

- Remove the left side panel;
- Disconnect the J1 AMP connector from the NBLS sensor;
- The NBLS sensor is stuck on the well;
- Remove the NBLS board from the internal of the centrifuge well.

12.33.2.3 Reassembly

- Clean perfectly the centrifuge well surface and remove old insertions;
- Stick the new NBLS board in its seat on the centrifuge;
- Connect the J1 AMP connector to the NBLS board.

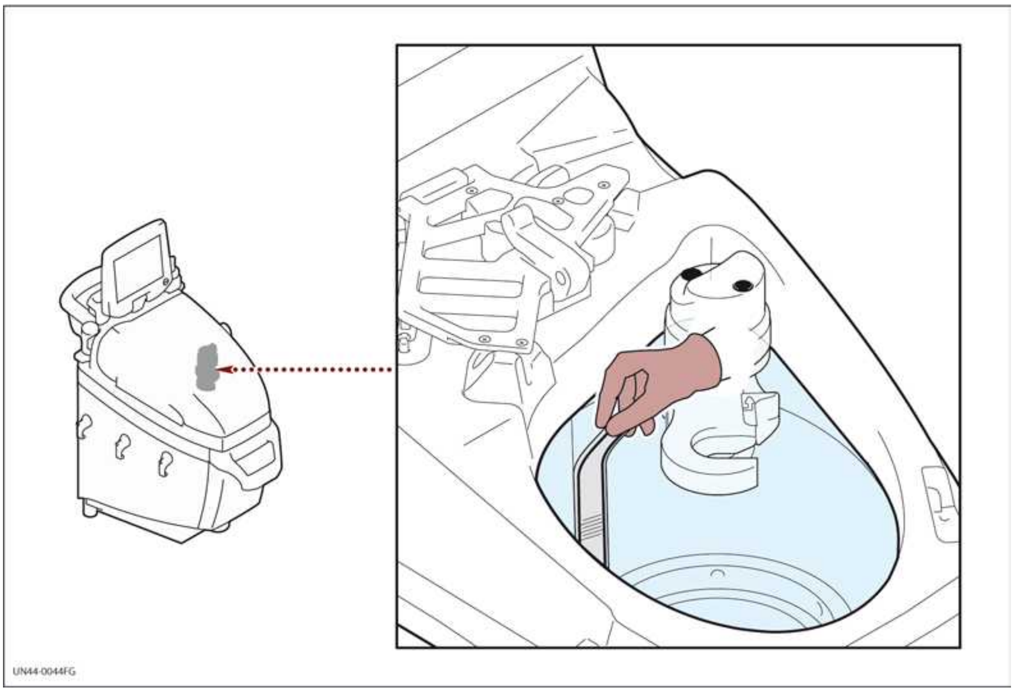

Fig. 12.33-1

12.33.3 Functional test

Perform the **Centrifuge Fluid Loss Sensor Test** described in the **(TEST_004)** card.
Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.34(DISM_034) cod. 65634 NBP p.c. Board rev.00

12.34.1 About this card

The purpose of this card is to describe the **NBP p.c. board** replacement, code **65634**

12.34.2 Procedure

12.34.2.1 Tools

- Set of screwdrivers;
- Set of keys;

NOTE: ESD protective measures must be taken while removing the p.c. board

12.34.2.2 Disassembly

- Remove the side panels, see the **(DISM_001) Opening the Unit** card;
- Disconnect the J2 connector from the NAD board;
- Disconnect the J13, J10, J7, J4, J3, J2, J1connectors from the NBB board;
- Disconnect the J5, J14, J17 connectors from the NBB board;
- Unscrew the load cell nut, paying attention not to lose its spilt washer;
- Disconnect the J8, J9, J11, J12, J13 connectors from the NBP board;
- Disconnect the J14, J16 connectors from the NBP boards;
- Disconnect the J18, J19, J20, J21 connectors from the NBP board;
- Disconnect the J23, J24, J25, J26, J27, J28 connectors from the NBP board;
- Disconnect the J29, J30, J31, J33, J34, J35 connectors from the NBP board;
- Disconnect the J36, J37, J38, J40, J41, J43 connectors from the NBP board;
- Unscrew the 4 TCCE M 4x12 screws which fix the rack to the frame;

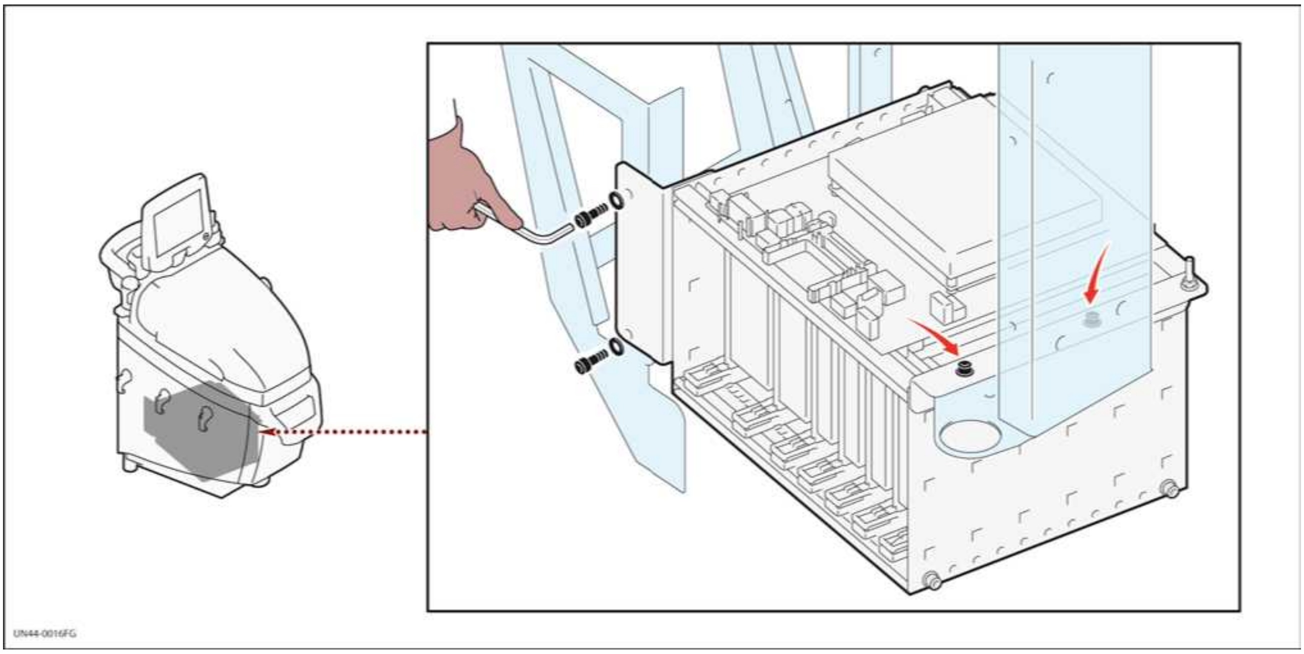

Fig. 12.34-1

- Remove the rack;
- Remove the NSA, NSC, NMC, NAC, NAD, NPS p.c. boards from the rack;
- Unscrew the fourteen TCC M 2,5x10 screws, with their washers, which fix the NBP board to the rack frame;
- Remove the NBP board paying attention to the two spacers between the board and the rack.

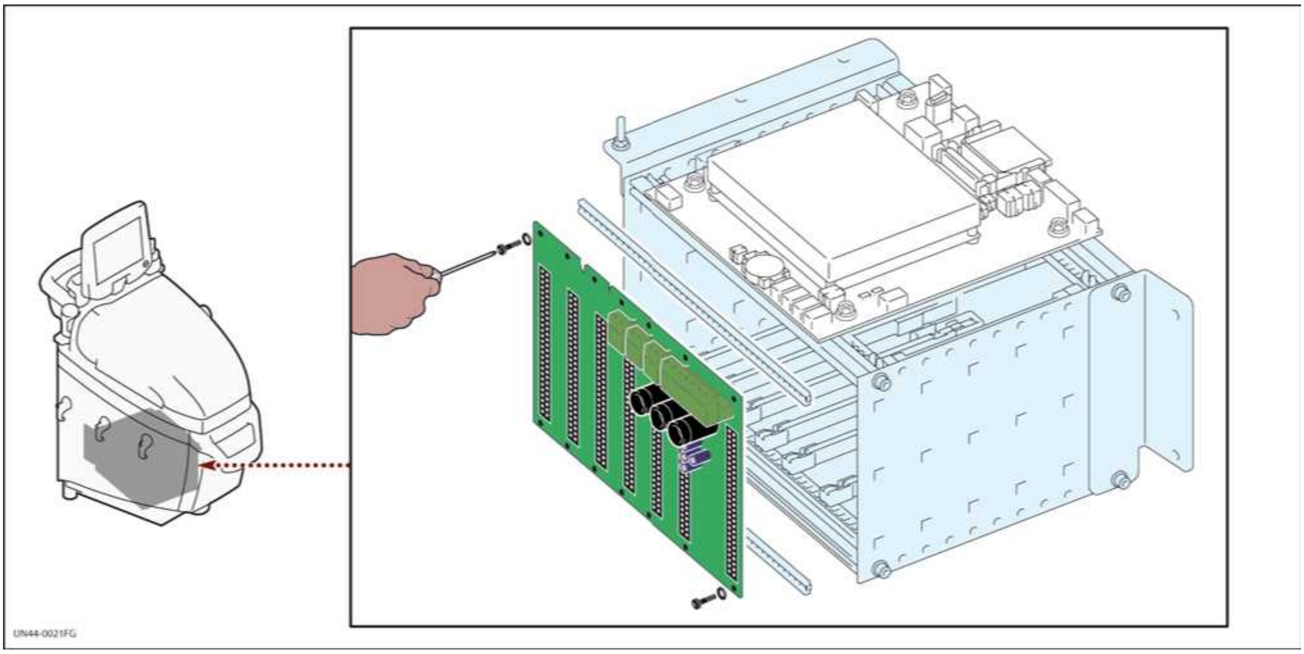

Fig. 12.34-2

12.34.2.3 Reassembly

- Put the new NBP board on the rack, inserting the two spacers between them, and fixing it with the fourteen TCC M 2,5x10 screws and flat washers;
- Insert the NSA, NSC, NMC, NAC, NAD, NPS p.c. boards back on the rack;
- Put the rack on, screwing the 4 TCCE M 4x12 screws which fix it to the frame;
- Put the J13 NBB and J37 NBP cables into their wire saddles;
- Connect the J8, J9, J11, J12, J13 connectors to the NBP board;
- Connect the J14, J16 connectors to the NBP board;
- Connect the J18, J19, J20, J21 connectors to the NBP board;
- Connect the J23, J24, J25, J26, J27, J28 connectors to the NBP board;
- Connect the J29, J30, J31, J33, J34, J35 connectors to the NBP board;
- Connect the J36, J37, J38, J40, J41, J43 connectors to the NBP board;
- Connect the J2 connector to the NAD board;
- Connect the J13, J10, J7, J4, J3, J2, J1connectors to the NBB board;
- Connect the J5, J14, J17 connectors to the NBB board;
- Screw the load cell nut, paying attention to insert its split washer.

12.34.3 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.35(DISM_035) cod. 65635 NCH p.c. board rev.00

12.35.1 About this card

The purpose of this card is to describe the **NCH p.c. board** replacement, code **65635.**

12.35.2 Procedure

12.35.2.1 Tools

- Set of screwdrivers.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.35.2.2 Disassembly

- Remove the right panel, see the **(DISM_001) Opening the Unit** card;;
- Disconnect the J1 connector from the NCH p.c. board;
- Unscrew the two KA M 35x10 screws which fix the NCH board support to the top;
- Draw the NCH board support away;
- Remove the NCH p.c. board from its support, unscrewing the two KA M 30x8 screws, paying attention not to lose the two metallic spacers between them.

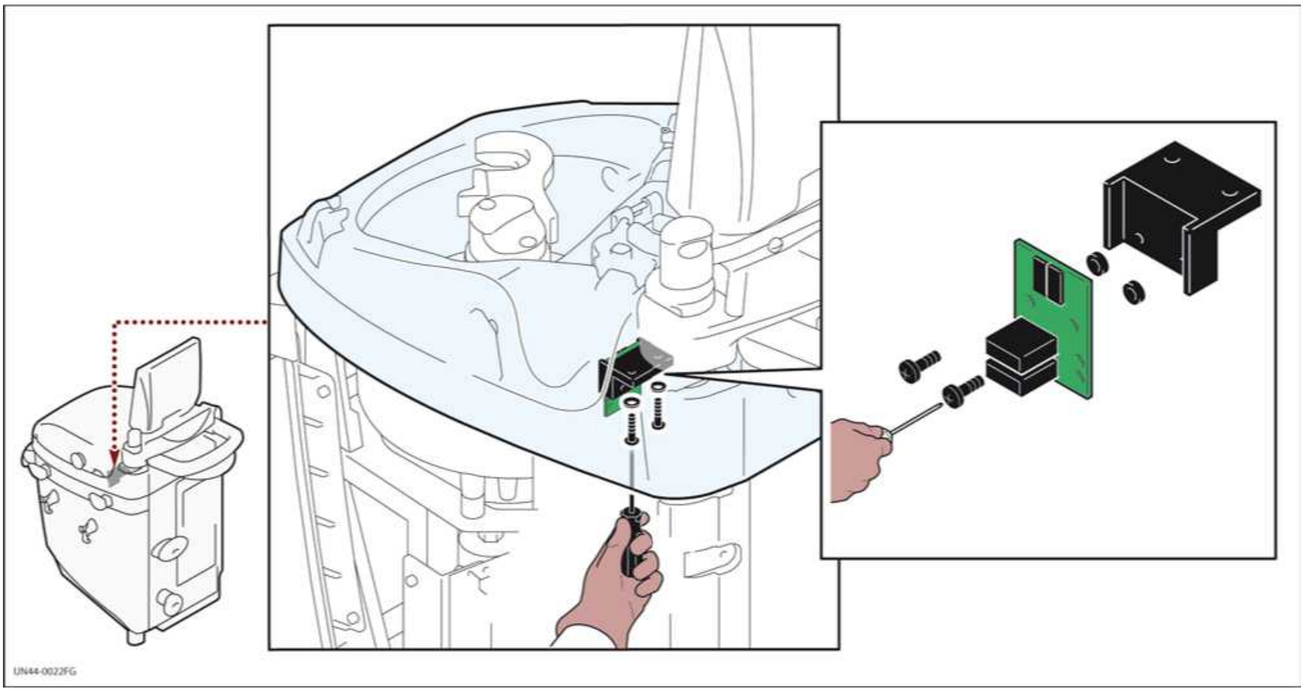

Fig. 12.35-1

12.35.2.3 Reassembly

- Put the new NCH p.c. board on the support and screw the two KA M 30x8 screws, inserting the two metallic spacers between them;
- Insert the new NHC board support on the top;
- Fix the NHC support to the top screwing the two KA M 35x10 screws;

- Connect the J1 connector to the NCH p.c. board.

12.35.3 Functional test

Perform the **Cover Sensor Test** described in the **(TEST_009)** card.
Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.36(DISM_036) cod. 65636 NLB Internal Centrifuge Light rev.00

12.36.1 About this card

The purpose of this card is to describe the **NLB Internal Centrifuge Light** replacement, code **65636**.

12.36.2 Procedure

12.36.2.1 Tools

- Set of screwdrivers.

12.36.2.2 Disassembly

- Remove the left panel;
- Disconnect the J1 connector from the NLB board;
- Unscrew the two TCC M 3x12 screws with the related flat and split washers that fix the internal centrifuge light board to the centrifuge well;
- Remove the old NLB board from its seat;

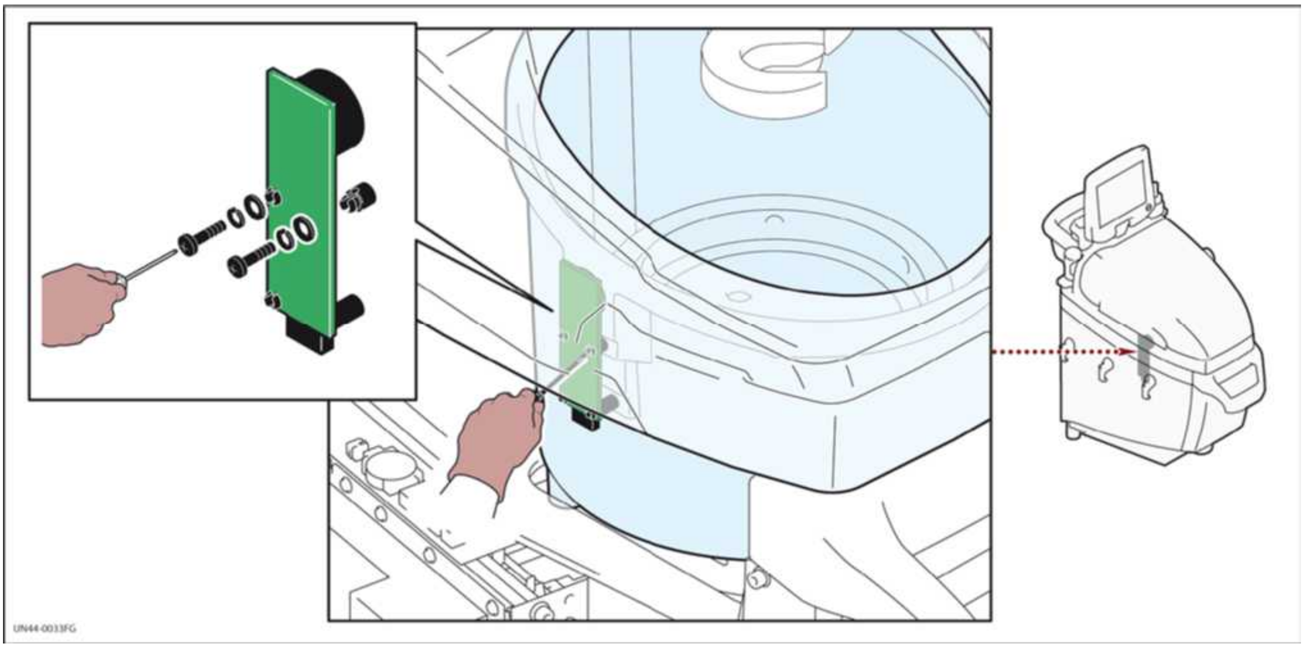

Fig. 12.36-1

12.36.2.3 Reassembly

- Insert the new NLB board;
- Fix the new centrifuge light to the centrifuge well with the two TCC M 3x12 screws;
- Connect the J1 connector of the new LED board;

12.36.3 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

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12.37(DISM_037) cod. 65637 NMC Flash rev.00

12.37.1 About this card

The purpose of this card is to describe the **NMC Flash** replacement, code **65637**.

12.37.2 Procedure

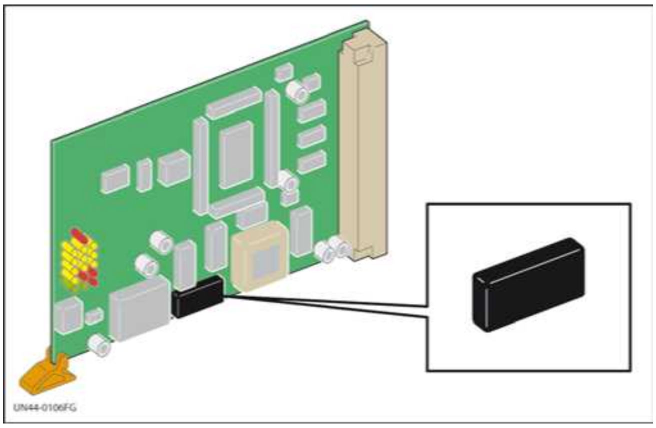
12.37.2.1 Tools

- Set of screwdrivers.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.37.2.2 Disassembly

- Open the XTRA right side panel;
- Bring the NMC board red lever down;
- Remove the NMC board catching it for its lever;
- Remove the NMC Flash opening its housing (see fig.12.37-1).



12.37-1

12.37.2.3 Reassembly

- Insert the new NMC Flash in its housing on the NMC board;
- Insert all the way the NMC board on its red guide, pushing on its lifted red lever;

12.37.3 Calibration

Perform the download of the software on the NMC p.c. board following the procedure for the NMC board described in the **7 Software Upgrade** card.

12.37.4 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

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12.38(DISM_038) cod. 65638 NMC p.c. Board rev.00

12.38.1 About this card

The purpose of this card is to describe the **NMC p.c. board** replacement, code **65638**.

12.38.2 Procedure

12.38.2.1 Tools

- Set of screwdrivers.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.38.2.2 Disassembly

- Open the XTRA right side panel, see the **(DISM_001) Opening the Unit** card;
- Bring the NMC board red lever down in the board rack;
- Remove the NMC board catching it for its lever.

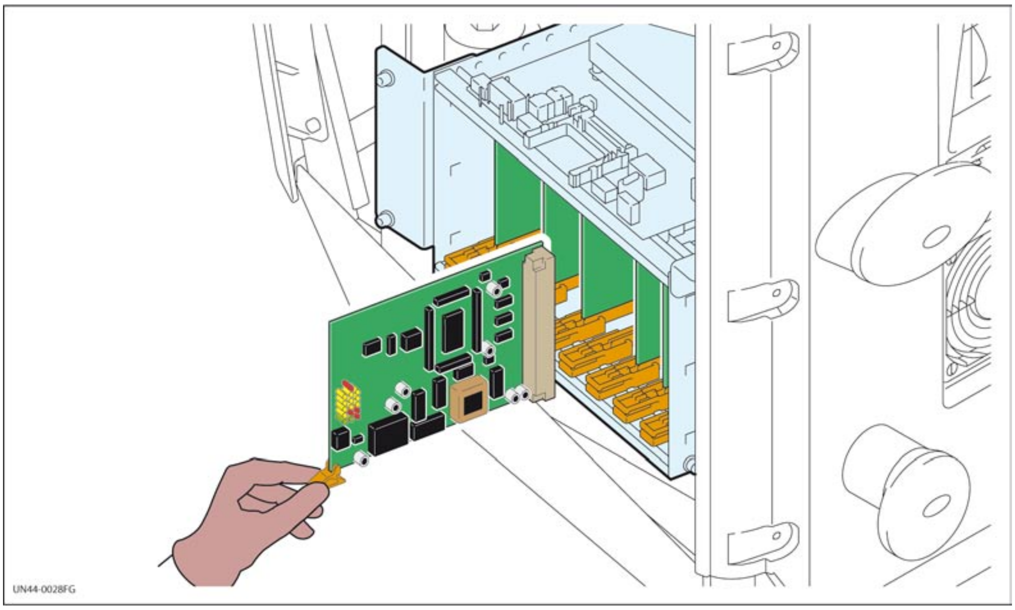


Fig. 12.38-1

12.38.2.3 Reassembly

- Insert all the way the NMC board on its red guide in the board rack, pushing on its lifted red lever.

12.38.3 Calibration

Perform the download of the software on the NMC p.c. board following the procedure for the NMC board in **7 Software Upgrade** card.

12.38.4 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.39(DISM_039) cod. 65639 NPS p.c. Board rev.00

12.39.1 About this card

The purpose of this card is to describe the **NPS p.c. board** replacement, code **65639**.

12.39.2 Procedure

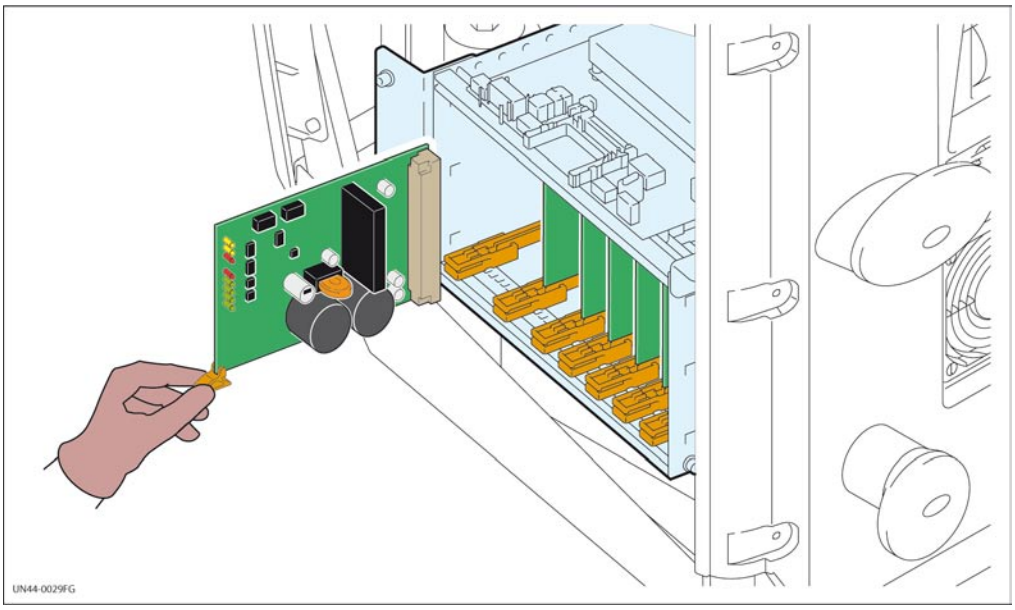
12.39.2.1 Tools

- Set of screwdrivers.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.39.2.2 Disassembly

- Open the XTRA right side panel
- Bring the NPS board red lever down in the board rack;
- Remove the NPS board catching it for its lever.



12.39-1

12.39.2.3 Reassembly

- Insert all the way the NPS board on its red guide in the rack, pushing on its lifted red lever.

12.39.3 Functional test

Perform the testing procedure described in the **(CALIBR_002) Power Supply Calibration** card.
Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.40(DISM_040) cod. 65640 NSA p.c. Board rev.00

12.40.1 About this card

The purpose of this card is to describe the **NSA p.c. board** replacement, code **65640**.

12.40.2 Procedure

12.40.2.1 Tools

- Set of screwdrivers.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.40.2.2 Disassembly

- Open the XTRA right side panel, see the **(DISM_001) Opening the Unit** card;
- Bring the NSA board red lever down in the board rack;
- Remove the NSA board catching it for its lever.

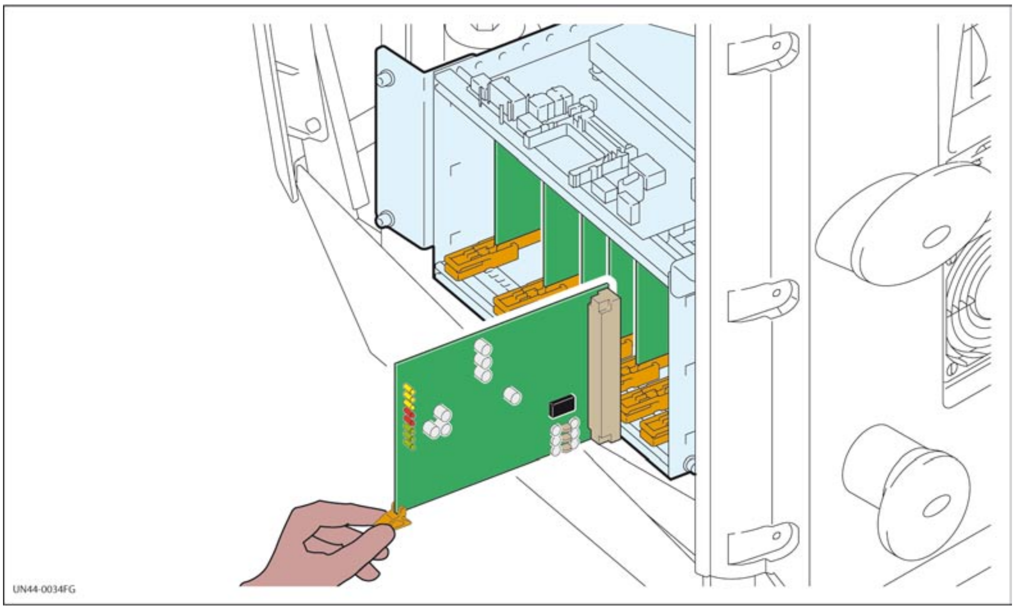


Fig. 12.40-1

12.40.2.3 Reassembly

- Insert all the way the NSA board on its red guide in the rack, pushing on its lifted red lever.

12.40.3 Calibration

Perform the (CALIBR _003) Load Cell Calibration;
Perform the (CALIBR _004) Waste Line Color Indicator Calibration;

Perform the (CALIBR _005) Haematocrit Indicator Calibration;
Perform the (CALIBR _006) Kit Sensor Calibration;
Perform the (CALIBR_007) RBC Detector Calibration.

12.40.4 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.41(DISM_041) cod. 65641 NSC p.c. Board rev.00

12.41.1 About this card

The purpose of this card is to describe the **NSC p.c. board** replacement, code **65641**.

12.41.2 Procedure

12.41.2.1 Tools

- Set of screwdrivers.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.41.2.2 Disassembly

- Open the XTRA right side panel, see the **(DISM_001) Opening the Unit** card;
- Bring the NSC board red lever down;
- Remove the NSC board catching it for its lever.

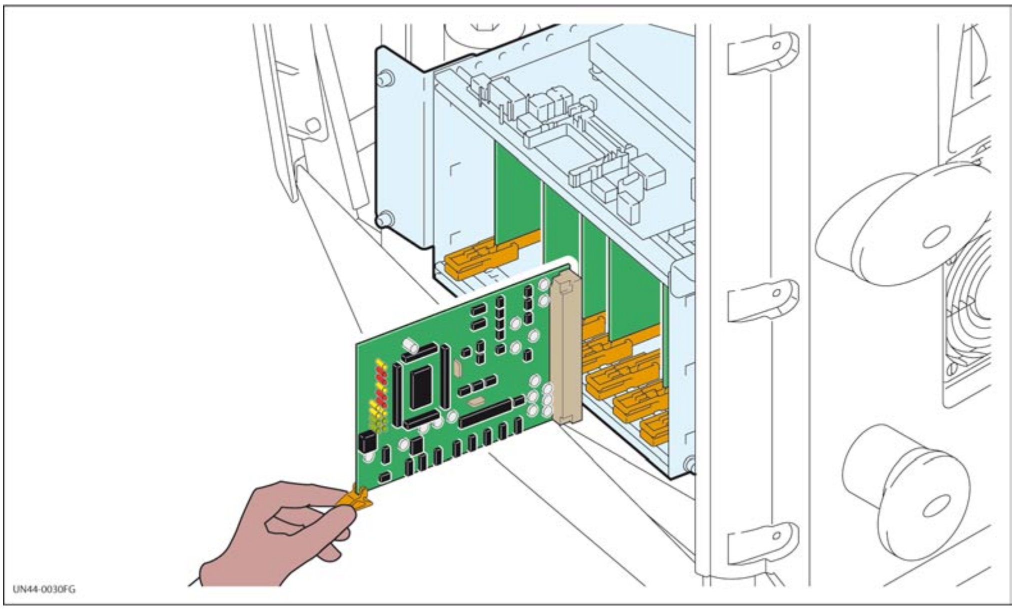


Fig. 12.41-1

12.41.2.3 Reassembly

- Insert all the way the NSC board on its red guide, pushing on its lifted red lever.

12.41.3 Calibration

Perform the download of the software on the NSC p.c. board following the procedure for the NSC board in **7 Software Upgrade** card.

12.41.4 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.42(DISM_042) cod. 65642 Power Supply rev.00

12.42.1 About this card

The purpose of this card is to describe the **Power Supply** replacement, code **65642**.

12.42.2 Procedure

12.42.2.1 Tools

- Set of screwdrivers;
- Set of keys;

NOTE: ESD protective measures must be taken while removing the p.c. board

12.42.2.2 Disassembly

- Lift the equipment up from its cart;
- Remove the side panels, see the **(DISM_001) Opening the Unit** card;
- Unscrew the 4 screws TSPC M 4x12 placed on the front of the machine down the front panel;
- Disconnect the drain tube from the centrifuge;
- Rotate 90° clockwise the liquid collection tank cap and draw it away through the hole;
- Disconnect the J2 connector from the NAD board;
- Disconnect the J13, J10, J7, J4, J3, J2, J1connectors from the NBB board;
- Disconnect the J5, J14, J17 connectors from the NBB board;
- Unscrew the load cell nut, paying attention not to lose its split washer;
- Disconnect the J8, J9, J11, J12, J13 connectors from the NBP board;
- Disconnect the J14, J16 connectors from the NBP boards;
- Disconnect the J18, J19, J20, J21 connectors from the NBP board;
- Disconnect the J23, J24, J25, J26, J27, J28 connectors from the NBP board;
- Disconnect the J29, J30, J31, J33, J34, J35 connectors from the NBP board;
- Disconnect the J36, J37, J38, J40, J41, J43 connectors from the NBP board;
- Unscrew the 4 TCCE M 4x12 screws which fix the rack to the frame;
- Remove the rack;
- Put the J13 NBB and J37 NBP cables out from their wire saddles;
- Disconnect the SLOT1, SLOT2, SLOT5, SLOT6 connectors from the power supply;
- Unscrew the 4 TSPC 4x6 screws which fix the power supply to the frame;
- Unscrew the IN and OUT ground cables of the power supply (points 4 and 6 in the fig.14.42-1) from the frame;

(DISM_042) cod. 65642 Power Supply rev.00

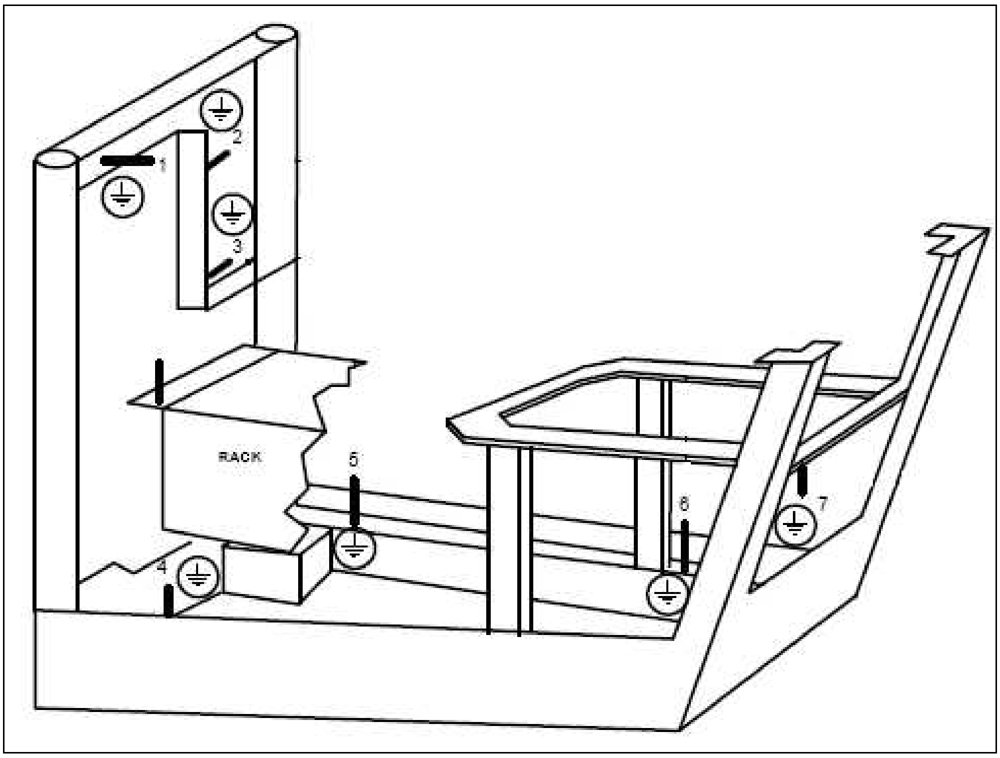


Fig. 12.42-1

- Disconnect the J2 connector from the MFN p.c. board;
- Disconnect the three VACUUM POWER connectors from the vacuum socket on the frame;
- Draw the power supply away from the equipment.

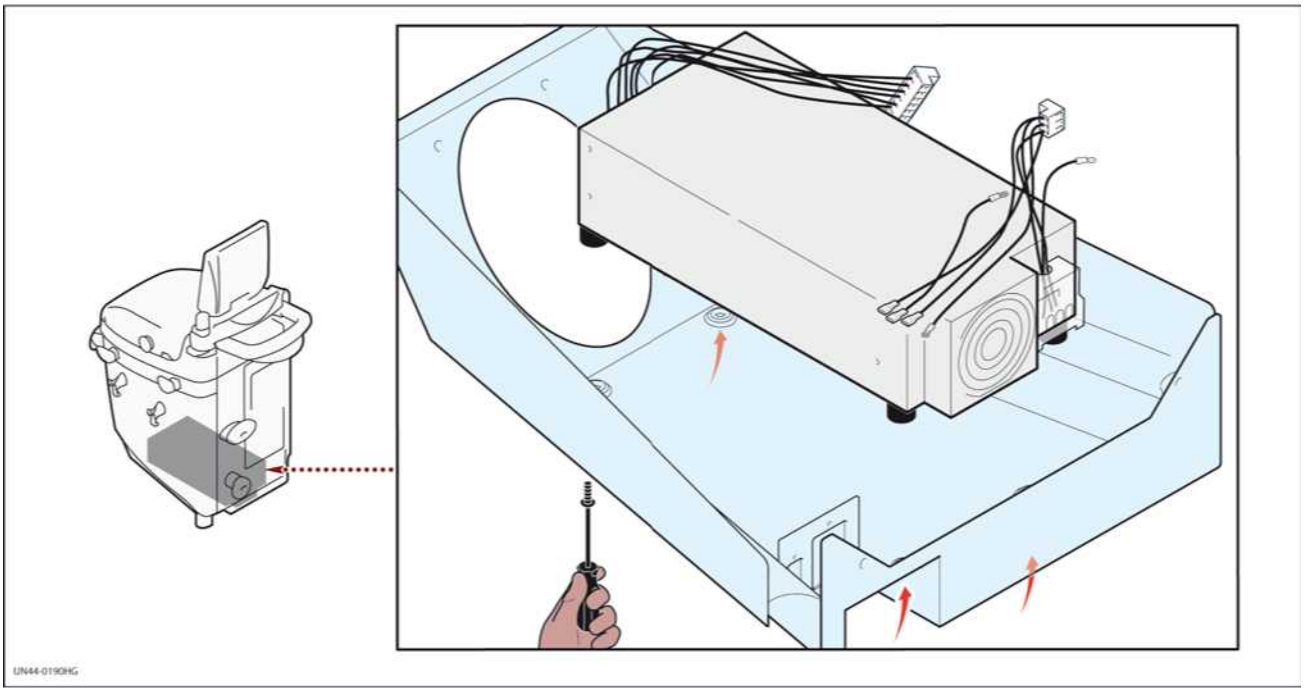


Fig. 12.42-2

12.42.2.3 Reassembly

- Put the power supply on the frame;
- Fix the power supply to the frame with the 4 TSPC 4x6 screws;
- Screw the IN and OUT ground cables of the power supply (points 4 and 6 in the fig.14.42-1) to the frame;
- Connect the J2 connector to the MFN p.c. board;
- Connect the three VACUUM POWER connectors to the vacuum socket on the frame;
- Connect the slot1, slot2, slot5, slot6 to the power supply;
- Put the rack on, screwing the 4 TCCE M 4x12 screws which fix it to the frame;
- Put the J13 NBB and J37 NBP cables into their wire saddles
- Connect the J8, J9, J11, J12, J13 connectors to the NBP board;
- Connect the J14, J16 connectors to the NBP boards;
- Connect the J18, J19, J20, J21 connectors to the NBP board;
- Connect the J23, J24, J25, J26, J27, J28 connectors to the NBP board;
- Connect the J29, J30, J31, J33, J34, J35 connectors to the NBP board;
- Connect the J36, J37, J38, J40, J41, J43 connectors to the NBP board;
- Connect the J2 connector to the NAD board;
- Connect the J13, J10, J7, J4, J3, J2, J1connectors to the NBB board;
- Connect the J5, J14, J17 connectors to the NBB board;
- Screw the load cell nut, paying attention to insert its spilt washer;
- Put the liquid collection tank cap back on the machine rotated 90° clockwise;
- When inserted, rotate the liquid collection tank cap 90° counter-clockwise so that the holes are aligned;
- Screw the four screws TSPC M 4x12;
- Re-connect the drain tube to the centrifuge;
- Close the equipment;
- Put the machine back on the cart.

12.42.3 Calibration

Perform the **Power Supply Calibration** described in the **(CALIBR_002)** card.

12.42.4 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

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12.43(DISM_043) cod. 65643 Printer Ink and Paper rev.00

12.43.1 About this card

The purpose of this card is to describe the **printer ink and paper** replacement, code **65643**.

12.43.2 Procedure

12.43.2.1 Tools

No tool is required.

12.43.2.2 Disassembly

- Open the printer little door;
- Push the **PUSH** button on the right side;
- Lift the printer up;
- Remove the ink cartridge, lifting its lodging up **(EJECT);**
- Remove the paper roll.

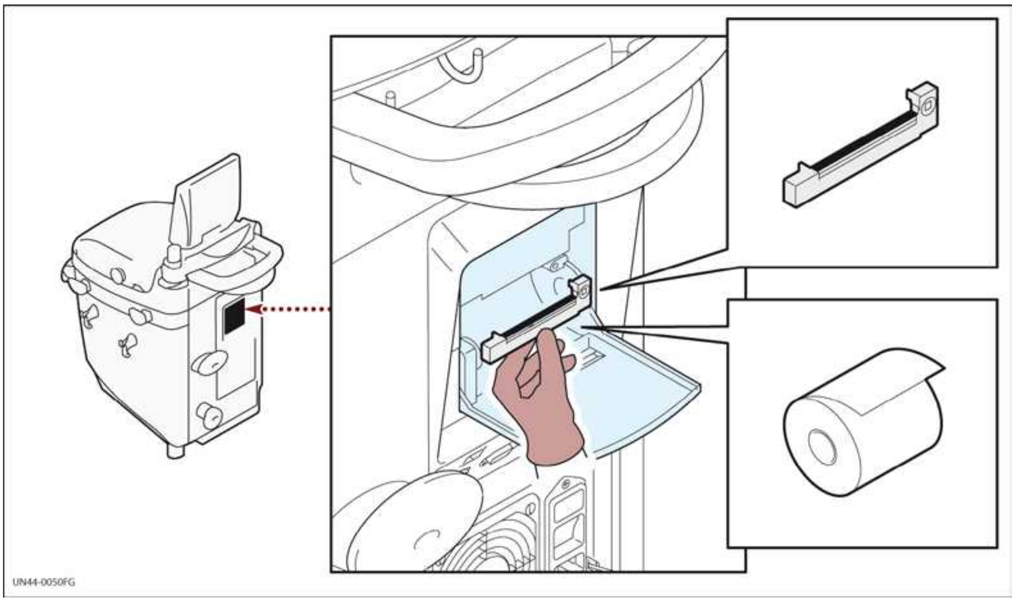

Fig. 12.43-1

12.43.2.3 Reassembly

- Insert the new ink cartridge;
- Insert the new paper roll setting the end free;
- Put the free end through the proper slit (under the ink cartridge) and contemporary push the **FEED** button;
- Re-close the cartridge lodging;
- Close the printer little door pulling the paper out.

(DISM_043) cod. 65643 Printer Ink and Paper rev.00

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12.44(DISM_044) cod. 65644 Printer rev.00

12.44.1 About this card

The purpose of this card is to describe the **Printer** replacement, code **65644**.

12.44.2 Procedure

12.44.2.1 Tools

- Set of screwdrivers.

12.44.2.2 Disassembly

- Open the left side panel, see the **(DISM_001) Opening the Unit** card;
- Disconnect the two PRINTER connectors from the printer;
- From the rear side of the XTRA open the printer small door;
- Remove the printer ink, see **(DISM_043) cod. 65643 Printer Ink and Paper** card**;**
- Unscrew the two cross screws located on left and right side of the paper (see fig.12.44-1);
- Remove the printer.

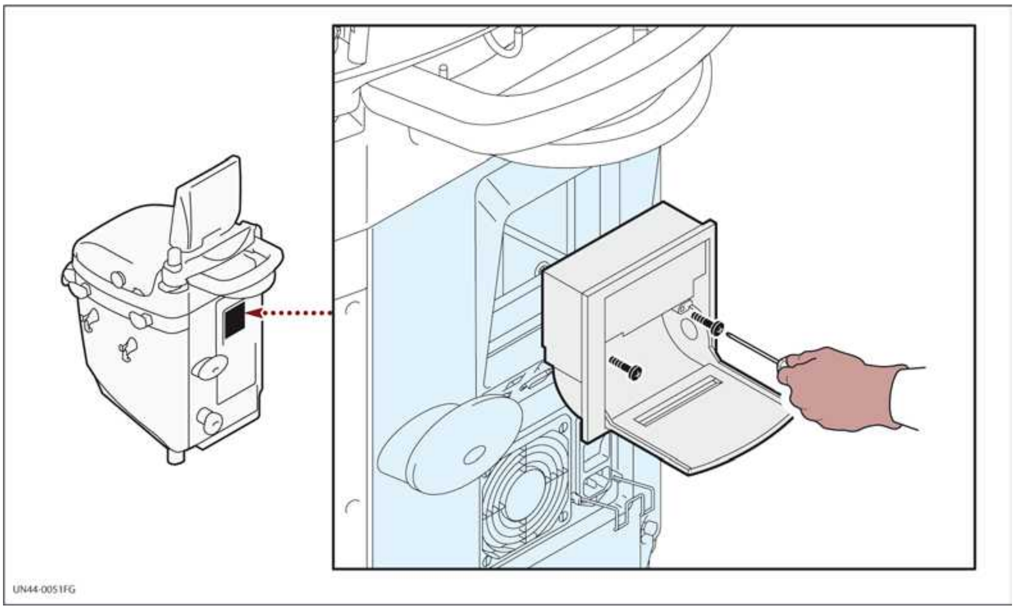

Fig. 12.44-1

12.44.2.3 Reassembly

- Insert the printer in the rear panel;
- Screw the two cross screws located on left and right side of the paper to fix the printer, taking care the position of the two little metallic brackets on the back;
- Put the printer ink back;
- Connect the two PRINTER connectors from the printer.

12.44.3 Functional test

- Switch on the XTRA;
- In the **Menu**/**Setup** screen select **Tally**;

- Select **PRINTER** in the drop down window;
- Select one case available in the database;
- Deselect **Add Bowl Tally** and **Add Alarms & Mods** and push **Send Output**;
- The printer must print the related report.

- In case there are no procedures on the data base, simulate a short procedure:
- From the **Setup** screen, push **Load Pump,** and while finishing the phase select **Fill**, **Wash** and **Empty**
- Then enter **Menu**/**Setup**/**Tally** screen and, following the procedure above, print the report.
- Close the equipment.
-

12.45(DISM_045) cod. 65645 Pump Motor rev.00

12.45.1 About this card

The purpose of this card is to describe the **pump motor** replacement, code **65645**.

12.45.2 Procedure

12.45.2.1 Tools

- Set of screwdrivers;
- Allen keys 3 and 5 mm.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.45.2.2 Disassembly

- Remove the left panel, see the **(DISM_001) Opening the Unit** card;
- Disconnect the Encoder Pump connector from the pump encoder, the J31 connector from the NBP p.c. board, and the flying HSP connector;
- Unscrew the TCCE M 4x12 screw with the flat and split washers which fix the ground cable to the pump group;
- Unscrew the four KA 40x10 screws which fix the pump group to the top;
- Open the centrifuge cover;
- Remove the pump rotor following the procedure described in the **(DISM 078) cod.65697 Pump Rotor** card;
- Pull gently down the pump group.

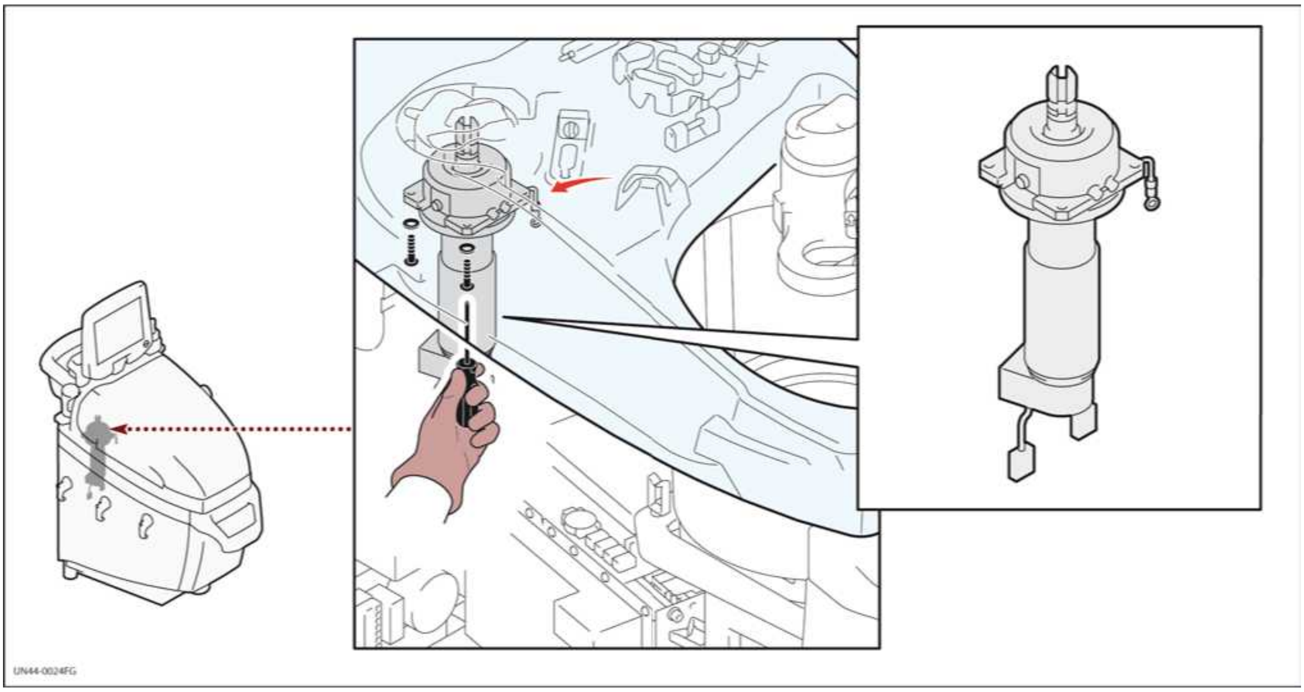

Fig. 12.45-1

12.45.2.3 Reassembly

- Fix the new pump group to the top screwing the four KA 40x10 screws;
- Fix the ground cable to the pump group screwing the other TCCE M 4x12 screw with the flat and split washers;
- Insert the pump rotor back;
- Connect the Encoder Pump connector to the pump encoder, the J31 connector to the NBP p.c. board, and the flying HSP connector.

12.45.3 Functional test

Perform the **Pump Test** described in the **(TEST_002)** card.
Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.46(DISM_046) cod. 65646 Recirculation Fan rev.00

12.46.1 About this card

The purpose of this card is to describe the **fan** replacement, code **65646**.

12.46.2 Procedure

12.46.2.1 Tools

- Set of screwdrivers;
- Set of keys;
- Pliers.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.46.2.2 Disassembly

- Remove the side panels, see the **(DISM_001) Opening the Unit** card;
- Disconnect the J2 connector from the NAD board;
- Disconnect the J13, J10, J7, J4, J3, J2, J1connectors from the NBB board;
- Disconnect the J5, J14, J17 connectors from the NBB board;
- Unscrew the load cell nut, paying attention not to lose its split washer;
- Disconnect the J8, J9, J11, J12, J13 connectors from the NBP board;
- Disconnect the J14, J16 connectors from the NBP board;
- Disconnect the J18, J19, J20, J21 connectors from the NBP board;
- Disconnect the J23, J24, J25, J26, J27, J28 connectors from the NBP board;
- Disconnect the J29, J30, J31, J33, J34, J35 connectors from the NBP board;
- Disconnect the J36, J37, J38, J40, J41, J43 connectors from the NBP board;
- Unscrew the four TCCE M 4x12 screws which fix the rack to the frame;
- Remove the rack;
- Disconnect the FAN AMP connector;
- Unscrew the four TSPI M 4x25 plastic screws from the external side of the rear panel, keeping each hex spacer with pliers and paying attention not to lose them;
- Draw the fan assembled away;

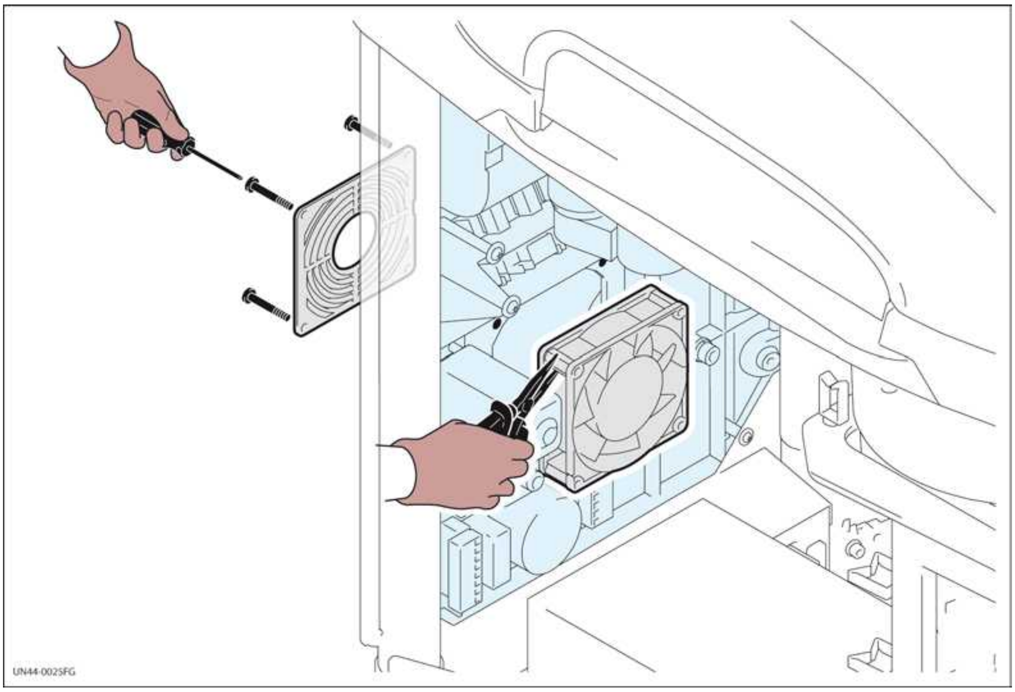

Fig. 12.46-1

12.46.2.3 Reassembly

- Join the fan and its shell;
- Insert them together in the rear panel;
- Screw the four screws which fix the fan to the rear panel;
- Connect the FAN AMP connector;
- Put the rack on, screwing the 4 TCCE M 4x12 screws which fix it to the frame;
- Put the J13 NBB and J37 NBP cables into their wire saddles
- Connect the J8, J9, J11, J12, J13 connectors to the NBP board;
- Connect the J14, J16 connectors to the NBP boards;
- Connect the J18, J19, J20, J21 connectors to the NBP board;
- Connect the J23, J24, J25, J26, J27, J28 connectors to the NBP board;
- Connect the J29, J30, J31, J33, J34, J35 connectors to the NBP board;
- Connect the J36, J37, J38, J40, J41, J43 connectors to the NBP board;
- Connect the J2 connector to the NAD board;
- Connect the J13, J10, J7, J4, J3, J2, J1connectors to the NBB board;
- Connect the J5, J14, J17 connectors to the NBB board;
- Screw the load cell nut, paying attention to insert its spilt washer;

12.46.3 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.47(DISM_047) cod. 65647 Schurter Module rev.00

12.47.1 About this card

The purpose of this card is to describe the **schurter module** replacement, code **65647.**

12.47.2 Procedure

12.47.2.1 Tools

- Set of screwdrivers;

NOTE: ESD protective measures must be taken while removing the p.c. board

12.47.2.2 Disassembly

- Remove the left panel, see the **(DISM_001) Opening the Unit** card;
- Unscrew the two screws which fix the schurter module to the rear panel;
- Draw partially the schurter module;
- Disconnect the three faston connectors;
- Remove the schurter module.

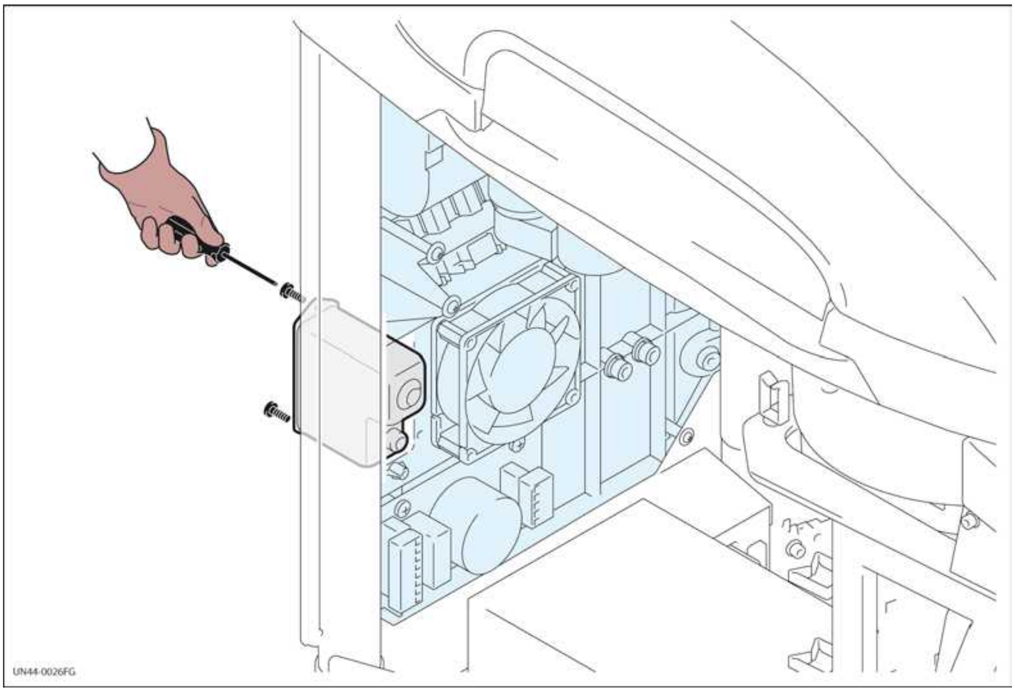

Fig. 12.47-1

12.47.2.3 Reassembly

- Connect the faston connectors to the new schurter module, paying attention the black cable is for the **L phase**, and the white one is for the **N neutral**;
- Insert the schurter module on the rear panel fixing it with the two screws.

12.47.3 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.48(DISM_048) cod. 65648 Serial Connection Cap rev.00

12.48.1 About this card

The purpose of this card is to describe the **serial connection cap** replacement, code **65648**.

12.48.2 Procedure

12.48.2.1 Tools

- Set of screwdrivers.

12.48.2.2 Disassembly

- Remove the serial communication cap from the serial socket, unscrewing the two TCC UNC 4-40x1/4 screws, with the related flat and split washers.

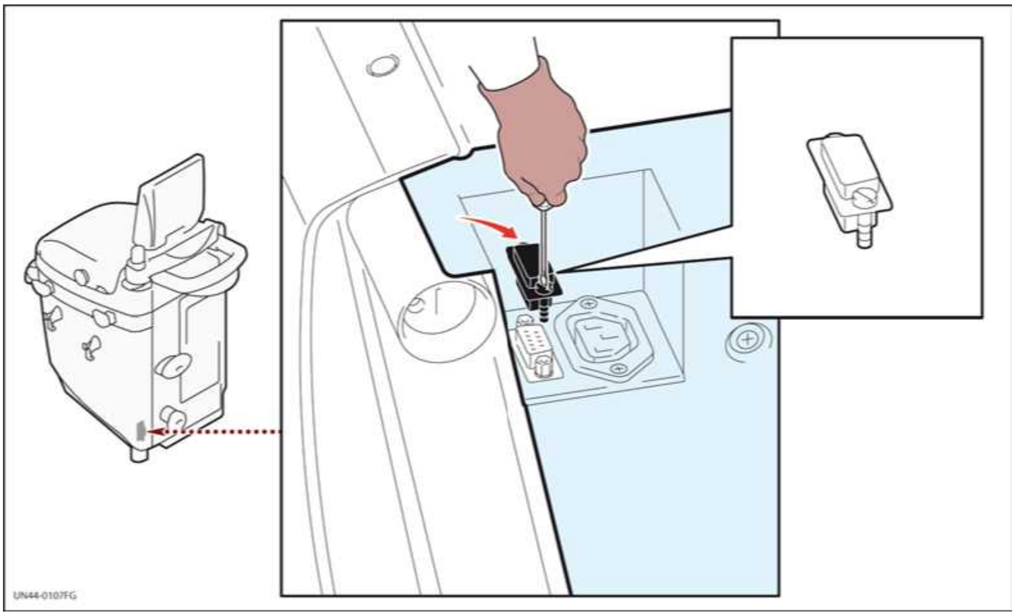

Fig. 12.48-1

12.48.2.3 Reassembly

- Fix the new serial communication cap on the serial socket, screwing the two TCC UNC 4-40x1/4 screws with the related flat and split washers.

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12.49(DISM_049) cod. 65649 SIR p.c. Board rev.00

12.49.1 About this card

The purpose of this card is to describe the **SIR p.c. board** replacement, code **65649**.

12.49.2 Procedure

12.49.2.1 Tools

- Set of screwdrivers;

NOTE: ESD protective measures must be taken while removing the p.c. board

12.49.2.2 Disassembly

- Remove the left panel;
- Disconnect the J31 and J30 connectors from the NBP board, in order to have an easier access to the SIR board;
- Disconnect the J5 connector from the SIR board;
- Loosen the two screws which fix the SIR board to the rear panel;
- Remove the SIR board.

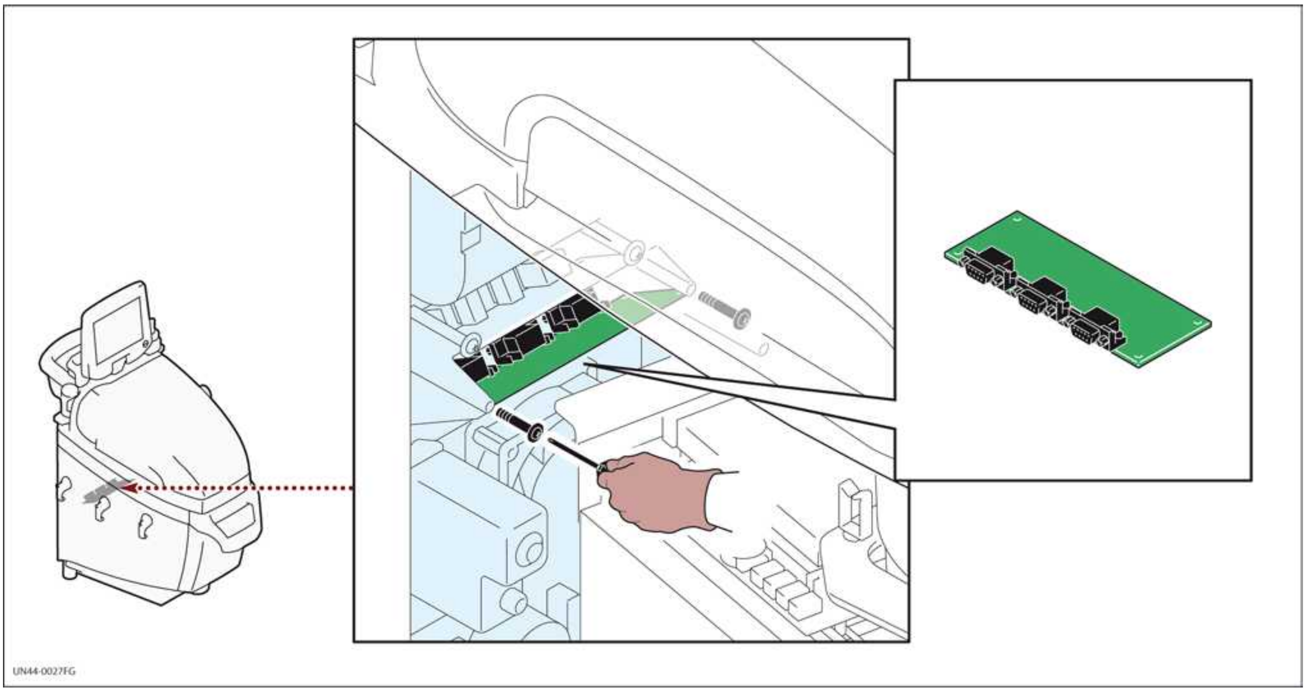

Fig. 12.49-1

12.49.2.3 Reassembly

- Put the new SIR board on the rear panel, paying attention to the serial connectors;
- Tighten the two screws which fix the SIR board to the rear panel;
- Connect the J5 connector to the SIR board;

- Connect the J31 and J30 connectors to the NBP board.

12.49.3 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.50(DISM_050) cod. 65650 XTRA Flash PC rev.00

12.50.1 About this card

The purpose of this card is to describe the **XTRA Flash PC** replacement, code **65650**.

12.50.2 Procedure

12.50.2.1 Tools

- Set of screwdrivers.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.50.2.2 Disassembly

- Open the XTRA right side panel, see the **(DISM_001) Opening the Unit** card;
- Remove the SW Flash PC from the NBB p.c. board.

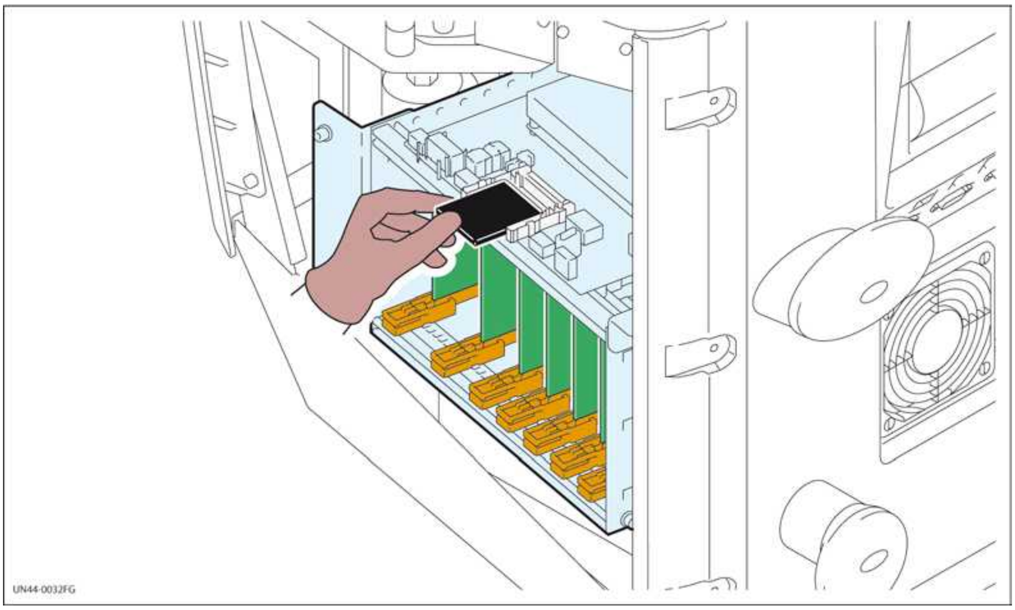

Fig. 12.50-1

12.50.2.3 Reassembly

- Insert the new SW Flash PC into its guide on the NBB p.c. board.

12.50.3 Calibration

Perform the **Touch Screen Calibration** described in the **(CALIBR_008)** card.
It could be necessary to perform the display contrast adjustment. To do this, in the **Setup** page in **Normal Mode** enter **Menu/Settings/Configuration Mode/Display**.
Perform the download of the software on the NUI following the procedure for the NUI described in the 7 Software Upgrade card.

12.50.4 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.51,(DISM_051) cod. 65651 XTRA Speaker rev.00

12.51.1 About this card

The purpose of this card is to describe the **XTRA speaker** replacement, code **65651**.

12.51.2 Procedure

12.51.2.1 Tools

- Set of screwdrivers;
- Allen keys 4 mm.

12.51.2.2 Disassembly

- Remove the side panels, see the **(DISM_001) Opening the Unit** card;
- Remove the front panel, see the **(DISM_001) Opening the Unit** card;
- Disconnect the SPEAKER AMP connector;
- Remove the speaker from the front panel, unscrewing the four KA 35x10 screws.

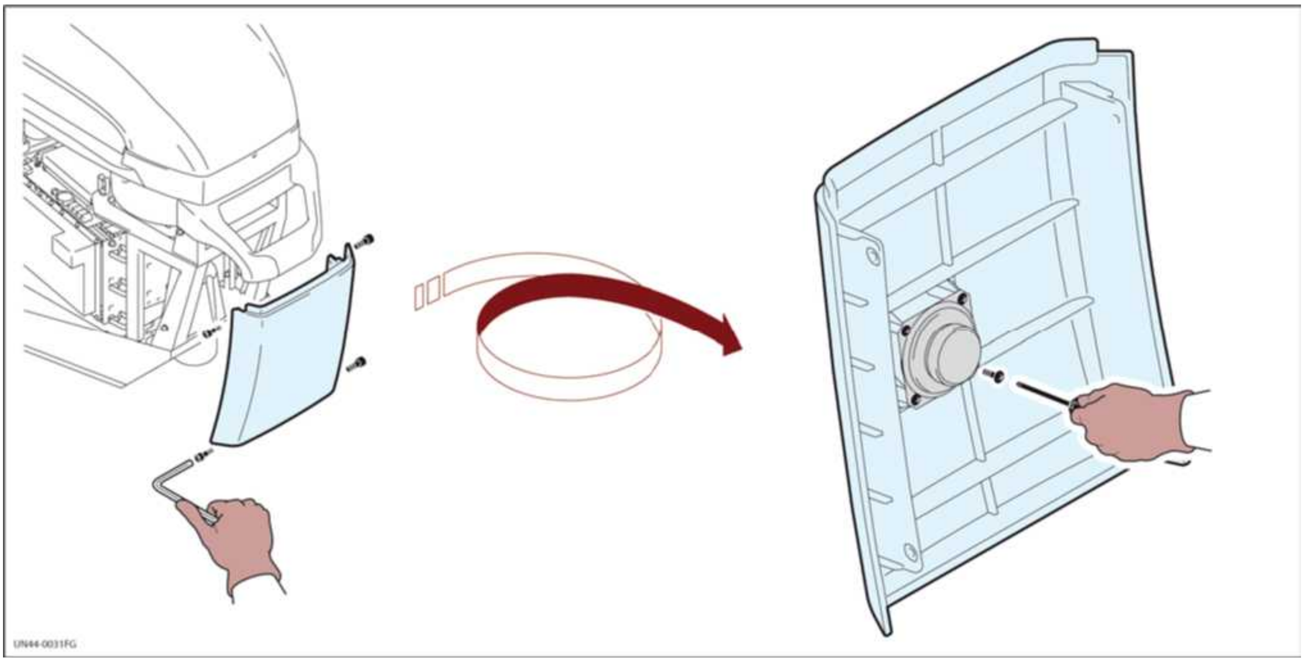

Fig. 12.51-1

12.51.2.3 Reassembly

- Put the new speaker in its position on the front panel and fix it screwing the four KA 35x10 screws;
- Connect the SPEAKER AMP connector;
- Close the equipment.

12.51.3 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.52(DISM_052) cod. 65652 Touch Screen Control Board rev.00

12.52.1 About this card

The purpose of this card is to describe the **Touch Screen Control board** replacement, code **65652**.

12.52.2 Procedure

12.52.2.1 Tools

12.52.2.2 Disassembly

- Remove the two black screw caps on the display group rear cover;
- Unscrew the two KA 40x10 screws which fix the rear cover to the front one;
- Remove the rear cover;
- Disconnect the CN2 TOUCH C and the touch panel cable connectors from the touch screen control board;
- Unscrew the four TCCE 4x6 screws with the related flat washers which fix the touch screen control board to its white support;
- Remove the touch screen control board.

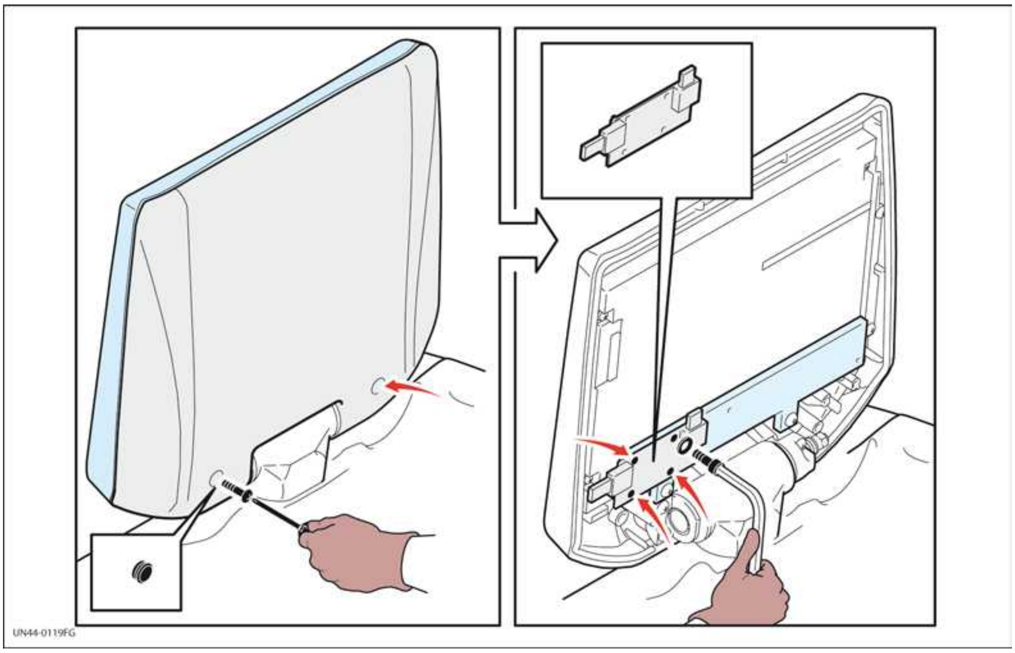

Fig. 12.52-1

12.52.2.3 Reassembly

- Put the new touch screen control board on the white support and fix it screwing the TCCE 4x6 screws with the related flat washers;
- Connect the CN2 TOUCH C and the touch panel cable connectors to the touch screen control board;
- Put the display rear cover in its position on the front one and screw the two KA 40x10 screws;
- Put the two black screw caps back on the display group rear cover.

12.52.3 Calibration

Only if necessary, perform the **Touch Screen Calibration** described in the **(CALIBR_008)** card.

12.52.4 Functional test

Close the XTRA panels and perform the **(DISM_003) Functional Verification test** #card.

12.53(DISM_053) cod. 65653 Waste Line Color Indicator rev.00

12.53.1 About this card

The purpose of this card is to describe the **waste line color indicator** replacement, code **65653**.

12.53.2 Procedure

12.53.2.1 Tools

- Set of screwdrivers;
- Allen keys 3 mm.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.53.2.2 Disassembly

- Remove the right panel, see the **(DISM_001) Opening the Unit** card;
- Disconnect the J3 connector from the HHR p.c. board;
- Unscrew the two TCCE M 4x12 screws with the flat and split washers which fix the waste line color indicator to the top;
- Open the centrifuge cover;
- Remove the waste line color indicator with its cable from the top.

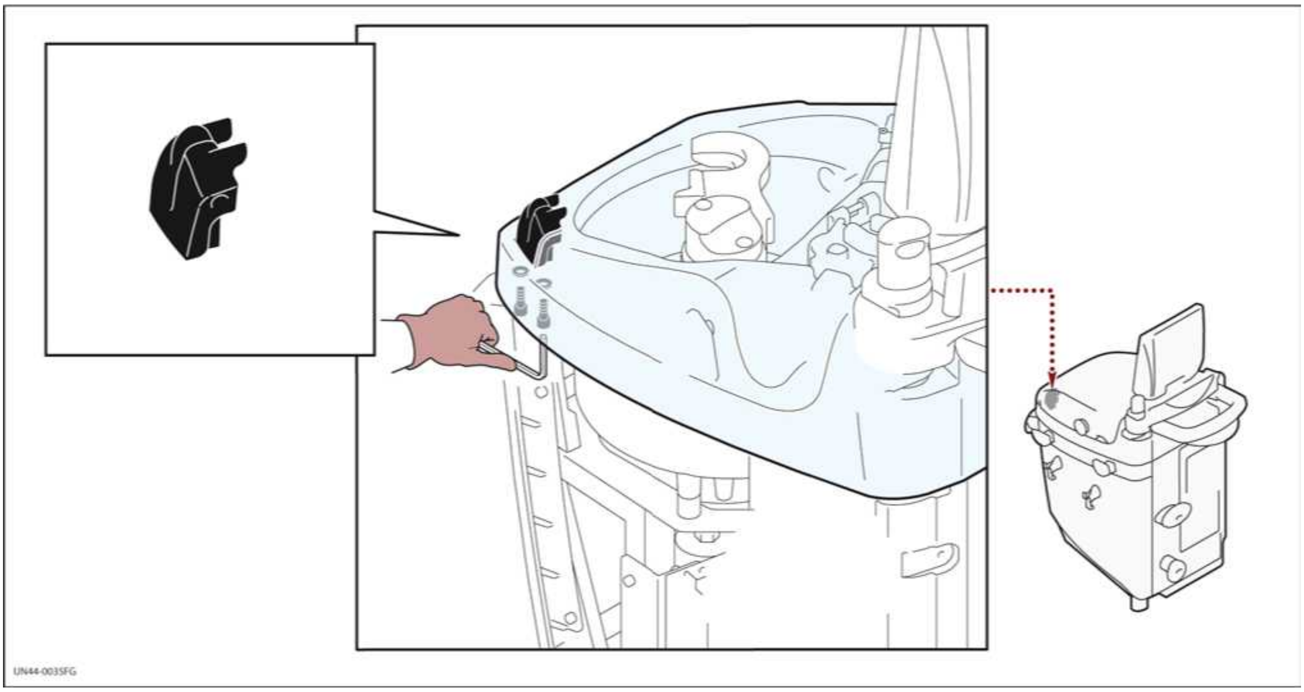

Fig. 12.53-1

12.53.2.3 Reassembly

- Insert the new waste line color indicator with its cable into its hole on the top;
- Fix the waste line color indicator to the top screwing the two TCCE M 4x12 screws with the flat and split washers;
- Connect the J3 connector to the HHR p.c. board;

- Close the centrifuge cover.

12.53.3 Calibration

Perform the **Waste Line Color Indicator Calibration** described in the **(CALIBR_004)** card.

12.53.4 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.54(DISM_054) cod. 65654 XTRA PC rev.00

12.54.1 About this card

The purpose of this card is to describe the **XTRA PC** replacement, code **65654**.

12.54.2 Procedure

12.54.2.1 Tools

- Set of screwdrivers;
- Set of socket wrenches.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.54.2.2 Disassembly

- Open the XTRA side panels, see the **(DISM_001) Opening the Unit** card;
- Disconnect the J1, J2, J3, J4, J5, J7, J10, J13, J14, J17 connectors from the NBB board;
- Unscrew the 4 M3 nuts which fix the NBB board to the rack, with their flat and split washers;
- Draw the NBB board together with the PC away;

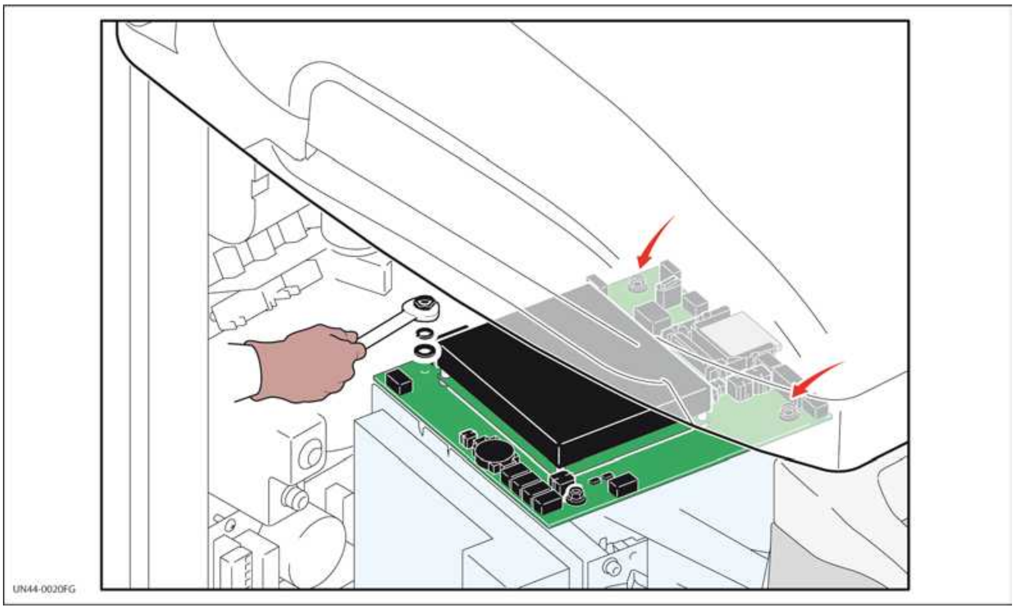

Fig. 12.54-1

- Remove the PC from the NBB board unscrewing the four TCC M 2.5x16 screws with their flat washers;
- Remove the four spacers which separate the PC from the board.

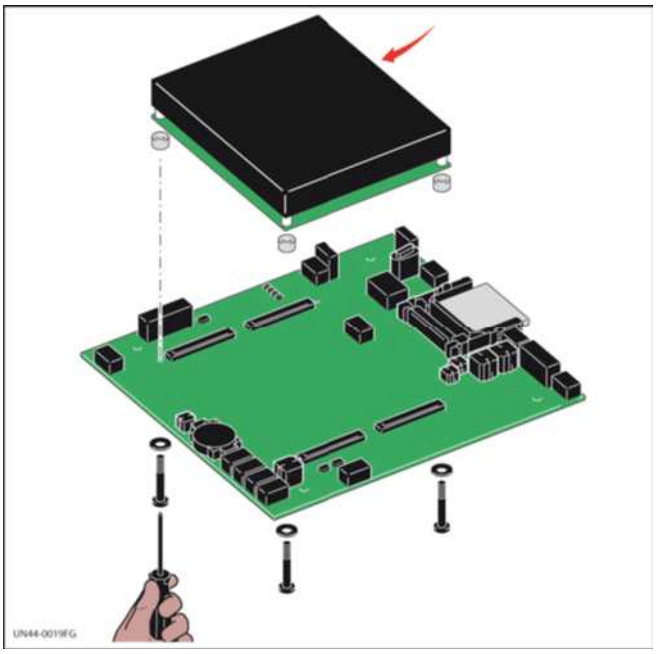

Fig. 12.54-2

12.54.2.3 Reassembly

- Unscrew the four screws wich fix the new PC to its heat sink;
- Put the PC on the new NBB board inserting the four spacers between them, paying attention to the correct direction of the PC (see Fig. 12.54-2);
- Fix the PC on the board screwing the four TCC M 2.5x16 screws with their flat washers;
- Put the NBB board with the PC on the rack, screwing the four nuts with their flat and split washers;
- Connect the J1, J2, J3, J4, J5, J7, J10, J13, J14, J17 connectors to the NBB board.

12.54.3 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

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12.55(DISM_055) cod. 65655 XTRA Serial Socket to XVAC rev.00

12.55.1 About this card

The purpose of this card is to describe the **XTRA serial socket to XVAC** replacement, code **65655**.

12.55.2 Procedure

12.55.2.1 Tools

- Set of screwdrivers;
- Socket wrenches.

NOTE: ESD protective measures must be taken while removing the p.c. board

12.55.2.2 Disassembly

- Remove the side panels;
- Disconnect the J27 AMP connector from the NBP board;
- Unscrew the two DSUB spacers which fix the socket to the frame;
- Remove the socket with its cable.

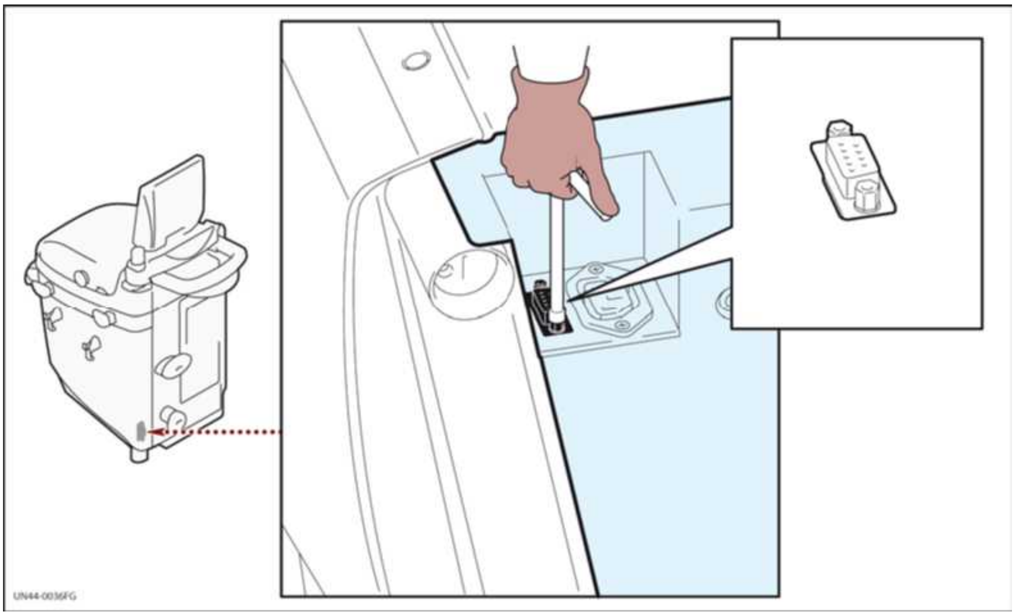

Fig. 12.55-1

12.55.2.3 Reassembly

- Insert the socket with its cable in its hole on the frame;
- Connect the J27 AMP connector to the NBP board;
- Fix the socket to the frame screwing the two DSUB spacers;
- Close the equipment.

12.55.3 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.56(DISM_056) cod. 65656 XTRA Line Socket to XVAC rev.00

12.56.1 About this card

The purpose of this card is to describe the **XTRA line socket to XVAC** replacement, code **65656.**

12.56.2 Procedure

12.56.2.1 Tools

- Set of screwdrivers;

NOTE: ESD protective measures must be taken while removing the p.c. board

12.56.2.2 Disassembly

- Unscrew the two TSPC M 3x6 screws which fix the socket to the frame;
- Put partially the socket away;
- Disconnect the three faston connectors;
- Remove the socket.

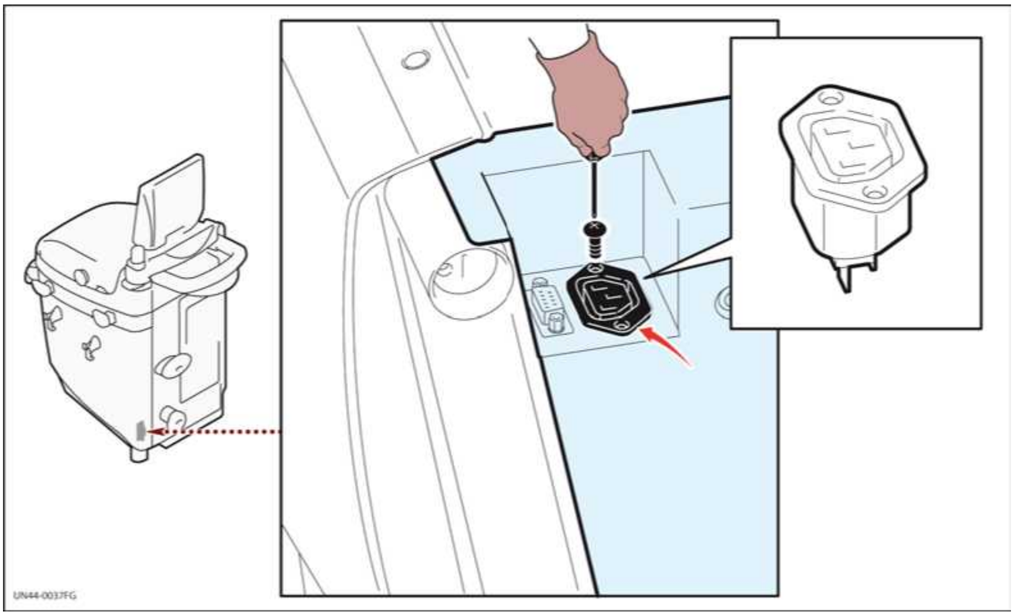

Fig. 12.56-1

12.56.2.3 Reassembly

- Connect the three faston connectors to the new power vacuum socket, paying attention the black cable is for the **L phase**, and the white one is for the **N neutral**;
- Insert the socket in its hole on the frame;
- Fix the socket to the frame screwing the two TSPC M 3x6 screws.

12.56.3 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.57(DISM_057) cod. 65676 Blister and Waste Bag Supports rev.00

12.57.1 About this card

The purpose of this card is to describe the **blister and waste bag supports** replacement, code **65767**.

12.57.2 Procedure

12.57.2.1 Tools

- Set of screwdrivers;
- Allen keys 4 mm;

12.57.2.2 Disassembly

- Remove the side panels, see the **(DISM_001) Opening the Unit** card;
- Unscrew the two TCCE M 4x20 screws which fix each support to the side panels, paying attention to the split and flat washers;
- Remove the supports.

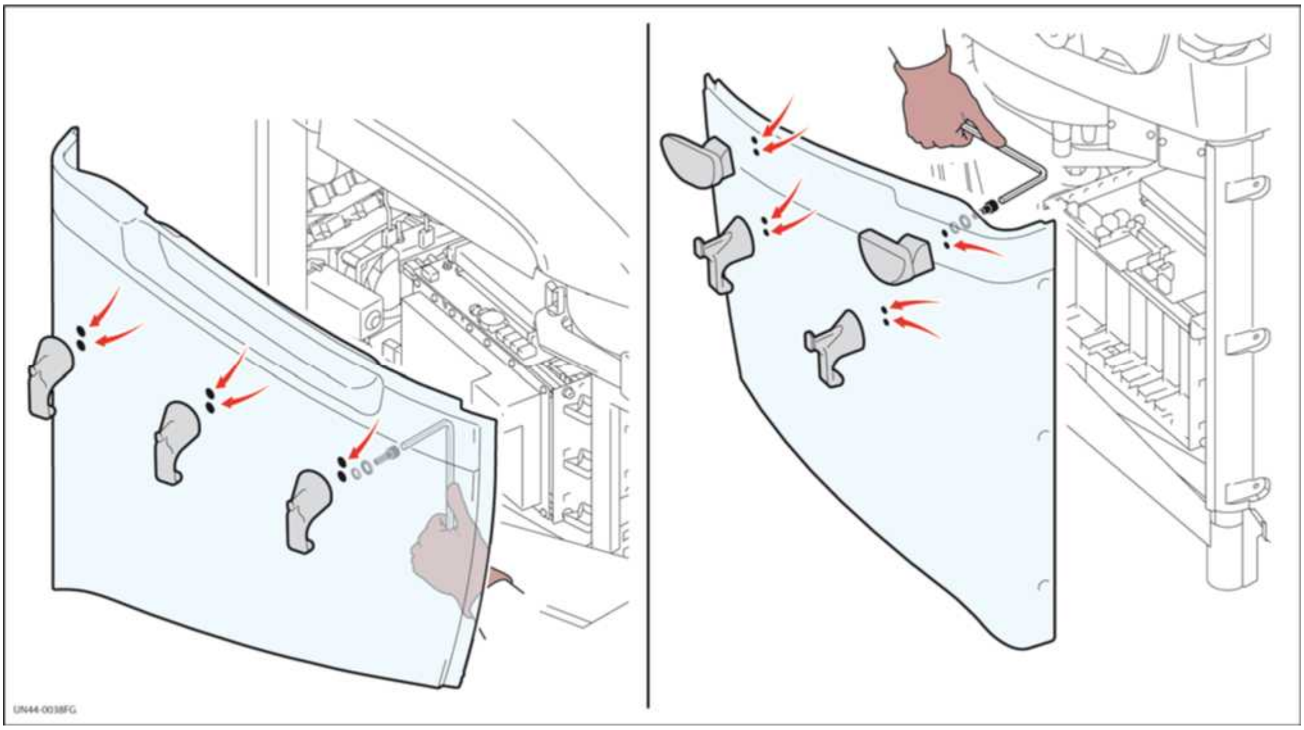

Fig. 12.57-1

12.57.2.3 Reassembly

- Put the supports in their position on the side panels, fixing them with their washers and screws;
- Close the equipment.

(DISM_057) cod. 65676 Blister and Waste Bag Supports rev.00

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12.58(DISM_058) cod. 65677 Bowl Arm rev.00

12.58.1 About this card

The purpose of this card is to describe the **bowl arm** replacement, code **65677**.

12.58.2 Procedure

12.58.2.1 Tools

- Set of screwdrivers;
- Allen key 3mm;
- Wire cutter;
- Wire ties;
- Torque wrench 3 Nm.

12.58.2.2 Disassembly

- Open the side panels, see the **(DISM_001) Opening the Unit** card;
- Open the centrifuge cover;
- Remove the bowl arm cover, removing first the two black caps and then unscrewing the two TCCE M 4x12 screws;

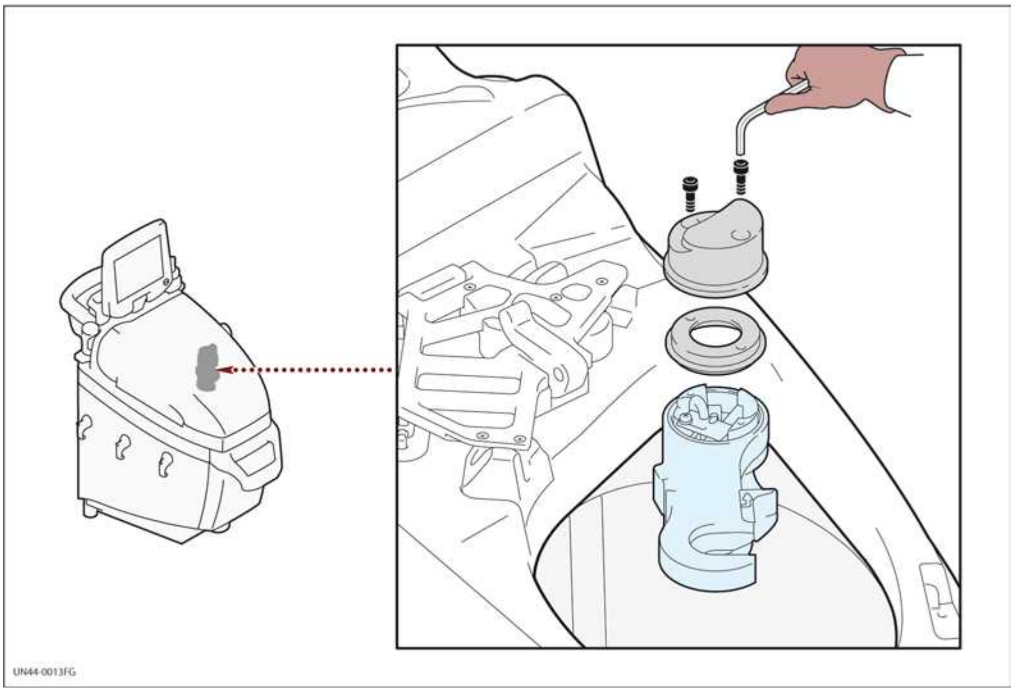

Fig. 12.58-1

- Unscrew the TCC M 3x10 screw (with the split and flat washers) which keeps the HS-A sensor in its seat;
- Disconnect the ILLUMIN flying connector;
- Unscrew the two TCCE M 4x16 screws that fix the bowl arm to the centrifuge well;
- Unscrew the TSPC M 3x10 screw and the two TSPC M 3x16 which fix the Low Level RBC Detector Illuminator support and the High Level RBC Detector to the bowl arm;

- Remove from the bottom side of the arm bowl the Low Level RBC Detector Illuminator support and the High Level RBC Detector;
- Remove the bowl arm passing the HS-A sensor through the hole on the bowl arm itself.

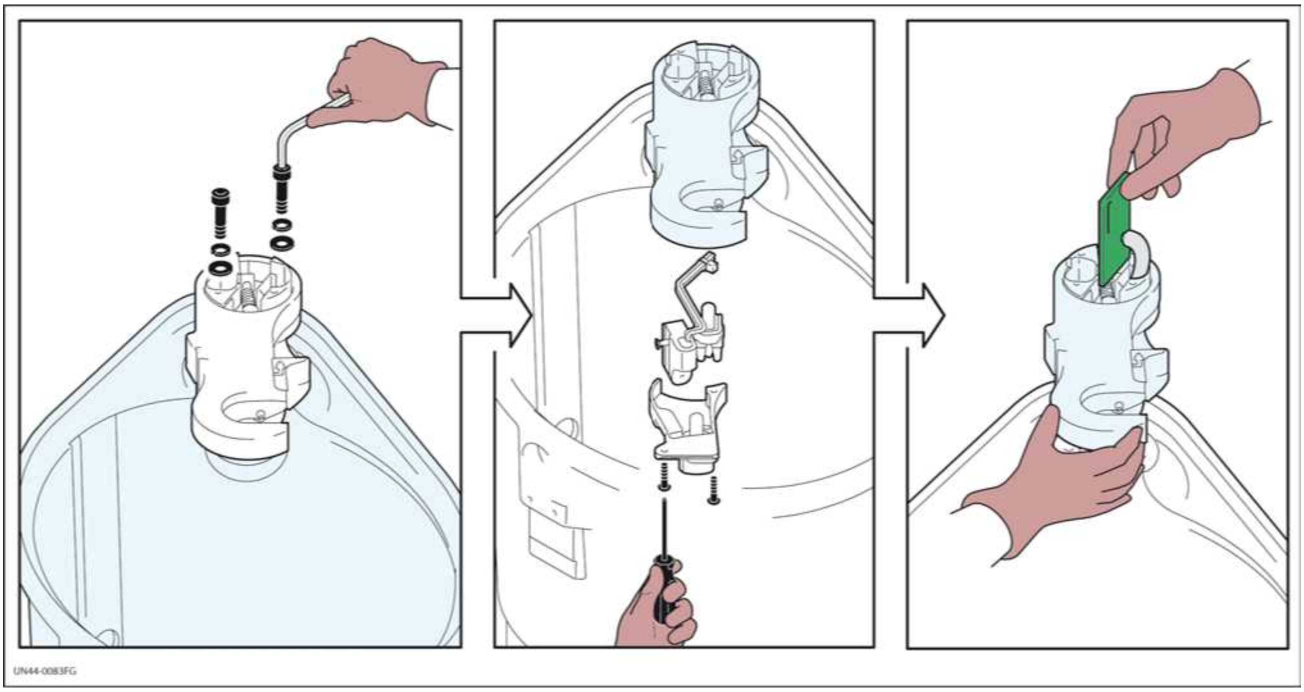

Fig. 12.58-2

12.58.2.3 Reassembly

- Fix the High Level RBC Detector to the new bowl arm with one of the TSPC 3x16 screws and then fix the Low Level RBC Detector Illuminator support with the other TSPC 3x16 screw and the TSPC M 3x10 screw;
- Place the bowl arm in its seat passing the the HS-A sensor through its hole and fastening the two TCCE M4x16 screws without tightening them;
- Fix the HS-A circuit following the procedure in the **(DISM_020) HS-A Bowl Arm Sensor** card;
- Connect the ILLUMIN flying connector.

12.58.3 Calibration

Perform the **Bowl Arm Calibration** described in the **(CALIBR_009)** card.

12.58.4 Functional test

- Perform the **Bowl Arm Sensor Test** described in the **(TEST_007)** card;
- Tighten the TCCE M 4x16 arm screws with the torque wrench 3 Nm;
- Put the bowl arm cover back on the bowl arm screwing the TCCE M 4x12 screws;
- Put the two black caps back.

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.59(DISM_059) cod. 65678 Brake Pedal rev.00

12.59.1 About this card

The purpose of this card is to describe the **brake pedal** replacement, code **65678**.

12.59.2 Procedure

12.59.2.1 Tools

- Set of screwdrivers;
- Allen key 2,5 mm.

12.59.2.2 Disassembly

- Remove the two grey caps on the sides of the front part of the cart;
- Loosen the brake pedal set screw;
- Push the brake bar from one side ot the opposite one until the brake pedal is free;
- Remove the brake pedal.

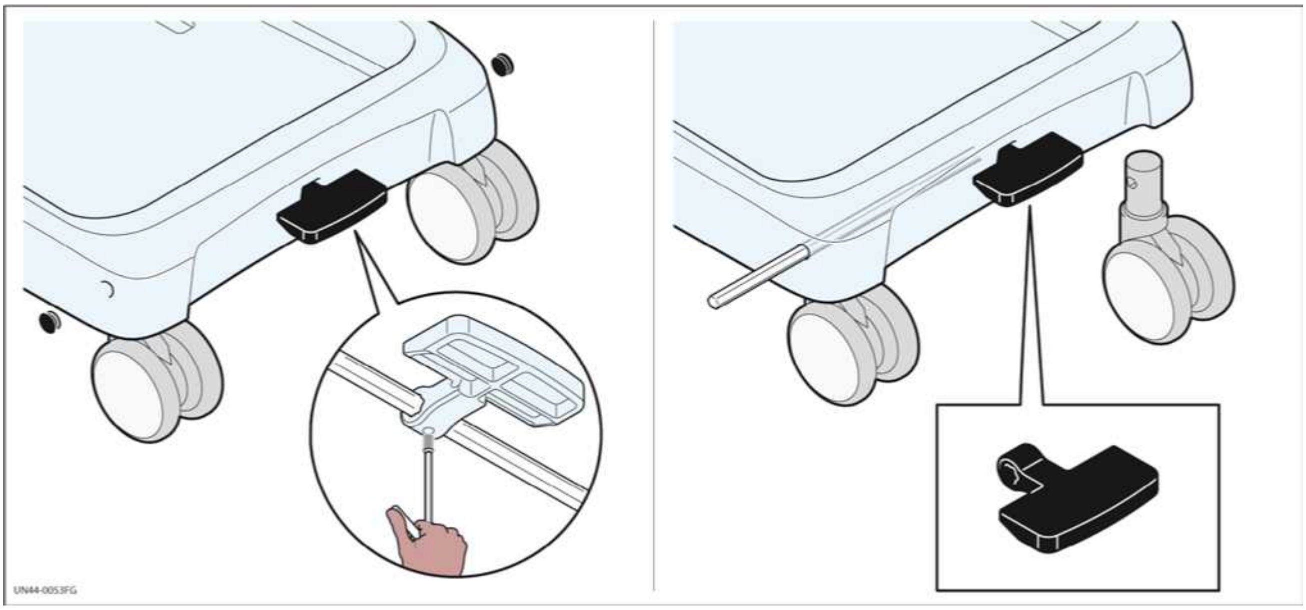

Fig. 12.59-1

12.59.2.3 Reassembly

- Insert the brake pedal in its position placing it upwards;
- Insert the bar through the pedal hole, making sure it is inserted in both the wheels (to check this, try to draw the wheel away, it should not come out);
- Screw the pedal set screw;
- Put the grey caps back on the sides of the chart.

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12.60 (DISM_060) cod. 65679 XTRA Bushings rev.00

12.60.1 About this card

The purpose of this card is to describe the cardiotomy and I.V. Pole **bushings** replacement, code **65679**.

12.60.2 Procedure

12.60.2.1 Tools

- Set of screwdrivers;
- Allen keys;
- I.V. Pole Mounting Tool cod. 63040.

12.60.2.2 Disassembling

12.60.2.2.1 Disassembling the Ø 25 mm I.V. pole bushing

- Lift the XTRA up from its chart;
- Remove the clamping clip;
- From bottom side, looking into the stainless steel pipe, unscrew a little bit the TCCE M 3x20 screw;
- Unscrew completely the metallic part (it looks like brass) using a large flare screw driver inserted in the indentation.
- At this point is possible that a plastic ring falls down, if not it does in next step;

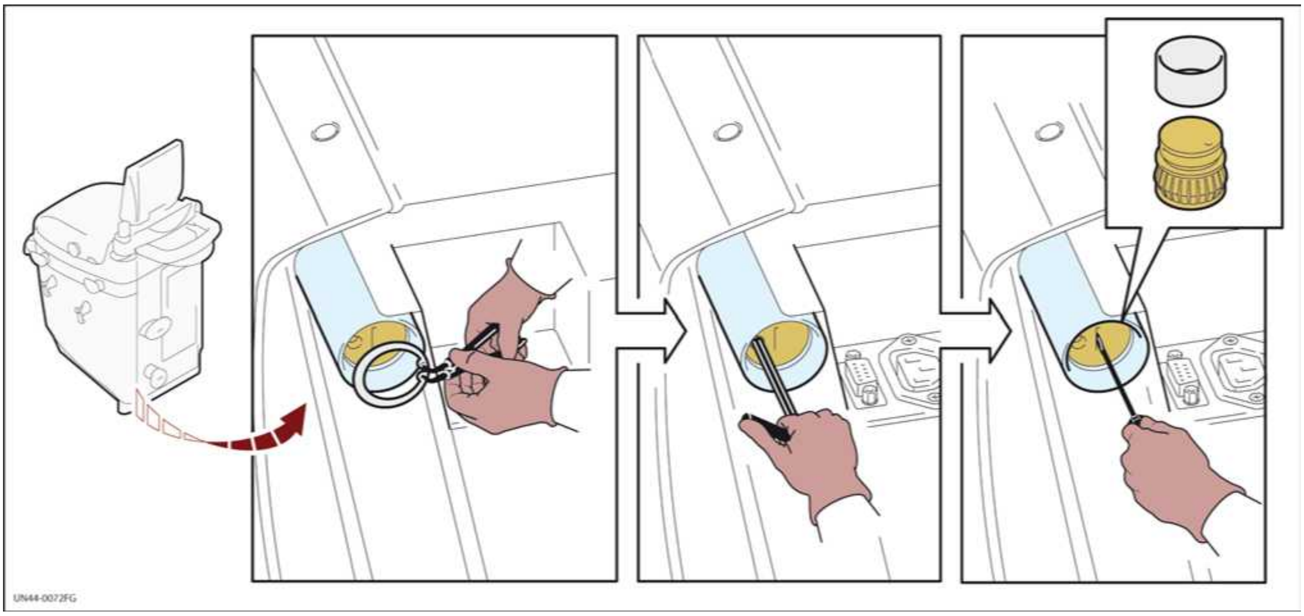
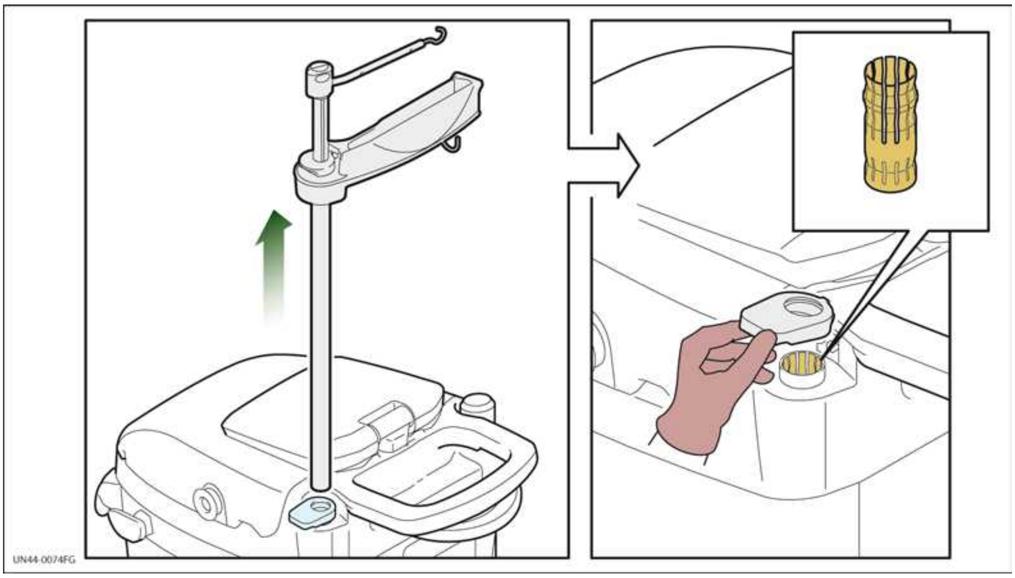


Fig. 12.60-1

- Lift up and remove the Ø 25 mm (with the 20 mm) I.V pole;
- Remove the Ø 25 mm I.V pole eccentric ring;
- Remove the Ø 25 mm I.V pole bushing.



12.60.2.2.2 Disassembling the Ø 20 mm bushing

- Unscrew a little bit the second TCCE M 3x30 screw;
- Unscrew completely the metallic part (it looks like brass) using a large flare screw driver inserted in the indentation;
- At this point is possible that a plastic spacer falls down, if not it does in next step;
- Lift up and remove the Ø 20 mm I.V. pole from the Ø 25 mm I.V. pole;
- Remove the eccentric ring;
- Remove the bushing.

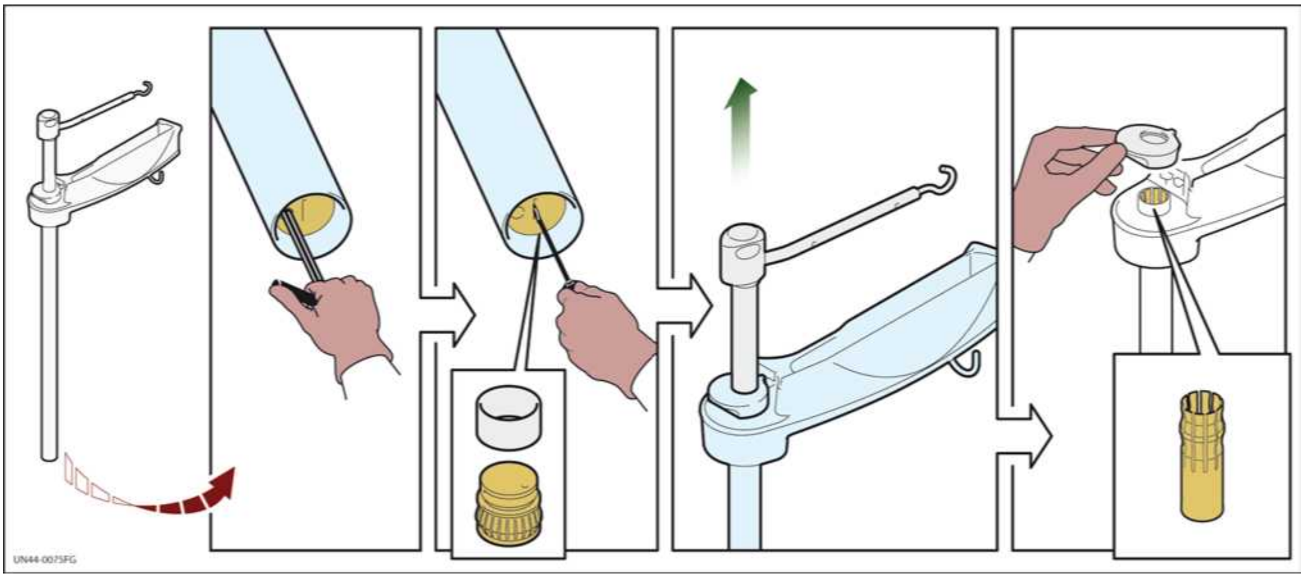


Fig. 12.60-2

12.60.2.2.3 Disassembling the cardiotomy bushing

- Remove the left panel;
- Lift a little bit the cardiotomy mast till the cardiotomy support is able to rotate;

(DISM_060) cod. 65679 XTRA Bushings rev.00

- Unscrew the pin in the cardiotomy support, paying attention to the pin direction, since the hole in which the pin thread is screwed is smallest than the hole through the pin is to be inserted to avoid damages to the support;
- Pay attention to the inside ball;
- Remove carefully, pulling up, the cardiotomy support;
- Unscrew the inner pin;

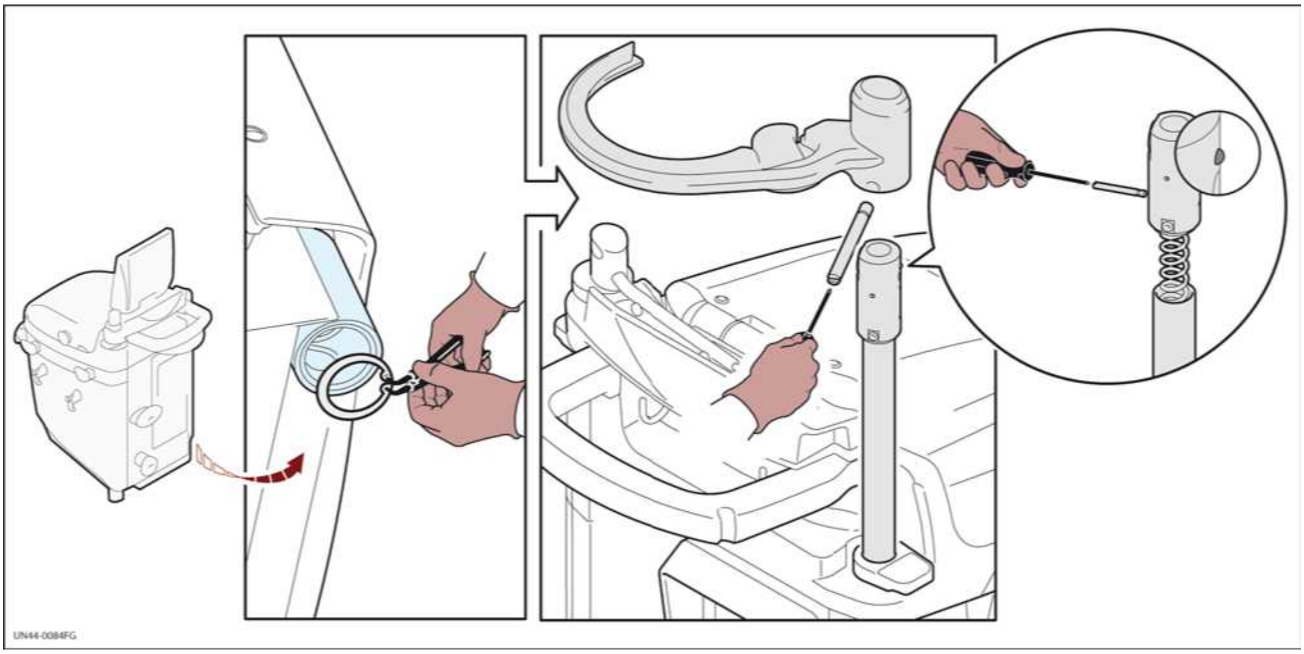


Fig. 12.60-3

- Unscrew the load cell coil cable shield (from the point indicated in the fig.12.60-4);

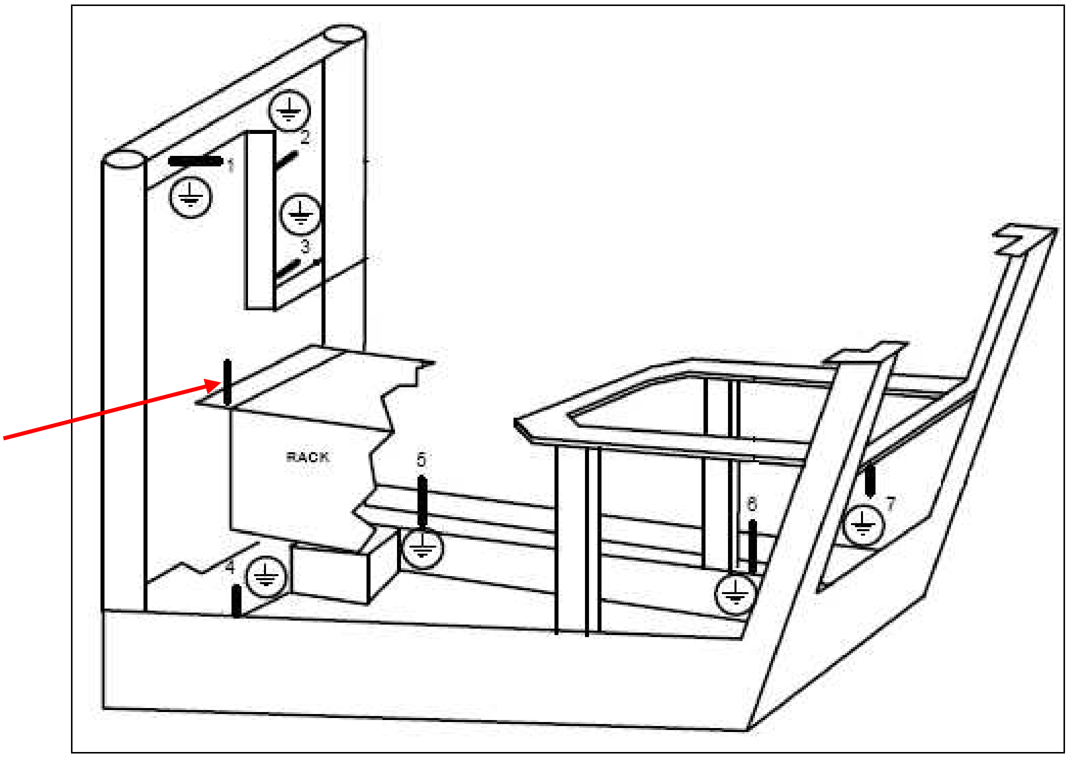


Fig. 12.60-4

- Disconnect the J8 AMP connector from the NBP board;
- Insert the coil cable inside the cardiotomy mast;
- Pull the load cell block up with its coil cable;
- Lift the cardiotomy eccentric ring up;
- Push the cardiotomy mast down;
- Remove the cardiotomy bushing.

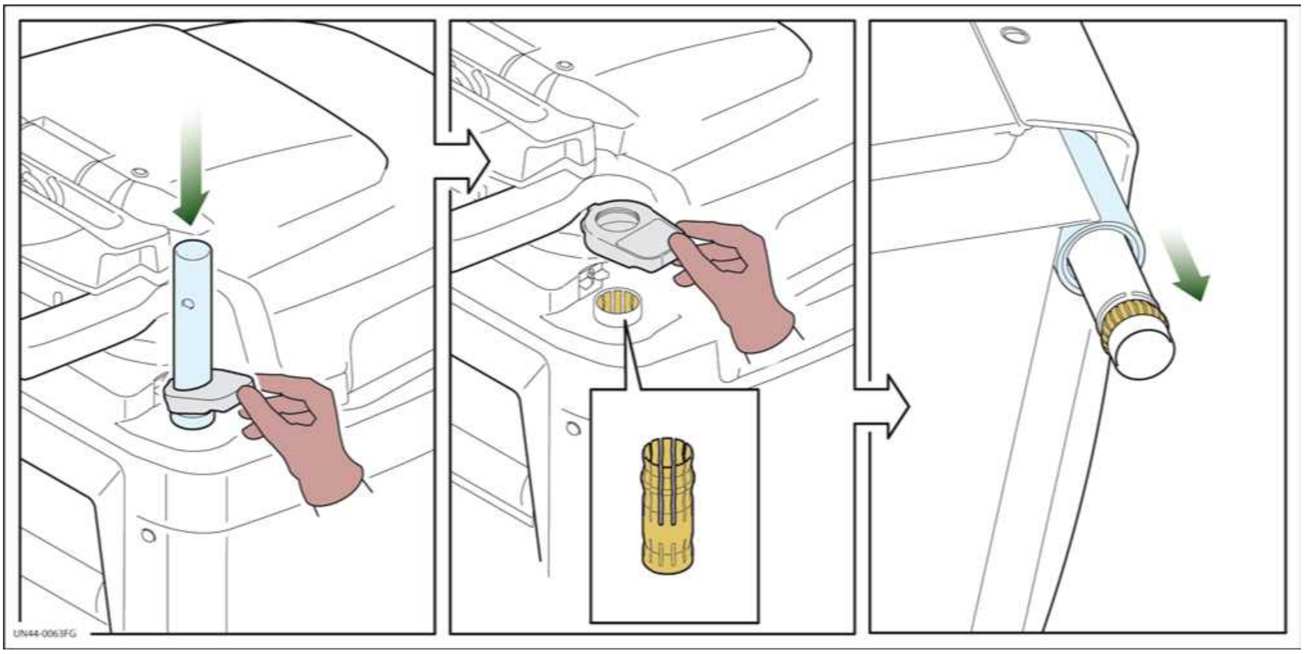


Fig. 12.60-5

12.60.2.3 Reassembling

12.60.2.3.1 Reassembling the Ø 20mm I.V. pole bushing

- Insert the bushing of the 20 mm I.V. pole into its seat in the 25 mm I.V. pole if removed (usually already inserted);
- Screw the 63040 Ø 20 mm tool on the Ø 20 mm I.V. pole;
- Insert the Ø 20 mm I.V. pole together with the tool into the Ø 25 mm I.V. pole, keeping the eccentric ring up and in its seat;

(DISM_060) cod. 65679 XTRA Bushings rev.00

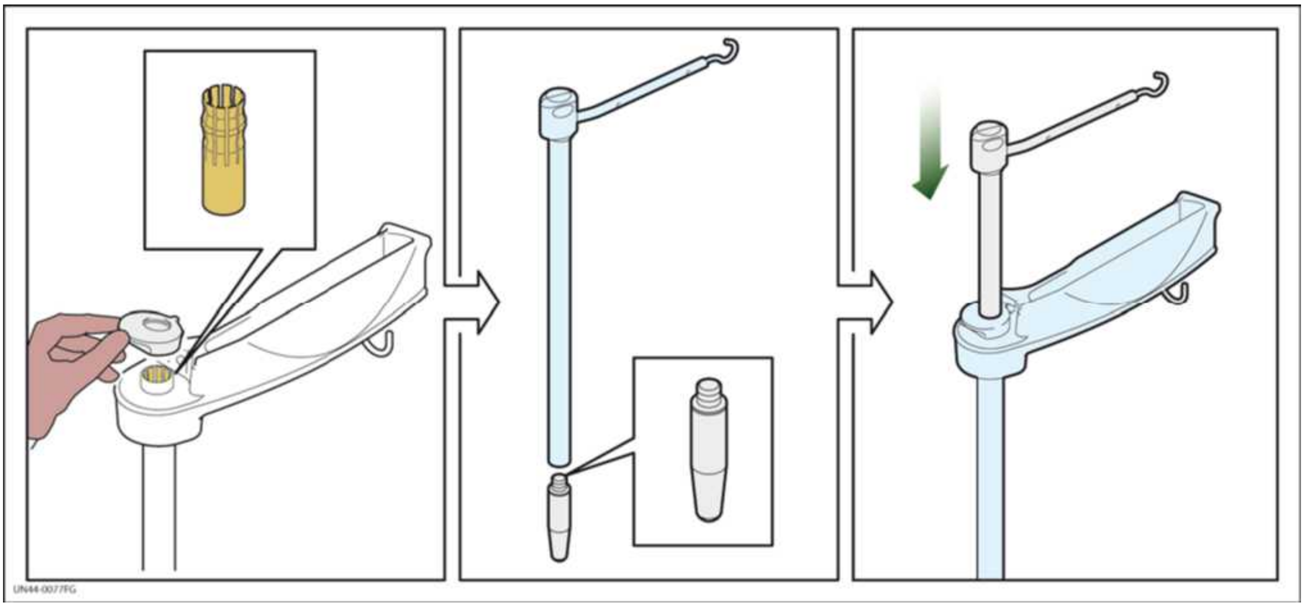


Fig. 12.60-6

- Insert from the bottom the plastic spacer;
- Insert the brass stop from the bottom;
- First fix it screwing the brass in the middle, then thigh it acting on the TCCE M 3x30 screw.

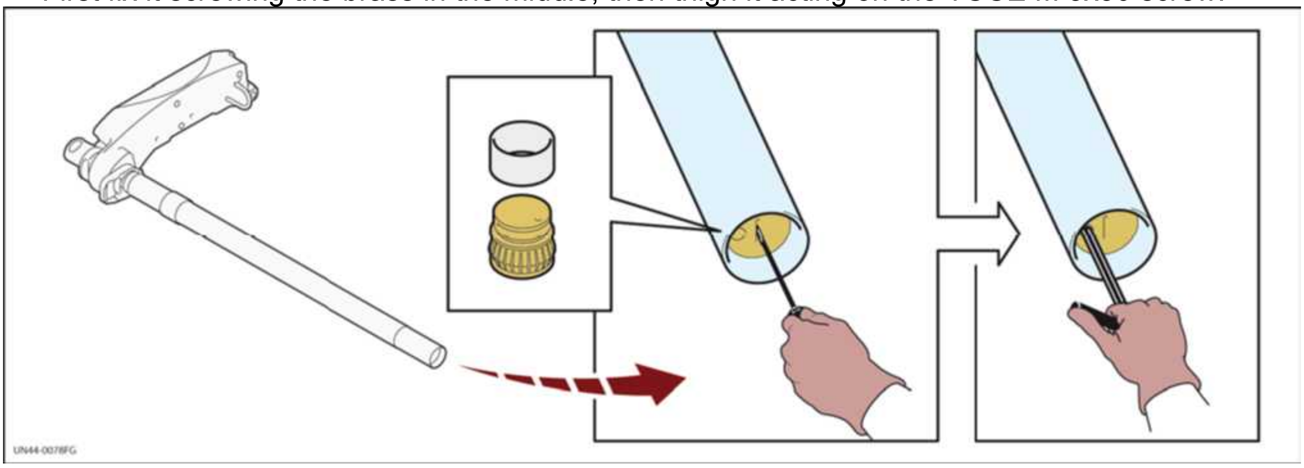


Fig. 12.60-7

12.60.2.3.2 Reassembling the Ø 25mm I.V. pole bushing

- Insert the bushing of the 25 mm I.V. pole into its seat on the frame;
- Screw the 63040 Ø 25 mm tool on the Ø 25 mm I.V. pole;
- Insert the Ø 25 mm I.V. pole together with the tool into the frame, keeping the eccentric ring up and in its seat;

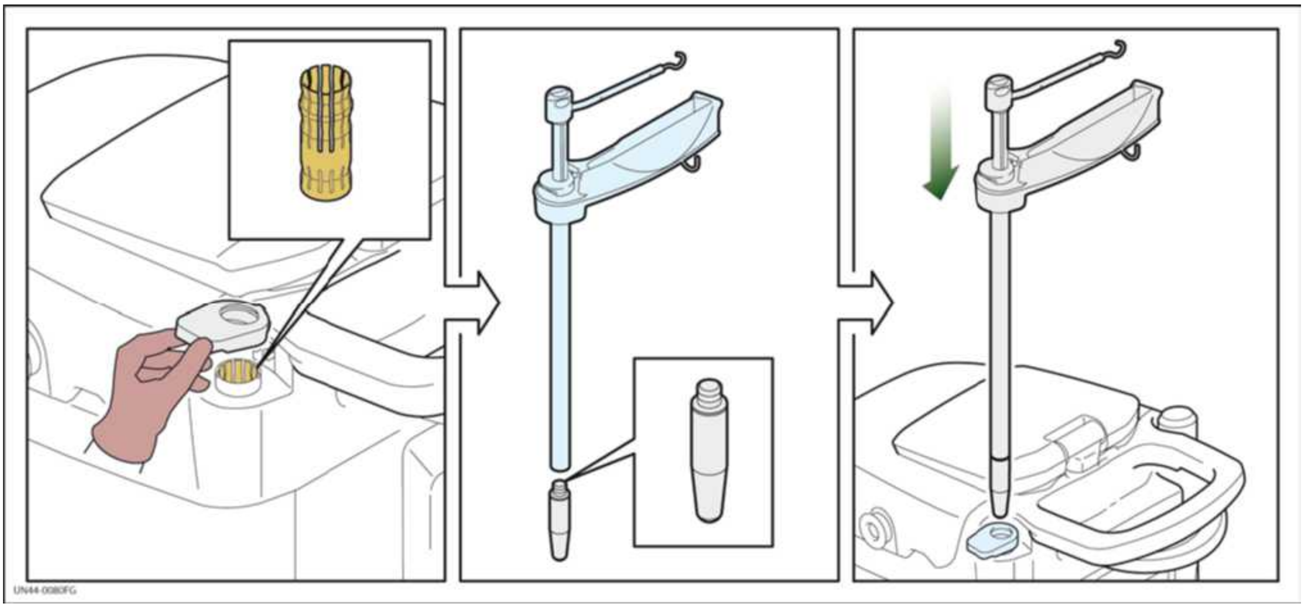


Fig. 12.60-8

- Insert from the bottom the plastic spacer;
- Insert the brass stop from the bottom;
- First fix it screwing the brass in the middle, then thigh it acting on the TCCE M 3x20 screw.

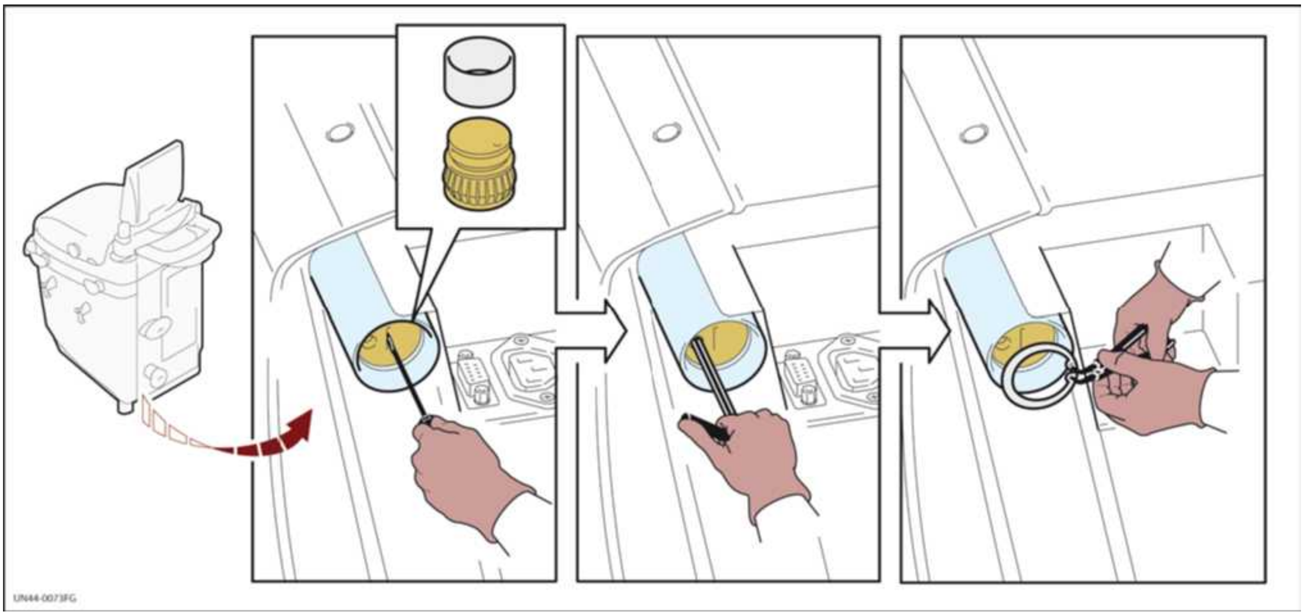


Fig. 12.60-9

12.60.2.3.3 Resassembling the cardiotomy bushing

- Insert the new cardiotomy bushing in its seat on the frame;
- Insert the cardiotomy mast from the bottom into its hole in the frame, pushing it up together with the 63040 Ø 25 mm tool till the mast is blocked in its eccentric ring;
- Remove the tool;
- Insert the clamping clip with the clamping clip wrench;

(DISM_060) cod. 65679 XTRA Bushings rev.00

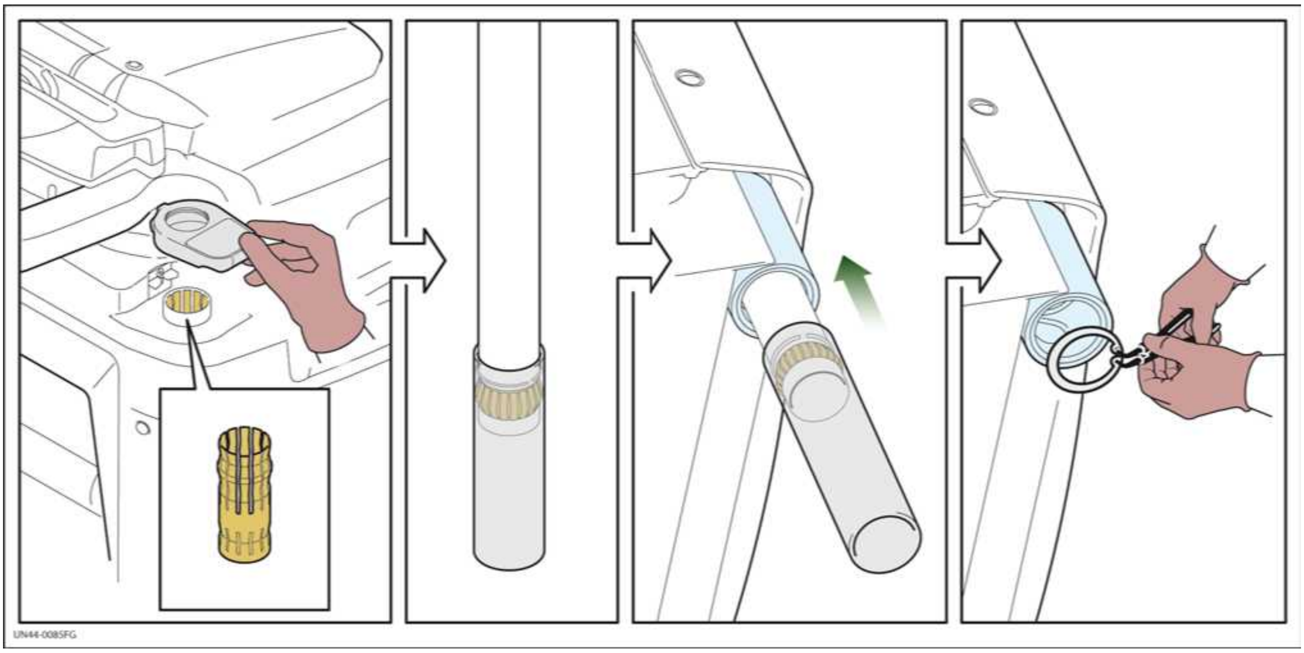


Fig. 12.60-10

- Put the load cell on the cardiotomy mast, drawing the coil cable down through the mast; during reassembly pay attention to the load cell cable in order to avoid wires disconnection or damages;
- Screw the inner pin in the right direction;
- Re-connect the J8 AMP connector to the NBP board;
- Screw the load cell coil cable shield in its point (see fig.12.60-4);
- Put a little bit grease against the small ball to keep it in its place;
- Put the cardiotomy support back on the mast paying attention that the cardiotomy support is opposite to the ball in order that the weight applied pushes the ball toward the load cell;
- Screw the external pin;

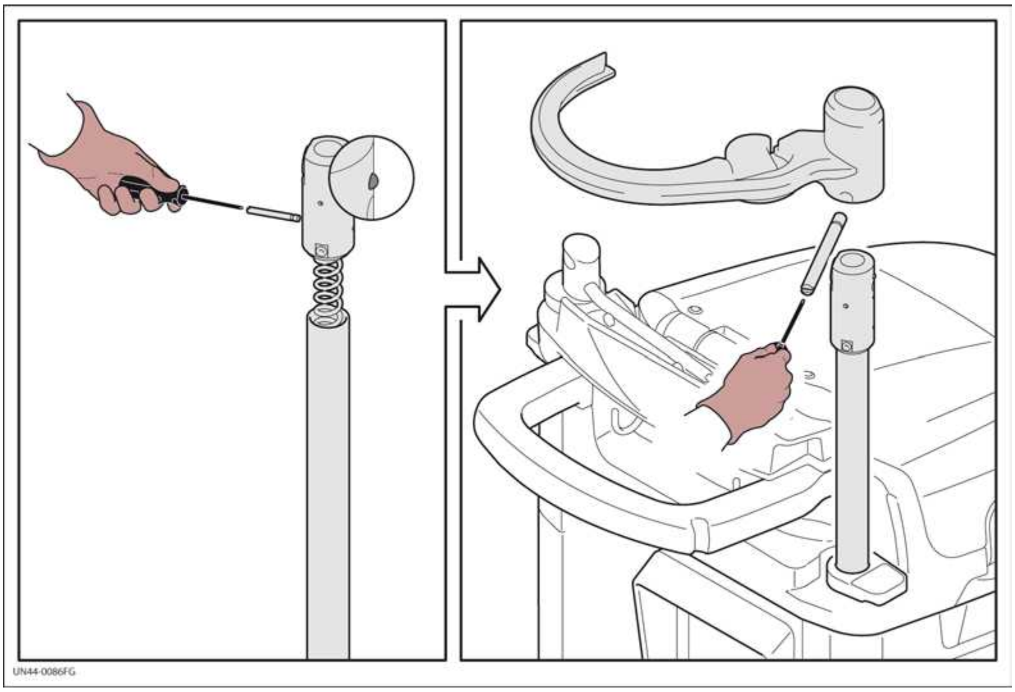


Fig. 12.60-11

- Verify if the mast slides properly without going beyond the bush stop position.

NOTE: Before inserting the masts, stick the related conductive springs on their grooves on the brass stops.

12.60.3 Functional test

Close the XTRA and perform a **(DISM_003) Functional Verification test** #card.

12.61 (DISM_061) cod. 65680 Cable Holder rev.00

12.61.1 About this card

The purpose of this card is to describe the **Cable Holder** replacement, code **65680**.

12.61.2 Procedure

12.61.2.1 Tools

- Set of screwdrivers;

12.61.2.2 Disassembly

- Open the left side panel;
- Unscrew the two M3 nuts, with the related flat and split washers, which fix the cable holder to the rear panel;
- Remove the cable holder.

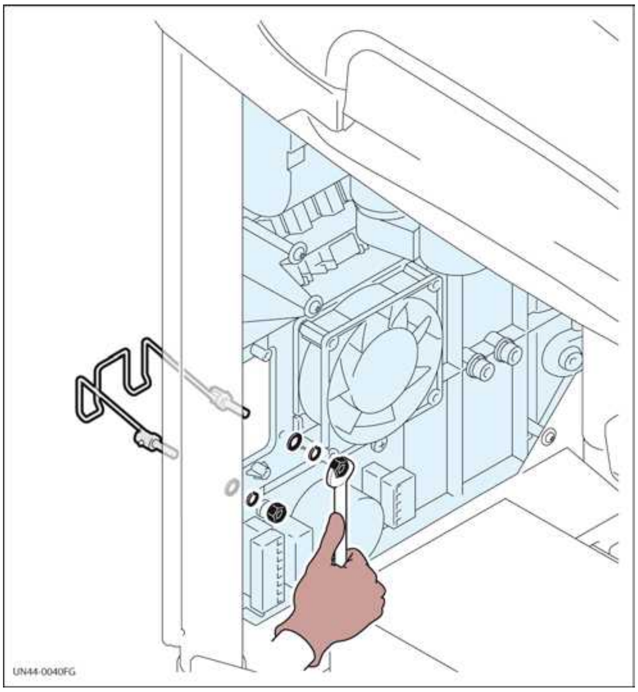


Fig. 12.61-1

12.61.2.3 Reassembly

- Put the new cable holder in its position on the rear panel;
- Fix the new cable holder to the rear panel screwing the two M3 nuts with the related flat and split washers;
- Close the XTRA.

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12.62(DISM_062) cod.65681 Cardiotomy Mast rev.00

12.62.1 About this card

The purpose of this card is to describe the **cardiotomy mast** replacement, code **65681**.

12.62.2 Procedure

12.62.2.1 Tools

- Set of screwdrivers;
- Clamping clip wrench;
- Pliers;
- I.V. Pole Mounting Tool cod. 63040.

12.62.2.2 Disassembly

- Remove the left panel;
- Lift a little bit the cardiotomy mast till the cardiotomy support is able to rotate;
- Unscrew the pin in the cardiotomy support, paying attention to the pin direction to avoid damages to the support, since the hole where the pin thread is screwed in is smallest than the hole through which the pin is to be inserted;
- Pay attention to the inside ball;
- Remove carefully, pulling up, the cardiotomy support;
- Unscrew the inner pin;

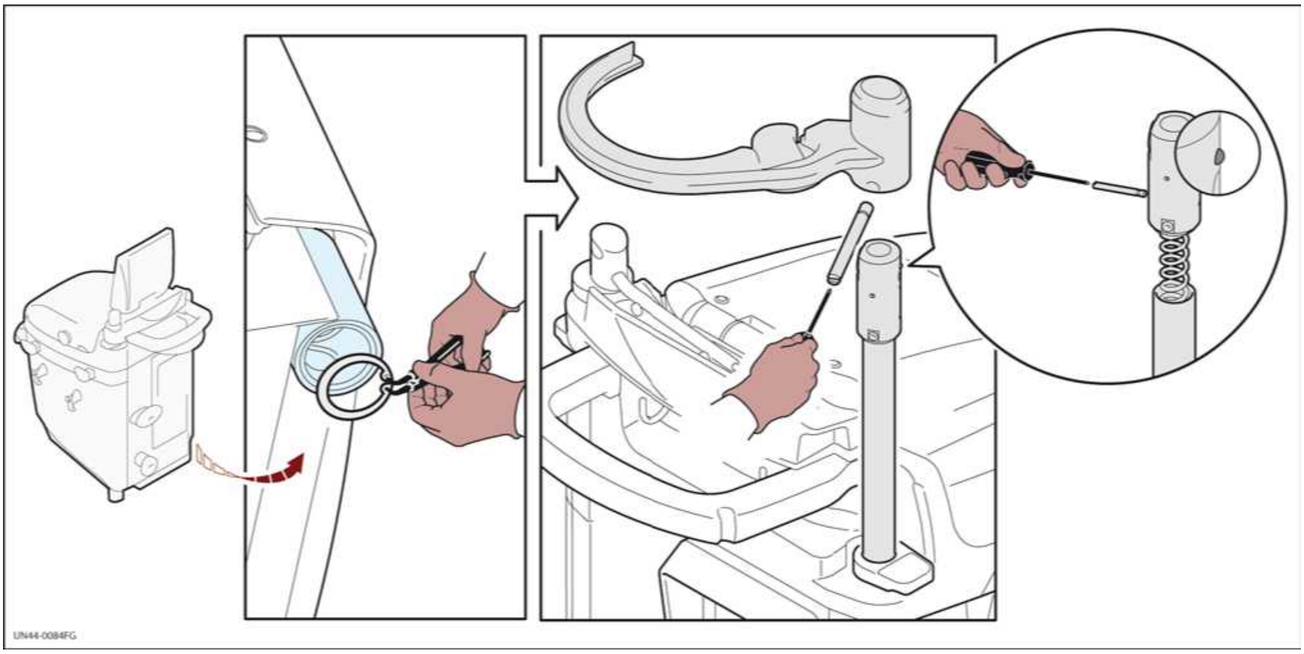

Fig. 12.62-1

- Unscrew the load cell coil cable shield;
- Disconnect the J8 AMP connector from the NBP board;
- Insert the coil cable inside the cardiotomy mast;
- Pull the load cell block up with its coil cable;
- Remove the clamping clip from its seat on the frame with the clamping clip wrench;

- Lift the cardiotomy eccentric ring up;
- Push the cardiotomy mast down.

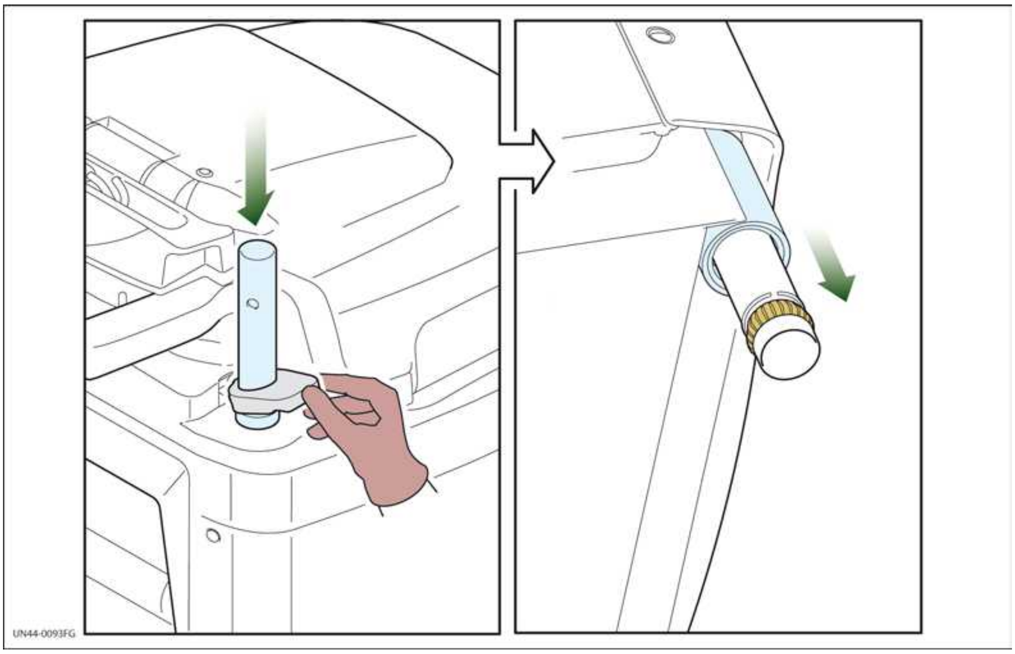

Fig. 12.62-2

WARNING ! *Pay attention not to lose the load cell ball.*

12.62.2.3 Reassembly

- Insert the cardiotomy bushing in its seat on the frame (if removed);
- Insert the new cardiotomy mast from the bottom into its hole in the frame, pushing it up together with the 63040 Ø 25 mm tool till the mast is blocked in its eccentric ring;
- Remove the tool;
- Insert the clamping clip with the clamping clip wrench;

(DISM_062) cod.65681 Cardiotomy Mast rev.00

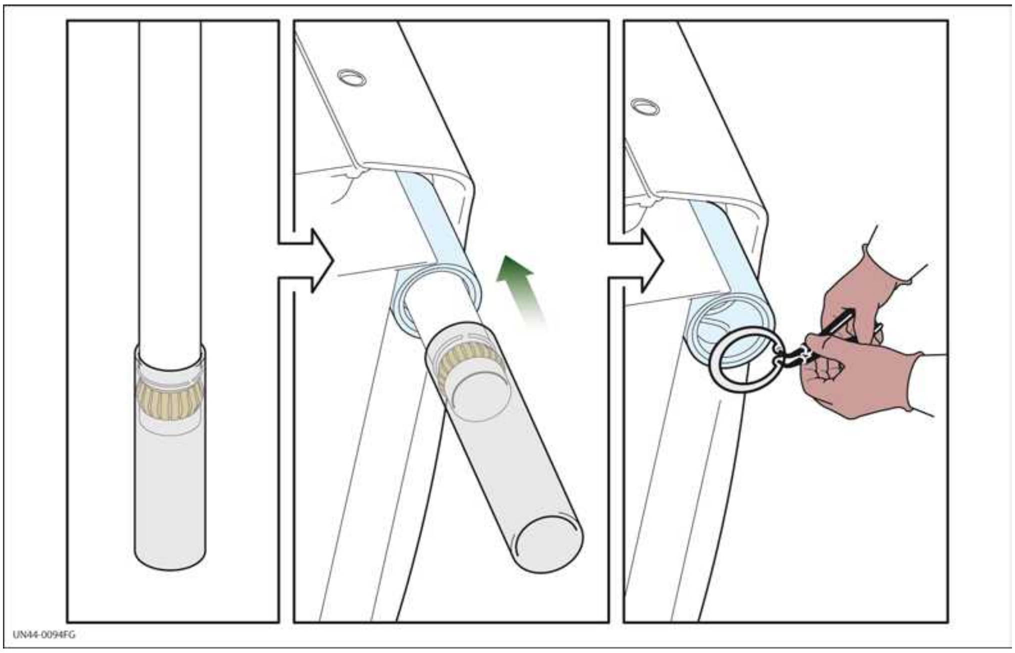

Fig. 12.62-3

- Put the load cell on the cardiotomy mast, drawing the coil cable down through the mast; during reassembly pay attention to the load cell cable in order to avoid wires disconnection or damages;
- Screw the inner pin in the right direction;
- Re-connect the J8 AMP connector to the NBP board;
- Screw the load cell coil cable shield in its point (see fig.12.62-4);

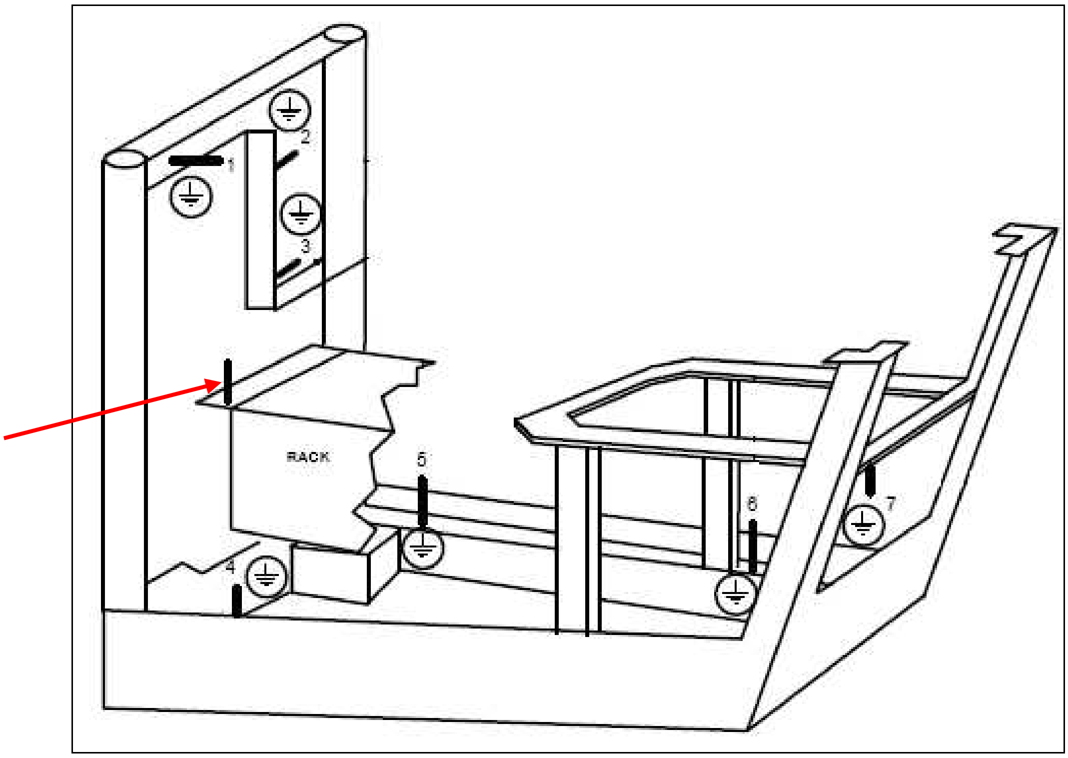

Fig. 12.62-4

- Put a little bit grease against the small ball to keep it in its place;

- Put the cardiotomy support back on the mast paying attention that the cardiotomy support is opposite to the ball in order that the weight applied pushes the ball toward the load cell ;
- Screw the external pin;

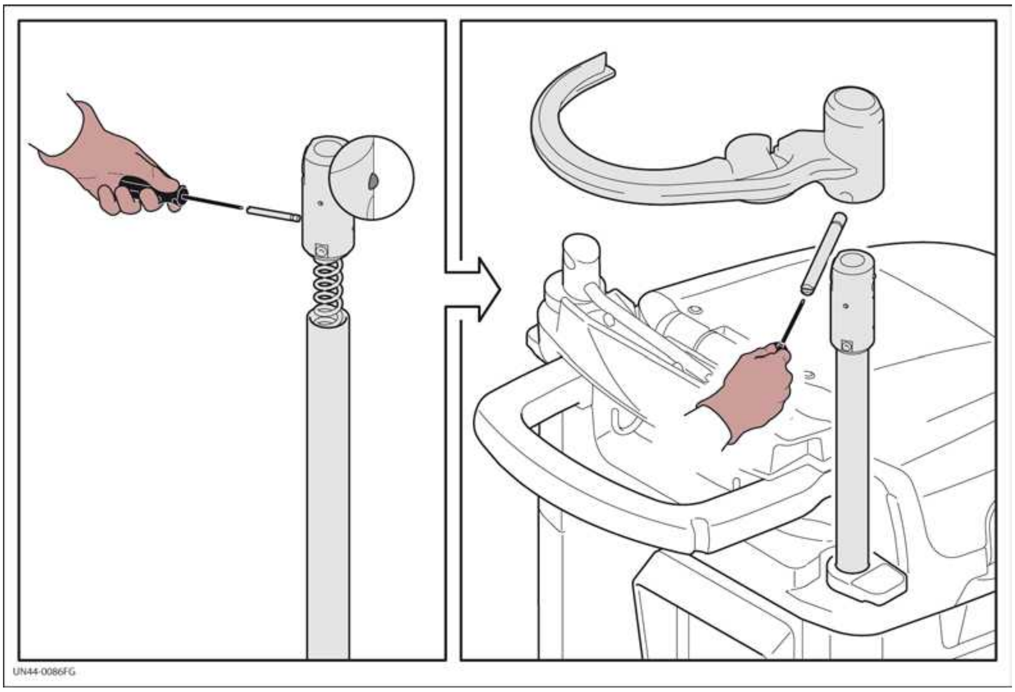

Fig. 12.62-5

- Verify if the mast slides properly without going beyond the bush stop position.

12.62.3 Calibration

Perform the testing procedure described in the **(CLBR_004) Load Cell Calibration** card.

12.62.4 Functional test

Close the XTRA and perform a **(DISM_003) Functional Verification test** # card.

12.63(DISM_063) cod. 65682 Cardiotomy Support rev.00

12.63.1 About this card

The purpose of this card is to describe the **cardiotomy support** replacement, code **65682**.

12.63.2 Procedure

12.63.2.1 Tools

- Set of screwdrivers;
- Weighing System Tool code 63041.

12.63.2.2 Disassembly

- Lift a little bit the cardiotomy mast till the cardiotomy support is able to rotate;
- Unscrew the pin in the cardiotomy support, paying attention to the pin direction, since the hole where the pin thread is screwed in is smallest than the hole through the pin is to be inserted to avoid damages to the support;
- Pay attention to the inside ball;
- Remove carefully, pulling up, the cardiotomy support.

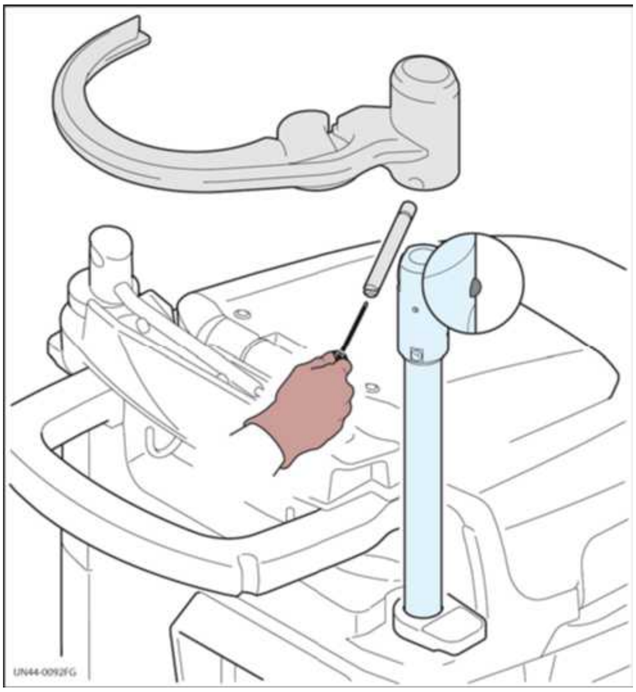

Fig. 12.63-1

12.63.2.3 Reassembly

- Put a little bit grease against the small ball to keep it in its place;
- Make sure that the cardiotomy support is opposite to the ball in order that the weight applied pushes the ball toward the load cell;
- Put the new cardiotomy support back on the cardiotomy mast;
- Screw the pin.

12.63.3 Calibration

Perform the testing procedure described in the **(CLBR_004) Load Cell Calibration** card.

12.64(DISM_064) cod. 65683 Centrifuge Chuck rev.00

12.64.1 About this card

The purpose of this card is to describe the **Centrifuge Chuck** replacement, code **65683**.

12.64.2 Procedure

12.64.2.1 Tools

- Set of screwdrivers;
- Allen key 3 mm;
- T-handle hexagon key 5 mm.

12.64.2.2 Disassembly

- Open the left side panel;
- Remove the centrifuge plate as the procedure in the **(DISM_066) Centrifuge Plate** card;
- Remove the encoder switch as the procedure in **(DISM_014) ENC Centrifuge Encoder Switch** card;
- Unscrew the four screws TCCE M4x16 inside the centrifuge well which fasten the chuck to the centrifuge group, with their flat and split washers;
- Remove the four metallic spacers with their OR ring;
- Remove the chuck from the centrifuge well;
- Remove the big OR ring placed under the chuck;
- Pay attention to the plastic joint inserted in the centrifuge motor shaft.

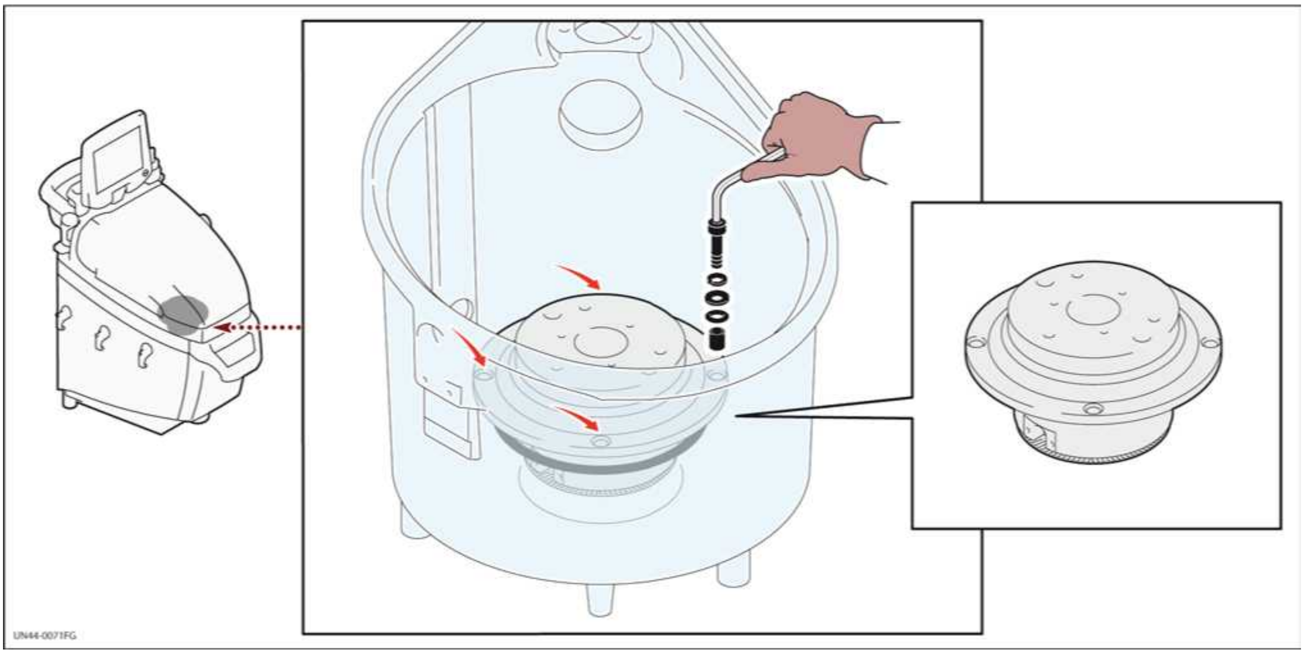

Fig. 12.64-1

12.64.2.3 Reassembly

- Put the OR ring (lubricated with grease) in its seat on the centrifuge chuck;
- Insert the chuck from the internal of the centrifuge well, paying attention the encoder switch seat is aligned with the centrifuge light;
- Insert the four metallic spacers with their OR ring;
- Fix it with the four TCCE M4x16 screws and the flat and split washers;
- Insert the encoder switch as the procedure in the **(DISM_014) ENC Centrifuge Encoder Switch** card;
- Insert back the centrifuge plate as the procedure in the **(DISM_066) Centrifuge Plate** card.

12.64.3 Calibration

The centrifuge motor needs to be aligned to the chuck to avoid noises problem coming from the assembled group. Proceed as following:

- Switch on XTRA in **Diagnostics mode \Actuators Checks and test\Centrifuge;**
- Run the centrifuge at slow speed (max 1500 rpm);
- Wait the assessment of the centrifuge to the chuck shaft;
- With the centrifuge running tighten the screws on the centrifuge motor paying attention that the centrifuge group noises are not increasing;
- In case it could be necessary to rotate the centrifuge motor and aligned it to the chuck shaft in a different position. This must be done rotating the motor and inserting it into the chuck shaft in the opposite side, to change the position of the plastic joint which makes the coupling between the two shafts (Fig.12.64-2).

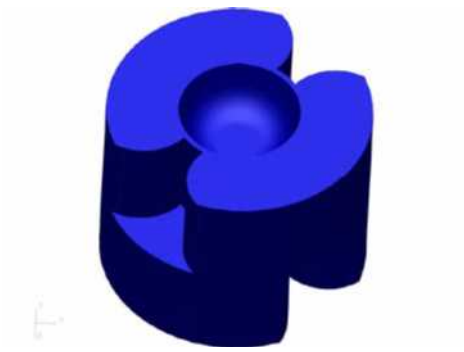

Fig. 12.64-2

12.64.4 Functional test

- Perform the **Centrifuge Test** described in the **(TEST_003)** card
- Close the XTRA.

12.65(DISM_065) cod. 65684 Centrifuge Encoder Disk rev.00

12.65.1 About this card

The purpose of this card is to describe the **Centrifuge Encoder Disk** replacement, code **65684**.

12.65.2 Procedure

12.65.2.1 Tools

- Set of screwdrivers;
- Allen keys 2,5 and 3 mm.

12.65.2.2 Disassembly

- Remove all the XTRA panels;
- Remove the centrifuge motor following the procedure in **(DISM_005) Centrifuge Motor** card;
- Remove the encoder switch by unscrewing the two screws TCC M 3x12 with their split and flat washers;

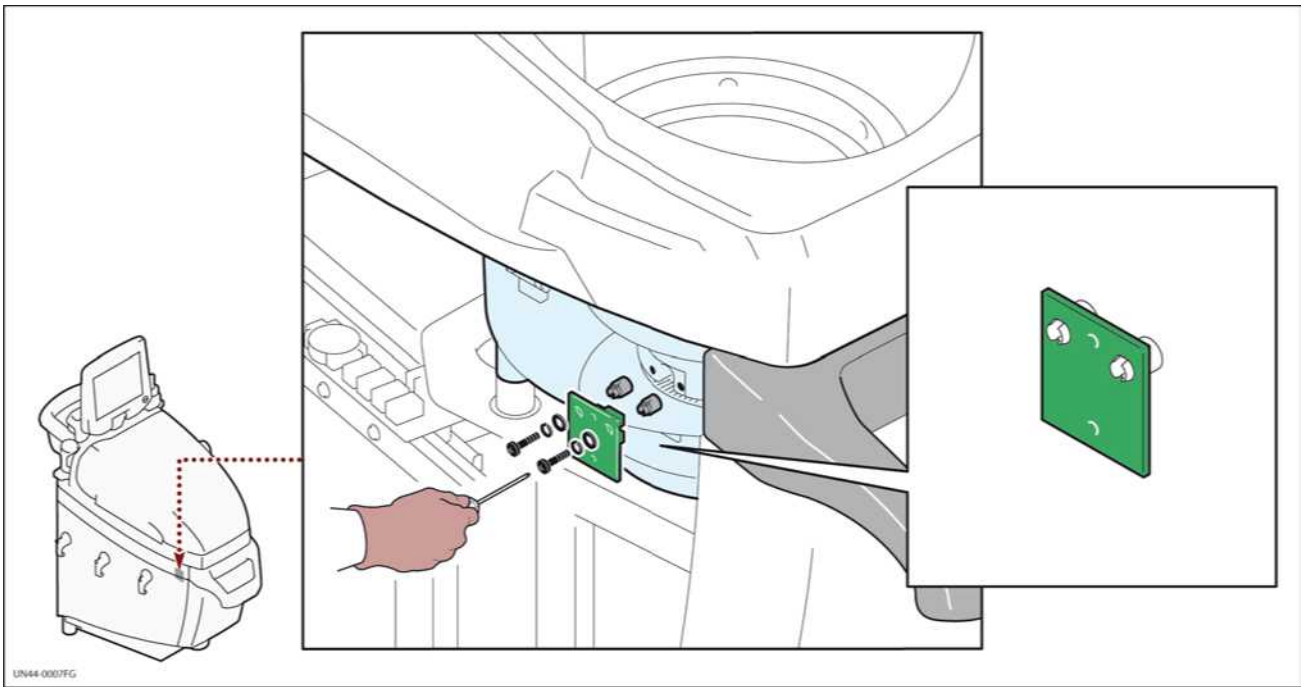

Fig. 12.65-1

- Unscrew the four encoder TCCE M 3x6 screws fixing the encoder to the chuck;
- Remove the encoder disk.

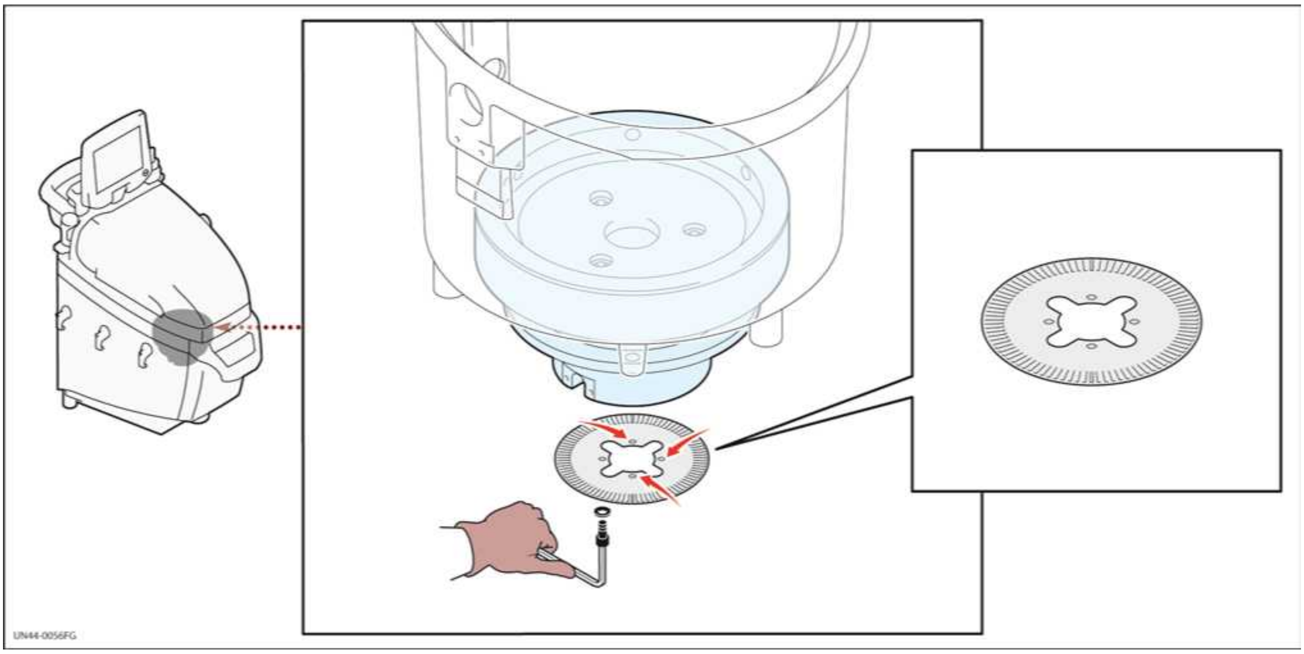

Fig. 12.65-2

12.65.2.3 Reassembly

- Insert the new encoder disk paying attention not to damage it while inserting in seat;
- Screw the four TCCE M 3x6 screws back;
- Insert the encoder switch back;
- Fix it with two TCC M 3x12 screws;
- Insert the centrifuge motor following the procedure in the **(DISM_005) Centrifuge Motor** card.

12.65.3 Functional test

Perform the **Centrifuge Test** described in the **(TEST_003)** card.
Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.66(DISM_066) cod. 65685 Centrifuge Plate rev.00

12.66.1 About this card

The purpose of this card is to describe the **Centrifuge Plate** replacement, code **65685**.

12.66.2 Procedure

12.66.2.1 Tools

- T-handle hexagon key 5 mm.

12.66.2.2 Disassembly

- Open the centrifuge cover;
- Keep the arm bowl in open position;
- Unscrew the three TCCE M 6x12 screws on the centrifuge plate, holding the plate with a hand;
- Remove the centrifuge plate.

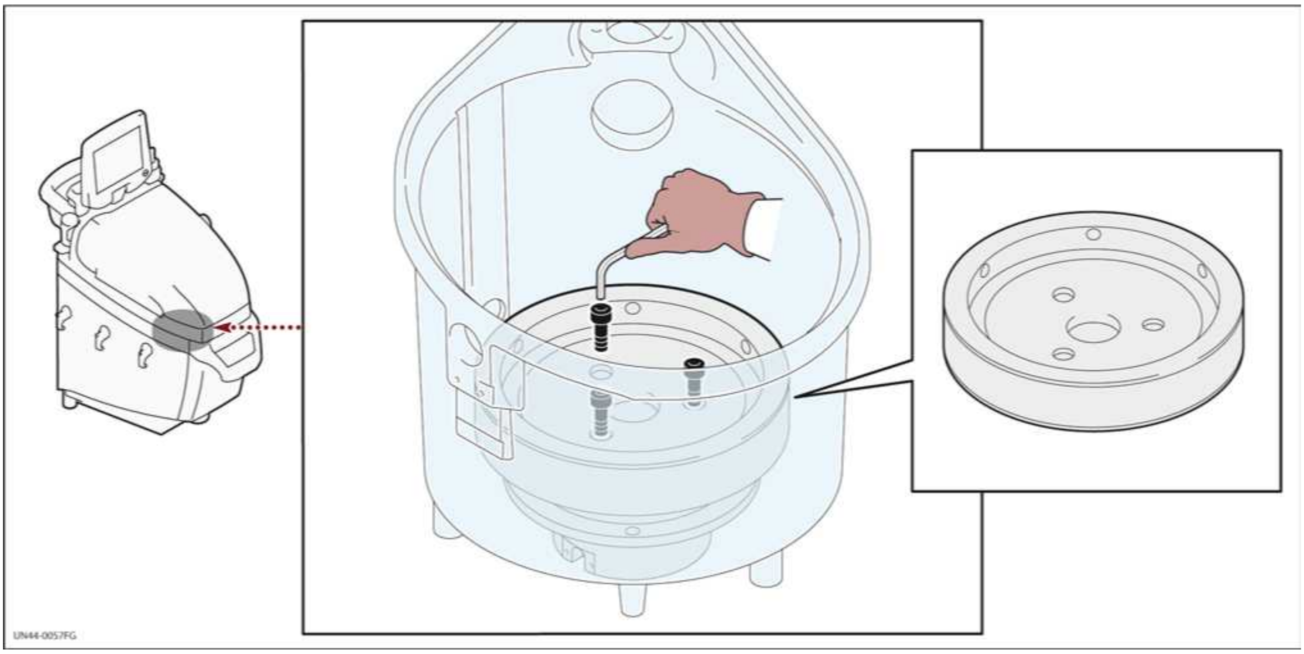

Fig. 12.66-1

12.66.2.3 Reassembly

- Insert the new centrifuge plate in the correct position by aligning the three screw holes;
- Screw the three TCCE M 6x12 screws.

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12.67(DISM_067) cod. 65686 Complete I.V. Pole rev.00

12.67.1 About this card

The purpose of this card is to describe the **Complete I.V. Pole** replacement, code **65686**.

12.67.2 Procedure

The I.V. pole group for bags consists of two sections whose diameters are respectively 25 mm and 20 mm.

12.67.2.1 Tools

- Set of screwdrivers;
- Clamping clip wrench;
- Allen keys;
- I.V. Pole Mounting Tool cod. 63040

12.67.2.2 Disassembling

12.67.2.2.1 Disassembling the complete I.V Pole

- Lift the XTRA up from its cart, disconnecting the serial communication and power cables between the equipment and the XVAC vacuum;
- In the bottom part, close to the rear right corner, you can find the stainless steel pipe where IV poles are inserted;
- From bottom side, looking into the stainless steel pipe, unscrew a little bit the TCCE M 3x20 screw;
- Unscrew completely the metallic part (looks like brass) using a large flare screw driver inserted in the indentation;
- At this point is possible that a plastic spacer falls down, if not it does in next step;

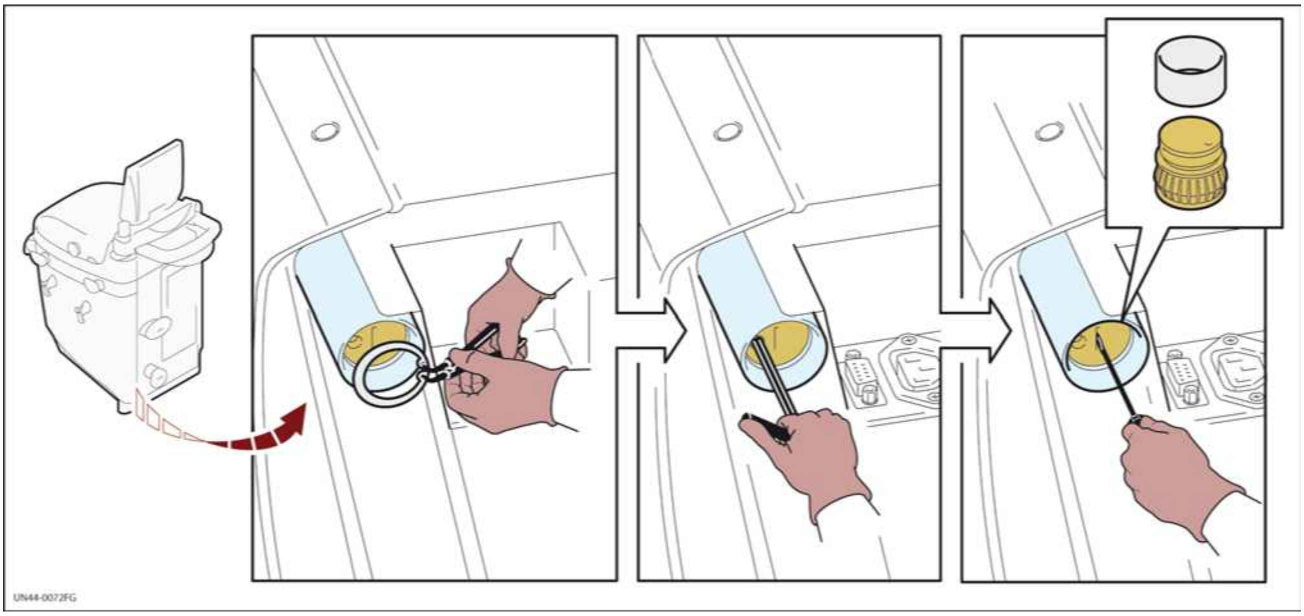

Fig. 12.67-1

- Lift up and remove the Ø 25 mm (with the 20 mm) I.V pole, without removing the eccentric ring.

12.67.2.2.2 Disassembling the Ø 20mm mast

- Unscrew a little bit the second TCCE M 3x30 screw;
- Unscrew completely the metallic part (it looks like brass) using a large flare screw driver inserted in the indentation;
- At this point is possible that a plastic spacer falls down, if not it does in next step;
- Lift up and remove the Ø 20 mm I.V. pole from the Ø 25 mm I.V. pole, without removing the eccentric ring.

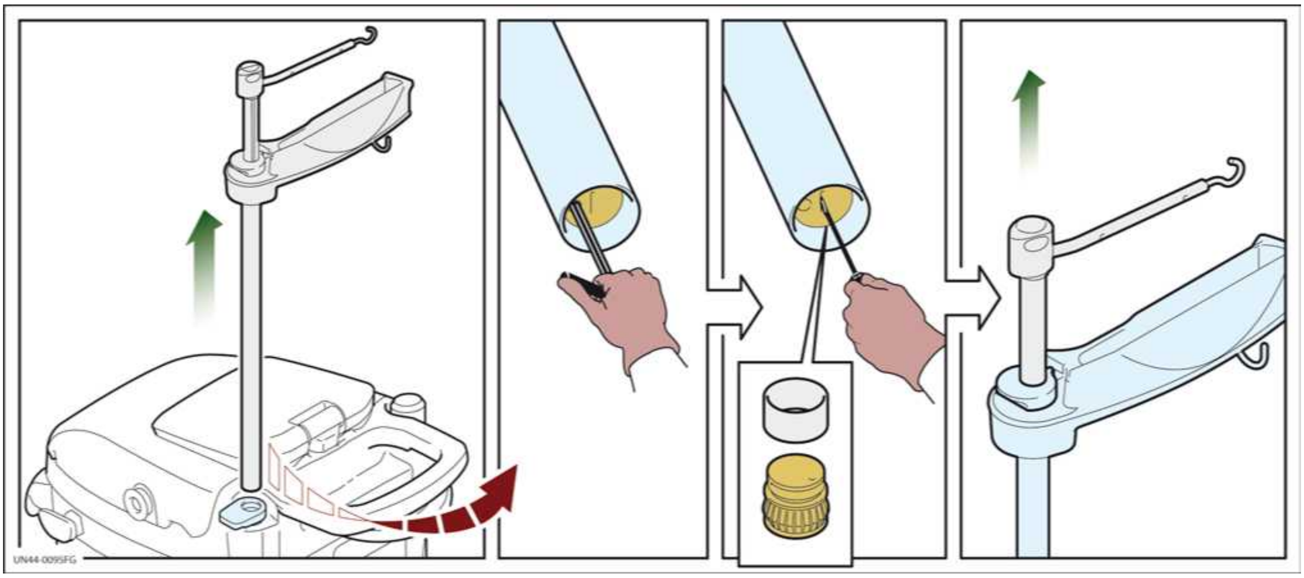

Fig. 12.67-2

12.67.2.3 Reassembling the I.V Pole completely

12.67.2.3.1 Reassembling the Ø 20mm mast

- Insert the bushing of the 20 mm I.V. pole into its seat in the 25 mm I.V. pole if removed (usually already inserted) removing the eccentric ring;
- Screw the 63040 Ø 20 mm tool on the Ø 20 mm I.V. pole;
- Insert the Ø 20 mm I.V. pole together with the tool into the Ø 25 mm I.V. pole, keeping the eccentric ring up and in its seat;

(DISM_067) cod. 65686 Complete I.V. Pole rev.00

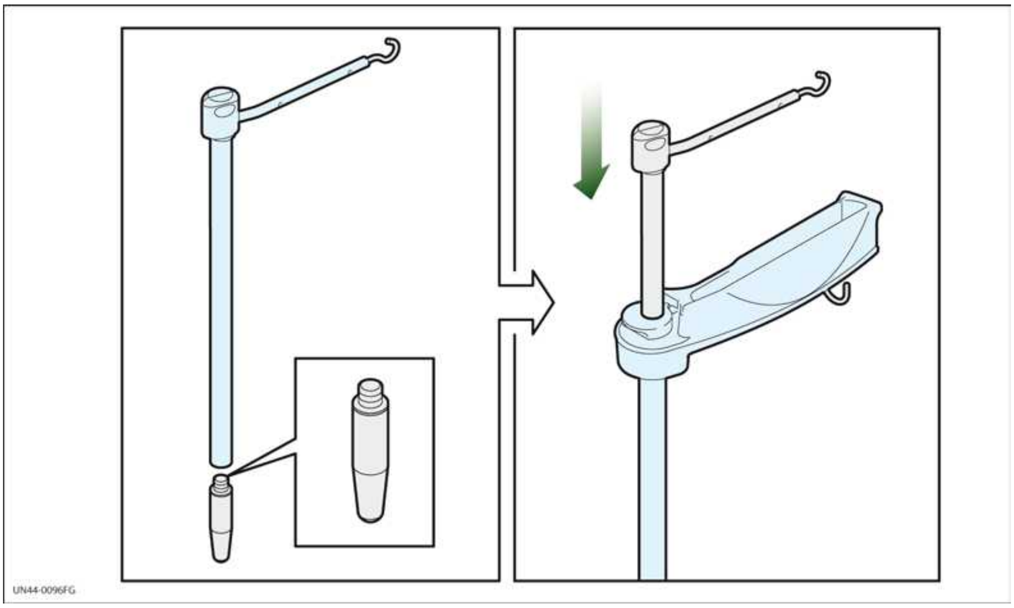

Fig. 12.67-3

- Insert from the bottom the plastic spacer;
- Insert the brass stop from the bottom;
- First fix the 20 mm I.V. pole screwing the brass, then fix it acting on the TCCE M 3x30 screw.

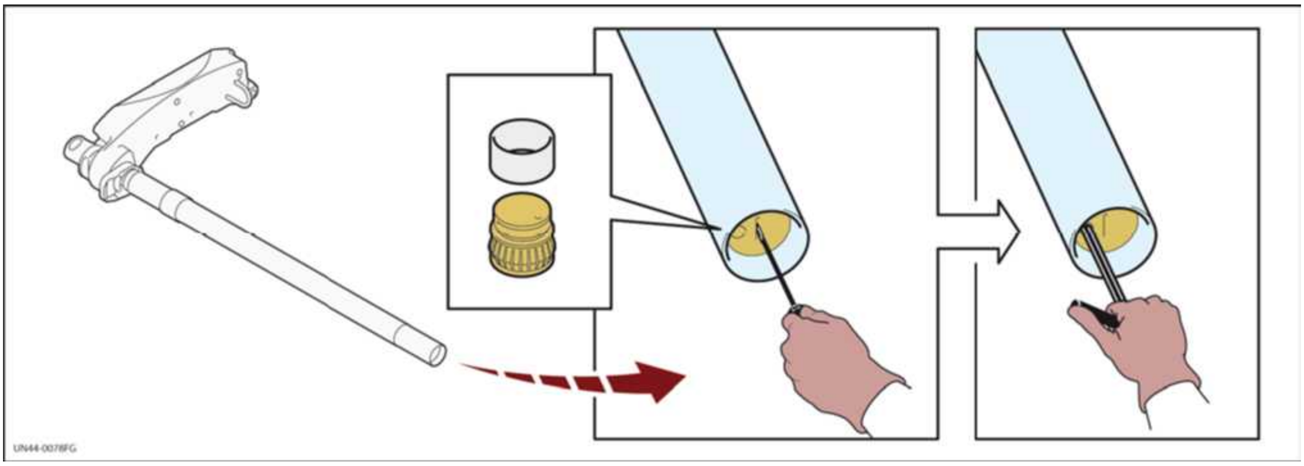

Fig. 12.67-4

12.67.2.3.2 Reassembling the Ø 25mm mast

- Insert the bushing of the 25 mm I.V. pole into its seat on the frame (if removed);
- Screw the 63040 Ø 25 mm tool on the Ø 25 mm I.V. pole;
- Insert the Ø 25 mm I.V. pole together with the tool into the frame, keeping the eccentric ring up and in its seat;

(DISM_067) cod. 65686 Complete I.V. Pole rev.00

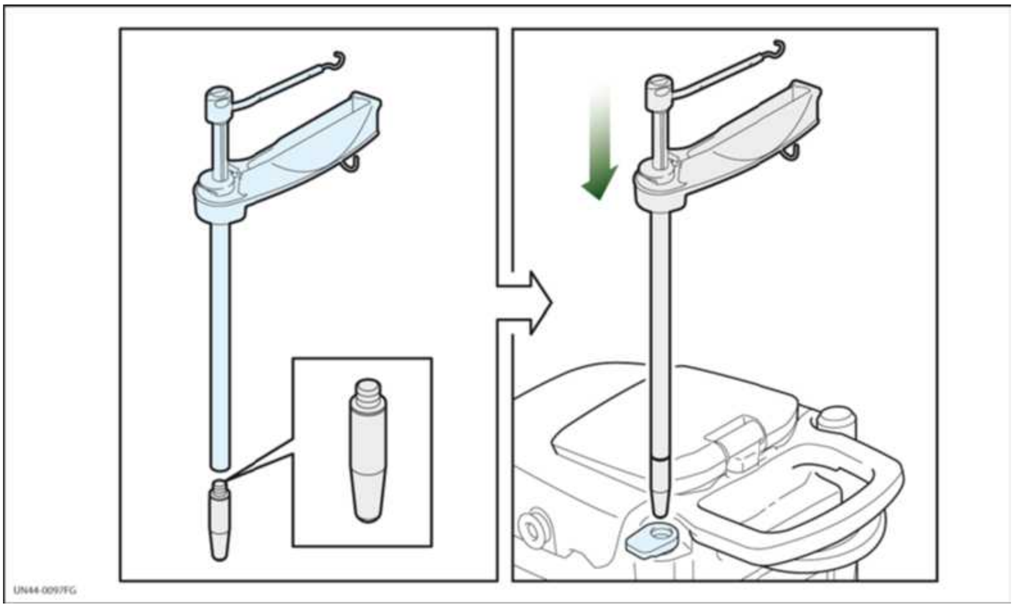

Fig. 12.67-5

- Insert from the bottom the plastic spacer;
- Insert the brass stop from the bottom;
- First fix the 25 mm I.V. pole screwing the brass, then fix it acting on the TCCE M 3x20 screw;

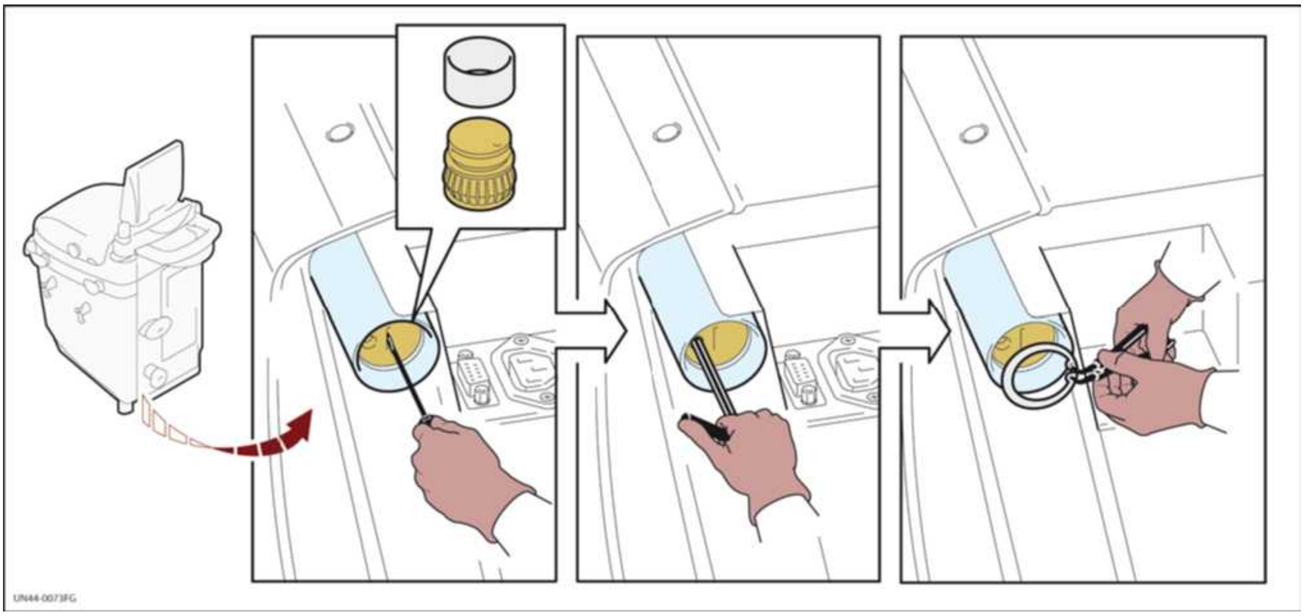

Fig. 12.67-6

- Put the XTRA back on its cart, connecting the serial communication and power cables between the equipment and the XVAC vacuum.

NOTE: Before inserting the masts, stick the related conductive springs on their grooves on the brass stops.

12.67.3 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.68(DISM_068) cod. 65687 Cover Closing Group rev.00

12.68.1 About this card

The purpose of this card is to describe the **Cover Closing Group** replacement, code **65687**.

12.68.2 Procedure

12.68.2.1 Tools

12.68.2.2 Disassembly

- Open the XTRA Cover;
- Unscrew the three TSPC M 3x12 screws which fix the closing group to the cover;
- Remove the closing group with its metallic plate from the cover.

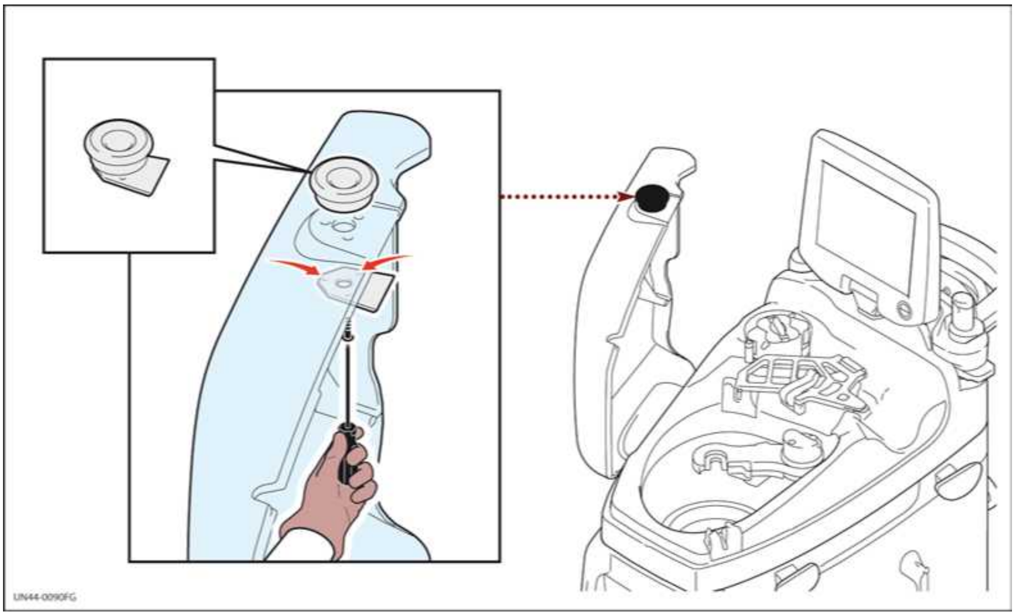

Fig. 12.68-1

12.68.2.3 Reassembly

- Put the new closing group and the metallic plate in their seat on the cover;
- Fix them screwing the three TSPC M 3x12 screws, without tighten them.

12.68.3 Functional test

- Close the cover;
- Move the cover closing group around its seat until the lock pivot is completely out and the black button of the closing group slides properly;
- Open the cover;
- Tighten the three screws;
- Close the cover and check again its correct opening and closing.

(DISM_068) cod. 65687 Cover Closing Group rev.00

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12.69(DISM_069) cod. 65688 Cover Hinges rev.00

12.69.1 About this card

The purpose of this card is to describe the **cover hinges** replacement, code **65688**.

12.69.2 Procedure

12.69.2.1 Tools

- Set of screwdrivers;
- Allen key 3 mm and 4 mm.

12.69.2.2 Disassembly

- Open the left side panel;
- Unscrew the two TCCE M 4x12 screws, with the related split washers, which fix the damaged hinge to the cover;
- Pay attention to the ground cable screwed on the rear screw of the rear hinge;
- Remove the hinge drawing it out from the top.

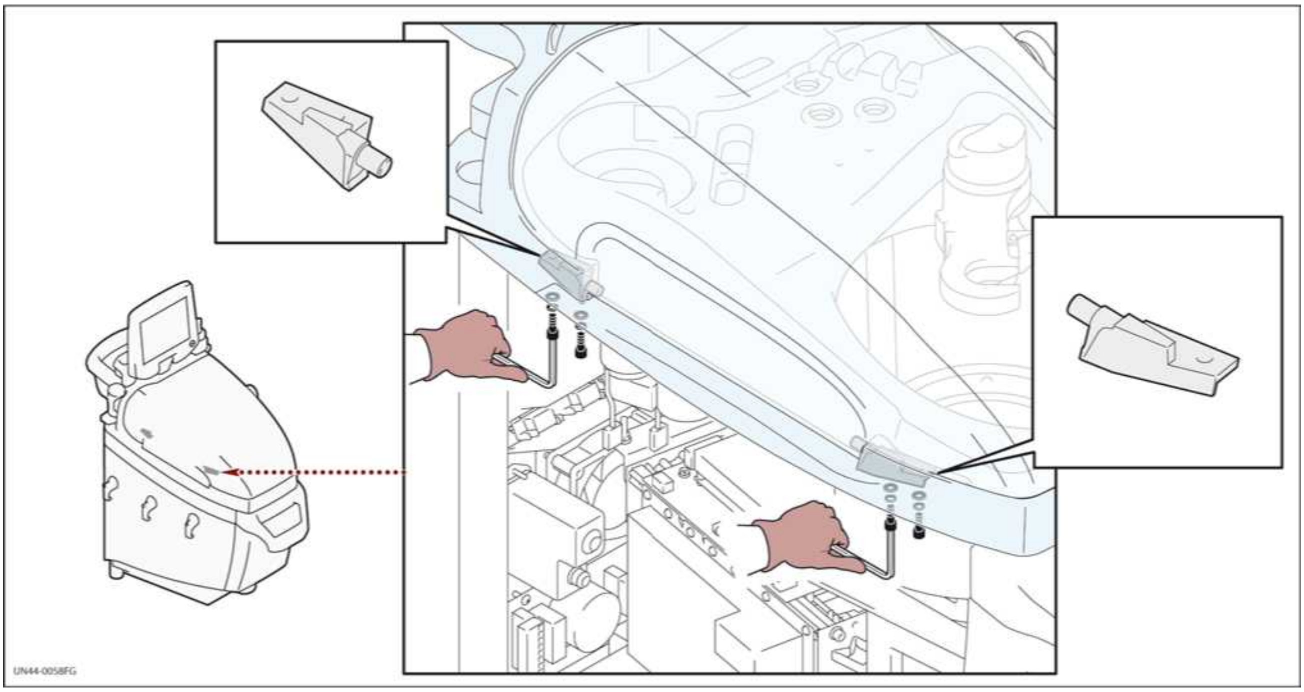

Fig. 12.69-1

12.69.2.3 Reassembly

- Put the new hinge in its position under the top, pushing it into the cover hole;
- Fix it screwing the two TCCE M 4x12 screws, with the related split washers, remembering to insert the ground cable if the removed hinge is the rear one.

12.69.3 Functional test

Perform the **Cover Sensor Test** described in the **(TEST_009)** card.

12.70(DISM_070) cod. 65689 Cover Lock Pivot rev.00

12.70.1 About this card

The purpose of this card is to describe the **cover lock pivot** replacement, code **65689**.

12.70.2 Procedure

12.70.2.1 Tools

- Set of screwdrivers;
- Allen keys 4 mm.

12.70.2.2 Disassembly

- Remove the right panel;
- Remove the Clamp Group, see the **(DISM_006) cod. 65606 Clamp** card;
- Disconnect the LOCK AMP flying connector;
- Unscrew the three KA 40x16 screws with the related washers which fix the white cover lock support to the top;
- Remove the cover lock group;
- Remove the cover locking system from the white pivot support, unscrewing the two TCCE 4x12 screws with the related flat and split washers.

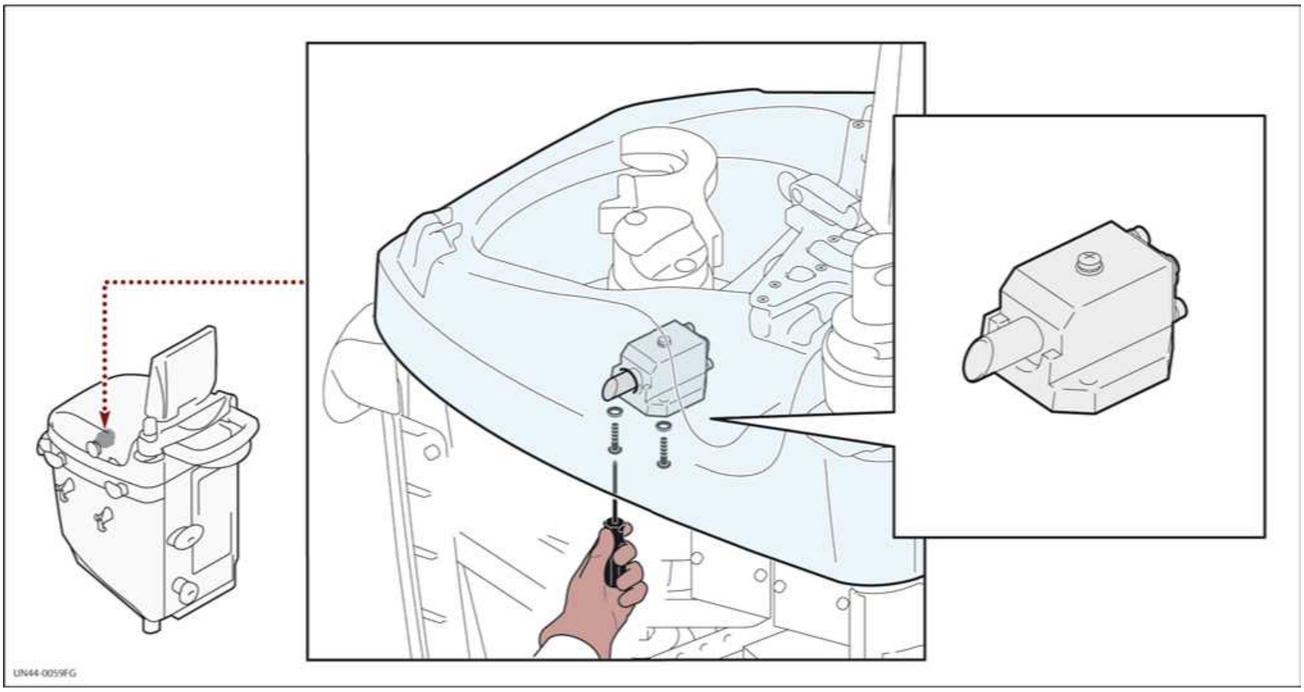

Fig. 12.70-1

12.70.2.3 Reassembly

- Insert the cover locking system on the new white pivot support, screwing the two TCCE 4x12 screws with the related flat and split washers;
- Put the new cover lock group under the top, fixing it with the three KA 40x16 screws with the related washers;
- Put the clamp group back under the top, see the **(DISM_006) cod. 65606 Clamp** card;

- Connect the LOCK AMP flying connector.

12.70.3 Calibration

Perform the **Cover Lock Test** described in the **(TEST_010)** card.

12.70.4 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.71(DISM_071) cod. 65690 Display Cover Gasket rev.00

12.71.1 About this card

The purpose of this card is to describe the **display cover gasket** replacement, code **65690**.

12.71.2 Procedure

12.71.2.1 Tools

- Allen key 2,5 mm

12.71.2.2 Disassembly

- Open the display cover, see the **(DISM_008) cod. 65608 XTRA Display Cover** card;
- Remove the cover gasket.

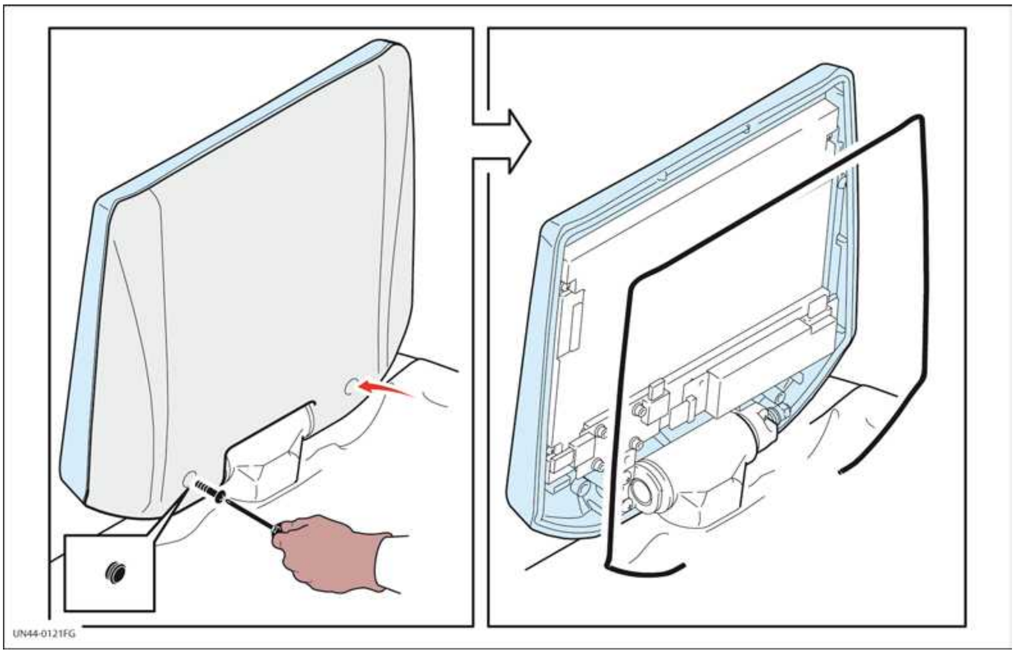

Fig. 12.71-1

12.71.2.3 Reassembly

- Put the new cover gasket in its groove on the display cover;
- Close the display cover, see the **(DISM_008) cod. 65608 XTRA Display Cover** card.

(DISM_071) cod. 65690 Display Cover Gasket rev.00

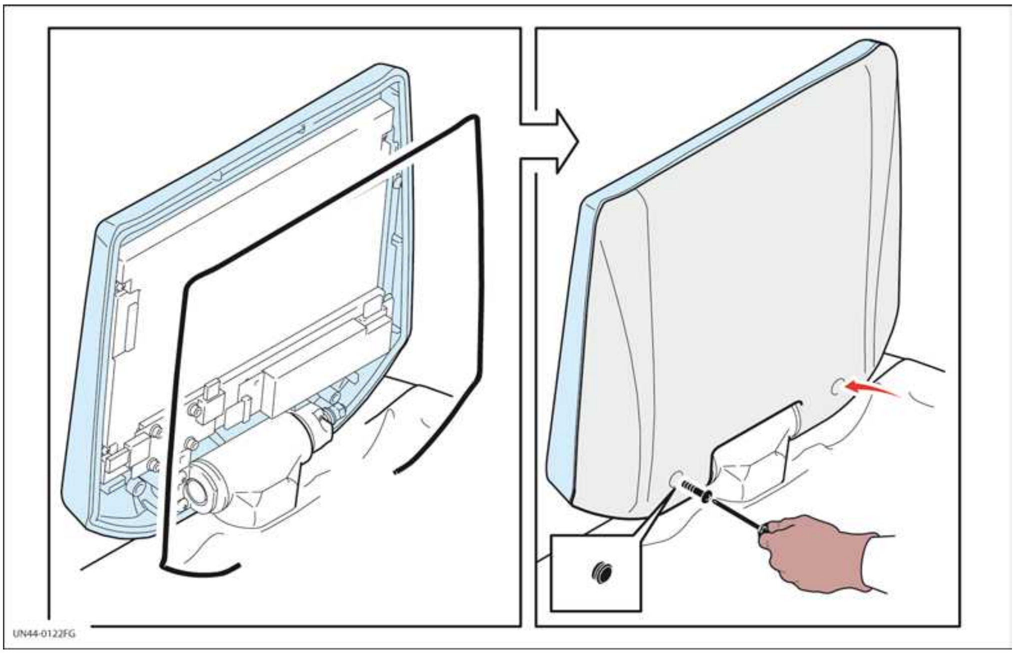

Fig. 12.71-2

12.72(DISM_072) cod. 65691 Eccentric Rings rev.00

12.72.1 About this card

The purpose of this card is to describe the **eccentric rings** replacement, code **65691**.

12.72.2 Procedure

- Set of screwdrivers;
- Allen keys;
- I.V. Pole Mounting Tool cod. 63040.

In the bottom part, close to the corner, you can find the stainless steel pipe where IV poles are inserted.

12.72.2.1 Disassembling

12.72.2.1.1 Disassembling the Ø 25 mm I.V. pole eccentric ring

- Lift the XTRA up from its chart;
- From bottom side, looking into the stainless steel pipe, unscrew a little bit the TCCE M 3x20 screw;
- Unscrew completely the metallic part (it looks like brass) using a large flare screw driver inserted in the indentation;
- At this point is possible that a plastic ring falls down, if not it does in next step;

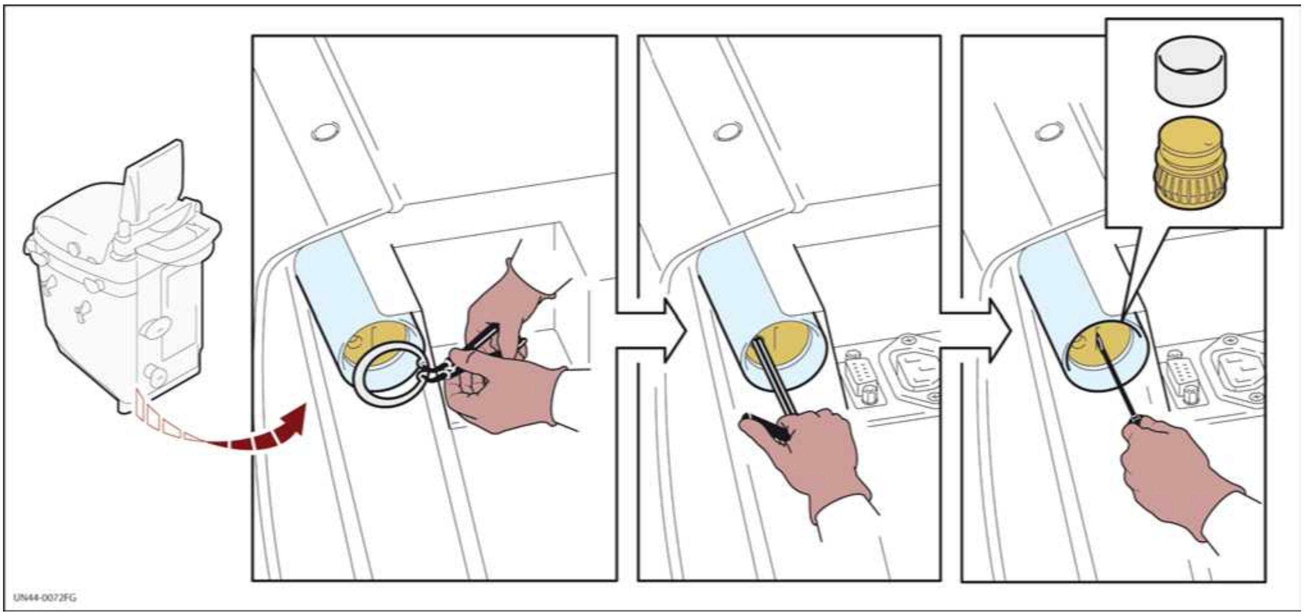

Fig. 12.72-1

- Lift up and remove the Ø 25 mm (with the Ø 20 mm) I.V pole;
- Remove the Ø 25 mm I.V pole eccentric ring.

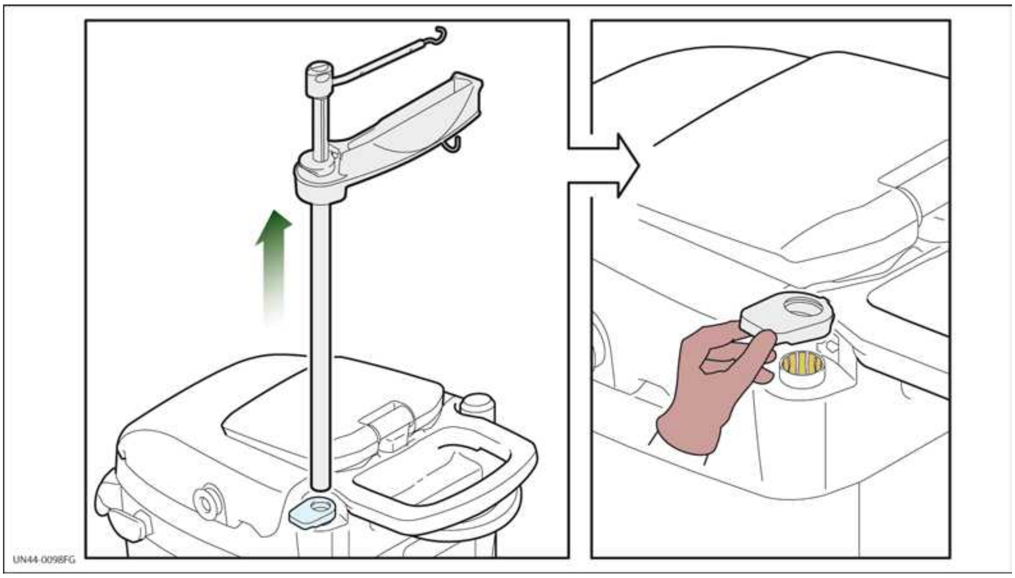

Fig. 12.72-2

12.72.2.1.2 Disassembling the Ø 20 mm eccentric ring

- Unscrew a little bit the second TCCE M 3x30 screw;
- Unscrew completely the metallic part (it looks like brass) using a large flare screw driver inserted in the indentation;
- At this point is possible that a plastic ring falls down, if not it does in next step;
- Lift up and remove the Ø 20 mm I.V. pole from the Ø 25 mm I.V. pole;
- Remove the eccentric ring.

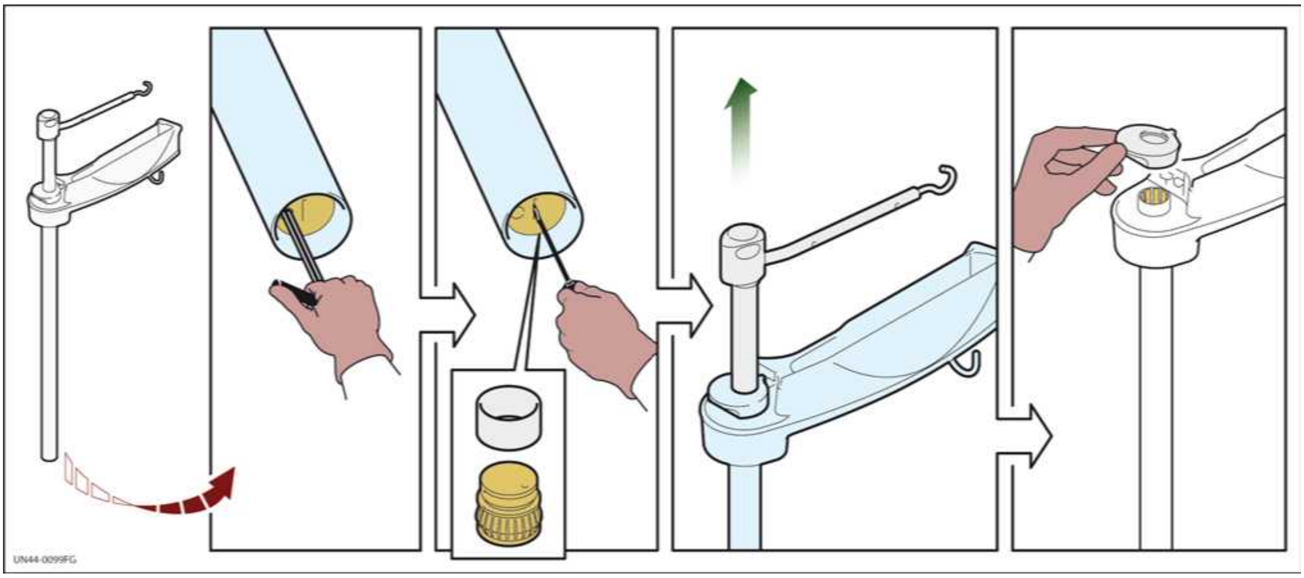

Fig. 12.72-3

12.72.2.1.3 Disassembling the cardiotomy eccentric ring

- Remove the left panel;
- Lift a little bit the cardiotomy mast till the cardiotomy support is able to rotate;
- Unscrew the pin in the cardiotomy support, paying attention to the pin direction to avoid damages to the support, since the hole where the pin thread is screwed in is smallest than the hole through which the pin is to be inserted;
- Pay attention to the inside ball;
- Remove carefully, pulling up, the cardiotomy support;
- Unscrew the inner pin;

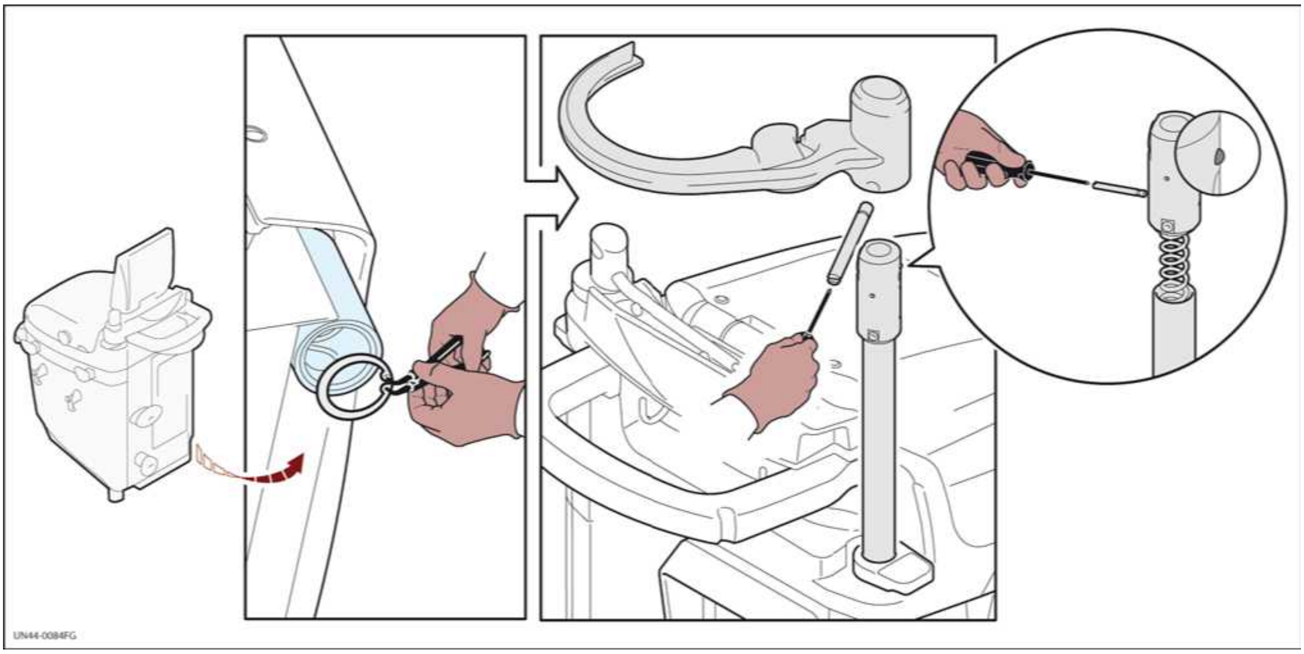

Fig. 12.72-4

- Unscrew the load cell coil cable shield (from the point indicated in the fig.12.72-5);

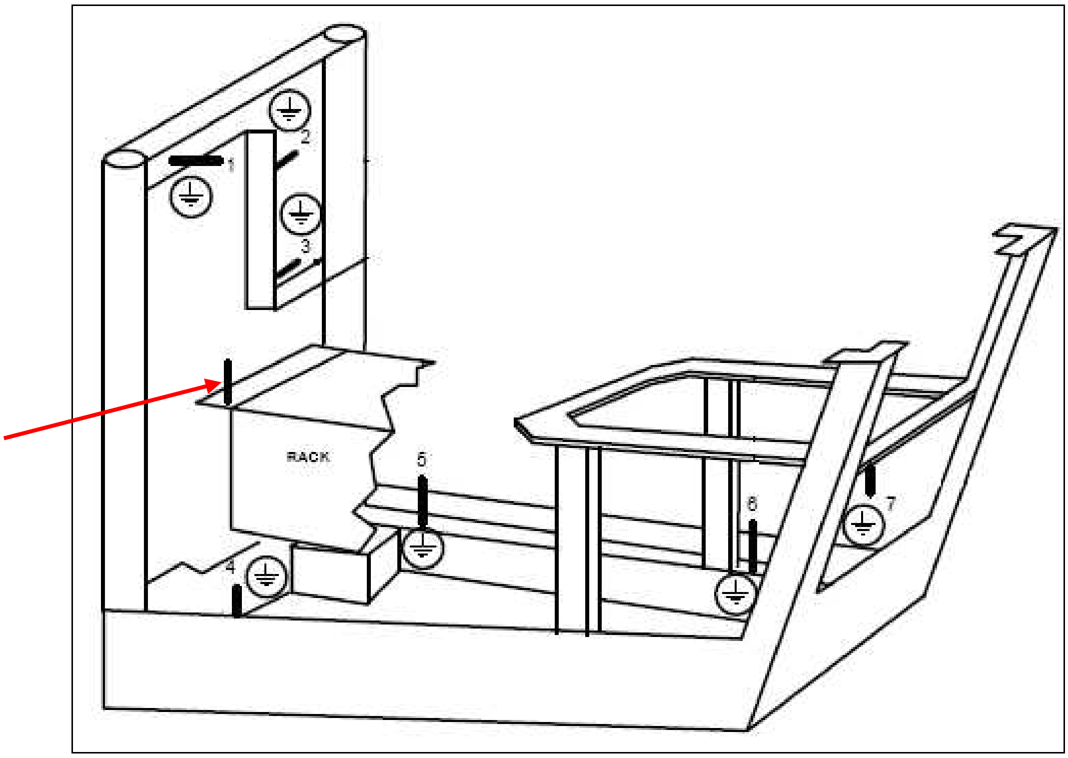

Fig. 12.72-5

- Disconnect the J8 AMP connector from the NBP board;
- Insert the coil cable inside the cardiotomy mast;
- Pull the load cell block up with its coil cable;
- Remove the cardiotomy mast;
- Remove the cardiotomy eccentric ring.

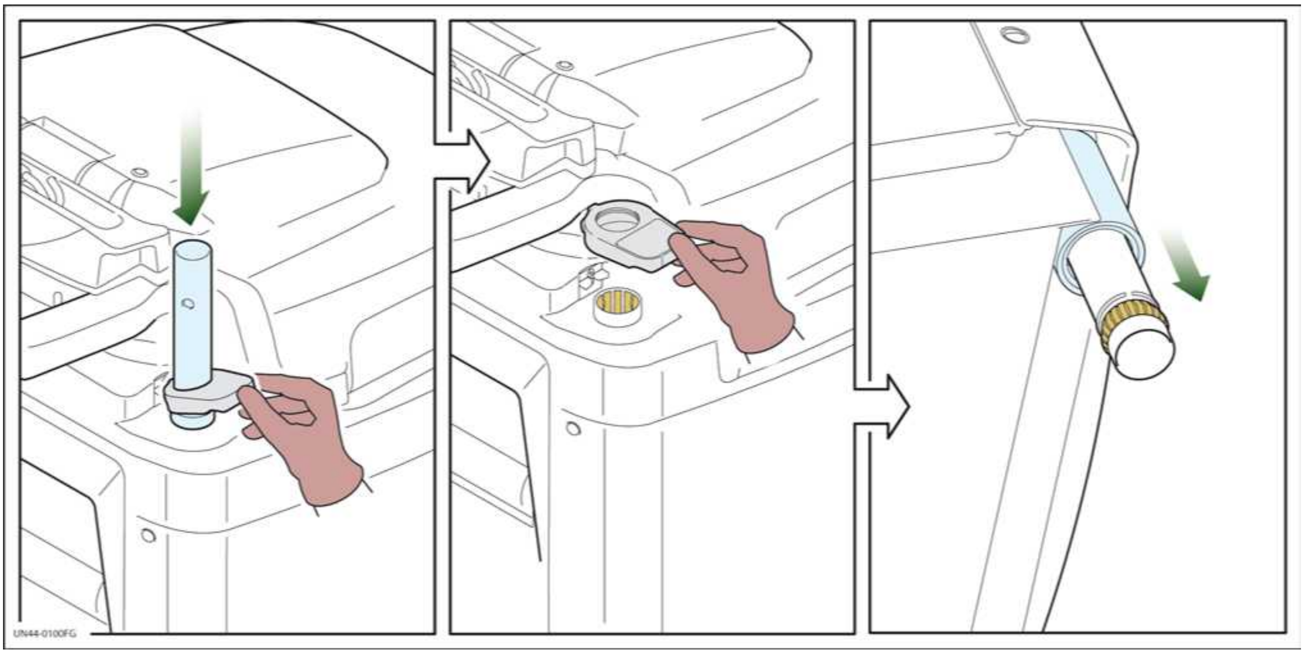

Fig. 12.72-6

12.72.2.2 Reassembling

12.72.2.2.1 Reassembling the Ø 20 mm I.V. pole eccentric ring

- Insert the new 20 mm I.V. pole eccentric ring into its seat;
- Screw the 63040 Ø 20 mm tool on the Ø 20 mm I.V. pole;
- Insert the Ø 20 mm I.V. pole together with the tool into the Ø 25 mm I.V. pole, keeping the eccentric ring up and in its seat;

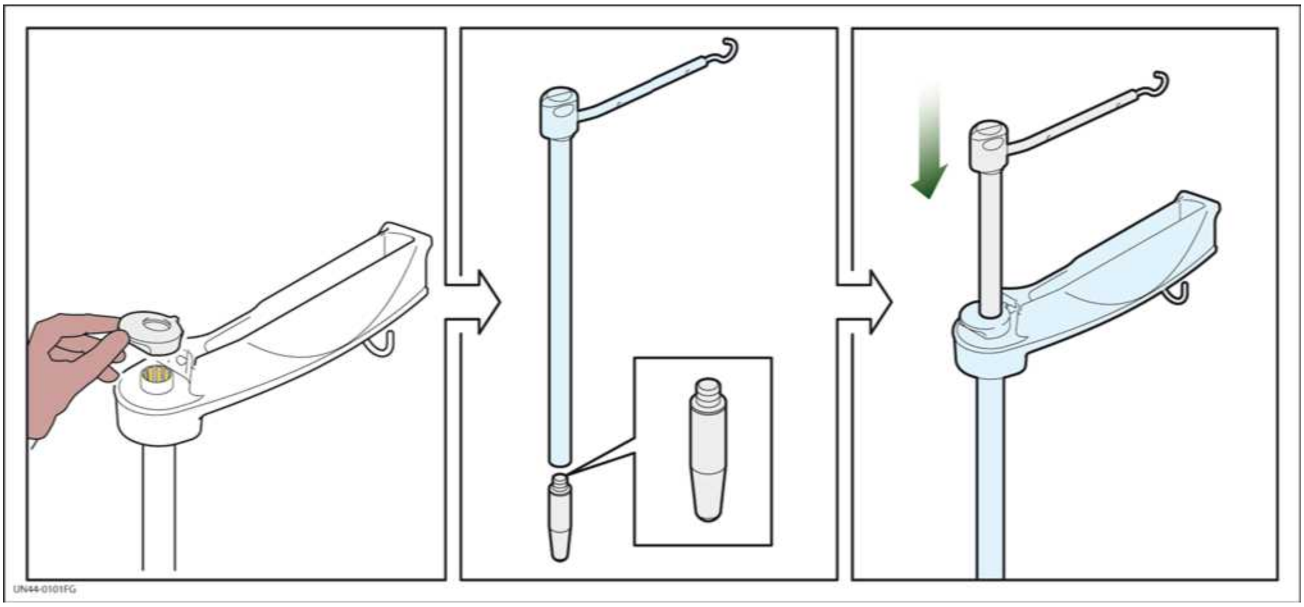

Fig. 12.72-7

- Insert from the bottom the plastic spacer;
- Insert the brass stop from the bottom;
- First fix it screwing the brass in the middle, then thigh it acting on the TCCE M 3x30 screw.

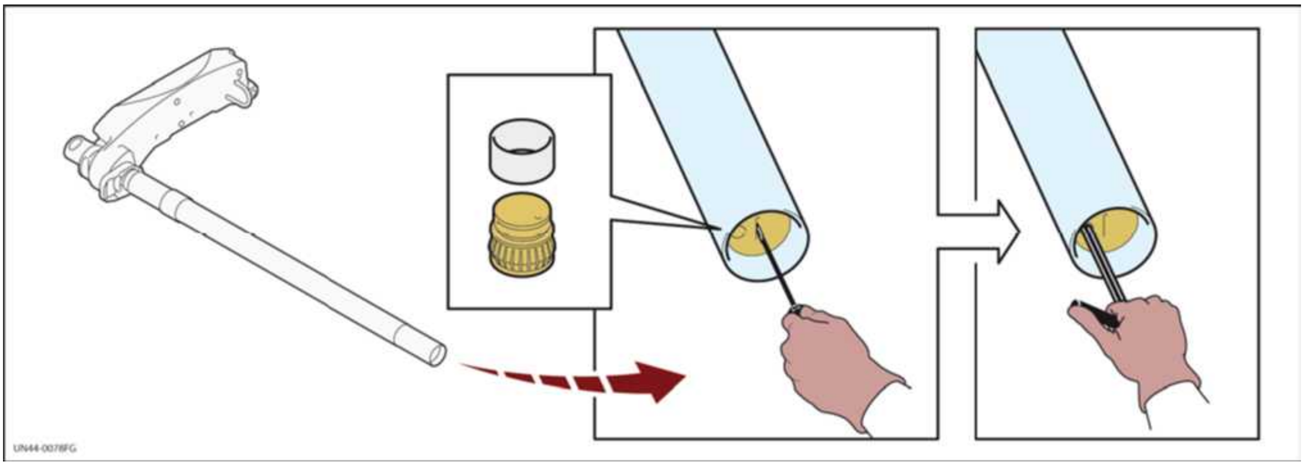

Fig. 12.72-8

12.72.2.2.2 Reassembling the Ø 25 mm I.V. pole eccentric ring

- Insert the new 25 mm I.V. pole eccentric ring into its seat;
- Screw the 63040 Ø 25 mm tool on the Ø 25 mm I.V. pole;
- Insert the Ø 25 mm I.V. pole together with the tool into the frame, keeping the eccentric ring up and in its seat;

(DISM_072) cod. 65691 Eccentric Rings rev.00

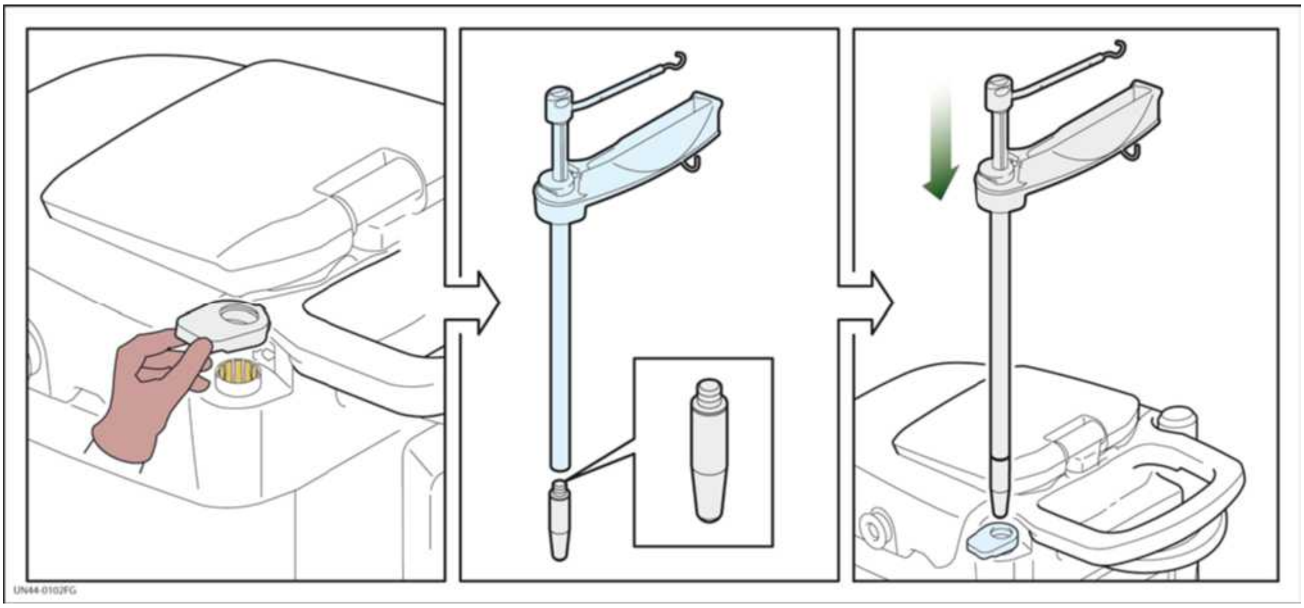

Fig. 12.72-9

- Insert from the bottom the plastic spacer;
- Insert the brass stop from the bottom;
- First fix it screwing the brass in the middle, then thigh it acting on the TCCE M 3x20 screw.

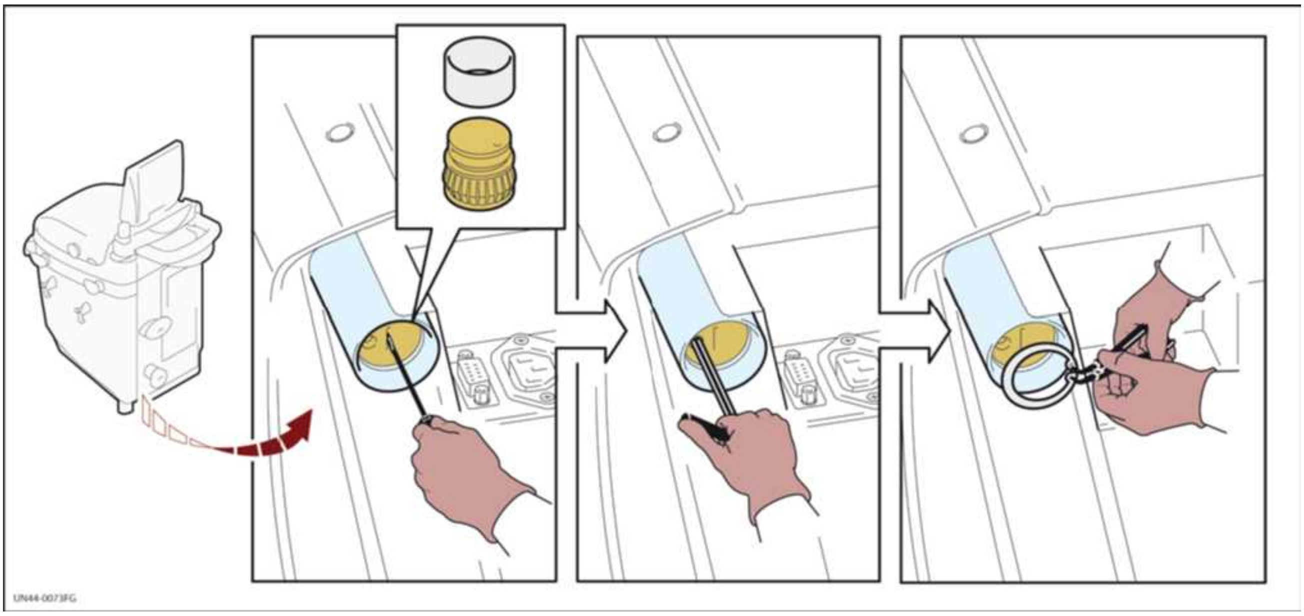

Fig. 12.72-10

12.72.2.2.3 Resassembling the cardiotomy eccentric ring

- Insert the new cardiotomy eccentric ring in its seat;
- Insert the cardiotomy mast from the bottom into its hole in the frame, pushing it up together with the 63040 Ø 25 mm tool till the mast is blocked in its eccentric ring;
- Remove the tool;
- Insert the clamping clip with the clamping clip wrench;

(DISM_072) cod. 65691 Eccentric Rings rev.00

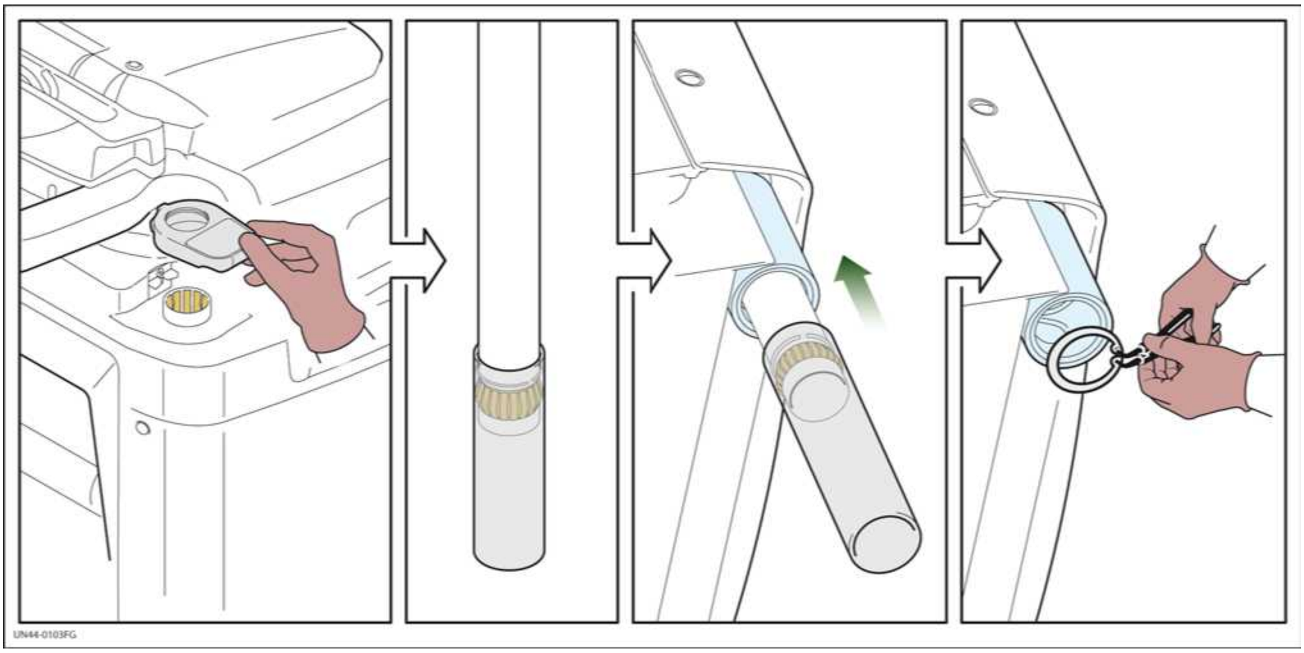

Fig. 12.72-11

- Put the load cell on the cardiotomy mast, drawing the coil cable down through the mast; during reassembly pay attention to the load cell cable in order to avoid wires disconnection or damages;
- Screw the inner pin in the right direction;
- Re-connect the J8 AMP connector to the NBP board;
- Screw the load cell coil cable shield in its point (see fig.12.72-5);
- Put a little bit grease against the small ball to keep it in its place;
- Put the cardiotomy support back on the mast paying attention that the cardiotomy support is opposite to the ball in order that the weight applied pushes the ball toward the load cell;
- Screw the external pin;

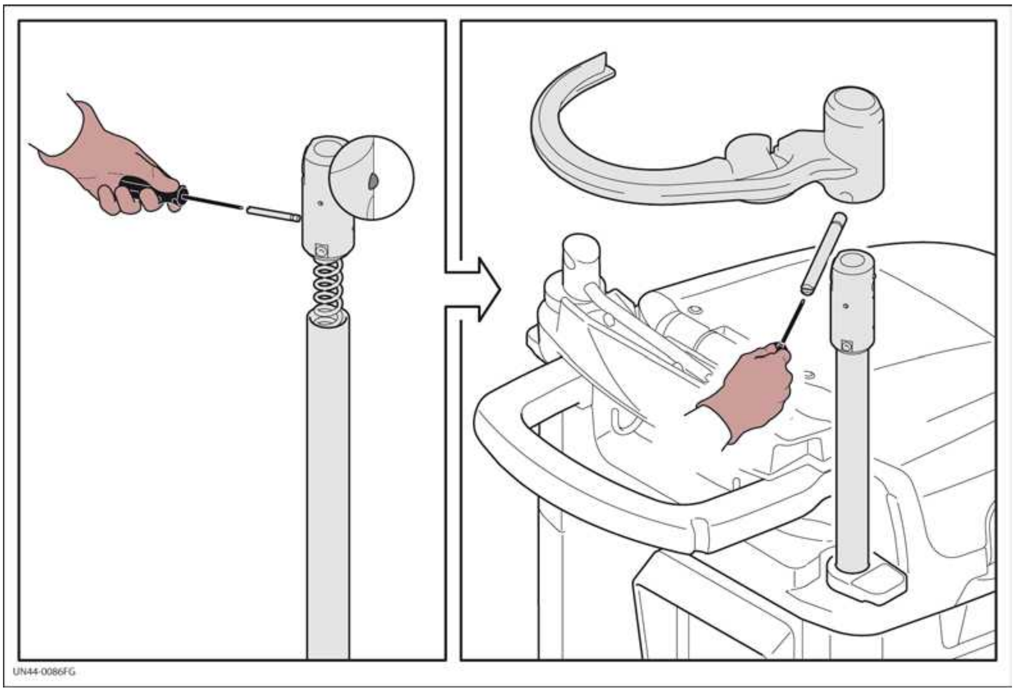

Fig. 12.72-12

- Verify if the mast slides properly without going beyond the bush stop position.

12.72.3 Functional test

Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.73(DISM_073) cod. 65692 Fixing Pump Plate rev.00

12.73.1 About this card

The purpose of this card is to describe the **Fixing Pump Plate** replacement, code **65692**.

12.73.2 Procedure

12.73.2.1 Tools

- Set of screwdrivers;
- Allen key 3 and 5 mm.

12.73.2.2 Disassembly

- Open the XTRA left side panel;
- Remove the pump rotor following the procedure described in the **(DISM 078) Pump Rotor** card;
- Remove the pump group following the procedure described in the **(DISM 045) Pump Motor** card;
- Remove the pump motor with its centering pump disk from the fixing pump plate unscrewing the two TCCE M 4x12 with the spilt washers,

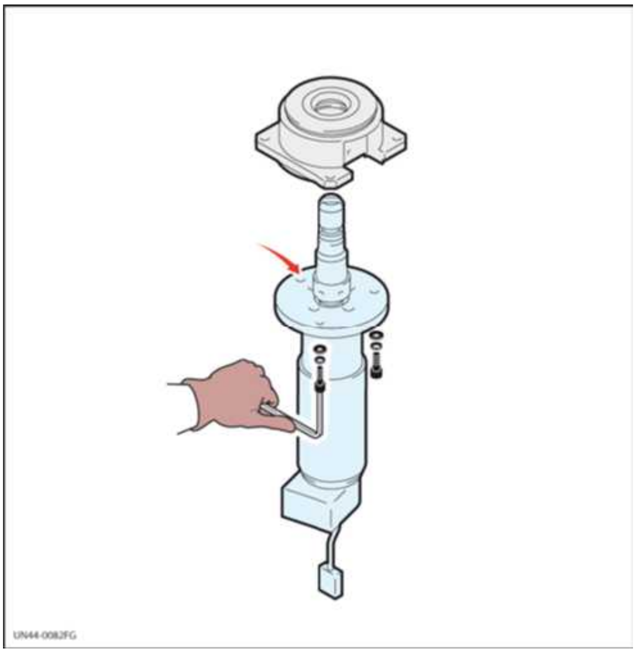

Fig. 12.73-1

- Remove the HS-P sensor following the procedure described in the **(DISM 022) HS-P Rotor Sensor** card.

12.73.2.3 Reassembly

- Fix the new pump plate on the pump motor screwing the two TCCE M 4x12 screws with the spilt washers to the pump disk;
- Fix the pump group to the top screwing the four KA 40x10 screws;
- Fix the ground cable to the pump group screwing the other TCCE M 4x12 screw with the split and flat washers;

- Put the HS-P sensor back on the pump plate, see **(DISM 022) HS-P Rotor Sensor** card;
- Insert the rotor, see **(DISM 078) Pump Rotor** card.

12.73.3 Functional test

Perform the **Pump Test** described in the **(TEST_002)** card.
Close the XTRA panels and perform the **Functional Verification test** described in the **(DISM_003)** card.

12.74(DISM_074) cod. 65693 XTRA Latch rev.00

12.74.1 About this card

The purpose of this card is to describe the **Latch** replacement, code **65693.**

12.74.2 Procedure

12.74.2.1 Tools

- Set of screwdrivers;
- Allen keys 3 mm.

12.74.2.2 Disassembly

- Remove the right panel;
- Unscrew the three TCCE M4X12 screws which fix the latch to the top, paying attention not to lose the related washers;
- Remove the latch lifting it up from the top.

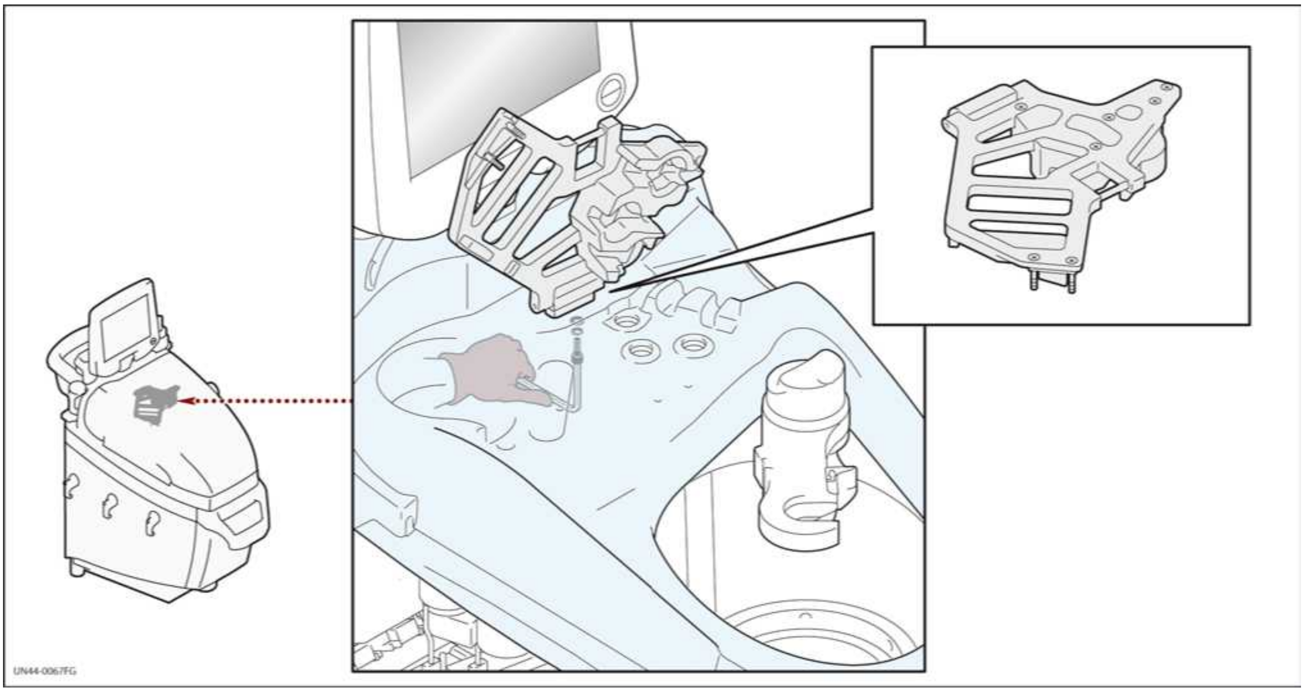

Fig. 12.74-1

12.74.2.3 Reassembly

- Put the new latch in its seat on the XTRA top, checking its correct movement;
- Fix the latch to the top screwing the three TCCE M4X12 screws with their washers, inserting the ground cable between the top and the central screw;
- Close the XTRA panel.

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12.75(DISM_075) cod. 65694 Latch Lever rev.00

12.75.1 About this card

The purpose of this card is to describe the **latch** lever replacement, code **65694**.

12.75.2 Procedure

12.75.2.1 Tools

- Set of screwdrivers;
- Allen keys 3 mm.

12.75.2.2 Disassembly

- Remove the left panel;
- Unscrew the two TCCE M4X12 screws which fix the latch lever to the top, paying attention not to lose the relative washers;
- Remove the latch lever lifting it up from the top.

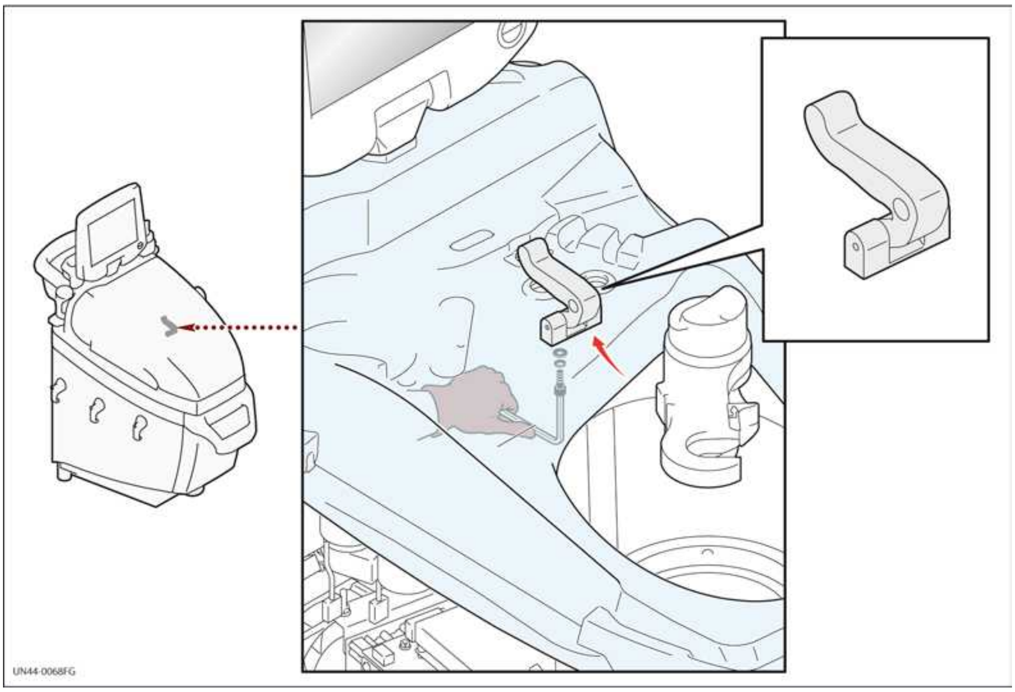

Fig. 12.75-1

12.75.2.3 Reassembly

- Put the new latch lever in its seat on the XTRA top, checking its correct movement;
- Fix the latch lever to the top screwing the two TCCE M4X12 screws with their washers, inserting the ground cable between the top and the left screw;
- During the fixing, regulate the position of the lever in the way it is aligned with the latch;
- Close the XTRA panel.

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12.76(DISM_076) cod. 65695 Liquid Collection Tank Group rev.00

12.76.1 About this card

The purpose of this card is to describe the **Liquid Collection Tank Group** replacement, code **65695**.

12.76.2 Procedure

12.76.2.1 Tools

- Set of screwdrivers;

12.76.2.2 Disassembly

- Lift the equipment up from its cart;
- Unscrew the 4 screws TSPC M 4x12 placed on the front of the machine down the front panel;
- Remove the left panel;
- Disconnect the drain tube from the centrifuge;
- Rotate 90° clockwise the liquid collection tank cap and draw it away through the oval hole.

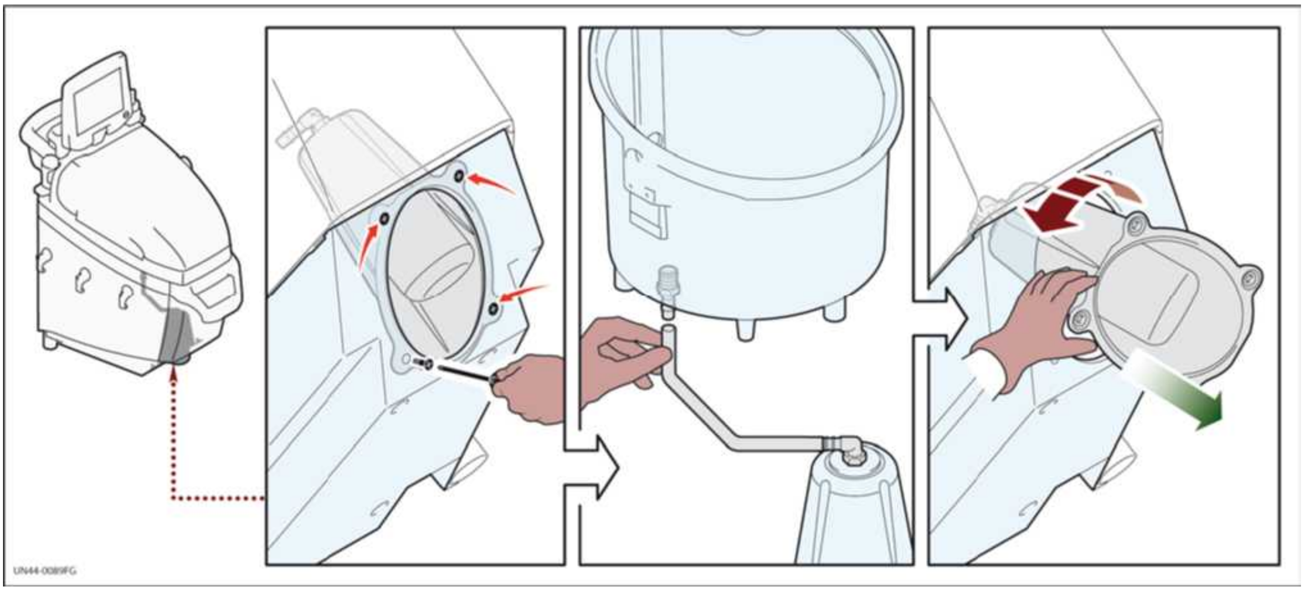

Fig. 12.76-1

12.76.2.3 Reassembly

- Put the liquid collection tank cap back on the machine rotated 90° clockwise;
- When inserted, rotate the liquid collection tank cap 90° counter-clockwise so that the holes are aligned;
- Screw the 4 screws TSPC M 4x12;
- Re-connect the drain tube to the centrifuge;
- Close the equipment;
- Put the machine back on the cart.

(DISM_076) cod. 65695 Liquid Collection Tank Group rev.00

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12.77(DISM_077) cod. 65696 Liquid Collection Tank rev.00

12.77.1 About this card

The purpose of this card is to describe the **Liquid Collection Tank** replacement, code **65696**.

12.77.2 Procedure

12.77.2.1 Tools

No tool is required.

12.77.2.2 Disassembly

- Unscrew the liquid collection tank and remove it from its seat;
- Close it with the available cap and discard it.

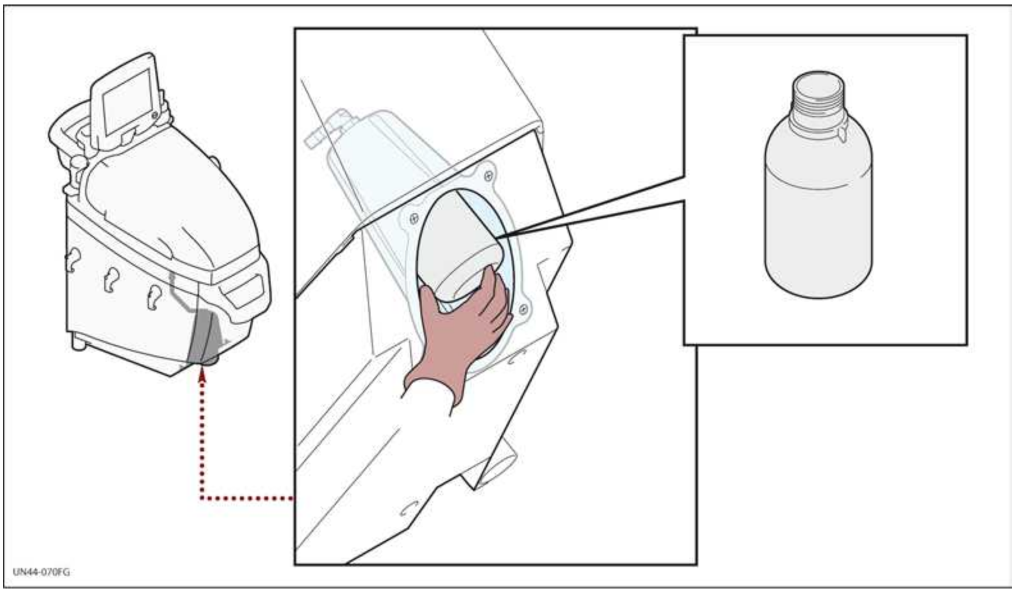

Fig. 12.77-1

12.77.2.3 Reassembly

- Fit a new liquid collection tank to the centrifuge well output connector and screw it into its seat.

(DISM_077) cod. 65696 Liquid Collection Tank rev.00

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12.78 (DISM_078) cod. 65697 Pump Rotor rev.00

12.78.1 About this card

The purpose of this card is to describe the **XTRA display cover** replacement, code **65697**.

12.78.2 Procedure

12.78.2.1 Tools

No tool is required.

12.78.2.2 Disassembly

- Open the centrifuge cover;
- To replace the pump rotor, lift the white lever and extract the rotor, making you sure that it is positioned where the knurling allows its extraction. To find the correct position turn the rotor round the shaft, till it is possible to lift it.

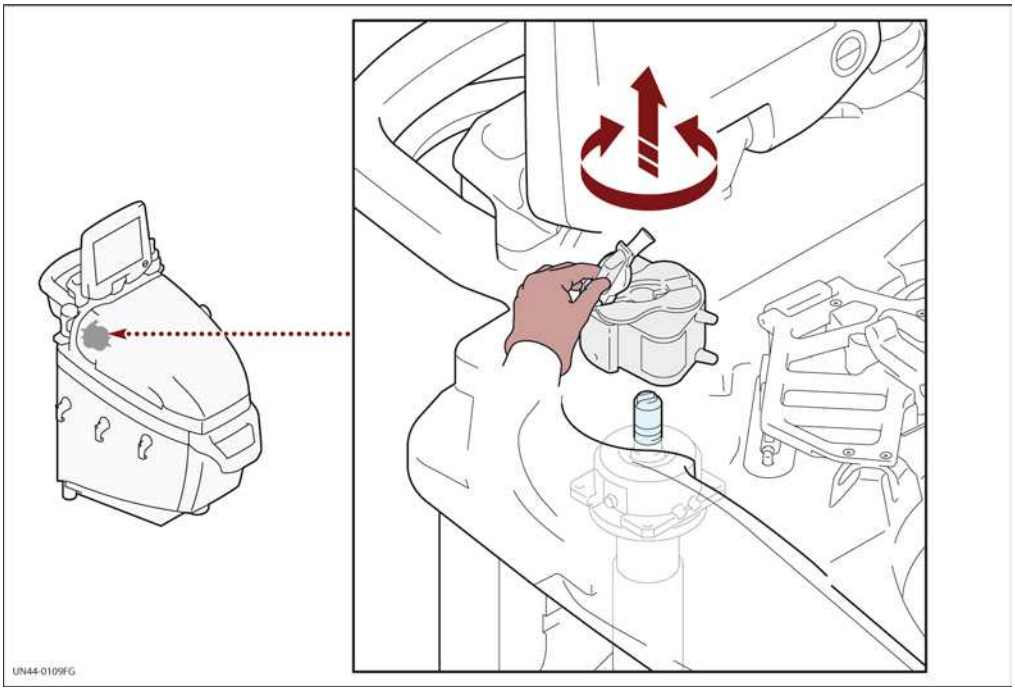

Fig. 12.78-1

12.78.2.3 Reassembly

- Insert the new pump rotor into the pump shaft;
- Find the correct angular position pushing the pump rotor completely down the shaft;
- Turn the pump rotor to align the white lever with the slot in the metallic shaft of the rotor;
- Block the rotor by closing the lever.

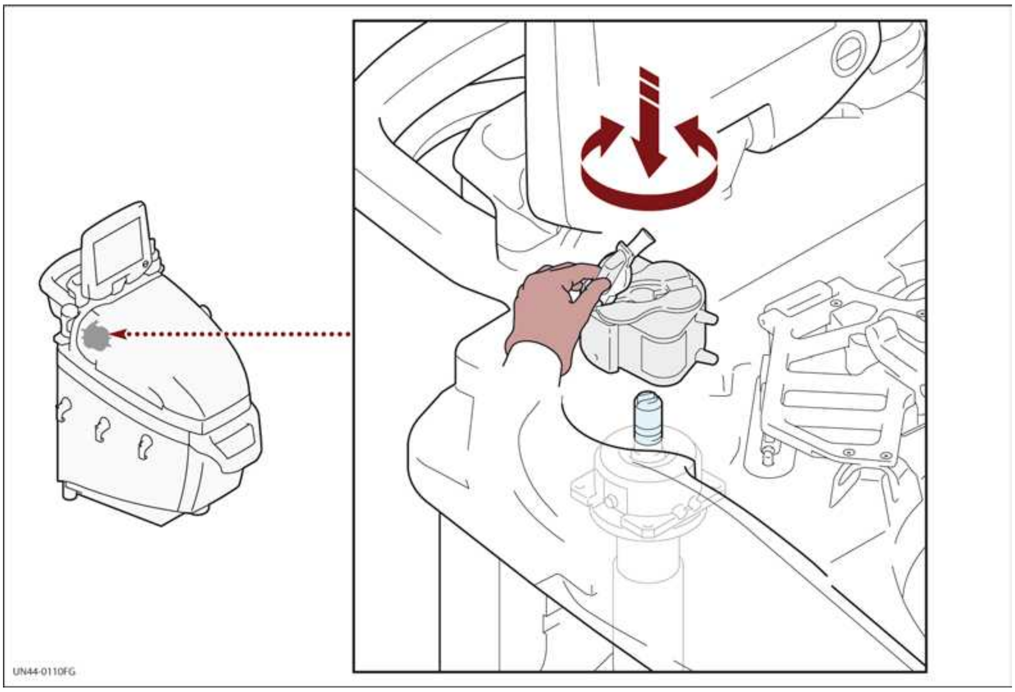

Fig. 12.78-2

12.78.3 Functional test

- Switch on the equipment in **Diagnostic Mode/ Actuators Checks and test/ Pump**;
- Test that running the pump at 150 ml/min the **Actual Flow** is in the range (150 ml/min ± 8 ml/min) in both directions (CW, CCW).

12.79(DISM_079) cod. 65698 Power Cord Wraps rev.00

12.79.1 About this card

The purpose of this card is to describe the **Power Cord Wraps** replacement, code **65698**.

12.79.2 Procedure

12.79.2.1 Tools

- Set of screwdrivers;
- Allen keys 5 mm;

12.79.2.2 Disassembly

- Remove the right side panel;
- Unscrew the two screws which fix the power cord wraps to the rear panel, paying attention to the split and flat washers;
- Remove the wraps.

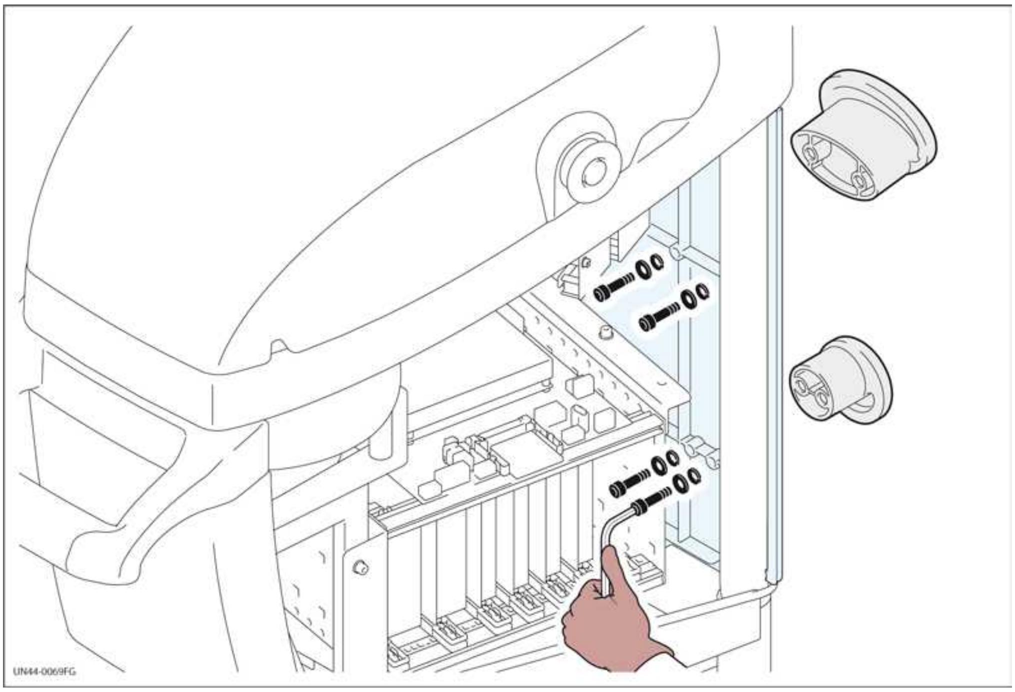

Fig. 12.79-1

12.79.2.3 Reassembly

- Put the power cord wraps on the rear panel fixing them with their washers and screws;
- Close the equipment.

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12.80(DISM_080) cod. 65699 Rear Panel rev.00

Under Construction

(DISM_080) cod. 65699 Rear Panel rev.00

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12.81(DISM_081) cod. 65700 XTRA Side and Front Panels rev.00

12.81.1 About this card

The purpose of this card is to describe the **XTRA Side and Front Panels** replacement, code **65700**.

12.81.2 Procedure

12.81.2.1 Tools

- Allen key 4 mm.

12.81.2.2 Disassembly

- Remove the screw caps placed on the rear part of the equipment on the six screws (3 for each side panel);
- Unscrew the six TCCE M 5x12 screw (3 for each panel);
- Draw the left panel out pushing it toward the back;
- To remove the right panel push it just a little toward the back and slide it outside;

Be careful not to damage the conductive gasket that puts the right panel on the ground.

- Remove the four TCCE M 4x12 screws (two per each side) which fix the front panel to the frame;
- Disconnect the SPEAKER AMP connector;
- Remove the front panel;
- Remove the XTRA Speaker from the front panel, see **(DISM_051) cod.65651 XTRA Speaker** card.

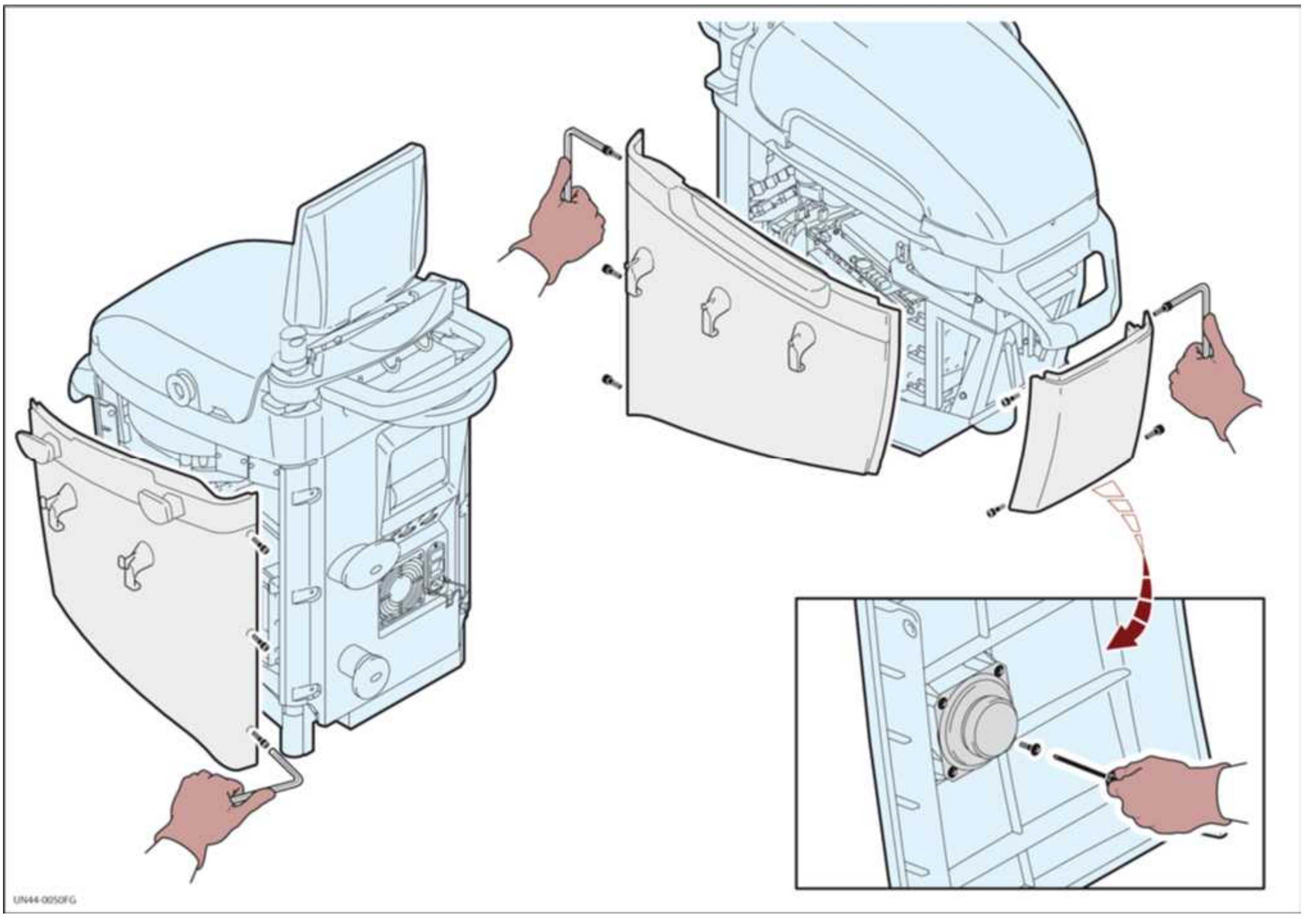

Fig. 12.81-1

12.81.2.3 Reassembly

- Put the XTRA Speaker on the new front panel, see **(DISM_051) cod.65651 XTRA Speaker** card;
- Put the new front panel in its position on the frame and fix it screwing the four TCCE M 4x12 screws;
- Connect the SPEAKER AMP connector;
- Put the new side panels on the equipment pushing them toward the front side;
- Fix them to the frame screwing the six TCCE M 5x12 screw (3 for each panel);
- Put the screw caps back on the six screws on the rear part of the equipment.

12.82(DISM_082) cod. 65701 XTRA Wheels rev.00

12.82.1 About this card

The purpose of this card is to describe the **XTRA wheels** replacement, code **65701**.

12.82.2 Procedure

12.82.2.1 Tools

- Set of screwdrivers;
- Allen key 2,5 mm, 5 mm, 11 mm.

12.82.2.2 Disassembly the front wheels

- Remove the two grey caps in the sides of the cart;
- Loosen the brake pedal set screw;
- Push the brake bar from one side ot the opposite one until the wheel is free to be removed;
- Remove the wheel.

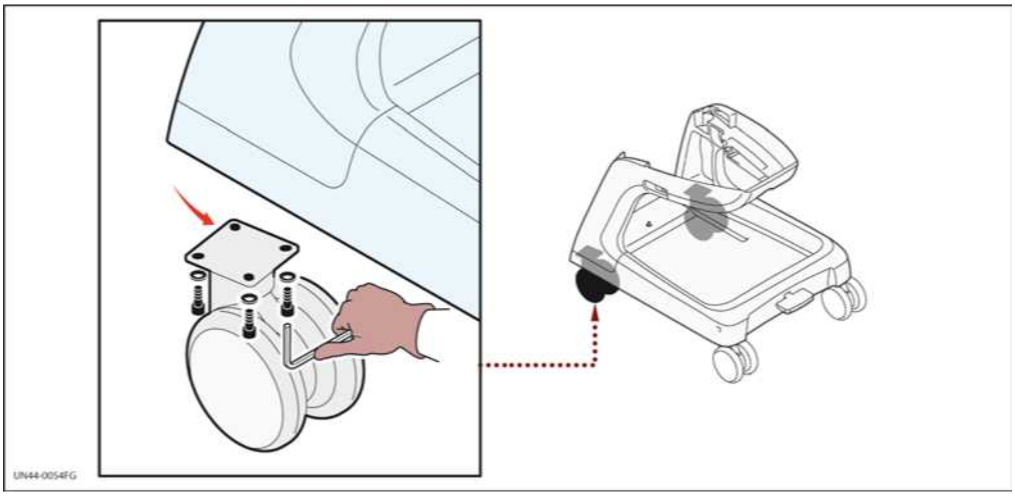

Fig. 12.82-1

12.82.2.3 Reassembly the front wheels

- Insert the new wheel in its position making sure it is free to rotate; if it is not so, insert an allen key 11 mm in the hole of the foot of the wheel and rotate it until it is free;
- Insert the bar through the pedal hole, making sure it is inserted in both the wheels (to check this, try to draw the wheel away, it should not come out);
- Screw the pedal set screw;
- Put the grey caps back on the sides of the chart.

12.82.2.4 Disassembly the rear wheels

- Unscrew the four TCCE M 6x12 screws, with the related flat and split washers, which fix the out of order wheel to the cart;
- Remove the out of order wheel.

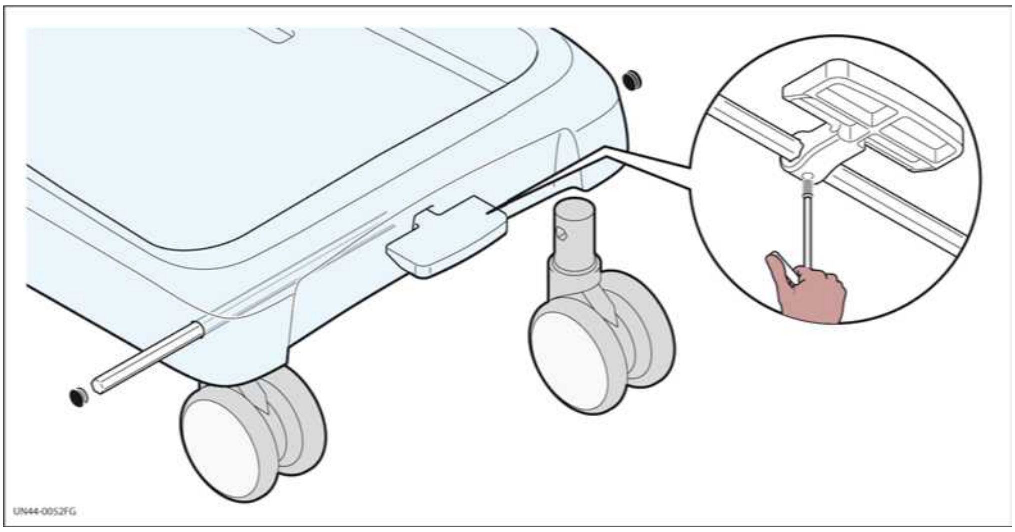

Fig. 12.82-2

12.82.2.5 Reassembly the rear wheels

- Put the new wheel in its position and fix it to the cart screwing the four TCCE M 6x12 screws, with the related flat and split washers.

12.83(DISM_083) cod. 65702 XTRA Cap Set rev.00

12.83.1 About this card

The purpose of this card is to describe the **XTRA cap set** replacement, code **65702**.

12.83.2 Procedure

12.83.2.1 Tools

- Set of screwdrivers.

12.83.2.2 Disassembly

- Remove the damaged cap.

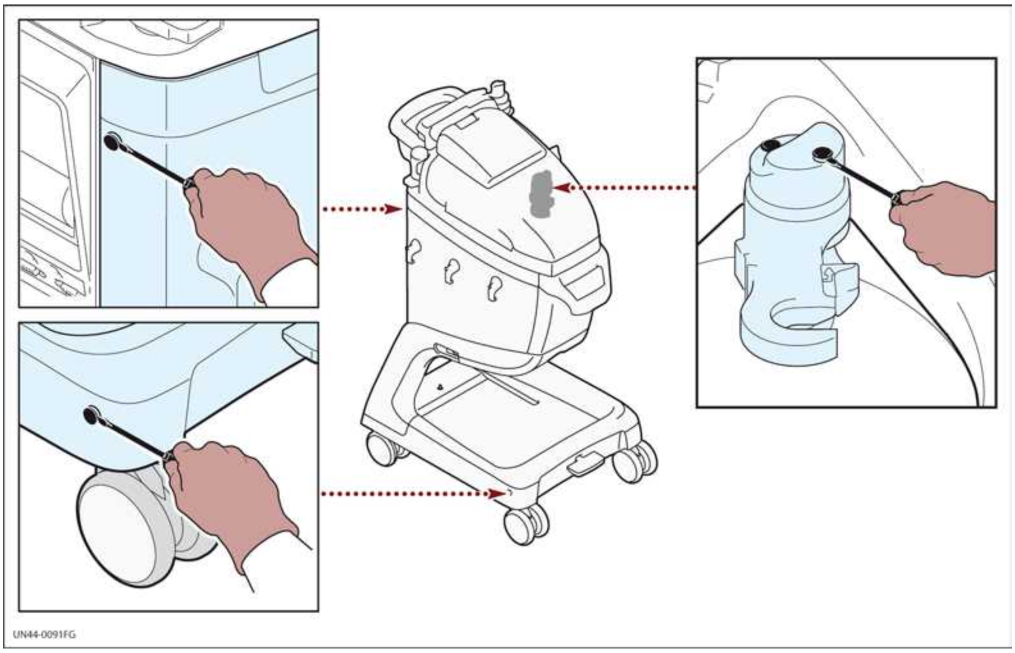

Fig. 12.83-1

12.83.2.3 Reassembly

- Put the new cap in its seat.

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12.84(DISM_084) cod. 65703 XTRA Cover rev.00

12.84.1 About this card

The purpose of this card is to describe the **XTRA cover** replacement, code **65703**.

12.84.2 Procedure

12.84.2.1 Tools

- Set of screwdrivers;
- Allen key 3 mm and 4 mm;

12.84.2.2 Disassembly

- Open the left side panel;
- Unscrew the four TCCE M 4x12 screws with which fix the two cover hinges to the cover;
- Pay attention to the ground cable screwed on the rear screw of the rear hinge;

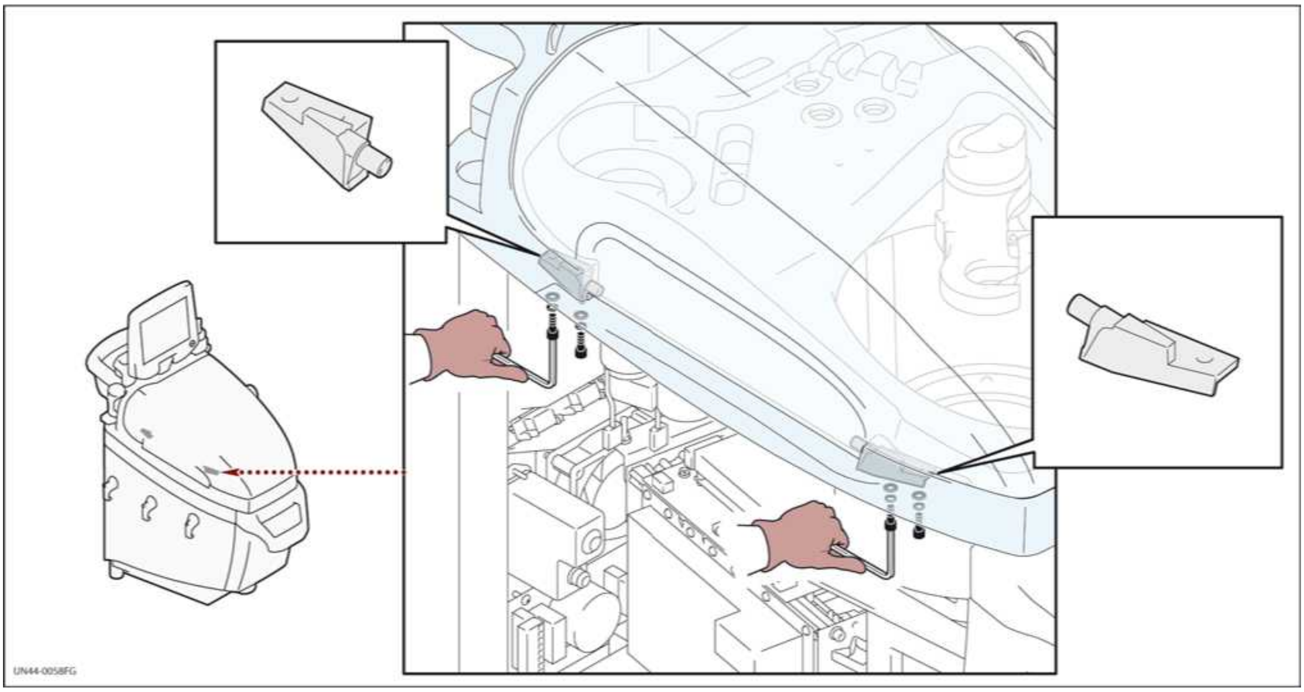

Fig. 12.84-1

- Remove the hinges drawing them out from the top;
- Remove the XTRA cover.

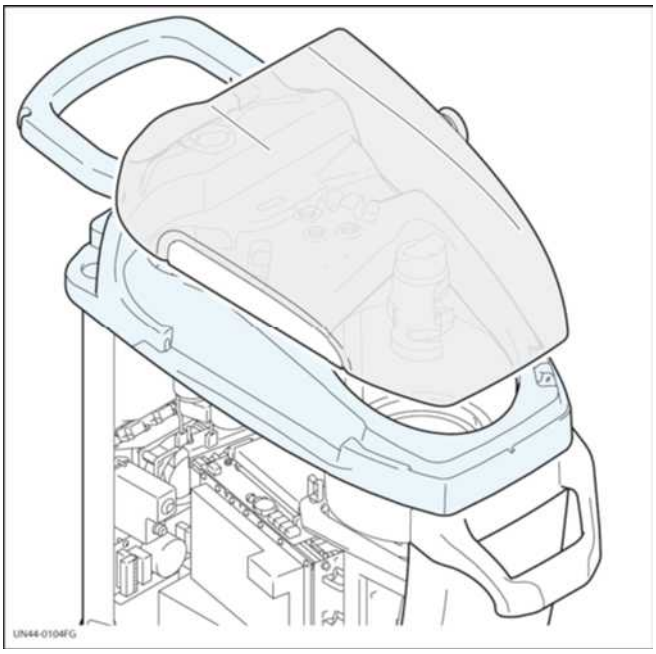

Fig. 12.84-2

12.84.2.3 Reassembly

- Put the new cover in its position on the top;
- Put the hinges back under the top, pushing them into the cover holes;
- Fix them screwing the four TCCE M 4x12 screws with the related split washers, remembering to insert the ground cable on the rear screw of the rear hinge.

12.84.3 Functional test

Perform the **Cover Sensor Test** described in the **(TEST_009)** card.

12.85(DISM_085) cod. 65704 XTRA Drain Tubing rev.00

12.85.1 About this card

The purpose of this card is to describe the **XTRA drain tubing** replacement, code **65704**.

12.85.2 Procedure

12.85.2.1 Tools

- Set of screwdrivers;
- Allen keys 4 mm.

12.85.2.2 Disassembly

- Open the left panel;
- It could be useful to remove the wire saddle near the centrifuge well drain connector;
- Disconnect the drain tube from the centrifuge well connector and from the liquid collection tank group connector.

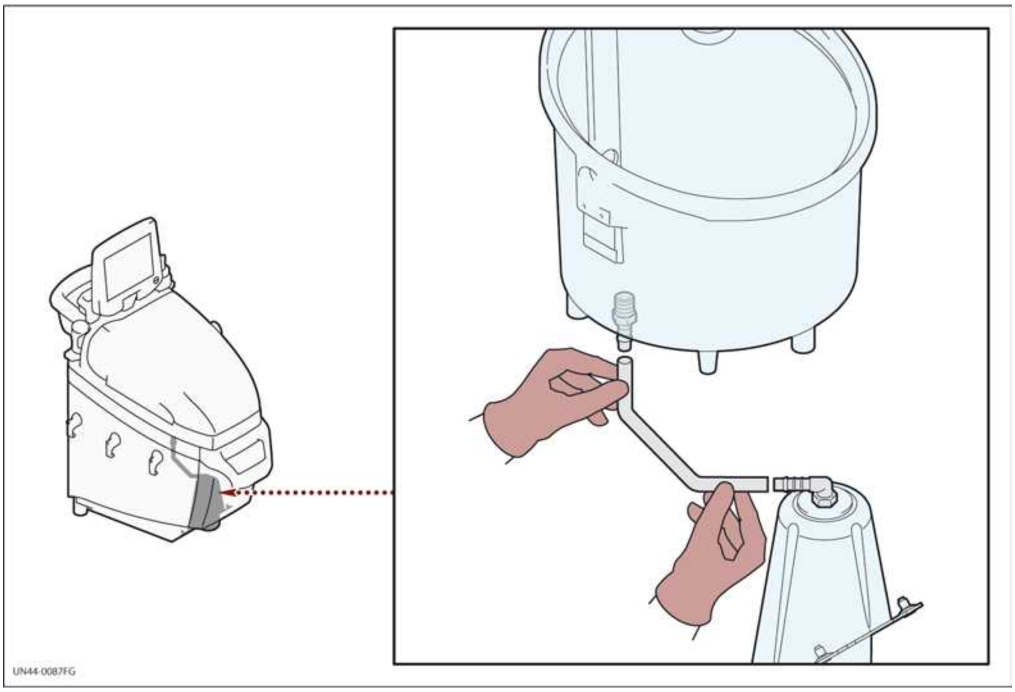

Fig. 12.85-1

12.85.2.3 Reassembly

- Insert the new drain tube before on the centrifuge well connector and then on the liquid collection tank group connector;
- Put the wire saddle back in its position;
- Close the equipment.

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12.86(DISM_086) cod. 65705 XTRA Top rev.00

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12.87(DISM_087) cod. 65715 Spring Levers rev.00

12.87.1 About this card

The purpose of this card is to describe the **spring levers** replacement, code **65715**.

12.87.2 Procedure

12.87.2.1 Tools

- Set of screwdrivers.

12.87.2.2 Disassembly

- Lift the machine up from the cart;
- Open the damaged spring lever;
- Unscrew the TSPC M 6X10 screw which fix the lever to the cart;
- Remove the spring lever.

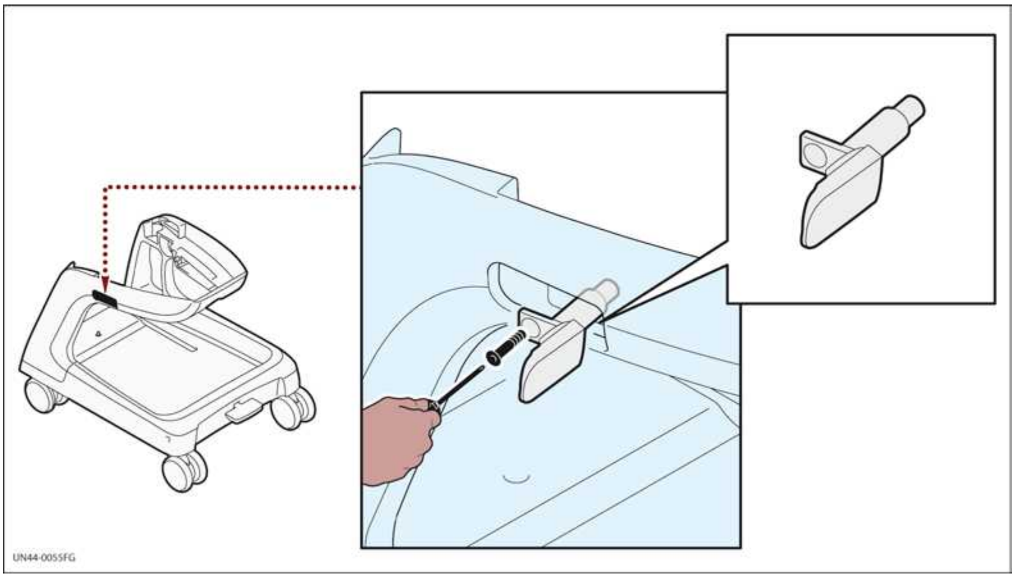

Fig. 12.87-1

12.87.2.3 Reassembly

- Put the new spring lever in its position on the cart;
- Fix it to the cart screwing the TSPC M 6X10 screw;
- Put the machine back on the cart;
- Close the lever.

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13 CALIBRATION PROCEDURES

13.1 (CALIBR_001) Calibration Overview rev.00

13.1.1 About this card

The purpose of this card is to give a general description of XTRA **testing** and **calibration** and to give an overview on **tools** needed to perform them.

Each card involving a calibration is divided in two parts:
- Testing (if possible);
- Calibration.

That is to say, in most cases, there is a testing procedure allowing to establish if a re-calibration is needed about a group. All cards have a calibration procedure included.

13.1.2 Tool overview

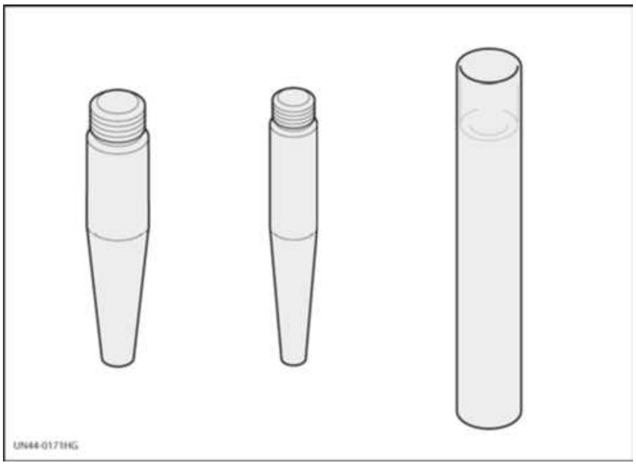
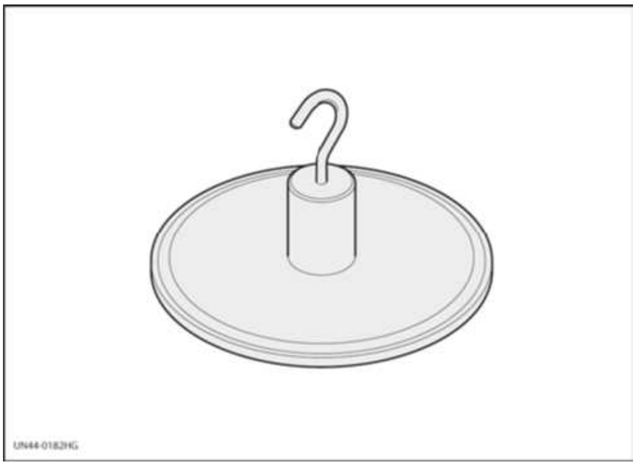
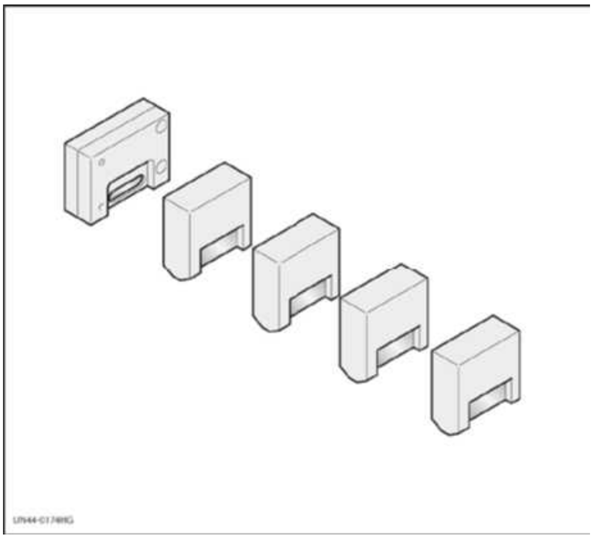
Below are listed tools (codified and not) needed to perform calibration and testing procedures.

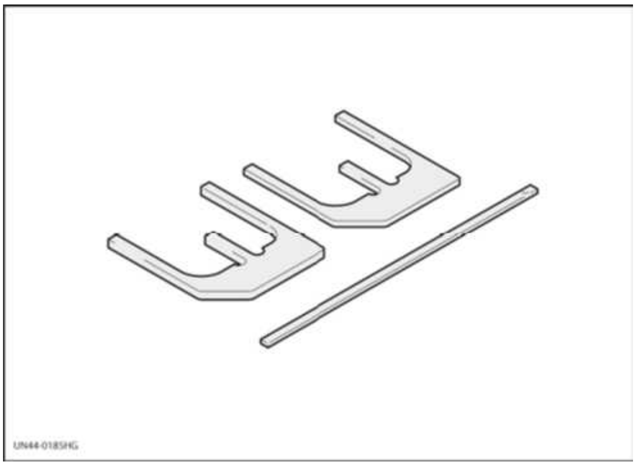
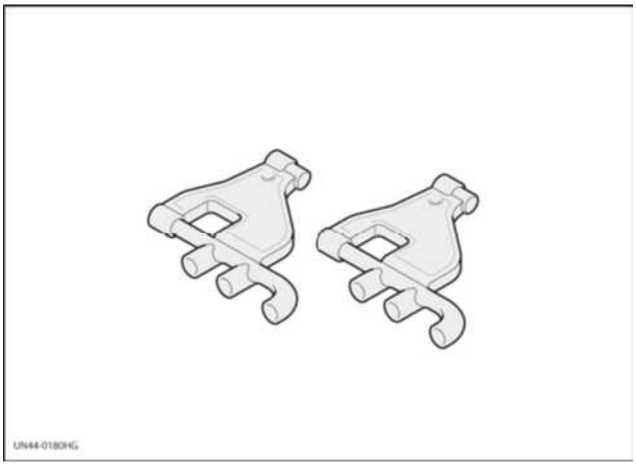
13.1.2.1 Not Codified Tools:

Description	Purpose
DIGITAL MULTIMETER (accuracy: ± 3% min)	To perform electrical measures: - voltage - resistance - current
PRESSURE CALIBRATOR (replaceable with pressure gauge and syringe)	To make and measure a pressure at the same time
PRESSURE GAUGE	Only to measure a pressure
CHRONOMETER	To measure time when performing check and calibration of delayed unlock time
BOWL (every size)	To check bowl arm stability after doing a fitting procedure
SET OF WEIGHTS (see **(CLBR_003) Load Cell Calibration** card to values)	To check and adjust the reservoir load cell (weight sensor)

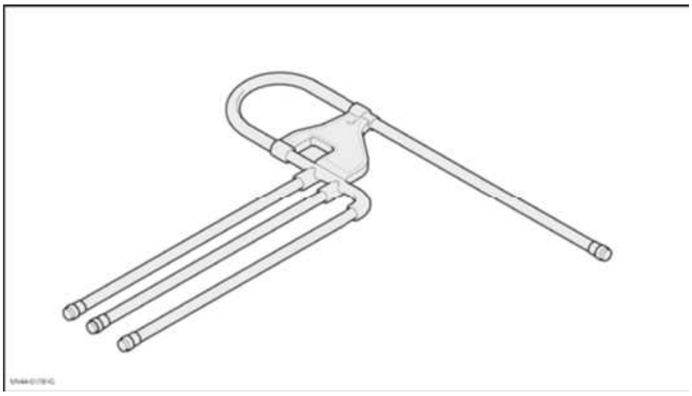
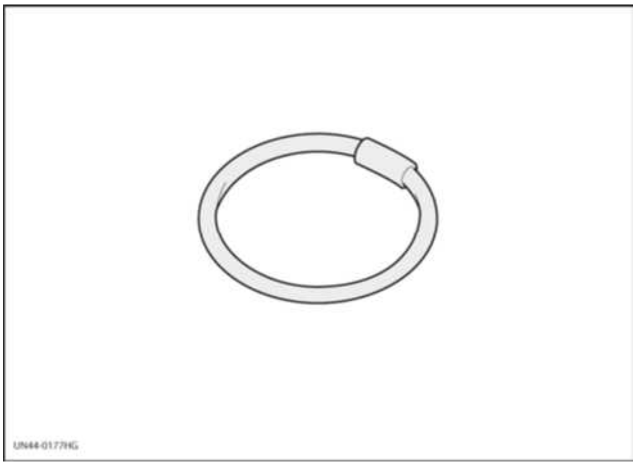
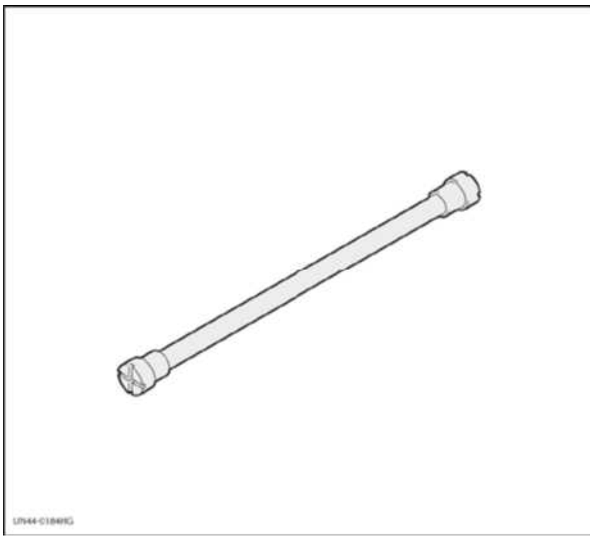
Table 13.1-1

13.1.2.2 Codified Tools:

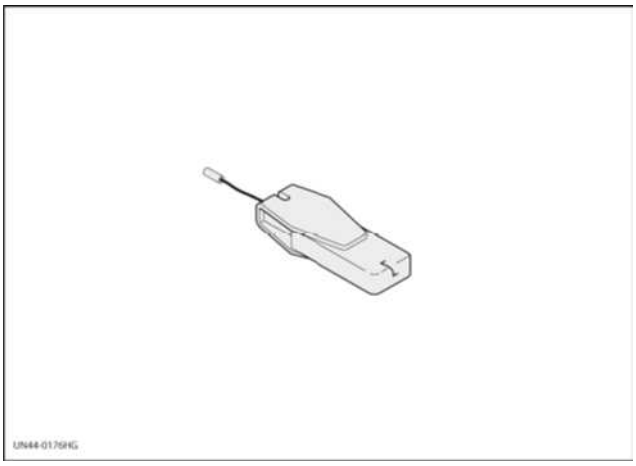
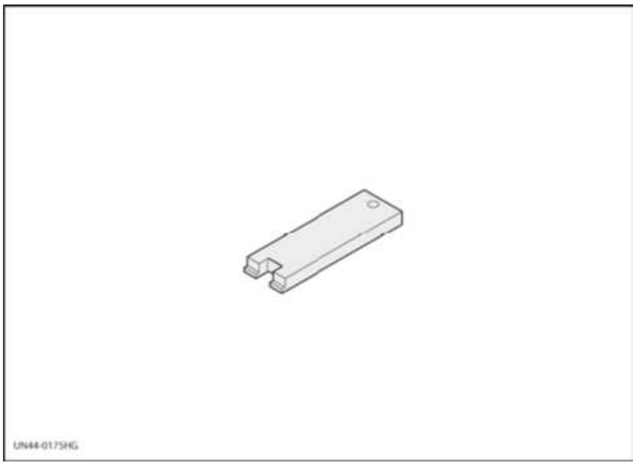
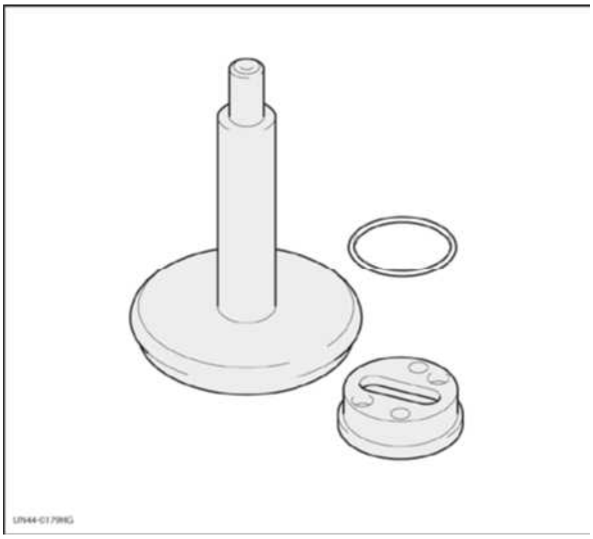
Code	Description	Purpose	Tool View
63040	**I.V. POLE MOUNTING TOOLS**	to mount the I.V. pole	
63041	**WEIGHING SYSTEM TOOL**	to check/adjust the load cell	
63042	**OPTICAL FILTERS SET**	to test/calibrate the haematocrit indicator	

Code	Description	Purpose	Tool View
63043	**CLAMP THICKNESS GAUGE TOOL**	to position clamp knob	
63044	**RBC DECTOR TEST BOWL**	to check/adjust the RBC detectors	
63045	**BAR CODE READER LABEL SET**	to check/adjust the kit sensor	

(CALIBR_001) Calibration Overview rev.00

Code	Description	Purpose	Tool View
63046	**PUMP AND CLAMP OCCLUSION SET**	to check the clamp and pump occlusion	
63047	**AIR SENSOR TOOL**	To check/adjust the air sensor	
63048	**WASTE LINE COLOR INDICATOR TOOL**	To test the waste line color indicator	

(CALIBR_001) Calibration Overview rev.00

Code	Description	Purpose	Tool View
63049	**XTRA FIELD SERVICE USB STICK**	To download the software on the microprocessor boards	
63050	**HS-C CALIBRATION TOOL**	To test/adjust the HS-C sensors	
63051	**BOWL ARM CENTERING TOOL**	to calibrate the bowl arm	

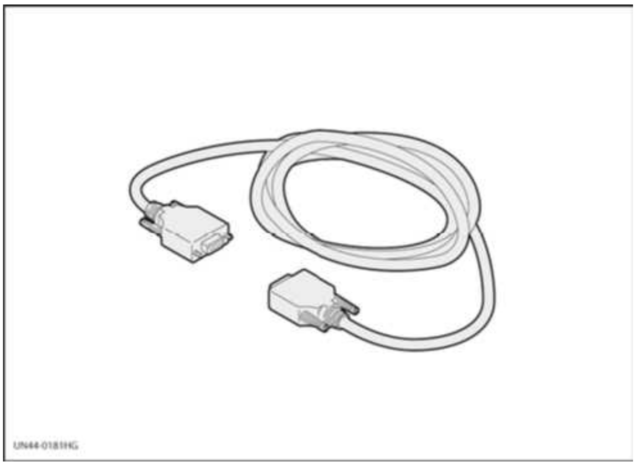
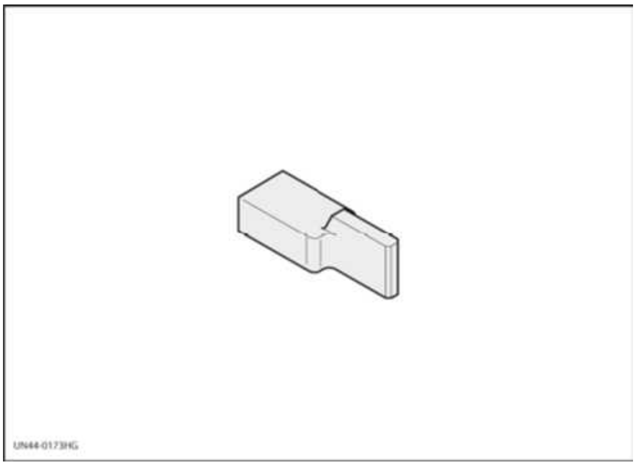
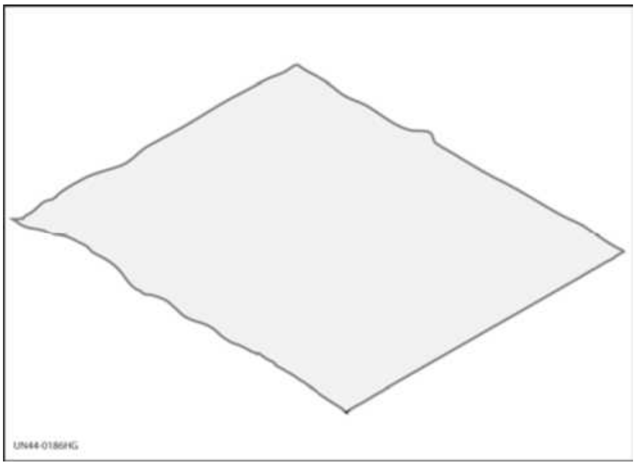
Code	Description	Purpose	Tool View
63052	**PROGRAMMING CABLE**	To connect the equipment to a pc.	
63053	**CLAMPED EMPTY LINE SENSOR TOOL**	To check the clamped empty line sensor	
63054	**RBC DET. LIGHT PROTECTION COVER**	to check/adjust the RBC detectors	

Table 13.1-2

WARNING

Technician must be careful in preserving calibration/testing tools. Any kind of damaging may involve a loss in performance.
In particular:

- **63044 RBC DECTOR TEST BOWL;**
- **63045 BAR-CODE READER LABEL SET.**

must be kept with care, to avoid early damaging/fading out of black traces.

13.2 (CALIBR_002) Power Supply Calibration rev.00

13.2.1 About this card

The purpose of present card is to give the **testing** and **calibration** procedure of **power supply** output DC voltages.
Testing is a check for calibration status: must be performed after doing calibration and to decide if re-calibration is needed.

XTRA power supply consists of five independent modules.
One is a main failure detecting unit and does not involve any calibration.
The other four produce the following voltages:

- **+30V** split on two **+15V** modules;
- **+12V** and **-12V** integrated in the same module;
- **+5V** as a single module.

All voltages can be adjusted directly on the power supply by means of a trimmer.

13.2.2 Tools needed

Here are the tools needed to perform testing and calibration:

- **Testing (Opening the unit involved):**
  - digital multimeter (accuracy: ± 3% min.).

- **Calibration (Opening the unit involved):**
  - trimmer tool (screwdriver for trimmers);
  - digital multimeter (accuracy: ± 3% min.).

13.2.3 Testing

- Open the unit (see **(DISM_001) Opening the Unit** card).
- Verify that voltage drop along the whole equipment (i.e. from PS to NBP, from PS to NBB, etc.) is regular. To do so, act as follows:
  - Switch on the XTRA equipment in Diagnostic Mode and check the following voltages on the J37 connector of the NBP p.c. board, (see Fig.13.2-1):

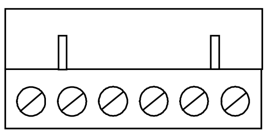


Fig. 13.2-1

Pin nr.	Voltage (V)
1	+30 (29,7 ÷ 30,3)
2	+5,2 (5,1 ÷ 5,2)
3	+12 (11,88 ÷12,12)
4	-12 (-11,88 ÷ -12,12)
5	GND
6	---

Table 13.2-1

TP	Voltage (V)
3	+5 (4,8 ÷ 5,2)

Table 13.2-2

Verify following voltages on NBB board Test Points:

TP	Voltage (V)
4	+5,2 (5,05 ÷ 5,02)
7	+12 (11,8 ÷ 12,2)
6	GND

Table 13.2-3

After done testing, restore XTRA enclosure.

13.2.4 Calibration

Open the unit (see **(DISM_001) Opening the Unit** card). Remove the waste tank holder, placed in front of power supply output. This operation is necessary to get a useful access to power supply trimmers.
Switch on the XTRA equipment in Diagnostic Mode and check the following voltages on the J37 connector of the NBP p.c. board:

Pin nr.	Voltage (V)	
1	+30 (29,7 ÷ 30,3)	
2	+5,2	To regulate with the power supply A trimmer (see Fig.13.2-2)
3	+12 (11,88 ÷ 12,12)	To regulate with the power supply C trimmer (see Fig.13.2-2)
4	-12 (-11,88 ÷ -12,12)	To regulate with the power supply D trimmer (see Fig.13.2-2)
5	GND	
6	---	

Table 13.2-4

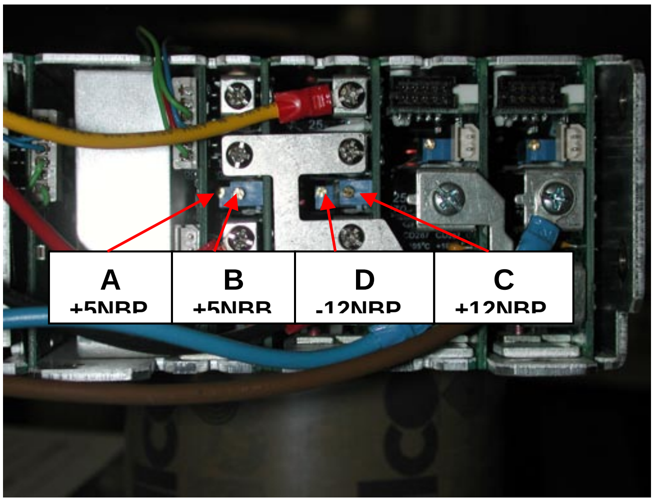


Fig. 13.2-2

If readings are not in range, lead them into by acting on relative trimmer.

<u>**Very Important:**</u>
Voltage measuring has to be performed with connector inserted. Values are referred to normal load situation. Therefore:
- **do not disconnect any cable;**
- **do not activate any actuator.**

After done calibration, restore XTRA enclosure.

13.3 (CALIBR _003) Load Cell Calibration rev.00

13.3.1 About this card

The purpose of present card is to give the **testing** and **calibration** procedure of **load cell**. That is the weighing device placed at reservoir holder.
Testing is a check for calibration status: must be performed after doing calibration and to decide if re-calibration is needed.

13.3.2 Tools needed

Here are the tools needed to perform testing and calibration:

- **Testing (Opening the unit NOT involved):**
- Cod. 63041 - Weighing System Tool;
- Set of weights (to reach values in table 13.3-1).

- **Calibration (Opening the unit involved):**
- Digital multimeter (accuracy: ± 3% min);
- Cod. 63041 - Weighing System Tool;
- Set of weights (to reach a value of 4.5kg).

13.3.3 Testing and Calibration

- Switch on the XTRA in Diagnostic mode (see **(UNIT_003) Diagnostics Pages** card):
- Rotate and lift the cardiotomy pole up;
- In the Main Diagnostic page push Sensors Calibration and Test and then Reservoir Scale;
- Check the correct functioning of the system with the following weights:

Total Weight [Kg]	Displayed value	Notes
0	0 (0 ÷ 10) g	without tool 63041
0,5	500 (475 ÷ 525) g	only tool 63041
5	5000 (4750 ÷ 5250) g	tool 63041 + 4500 g

Table 13.3-1

- Push Factory Mode and then Calib;
- Push 1st Point without weights on the pole, and check there is the value 5000 in the "g" displet;
- If the value is different, set it to 5000 with the ▼▲ buttons;
- Put the tool 63041 and some weights on the pole in order to get a total value of 5 Kg (including the tool);
- Push 2nd Point;
- If the test is OK in the lower displet a message **Reservoir Scale Calibration Finished** appears;
- Push Store;
- Remove the weights and the tool from the pole;
- Check the linearity of the system with the following weights:

Weight to hang on tool 63041 [Kg]	Total Weight [Kg]	Displayed value
0	0 (without tool)	0 (0÷ 5) g
0.5	1	1000g (950 ÷ 1050) g
1.5	2	2000 (1900 ÷ 2100) g
2.5	3	3000 (2850 ÷ 3150) g
3.5	4	4000 (3800 ÷ 4200) g
4.5	5	5000 (4950 ÷ 5050) g
5.5	6	6000 (5400 ÷ 6000) g

Table 13.3-2

NOTE: **hang the weights on hook of cod. 63041 tool. The global weight (including tool contribution) must reach the value displayed in the "Total weigh" column**

NOTE: verify of 6 Kg accepts very large tolerance, because of mechanical safety included in reservoir holder. It can act in this range. The effect of this safety is to make a saturation of weight read.

- Connect the multimeter to the TP4 of the NSA p.c. board and hang 5.5 Kg (to make 6 Kg), gradually press on the reservoir support, making sure that the voltage does not exceed 1.1V.

<u>Warning: Do not exceed 1.1v or the loading cell could be damaged.</u>

- Remove the weights and the tool 63041 from the pole;
- Push Factory Mode and in the and Reservoir Scale;
- After done calibration, restore XTRA enclosure.

13.4 (CALIBR _004) Waste Line Color Indicator Calibration rev.00

13.4.1 About this card

The purpose of present card is to give the **calibration** procedure of **waste line color indicator**

13.4.2 Tools needed

Here are the tools needed to perform calibration (opening the unit NOT involved):

- trimmer tool (screwdriver for trimmers;
- cod. 63048 - Waste Line Color Indicator Tool.

13.4.3 Calibration

- Switch the XTRA equipment on in Dignostic Mode;
- Push Sensors Calibration and Test → Haemoglobin (HGB)→ Factory Mode;
- Insert the 63048 tool tube filled with saline solution in the HGB sensor, making you sure no air bubbles are present;
- Push ledCalib and wait for the sensor calibration (calibration time ≤ 80s) and check:
    i. In the RefRxCount page the value 935 is shown;
    ii. In the displet below the **ledCalib is running** message is shown;
    iii. If the calibration is OK, in the displet below the **ledCalib completed succesfully** message appears;
- In the RxCount displet, a 935 ± 5 value is shown;
- Push Store.
- Switch the XTRA off and draw the tube away from the sensor.

NOTE: The tube could have a memory effect while keeping it inside the HGB sensor. Do not worry if after a while the calibration will show you a value of 935 ± 50 counts in the diagnostics. This is due to the assessment of the tube.

(CALIBR _004) Waste Line Color Indicator Calibration rev.00

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13.5 (CALIBR _005) Haematocrit Indicator Calibration rev.00

13.5.1 About this card

The purpose of present card is to give the **testing** and **calibration** procedure of **HCT (Haematocrit) indicator**.
Testing is a check for calibration status: must be performed after doing calibration and to decide if re-calibration is needed.

13.5.2 Tools needed

Here are the tools needed to perform testing and calibration:

- **Testing (Opening the unit NOT involved):**
- cod. 63042 - Optical Filter Set.

- **Calibration (Opening the unit involved):**
- Trimmer tool (screwdriver for trimmers);
- Digital oscilloscope;
- cod. 63042 - Optical Filter Set.

13.5.3 Testing

- Push Sensors calibration and Test → Haematocrit (HCT);

It is possible to check the linearity of the HCT sensor, by using the 5 filters provided in the kit 63042.
Proceed as follows:

- Make you sure the ACD button is enabled (otherwise active it);
- <u>Without inserting filters</u> push zeroAdjust and check that:
  - o In the RefRxCount displet the value 935 is shown;
  - o In one minute from the button pushing, the value in the RxCount displet goes to 935±6 count;
  - o In the displet below the message HCT's ZeroAdjust is Finished appears.

- Insert the G=10 filter and check in the RxFactor displet is shown 10;
- Remove the filter;
- Repeat the operation with the other filters from G49 to G1938.

13.5.4 Calibration

- Switch the XTRA on in Diagnostic Mode;
- Push Sensors calibration and Test →Haematocrit (HCT)→ Factory Mode;
- Open the latch and insert the G=10 filter in the HCT sensor;
- Push ACD;
- Push ledCalib, wait for sensor calibration (calibration time ≤ 80sec) and check that:
  - o In the RxFactor displet the value 10 is shown;
  - o In the RefRxCount displet the value 740 is shown.

At the end of the calibration, if OK, in the displet below the message HCT's LedCalib is Finished is displayed.

- In the RxCount displet is shown a value of 740±5.
- Press Store;

(CALIBR _005) Haematocrit Indicator Calibration rev.00

- Push Factory Mode;
- Perform the 14.5.3 Testing procedure;
- Switch the XTRA off.

13.6 (CALIBR _006) Kit Sensor Calibration rev.00

13.6.1 About this card

The purpose of present card is to give the **calibration** procedure of **Bar Code Reader**. That is the device able to read the bar code placed under the kit cartridge to allow the bowl size identification.

13.6.2 Tools needed

- cod. 63045 - Bar Code Reader Label Set.

13.6.3 Calibration

Here is the calibration procedure:

- Press Kit Reader → Factory Mode;
- Open the lid, lift the latch up and check there is nothing on the Bar-Code sensor;
- Holding the lid open, press Factory Mode;
- Press Calibrate and wait for the end of the test; if it is OK, in the displet below of the display the message **Kit Reader Calibration Finished** appears;
- Press Store;
- Put the several cartridges inside the 63045 tool with their labels on the sensor and check the correct match between the labels data and what appears on the display;
- Remove the cartridge, put down and lock the latch and check no bowl type is recognized;
- Press Factory Mode and then Kit Reader.

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13.7 (CALIBR_007) RBC Detector Calibration rev.00

13.7.1 About this card

The purpose of present card is to give the **testing** and **calibration** procedure of RBC Detectors.

13.7.2 Tools needed

- **Testing (Opening the unit NOT involved):**
- Cod. 63044 - RBC Detector Test Bowl.

- **Calibration (Opening the unit involved):**
- trimmer tool (screwdriver for trimmers);
- Cod. 63044 RBC Detector Test Bowl;
- Cod. 63054 RBC Det. Light Protection Cover.

(*) cursors facility for amplitude/time measuring is needed for present calibration

13.7.3 Low Level RBC Detector calibration

- Make sure the CCD circuit is completely mounted toward and downward;
- Put the RBC Detector Test Bowl on the centrifuge plate;
- Switch on the XTRA equipment in Diagnostic Mode;
- Press **Sensors calibration and Test**, then **Buffy Coat** and then **Factory Mode**;
- Rotate the bowl so that the **"Calibration Side"** is in front of the Low Level RBC Detector; the correct centering position is when the signal wave form between the two peaks reaches the lowest value (it corresponds to Vmin);
- Select the **Ref.Vmin** displet and with the ▼▲ buttons insert the value written on the bowl;

Fig. 13.7-1

- Put the cover (63054 tool) on the lid to shield the external light;
- Press **IR1 Calibrate**;

(CALIBR_007) RBC Detector Calibration rev.00

- If the electrical calibration is successful, in the window below in the display the "**BC-Low IR1 Calibration is completed successfully**" message appears.

a) If the displayed signal and data comply with the signal and the values in the fig.13.7-2 and table 13.7-1, press **Store**;

b) If they do not comply with the signal and the values in the fig.13.7-2 and table 13.7-1, press **Cancel**;

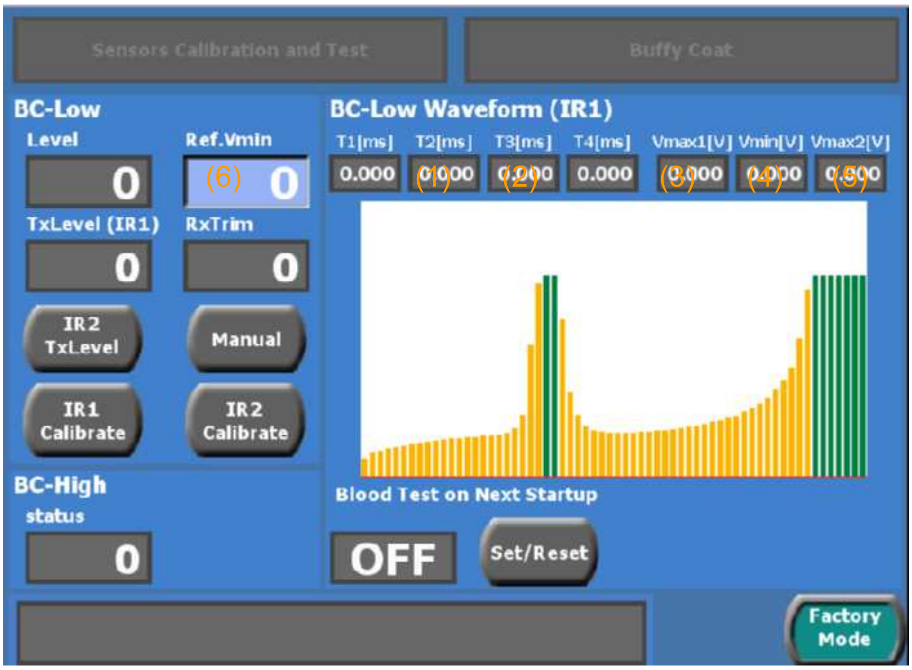

Fig. 13.7-2

ID	Label	Value
1	T2	< 11 ms
2	T3	22,8 ± 0,5 ms
6	Vmax1	3,55 ± 50 mV
10	Vmin	0,Ref.Vmin (ID number 6) ± 20 mV
11	Vmax2	3,55 ± 50 mV

Table 13.7-1

If the calibration requires the correction of the time, act meccanically on the self-stabilizing screws of the CCD (see the following figure), then press **IR1 Calibrate** and check the point **a**.

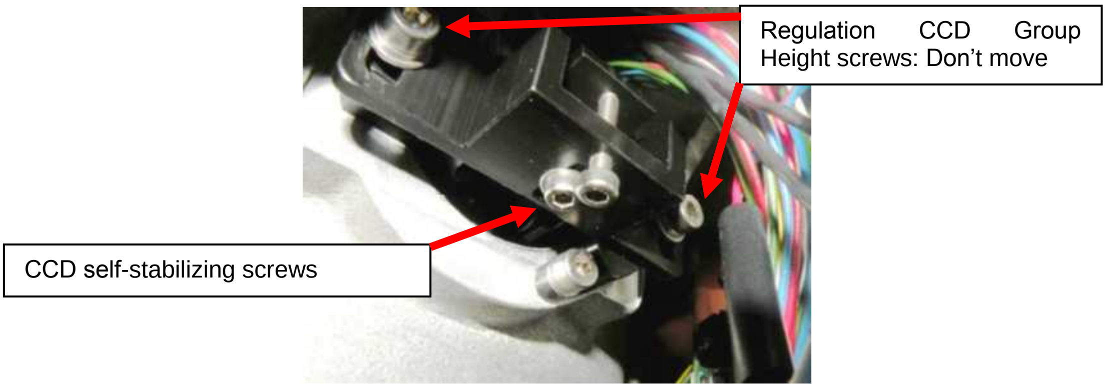

Fig. 13.7-3

- Press **IR2 Calibrate**;
- If the electrical calibration is successful, in the window below in the display the "**BC-Low IR2 Calibration is completed successfully**" message appears;
- The **Vmin** value should be 100 mV ± 10 mV higher than the one read for IR1

13.7.4 High Level RBC Detector calibration

- Put the bowl on the centrifuge plate and check in the **Status** displet there is a value higher than **619**;
- Cover the High Level RBC Detector (it is sufficient to insert a paper sheet between the bowl and the detector) and check in the **Status** displet there is a value lower than **599**;
- Remove the bowl and press **Sensors calibration and Test.**

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13.8 (CALIBR _008) Touch Screen Calibration rev.00

13.8.1 About this card

The purpose of present card is to give the **calibration** procedure of the display **touch screen**.

13.8.2 Tools needed

- Smooth thin body (i.e. a pen cap).

13.8.3 Calibration

- Insert the FST Service key into one of the USB ports located in the XTRA rear panel;
- Press the STOP button near the display;
- While keeping the STOP button pressed, switch on the XTRA;
- When the following screen is shown, do not touch any area of the screen and within 10 seconds disconnect the Service key from the USB port:

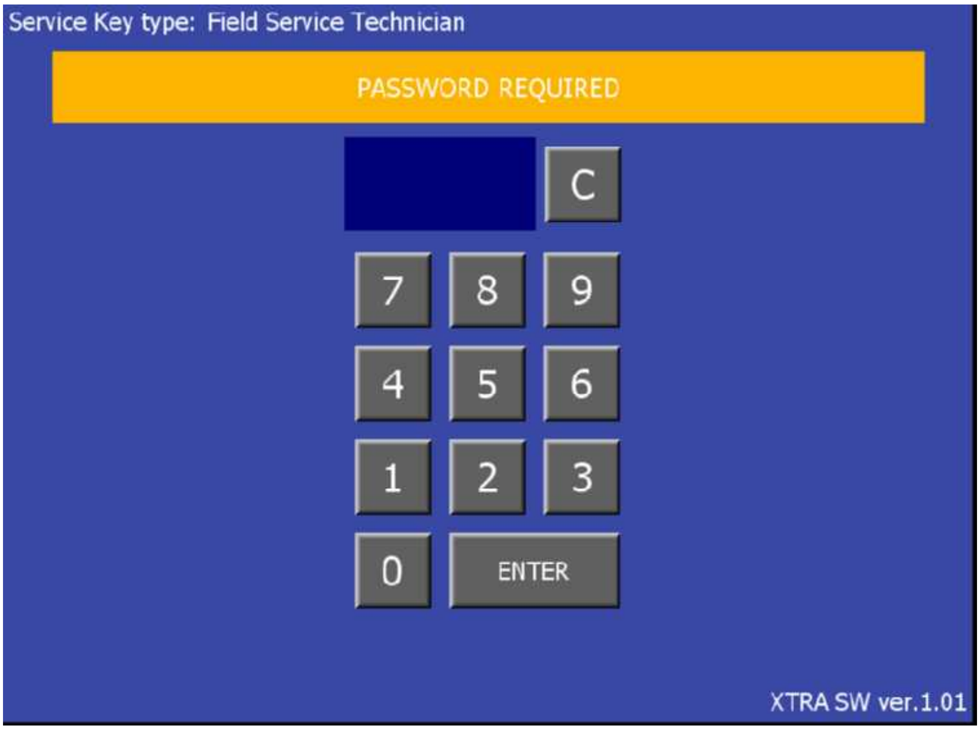

Fig. 13.8-1

(CALIBR _008) Touch Screen Calibration rev.00

- After almost 10 s the following message will be showed:

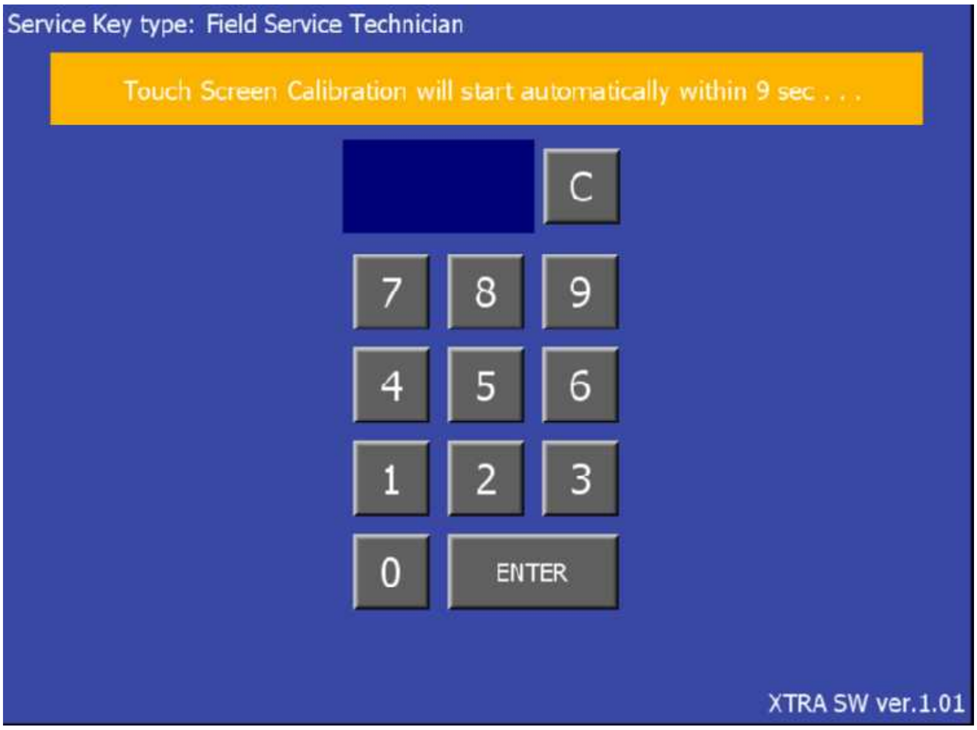

Fig. 13.8-2

- Wait for count-down expiring, without touching any area of the screen;
- When the timer expires, the touch screen calibration program is launched;
- Within 15 s start to touch the screen area indicated by the touch screen calibration program (that implements a 4 point-calibration method), be aware to parallax;
- Touch the display in the centre of the circles wthich are displayed in sequence, the calibration point is shown when the external thin body is removed;
- When all requested screen-point have been pressed, you have 90 s for calibration testing (check the pointer moves according your touch) and ACCEPT or CANCEL the changes.

13.9 (CALIBR_009) Bowl Arm Calibration rev.00

13.9.1 About this card

The purpose of present card is to give the **calibration** procedure of the **bowl arm**.

13.9.2 Tools needed

- cod. 63051 – Bowl Arm Centering Tool;
- Set of screwdrivers.

13.9.3 Calibration

- Fix the bowl arm immobilizer cap, contained in the Bowl Arm Centering tool, code 63051, in place of the arm cap, and fix it with two TCCE M 4x16 screws;
- Put the centring tool on the centrifuge plate;
- Loosen the TCCE M 4x16 bowl arm fixing screws inside the immobilizer;
- Close the bowl arm around the tool in working position;
- Switch on the XTRA in Diagnostic mode;
- Enter Actuators Checks and test/Centrifuge;
- Run the centrifuge at 200 rpm and visually check the centring tool is rotating homogeneously around the arm;
- Check even for noises and in case act on the above screws till the conditions are satisfied;
- Tighten the bowl arm fixing screws;
- Verify the arm bowl is well fixed by moving it from close into open position and vice versa (with the centring tool mounted);
- Remove the immobilizer cap from the arm bowl and the centring tool from the centrifuge plate.

Verify stability of arm during centrifuge rotation. Do as follows:
- Place a bowl on its site, close the arm on it;
- Run the centrifuge at 5600 rpm and verify the bowl arm does not vibrate.
- Stop the centrifuge and switch off the unit.

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14 TESTING PROCEDURES

14.1 (TEST_001) Testing Overview rev.00

14.1.1 About this card

The purpose of this card is to give a general description of XTRA **testing**. Testing procedures are only to check group functionality and **do not involve any calibration**. All testing procedures related to a calibration are included in the respective calibration card (*Testing* paragraph).
So, present cards describe testing methods to verify if there is some failure/damaging about a group.

14.1.2 Tool overview

Below are listed not codified tools needed to perform testing procedures.

Description	Purpose
stroboscopic lamp;	to visualize the centrifugal masses of the centrifuge plate
chronometer	to take the time
syringe	to wet blood loss sensor
pressure calibrator	to perform the pressure reading

Table 14.1-1

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14.2 (TEST_002) Pump Test rev.00

14.2.1 About this card

The purpose of present card is to give the **testing** procedure for the pump group. In particular, present procedure checks the correct behaviour of pump optical encoder and general speed/direction detecting system.

14.2.2 Tools needed

14.2.3 Testing

- In the Actuator Check and test page press Pump;
- Press on the Set Point displet and with the ▼▲ buttons set the flow rate to 150ml/min; then press on the Set Point displet again;
- Make you sure the counterclockwise rotation direction is enabled: CCW button active;
- Make you sure the OVC Protection function is ON;
- Enable the Enable button;
- Press ON: the pump rotates CCW;
- In the Pump Monitor section check that:
  - In the Actual Flow displet a value of 150±8ml/min is indicated;
  - In the three Dir.Enc.NAC, Dir.Enc.NMC and Dir.Shaft NMC displets CCW appears .
  - In the Neg.Err and Pos.Err displets there is a value between 0 and 8[ml/min].
- Press ON to stop the pump;
- Press CW.
- Press ON again: the pump rotates CW;
  - In the Actual Flow displet a value of 150±8 ml/min is indicated;
  - In the three Dir.Enc.NAC, Dir.Enc.NMC and Dir.Shaft NMC displets CCW appears .
  - In the Neg.Err and Pos.Err displets there is a value between 0 and 8 [ml/min].
- Press on the Set Point displet and with the ▼▲ buttons set the flow rate to 1000 ml/min; then press on the Set Point displet again;
  - In the Actual Flow displet a value of 1000±50 ml/min is indicated.
- Press ON to stop the pump;
- Press CCW;
- Press ON again: the pump accelarates rotating CCW;
  - In the Actual Flow displet a value of 1000±50 ml/min is indicated;
- Press ON to stop the pump, then press Pump.

14.2.3.1 Testing

- Switch the XTRA on in Diagnostic Mode;
- Press “Electronics checks” and then “Power Supply” and check that:
  - The displyed voltages are in the indicated range;
  - The +30V EN command and +30V_On/Off status functions are ON;
  - The +30<7V and +5 NUI status functions are OK.
- Press the +30V Disable button and check the +30V EN command function goes from ON to OFF.
- Press the +30V Disable button again to set the +30V option to ON.

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14.3 (TEST_003) Centrifuge Test rev.00

14.3.1 About this card

The purpose of present card is to give the **testing** procedure for the **centrifuge** group. In particular, present procedure checks the correct behaviour of centrifuge and general speed/direction detecting system.

14.3.2 Tools needed

- Stroboscopic lamp;
- chronometer

14.3.3 Testing

14.3.3.1 Speed Control and Bowl Lock System Test

- Make you sure all bowl locking spheres are visible in the centrifuge plate;
- Check the spheres are free to move pushing manually on them;
- Press on the Set Point displet and with the ▼▲ buttons, set the speed of 100 rpm;the press on the Set Point displet again;
- Press the Enable button to enable the centrifuge functioning;
- Press ON and check that:
  - The centrifuge rotates CCW;
  - The Actual Speed displet show a speed of 100±10 rpm;
  - In the Neg.Err and Pos.Err displets there is a value between 0 e 10 [rpm];
  - In the three Dir.Enc.NAC, Dir.Enc.NMC and Dir.Shaft NMC displets CCW appears.
- Press on the Set Point displet and with the ▼▲ buttons set the speed to 5600 rpm; then press on the Set Point displet again;
- The centrifuge accelerates, when the speed is stable check that:
  - In the Actual Speed displet a speed of 5600±50 rpm is indicated.
  - In the Neg.Err and Pos.Err displets there is a value between 0 and 50 [rpm].
- Using a stroboscopic lamp, set at value indicated in the Actual Speed displet, check that all the bowl locking spheres are out from the centrifuge plate;
- Press ON and check the centrifuge stops (T≤15 seconds);
- Check on more time that the bowl docking spheres are free to move pushing manually on them.

14.3.3.2 Centrifuge Acceleration Time Test

- With the centrifuge in stop status, set the Set Point to 5600 rpm and press ON: check the displayed centrifuge acceleration time (Speed-up Time) is <10 seconds.

14.3.3.3 Centrifuge Absorption Test

- With the centrifuge at maximum speed (5600 rpm) check the Current [A] values is ≤ 5.0 A;
- Press ON to stop the centrifuge;
- Press on the Set Point displet and with the ▼▲ buttons set the speed to 4000 rpm, then press again on the Set Point displet;
- Press ON to start the centrifuge;
- Wait for the speed is stable and check the Current (A) value is ≤5.0 A;
- Press ON to stop the centrifuge;

- Press Actuators Checks and test.
- Turn the XTRA off.

14.4 (TEST_004) Centrifuge Fluid Loss Sensor Test rev.00

14.4.1 About this card

The purpose of present card is to give the **testing** procedure for the Centrifuge Fluid Loss sensor.

14.4.2 Tools needed

Here are the tools needed to perform testing:

- Syringe.

14.4.3 Testing

- In the Sensors Calibration and Test page press Others Sensors;
- In the Others Sensors page check in the Blood Loss section the status of the sensor which detects the loss of liquids in the centrifuge well;
- In normal conditions, in the NSC Status displet there should be “DRY”;
- Wet the blood-loss sensor and check on the display “WET” appears;
- Dry the sensor.

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14.5 (TEST_005) Air Sensor Test rev.00

14.5.1 About this card

The purpose of present card is to give the **testing** for the **Air Sensor**. This is the air sensor placed inside the black holder between pump site and centrifuge well (see next figure). Two ultrasonic probes (TX and RX) stay at the sides of that position: a burst of pulses can pass from one to other only if liquid interface is present.

14.5.2 Tools needed

Here are the tools needed to perform testing:

- cod. 63047 – Air Sensor tool.

14.5.3 Testing

- In the Sensors Calibration and Test page press Others Sensors;
- In the Others Sensors page check in the Air Bubble Detector section the status of the Air Sensor: with nothing inserted in the sensor, both the NMC Status and NAC Status displets should display “AIR”;
- Insert the full set simulator cod 63047 in the sensor;
- Check both the NMC Status and NAC Status displets display “LIQUID”;
- Remove the full set simulator.

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14.6 (TEST_006) Clamped Empty Line Sensor Test rev.00

14.6.1 About this card

The purpose of present card is to give the **testing** procedure of **Red Pressure** sensor.

14.6.2 Tools needed

- Cod. 63053 Clamped Empty Line Sensor tool

14.6.3 Testing

- In the Sensors Calibration and Test page press Others Sensors;
- In the Others Sensors page check in the RBC line section the status see the mV value of the offset of the sensor;
- Insert the tool 63053 in the empty line clamp groove and check the shown value reaches 5100 mV;
- Press Sensors Calibration and Test.

(TEST_006) Clamped Empty Line Sensor Test rev.00

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14.7 (TEST_007) Bowl Arm Sensor Test rev.00

14.7.1 About this card

The purpose of present card is to give the **testing** procedure of **Bowl Arm** sensor.

14.7.2 Tools needed

- No tool is required.

14.7.3 Testing

- In the Sensors Calibration and Test page press Others Sensors;
- In the Others Sensors page check in the Bowl Arm section the status of the sensor detecting the position of the bowl arm;
  - With the arm closed the NMC Status and the NAC Status have to show “CLOSE”;
  - With the arm open the NMC Status and the NAC Status have to show “OPEN”.

Note: With the arm in closed position, moving the unlock arm button in the arrow direction, the status change from Close to Open and vice versa happens in different times between NMC Status and NAC Status.

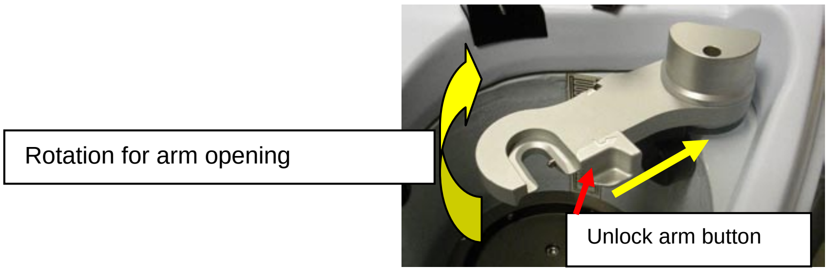

Fig. 14.7-1

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14.8 (TEST_008) Ejector Test rev.00

14.8.1 About this card

The purpose of present card is to give the **testing** procedure of **Red Pressure** sensor.

14.8.2 Tools needed

- No tool is required.

14.8.3 Testing

- Switch XTRA in Diagnostic Mode;
- Press Actuators Check and test and then Cassette Ejector;
- Press Ejector Autotest and check the uplift of the ejector.

Notes:

- The ejector remains enabled for 10 seconds; the maximum values of current are detected after 2÷3 seconds after the activation, then they decrease;
- After the disabling, it is no possible to enable the ejector for the following 50 seconds.

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14.9 (TEST_009) Cover Sensor Test rev.00

14.9.1 About this card

The purpose of present card is to give the **testing** procedure of **Cover** sensor.

14.9.2 Tools needed

- No tool is required.

14.9.3 Testing

- Switch XTRA in Diagnostic Mode;
- Press Actuators Check and test and then Cover Lock;
- In the Cover Section check the sensor status in NAC and NSC displets: Closed when the cover is closed, OPEN when the cover is open.

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14.10(TEST_010) Cover Lock Test rev.00

14.10.1 About this card

The purpose of present card is to give the **testing** procedure of **Cover Lock**.

14.10.2 Tools needed

- No tool is required.

14.10.3 Testing

- Switch XTRA in Diagnostic Mode;
- Press Actuators Check and test and then Cover Lock;
- With the cover open, manually check the lock is free to run in its seat;
- Press Lock and check that:
  - The cover lock is blocked;
  - Both the Command and Status displets show ON (their status change happens with two just a bit different times);
- Press Lock again: the lock is free and both Command and Status displets show OFF;
- Close the cover;
- Press Lock;
- Check it is not possible to open the cover and both the Command and Status displets display ON;
- Press Lock again and open the cover;
- Partially close the cover until in the NAC and NSC displets CLOSE appears;
- In this condition press Lock and check that:
  - The Command displet displays ON while the Status one displays OFF;
  - The cover is not blocket.
- Press Lock one more time and wait for the Command and Status displets display OFF;
- Close correctly the cover, press Lock to block it, and then turn off the equipment;
- Check the time it takes from turning off the machine to the automatic opening of the lock is ≈1 min (50’’÷1’30’’).

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14.11(TEST_011) Clamp Occlusion Test rev.00

14.11.1 About this card

The purpose of present card is to give the **testing** procedure of **clamps occlusion**.

14.11.2 Tools needed

- cod. 63046 - Pump And Clamp Occlusion Set;
- Pressure calibrator;
- Chronometer.

14.11.3 Testing

- Switch XTRA in Diagnostic Mode;
- Insert the occlusion kit cod.63046 only in the clamps;
- Connect the pressure calibrator to the Bowl Line of the tool (see fig.x);
- Do not insert the cartridge tube in the pump rotor;

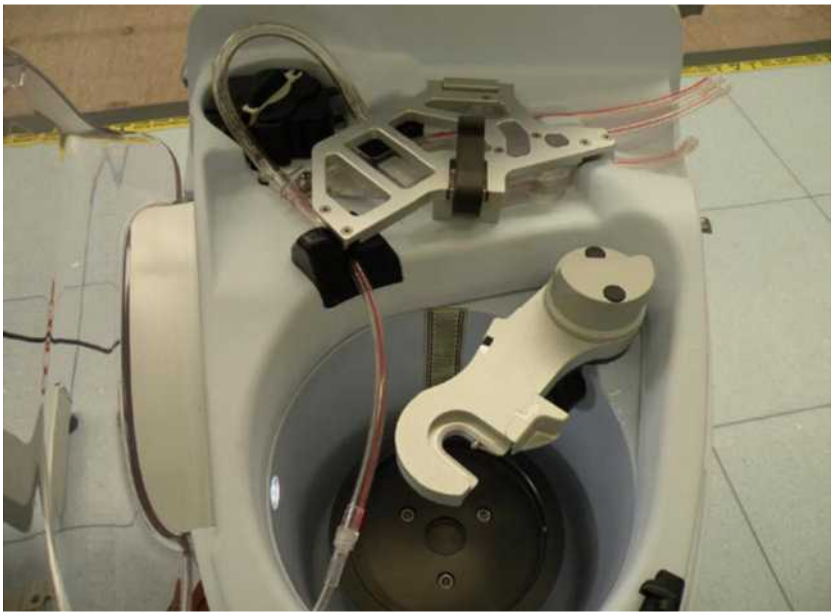

Fig. 14.11-1

- Bring the pressure to 1,5 bar;
- Verify that keeping the pressure for 60 s the leak in the lines inserted in the clamps is below 0,1 bar;
- If the leak is over the recommended value, connect the pressure calibrator to each clamp line and verify which is the out of order one.
- Disconnect the pressure calibrator.

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14.12(TEST_012) Pump Occlusion Test rev.00

14.12.1 About this card

The purpose of present card is to give the **testing** procedure of **pump occlusion**.

14.12.2 Tools needed

- cod. 63046 - Pump And Clamp Occlusion Set;
- Pressure calibrator;
- Chronometer.

14.12.3 Testing

- Switch the XTRA in Diagnostic Mode;
- Insert the occlusion kit cod. 63046 in the pump;
- Connect the pressure calibrator to the Bowl Line of the tool (see fig.14.12-1);

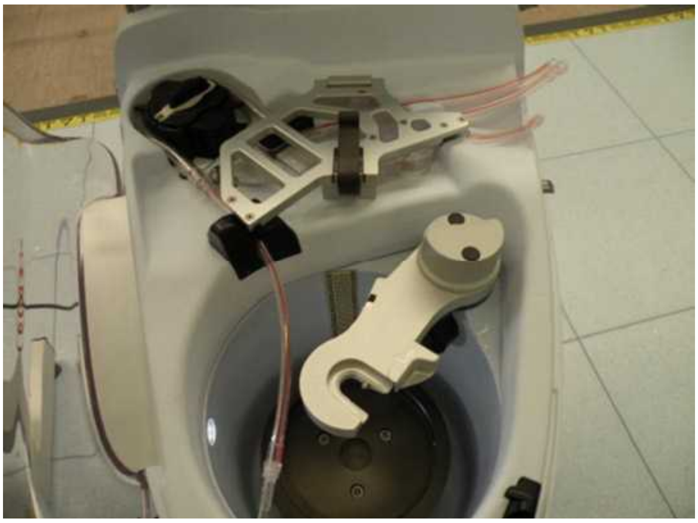

Fig. 14.12-1

- Open at least one clamp;
- Bring the pressure to 1,5 bar;
- Stop the pump so that one of the pump roll is in the occlusion sector (see fig.14.12-2), so that it occludes the tube, and wait 60 s to check that on the calirator the pressure is not decreasing below max 0,1 bar;

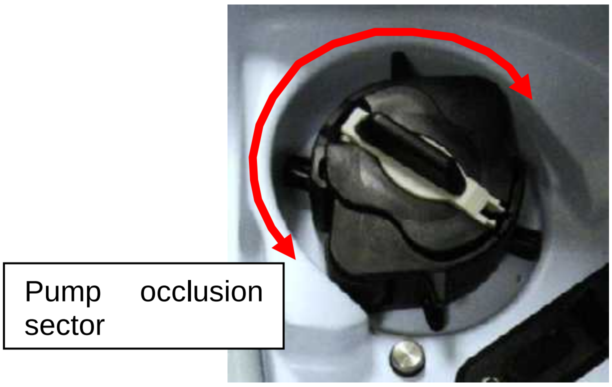

Fig. 14.12-2

- Repeat the test with the other pump roll;

If there is a bigger leak replace the pump rotor.

- Switch the XTRA off.
-

14.13(TEST_013) Clamp Test rev.00

14.13.1 About this card

The purpose of present card is to give the **testing** procedure of **clamps**.

14.13.2 Tools needed

- No tool is required.

14.13.3 Testing

- Switch XTRA in Diagnostic Mode;
- Enter Actuator Check and test and press Clamps;
- Carry out the Autotest for each clamp: the tested clamp performs an opening-closing cycle. At the end the tested clamp has to be closed and both the NAC and NMC functions have to display CLOSE;
- Command the opening/closing of each clamp with the relative Open/Close button;
- Verify the congruence of the displayed NAC and NMC functions with the status commanded to each clamp.

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14.14 (TEST_014) Clamp Sensor Test rev.00

14.14.1 About this card

The purpose of present card is to give the **testing** procedure of **clamps sensors**.

14.14.2 Tools needed

- Cod.63043 - Clamp Thickness Gauge tool.

14.14.3 Testing

- Switch XTRA in Diagnostic Mode;
- Insert the little thickness of the kit cod. 63043 under the closed clamp closing and blocking the latch;
- Check the latch is closed:
  - Both the functions of the tested clamp are displayed as Close;
  - The thickness is blocked and it is not possible to extract it;
- Replace the thickness under the clamp inserting the medium one;
- Open and close the clamp through the relative Open/Close button and check the congruence of the condition detected by the sensors;
- Open the clamp through the relative button (both the functions display OPEN);
- Keeping the clamps open, replace the thickness inserting the biggest one of the kit cod.63043 and close the latch;
- Close the clamp with its button;
- Verify that:
  - The command button of the clamp is disabled;
  - At the NAC function nothing is displayed;
  - At the NMC function OPEN is displayed;
- Press Clamps and draw the thickness away.

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15 MAINTENANCE

15.1 (MAIN_001) Maintenance Overview rev.00

15.1.1 Glossary

• **Routine Maintenance**: is defined as every maintenance action that must be performed regularly by the user of the XTRA;

• **Preventive Maintenance**: is defined as every maintenance action performed by an authorized technician every interval defined by the equipment manufacturer.

15.1.2 Routine Maintenance

Regular care and maintenance is important for the function and operation of the XTRA because it:
• Increases operational safety and reliability;
• Reduces susceptibility to failure;
• Increases the service life of all the components (value maintenance).

The instructions for routine maintenance which are given in the following sections form part of the operating conditions for the XTRA. This applies both to the routine maintenance which is carried out by the user of the XTRA and to the preventive maintenance which is performed by authorized service technicians and other testing entities.

15.1.3 General Maintenance Instructions

15.1.3.1 Safety Instructions for Routine Maintenance

• Before carrying out routine maintenance, disconnect the XTRA fully from the mains power supply making certain that the system is switched off;
• Do not fail to follow the regulations concerning routine maintenance, as well as the prescribed maintenance intervals stated in the operating instructions;
• Follow the separate operating instructions for all accessories;
• Use recommended cleaning agents;
• Wear protective gloves when disconnecting used tubing sets and disposables;
• Routine maintenance work must only be carried out by qualified personnel;
• Preventive maintenance and repair work on the machine must only be carried out by authorized service technicians. To guarantee safe and reliable operation of the XTRA, only genuine spare parts from SORIN GROUP may be used.

15.1.3.2 Discarding of disposables

Environmental regulations request proper ways of discarding refuse separated by their chemical compounds.
The technical personnel in hospitals involved with it must be adequately informed.
Disposables must be discarded in conformity with the law in force in the country of use.

15.1.4 Routine Visual Inspection

The XTRA equipment should be inspected periodically for any problems such as bent or broken switches, frayed or twisted power cords, and loose or missing hardware. Discontinue use of the XTRA if the device displays one or more of the above conditions until the problem is corrected and it has been verified that the device is operating correctly. Verify that the connectors, located on the exterior of the XTRA, for Data and Ethernet are intact and are not damaged and that the cables are correctly connected.

Check the following components:

• Power supply cable (see Figure 15.1-1 “A”): check the power supply insulation and shielding is undamaged along the entire length of the cable (cracks, cuts, clearly visible kinks);
• Vacuum Pump and Serial Connection cables (see Figure 15.1-1 “B”): check the power supply insulation and shielding is undamaged along the entire length of the cable (cracks, cuts, clearly visible kinks).

Fig. 15.1-1 Power Supply Cable (A)

Fig. 15.1-2 Serial Cable and Vacuum Pump Power Supply (B)

If any of the above cables are found damaged replace it. Have the service technician check defective accessories in any case.

Routine maintenance includes regular cleaning of the equipment. The frequency of cleaning operations depends on the operating and ambient conditions of use.

15.1.5 Cleaning and Disinfecting

Apart from the hygienic aspect, it is essential for the operational safety and reliability of the XTRA that it be kept clean. Perform the following cleaning routine every time it is necessary.
Perform the disinfection only in case of loss of blood.
Before cleaning the XTRA, disconnect it from the mains power supply and ensure that the system is switched off.

WARNING	Cleaning and disinfections of the unit must be performed every Preventive Maintenance and every time of blood spillage from the disposable kit.

WARNING	The salvaged blood must be considered as a potential carrier of infectious diseases. The operator should use any appropriate safety precautions when cleaning and disinfecting the equipment.

CAUTION	Quickly remove all traces of blood using detergent and disinfecting solution: this will speed up the cleaning operations and protect inside components from seepage of liquids. Do not use more detergent solution than absolutely necessary. Do not use chemical solvents such as benzol, xylene, acetone or similar products which might damage the unit protective panels. Deposits of dust and particles on surfaces can be removed with a soft cloth or a brush or they can vacuum cleaned.

15.1.5.1 External Surfaces

Clean all surfaces of the XTRA equipment, including the trolley surfaces.

15.1.5.1.1 Cleaning

To clean the external surfaces use soapy water, ethyl alcohol and ammonia based cleaning solutions.

15.1.5.1.2 Disinfecting

Use disinfectant products specifically provided for rubber / plastic medical tools and devices.
Rinse with water and wipe off the disinfectant product in order to prevent possible damage. Comply with the dilution required and with instructions provided by the manufacturer of the product (read carefully instructions for use and label of the product).

15.1.5.2 Touch Screen

To clean the touch screen:

- Use a soft lint-free cloth.
- The cloth may be used dry or lightly dampened with a mild cleaner or Ethanol.
- Be sure the cloth is only lightly dampened, not wet.
- Cleaner must be neither acid nor alkali (neutral pH).
- When using cleaner, avoid contact with the edges of the film or glass, and with the flex tail.
- Wipe the surface gently; if there is a directional surface texture, wipe in the same direction as the texture.
- Suitable cleaning products are commercially available pre-packaged for use;
- Use of incorrect cleaners can result in optical impairment of touch panel and/or damage to functionality.

Note: Most products contain 1-3% Isopropyl Alcohol by volume, which is within acceptable limits for Resistive Touch Panel cleaning use.

WARNING Comply with the dilution required and with instructions provided by the manufacturer of the product (read carefully instructions for use and label of the product).

WARNING Do not use sodium hypochlorite based disinfectants, aldehydes (formic aldehide, glutaralehyde) and solvents.

WARNING Never apply cleaner directly to touch panel surface; if cleaner is spilled onto touch panel, soak it up immediately with absorbent cloth.

WARNING Never use acidic or alkaline cleaners or organic chemicals such as: paint thinner, acetone, tolulene, xylene, propyl or isopropyl alcohol, or kerosene.

CAUTION Many products contain Ammonia, Phosphates, and/or Ethylene Glycol, which are NOT ACCEPTABLE; check product content label carefully.

15.1.5.3 Clamps and Pump Loop Ejector

Fig. 15.1-3

To clean clamps unlatch the clamp lid, lift it and follow the indications reported in the “External Surfaces” section on page 15.1-3. Follow the same indications for the pump loop ejector.

15.1.5.4 Pump Rotor

Remove the rotor and clean the area underneath it, following the indications reported in section “External Surfaces” on page 15.1-3.

15.1.5.5 Centrifuge Well

Swing open the centrifuge arm (see Figure 15.1-4) and clean the well following the indications reported in section “External Surfaces” on page 15-1.3.

Fig. 15.1-4

15.1.5.6 Centrifuge Well Fluid Container

Whenever organic fluids enter it, the container must be cleaned with suitable disinfectant solution or alternatively, replaced.

15.1.5.7 Vacuum System Overflow Trap

Accumulation of dust, dirt, or other debris within the trap assembly may block air passage or prevent effective vacuum shutoff. Cleaning should be performed when liquid overflows into the trap.
The trap should be removed and disassembled for cleaning. Push up on the quick-lock connector to remove the trap from the vacuum system (see Figure 15.1-5).

Fig. 15.1-5

The following drawing illustrates the disassembled parts of the overflow trap.

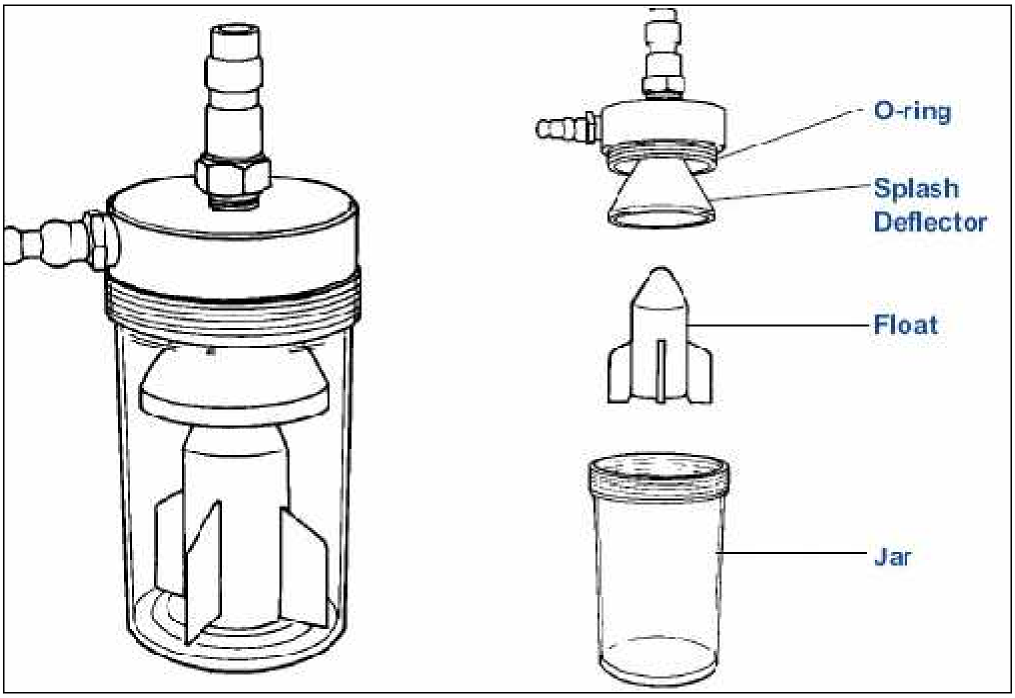


Fig. 15.1-6

After removing the trap from the XVAC do the following:
1. Unscrew the jar from the cap.
2. Remove the float from the jar; pull the rubber splash deflector from the base of the cap.
3. Clean all surfaces and air passages thoroughly; replace any worn or damaged parts.

4. Sparingly lubricate the rubber O-ring on the cap with Dow-Corning 111 silicone grease.
5. Reassemble the trap and reconnect to the XVAC Vacuum System.

CAUTION Incorrect assembly of the vacuum overflow trap or assembly using damaged components could allow an overflow to enter the machine and damage internal vacuum system parts.
Incorrect assembly of the vacuum overflow trap or assembly using damaged components could allow an overflow to enter the machine and damage internal vacuum system parts.

15.1.5.8 Sensors

Do not use abrasive cleaning solutions (refer to “External Surfaces” on page 15.1-3) on the following sensors:

A. Bar Code Sensor
B. Hct Sensor
C. Transparency Sensor
D. Fluid Loss Sensor
E. RBC Line Clamped Sensor
F. RBC Sensors

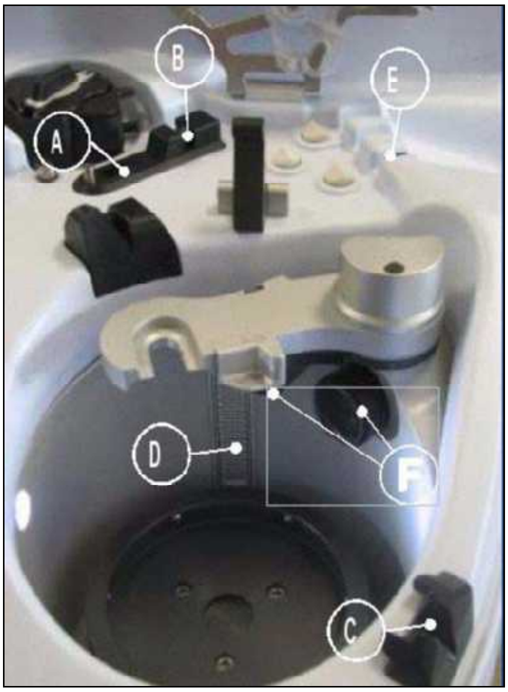


Fig. 15.1-7

(MAIN_001) Maintenance Overview rev.00

Machine Repair

The hospital personnel is allowed to perform the routine checks described in this chapter.

The Preventive maintenance as well as all the corrective maintenances on the XTRA must be performed by Field Service Engineers expressly authorized by Sorin Group. Directly contact Sorin Group Italia:

Sorin Group Italia s.r.l.
Via Statale 12 Nord, 86 - P.O. Box 87
41037 MIRANDOLA (MO) – Italy
Tel. +39/0535/29811 - Fax. +39/0535/25229

15.2 (MAIN_002) Preventive Maintenance rev.00

This card will guide the Field Service Engineer to perform the **Preventive Maintenance** procedure. To prolong the life of the equipment and to assure the Manufacturer performances the Preventive Maintenance procedure must be performed as scheduled.

WARNING	The preventive maintenance of the XTRA must be carried out by an authorized service technician at regular intervals in accordance with the maintenance contract (where a contract exists). Regardless of whether there is a service contract or not, the XTRA must be subjected to a regular maintenance check by the authorized service technician (in accordance with the European Directive 93/42 EEC and the national standards which are based on this directive). The maintenance check must be carried out on the XTRA every 1000 operating hours.

WARNING	Before connecting the unit, check that power supply corresponds to that printed on the rear label of the equipment; Ensure that the mains socket is fused and ground protected; Connect the unit plug to a socket of same size, do not use adapters; Ensure that the power switch is turned off and the plug is disconnected from the mains before inspecting the inside of the unit; Never connect (or disconnect) the plug from the mains socket with wet or damp hands; If during use liquids have accidentally spilled into the unit, switch it off and disconnect the plug before inspecting the inside; Before disconnecting the power plug ensure that the main switch is turned to OFF; Grasp the plug with your hand to disconnect it; do not pull on the power cord.

WARNING	The display is an important source of information for the user as well as an important instrument for controlling and preventing possible malfunctions.

15.2.1 Electrical supply check

15.2.1.1 Tools needed:

- Digital Multimeter;
- Set of screwdriver.

15.2.1.2 Procedure:

Switch the XTRA on in **Diagnostic Mode**;
Open the unit (see **(DISM_001) Opening the Unit** card). Verify that voltage drop along the whole equipment (i.e. from PS to NBP, from PS to NBB, etc.) is regular. To do so, act as follows:
Verify following voltages on NBP board Test Points:

TP	Voltage (V)
5	+5 (5,1 ÷ 5,2)

Verify following voltages on NBB board Test Points:

TP	Voltage (V)
4	+5,2 (5,05 ÷ 5,2)
7	+12 (11,8 ÷ 12,2)
6	GND

After done testing, restore XTRA enclosure.

- Press **Electronics checks** and then **Power Supply** and check that:
  - The displyed voltages are in the indicated range;
  - The **+30V EN** command and **+30V_On/Off status** functions are **ON**;
  - The **+30<7V** and **+5 NUI status** functions are **OK**.
- Press the **+30V Disable** button and check the **+30V EN command** function goes from **ON** to **OFF**.
- Press the **+30V Disable** button again to set the **+30V** option to **ON**.

15.2.2 Pump check

15.2.2.1 Tools needed:

- No tools is required.

15.2.2.2 Procedure:

- In the **Actuator Check and Test** page press **Pump**;
- Press on the **Set Point** displet and with the ▼▲ buttons set the flow rate to 150ml/min; then press on the **Set Point** displet again;
- Make you sure the counterclockwise rotation direction is enabled: **CCW** button active;
- Make you sure the **OVC Protection** function is **ON**;
- Enable the **Enable** button;
- Press **ON**: the pump rotates **CCW**;
- In the **Pump Monitor** section check that:
  - In the **Actual Flow** displet a value of 150±8ml/min is indicated;

- In the three **Dir.Enc.NAC, Dir.Enc.NMC** and **Dir.Shaft NMC** displets **CCW** appears ;
- In the **Neg.Err and Pos.Err** displets there is a value between 0 and 8 [ml/min].

- Press **ON** to stop the pump;
- Press **CW**;
- Press **ON** again: the pump rotates **CW**;
  - In the **Actual Flow** displet a value of 150±8 ml/min is indicated;
  - In the three **Dir.Enc.NAC, Dir.Enc.NMC** and **Dir.Shaft NMC** displets **CCW** appears;
  - In the **Neg.Err and Pos.Err** displets there is a value between 0 and 8 [ml/min].
- Press on the **Set Point** displet and with the ▼▲ buttons set the flow rate to 1000 ml/min; then press on the **Set Point** displet again;
  - In the **Actual Flow** displet a value of 1000±50 ml/min is indicated.
- Press **ON** to stop the pump;
- Press **CCW**;
- Press **ON** again: the pump accelarates rotating CCW;
  - In the **Actual Flow** displet a value of 1000±50 ml/min is indicated;
- Press **ON** to stop the pump, then press **Pump**.

15.2.3 Pump Occlusion check

15.2.3.1 Tools needed:

- cod. 63046 - Pump And Clamp Occlusion Set;
- Pressure calibrator;
- Chronometer.

15.2.3.2 Procedure:

- Insert the occlusion kit cod. 63046 in the pump;
- Connect the pressure calibrator to the Bowl Line of the tool (see fig.x);

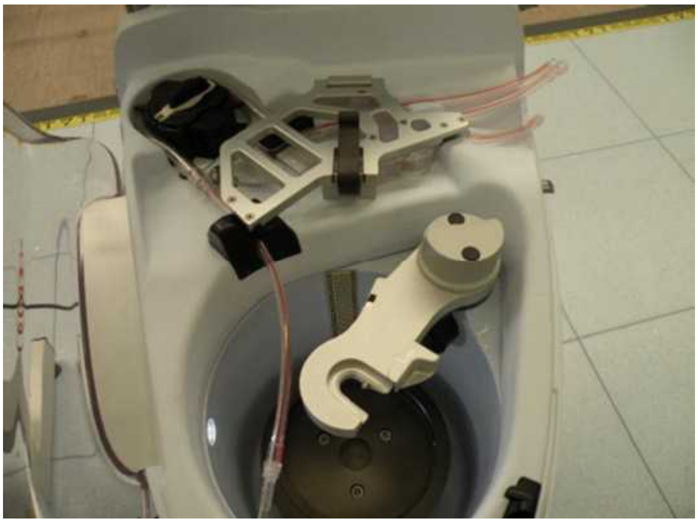


Fig. 15.2-1

- Open at least one clamp;
- Bring the pressure to 1,5 bar;

- Stop the pump so that one of the pump roll is in the occlusion sector (see fig. 15.2-2), so that it occludes the tube, and wait 60 s to check that on the calibrator the pressure is not decreasing below max 0,1 bar;

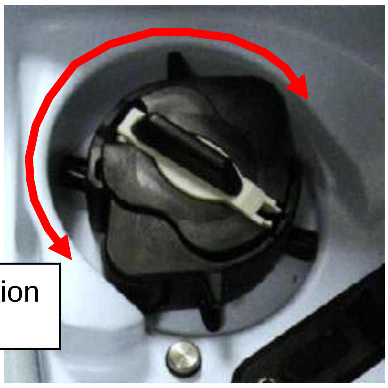


Fig. 15.2-2

- Repeat the test with the other pump roll;

If there is a bigger leak replace the pump rotor.

15.2.4 Centrifuge check

15.2.4.1 Tools needed:

- Stroboscopic lamp;
- chronometer

15.2.4.2 Procedure:

15.2.4.2.1 Speed Control and Bowl Lock System Test

- Make you sure all bowl locking spheres are visible in the centrifuge plate;
- Check the spheres are free to move pushing manually on them;
- Press on the **Set Point** displet and with the ▼▲ buttons set the speed of 100 rpm; then press on the **Set Point** displet again;
- Press the **Enable** button to enable the centrifuge functioning;
- Press **ON** and check that:
  - The centrifuge rotates CCW;
  - The **Actual Speed** displet show a speed of 100 ± 10 rpm;
  - In the **Neg.Err and Pos.Err** displets there is a value between 0 e 10 [rpm];
  - In the three **Dir.Enc.NAC**, **Dir.Enc.NMC** and **Dir.Shaft NMC** displets **CCW** appears.
- Press on the **Set Point** displet and with the ▼▲ buttons set the speed to 5600 rpm; then press on the **Set Point** displet again;
- The centrifuge accelerates, when the speed is stable check that:
  - In the **Actual Speed** displet a speed of 5600 ± 50 rpm is indicated.
  - In the **Neg.Err and Pos.Err** displets there is a value between 0 and 50 [rpm].
- Using a stroboscopic lamp, set at value indicated in the **Actual Speed** displet, check that all the bowl locking spheres are out from the centrifuge plate;
- Press **ON** and check the centrifuge stops (T≤15 seconds);
- Check on more time that the bowl docking spheres are free to move pushing manually on them.

15.2.4.2.2 Centrifuge Acceleration Time Test

- With the centrifuge in stop status, set the **Set Point** to 5600 rpm and press **ON**: check the displayed centrifuge acceleration time (**Speed-up Time**) is <10 seconds.

15.2.4.2.3 Centrifuge Absorption Test

- With the centrifuge at maximum speed (5600 rpm) check the **Current [A]** values is ≤ 5,0 A.
- Press **ON** to stop the centrifuge.
- Press on the **Set Point** displet and with the ▼▲ buttons set the speed to 4000 rpm, then press again on the **Set Point** displet;
- Press **ON** to start the centrifuge;
- Wait for the speed is stable and check the **Current (A)** value is ≤ 5,0 A;
- Press **ON** to stop the centrifuge;
- Press **Actuators Checks and test**.

15.2.5 Centrifuge Fluid Loss Sensor check

15.2.5.1 Tools needed:

- Syringe.

15.2.5.2 Procedure:

- In the **Sensors Calibration and Test** page press **Others Sensors**;
- In the **Others Sensors** page check in the **Blood Loss** section the status of the sensor which detects the loss of liquids in the centrifuge well;
- In normal conditions, in the **NSC Status** displet there should be **DRY**;
- Wet the blood-loss sensor and check on the display **WET** appears;
- Dry the sensor.

15.2.6 Air Sensor check

15.2.6.1 Tools needed:

- Cod. 63047 – Air Sensor tool

15.2.6.2 Procedure:

- In the **Sensors Calibration and Test** page press **Others Sensors**;
- In the **Others Sensors** page check in the **Air Bubble Detector** section the status of the **Air Sensor**: with nothing inserted in the sensor, both the **NMC Status** and **NAC Status** displets should display **AIR**;
- Insert the full set simulator cod. 63047 in the sensor;
- Check both the **NMC Status** and **NAC Status** displets display **LIQUID**;
- Remove the full set simulator.

15.2.7 Clamped Empty Line Sensor check

15.2.7.1 Tools needed:

- cod. 63053 - Clamped Empty Line sensor tool.

15.2.7.2 Procedure:

- In the **Sensors Calibration and Test** page press **Others Sensors**;

- In the **Others Sensors** page check in the **RBC line** section the status, see the mV value of the offset of the sensor;
- Insert the tool 63053 into the empty clamp groove and check the shown value reaches 5100 mV;
- Press **Sensors Calibration and Test**.

15.2.8 Bowl Arm Sensor check

15.2.8.1 Tools needed:

- No tool is required.

15.2.8.2 Procedure:

- In the **Sensors Calibration and Test** page press **Others Sensors**;
- In the **Others Sensors** page check in the **Bowl Arm** section the status of the sensor detecting the position of the bowl arm;
  - With the arm closed the **NMC Status** and the **NAC Status** have to show **CLOSE**;
  - With the arm open the **NMC Status** and the **NAC Status** have to show **OPEN**.

Note: With the arm in closed position, moving the unlock arm button in the arrow direction, the status change from **Close** to **Open** and vice versa happens in different times between **NMC Status** and **NAC Status**.

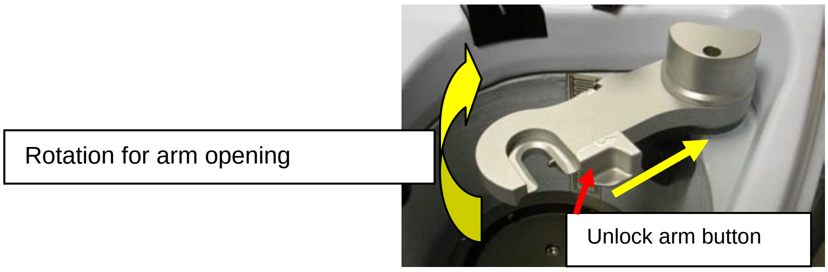


Fig. 15.2-3

15.2.9 Ejector check

15.2.9.1 Tools needed:

- No tool is required.

15.2.9.2 Procedure:

- Press **Actuators Check and Test** and then **Cassette Ejector**;
- Press **Ejector Autotest** and check the uplift of the ejector.

Notes:
- The ejector remains enabled for 10 seconds; the maximum values of current are detected after 2 ÷ 3 seconds after the activation, then they decrease;
- After the disabling, it is no possible to enable the ejector for the following 50 seconds.

15.2.10 Cover Sensor check

15.2.10.1 Tools needed:

- No tool is required.

15.2.10.2 Procedure:

- Press **Actuators Check and Test** and then **Cover Lock**;
- In the **Cover Section** check the sensor status in **NAC** and **NSC** displets: **CLOSED** when the cover is closed, **OPEN** when the cover is open.

15.2.11 Cover Lock check

15.2.11.1 Tools needed:

- No tool is required.

15.2.11.2 Procedure:

- Press **Actuators Check and Test** and then **Cover Lock**;
- With the cover open, manually check the lock is free to run in its seat;
- Press **Lock** and check that:
  - The cover lock is blocked;
  - Both the **Command** and **Status** displets show **ON** (their status change happens with two just a bit different times);
- Press **Lock** again: the lock is free and both **Command** and **Status** displets show **OFF**;
- Close the cover;
- Press **Lock**;
- Check it is not possible to open the cover and both the **Command** and **Status** displets display **ON**;
- Press **Lock** again and open the cover;
- Partially close the cover until in the **NAC** and **NSC** displets **CLOSE** appears;
- In this condition press **Lock** and check that:
  - The **Command** displet displays **ON** while the **Status** one displays **OFF**;
  - The cover is not blocket.
- Press **Lock** one more time and wait for the **Command** and **Status** displets display **OFF**;
- Close correctly the cover, press **Lock** to block it, and then turn off the equipment;
- Check the time it takes from turning off the machine to the automatic opening of the lock is ≈1 min (50''÷1'30'').

15.2.12 Clamp check

15.2.12.1 Tools needed:

- No tool is required.

15.2.12.2 Procedure:

- Enter **Actuator Check and Test** and press **Clamps**;
- Carry out the **Autotest** for each clamp: the tested clamp performs an opening-closing cycle. At the end the tested clamp has to be closed and both the **NAC** and **NMC** functions have to display **CLOSE**;
- Command the opening/closing of each clamp with the relative **Open/Close** button;

- Verify the congruence of the displayed **NAC** and **NMC** functions with the status commanded to each clamp.

15.2.13 Clamp Occlusion check

15.2.13.1 Tools needed:

- cod. 63046 - Pump And Clamp Occlusion Set;
- Pressure calibrator;
- Chronometer.

15.2.13.2 Procedure:

- Insert the occlusion kit cod.63046 only in the clamps;
- Connect the pressure calibrator to the Bowl Line of the tool;
- Do not insert the cartridge tube in the pump rotor;

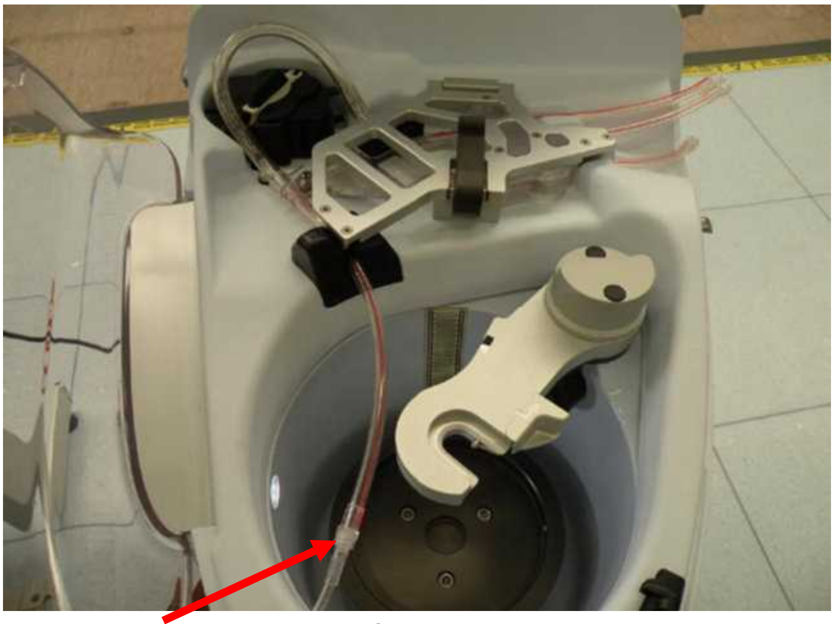


Fig. 15.2-4

- Bring the pressure to 1,5 bar;
- Verify that keeping the pressure for 60 s the leak in the lines inserted in the clamps is below 0,1 bar;
- Disconnect the pressure calibrator.

15.2.14 Clamp Sensor check

15.2.14.1 Tools needed

- Cod.63043 - Clamp Thickness Gauge tool.

15.2.14.2 Procedure:

- Insert the little thickness of the kit cod. 63043 under the closed clamp closing and blocking the latch;
- Check the latch is closed:
  - Both the functions of the tested clamp are displayed as **Close**;

  - The thickness is blocked and it is not possible to extract it;
- Replace the thickness under the clamp inserting the medium one;
- Open and close the clamp through the relative **Open/Close** button and check the congruence of the condition detected by the sensors;
- Open the clamp through the relative button (both the functions display **OPEN**);
- Keeping the clamps open, replace the thickness inserting the biggest one of the kit cod.63043 and close the latch;
- Close the clamp with its button;
- Verify that:
  - The command button of the clamp is disabled;
  - At the **NAC** function nothing is displayed;
  - At the **NMC** function **OPEN** is displayed;
- Press **Clamps** and draw the thickness away.

15.2.15 Waste Line Color Indicator check

15.2.15.1 Tools needed:

- cod. 63048 - Waste Line Color Indicator Tool filled with saline solution.

15.2.15.2 Procedure:

- Push **Sensors Calibration and Test** , then **Haemoglobin (HGB)** and then **Factory Mode**;
- Insert the tool 63048 filled with saline solution in the **Waste Line Color Indicator**, making you sure no air bubbles are present;
- Perform different insertions and wait the assessment of the tube inside the support;
- Verify that the **HGB RxCount** reading is **935** (range from 870 to 1000).

15.2.16 Haematocrit Indicator check

15.2.16.1 Tools needed:

- cod. 63042 - Optical Filter Set.

15.2.16.2 Procedure:

- Insert the filter **G10** inside the **HCT Indicator** support and verify that the counts are inside the range 700-770.

15.2.17 Reservoir Load Cell Sensor check

15.2.17.1 Tools needed:

- Cod. 63041 Weighing System tool.

15.2.17.2 Procedure:

- Lift the cardiotomy arm and insert the tool in the cardiotomy support
- Check the linearity of the system with the following weights:

Weight to hang on tool [Kg]	Total Weight [Kg]	Displayed value
0	0	0 (0÷ +5g)

	(without tool x)	
0.5	1	1000g (950 ÷ 1050g)
1.5	2	2000 (1900 ÷ 2100g)
2.5	3	3000 (2850 ÷ 3150g)
3.5	4	4000 (3800 ÷ 4200g)
4.5	5	5000 (4950 ÷ 5050g)
5.5	6	6000 (5400 ÷ 6000g)

Table 15.2-1

NOTE: **hang the weights on hook of cod. 63041 tool. The global weight (including tool contribution) must reach the value displayed in the "Total weigh" column**

NOTE: verify of 6 Kg accepts very large tolerance, because of mechanical safety included in reservoir holder. It can act in this range. The effect of this safety is to make a saturation of weight read.

- Connect the multimeter to the TP4 of the NSA p.c. board and hang 5.5 Kg (to make 6 Kg), gradually press on the reservoir support, making sure that the voltage does not exceed 1.1V.

Warning: Do not exceed 1.1 V or the loading cell could be damaged.

15.2.18 Kit Sensor check

15.2.18.1 Tools needed:

- Cod. 63045 Bar-code reader label set.

15.2.18.2 Procedure:

- Push **Sensors Calibration and Test**, then press **Kit Reader**;
- Insert the tool 63045 X/125 on the kit sensor;
- Check the following value are displayed:
    - **Bowl Type: X/125;**
    - **Label 1: White;**
    - **Label 2: Black;**
    - **Label 3: White**.
- Replace the tool 63045 **X/125** with the 63045 **X/175**;
- Checking the following value are displayed:
    - **Bowl Type: X/175;**
    - **Label 1: Black;**
    - **Label 2: White;**
    - **Label 3: Black.**
- Remove the tool 63045 X/175.
- Push the **Kit Reader** button.

15.2.19 RBC Detectors (Buffy Coat) check

15.2.19.1 Tools needed:

- Cod. 63044 - RBC Detector Test Bowl.

15.2.19.2 Procedure:

- Push **Sensors Calibration and Test**, then press **Buffy Coat**;
- Put the RBC detector test bowl in the XTRA centrifuge well in the way that the **Test Side** is facing the detector window;

Fig. 15.2-5

- Verify that **BC-LOW Level** value is in the range 845-865 counts;
- Verify that **BC-High Status** value is higher then 619 counts;
- Remove the RBC detector test bowl from the centrifuge well;
- Verify that **BC-High Status** value is lower then 599 counts.

Note: in case the value is out of range and there is no evidence of buffy coat sensor malfunctioning, it is not necessary to perform the calibration.

15.2.20 XVAC check (if present).

Please refer to the XVAC Service Manual, **Preventive Maintenance** card.

15.2.21 Electrical safety tests

XTRA Classification
Protection class: I
Type: B
Parts applied: 1
Electrical safety tests refer to the IEC 60.601-1 and UL 60.601-1 regulation.

Tools:
- Automatic Safety tester.

The following are the tests to be carried out on XTRA:
1) Ground efficiency test;
2) Leakage currents toward ground.

TESTS	ADMISSIBLE VALUES	
	NC*	SFC**
Leakage currents toward ground	0,5 mA (for IEC 60.601-1) 0,3 mA (for UL 60.601-1)	1 mA
Ground efficiency	200 mΩ	NA

* Normal condition,
** Single fault condition.

(MAIN_002) Preventive Maintenance rev.00

TECHNICAL CARD FOR PREVENTIVE MAINTENANCE of XTRA

HOSPITAL	WARD ....
TECHNICIAN	DATE ....
SERIAL NUMBER	HOURS OF OPERATION ....

CLEANING GENERAL EQUIPMENT CHECKOUT

- External cleaning;
- Cleaning of the pump seat;
- Cleaning of the centrifuge well;
- Check on the power supply cable.

POWER SUPPLIES

- NBP p.c. board:
  - + 30 V (29.7 ÷ 30.0);
  - + 5 V (5.1 ÷ 5,2);
  - + 12 V (11.88 ÷ 12.12);
  - - 12 V (-11.88 ÷ 12.12).

- NBB p.c. board:
  - + 5 V (5.05 ÷ 5,2);
  - + 12 V (11.8 ÷ 12.2).

MECHANICAL GROUPS

Roller pump

- Check on the roller pump's occlusion;
- Check on the speed and encoder at 150 ml (± 8 ml/min);
  at 100 0ml (± 50 ml/min).
- Check the pump hall effect sensor;
- Check on the pump direction.

Centrifuge

- Check on the operating speed at 5600 rpm (± 50 rpm);
- Check on the rotating plate centrifugal masses at 5600 rpm;

Clamp group

- Check the Clamp group and sensor;
- Check on the occlusion of the:
  - Prime electroclamp;
  - Wash electroclamp;
  - Empty electroclamp.

Vacuum group

- Check the XVAC functionality.

Locking system

- Check the Centrifuge Lid Position sensor;
- Check the Centrifuge Lid Lock Position sensor.

DIGITAL SIGNALS

- Check on the Air Sensor;
- Check the Bowl Arm Position Sensor;
- Check on the Centrifuge Fluid Loss Sensor;
- Check the kit sensor.

ANALOG SIGNALS

- Check on the Waste Line Color Indicator;
- Check on the Haematocrit indicator;
- Check on the Weighing System;
- Check the Clamped Empty Line Sensor;
- Check the RBC Detectors.

ELECTRICAL SAFETY TEST

Check on the leakage currents according to the IEC 60.601-1 and UL 60.601-1 regulation.

DATE___________________ SIGNATURE ____________________

16 INSTALLATION AND TRASPORTATION

16.1 (INST&TRAN_001) XTRA Installation Procedure rev.00

16.1.1 About this card

The purpose of this card is to describe the **installation procedure** of the XTRA equipment and the check of the correct functionality

16.1.2 Procedure

This procedure should be applied in the following condition:

1) After unpacking the equipment and before the first use;
2) Generally after unpacking the equipment before any installation.

NOTE: This procedure is inserted outside of the packing of each XTRA

16.1.2.1 Tools

- Cutter;
- A copy of the XTRA Unpacking Instruction.

16.1.2.2 Minimum space requirement for the unpacking

- 2,50 m from the floor to the roof;
- 6 m^2 floor space.

16.1.2.3 Unpacking

Verify that the two cardboard boxes have not been damaged during transportation(Fill the XTRA Unpacking Check; page 16.1-7, point 1);
Check the presence of the corresponding Country Box following the list below (fill out the XTRA Unpacking Check; page 16.1-7, point 2-3-4):

Code	Description	Countries	User manual	Main Cable	Note
28020	Country box “I”	Italy	Italian	Italian standard	
28021	Country box “F”	France	French		
28022	Country box “E”	Spain,	Spanish		
28023	Country box “D”, “A”	Germany, Austria	German		User manual 2 copies
28024	Country box “GB”, “”IRL”	United Kingdom, Ireland	-	UK Standard	
28025	Country box “NL”, “B”, “CH”	Netherlands, Belgium, Switzerland	French, Dutch, German, Italian		
28026	Country box “F”	Finland	Finnish		

(INST&TRAN_001) XTRA Installation Procedure rev.00

In case of inconsistency between the equipment and country box, please advise your Customer Service Department to have the correct configuration.
The XTRA complete packaging is made up two separated cardboard boxes, one containing the XTRA machine, the other containing the XTRA cart.
The box with the machine presents two labels (cod.16047 or 16102) with the serial number of the equipment.

1) Cut all the straps;
2) Remove the dampened paper;
3) Remove all the staples;
4) Open the cardboard box containing the cart;
5) Remove the upper polyethylene foam protection;
6) Draw the cart up from the box together with the transparent protection sack;
7) Separate the cart from its sack;
8) Brake the cart;
9) Open the cart spring levers for the machine fixing;
10) Open the XTRA machine cardboard box;
11) Take the shipping box inside the cardboard. Check inside the box the following items are present:
    a. User Manual English version;
    b. Line cord;
    c. The form **STMPB018** out with the Electrical Safety Test, which must be kept as documentation of the passed test for the Manufacturer guarantee. (Fill the XTRA Unpacking Check; page 16.1-7, point 5);
    d. The first page of the equipment worksheet;
    e. XTRA antidust cover;
12) Remove the upper polyethylene foam protection;
13) Open the machine transparent protection sack;
14) Lift the machine up from the sack and put it on its cart,so that the four holes on the cart fit the bottom part of the machine;
15) Lock the machine to the cart closing the spring levers;
16) Lift the 20 and 25 cm I.V. poles and the display up and remove the display protection;
17) Lift the cartiotomy mast eccentric ring, rotate the cardiotomy support and remove the cardiotomy support protection;
18) Bring the display down;
19) Bring the I.V. pole down;
20) Lift the cartiotomy mast eccentric ring and rotate the cardiotomy support in closed position.
21) Put all the polyethylene foam protection and the transparent protection sack inside the cardboard boxes.
22) Release the trolley brake;
23) Ensure the required line voltage and current comply with what is indicated on the identification labels of the equipment;
24) Connect the mains cable contained into the Country box to the rear part of the equipment and fix it with the cable holder;
25) Lift the XTRA display up.

(INST&TRAN_001) XTRA Installation Procedure rev.00

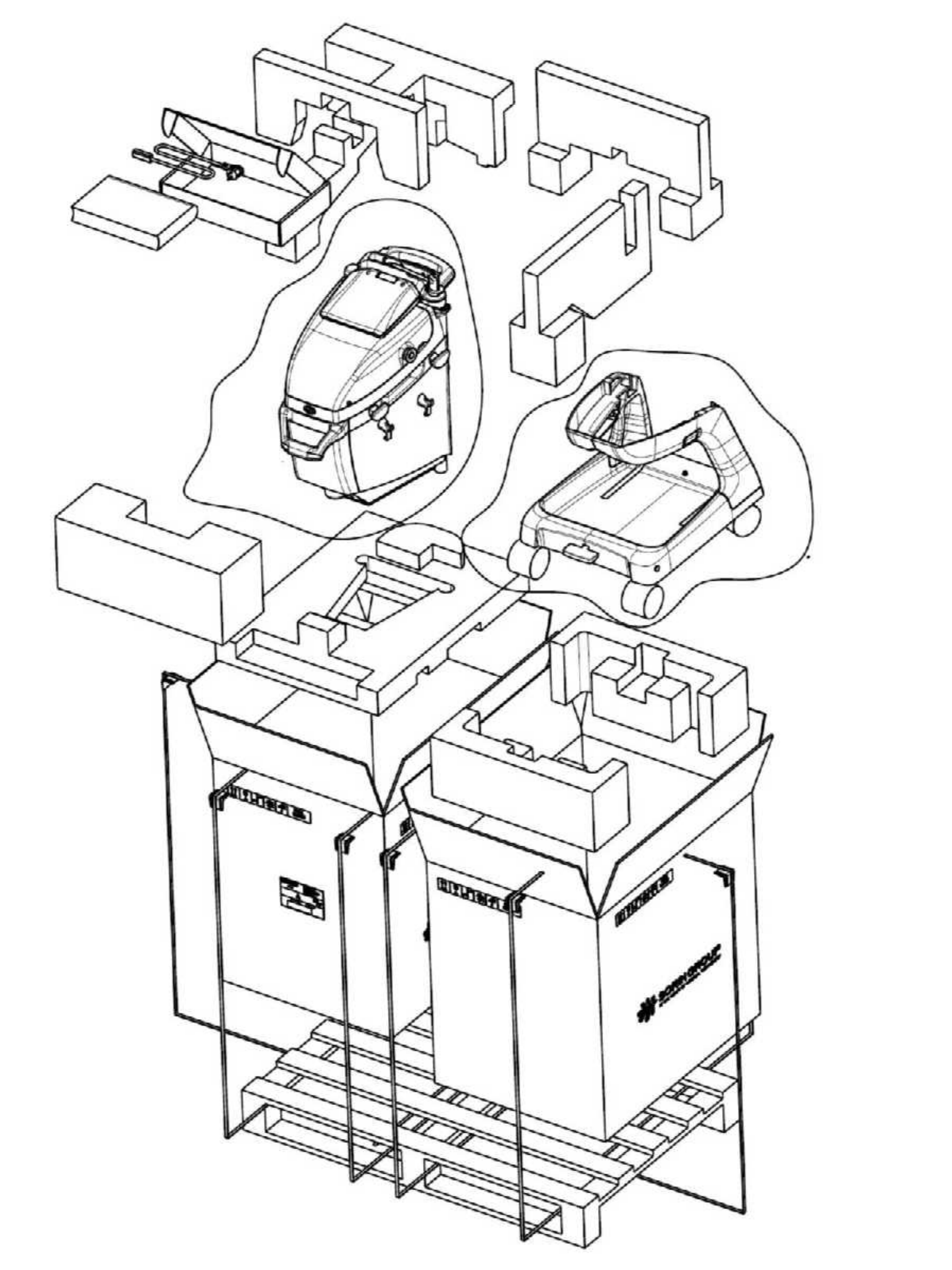


Fig. 16.1-1

16.1.2.4 Functional test

1) Connect the cable to the power network;
2) Switch on the XTRA by pushing the **I/O** button in the rear part of the machine;
3) **The system is booting. Please wait...** message appears;
4) Then **Self test in progress. Please stand by.** message appears;
5) Verify after some seconds the **Set-up** page is shown (Fill the XTRA Unpacking Check; page 16.1-7, point 7);

Fig. 16.1-2

6) Check the bowl arm is in closed position (in the centre of the centrifuge well);
7) Press the **Unload** button;

Fig. 16.1-3

8) As soon as the **BOWL SIZE NOT RECOGNIZED** warning appears, select **125** bowl size and push **Play** (Fill the XTRA Unpacking Check; page 16.1-7, point 8);

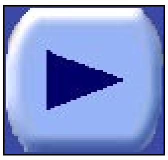


Fig. 16.1-4

9) **Auto-load in progress...** message appears;
10) Check the cover locking system is activated;
11) Check the clamp test is performed;
12) Check the pump runs CCW at low speed;
13) Check that the centrifuge starts running CCW at low speed and contemporary the pump runs CW and CCW at higher speed;

(INST&TRAN_001) XTRA Installation Procedure rev.00

14) The centrifuge and pump stop, some instants after the pump runs CCW again;
15) At this point the locking system is unlocked and the **Ready** page is shown;
16) Check that **125** bowl size, **Popt** protocol and **1Touch** mode appear;

Fig. 16.1-5

17) Press the **Start** button in the **Ready** window;

Fig. 16.1-6

18) Check the locking system is closed and the **Fill** phase starts (Fill the XTRA Unpacking Check; page 16.1-7, point 9);
19) Check that the centrifuge is running at high speed; after some seconds the equipment switch to **Wash** phase and the pump starts to move some turns counter clockwise and clockwise (Fill the XTRA Unpacking Check; page 16.1-7, point 10);
20) When the **WASH BAG EMPTY** warning is shown, push the **Stop** hard key. The centrifuge stops and the cover lock is open;
21) The **Ready** page is displayed;
22) Switch off the equipment;
23) Switch it on again;
24) After the boot phase, as soon as the **Set-Up** page is shown, press the **Menu** button;

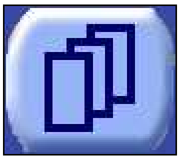


Fig. 16.1-7

25) Press **Settings**;

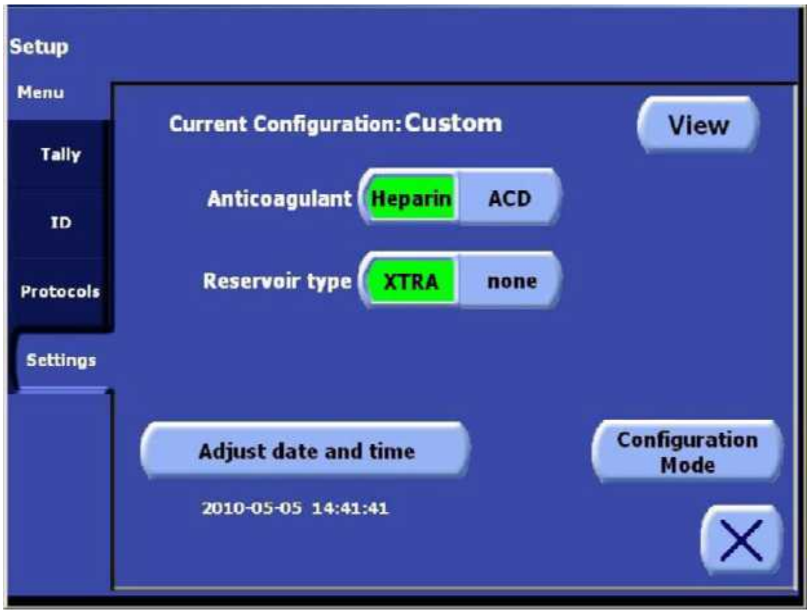


Fig. 16.1-8

26) Press **Adjust date and time** and press the related displets in order to set the date and the time (Fill the XTRA Unpacking Check; page 16.1-7, point 11);
27) Press **Configuration Mode;**

Fig. 16.1-9

28) Enter the password **41037** and then confirm with the relative button;

Fig. 16.1-10

(INST&TRAN_001) XTRA Installation Procedure rev.00

29) In this way you enter the **Configuration Mode** menu (Fill the XTRA Unpacking Check; page 16.1-7, point 12);
30) Push the **Language** button and select the language according to the country (Fill the XTRA Unpacking Check; page 16.1-7, point 13);

Fig. 16.1-11

31) Press **Features** to set the XTRA features as required by the hospital user. There are two pre-defined configurations, **BASIC** and **ADVANCED**, for a personalization for two different typologies of users. Each of the 14 features can be enabled/disabled permitting a full personalization of the equipment (**CUSTOM** configuration). The default configuration is **BASIC**;

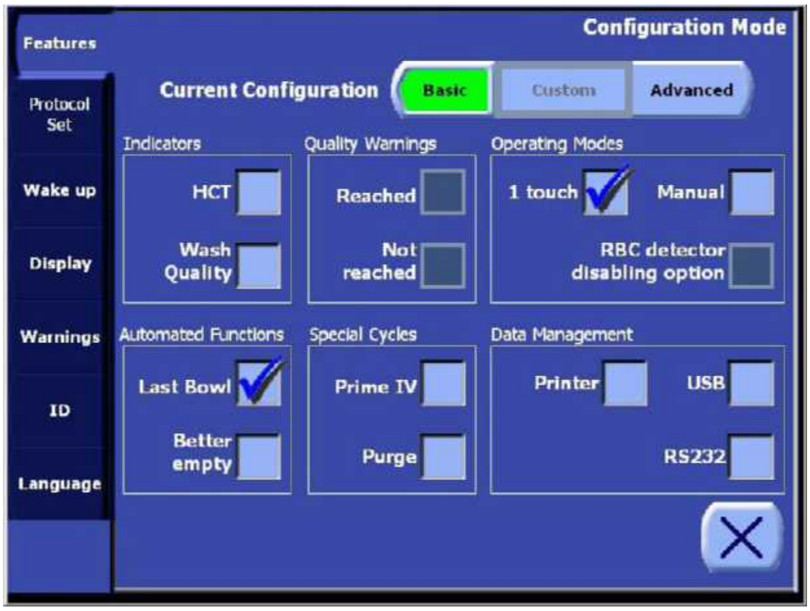
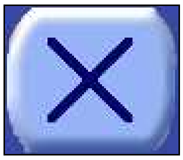


Fig. 16.1-12

32) Set all the other **Configuration Mode** functions according to the **XTRA User Manual**, chapter number **eight**;

33) Close the **Configuration Mode** menu pressing twice the  button;
34) Switch off the XTRA equipment.

NOTE: If one of the **FUNCTIONAL TEST** fails, immediately contact your local Field Service Dept.

After performing the checks please fill and sign the XTRA Unpacking Check form and send it to your representative Field Service Dept.

(INST&TRAN_001) XTRA Installation Procedure rev.00

XTRA UNPACKING CHECK

Hospital_____________________ Country_____________________
Date_________________________ XTRA s/n_____________________

- **Unpacking procedure**

	OK	N.OK
1. Package integrity	☐	☐
2. Country Box	☐	☐
3. IFUs	☐	☐
4. Main supply cables (Schuko, Italian, UK)	☐	☐
5. STMPB018 Electrical Safety Test sheet	☐	☐
6. XTRA antidust cover	☐	☐

- **Functional test**

7. Set up page	☐	☐
8. Select bowl	☐	☐
9. Fill phase	☐	☐
10. Wash phase	☐	☐
11. Adjust date and time	☐	☐
12. Configuration Mode	☐	☐
13. Language selection	☐	☐

Company Rep. Notes

Customer Notes

Company Rep. Signature

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16.2 (INST&TRAN_002) Unpacked XTRA transport procedure rev.00

16.2.1 About this card

The purpose of this card is to describe the way to move the equipment from one side to another without the original package.

16.2.2 Unpacked XTRA Transportation

XTRA is generally designed for an easy and secure transportability. It was validated through tests, which exceed the normal car/truck shift conditions, according to the EN24180/2 standard.
Nevertheless, some simple precautions should be taken for an optimal transportation.

16.2.2.1 Transportation in small volume (example: by car)

- Take the XTRA out from the cart (see Fig.16.2-1): the cart can be handled without particular precautions (it is only a mechanical component);

Fig. 16.2-1

- Set XTRA in vertical position (see next figure);

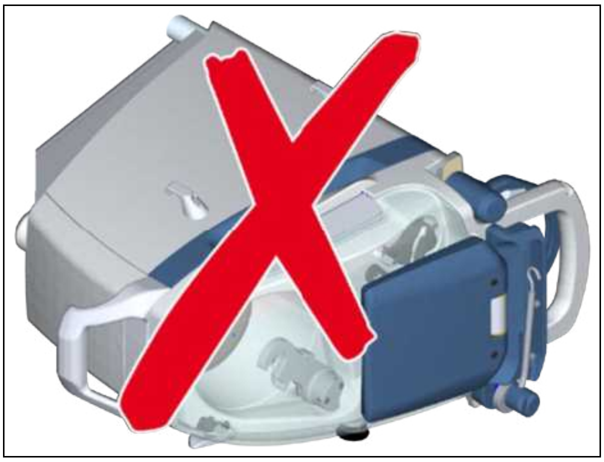

Fig. 16.2-2

- Fold the XTRA in at least one pluriball sheet (to prevent scratches);

(INST&TRAN_002) Unpacked XTRA transport procedure rev.00

- Use the car belts to hold the XTRA on the back seat in vertical position.

Fig. 16.2-3

16.2.2.2 Transportation in larger volume (example: by truck)

Same precautions as above described are to be taken, but the XTRA can remain on its trolley (making sure the brake is activated); pluriball protection and belts should be used to prevent scratches and shifting during transport. Keep the unit steady in vertical position.

Fig. 16.2-4

17 SPARE PARTS AND TOOLS

17.1 (SPART&TOOLS_001) Spare parts rev.00

Tav. 1: Top

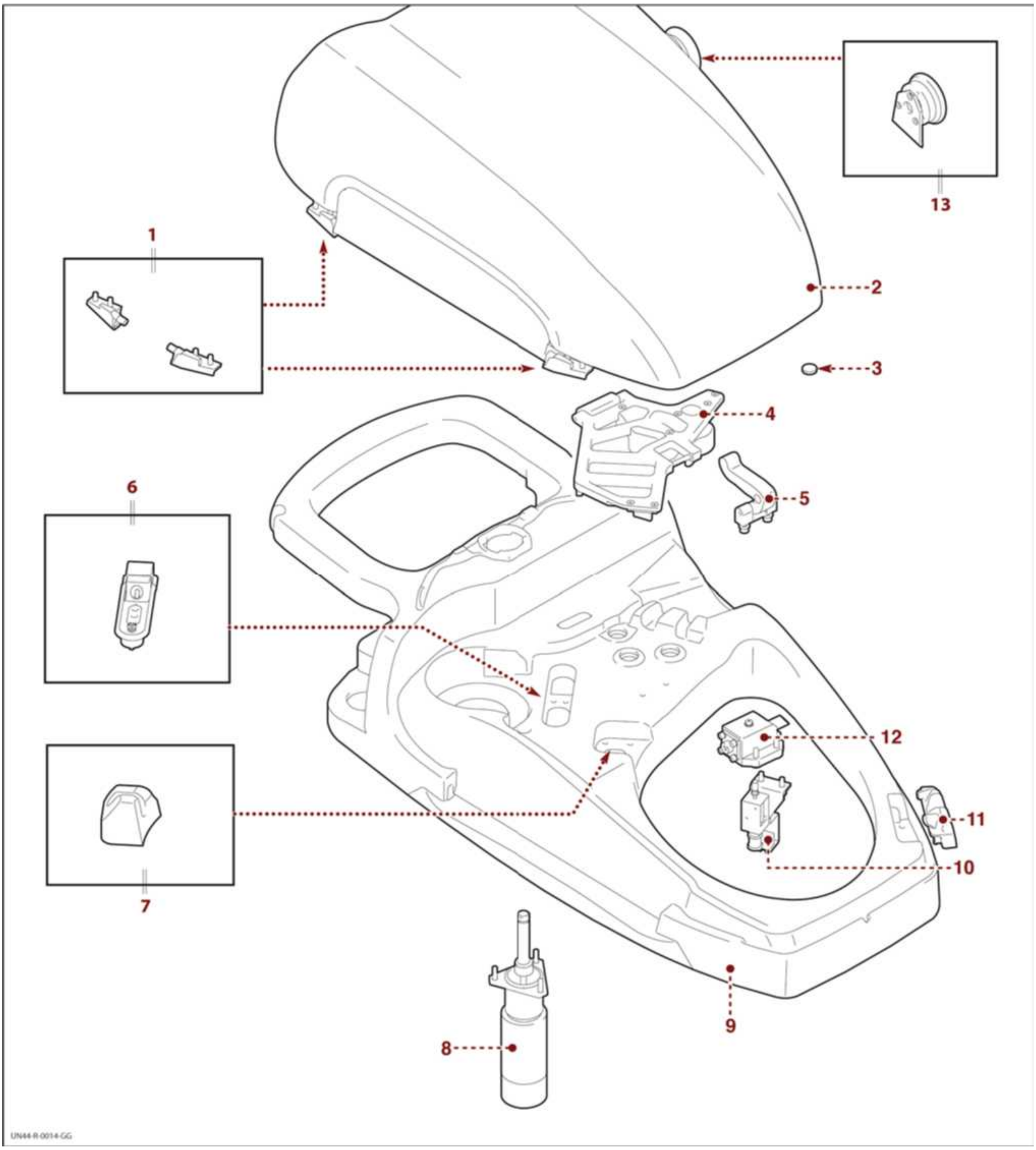

Fig. 17.1-1

(SPART&TOOLS_001) Spare parts rev.00

Number	Code	Description	Notes
1	65688	Cover Hinges	
2	65703	XTRA Cover	
3	65610	Cover Magnet	
4	65693	XTRA Latch	
5	65694	Latch Lever	
6	65623	Bar-code Holder and HCT	
7	65604	Air Sensor	
8	65613	Disposable Ejector	
9	65705	XTRA Top	
10	65609	Cover Locking System	
11	65653	Waste Line Color Indicator	
12	65689	Cover Lock Pivot	
13	65687	Cover Closing Group	

Table 17.1-1

(SPART&TOOLS_001) Spare parts rev.00

Tav. 2: Pump Group

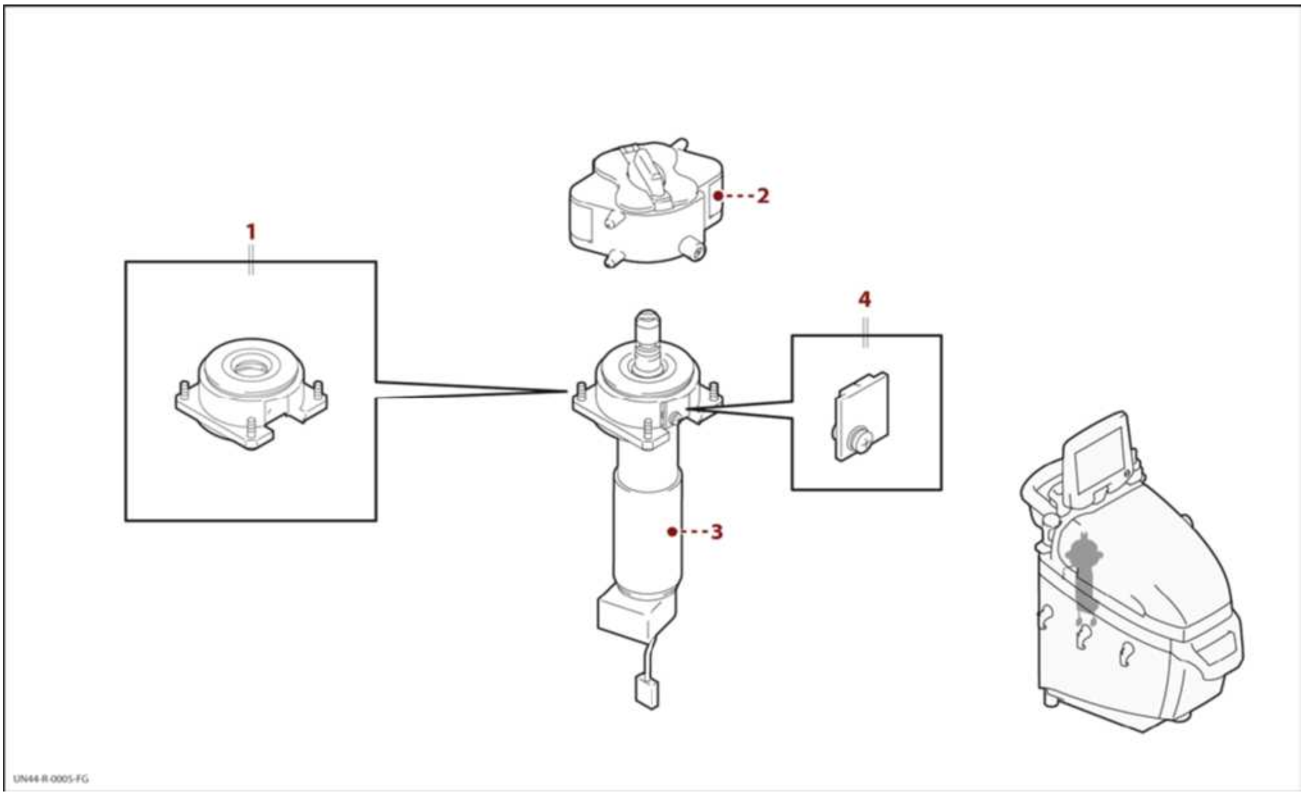

Fig. 17.1-2

Number	Code	Description	Notes
1	65692	Fixing Pump Plate	
2	65697	Pump Rotor	
3	65645	Pump Motor	
4	65622	HS-P Pump Sensor	

Table 17.1-2

Tav. 3: Centrifuge Group

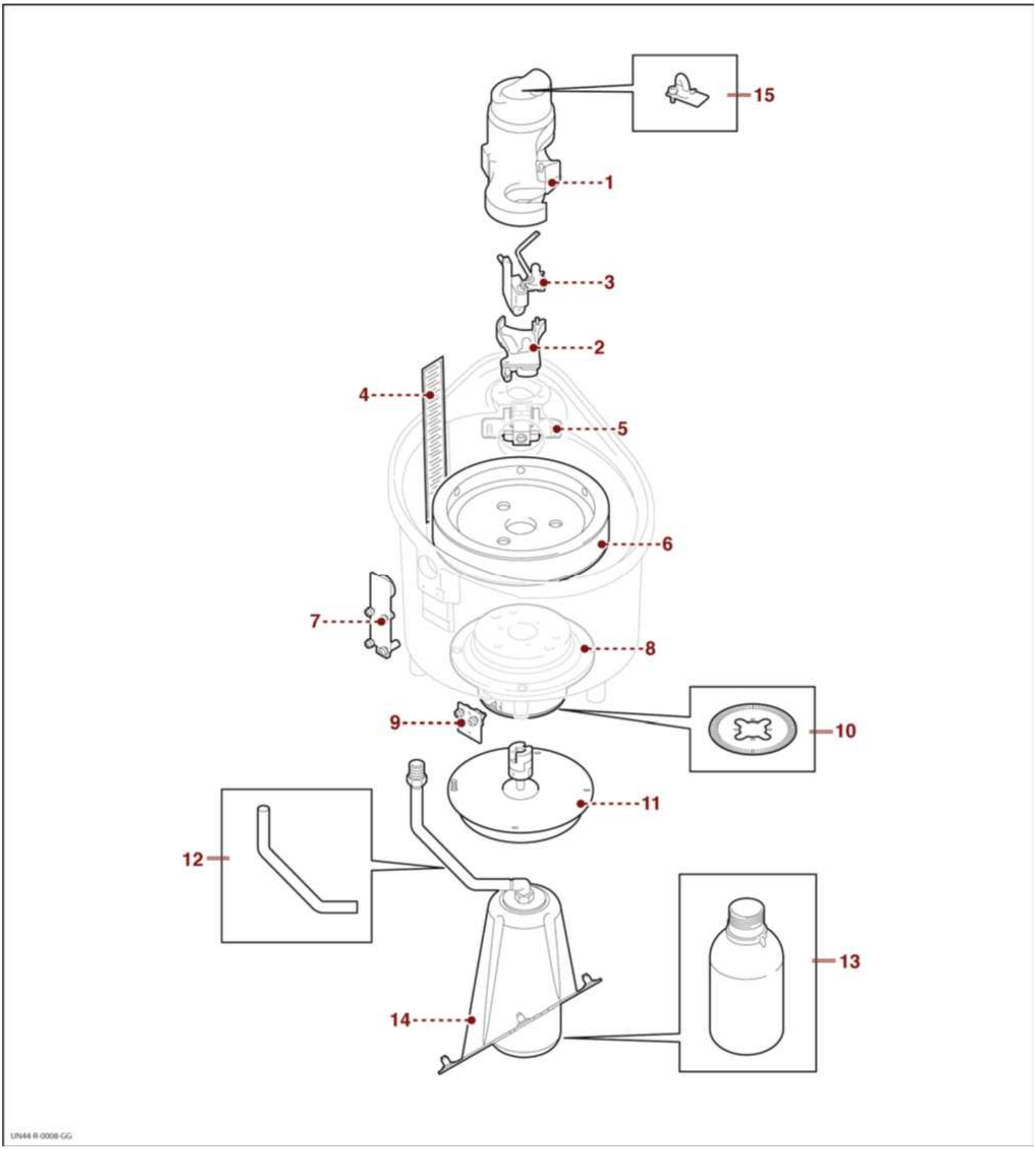

Fig. 17.1-3

(SPART&TOOLS_001) Spare parts rev.00

Number	Code	Description	Notes
1	65620	Bowl Arm	
2	65626	Low Level RBC Detector Illuminator	
3	65618	High Level RBC Detector	
4	65633	NBLS Fluid Loss Sensor	
5	65625	Low Level RBC Detector	
6	65685	Centrifuge Plate	
7	65636	NLB Internal Centrifuge Light	
8	65683	Centrifuge Chuck	
9	65614	ENC Centrifuge Encoder Switch	
10	65684	Centrifuge Encoder Disk	
11	65605	Centrifuge Motor	
12	65704	XTRA Drain Tubing	
13	65696	Liquid Collection Tank	
14	65695	Liquid Collection Tank Group	
15	65677	HS-A Bowl Arm Sensor	

Table 17.1-3

Tav. 4: Clamp Group

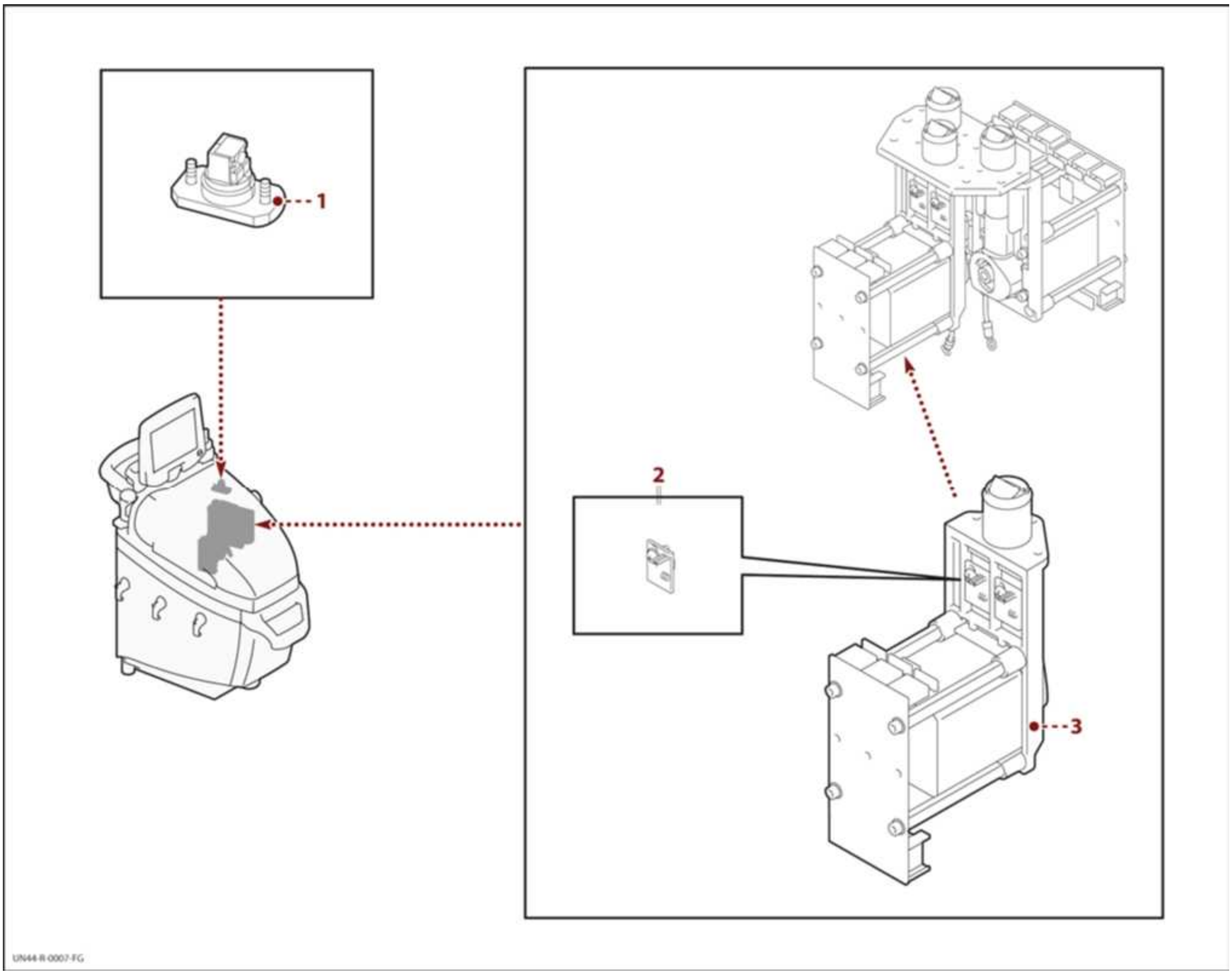

Fig. 17.1-4

Number	Code	Description	Notes
1	65607	Clamped Empty Line Sensor	
2	65607	HS-C Clamp Sensor	
3	65606	XTRA Clamp	

Table 17.1-4

Tav. 5: Display Group

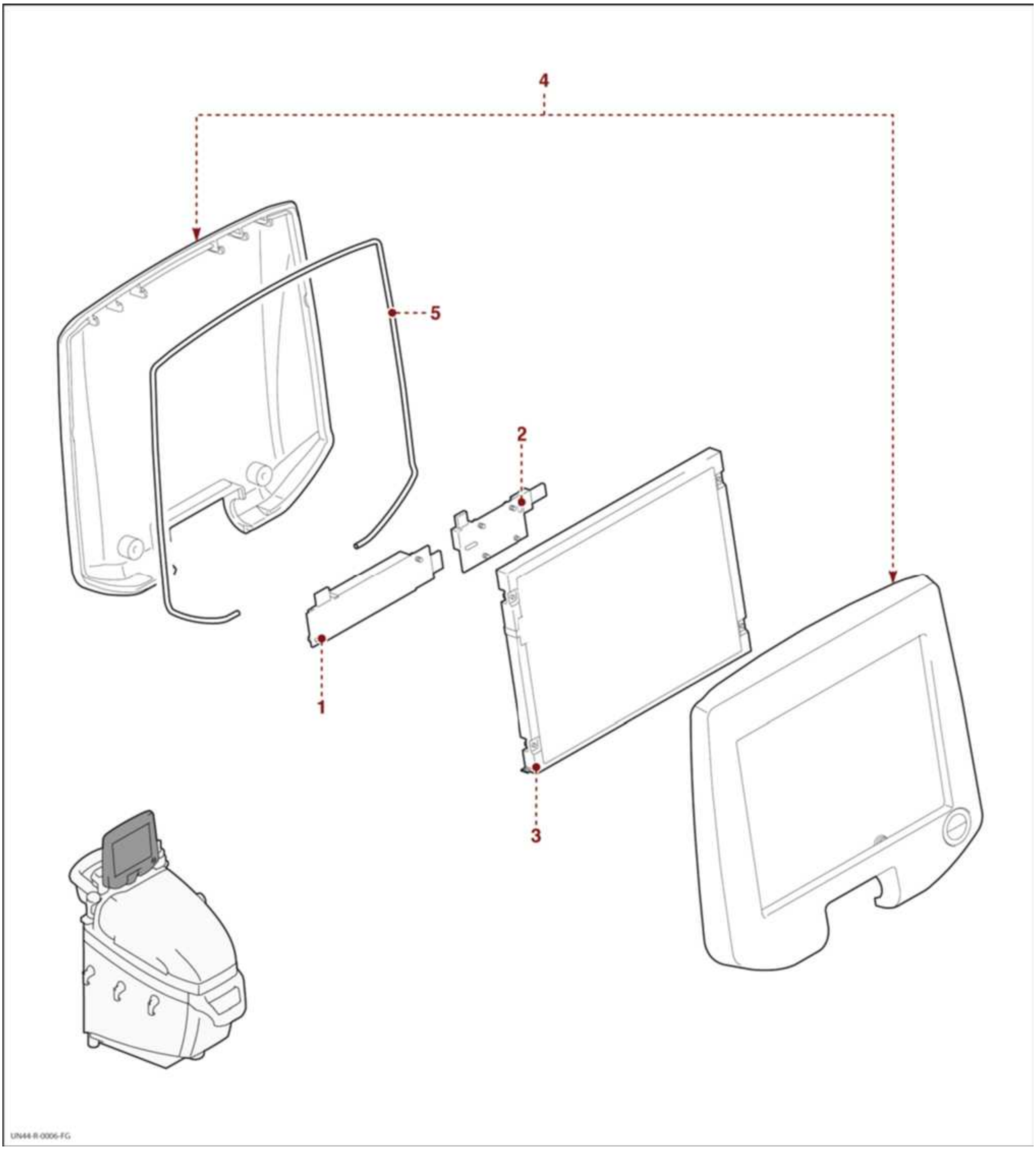

Fig. 17.1-5

Number	Code	Description	Notes
1	65612	Display Inverter	
2	65652	Touch Screen Control Board	
3	65611	XTRA Display	
4	65608	XTRA Display Cover	
5	65690	Display Cover Gasket	

Table 17.1-5

Tav. 6: Electronic boards

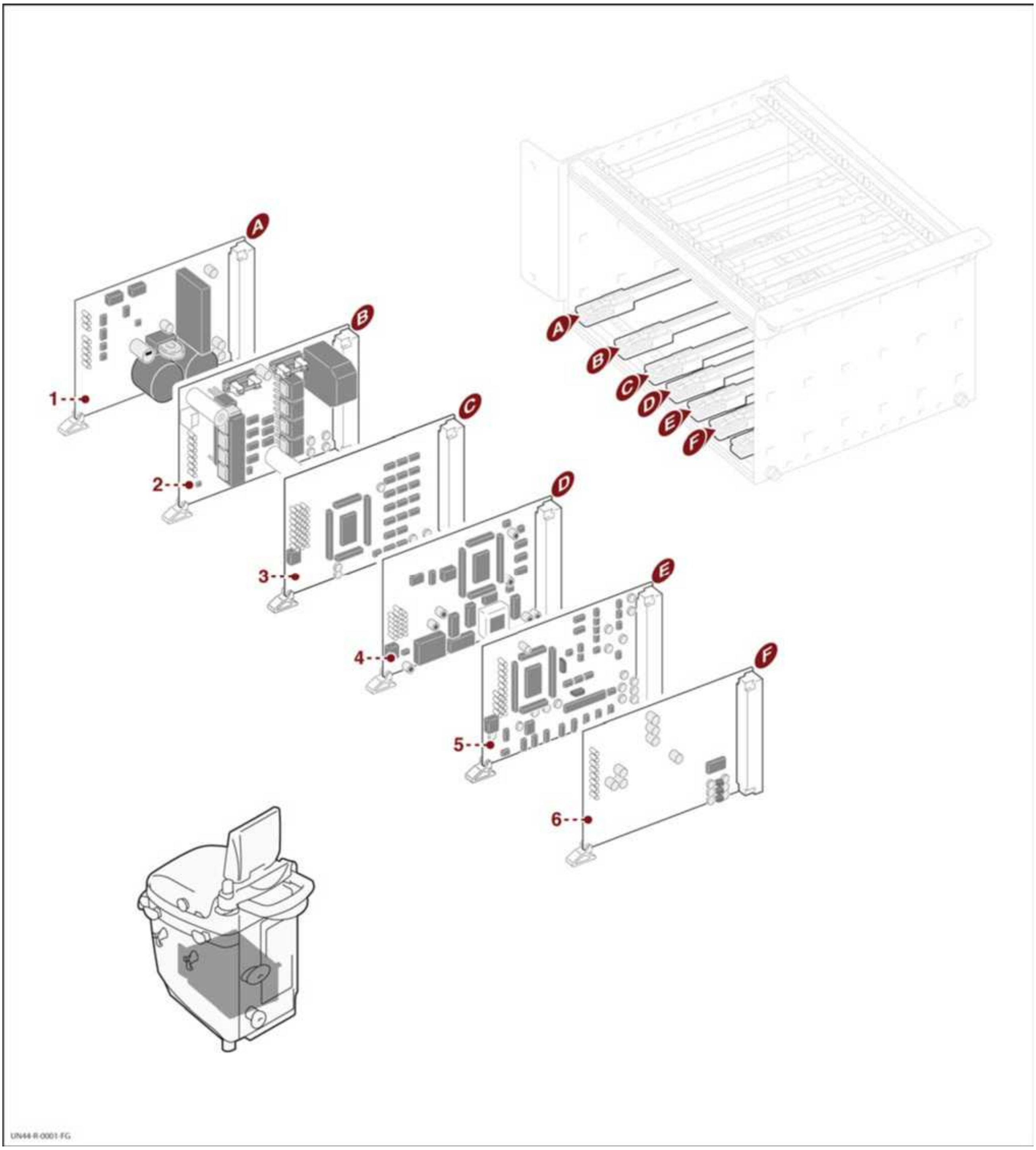

Fig. 17.1-6

Number	Code	Description	Notes
1	65639	NPS p.c. board	
2	65629	NAD p.c. board	
3	65628	NAC p.c. board	
4	65638	NMC p.c. board	
5	65641	NSC p.c. board	
6	65640	NSA p.c. board	

Table 17.1-6

Tav. 7: Electronic boards

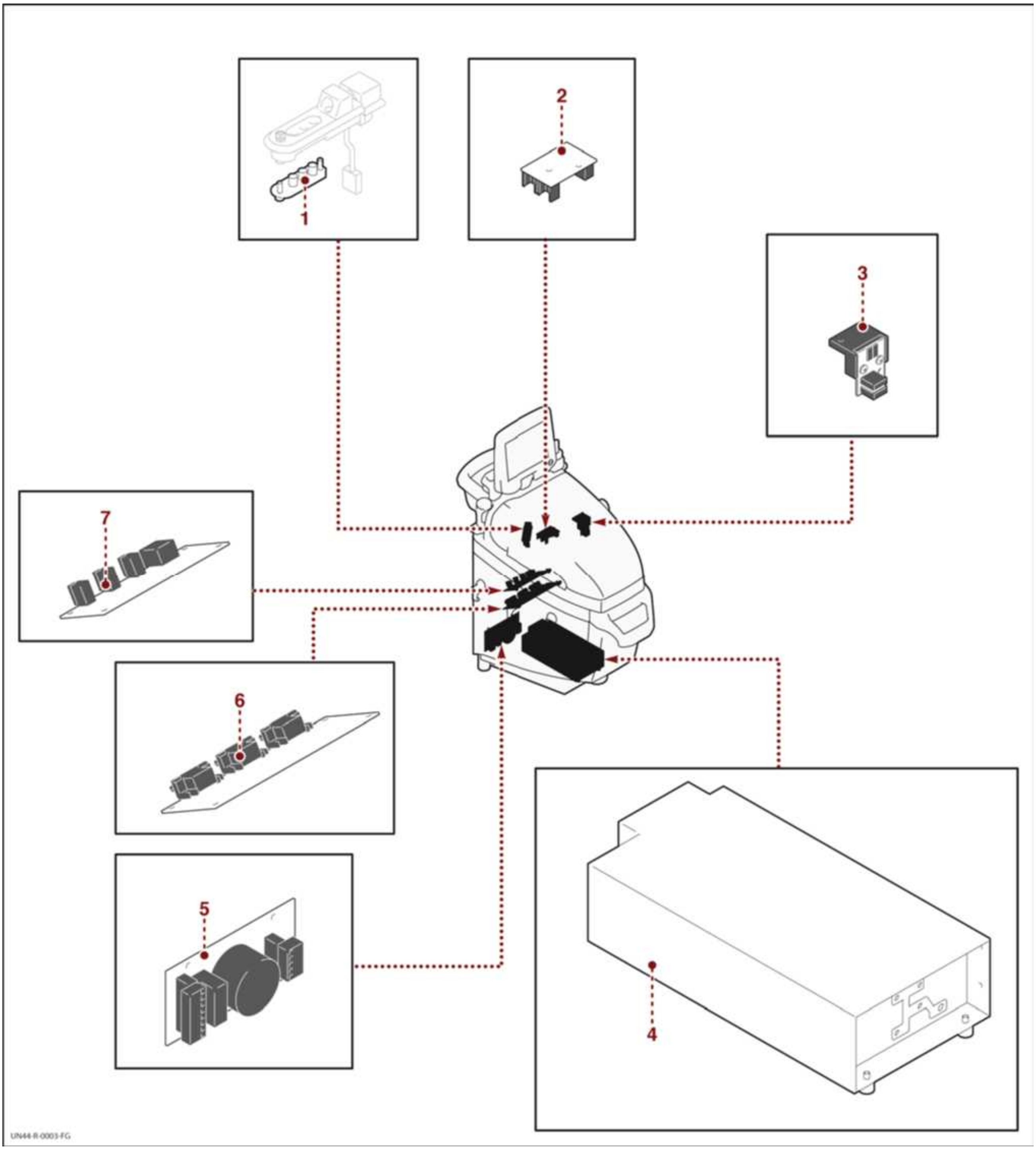

Fig. 17.1-7

(SPART&TOOLS_001) Spare parts rev.00

Number	Code	Description	Notes
1	65632	NBC p.c. board	
2	65617	HHR p.c. board	
3	65635	NCH p.c. board	
4	65642	Power Supply	
5	65627	MFN p.c. board	
6	65649	SIR p.c. board	
7	65619	HIR p.c. board	

Table 17.1-7

Tav. 8: Electronic boards

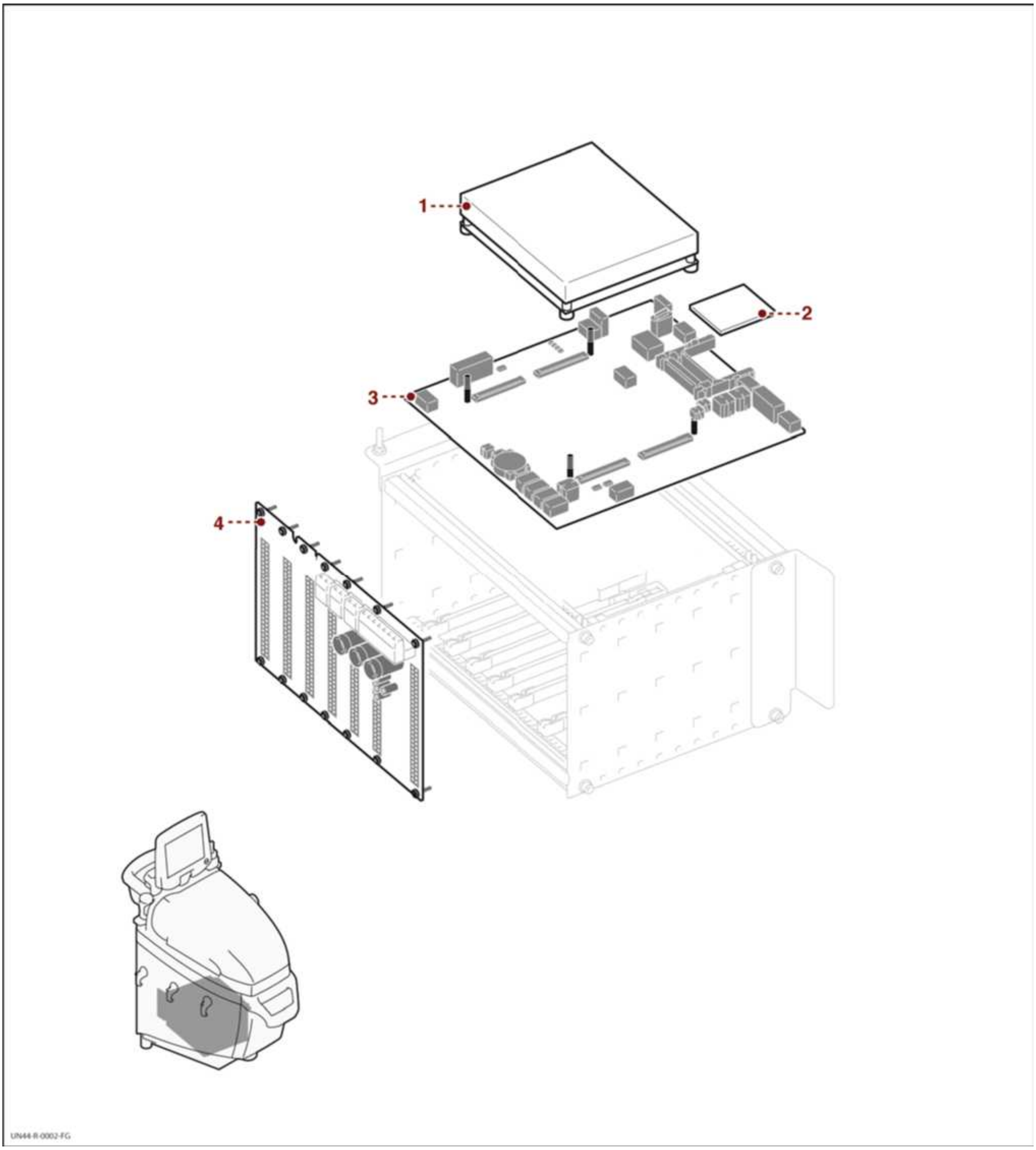

Fig. 17.1-8

(SPART&TOOLS_001) Spare parts rev.00

Number	Code	Description	Notes
1	65654	XTRA PC	
2	65650	XTRA Flash PC	
3	65631	NBB p.c. board	
4	65634	NBP p.c. board	

Table 17.1-8

Tav. 9: Rear Panel

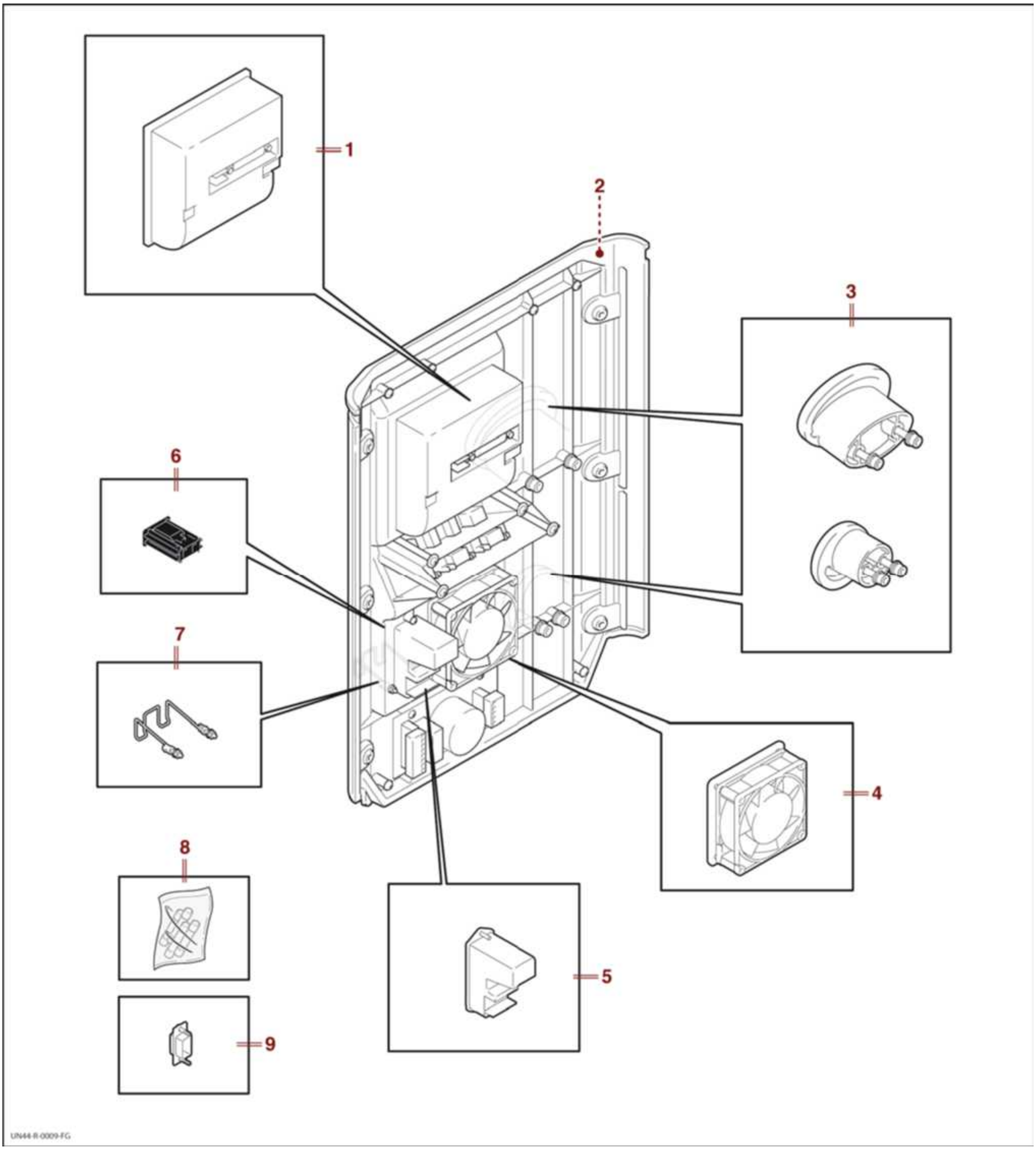

Fig. 17.1-9

Number	Code	Description	Notes
1	65644	Printer	
2	65699	Rear Panel	
3	65698	Power Cord Wrap	
4	65646	Recirculation Fan	
5	65647	Schurter Module	
6	65616	Fuses Holder	
7	65680	Cable Holder	
8	65615	Fuses	
9	65648	Serial Connector Cap	

Table 17.1-9

Tav. 10: Panel Group

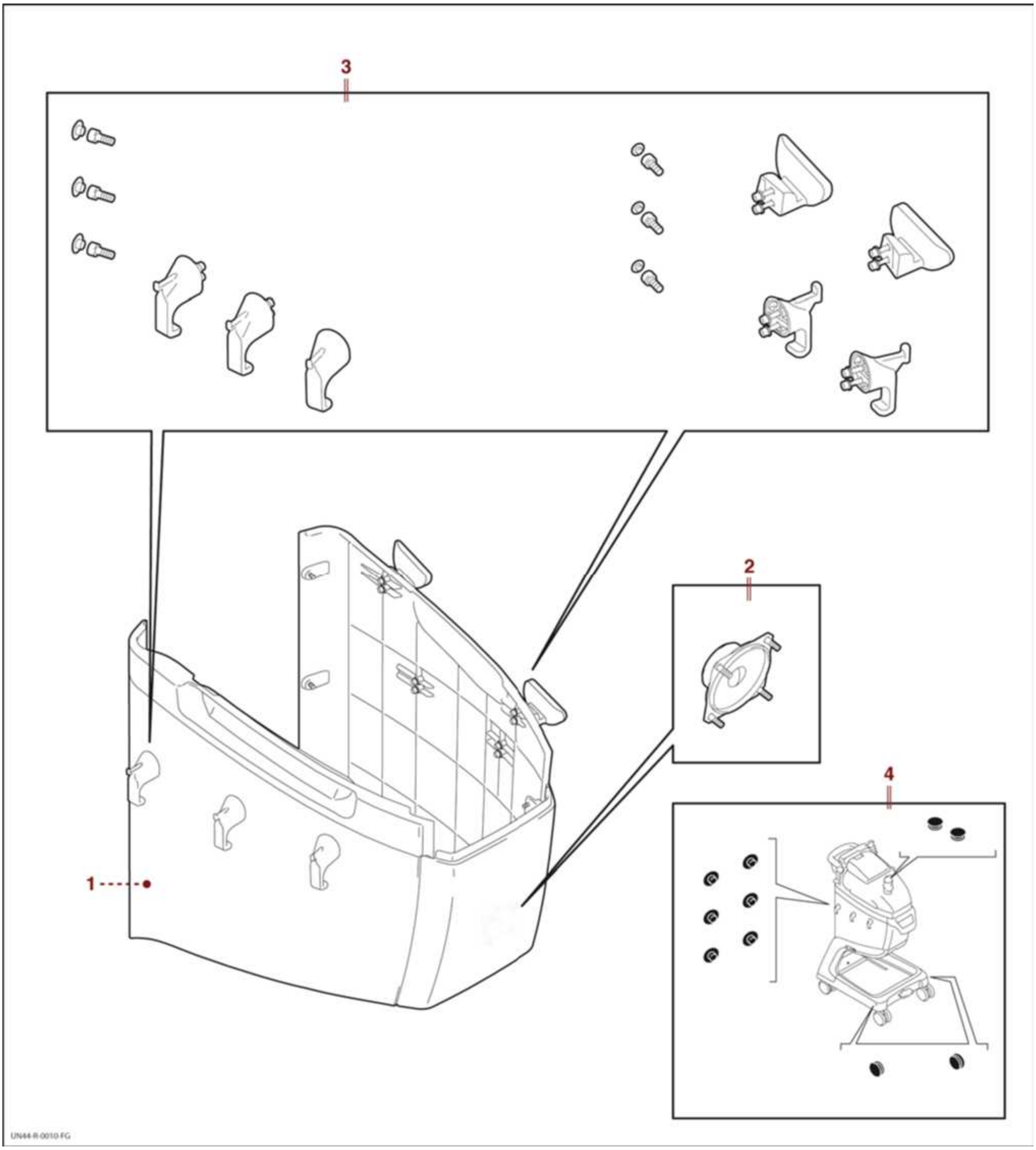

Fig. 17.1-10

(SPART&TOOLS_001) Spare parts rev.00

Number	Code	Description	Notes
1	65700	XTRA Side and Front Panels	
2	65651	XTRA Speaker	
3	65676	Blister and Waste Bag Supports	
4	65702	XTRA Caps Set	

Table 17.1-10

(SPART&TOOLS_001) Spare parts rev.00

Tav. 11: I.V. Pole and Cardiotomy Mast

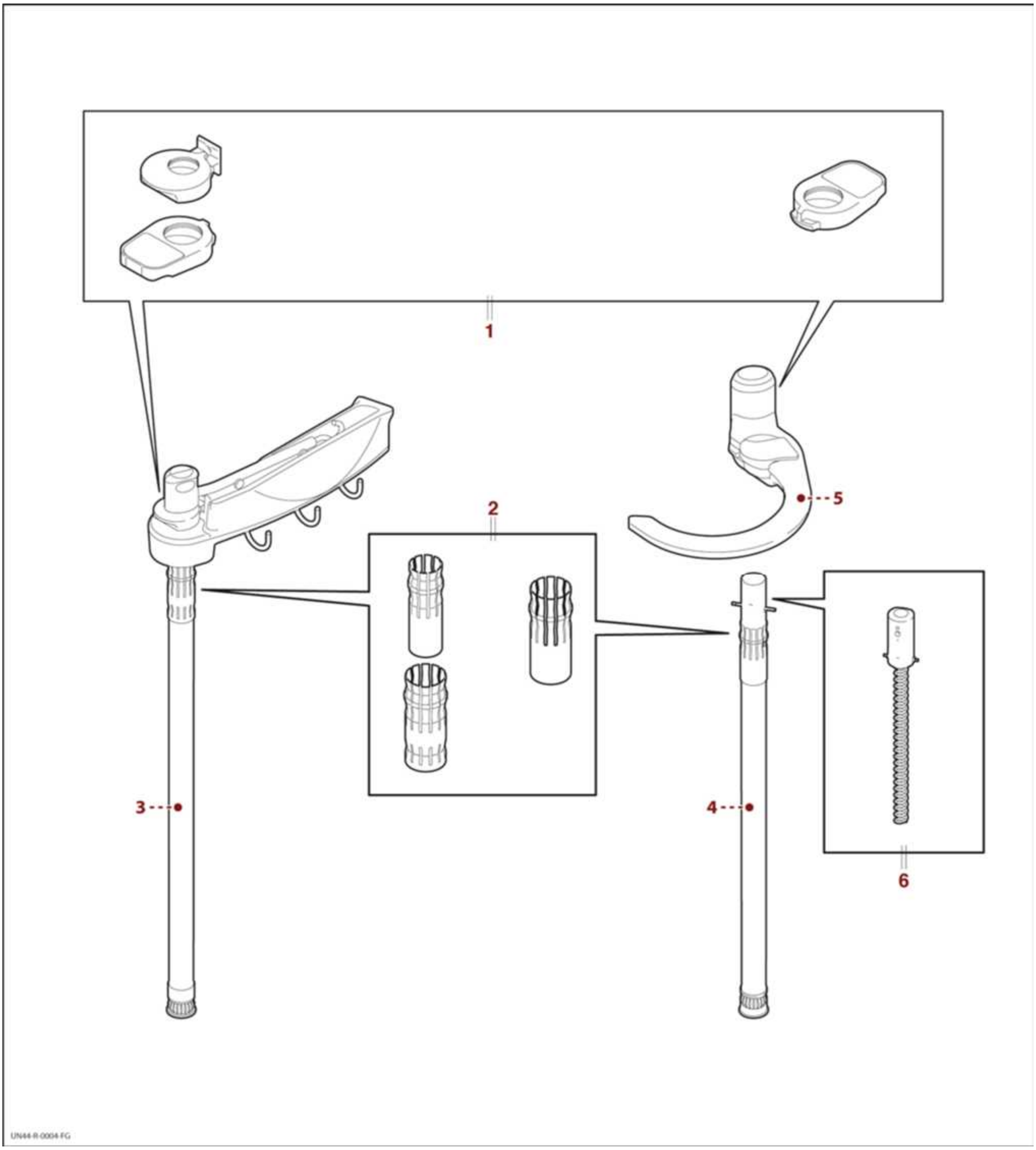

Fig. 17.1-11

(SPART&TOOLS_001) Spare parts rev.00

Number	Code	Description	Notes
1	65691	Eccentric Rings	
2	65679	XTRA Bushings	
3	65686	Complete I.V. Pole	
4	65681	Cardiotomy Mast	
5	65682	Cardiotomy Support	
6	65624	Load Cell	

Table 17.1-11

Tav. 12: Accessories

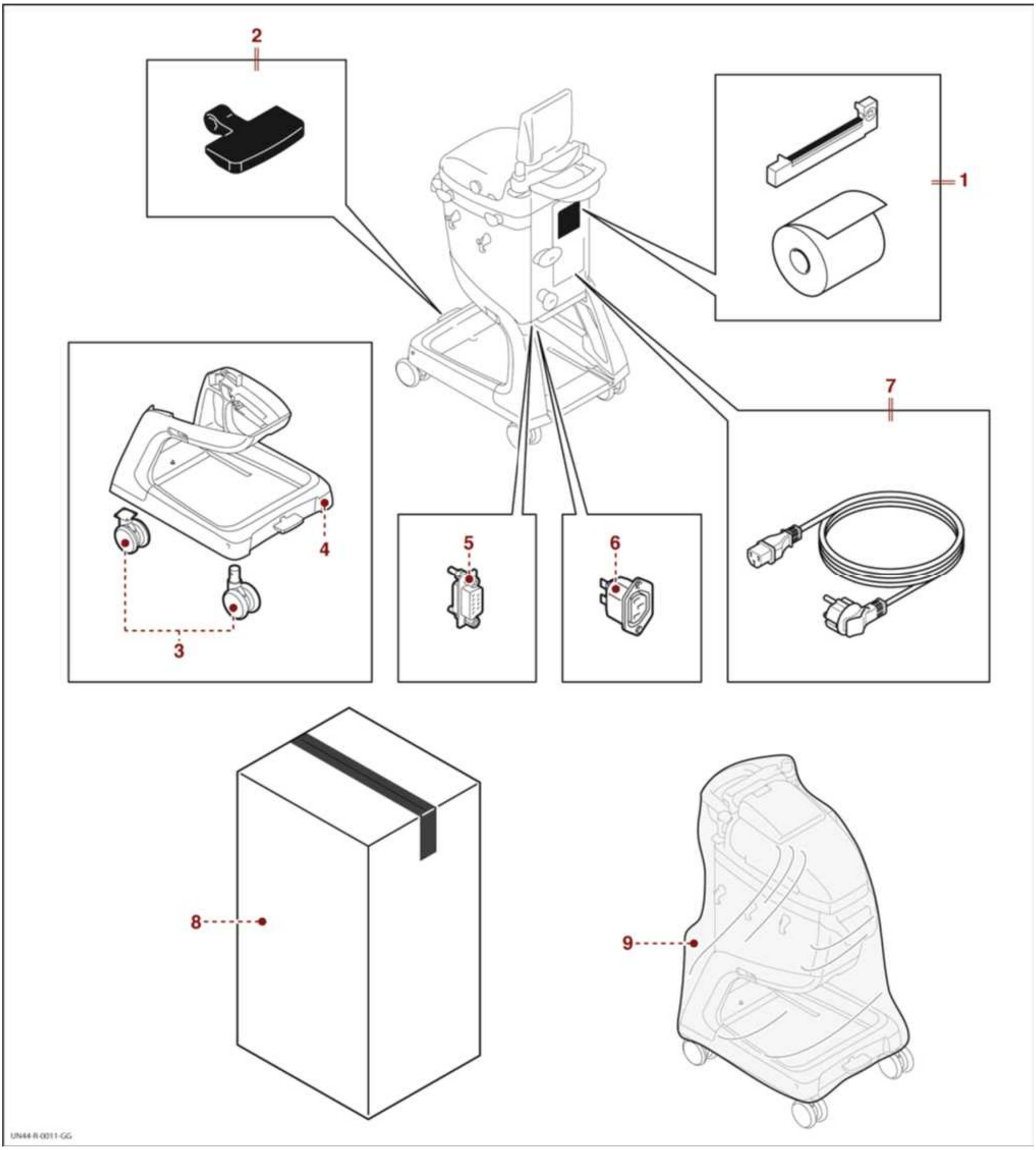

Fig. 17.1-12

Number	Code	Description	Notes
1	65643	Printer Ink and Paper	
2	65678	Brake Pedal	
3	65701	XTRA Wheels	

4	65716	XTRA Cart	
5	65655	XTRA Serial Socket to XVAC	
6	65656	XTRA Line Socket to XVAC	
7	65603	220 V Line Cord	For 220 V countries
	65602	110 V Line Cord	For 110 V countries
8	65713	XTRA Packaging	
9	65666	Dust Cover	

Table 17.1-12

17.2 (SPART&TOOLS_002) Tools rev.00

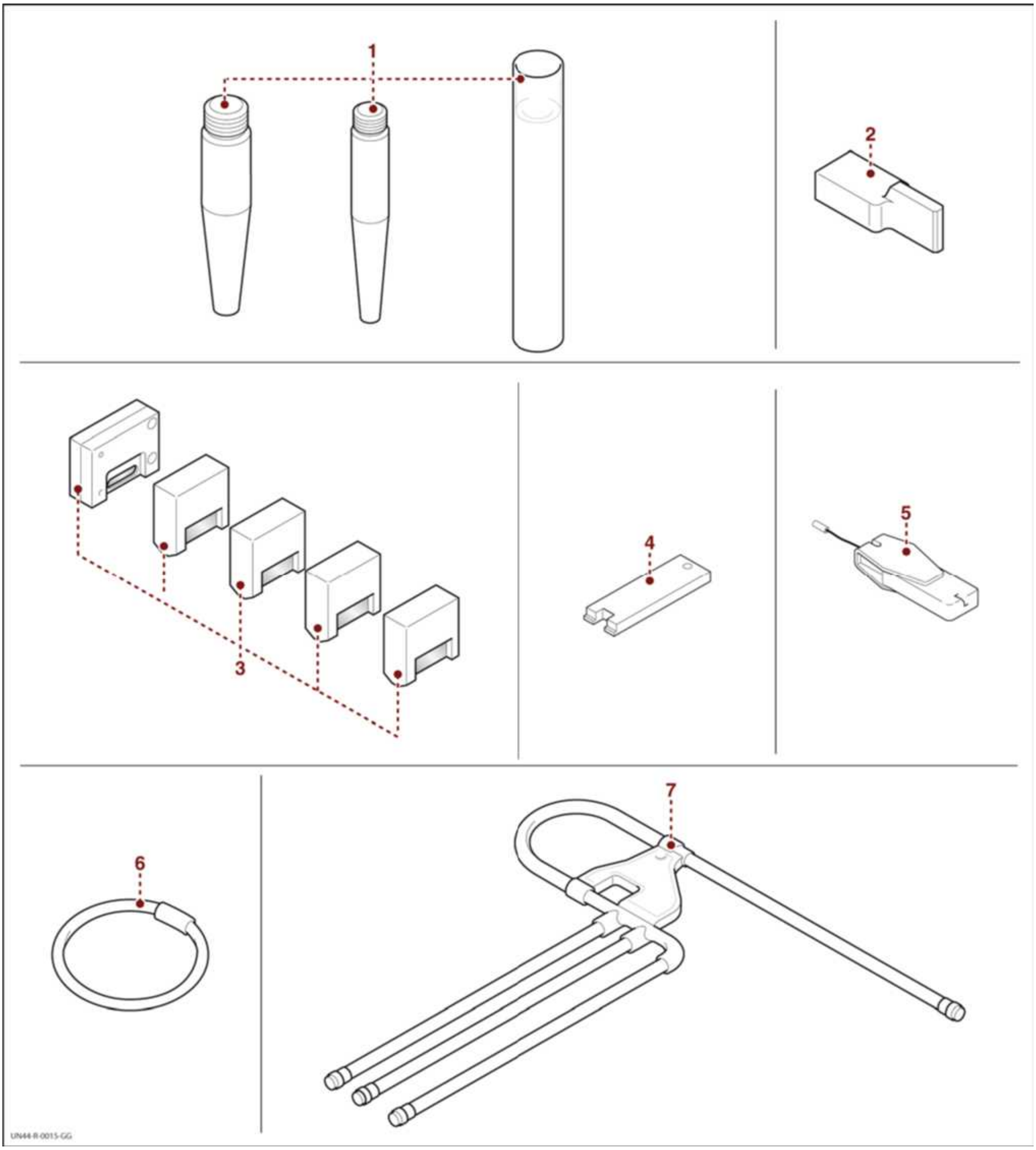

Fig. 17.2-1

(SPART&TOOLS_002) Tools rev.00

Number	Code	Description	Notes
1	63040	I.V. POLE MOUNTING TOOLS	
2	63053	CLAMPED EMPTY LINE SENSOR TOOL	
3	63042	OPTICAL FILTER SET	
4	63050	HS-C CALIBRATION TOOL	
5	63049	XTRA FIELD SERVICE USB STICK	
6	63047	AIR SENSOR TOOL	
7	63046	PUMP AND CLAMP OCCLUSION SET	

(SPART&TOOLS_002) Tools rev.00

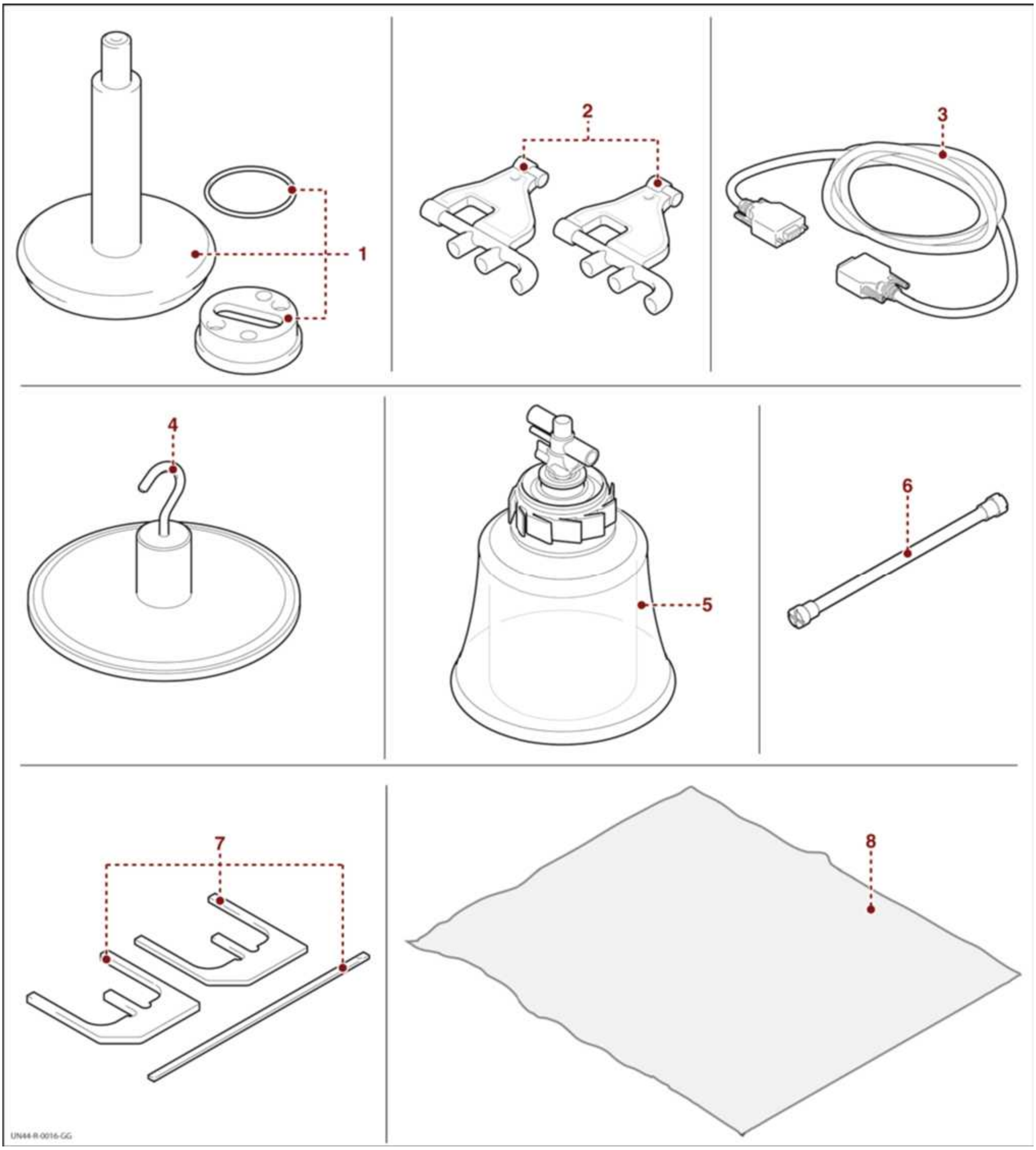

Fig. 17.2-2

(SPART&TOOLS_002) Tools rev.00

1	63051	BOWL ARM CENTERING TOOL	
2	63045	BAR CODE READER LABEL SET	
3	63052	PROGRAMMING CABLE	
4	63041	WEIGHING SYSTEM TOOL	
5	63044	RBC DECTOR TEST BOWL	
6	63048	WASTE LINE COLOR INDICATOR TOOL	
7	63043	CLAMP THICKNESS GAUGE TOOL	
8	63054	RBC DET. LIGHT PROTECTION COVER	

18 SCHEMATICS rev.00

18.1 XTRA Schematics Overview rev.00

18.1.1 About this card

The purpose of this card is to give an overview about XTRA schematics.

Present release includes:

- General **XTRA Wiring.**

- Boards (Layout and Electrical schematics):
  - **NMC -** XTRA Master board;
  - **NBB -** XTRA Base board;
  - **NBP -** XTRA Back Plane board;
  - **NAC -** XTRA Actuator CPU board;
  - **NAD -** XTRA Actuator Driver board;
  - **MFN -** XTRA Main Filter board;
  - **HIR -** XTRA USB Hub board;
  - **CBN -** XTRA Clamps board;
  - **NPS -** XTRA Power Supply board;
  - **SIR -** XTRA Serial Interface board;
  - **NSA -** XTRA Sensor Analog board;
  - **NSC -** XTRA Sensor CPU board;
  - **HHR -** XTRA HGB and HCT receivers board;
  - **NBC -** XTRA Bar Code interface board.

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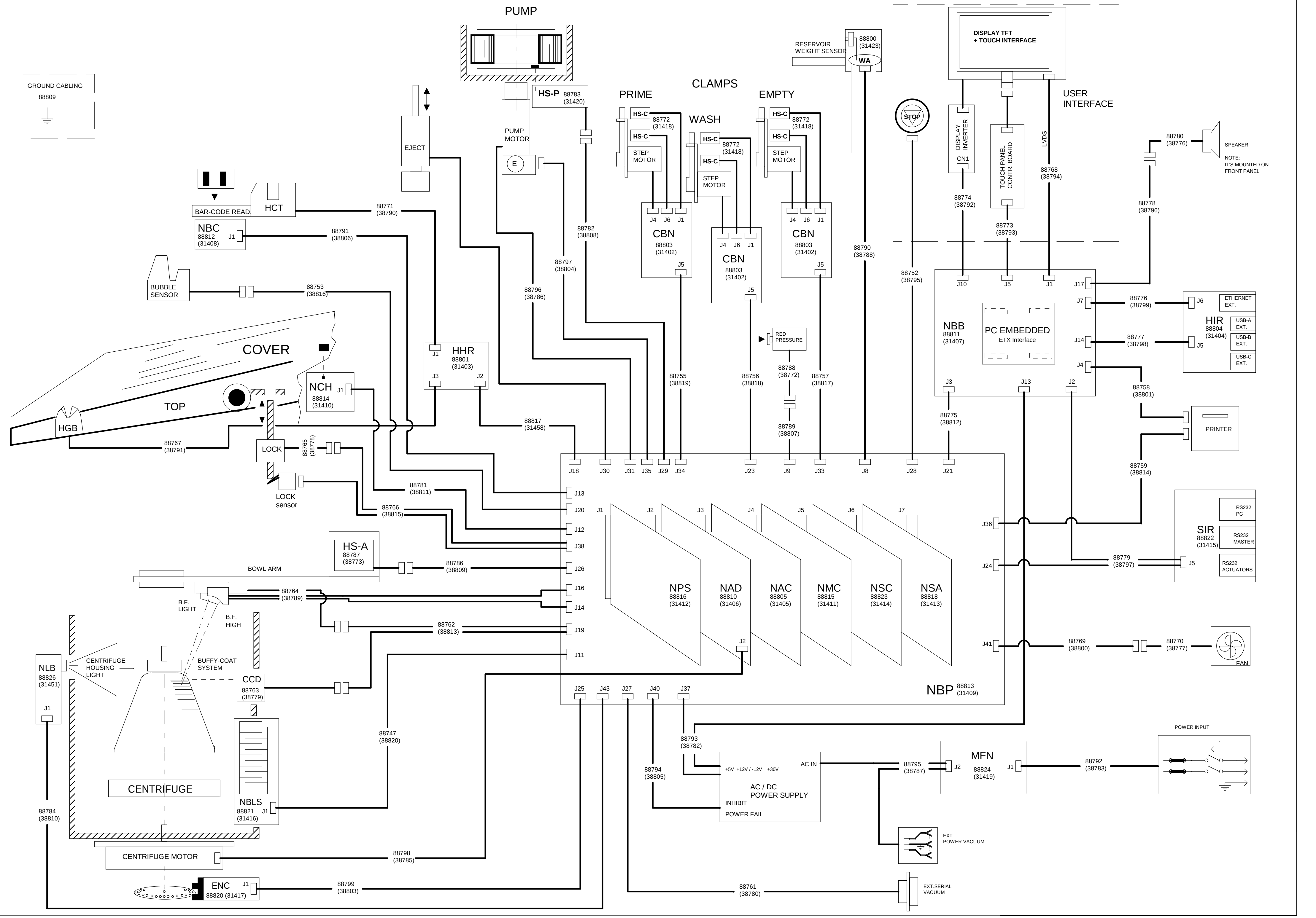
18.2 Wiring Schematics rev.00

18.2.1 About this card

The purpose of this card is to illustrate the XTRA **wiring** schematics

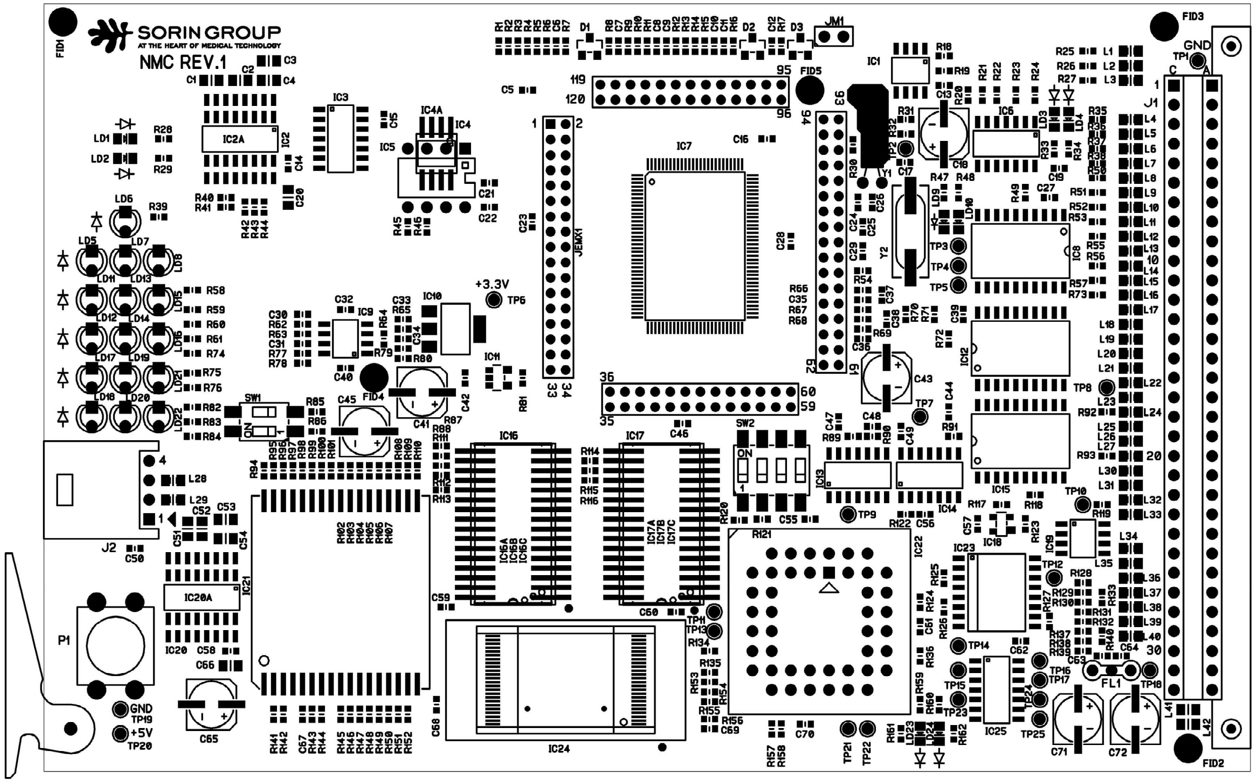


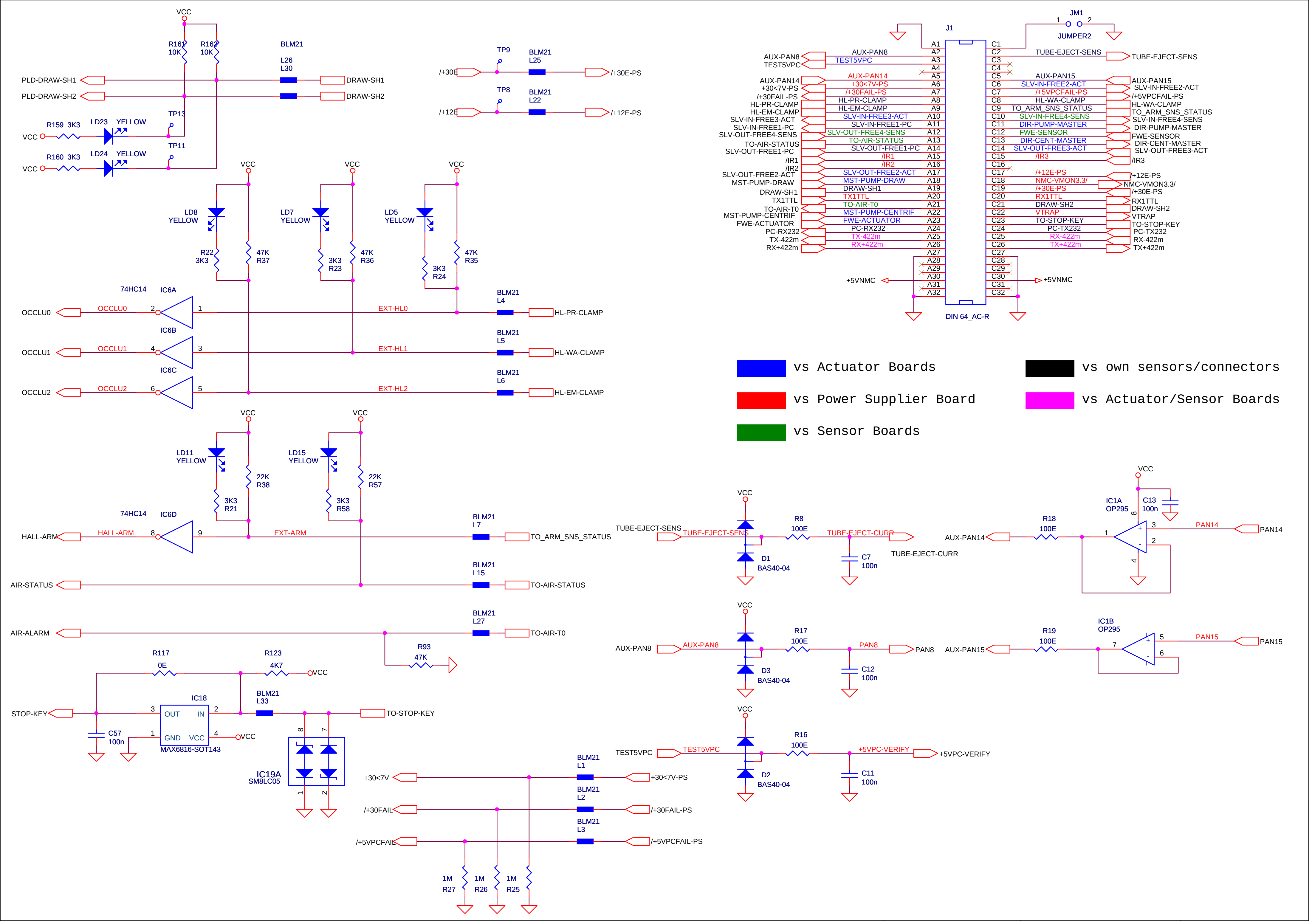
PUMP
GROUND CABLING
88809
HS-P 88783 (31420)
PUMP MOTOR
E
EJECT
PRIME
CLAMPS
WASH
EMPTY
HS-C
88772 (31418)
STEP MOTOR
CBN 88803 (31402)
RESERVOIR WEIGHT SENSOR
88800 (31423)
WA
STOP
DISPLAY TFT + TOUCH INTERFACE
DISPLAY INVERTER
CN1
TOUCH PANEL CONTR. BOARD
LVDS
USER INTERFACE
SPEAKER
NOTE: IT'S MOUNTED ON FRONT PANEL
88780 (38776)
88778 (38796)
88768 (38794)
88774 (38792)
88773 (38793)
BAR-CODE READ
HCT
NBC 88812 (31408)
88771 (38790)
88791 (38806)
BUBBLE SENSOR
88753 (38816)
88782 (38808)
88797 (38804)
88796 (38786)
88790 (38788)
88752 (38795)
NBB 88811 (31407)
PC EMBEDDED
ETX Interface
HIR 88804 (31404)
ETHERNET EXT.
USB-A EXT.
USB-B EXT.
USB-C EXT.
88776 (38799)
88777 (38798)
COVER
TOP
HGB
NCH 88814 (31410)
HHR 88801 (31403)
RED PRESSURE
88755 (38819)
88756 (38818)
88788 (38772)
88757 (38817)
88758 (38801)
PRINTER
88775 (38812)
88817 (31458)
88767 (38791)
LOCK
88765 (38778)
LOCK sensor
88789 (38807)
88759 (38814)
88781 (38811)
88766 (38815)
HS-A 88787 (38773)
BOWL ARM
88786 (38809)
SIR 88822 (31415)
RS232 PC
RS232 MASTER
RS232 ACTUATORS
88779 (38797)
B.F. LIGHT
B.F. HIGH
88764 (38789)
88762 (38813)
NPS 88816 (31412)
NAD 88810 (31406)
NAC 88805 (31405)
NMC 88815 (31411)
NSC 88823 (31414)
NSA 88818 (31413)
88769 (38800)
88770 (38777)
FAN
NLB 88826 (31451)
CENTRIFUGE HOUSING LIGHT
BUFFY-COAT SYSTEM
CCD 88763 (38779)
NBP 88813 (31409)
88747 (38820)
88793 (38782)
88794 (38805)
POWER INPUT
+5V +12V / -12V +30V
AC IN
AC / DC POWER SUPPLY
INHIBIT
POWER FAIL
MFN 88824 (31419)
88795 (38787)
88792 (38783)
CENTRIFUGE
NBLS 88821 (31416)
88784 (38810)
EXT. POWER VACUUM
CENTRIFUGE MOTOR
88798 (38785)
ENC 88820 (31417)
88799 (38803)
88761 (38780)
EXT.SERIAL VACUUM

18.3 NMC p.c. board Schematics rev.00

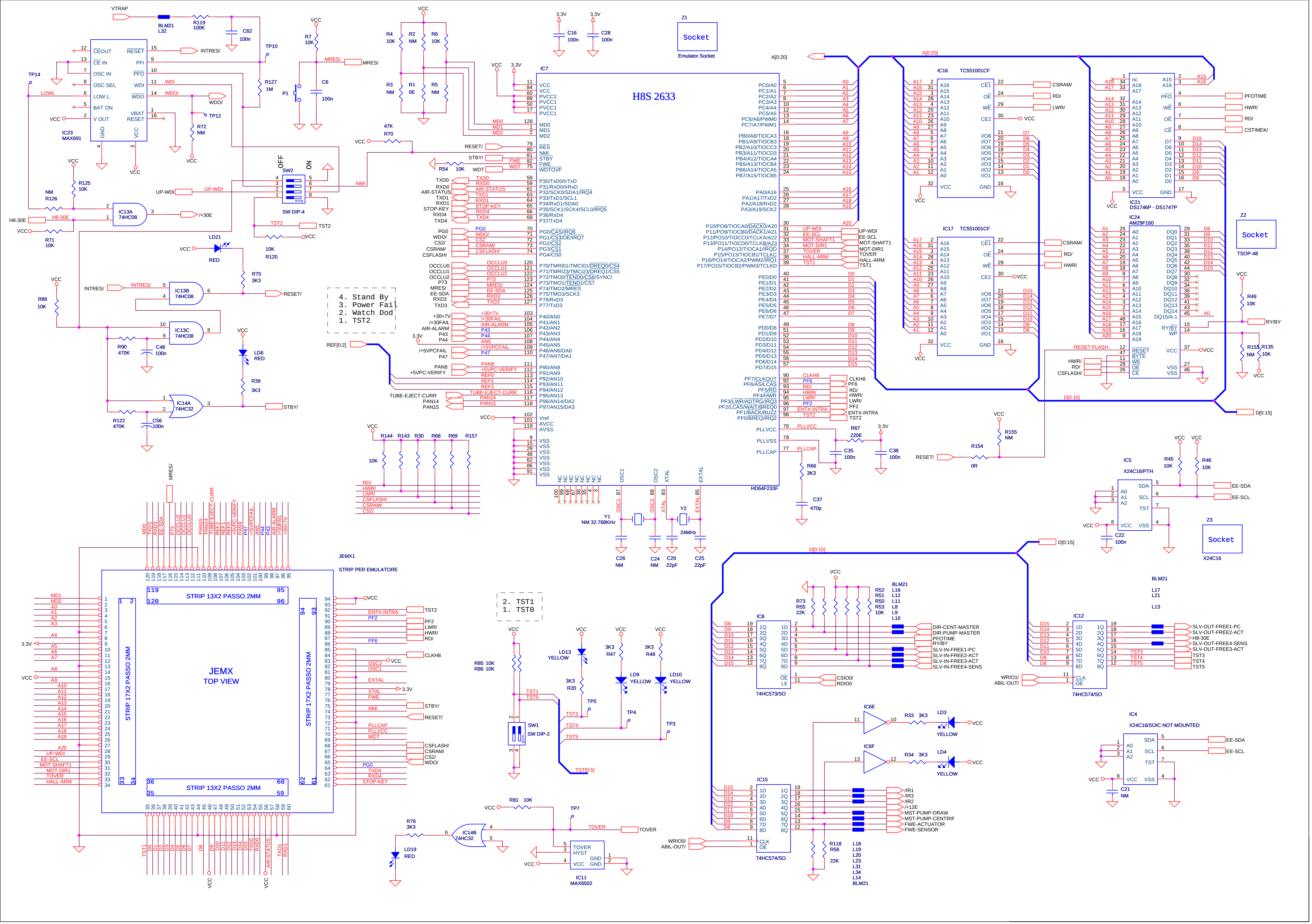
18.3.1 About this card

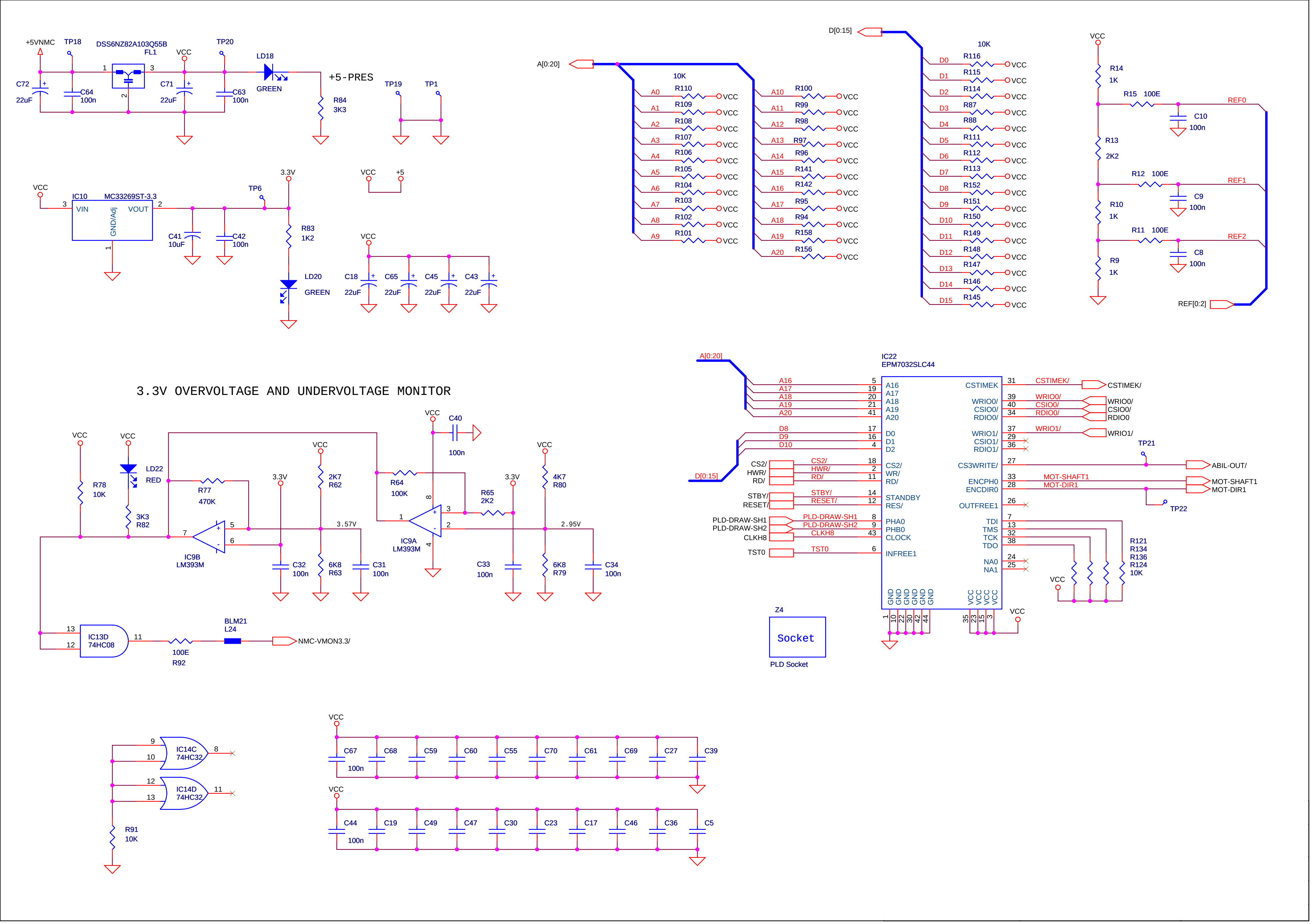
The purpose of this card is to illustrate the **NMC p.c. board** schematics.


SORIN GROUP
AT THE HEART OF MEDICAL TECHNOLOGY
NMC REV.1

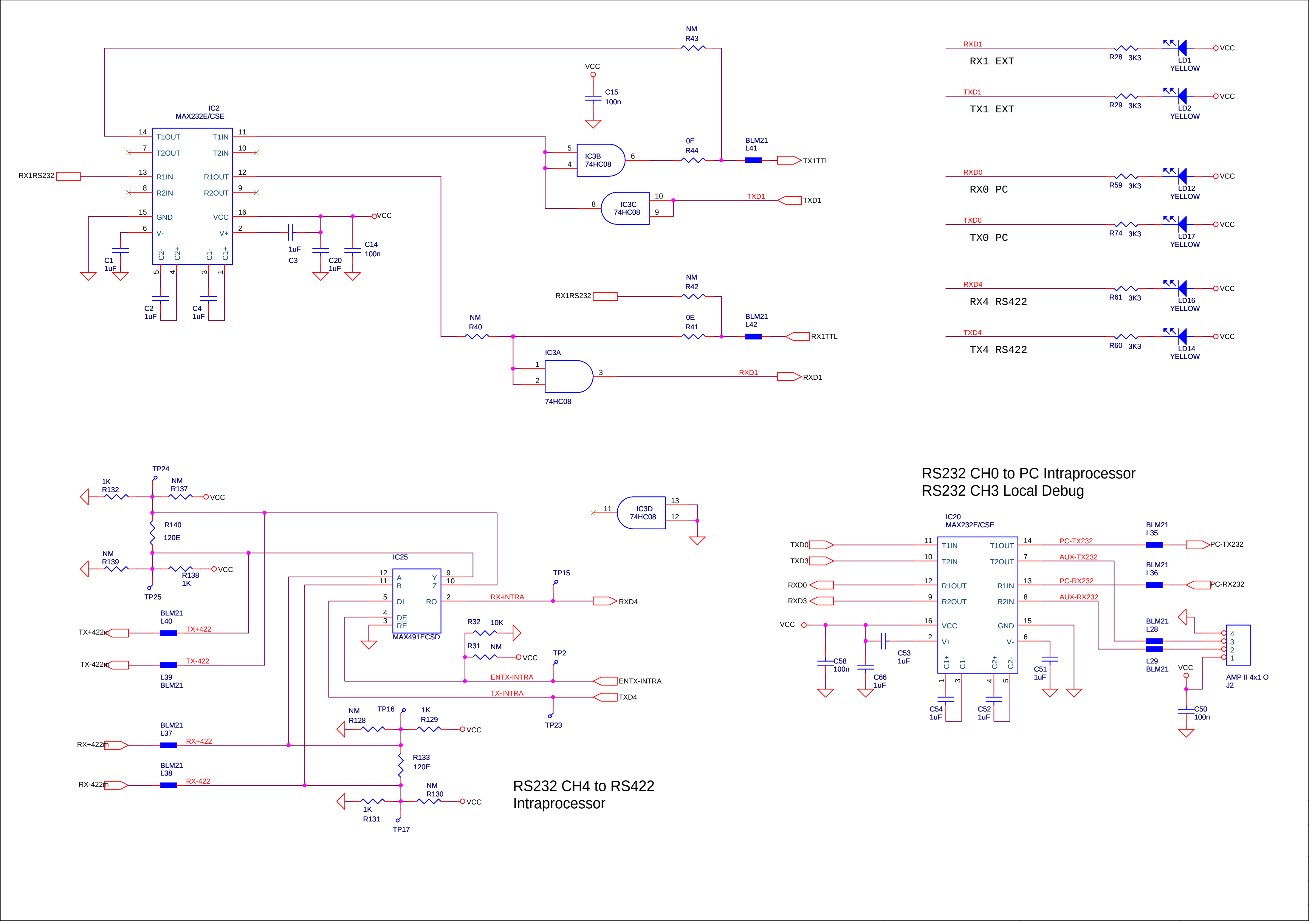


vs Actuator Boards
vs own sensors/connectors
vs Power Supplier Board
vs Actuator/Sensor Boards
vs Sensor Boards
J1
DIN 64_AC-R
JM1
JUMPER2
TUBE-EJECT-SENS
AUX-PAN8
TEST5VPC
AUX-PAN14
AUX-PAN15
+5VNMC
PLD-DRAW-SH1
PLD-DRAW-SH2
DRAW-SH1
DRAW-SH2
/+30E
/+30E-PS
/+12E
/+12E-PS
74HC14
OCCLU0
OCCLU1
OCCLU2
EXT-HL0
EXT-HL1
EXT-HL2
HL-PR-CLAMP
HL-WA-CLAMP
HL-EM-CLAMP
HALL-ARM
EXT-ARM
TO_ARM_SNS_STATUS
AIR-STATUS
TO-AIR-STATUS
AIR-ALARM
TO-AIR-T0
STOP-KEY
TO-STOP-KEY
MAX6816-SOT143
IC19A
SM8LC05
+30<7V
+30<7V-PS
/+30FAIL
/+30FAIL-PS
/+5VPCFAIL
/+5VPCFAIL-PS
TUBE-EJECT-CURR
BAS40-04
PAN8
PAN14
PAN15
+5VPC-VERIFY
OP295


H8S 2633
HD64F233F
IC7
IC23 MAX691
IC16 TC551001CF
IC17 TC551001CF
IC21 DS1746P - DS1747P
IC24 AM29F160
TSOP-48
Socket
Emulator Socket
X24C16/PTH
X24C16
X24C16/SOIC NOT MOUNTED
JEMX1
STRIP PER EMULATORE
JEMX
TOP VIEW
STRIP 13X2 PASSO 2MM
STRIP 17X2 PASSO 2MM
SW DIP-4
SW DIP-2
4. Stand By
3. Power Fail
2. Watch Dod
1. TST2
2. TST1
1. TST0
74HC573/SO
74HC574/SO
MAX6502
A[0:20]
D[0:15]
REF[0:2]
TST[0:5]
NM 32.768KHz
24MHz



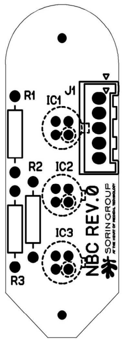
+5VNMC
TP18
DSS6NZ82A103Q55B
FL1
TP20
VCC
LD18
GREEN
+5-PRES
C72
22uF
C64
100n
C71
22uF
C63
100n
R84
3K3
TP19
TP1
VCC
IC10
MC33269ST-3.3
VIN
VOUT
GND/Adj
TP6
3.3V
C41
10uF
C42
100n
R83
1K2
LD20
GREEN
+5
C18
22uF
C65
22uF
C45
22uF
C43
22uF
A[0:20]
10K
A0 R110 VCC
A1 R109 VCC
A2 R108 VCC
A3 R107 VCC
A4 R106 VCC
A5 R105 VCC
A6 R104 VCC
A7 R103 VCC
A8 R102 VCC
A9 R101 VCC
A10 R100 VCC
A11 R99 VCC
A12 R98 VCC
A13 R97 VCC
A14 R96 VCC
A15 R141 VCC
A16 R142 VCC
A17 R95 VCC
A18 R94 VCC
A19 R158 VCC
A20 R156 VCC
D[0:15]
10K
D0 R116 VCC
D1 R115 VCC
D2 R114 VCC
D3 R87 VCC
D4 R88 VCC
D5 R111 VCC
D6 R112 VCC
D7 R113 VCC
D8 R152 VCC
D9 R151 VCC
D10 R150 VCC
D11 R149 VCC
D12 R148 VCC
D13 R147 VCC
D14 R146 VCC
D15 R145 VCC
R14
1K
R15 100E
C10
100n
REF0
R13
2K2
R12 100E
C9
100n
REF1
R10
1K
R11 100E
C8
100n
REF2
R9
1K
REF[0:2]
3.3V OVERVOLTAGE AND UNDERVOLTAGE MONITOR
VCC
LD22
RED
R78
10K
3K3
R82
R77
470K
IC9B
LM393M
3.3V
C32
100n
2K7
R62
6K8
R63
3.57V
C31
100n
C40
100n
R64
100K
IC9A
LM393M
R65
2K2
C33
100n
4K7
R80
6K8
R79
2.95V
C34
100n
IC13D
74HC08
100E
R92
BLM21
L24
NMC-VMON3.3/
IC14C
74HC32
IC14D
74HC32
R91
10K
C67 C68 C59 C60 C55 C70 C61 C69 C27 C39
100n
C44 C19 C49 C47 C30 C23 C17 C46 C36 C5
100n
A[0:20]
IC22
EPM7032SLC44
A16 A17 A18 A19 A20
D8 D9 D10
D0 D1 D2
D[0:15]
CS2/ HWR/ RD/
CS2/ WR/ RD/
STBY/ RESET/
STANDBY
RES/
PLD-DRAW-SH1
PLD-DRAW-SH2
CLKH8
PHA0 PHB0 CLOCK
TST0
INFREE1
CSTIMEK
CSTIMEK/
WRIO0/ CSIO0/ RDIO0/
WRIO1/ CSIO1/ RDIO1/
CS3WRITE/
TP21
ABIL-OUT/
ENCPH0 ENCDIR0
MOT-SHAFT1
MOT-DIR1
TP22
OUTFREE1
TDI TMS TCK TDO
NA0 NA1
R121
R134
R136
R124
10K
GND
VCC
Z4
Socket
PLD Socket

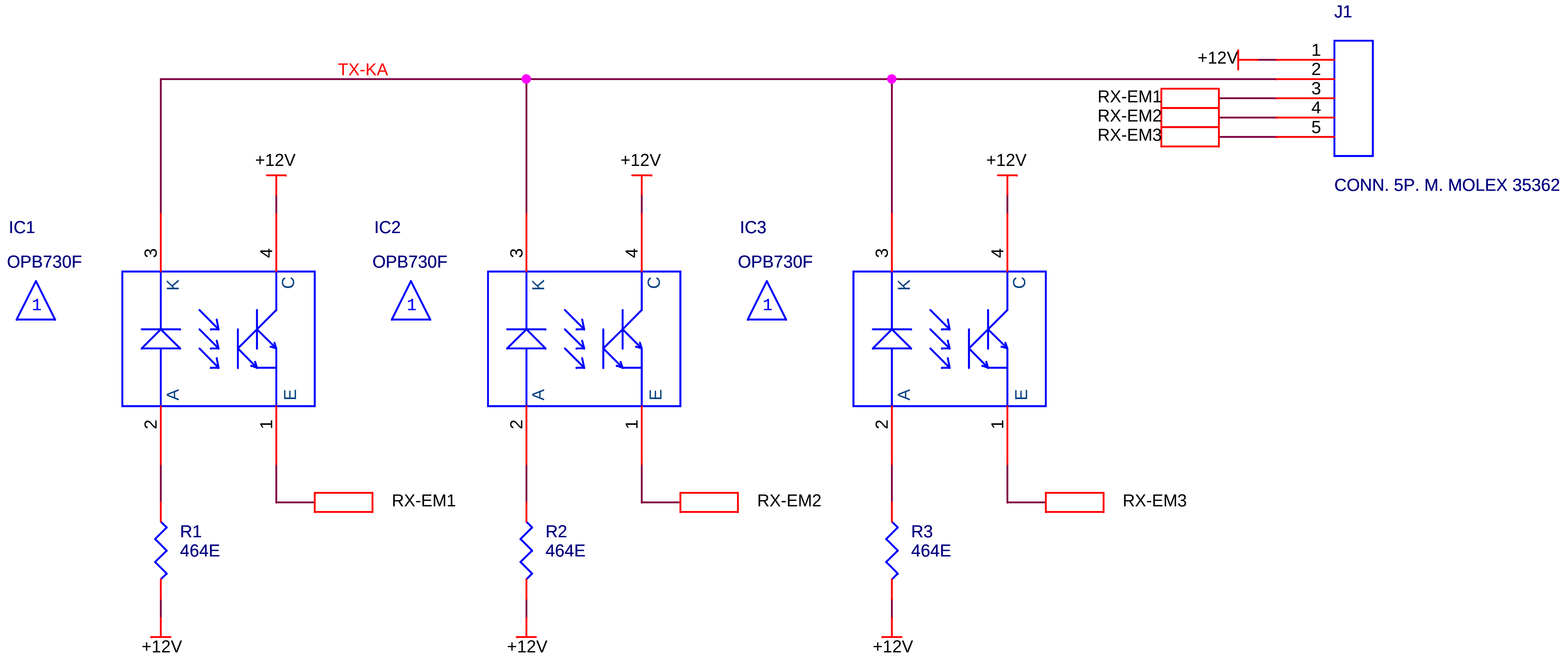

RS232 CH0 to PC Intraprocessor
RS232 CH3 Local Debug
RS232 CH4 to RS422 Intraprocessor
IC2
MAX232E/CSE
T1OUT
T2OUT
R1IN
R2IN
GND
V-
T1IN
T2IN
R1OUT
R2OUT
VCC
V+
C2-
C2+
C1-
C1+
RX1RS232
C1 1uF
C2 1uF
C4 1uF
C3 1uF
C20 1uF
C14 100n
VCC
C15 100n
NM R43
IC3B 74HC08
IC3C 74HC08
IC3A 74HC08
IC3D 74HC08
0E R44
BLM21 L41
TX1TTL
TXD1
NM R42
NM R40
0E R41
BLM21 L42
RX1TTL
RXD1
RXD1 RX1 EXT R28 3K3 LD1 YELLOW
TXD1 TX1 EXT R29 3K3 LD2 YELLOW
RXD0 RX0 PC R59 3K3 LD12 YELLOW
TXD0 TX0 PC R74 3K3 LD17 YELLOW
RXD4 RX4 RS422 R61 3K3 LD16 YELLOW
TXD4 TX4 RS422 R60 3K3 LD14 YELLOW
TP24
1K R132
NM R137
R140 120E
NM R139
R138 1K
TP25
IC25
MAX491ECSD
A
B
DI
DE
RE
Y
Z
RO
TX+422
TX-422
RX+422
RX-422
BLM21 L40
L39 BLM21
BLM21 L37
BLM21 L38
RX-INTRA
RXD4
TP15
R32 10K
R31 NM
TP2
ENTX-INTRA
TX-INTRA
TXD4
TP23
NM R128
TP16
1K R129
R133 120E
NM R130
1K R131
TP17
IC20
MAX232E/CSE
TXD0
TXD3
RXD0
RXD3
PC-TX232
AUX-TX232
PC-RX232
AUX-RX232
BLM21 L35
BLM21 L36
BLM21 L28
L29 BLM21
C58 100n
C66 1uF
C53 1uF
C54 1uF
C52 1uF
C51 1uF
C50 100n
AMP II 4x1 O
J2

18.4 NBC p.c. board Schematics rev.00

18.4.1 About this card

The purpose of this card is to illustrate the **NBC p.c. board** schematics.


R1
IC1
J1
R2
IC2
IC3
R3
NBC REV.0
SORIN GROUP



1 MOUNTED ON PLASTIC SPACER 3mm
ON BOTTOM SIDE

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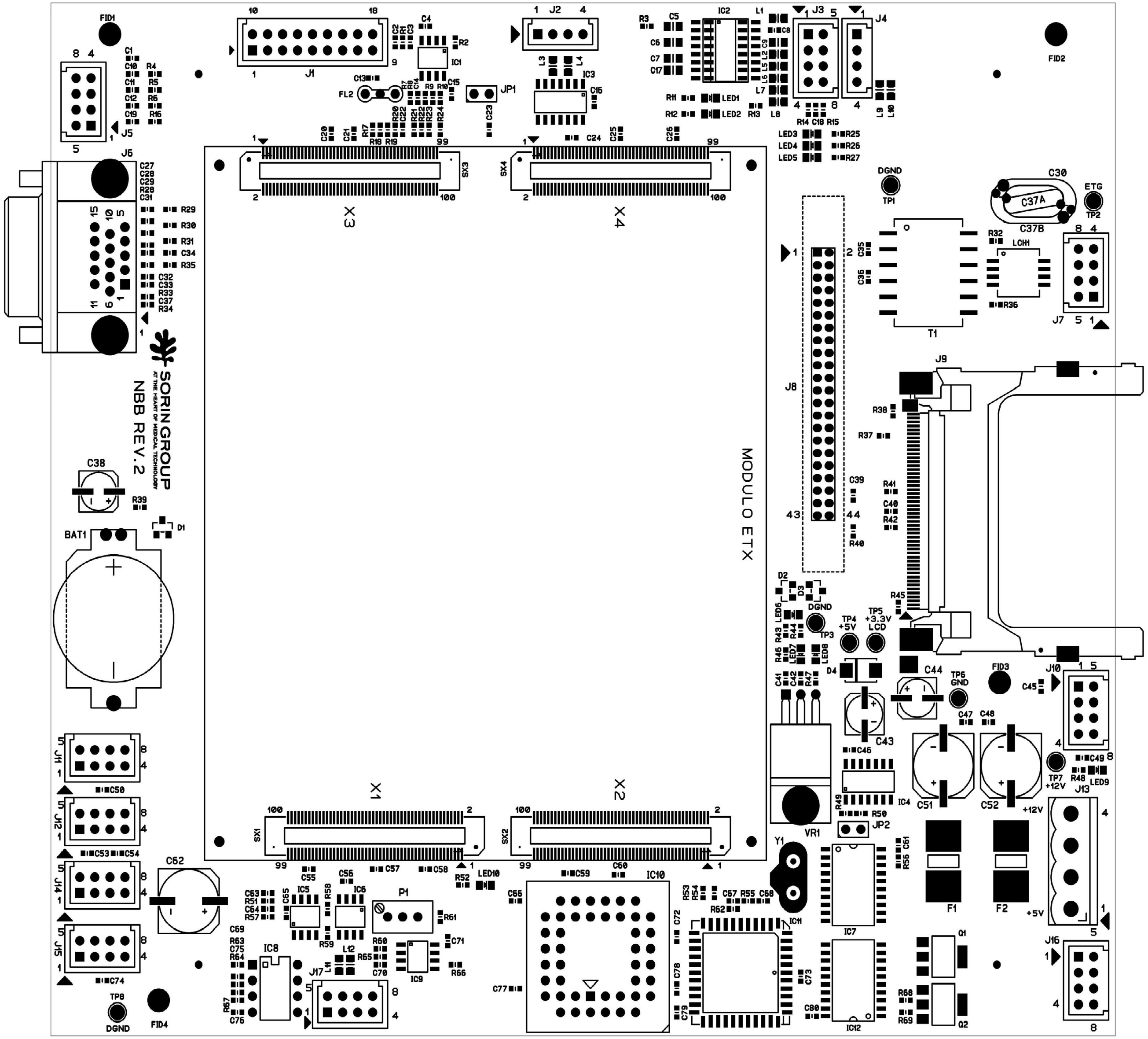
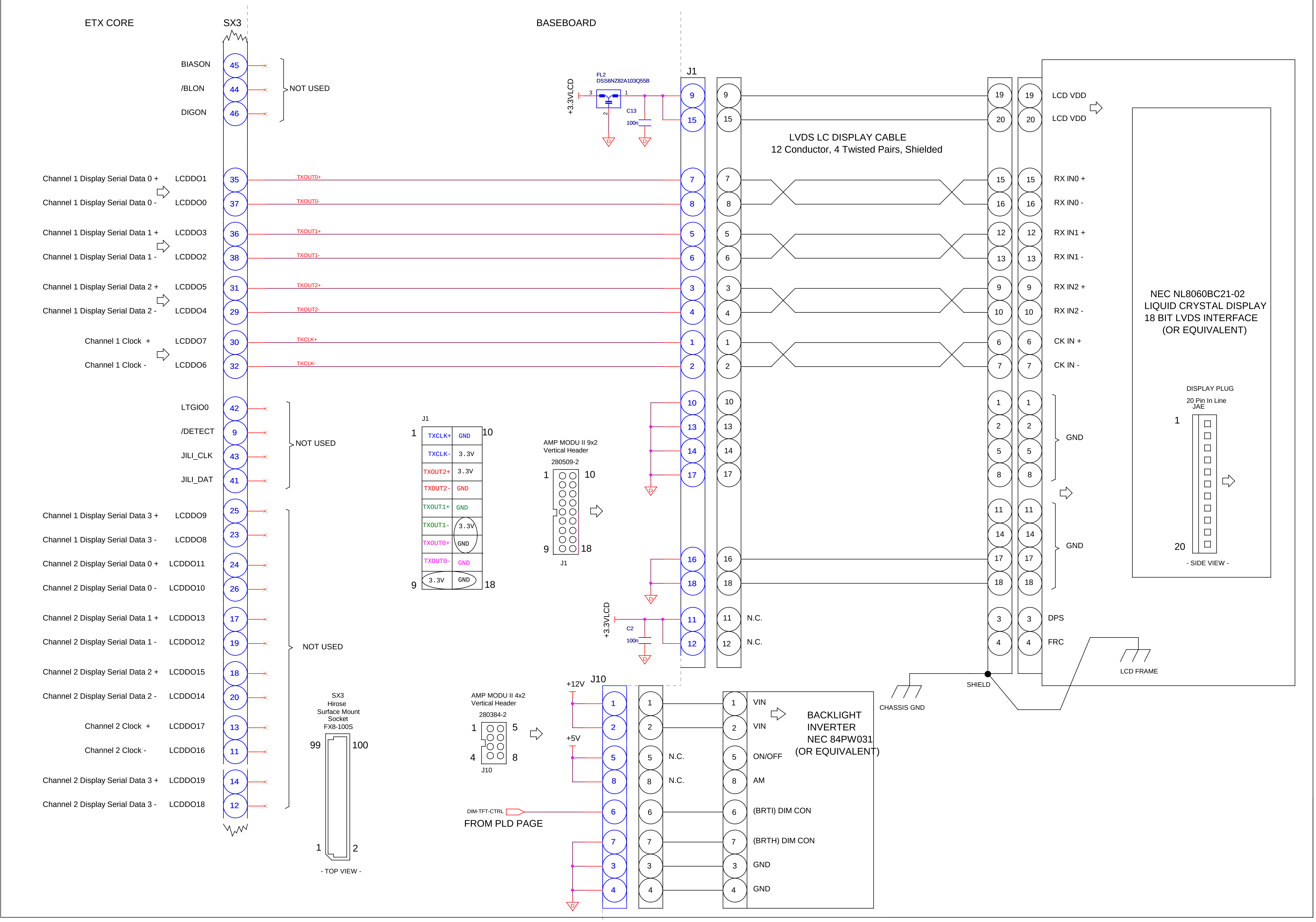
18.5 NBB p.c. board Schematics rev.00

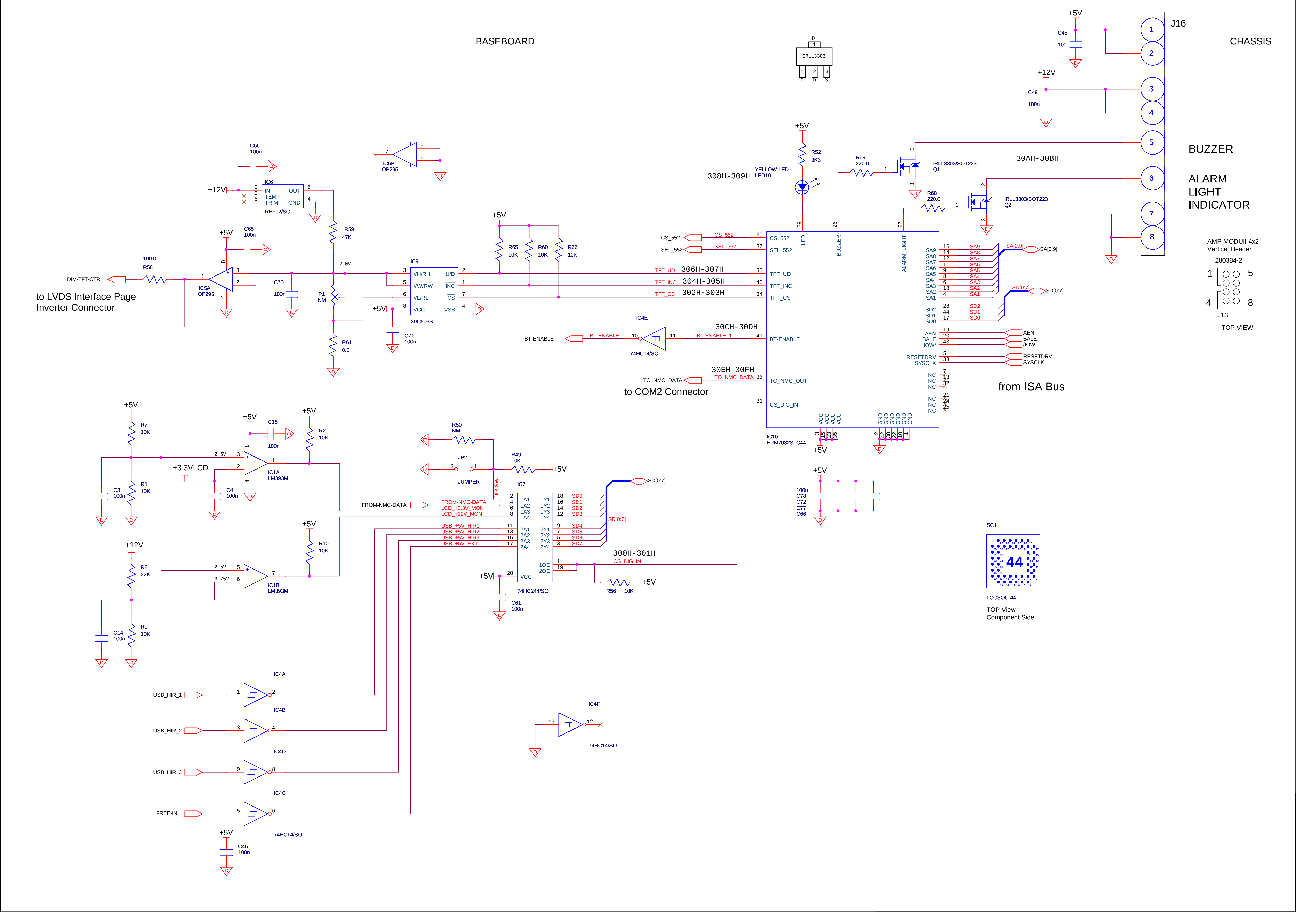
18.5.1 About this card

The purpose of this card is to illustrate the **NBB p.c. board** schematics.





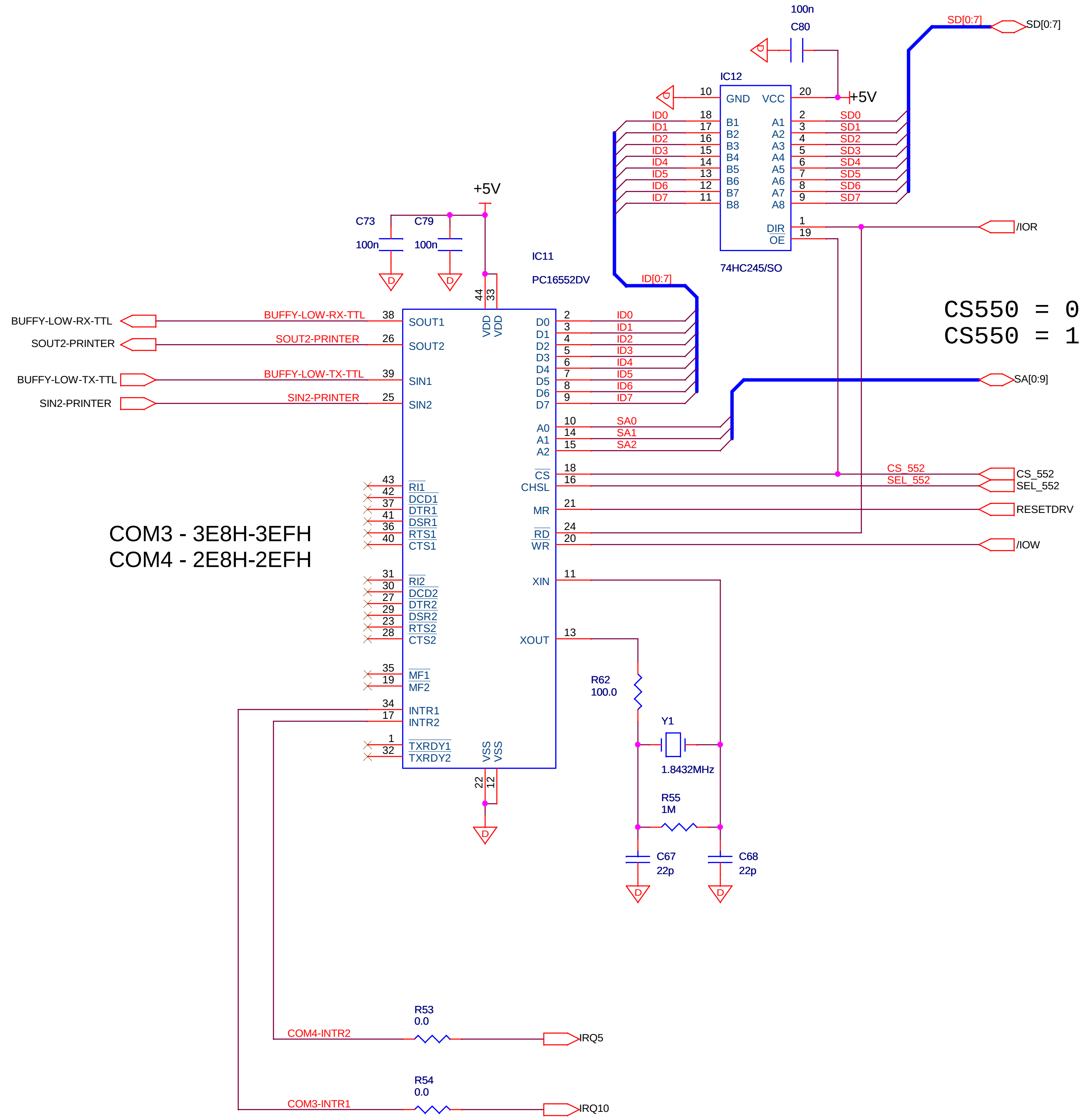
ETX CORE
SX3
BASEBOARD
J1
BIASON
/BLON
DIGON
NOT USED
FL2
DSS6NZ82A103Q55B
+3.3VLCD
C13
100n
LVDS LC DISPLAY CABLE
12 Conductor, 4 Twisted Pairs, Shielded
LCD VDD
LCD VDD
Channel 1 Display Serial Data 0 + LCDDO1
Channel 1 Display Serial Data 0 - LCDDO0
Channel 1 Display Serial Data 1 + LCDDO3
Channel 1 Display Serial Data 1 - LCDDO2
Channel 1 Display Serial Data 2 + LCDDO5
Channel 1 Display Serial Data 2 - LCDDO4
Channel 1 Clock + LCDDO7
Channel 1 Clock - LCDDO6
TXOUT0+
TXOUT0-
TXOUT1+
TXOUT1-
TXOUT2+
TXOUT2-
TXCLK+
TXCLK-
RX IN0 +
RX IN0 -
RX IN1 +
RX IN1 -
RX IN2 +
RX IN2 -
CK IN +
CK IN -
NEC NL8060BC21-02
LIQUID CRYSTAL DISPLAY
18 BIT LVDS INTERFACE
(OR EQUIVALENT)
LTGIO0
/DETECT
JILI_CLK
JILI_DAT
NOT USED
DISPLAY PLUG
20 Pin In Line
JAE
GND
GND
- SIDE VIEW -
AMP MODU II 9x2
Vertical Header
280509-2
Channel 1 Display Serial Data 3 + LCDDO9
Channel 1 Display Serial Data 3 - LCDDO8
Channel 2 Display Serial Data 0 + LCDDO11
Channel 2 Display Serial Data 0 - LCDDO10
Channel 2 Display Serial Data 1 + LCDDO13
Channel 2 Display Serial Data 1 - LCDDO12
Channel 2 Display Serial Data 2 + LCDDO15
Channel 2 Display Serial Data 2 - LCDDO14
Channel 2 Clock + LCDDO17
Channel 2 Clock - LCDDO16
Channel 2 Display Serial Data 3 + LCDDO19
Channel 2 Display Serial Data 3 - LCDDO18
NOT USED
TXCLK+ GND
TXCLK- 3.3V
TXOUT2+ 3.3V
TXOUT2- GND
TXOUT1+ GND
TXOUT1- 3.3V
TXOUT0+ GND
TXOUT0- GND
3.3V GND
N.C.
N.C.
DPS
FRC
C2
100n
LCD FRAME
CHASSIS GND
SHIELD
SX3
Hirose
Surface Mount
Socket
FX8-100S
- TOP VIEW -
AMP MODU II 4x2
Vertical Header
280384-2
J10
+12V
+5V
DIM-TFT-CTRL
FROM PLD PAGE
VIN
VIN
ON/OFF
AM
(BRTI) DIM CON
(BRTH) DIM CON
GND
GND
BACKLIGHT
INVERTER
NEC 84PW031
(OR EQUIVALENT)



BASEBOARD
CHASSIS
J16
BUZZER
ALARM LIGHT INDICATOR
30AH-30BH
308H-309H
306H-307H
304H-305H
302H-303H
30CH-30DH
30EH-30FH
300H-301H
to LVDS Interface Page Inverter Connector
to COM2 Connector
from ISA Bus
IC10 EPM7032SLC44
IC9 X9C503S
IC6 REF02/SO
IC7 74HC244/SO
IC1A LM393M
IC1B LM393M
IC5A OP295
IC5B OP295
IC4E 74HC14/SO
IC4F 74HC14/SO
IRLL3303/SOT223 Q1
IRLL3303/SOT223 Q2
YELLOW LED LED10
AMP MODUII 4x2 Vertical Header
280384-2
J13
- TOP VIEW -
SC1
LCCSOC-44
TOP View Component Side
DIM-TFT-CTRL
USB_HIR_1
USB_HIR_2
USB_HIR_3
FREE-IN
FROM-NMC-DATA
BT-ENABLE
TO_NMC_DATA
CS_552
SEL_552
SA[0:9]
SD[0:7]
AEN
BALE
/IOW
RESETDRV
SYSCLK
JUMPER
JP2

CHASSIS

BASEBOARD

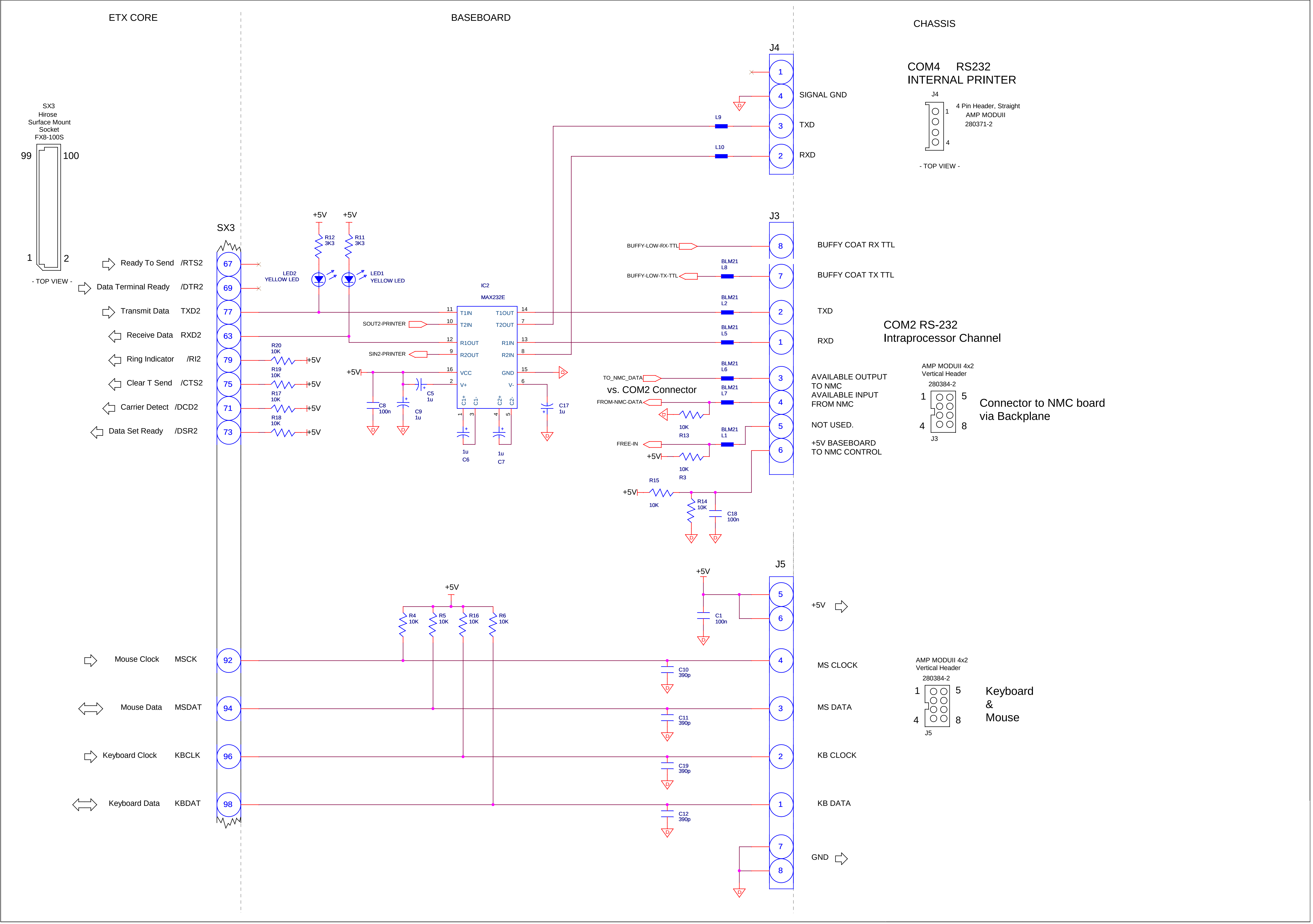


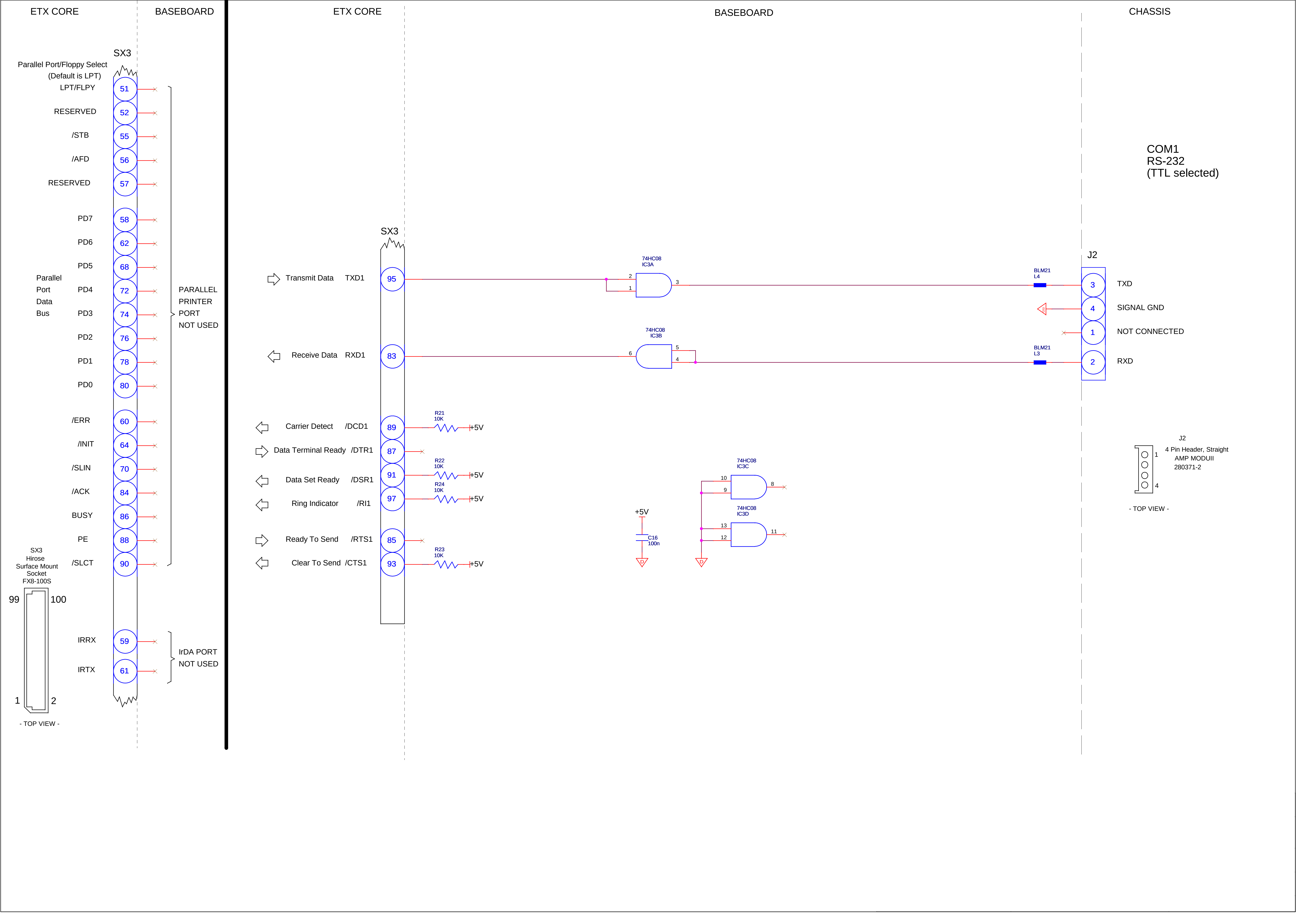
CS550 = 0 -> COM4
CS550 = 1 -> COM3

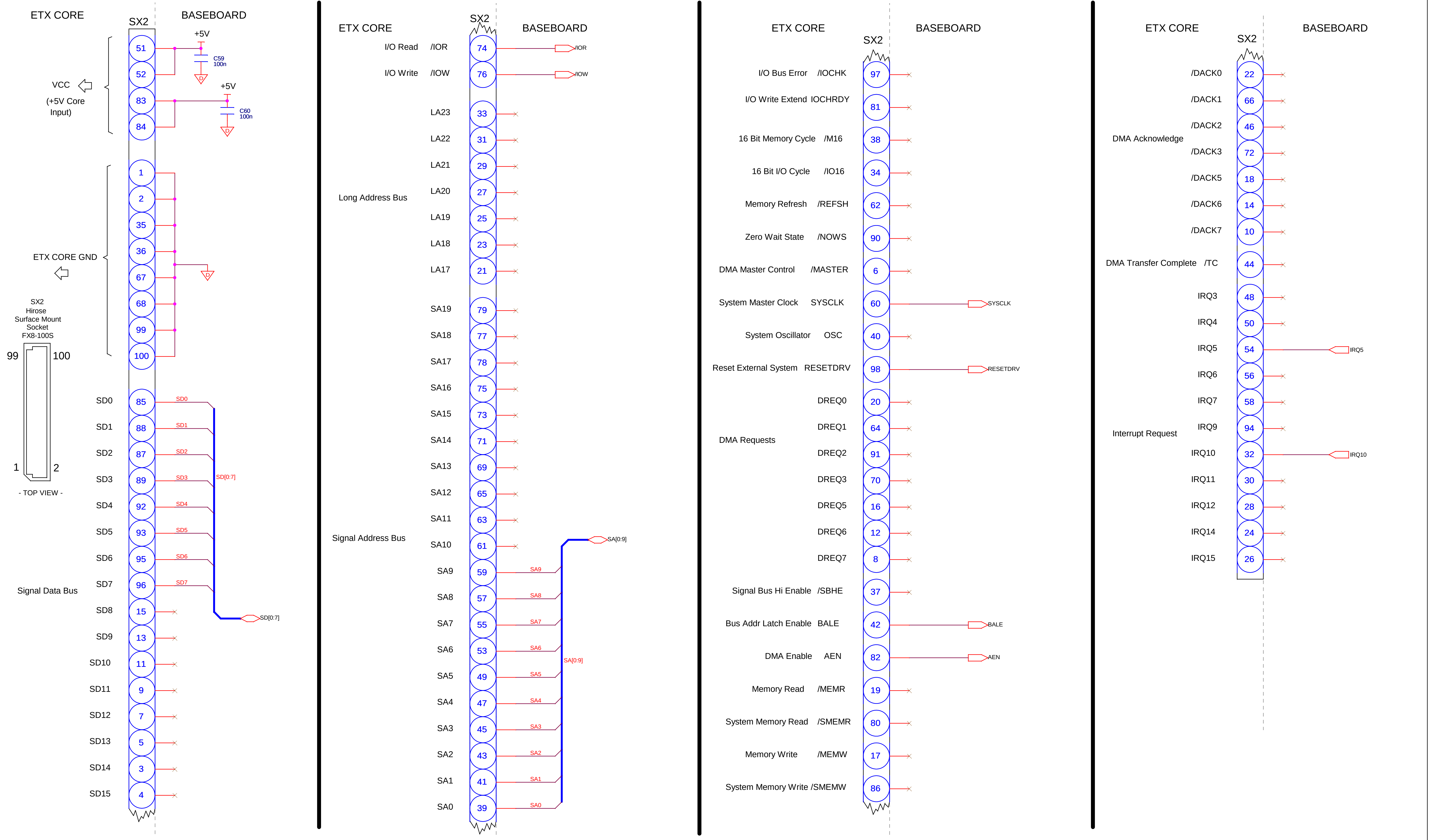
COM3 - 3E8H-3EFH
COM4 - 2E8H-2EFH

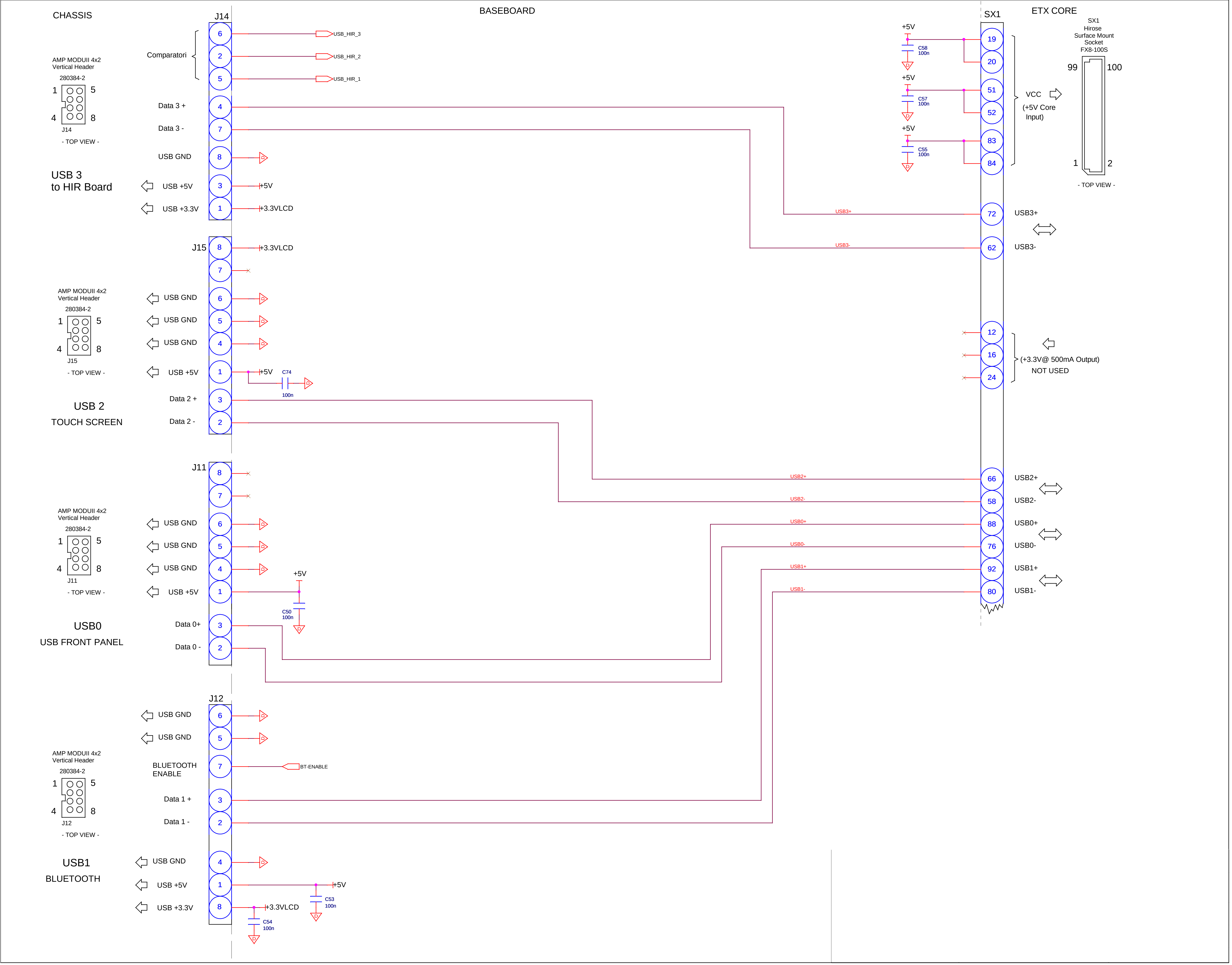
COM3 TTL
BUFFY COAT LOW RX TTL

COM4 RS232
INTERNAL PRINTER

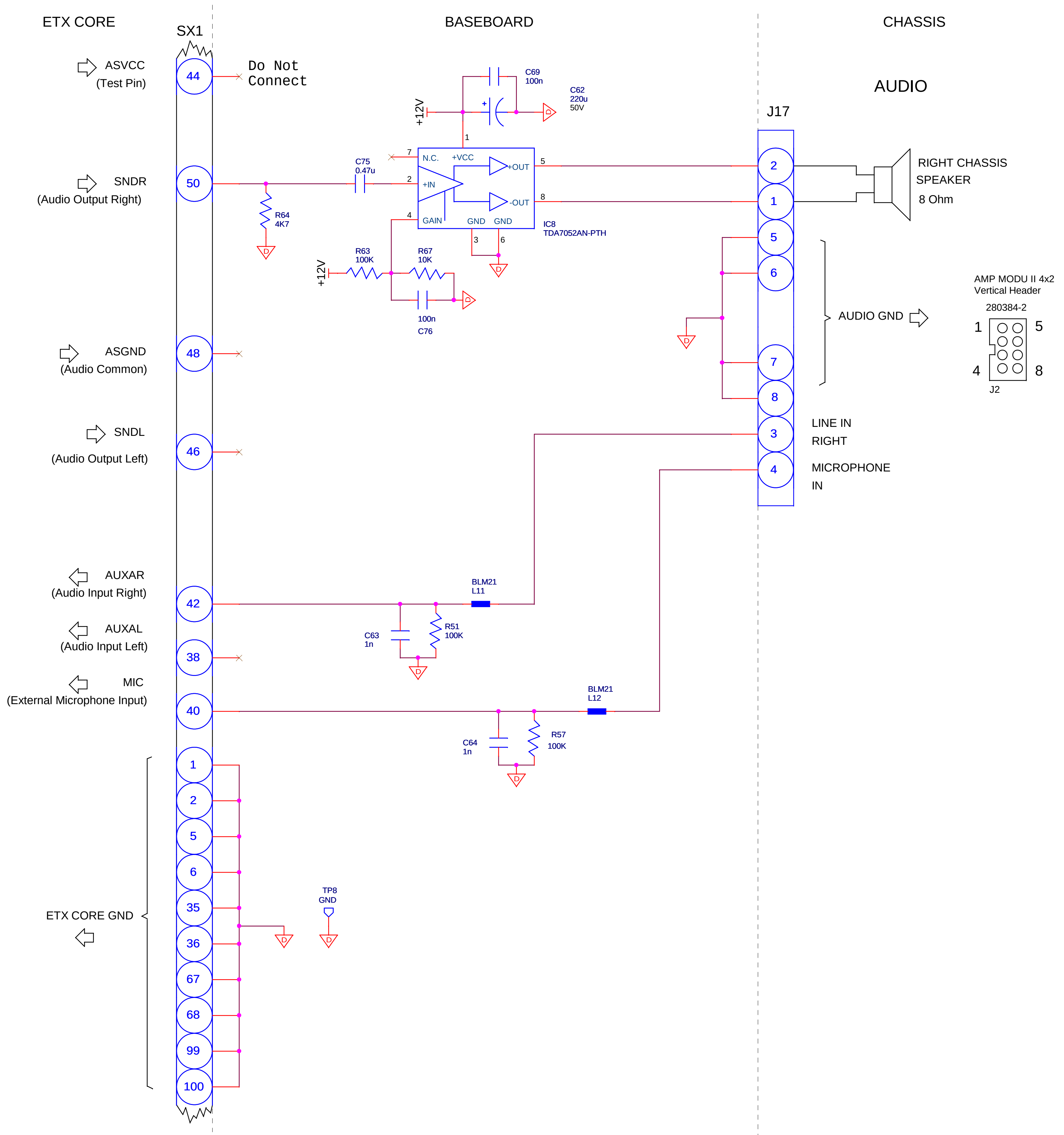

ETX CORE
BASEBOARD
CHASSIS
SX3
Hirose
Surface Mount
Socket
FX8-100S
99
100
1
2
- TOP VIEW -
SX3
Ready To Send /RTS2
Data Terminal Ready /DTR2
Transmit Data TXD2
Receive Data RXD2
Ring Indicator /RI2
Clear T Send /CTS2
Carrier Detect /DCD2
Data Set Ready /DSR2
Mouse Clock MSCK
Mouse Data MSDAT
Keyboard Clock KBCLK
Keyboard Data KBDAT
67
69
77
63
79
75
71
73
92
94
96
98
+5V
R12 3K3
R11 3K3
LED2 YELLOW LED
LED1 YELLOW LED
R20 10K
R19 10K
R17 10K
R18 10K
IC2
MAX232E
T1IN
T2IN
R1OUT
R2OUT
VCC
V+
T1OUT
T2OUT
R1IN
R2IN
GND
V-
C1+
C1-
C2+
C2-
SOUT2-PRINTER
SIN2-PRINTER
C8 100n
C9 1u
C5 1u
C6 1u
C7 1u
C17 1u
J4
1
4
3
2
SIGNAL GND
TXD
RXD
L9
L10
COM4 RS232
INTERNAL PRINTER
J4
4 Pin Header, Straight
AMP MODUII
280371-2
- TOP VIEW -
J3
BUFFY-LOW-RX-TTL
BUFFY-LOW-TX-TTL
BLM21 L8
BLM21 L2
BLM21 L5
BLM21 L6
BLM21 L7
BLM21 L1
TO_NMC_DATA
vs. COM2 Connector
FROM-NMC-DATA
FREE-IN
10K R13
10K R3
R15 10K
R14 10K
C18 100n
8
7
2
1
3
4
5
6
BUFFY COAT RX TTL
BUFFY COAT TX TTL
TXD
RXD
COM2 RS-232
Intraprocessor Channel
AVAILABLE OUTPUT
TO NMC
AVAILABLE INPUT
FROM NMC
NOT USED.
+5V BASEBOARD
TO NMC CONTROL
AMP MODUII 4x2
Vertical Header
280384-2
J3
Connector to NMC board
via Backplane
J5
R4 10K
R5 10K
R16 10K
R6 10K
C1 100n
C10 390p
C11 390p
C19 390p
C12 390p
+5V
MS CLOCK
MS DATA
KB CLOCK
KB DATA
GND
AMP MODUII 4x2
Vertical Header
280384-2
J5
Keyboard
&
Mouse


ETX CORE
BASEBOARD
ETX CORE
BASEBOARD
CHASSIS
SX3
Parallel Port/Floppy Select
(Default is LPT)
LPT/FLPY 51
RESERVED 52
/STB 55
/AFD 56
RESERVED 57
PD7 58
PD6 62
PD5 68
PD4 72
PD3 74
PD2 76
PD1 78
PD0 80
Parallel
Port
Data
Bus
/ERR 60
/INIT 64
/SLIN 70
/ACK 84
BUSY 86
PE 88
/SLCT 90
PARALLEL
PRINTER
PORT
NOT USED
SX3
Hirose
Surface Mount
Socket
FX8-100S
99
100
1
2
- TOP VIEW -
IRRX 59
IRTX 61
IrDA PORT
NOT USED
SX3
Transmit Data TXD1 95
Receive Data RXD1 83
Carrier Detect /DCD1 89
Data Terminal Ready /DTR1 87
Data Set Ready /DSR1 91
Ring Indicator /RI1 97
Ready To Send /RTS1 85
Clear To Send /CTS1 93
R21 10K +5V
R22 10K +5V
R24 10K +5V
R23 10K +5V
74HC08 IC3A
74HC08 IC3B
74HC08 IC3C
74HC08 IC3D
+5V
C16 100n
BLM21 L4
BLM21 L3
J2
3 TXD
4 SIGNAL GND
1 NOT CONNECTED
2 RXD
COM1
RS-232
(TTL selected)
J2
4 Pin Header, Straight
AMP MODUII
280371-2
- TOP VIEW -

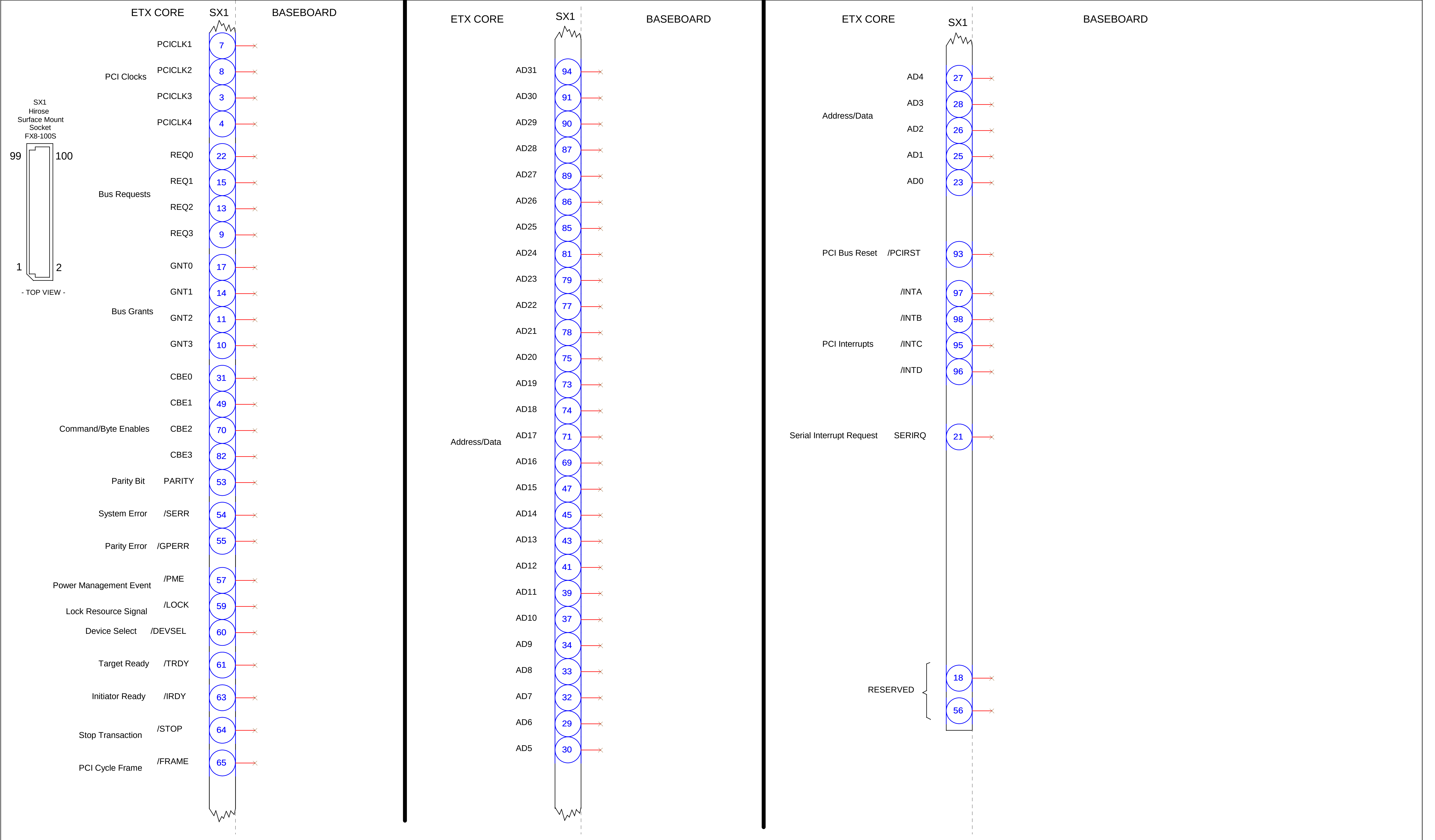

ETX CORE
SX2
BASEBOARD
+5V
C59
100n
+5V
C60
100n
VCC
(+5V Core Input)
ETX CORE GND
SX2
Hirose
Surface Mount
Socket
FX8-100S
99
100
1
2
- TOP VIEW -
SD0
SD1
SD2
SD3
SD4
SD5
SD6
SD7
SD8
SD9
SD10
SD11
SD12
SD13
SD14
SD15
Signal Data Bus
SD[0:7]
I/O Read /IOR
I/O Write /IOW
LA23
LA22
LA21
LA20
LA19
LA18
LA17
Long Address Bus
SA19
SA18
SA17
SA16
SA15
SA14
SA13
SA12
SA11
SA10
SA9
SA8
SA7
SA6
SA5
SA4
SA3
SA2
SA1
SA0
Signal Address Bus
SA[0:9]
I/O Bus Error /IOCHK
I/O Write Extend IOCHRDY
16 Bit Memory Cycle /M16
16 Bit I/O Cycle /IO16
Memory Refresh /REFSH
Zero Wait State /NOWS
DMA Master Control /MASTER
System Master Clock SYSCLK
System Oscillator OSC
Reset External System RESETDRV
DREQ0
DREQ1
DREQ2
DREQ3
DREQ5
DREQ6
DREQ7
DMA Requests
Signal Bus Hi Enable /SBHE
Bus Addr Latch Enable BALE
DMA Enable AEN
Memory Read /MEMR
System Memory Read /SMEMR
Memory Write /MEMW
System Memory Write /SMEMW
/DACK0
/DACK1
/DACK2
/DACK3
/DACK5
/DACK6
/DACK7
DMA Acknowledge
DMA Transfer Complete /TC
IRQ3
IRQ4
IRQ5
IRQ6
IRQ7
IRQ9
IRQ10
IRQ11
IRQ12
IRQ14
IRQ15
Interrupt Request

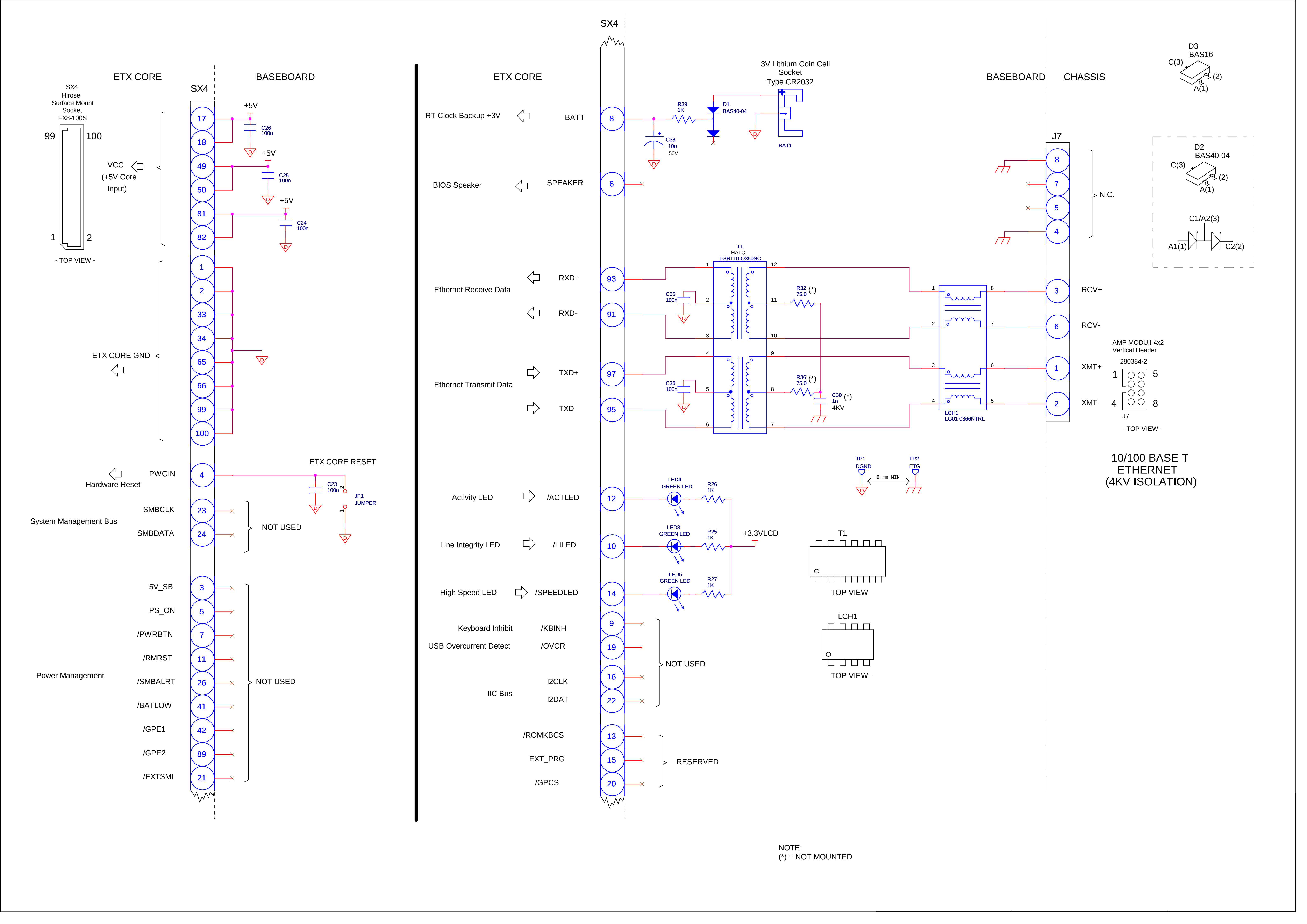


CHASSIS
BASEBOARD
ETX CORE
J14
SX1
Comparatori
USB_HIR_3
USB_HIR_2
USB_HIR_1
Data 3 +
Data 3 -
USB GND
USB 3
to HIR Board
USB +5V
USB +3.3V
+5V
+3.3VLCD
AMP MODUII 4x2
Vertical Header
280384-2
- TOP VIEW -
J15
USB 2
TOUCH SCREEN
Data 2 +
Data 2 -
C74
100n
J11
USB0
USB FRONT PANEL
Data 0+
Data 0 -
C50
100n
J12
BLUETOOTH
ENABLE
BT-ENABLE
Data 1 +
Data 1 -
USB1
BLUETOOTH
C53
100n
C54
100n
C58
C57
C55
VCC
(+5V Core
Input)
SX1
Hirose
Surface Mount
Socket
FX8-100S
USB3+
USB3-
(+3.3V@ 500mA Output)
NOT USED
USB2+
USB2-
USB0+
USB0-
USB1+
USB1-

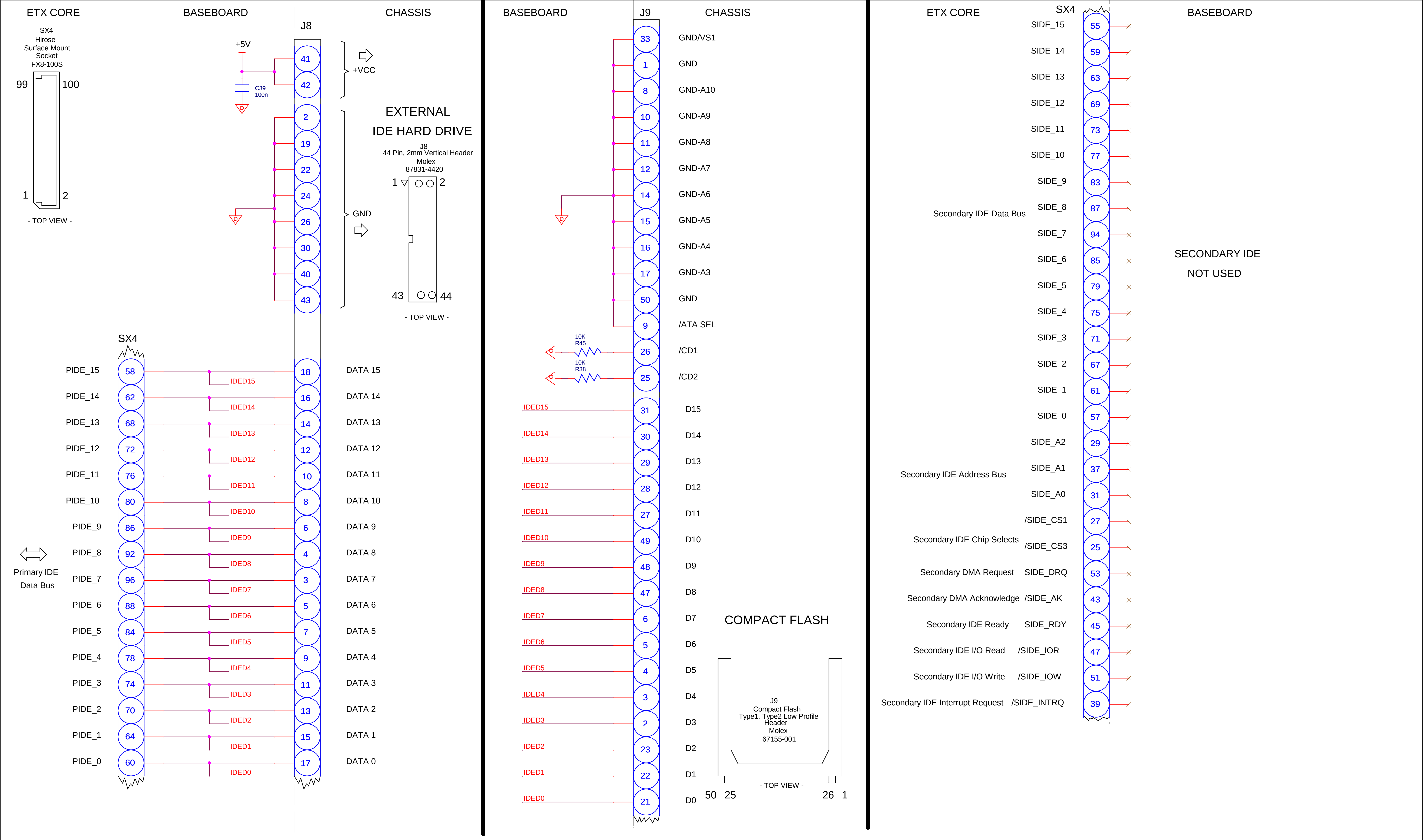


ETX CORE
SX1
BASEBOARD
CHASSIS
ASVCC
(Test Pin)
Do Not Connect
SNDR
(Audio Output Right)
ASGND
(Audio Common)
SNDL
(Audio Output Left)
AUXAR
(Audio Input Right)
AUXAL
(Audio Input Left)
MIC
(External Microphone Input)
ETX CORE GND
C69 100n
C62 220u 50V
+12V
C75 0.47u
R64 4K7
IC8 TDA7052AN-PTH
N.C.
+VCC
+IN
+OUT
-OUT
GAIN
GND
R63 100K
R67 10K
100n C76
BLM21 L11
C63 1n
R51 100K
BLM21 L12
C64 1n
R57 100K
TP8 GND
AUDIO
J17
RIGHT CHASSIS SPEAKER
8 Ohm
AUDIO GND
AMP MODU II 4x2 Vertical Header
280384-2
J2
LINE IN RIGHT
MICROPHONE IN

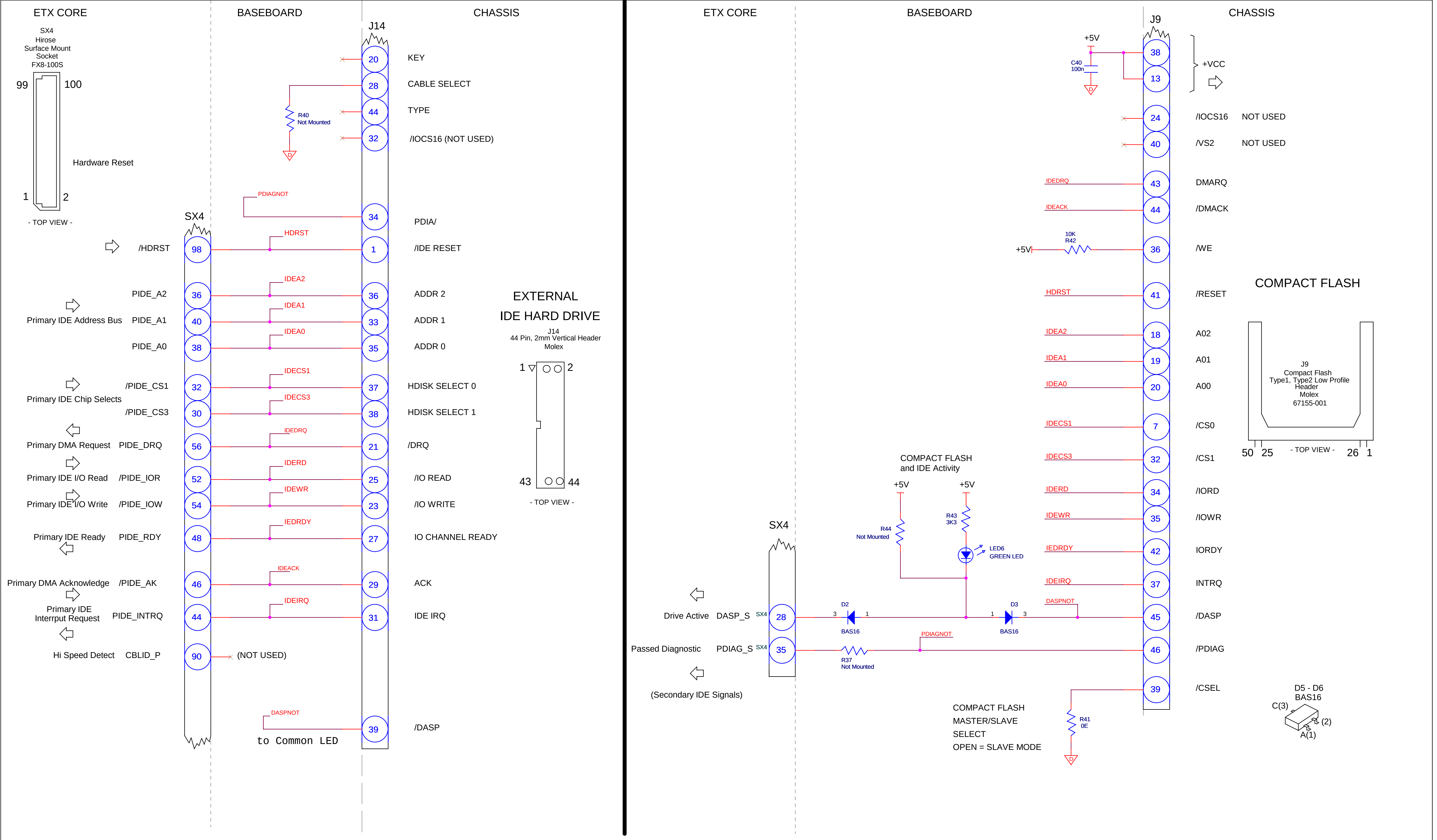

ETX CORE
SX1
BASEBOARD
SX1
Hirose
Surface Mount
Socket
FX8-100S
99
100
1
2
- TOP VIEW -
PCI Clocks
PCICLK1 7
PCICLK2 8
PCICLK3 3
PCICLK4 4
Bus Requests
REQ0 22
REQ1 15
REQ2 13
REQ3 9
Bus Grants
GNT0 17
GNT1 14
GNT2 11
GNT3 10
Command/Byte Enables
CBE0 31
CBE1 49
CBE2 70
CBE3 82
Parity Bit PARITY 53
System Error /SERR 54
Parity Error /GPERR 55
Power Management Event /PME 57
Lock Resource Signal /LOCK 59
Device Select /DEVSEL 60
Target Ready /TRDY 61
Initiator Ready /IRDY 63
Stop Transaction /STOP 64
PCI Cycle Frame /FRAME 65
ETX CORE
SX1
BASEBOARD
Address/Data
AD31 94
AD30 91
AD29 90
AD28 87
AD27 89
AD26 86
AD25 85
AD24 81
AD23 79
AD22 77
AD21 78
AD20 75
AD19 73
AD18 74
AD17 71
AD16 69
AD15 47
AD14 45
AD13 43
AD12 41
AD11 39
AD10 37
AD9 34
AD8 33
AD7 32
AD6 29
AD5 30
ETX CORE
SX1
BASEBOARD
Address/Data
AD4 27
AD3 28
AD2 26
AD1 25
AD0 23
PCI Bus Reset /PCIRST 93
PCI Interrupts
/INTA 97
/INTB 98
/INTC 95
/INTD 96
Serial Interrupt Request SERIRQ 21
RESERVED
18
56



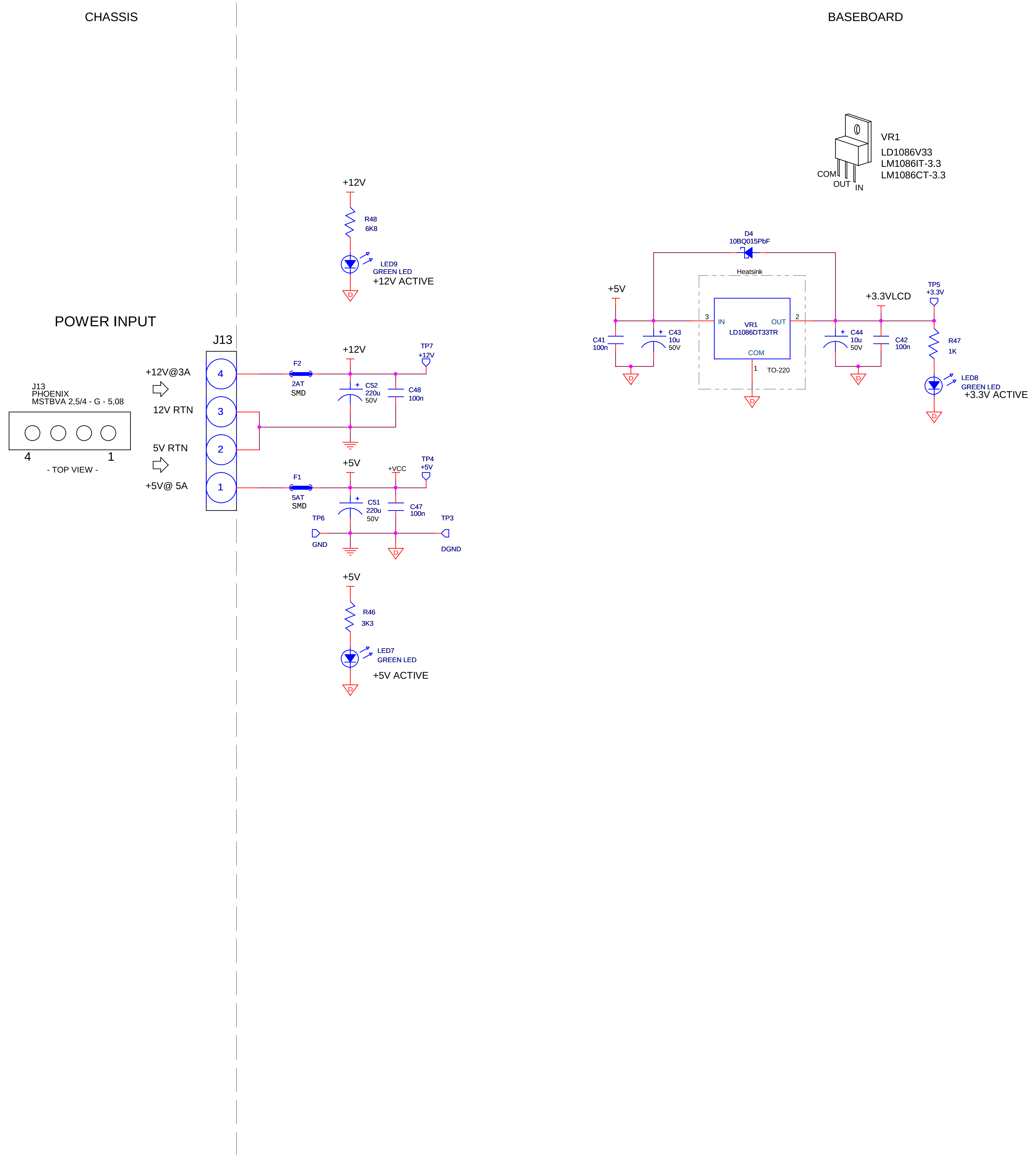
ETX CORE
BASEBOARD
SX4
SX4 Hirose Surface Mount Socket FX8-100S
99 100 1 2
- TOP VIEW -
VCC (+5V Core Input)
+5V
C26 100n
C25 100n
C24 100n
17 18 49 50 81 82
1 2 33 34 65 66 99 100
ETX CORE GND
PWGIN
Hardware Reset
ETX CORE RESET
C23 100n
JP1 JUMPER
System Management Bus
SMBCLK
SMBDATA
NOT USED
Power Management
5V_SB
PS_ON
/PWRBTN
/RMRST
/SMBALRT
/BATLOW
/GPE1
/GPE2
/EXTSMI
NOT USED
ETX CORE
RT Clock Backup +3V
BATT
3V Lithium Coin Cell Socket Type CR2032
R39 1K
D1 BAS40-04
C38 10u 50V
BAT1
BIOS Speaker
SPEAKER
BASEBOARD
CHASSIS
D3 BAS16
C(3) (2) A(1)
J7
N.C.
D2 BAS40-04
C(3) (2) A(1)
C1/A2(3)
A1(1) C2(2)
T1 HALO TGR110-Q350NC
Ethernet Receive Data
RXD+
RXD-
C35 100n
R32 (*) 75.0
R36 (*) 75.0
C30 (*) 1n 4KV
C36 100n
Ethernet Transmit Data
TXD+
TXD-
LCH1 LG01-0366NTRL
RCV+
RCV-
XMT+
XMT-
AMP MODUII 4x2 Vertical Header 280384-2
1 5 4 8
J7
- TOP VIEW -
10/100 BASE T ETHERNET (4KV ISOLATION)
TP1 DGND
TP2 ETG
8 mm MIN
Activity LED
/ACTLED
LED4 GREEN LED
R26 1K
Line Integrity LED
/LILED
LED3 GREEN LED
R25 1K
+3.3VLCD
High Speed LED
/SPEEDLED
LED5 GREEN LED
R27 1K
T1
- TOP VIEW -
LCH1
- TOP VIEW -
Keyboard Inhibit
/KBINH
USB Overcurrent Detect
/OVCR
IIC Bus
I2CLK
I2DAT
NOT USED
/ROMKBCS
EXT_PRG
/GPCS
RESERVED
NOTE:
(*) = NOT MOUNTED



ETX CORE
BASEBOARD
CHASSIS
J8
SX4
Hirose
Surface Mount
Socket
FX8-100S
99
100
1
2
- TOP VIEW -
+5V
C39
100n
41
42
+VCC
2
19
22
24
26
30
40
43
GND
EXTERNAL
IDE HARD DRIVE
J8
44 Pin, 2mm Vertical Header
Molex
87831-4420
1
2
43
44
- TOP VIEW -
SX4
PIDE_15
58
IDED15
18
DATA 15
PIDE_14
62
IDED14
16
DATA 14
PIDE_13
68
IDED13
14
DATA 13
PIDE_12
72
IDED12
12
DATA 12
PIDE_11
76
IDED11
10
DATA 11
PIDE_10
80
IDED10
8
DATA 10
PIDE_9
86
IDED9
6
DATA 9
PIDE_8
92
IDED8
4
DATA 8
PIDE_7
96
IDED7
3
DATA 7
PIDE_6
88
IDED6
5
DATA 6
PIDE_5
84
IDED5
7
DATA 5
PIDE_4
78
IDED4
9
DATA 4
PIDE_3
74
IDED3
11
DATA 3
PIDE_2
70
IDED2
13
DATA 2
PIDE_1
64
IDED1
15
DATA 1
PIDE_0
60
IDED0
17
DATA 0
Primary IDE
Data Bus
BASEBOARD
J9
CHASSIS
33 GND/VS1
1 GND
8 GND-A10
10 GND-A9
11 GND-A8
12 GND-A7
14 GND-A6
15 GND-A5
16 GND-A4
17 GND-A3
50 GND
9 /ATA SEL
10K
R45
26 /CD1
10K
R38
25 /CD2
IDED15 31 D15
IDED14 30 D14
IDED13 29 D13
IDED12 28 D12
IDED11 27 D11
IDED10 49 D10
IDED9 48 D9
IDED8 47 D8
IDED7 6 D7
IDED6 5 D6
IDED5 4 D5
IDED4 3 D4
IDED3 2 D3
IDED2 23 D2
IDED1 22 D1
IDED0 21 D0
COMPACT FLASH
J9
Compact Flash
Type1, Type2 Low Profile
Header
Molex
67155-001
- TOP VIEW -
50
25
26
1
ETX CORE
SX4
BASEBOARD
SIDE_15 55
SIDE_14 59
SIDE_13 63
SIDE_12 69
SIDE_11 73
SIDE_10 77
SIDE_9 83
SIDE_8 87
Secondary IDE Data Bus
SIDE_7 94
SIDE_6 85
SIDE_5 79
SIDE_4 75
SIDE_3 71
SIDE_2 67
SIDE_1 61
SIDE_0 57
SIDE_A2 29
SIDE_A1 37
Secondary IDE Address Bus
SIDE_A0 31
/SIDE_CS1 27
Secondary IDE Chip Selects
/SIDE_CS3 25
Secondary DMA Request SIDE_DRQ 53
Secondary DMA Acknowledge /SIDE_AK 43
Secondary IDE Ready SIDE_RDY 45
Secondary IDE I/O Read /SIDE_IOR 47
Secondary IDE I/O Write /SIDE_IOW 51
Secondary IDE Interrupt Request /SIDE_INTRQ 39
SECONDARY IDE
NOT USED

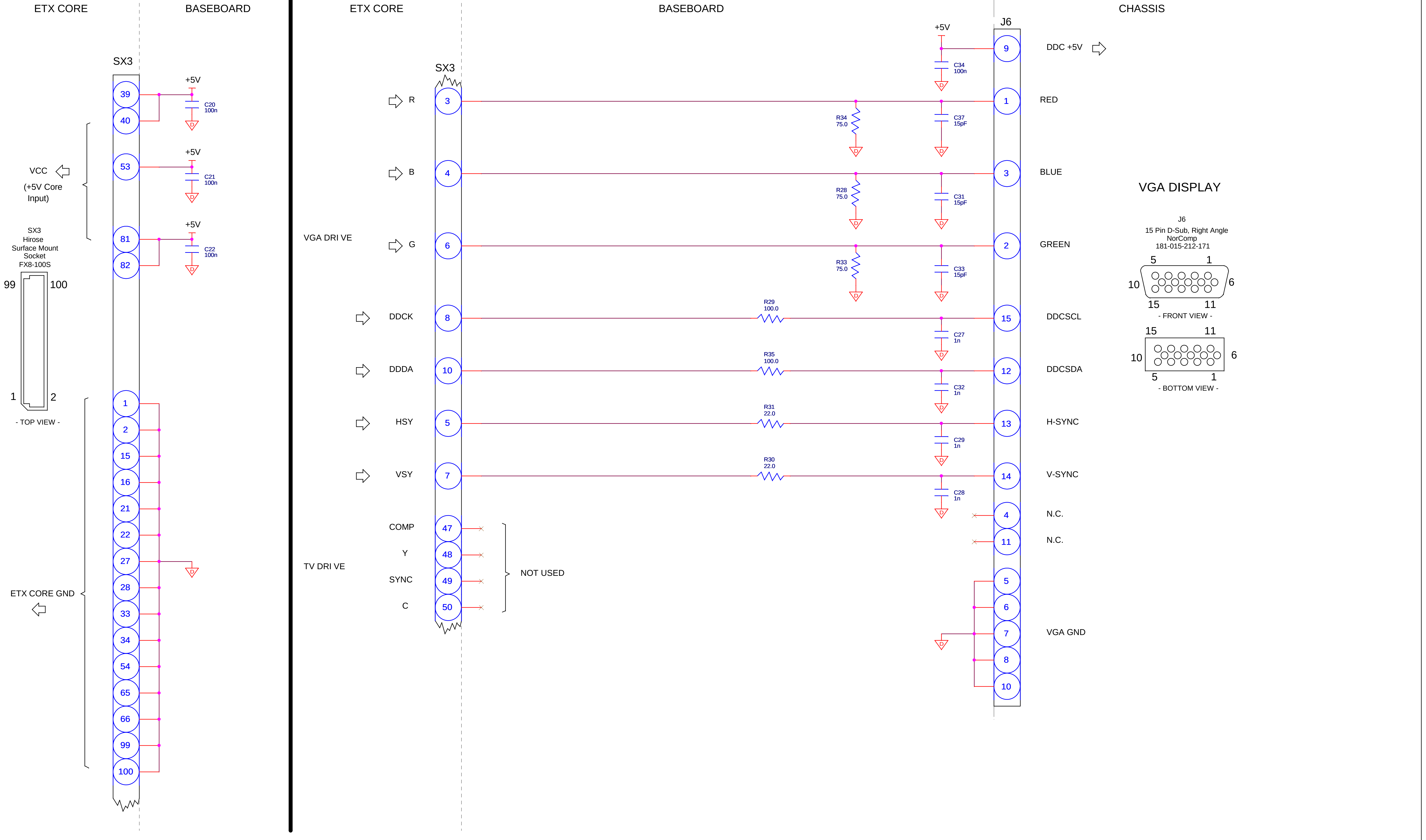


ETX CORE
BASEBOARD
CHASSIS
SX4
Hirose
Surface Mount
Socket
FX8-100S
99
100
Hardware Reset
1
2
- TOP VIEW -
J14
20 KEY
28 CABLE SELECT
44 TYPE
32 /IOCS16 (NOT USED)
R40
Not Mounted
PDIAGNOT
34 PDIA/
SX4
/HDRST 98 HDRST 1 /IDE RESET
PIDE_A2 36 IDEA2 36 ADDR 2
Primary IDE Address Bus PIDE_A1 40 IDEA1 33 ADDR 1
PIDE_A0 38 IDEA0 35 ADDR 0
/PIDE_CS1 32 IDECS1 37 HDISK SELECT 0
Primary IDE Chip Selects
/PIDE_CS3 30 IDECS3 38 HDISK SELECT 1
Primary DMA Request PIDE_DRQ 56 IDEDRQ 21 /DRQ
Primary IDE I/O Read /PIDE_IOR 52 IDERD 25 /IO READ
Primary IDE I/O Write /PIDE_IOW 54 IDEWR 23 /IO WRITE
Primary IDE Ready PIDE_RDY 48 IEDRDY 27 IO CHANNEL READY
Primary DMA Acknowledge /PIDE_AK 46 IDEACK 29 ACK
Primary IDE Interrput Request PIDE_INTRQ 44 IDEIRQ 31 IDE IRQ
Hi Speed Detect CBLID_P 90 (NOT USED)
DASPNOT
39 /DASP
to Common LED
EXTERNAL
IDE HARD DRIVE
J14
44 Pin, 2mm Vertical Header
Molex
1 2
43 44
- TOP VIEW -
ETX CORE
BASEBOARD
CHASSIS
J9
+5V
C40
100n
38
13
+VCC
24 /IOCS16 NOT USED
40 /VS2 NOT USED
IDEDRQ 43 DMARQ
IDEACK 44 /DMACK
10K
R42
+5V 36 /WE
HDRST 41 /RESET
COMPACT FLASH
IDEA2 18 A02
IDEA1 19 A01
IDEA0 20 A00
J9
Compact Flash
Type1, Type2 Low Profile
Header
Molex
67155-001
IDECS1 7 /CS0
50 25 - TOP VIEW - 26 1
IDECS3 32 /CS1
COMPACT FLASH
and IDE Activity
+5V
+5V
IDERD 34 /IORD
R44
Not Mounted
R43
3K3
IDEWR 35 /IOWR
SX4
LED6
GREEN LED
IEDRDY 42 IORDY
IDEIRQ 37 INTRQ
D2
D3
DASPNOT
Drive Active DASP_S SX4 28
3 1 1 3
45 /DASP
BAS16
BAS16
PDIAGNOT
Passed Diagnostic PDIAG_S SX4 35
R37
Not Mounted
46 /PDIAG
(Secondary IDE Signals)
39 /CSEL
D5 - D6
BAS16
C(3)
(2)
A(1)
COMPACT FLASH
MASTER/SLAVE
SELECT
OPEN = SLAVE MODE
R41
0E



NOTES:

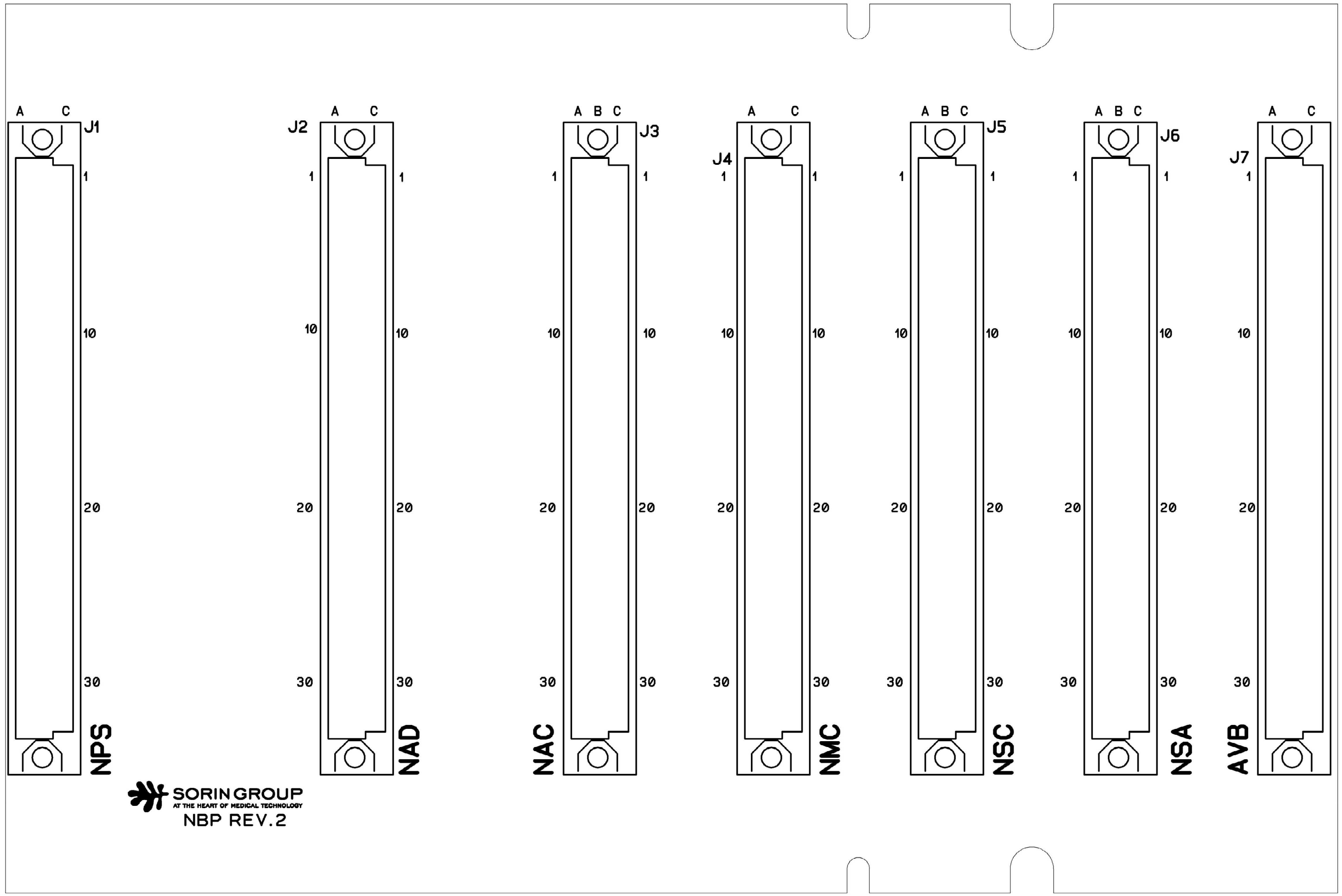
1. All resistors in Ohms, unless otherwise specified.
2. All capacitors in microfarads unless otherwise specified.
3. denotes digital return.
4. denotes high level return.
5. denotes audio return.
6. denotes analog return.
7. denotes chassis ground.
8. denotes isolated return.


ETX CORE
BASEBOARD
SX3
+5V
C20
100n
C21
100n
C22
100n
VCC
(+5V Core Input)
SX3
Hirose
Surface Mount
Socket
FX8-100S
99
100
1
2
- TOP VIEW -
ETX CORE GND
39
40
53
81
82
1
2
15
16
21
22
27
28
33
34
54
65
66
99
100
ETX CORE
BASEBOARD
CHASSIS
J6
DDC +5V
C34
100n
R
B
G
VGA DRI VE
DDCK
DDDA
HSY
VSY
COMP
Y
SYNC
C
TV DRI VE
NOT USED
R34
75.0
C37
15pF
R28
75.0
C31
15pF
R33
75.0
C33
15pF
R29
100.0
C27
1n
R35
100.0
C32
1n
R31
22.0
C29
1n
R30
22.0
C28
1n
RED
BLUE
GREEN
DDCSCL
DDCSDA
H-SYNC
V-SYNC
N.C.
N.C.
VGA GND
VGA DISPLAY
J6
15 Pin D-Sub, Right Angle
NorComp
181-015-212-171
- FRONT VIEW -
- BOTTOM VIEW -

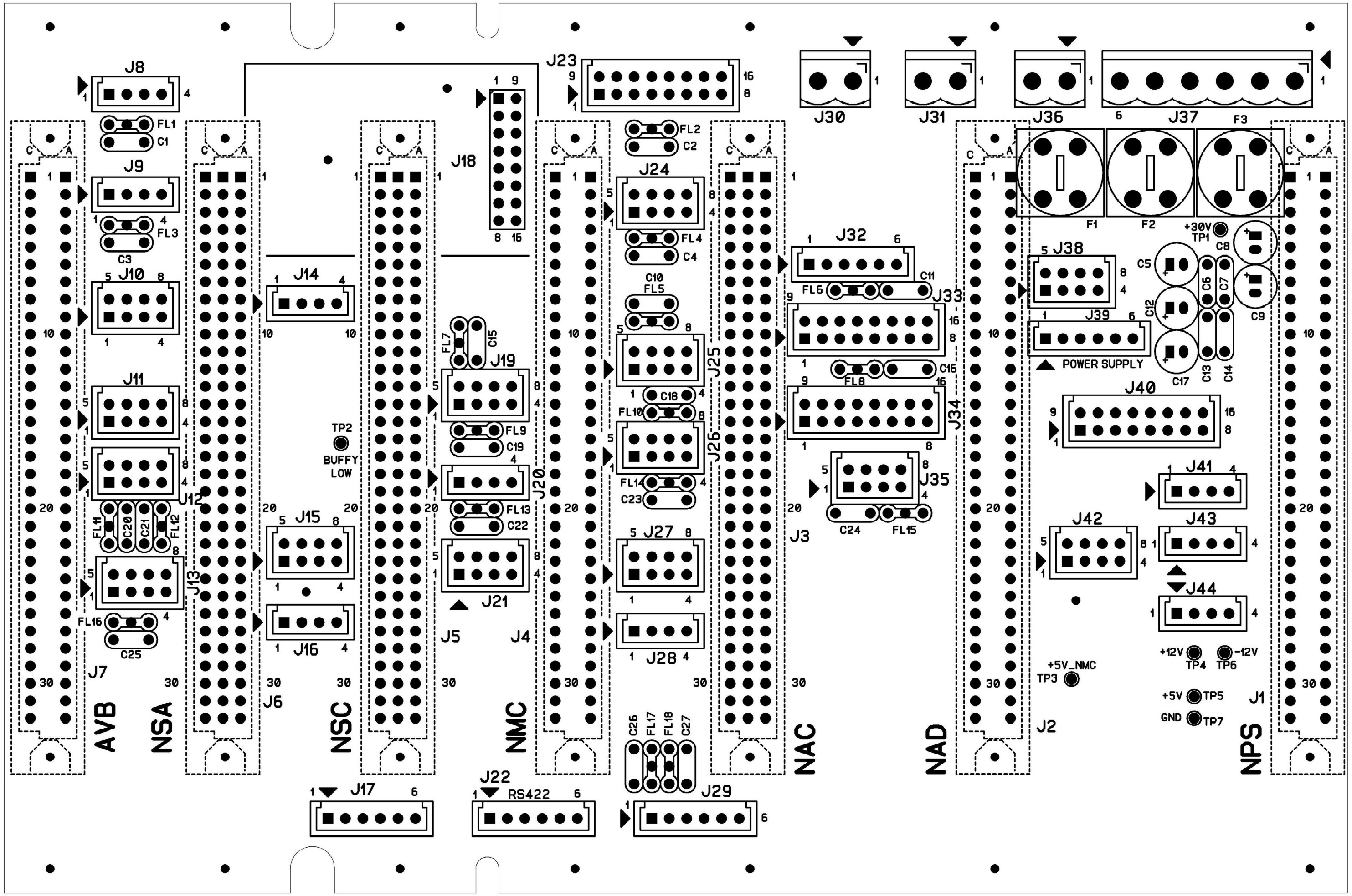
18.6 NBP p.c. board Schematics rev.00

18.6.1 About this card

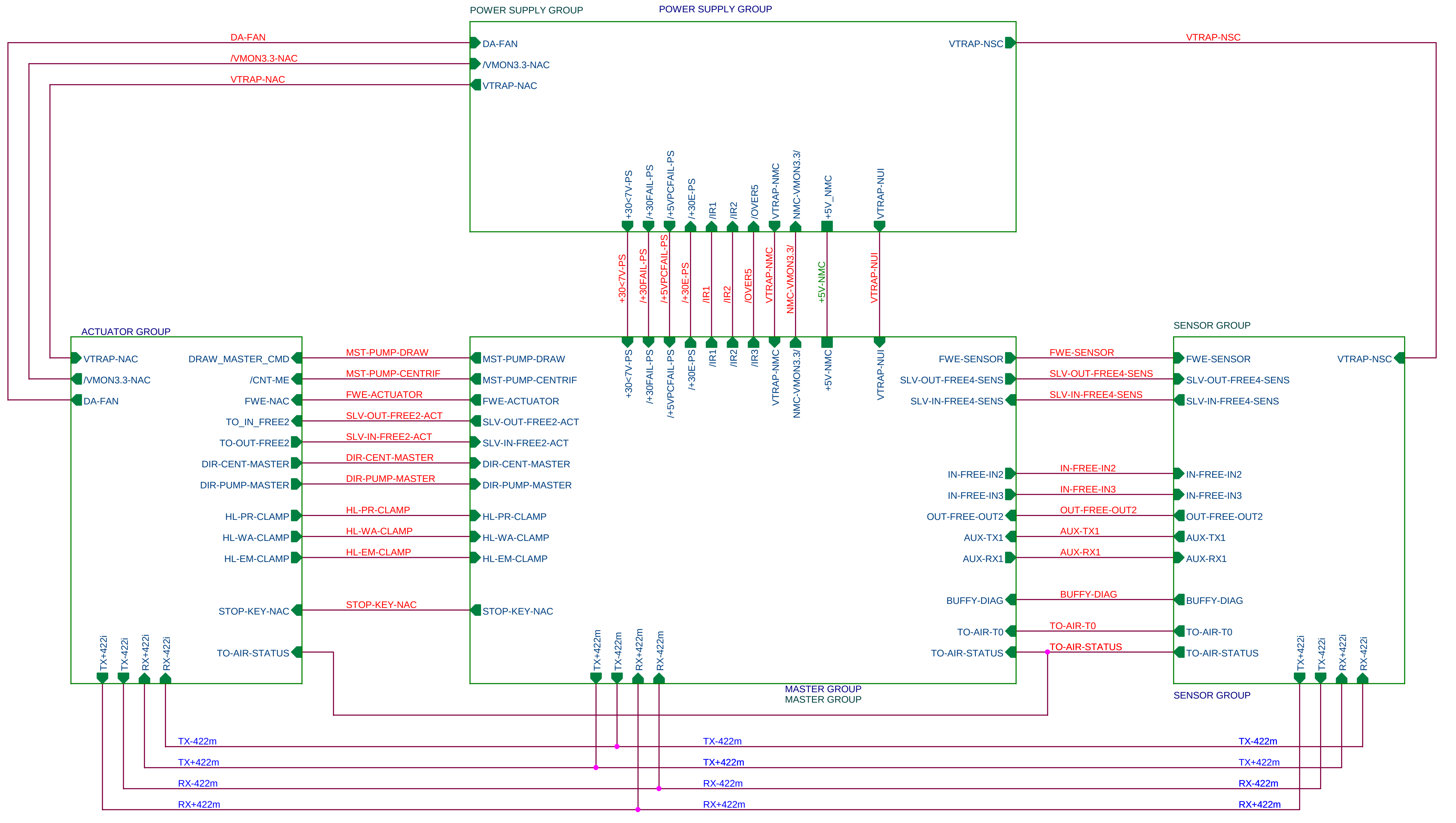
The purpose of this card is to illustrate the **NBP p.c. board** schematics.

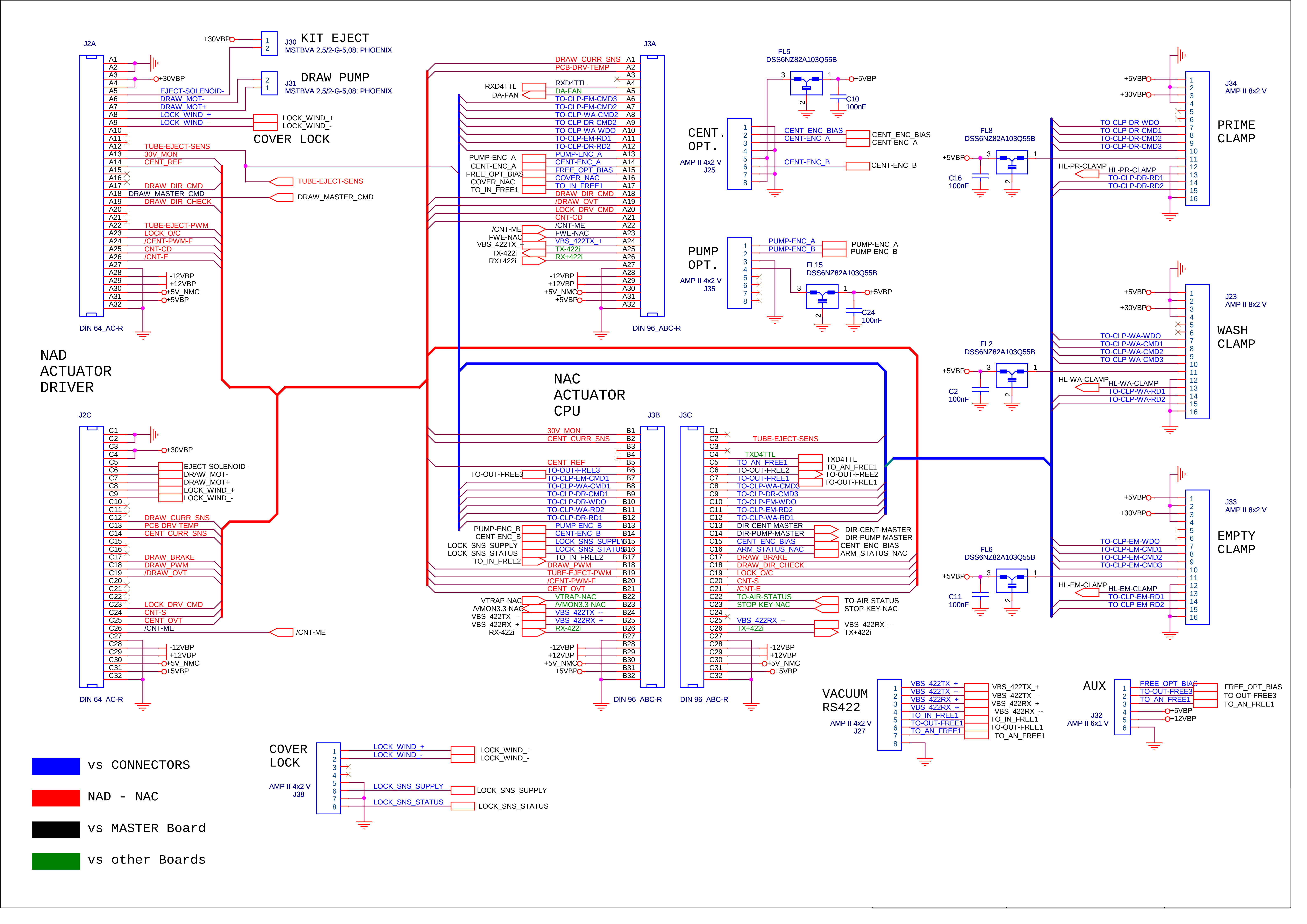

A C J1
J2 A C
A B C J3
J4 A C
A B C J5
A B C J6
J7 A C
NPS
NAD
NAC
NMC
NSC
NSA
AVB
SORIN GROUP
NBP REV.2

TOP SIDE

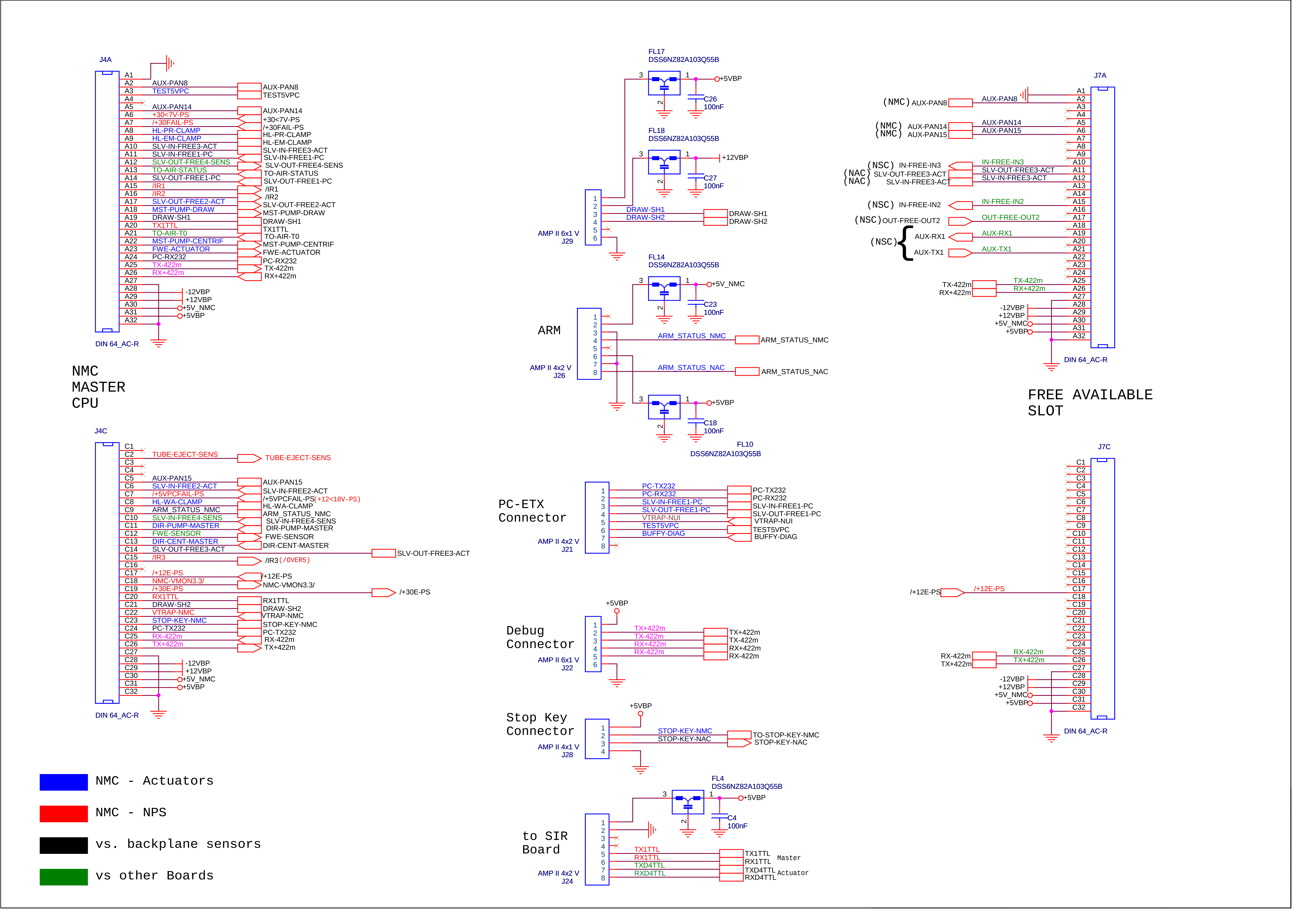

J8
J9
J10
J11
J12
J13
J7
AVB
NSA
J6
J14
J15
J16
NSC
J5
J18
J19
J21
J4
NMC
J20
J23
J24
J25
J26
J27
J28
J29
J22
RS422
J17
J3
NAC
J30
J31
J32
J33
J34
J35
NAD
J2
J36
J37
J38
J39
POWER SUPPLY
J40
J41
J42
J43
J44
NPS
J1
BUFFY LOW
TP2
+5V_NMC
TP3
+12V
TP4
-12V
TP6
+5V
TP5
GND
TP7
+30V
TP1
F1
F2
F3

BOTTOM SIDE

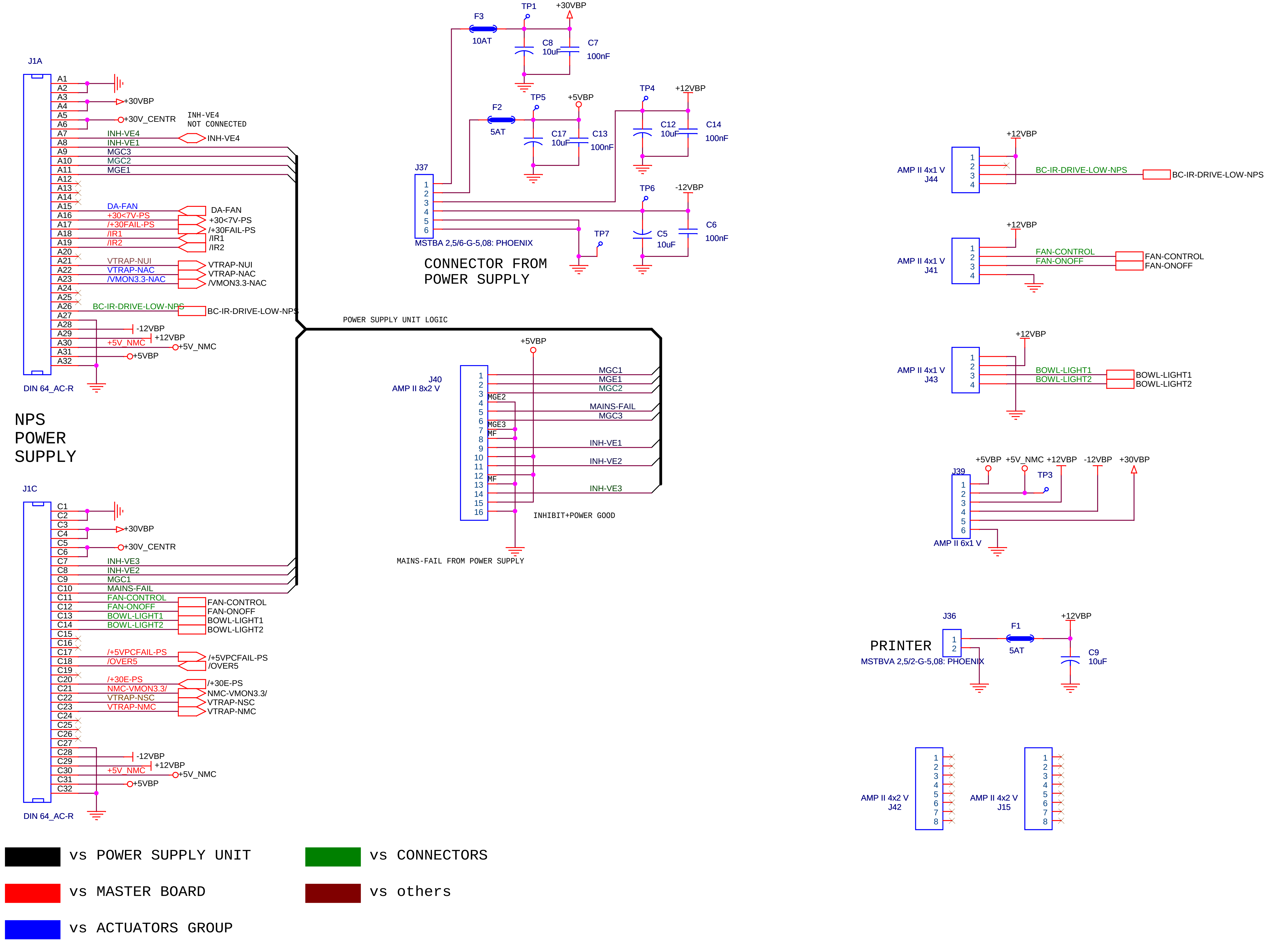

POWER SUPPLY GROUP
POWER SUPPLY GROUP
DA-FAN
/VMON3.3-NAC
VTRAP-NAC
VTRAP-NSC
+30<7V-PS
/+30FAIL-PS
/+5VPCFAIL-PS
/+30E-PS
/IR1
/IR2
/OVER5
VTRAP-NMC
NMC-VMON3.3/
+5V_NMC
VTRAP-NUI
+5V-NMC
/IR3
ACTUATOR GROUP
DRAW_MASTER_CMD
/CNT-ME
FWE-NAC
TO_IN_FREE2
TO-OUT-FREE2
DIR-CENT-MASTER
DIR-PUMP-MASTER
HL-PR-CLAMP
HL-WA-CLAMP
HL-EM-CLAMP
STOP-KEY-NAC
TO-AIR-STATUS
TX+422i
TX-422i
RX+422i
RX-422i
MST-PUMP-DRAW
MST-PUMP-CENTRIF
FWE-ACTUATOR
SLV-OUT-FREE2-ACT
SLV-IN-FREE2-ACT
TX+422m
TX-422m
RX+422m
RX-422m
MASTER GROUP
MASTER GROUP
FWE-SENSOR
SLV-OUT-FREE4-SENS
SLV-IN-FREE4-SENS
IN-FREE-IN2
IN-FREE-IN3
OUT-FREE-OUT2
AUX-TX1
AUX-RX1
BUFFY-DIAG
TO-AIR-T0
SENSOR GROUP
SENSOR GROUP



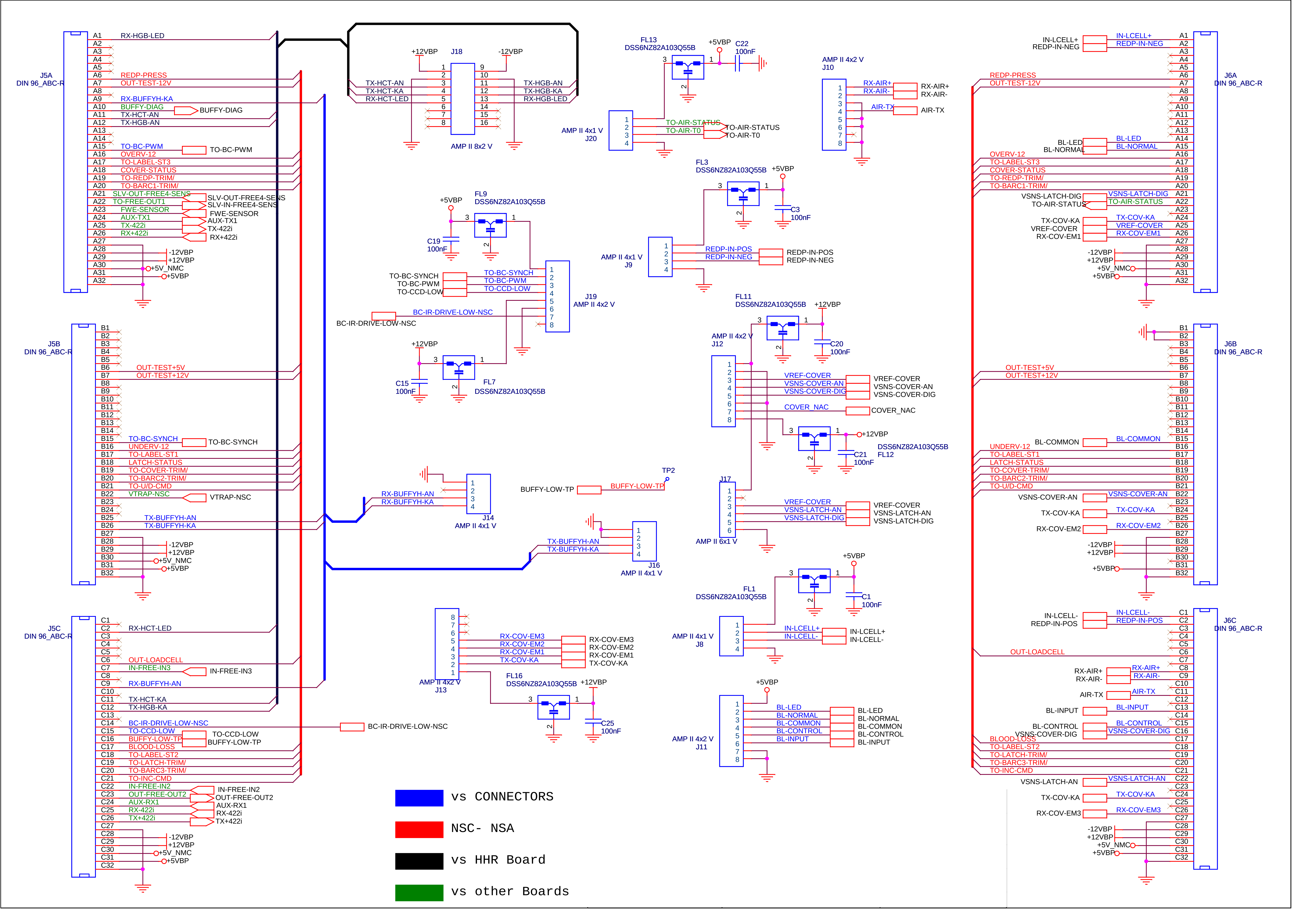
NAD ACTUATOR DRIVER
NAC ACTUATOR CPU
KIT EJECT
DRAW PUMP
COVER LOCK
CENT. OPT.
PUMP OPT.
PRIME CLAMP
WASH CLAMP
EMPTY CLAMP
VACUUM RS422
AUX
J2A
J2C
J3A
J3B
J3C
J30 MSTBVA 2,5/2-G-5,08: PHOENIX
J31 MSTBVA 2,5/2-G-5,08: PHOENIX
DIN 64_AC-R
DIN 96_ABC-R
AMP II 4x2 V J25
AMP II 4x2 V J35
AMP II 4x2 V J27
AMP II 4x2 V J38
AMP II 6x1 V J32
J34 AMP II 8x2 V
J23 AMP II 8x2 V
J33 AMP II 8x2 V
FL5 DSS6NZ82A103Q55B
FL15 DSS6NZ82A103Q55B
FL8 DSS6NZ82A103Q55B
FL2 DSS6NZ82A103Q55B
FL6 DSS6NZ82A103Q55B
vs CONNECTORS
NAD - NAC
vs MASTER Board
vs other Boards



NMC MASTER CPU
J4A
DIN 64_AC-R
J4C
FL17 DSS6NZ82A103Q55B
FL18 DSS6NZ82A103Q55B
FL14 DSS6NZ82A103Q55B
FL10 DSS6NZ82A103Q55B
FL4 DSS6NZ82A103Q55B
ARM
AMP II 6x1 V J29
AMP II 4x2 V J26
ARM_STATUS_NMC
ARM_STATUS_NAC
PC-ETX Connector
AMP II 4x2 V J21
Debug Connector
AMP II 6x1 V J22
Stop Key Connector
AMP II 4x1 V J28
to SIR Board
AMP II 4x2 V J24
Master
Actuator
FREE AVAILABLE SLOT
J7A
J7C
NMC - Actuators
NMC - NPS
vs. backplane sensors
vs other Boards



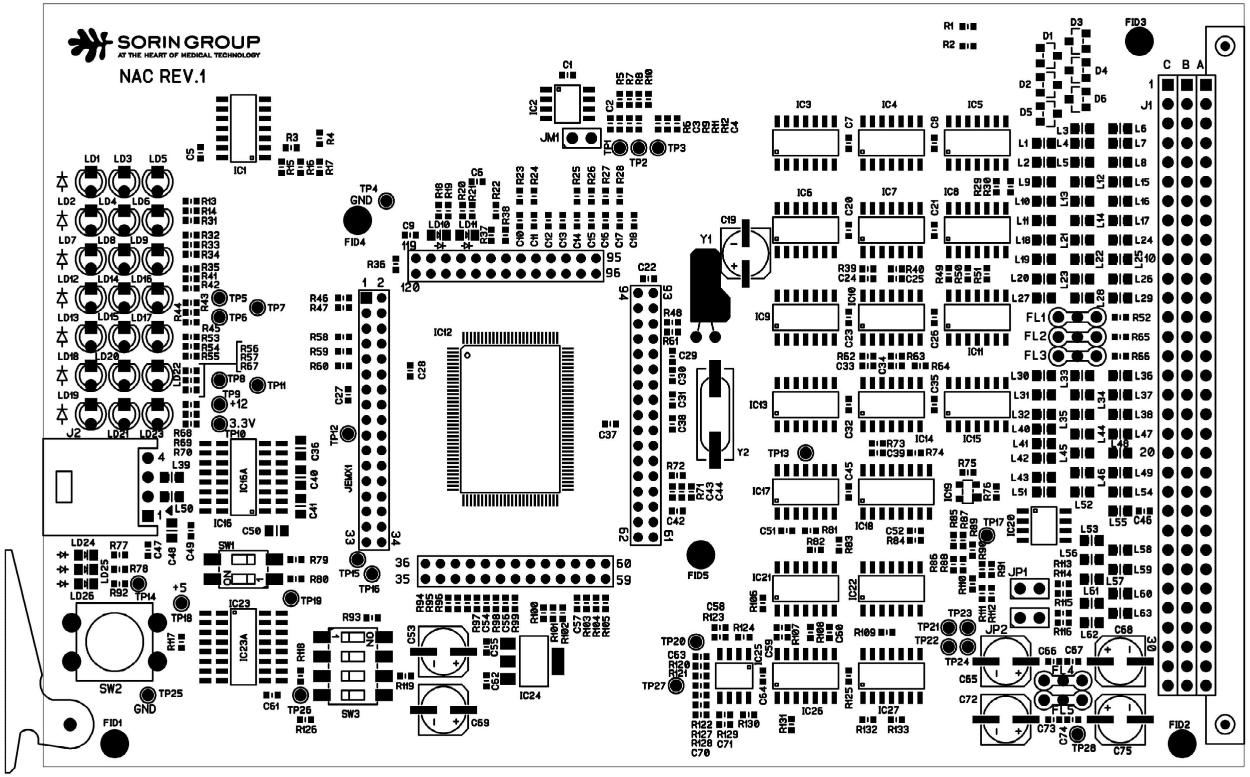
NPS POWER SUPPLY
J1A
DIN 64_AC-R
J1C
DIN 64_AC-R
+30VBP
+30V_CENTR
INH-VE4 NOT CONNECTED
INH-VE4
INH-VE1
MGC3
MGC2
MGE1
DA-FAN
+30<7V-PS
/+30FAIL-PS
/IR1
/IR2
VTRAP-NUI
VTRAP-NAC
/VMON3.3-NAC
BC-IR-DRIVE-LOW-NPS
-12VBP
+12VBP
+5V_NMC
+5VBP
INH-VE3
INH-VE2
MGC1
MAINS-FAIL
FAN-CONTROL
FAN-ONOFF
BOWL-LIGHT1
BOWL-LIGHT2
/+5VPCFAIL-PS
/OVER5
/+30E-PS
NMC-VMON3.3/
VTRAP-NSC
VTRAP-NMC
CONNECTOR FROM POWER SUPPLY
J37
MSTBA 2,5/6-G-5,08: PHOENIX
F3 10AT
F2 5AT
TP1 TP4 TP5 TP6 TP7
C8 10uF
C7 100nF
C17 10uF
C13 100nF
C12 10uF
C14 100nF
C5 10uF
C6 100nF
POWER SUPPLY UNIT LOGIC
J40
AMP II 8x2 V
MGE2
MGE3
MF
MAINS-FAIL
INH-VE1
INH-VE2
INH-VE3
INHIBIT+POWER GOOD
MAINS-FAIL FROM POWER SUPPLY
AMP II 4x1 V J44
AMP II 4x1 V J41
AMP II 4x1 V J43
J39
AMP II 6x1 V
TP3
J36
F1 5AT
C9 10uF
PRINTER
MSTBVA 2,5/2-G-5,08: PHOENIX
AMP II 4x2 V J42
AMP II 4x2 V J15
vs POWER SUPPLY UNIT
vs MASTER BOARD
vs ACTUATORS GROUP
vs CONNECTORS
vs others

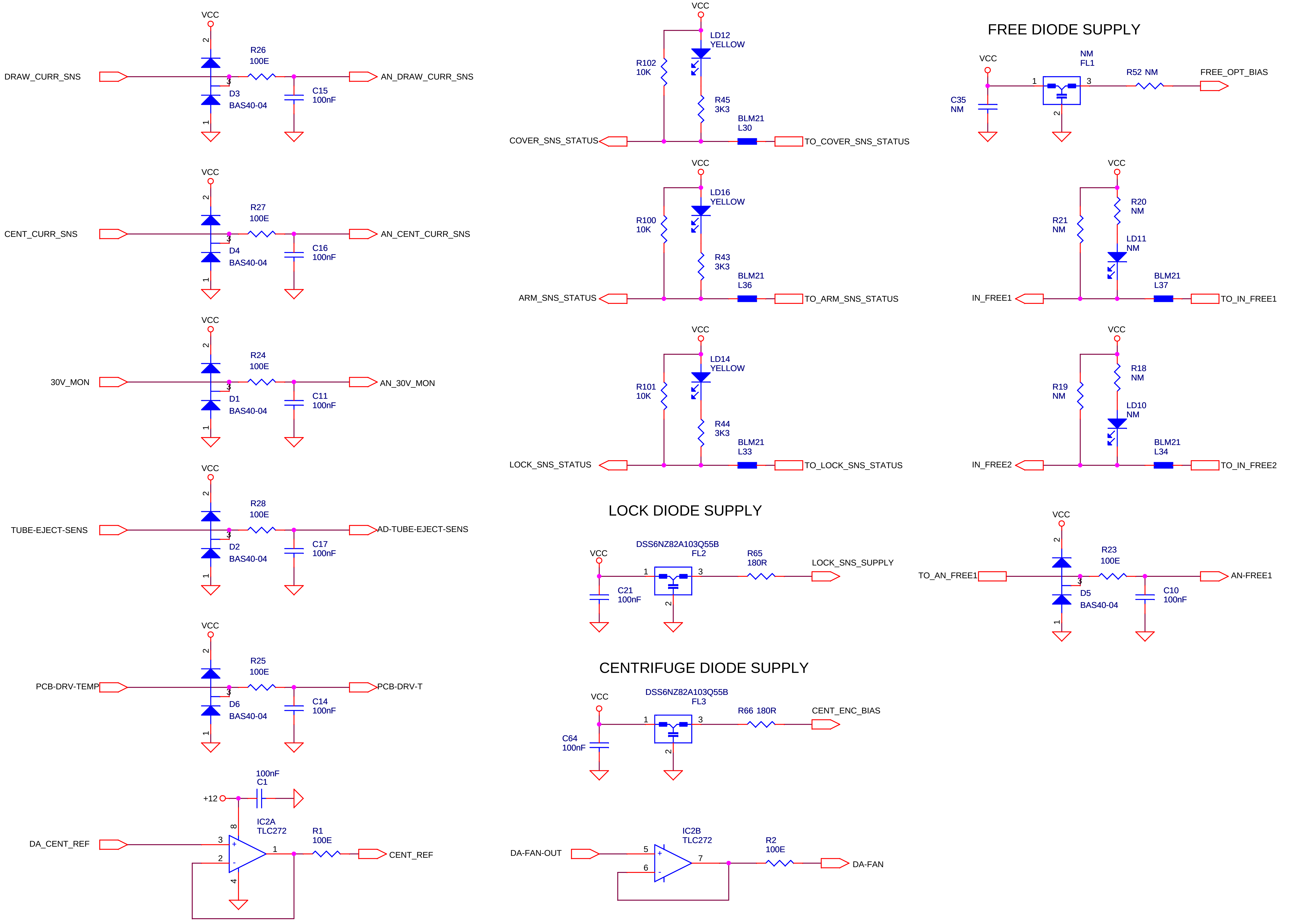

J5A
DIN 96_ABC-R
J5B
DIN 96_ABC-R
J5C
DIN 96_ABC-R
J6A
DIN 96_ABC-R
J6B
DIN 96_ABC-R
J6C
DIN 96_ABC-R
J18
AMP II 8x2 V
+12VBP
-12VBP
TX-HCT-AN
TX-HCT-KA
RX-HCT-LED
TX-HGB-AN
TX-HGB-KA
RX-HGB-LED
FL13
DSS6NZ82A103Q55B
+5VBP
C22
100nF
AMP II 4x1 V
J20
TO-AIR-STATUS
TO-AIR-T0
AMP II 4x2 V
J10
RX-AIR+
RX-AIR-
AIR-TX
FL3
DSS6NZ82A103Q55B
C3
100nF
AMP II 4x1 V
J9
REDP-IN-POS
REDP-IN-NEG
FL9
DSS6NZ82A103Q55B
C19
100nF
TO-BC-SYNCH
TO-BC-PWM
TO-CCD-LOW
J19
AMP II 4x2 V
BC-IR-DRIVE-LOW-NSC
FL7
DSS6NZ82A103Q55B
C15
100nF
FL11
DSS6NZ82A103Q55B
+12VBP
C20
100nF
AMP II 4x2 V
J12
VREF-COVER
VSNS-COVER-AN
VSNS-COVER-DIG
COVER_NAC
FL12
DSS6NZ82A103Q55B
C21
100nF
J17
AMP II 6x1 V
VSNS-LATCH-AN
VSNS-LATCH-DIG
J14
AMP II 4x1 V
RX-BUFFYH-AN
RX-BUFFYH-KA
TP2
BUFFY-LOW-TP
J16
AMP II 4x1 V
TX-BUFFYH-AN
TX-BUFFYH-KA
FL1
DSS6NZ82A103Q55B
C1
100nF
AMP II 4x1 V
J8
IN-LCELL+
IN-LCELL-
AMP II 4x2 V
J13
RX-COV-EM3
RX-COV-EM2
RX-COV-EM1
TX-COV-KA
FL16
DSS6NZ82A103Q55B
C25
100nF
AMP II 4x2 V
J11
BL-LED
BL-NORMAL
BL-COMMON
BL-CONTROL
BL-INPUT
vs CONNECTORS
NSC- NSA
vs HHR Board
vs other Boards

18.7 NAC p.c. board Schematics rev.00

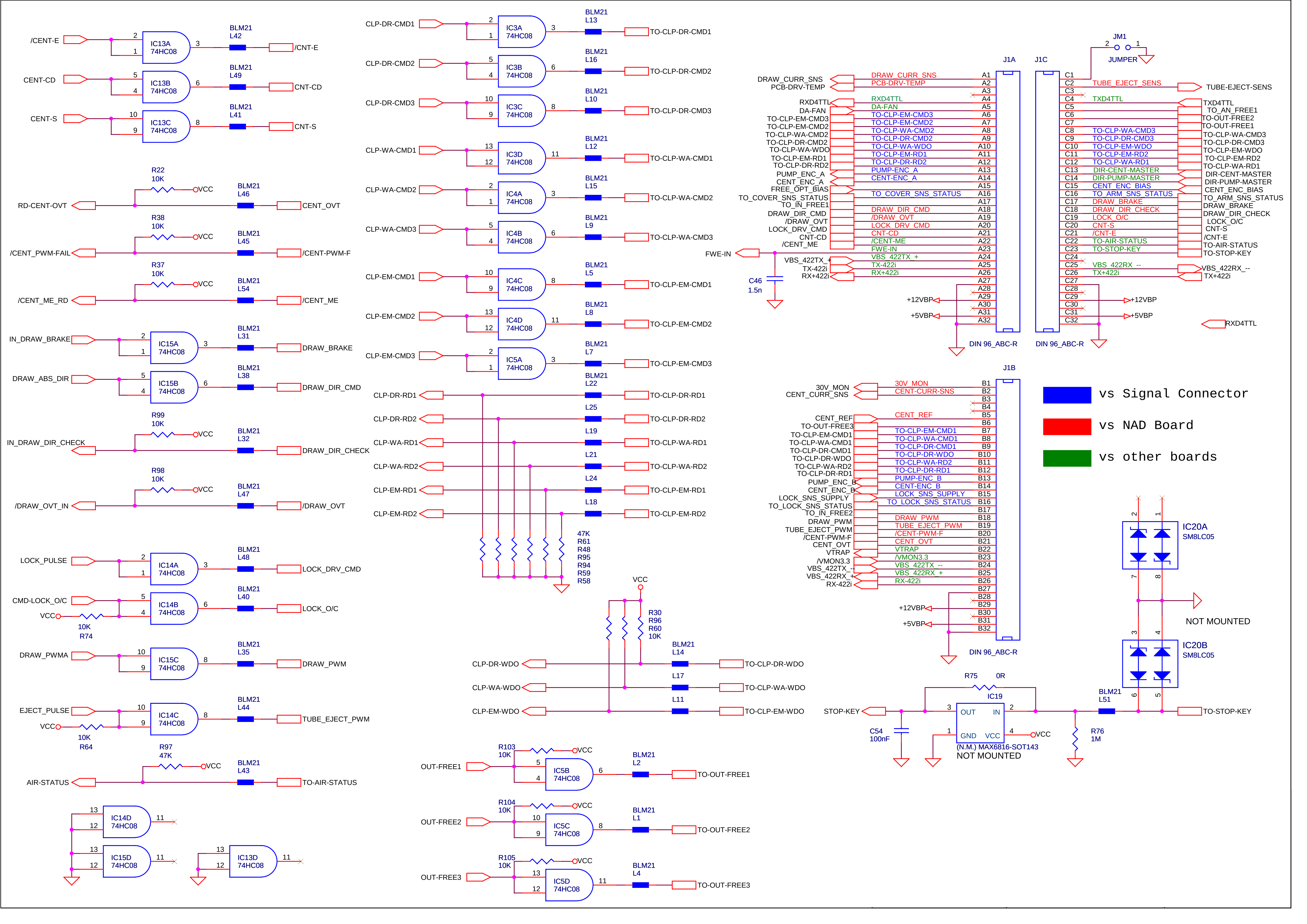
18.7.1 About this card

The purpose of this card is to illustrate the **NAC p.c. board** schematics.

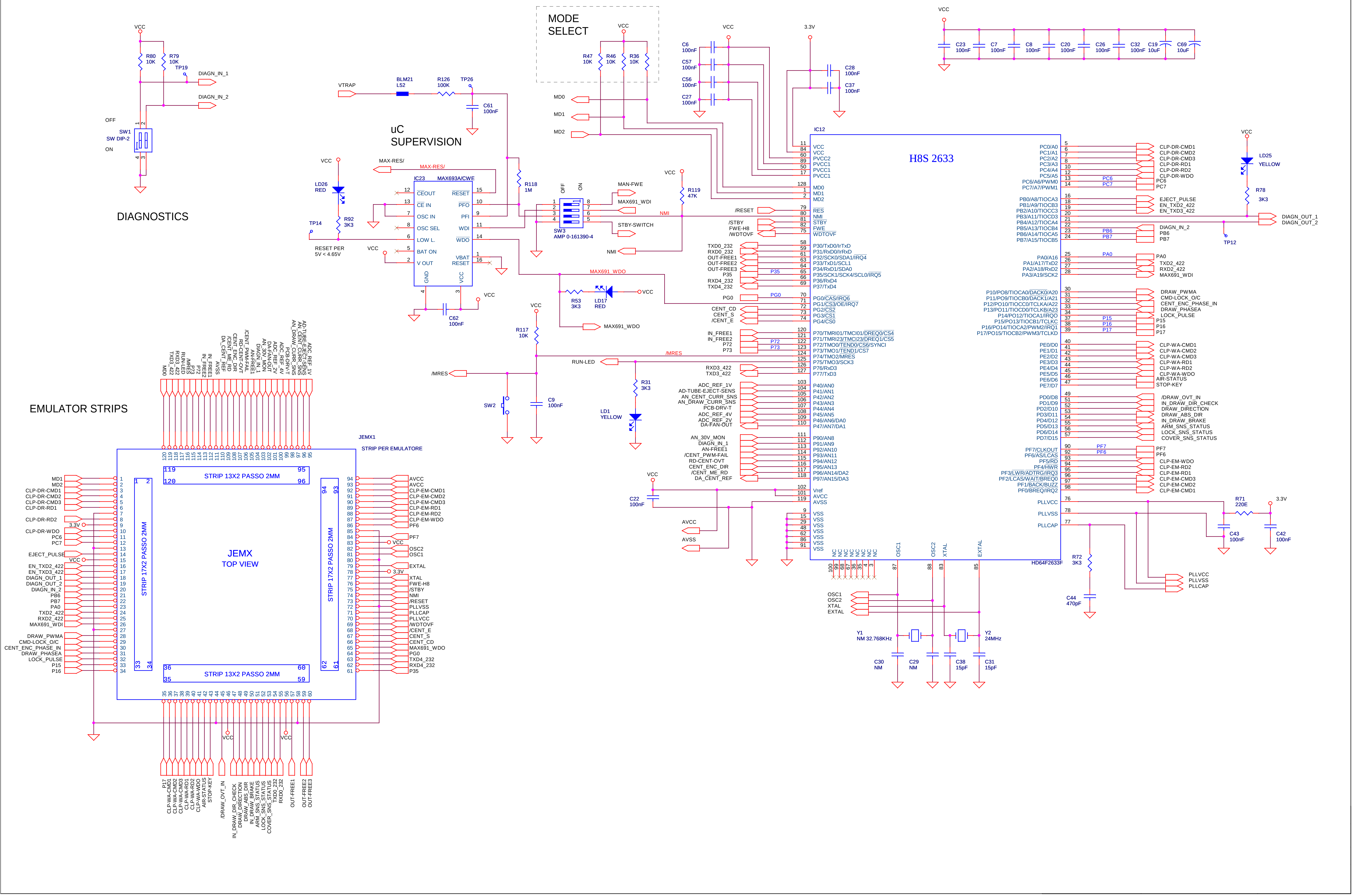

SORIN GROUP
AT THE HEART OF MEDICAL TECHNOLOGY
NAC REV.1

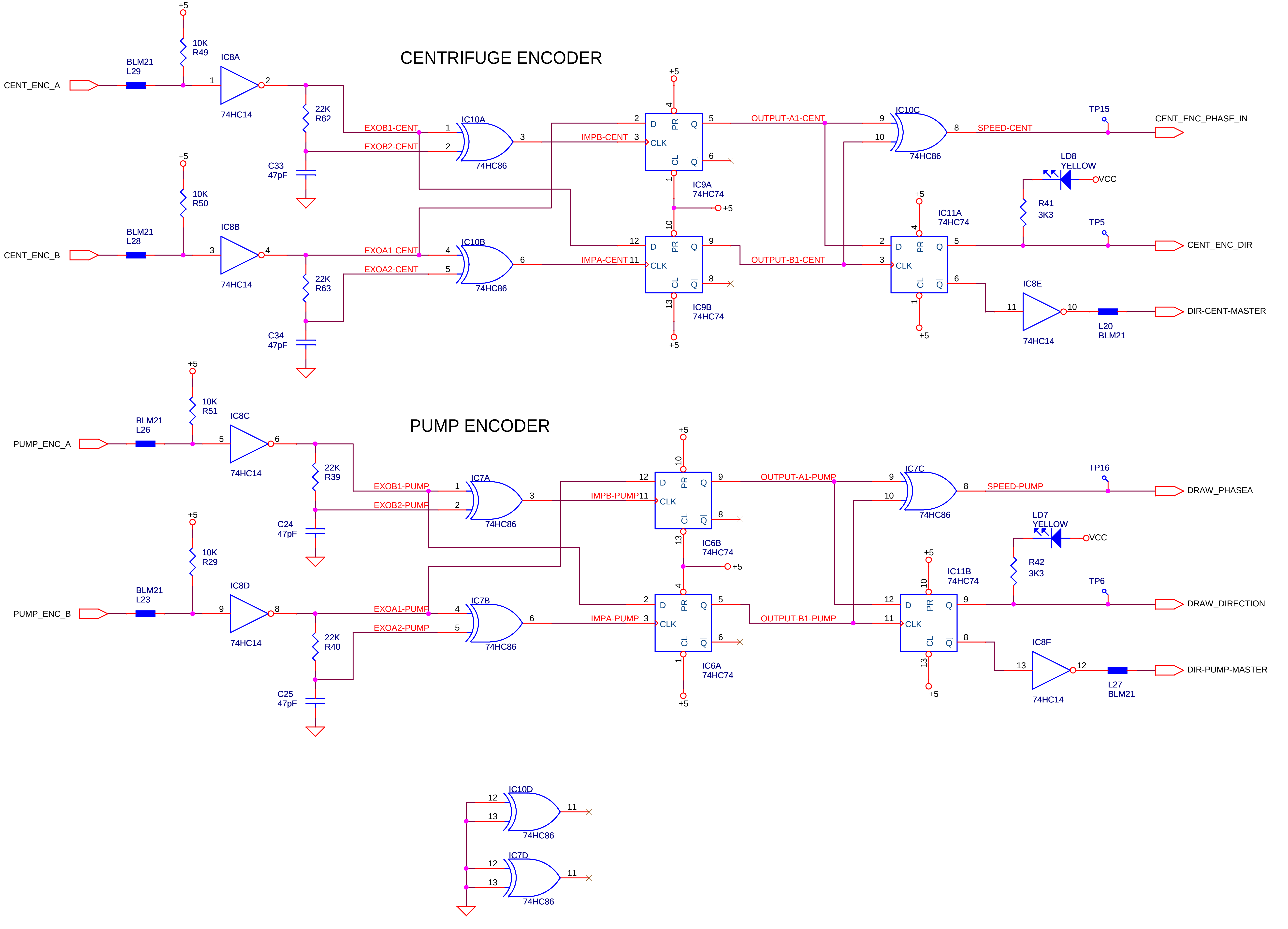


FREE DIODE SUPPLY
LOCK DIODE SUPPLY
CENTRIFUGE DIODE SUPPLY
VCC
DRAW_CURR_SNS
R26 100E
D3 BAS40-04
C15 100nF
AN_DRAW_CURR_SNS
CENT_CURR_SNS
R27 100E
D4 BAS40-04
C16 100nF
AN_CENT_CURR_SNS
30V_MON
R24 100E
D1 BAS40-04
C11 100nF
AN_30V_MON
TUBE-EJECT-SENS
R28 100E
D2 BAS40-04
C17 100nF
AD-TUBE-EJECT-SENS
PCB-DRV-TEMP
R25 100E
D6 BAS40-04
C14 100nF
PCB-DRV-T
+12
100nF C1
IC2A TLC272
DA_CENT_REF
R1 100E
CENT_REF
LD12 YELLOW
R102 10K
R45 3K3
BLM21 L30
COVER_SNS_STATUS
TO_COVER_SNS_STATUS
LD16 YELLOW
R100 10K
R43 3K3
BLM21 L36
ARM_SNS_STATUS
TO_ARM_SNS_STATUS
LD14 YELLOW
R101 10K
R44 3K3
BLM21 L33
LOCK_SNS_STATUS
TO_LOCK_SNS_STATUS
DSS6NZ82A103Q55B FL2
R65 180R
C21 100nF
LOCK_SNS_SUPPLY
DSS6NZ82A103Q55B FL3
R66 180R
C64 100nF
CENT_ENC_BIAS
IC2B TLC272
DA-FAN-OUT
R2 100E
DA-FAN
NM FL1
C35 NM
R52 NM
FREE_OPT_BIAS
R20 NM
R21 NM
LD11 NM
BLM21 L37
IN_FREE1
TO_IN_FREE1
R18 NM
R19 NM
LD10 NM
BLM21 L34
IN_FREE2
TO_IN_FREE2
TO_AN_FREE1
R23 100E
D5 BAS40-04
C10 100nF
AN-FREE1

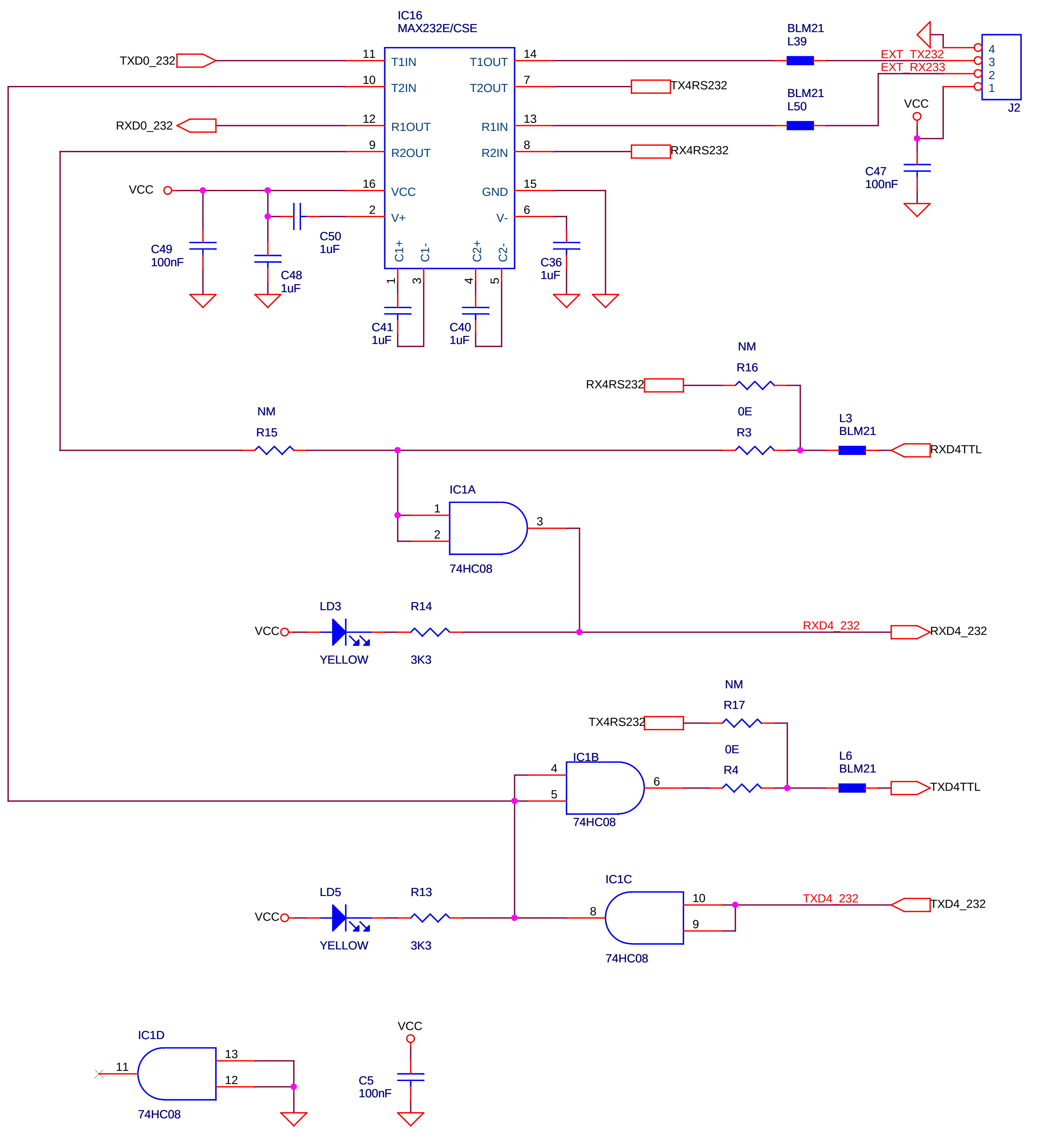


/CENT-E
IC13A 74HC08
BLM21 L42
/CNT-E
CENT-CD
IC13B 74HC08
BLM21 L49
CNT-CD
CENT-S
IC13C 74HC08
BLM21 L41
CNT-S
R22 10K
VCC
RD-CENT-OVT
BLM21 L46
CENT_OVT
R38 10K
/CENT_PWM-FAIL
BLM21 L45
/CENT-PWM-F
R37 10K
/CENT_ME_RD
BLM21 L54
/CENT_ME
IN_DRAW_BRAKE
IC15A 74HC08
BLM21 L31
DRAW_BRAKE
DRAW_ABS_DIR
IC15B 74HC08
BLM21 L38
DRAW_DIR_CMD
R99 10K
IN_DRAW_DIR_CHECK
BLM21 L32
DRAW_DIR_CHECK
R98 10K
/DRAW_OVT_IN
BLM21 L47
/DRAW_OVT
LOCK_PULSE
IC14A 74HC08
BLM21 L48
LOCK_DRV_CMD
CMD-LOCK_O/C
IC14B 74HC08
BLM21 L40
LOCK_O/C
10K R74
DRAW_PWMA
IC15C 74HC08
BLM21 L35
DRAW_PWM
EJECT_PULSE
IC14C 74HC08
BLM21 L44
TUBE_EJECT_PWM
10K R64
R97 47K
AIR-STATUS
BLM21 L43
TO-AIR-STATUS
IC14D 74HC08
IC15D 74HC08
IC13D 74HC08
CLP-DR-CMD1
IC3A 74HC08
BLM21 L13
TO-CLP-DR-CMD1
CLP-DR-CMD2
IC3B 74HC08
BLM21 L16
TO-CLP-DR-CMD2
CLP-DR-CMD3
IC3C 74HC08
BLM21 L10
TO-CLP-DR-CMD3
CLP-WA-CMD1
IC3D 74HC08
BLM21 L12
TO-CLP-WA-CMD1
CLP-WA-CMD2
IC4A 74HC08
BLM21 L15
TO-CLP-WA-CMD2
CLP-WA-CMD3
IC4B 74HC08
BLM21 L9
TO-CLP-WA-CMD3
CLP-EM-CMD1
IC4C 74HC08
BLM21 L5
TO-CLP-EM-CMD1
CLP-EM-CMD2
IC4D 74HC08
BLM21 L8
TO-CLP-EM-CMD2
CLP-EM-CMD3
IC5A 74HC08
BLM21 L7
TO-CLP-EM-CMD3
CLP-DR-RD1
BLM21 L22
TO-CLP-DR-RD1
CLP-DR-RD2
L25
TO-CLP-DR-RD2
CLP-WA-RD1
L19
TO-CLP-WA-RD1
CLP-WA-RD2
L21
TO-CLP-WA-RD2
CLP-EM-RD1
L24
TO-CLP-EM-RD1
CLP-EM-RD2
L18
TO-CLP-EM-RD2
47K R61 R48 R95 R94 R59 R58
VCC
R30 R96 R60 10K
CLP-DR-WDO
BLM21 L14
TO-CLP-DR-WDO
CLP-WA-WDO
L17
TO-CLP-WA-WDO
CLP-EM-WDO
L11
TO-CLP-EM-WDO
R103 10K
OUT-FREE1
IC5B 74HC08
BLM21 L2
TO-OUT-FREE1
R104 10K
OUT-FREE2
IC5C 74HC08
BLM21 L1
TO-OUT-FREE2
R105 10K
OUT-FREE3
IC5D 74HC08
BLM21 L4
TO-OUT-FREE3
J1A
DRAW_CURR_SNS
PCB-DRV-TEMP
RXD4TTL
DA-FAN
TO-CLP-EM-CMD3
TO-CLP-EM-CMD2
TO-CLP-WA-CMD2
TO-CLP-DR-CMD2
TO-CLP-WA-WDO
TO-CLP-EM-RD1
TO-CLP-DR-RD2
PUMP_ENC_A
CENT_ENC_A
FREE_OPT_BIAS
TO_COVER_SNS_STATUS
TO_IN_FREE1
DRAW_DIR_CMD
/DRAW_OVT
LOCK_DRV_CMD
CNT-CD
/CENT_ME
FWE-IN
VBS_422TX_+
TX-422i
RX+422i
C46 1.5n
+12VBP
+5VBP
DIN 96_ABC-R
J1C
JM1
JUMPER
TUBE_EJECT_SENS
TUBE-EJECT-SENS
TXD4TTL
TO_AN_FREE1
TO-OUT-FREE2
TO-OUT-FREE1
TO-CLP-WA-CMD3
TO-CLP-DR-CMD3
TO-CLP-EM-WDO
TO-CLP-EM-RD2
TO-CLP-WA-RD1
DIR-CENT-MASTER
DIR-PUMP-MASTER
CENT_ENC_BIAS
TO_ARM_SNS_STATUS
DRAW_BRAKE
DRAW_DIR_CHECK
LOCK_O/C
CNT-S
/CNT-E
TO-AIR-STATUS
TO-STOP-KEY
VBS_422RX_--
TX+422i
RXD4TTL
J1B
30V_MON
CENT_CURR_SNS
CENT_REF
TO-OUT-FREE3
TO-CLP-EM-CMD1
TO-CLP-WA-CMD1
TO-CLP-DR-CMD1
TO-CLP-DR-WDO
TO-CLP-WA-RD2
TO-CLP-DR-RD1
PUMP_ENC_B
CENT_ENC_B
LOCK_SNS_SUPPLY
TO_LOCK_SNS_STATUS
TO_IN_FREE2
DRAW_PWM
TUBE_EJECT_PWM
/CENT-PWM-F
CENT_OVT
VTRAP
/VMON3.3
VBS_422TX_--
VBS_422RX_+
RX-422i
vs Signal Connector
vs NAD Board
vs other boards
IC20A SM8LC05
NOT MOUNTED
IC20B SM8LC05
R75 0R
IC19
OUT IN
GND VCC
(N.M.) MAX6816-SOT143
NOT MOUNTED
STOP-KEY
C54 100nF
R76 1M
BLM21 L51
TO-STOP-KEY


DIAGNOSTICS
MODE SELECT
uC SUPERVISION
H8S 2633
EMULATOR STRIPS
JEMX
TOP VIEW
STRIP 13X2 PASSO 2MM
STRIP 17X2 PASSO 2MM
JEMX1
STRIP PER EMULATORE
IC12
HD64F2633F
IC23 MAX693A/CWE
SW3 AMP 0-161390-4
SW1 SW DIP-2
RESET PER 5V < 4.65V

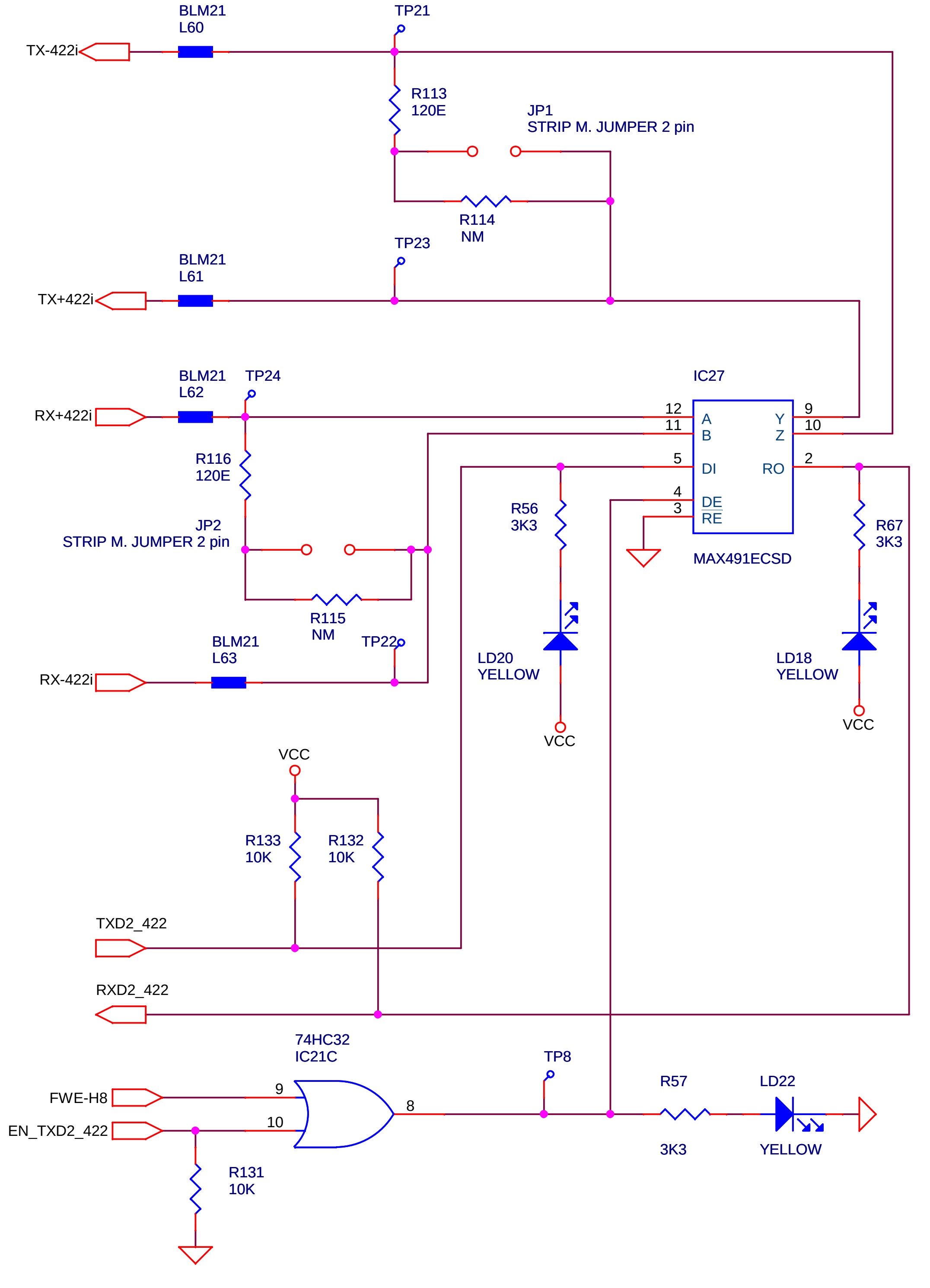


CENTRIFUGE ENCODER
CENT_ENC_A
CENT_ENC_B
BLM21 L29
BLM21 L28
10K R49
10K R50
IC8A 74HC14
IC8B 74HC14
22K R62
22K R63
C33 47pF
C34 47pF
EXOB1-CENT
EXOB2-CENT
EXOA1-CENT
EXOA2-CENT
IC10A 74HC86
IC10B 74HC86
IMPB-CENT
IMPA-CENT
IC9A 74HC74
IC9B 74HC74
OUTPUT-A1-CENT
OUTPUT-B1-CENT
IC10C 74HC86
SPEED-CENT
TP15
CENT_ENC_PHASE_IN
LD8 YELLOW
VCC
R41 3K3
IC11A 74HC74
TP5
CENT_ENC_DIR
IC8E 74HC14
L20 BLM21
DIR-CENT-MASTER
PUMP ENCODER
PUMP_ENC_A
PUMP_ENC_B
BLM21 L26
BLM21 L23
10K R51
10K R29
IC8C 74HC14
IC8D 74HC14
22K R39
22K R40
C24 47pF
C25 47pF
EXOB1-PUMP
EXOB2-PUMP
EXOA1-PUMP
EXOA2-PUMP
IC7A 74HC86
IC7B 74HC86
IMPB-PUMP
IMPA-PUMP
IC6B 74HC74
IC6A 74HC74
OUTPUT-A1-PUMP
OUTPUT-B1-PUMP
IC7C 74HC86
SPEED-PUMP
TP16
DRAW_PHASEA
LD7 YELLOW
VCC
R42 3K3
IC11B 74HC74
TP6
DRAW_DIRECTION
IC8F 74HC14
L27 BLM21
DIR-PUMP-MASTER
IC10D 74HC86
IC7D 74HC86

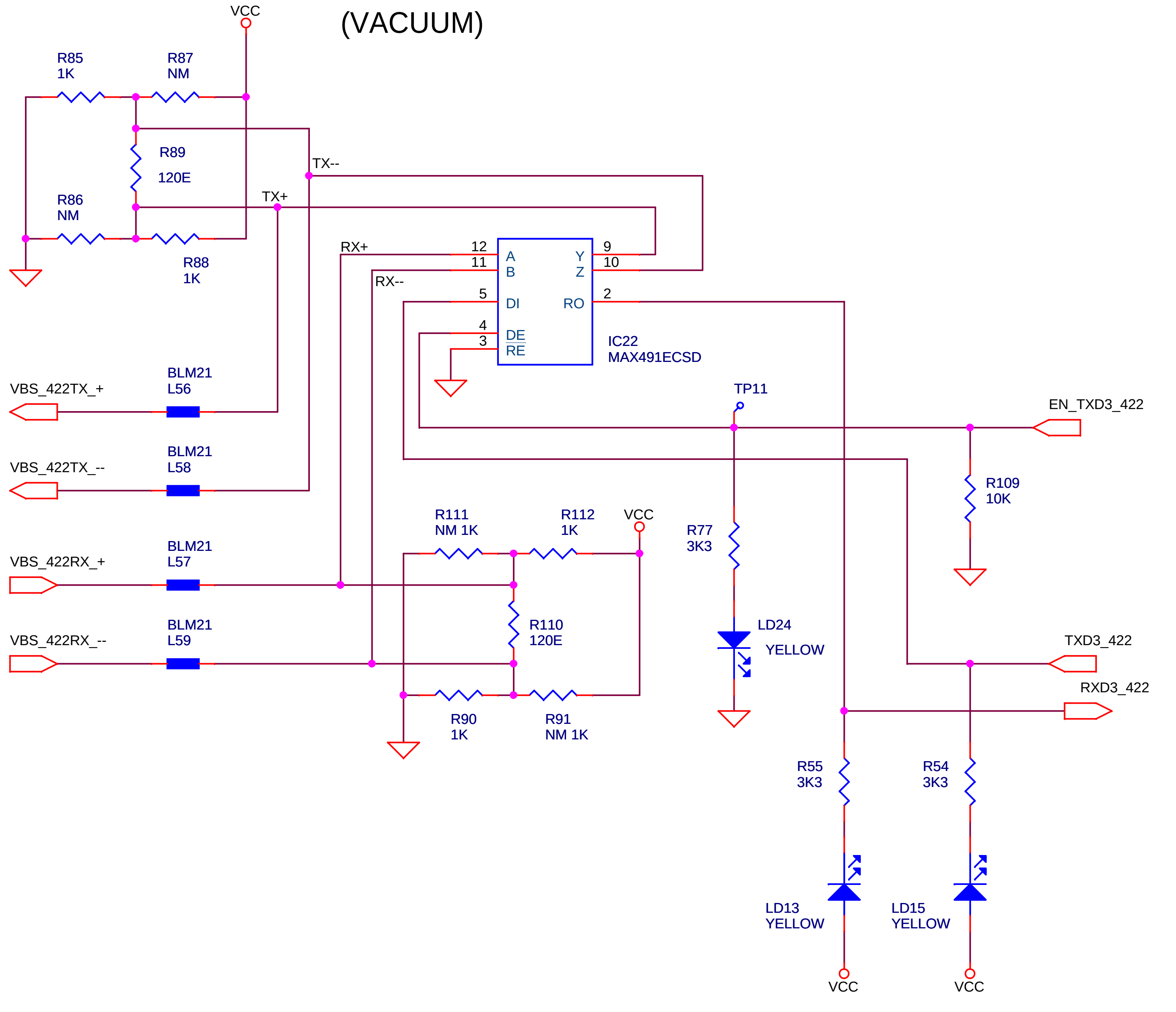


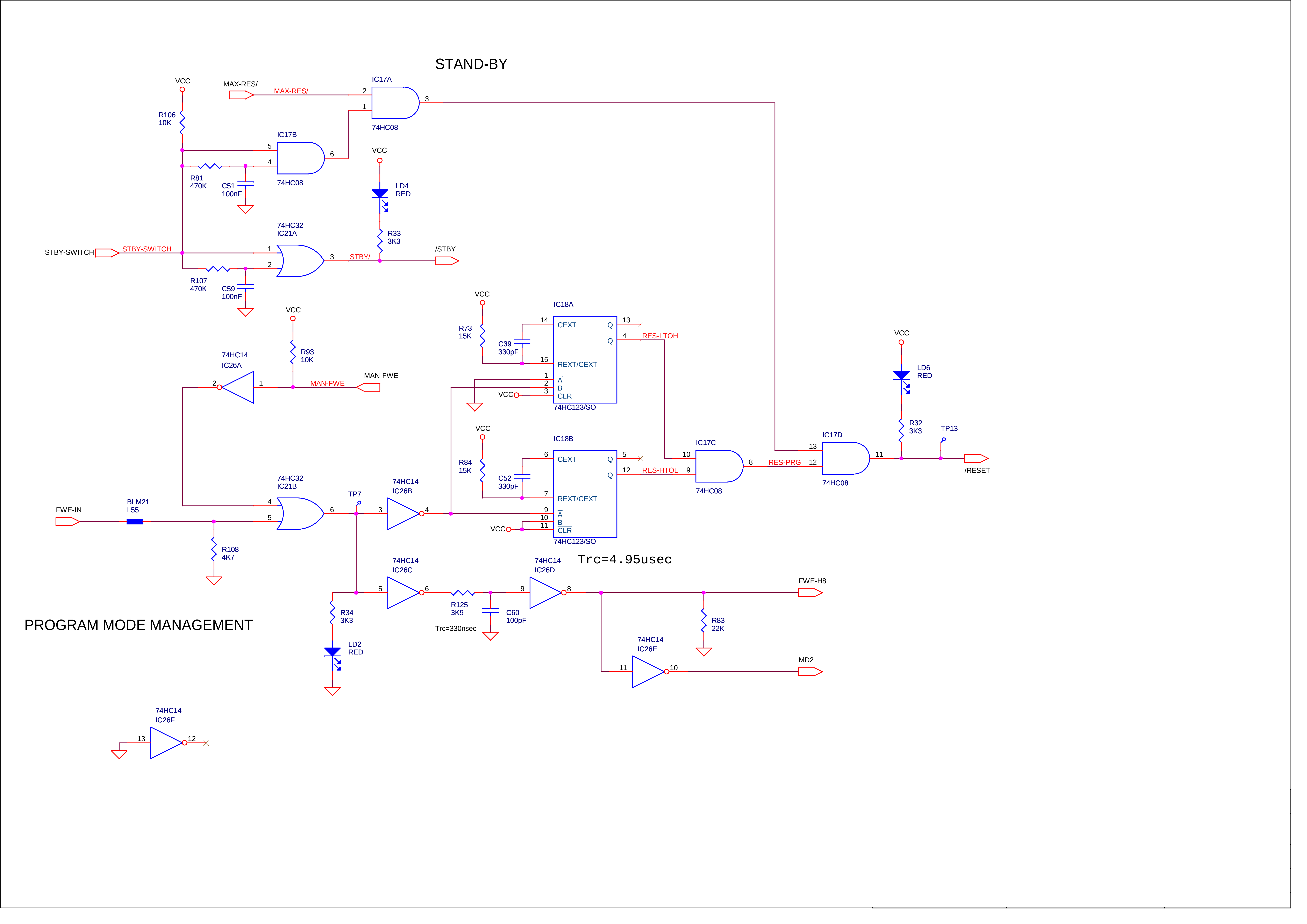
RS232 SERIAL CONNECTIONS

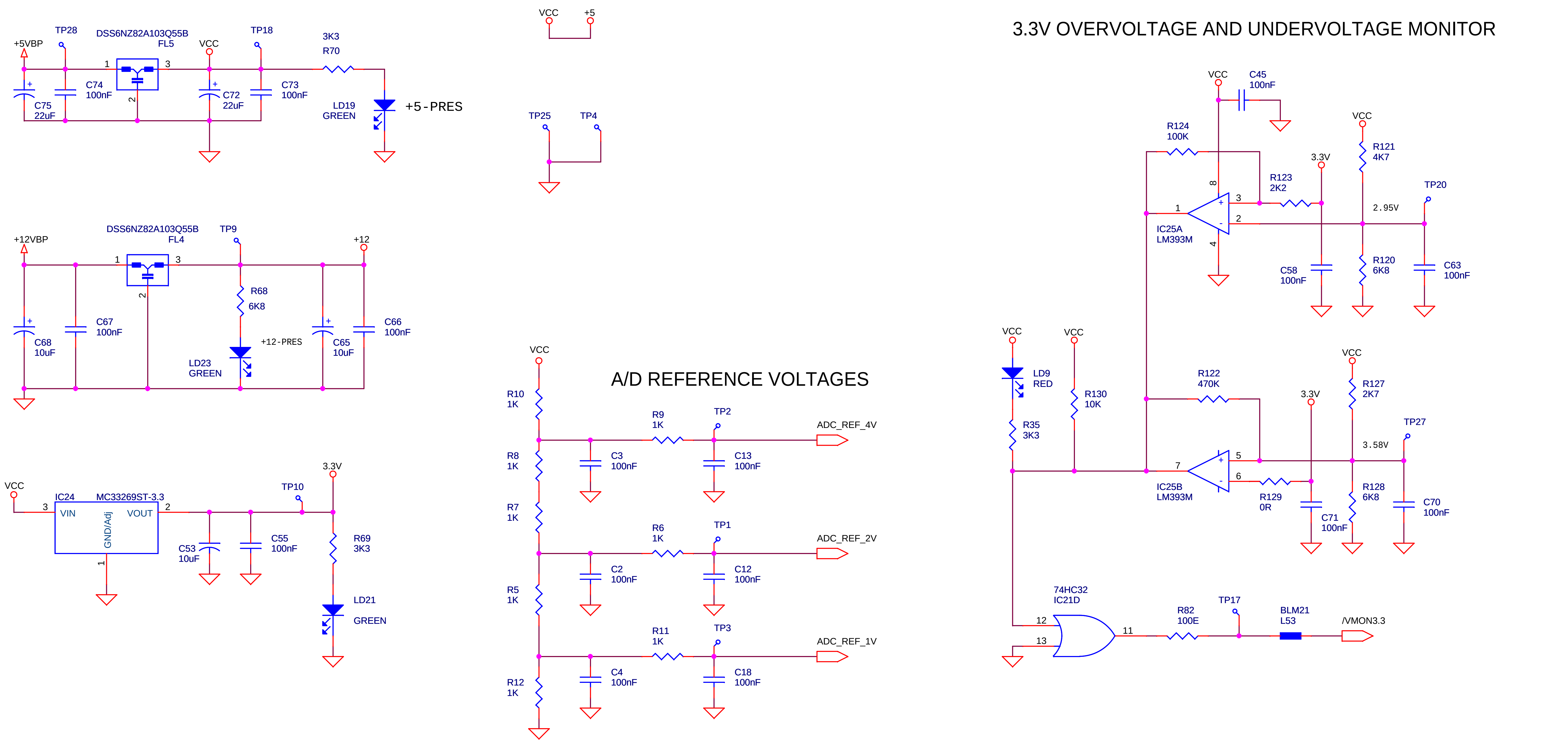
RS422 1ST LOOP SERIAL CONNECTION (MASTER)



RS422 2ND LOOP SERIAL CONNECTION (VACUUM)



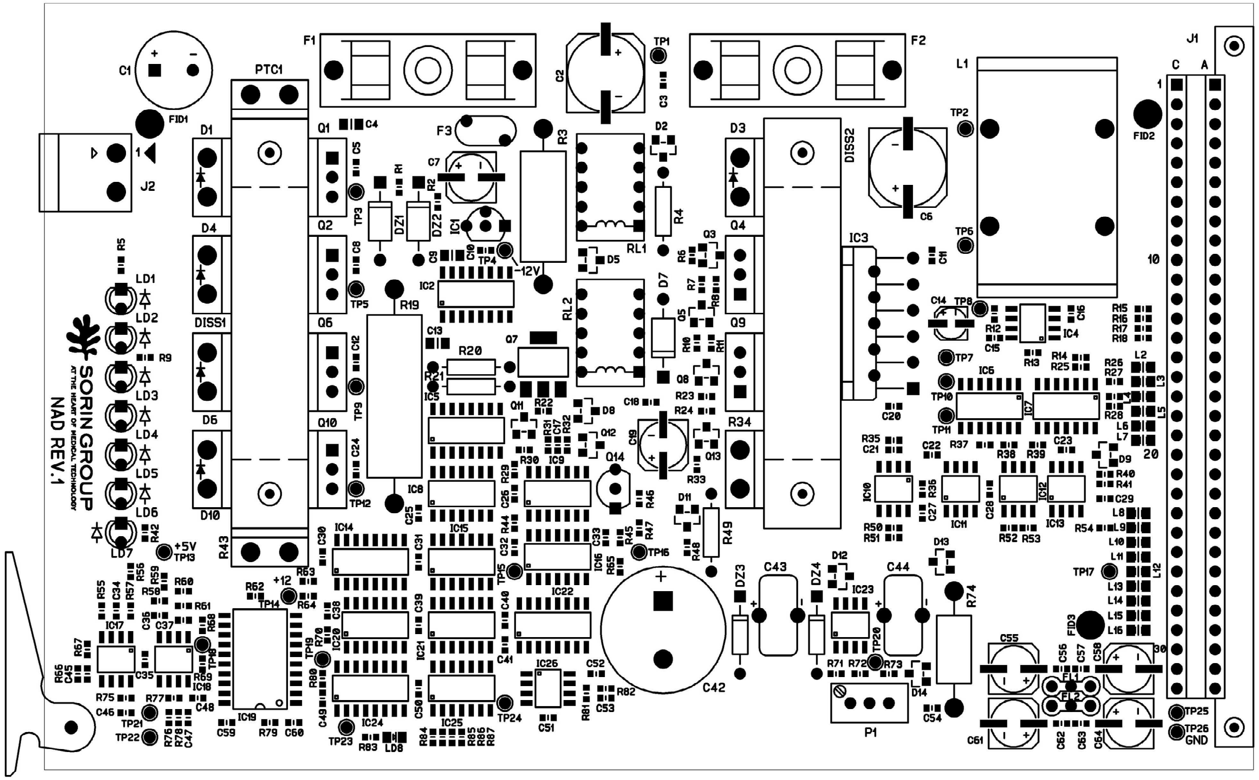

STAND-BY
MAX-RES/
IC17A
74HC08
IC17B
74HC08
VCC
R106
10K
R81
470K
C51
100nF
LD4
RED
R33
3K3
74HC32
IC21A
STBY-SWITCH
STBY/
/STBY
R107
470K
C59
100nF
IC18A
CEXT
REXT/CEXT
CLR
74HC123/SO
RES-LTOH
R73
15K
C39
330pF
74HC14
IC26A
R93
10K
MAN-FWE
IC18B
R84
15K
C52
330pF
RES-HTOL
IC17C
RES-PRG
IC17D
LD6
RED
R32
3K3
TP13
/RESET
74HC32
IC21B
TP7
IC26B
FWE-IN
BLM21
L55
R108
4K7
Trc=4.95usec
IC26C
IC26D
R125
3K9
C60
100pF
Trc=330nsec
FWE-H8
R83
22K
R34
3K3
LD2
RED
IC26E
MD2
PROGRAM MODE MANAGEMENT
IC26F

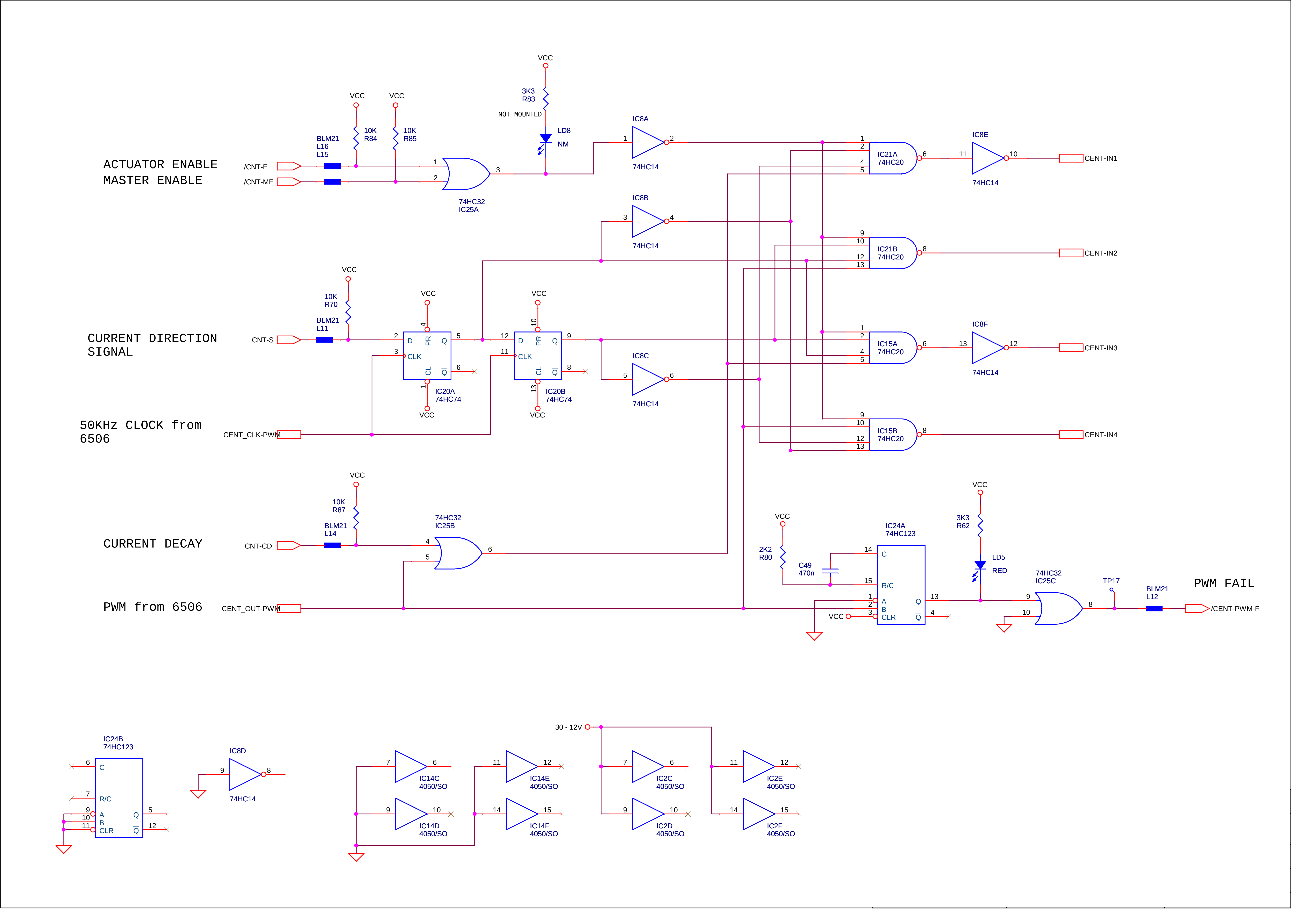

3.3V OVERVOLTAGE AND UNDERVOLTAGE MONITOR
A/D REFERENCE VOLTAGES
+5VBP
TP28
DSS6NZ82A103Q55B
FL5
VCC
TP18
3K3
R70
C75
22uF
C74
100nF
C72
22uF
C73
100nF
LD19
GREEN
+5-PRES
VCC
+5
TP25
TP4
+12VBP
DSS6NZ82A103Q55B
FL4
TP9
+12
R68
6K8
+12-PRES
LD23
GREEN
C68
10uF
C67
100nF
C65
10uF
C66
100nF
VCC
IC24
MC33269ST-3.3
VIN
VOUT
GND/Adj
TP10
3.3V
C53
10uF
C55
100nF
R69
3K3
LD21
GREEN
R10
1K
R8
1K
R7
1K
R5
1K
R12
1K
R9
1K
TP2
C3
100nF
C13
100nF
ADC_REF_4V
R6
1K
TP1
C2
100nF
C12
100nF
ADC_REF_2V
R11
1K
TP3
C4
100nF
C18
100nF
ADC_REF_1V
C45
100nF
R124
100K
R121
4K7
R123
2K2
TP20
2.95V
IC25A
LM393M
C58
100nF
R120
6K8
C63
100nF
LD9
RED
R130
10K
R35
3K3
R122
470K
R127
2K7
TP27
3.58V
IC25B
LM393M
R129
0R
C71
100nF
R128
6K8
C70
100nF
74HC32
IC21D
R82
100E
TP17
BLM21
L53
/VMON3.3

18.8 NAD p.c. board Schematics rev.00

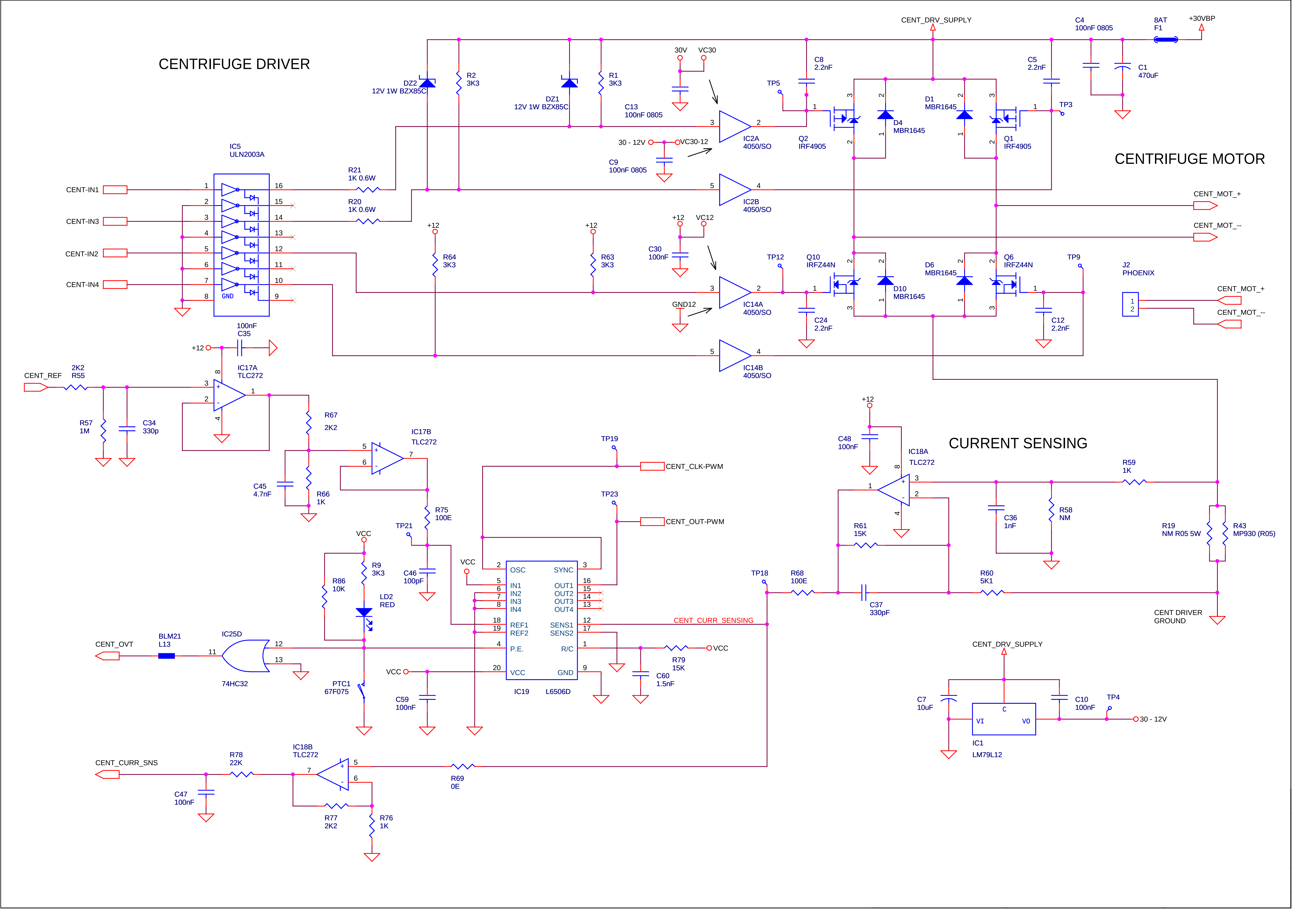
18.8.1 About this card

The purpose of this card is to illustrate the **NAD p.c. board** schematics.

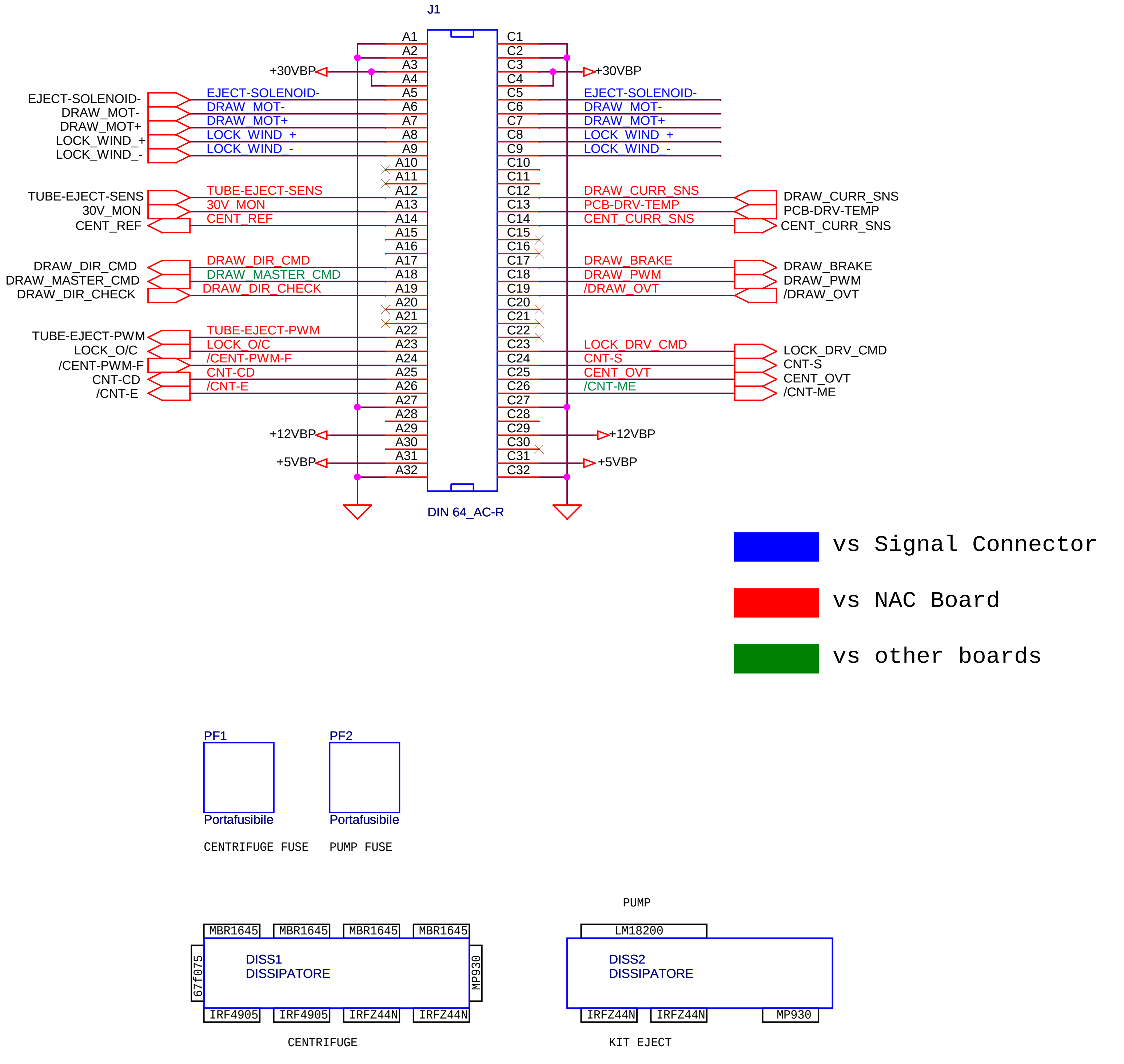




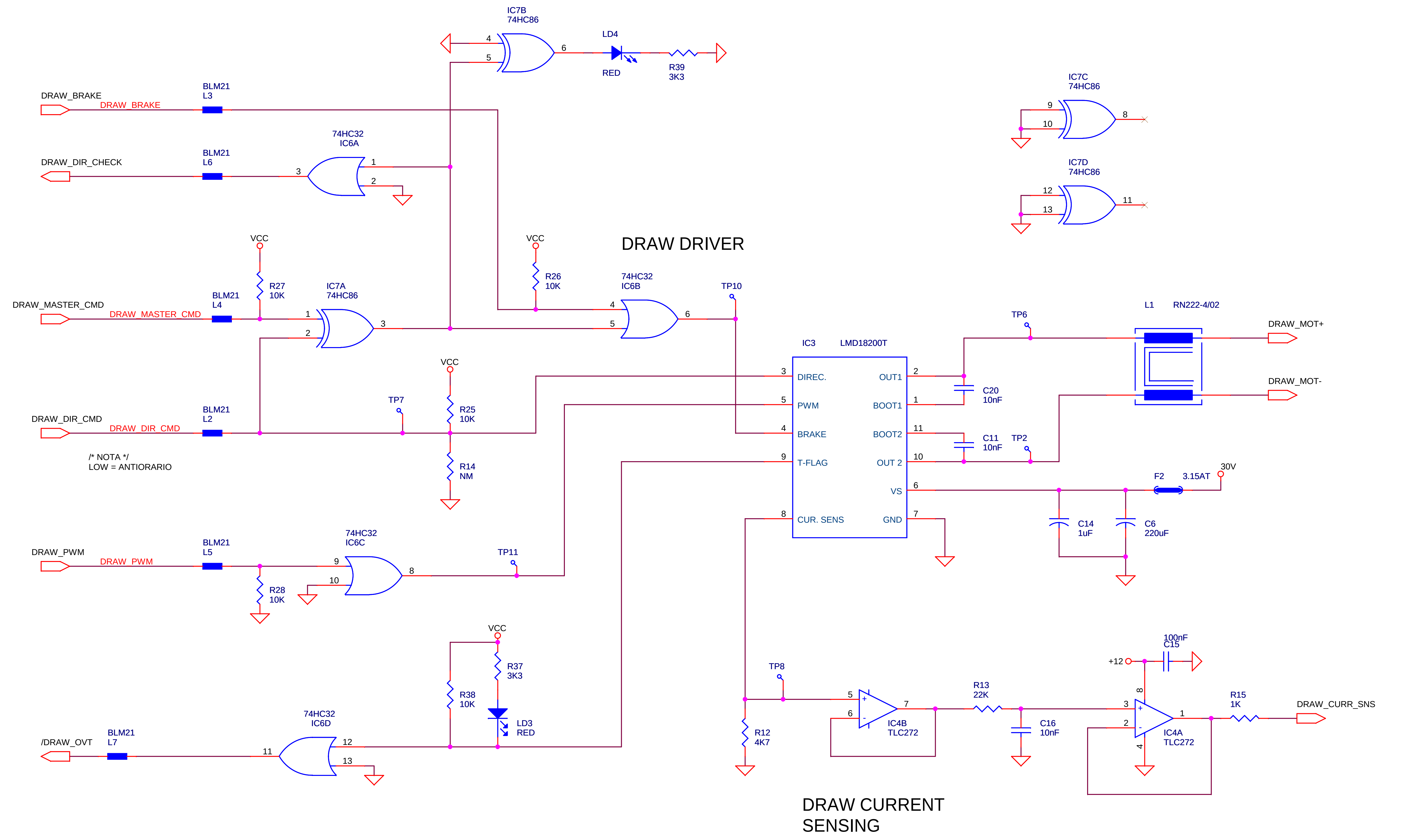
ACTUATOR ENABLE
MASTER ENABLE
/CNT-E
/CNT-ME
BLM21 L16 L15
10K R84
10K R85
VCC
74HC32 IC25A
3K3 R83
NOT MOUNTED
LD8
NM
IC8A
74HC14
IC8B
IC8C
IC8E
IC8F
IC21A 74HC20
IC21B 74HC20
IC15A 74HC20
IC15B 74HC20
CENT-IN1
CENT-IN2
CENT-IN3
CENT-IN4
CURRENT DIRECTION SIGNAL
CNT-S
10K R70
BLM21 L11
IC20A 74HC74
IC20B 74HC74
50KHz CLOCK from 6506
CENT_CLK-PWM
CURRENT DECAY
CNT-CD
10K R87
BLM21 L14
74HC32 IC25B
PWM from 6506
CENT_OUT-PWM
2K2 R80
C49 470n
IC24A 74HC123
3K3 R62
LD5
RED
74HC32 IC25C
TP17
BLM21 L12
PWM FAIL
/CENT-PWM-F
IC24B 74HC123
IC8D
30 - 12V
IC14C 4050/SO
IC14D 4050/SO
IC14E 4050/SO
IC14F 4050/SO
IC2C 4050/SO
IC2D 4050/SO
IC2E 4050/SO
IC2F 4050/SO

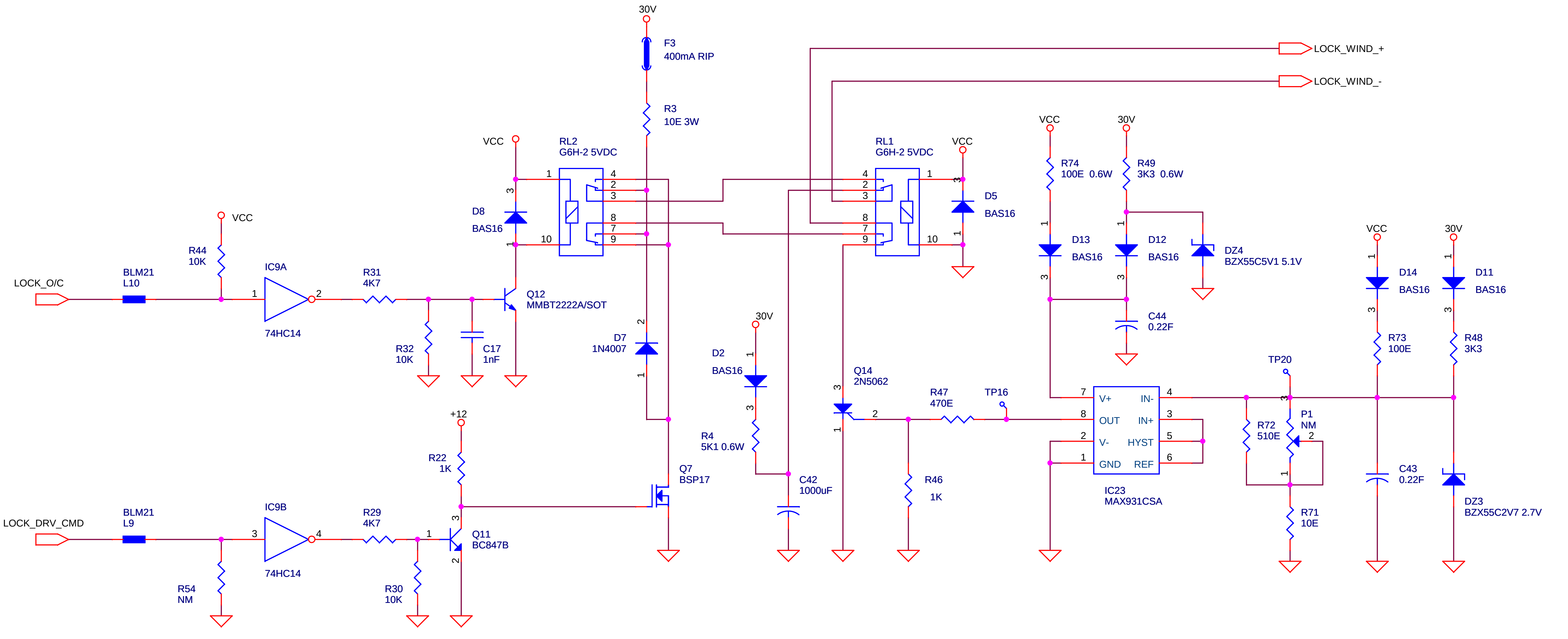


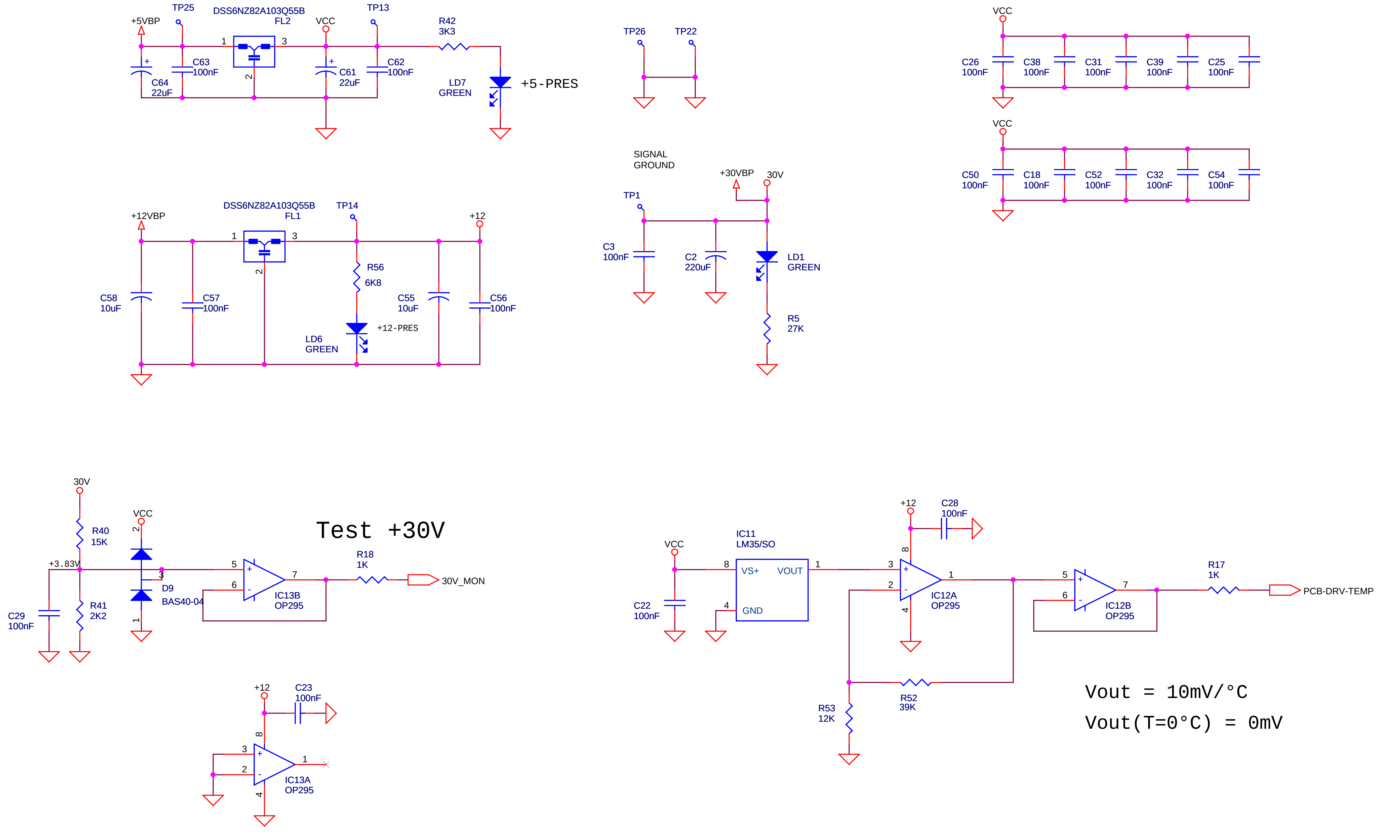
CENTRIFUGE DRIVER
CENTRIFUGE MOTOR
CURRENT SENSING
CENT_DRV_SUPPLY
C4 100nF 0805
8AT F1
+30VBP
C1 470uF
C5 2.2nF
C8 2.2nF
30V
VC30
DZ2 12V 1W BZX85C
R2 3K3
DZ1 12V 1W BZX85C
R1 3K3
C13 100nF 0805
TP5
TP3
D1 MBR1645
D4 MBR1645
Q1 IRF4905
Q2 IRF4905
IC2A 4050/SO
IC2B 4050/SO
30 - 12V
VC30-12
C9 100nF 0805
IC5 ULN2003A
GND
CENT-IN1
CENT-IN3
CENT-IN2
CENT-IN4
R21 1K 0.6W
R20 1K 0.6W
CENT_MOT_+
CENT_MOT_--
+12
VC12
R64 3K3
R63 3K3
C30 100nF
TP12
Q10 IRFZ44N
D6 MBR1645
Q6 IRFZ44N
TP9
D10 MBR1645
IC14A 4050/SO
IC14B 4050/SO
GND12
C24 2.2nF
C12 2.2nF
J2 PHOENIX
100nF C35
CENT_REF
2K2 R55
IC17A TLC272
R57 1M
C34 330p
R67 2K2
IC17B TLC272
C45 4.7nF
R66 1K
R75 100E
TP19
CENT_CLK-PWM
TP23
CENT_OUT-PWM
TP21
VCC
R9 3K3
R86 10K
LD2 RED
C46 100pF
OSC
SYNC
IN1 IN2 IN3 IN4
OUT1 OUT2 OUT3 OUT4
REF1 REF2
SENS1 SENS2
P.E.
R/C
GND
IC19 L6506D
CENT_CURR_SENSING
R79 15K
C60 1.5nF
CENT_OVT
BLM21 L13
IC25D
74HC32
PTC1 67F075
C59 100nF
C48 100nF
IC18A TLC272
R59 1K
C36 1nF
R58 NM
R19 NM R05 5W
R43 MP930 (R05)
R61 15K
TP18
R68 100E
C37 330pF
R60 5K1
CENT DRIVER GROUND
C7 10uF
C10 100nF
TP4
VI C VO
IC1 LM79L12
CENT_CURR_SNS
R78 22K
IC18B TLC272
C47 100nF
R69 0E
R77 2K2
R76 1K



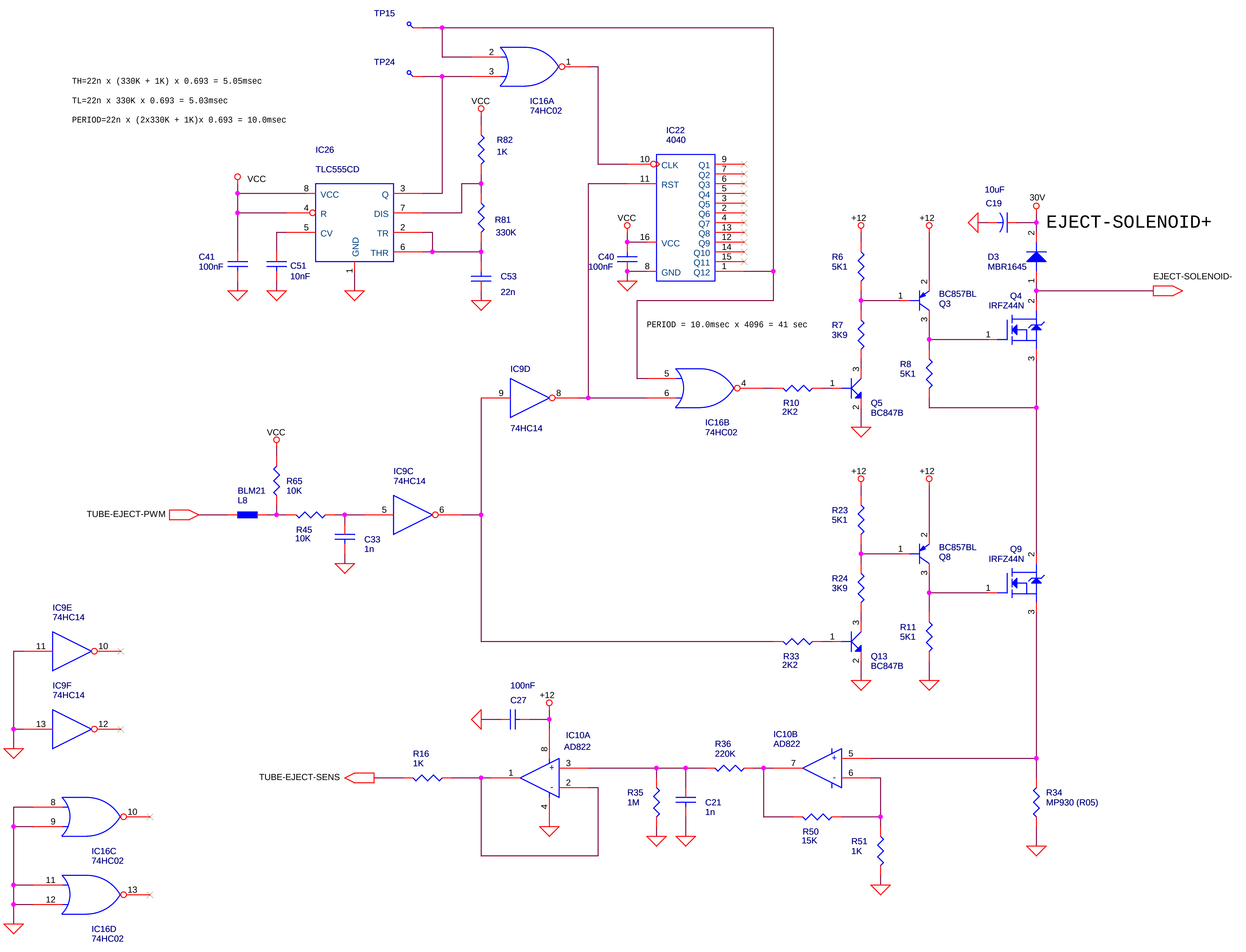
J1
DIN 64_AC-R
+30VBP
+30VBP
EJECT-SOLENOID-
DRAW_MOT-
DRAW_MOT+
LOCK_WIND_+
LOCK_WIND_-
TUBE-EJECT-SENS
30V_MON
CENT_REF
DRAW_DIR_CMD
DRAW_MASTER_CMD
DRAW_DIR_CHECK
TUBE-EJECT-PWM
LOCK_O/C
/CENT-PWM-F
CNT-CD
/CNT-E
+12VBP
+5VBP
DRAW_CURR_SNS
PCB-DRV-TEMP
CENT_CURR_SNS
DRAW_BRAKE
DRAW_PWM
/DRAW_OVT
LOCK_DRV_CMD
CNT-S
CENT_OVT
/CNT-ME
+12VBP
+5VBP
vs Signal Connector
vs NAC Board
vs other boards
PF1
Portafusibile
CENTRIFUGE FUSE
PF2
Portafusibile
PUMP FUSE
MBR1645
MBR1645
MBR1645
MBR1645
67F075
DISS1
DISSIPATORE
MP930
IRF4905
IRF4905
IRFZ44N
IRFZ44N
CENTRIFUGE
PUMP
LM18200
DISS2
DISSIPATORE
IRFZ44N
IRFZ44N
MP930
KIT EJECT


DRAW DRIVER
DRAW CURRENT SENSING
DRAW_BRAKE
DRAW_DIR_CHECK
DRAW_MASTER_CMD
DRAW_DIR_CMD
/* NOTA */
LOW = ANTIORARIO
DRAW_PWM
/DRAW_OVT
BLM21
IC7B 74HC86
IC7C 74HC86
IC7D 74HC86
IC7A 74HC86
74HC32 IC6A
74HC32 IC6B
74HC32 IC6C
74HC32 IC6D
LD4 RED
LD3 RED
R39 3K3
R37 3K3
R38 10K
R27 10K
R26 10K
R25 10K
R14 NM
R28 10K
IC3 LMD18200T
DIREC.
PWM
BRAKE
T-FLAG
CUR. SENS
OUT1
BOOT1
BOOT2
OUT 2
VS
GND
C20 10nF
C11 10nF
L1 RN222-4/02
DRAW_MOT+
DRAW_MOT-
F2 3.15AT
30V
C14 1uF
C6 220uF
+12
100nF C15
R13 22K
C16 10nF
R12 4K7
IC4B TLC272
IC4A TLC272
R15 1K
DRAW_CURR_SNS


30V
F3
400mA RIP
R3
10E 3W
LOCK_WIND_+
LOCK_WIND_-
VCC
RL2
G6H-2 5VDC
RL1
G6H-2 5VDC
D8
BAS16
D5
BAS16
VCC
R44
10K
LOCK_O/C
BLM21
L10
IC9A
74HC14
R31
4K7
Q12
MMBT2222A/SOT
R32
10K
C17
1nF
D7
1N4007
30V
D2
BAS16
R4
5K1 0.6W
C42
1000uF
Q14
2N5062
R47
470E
TP16
R46
1K
VCC
R74
100E 0.6W
30V
R49
3K3 0.6W
D13
BAS16
D12
BAS16
DZ4
BZX55C5V1 5.1V
C44
0.22F
IC23
MAX931CSA
V+
OUT
V-
GND
IN-
IN+
HYST
REF
TP20
R72
510E
P1
NM
R71
10E
VCC
D14
BAS16
R73
100E
C43
0.22F
30V
D11
BAS16
R48
3K3
DZ3
BZX55C2V7 2.7V
+12
R22
1K
Q7
BSP17
LOCK_DRV_CMD
BLM21
L9
IC9B
74HC14
R29
4K7
Q11
BC847B
R54
NM
R30
10K



+5VBP
TP25
DSS6NZ82A103Q55B
FL2
VCC
TP13
R42
3K3
C63
100nF
C64
22uF
C61
22uF
C62
100nF
LD7
GREEN
+5-PRES
TP26
TP22
VCC
C26
100nF
C38
100nF
C31
100nF
C39
100nF
C25
100nF
VCC
C50
100nF
C18
100nF
C52
100nF
C32
100nF
C54
100nF
SIGNAL
GROUND
+30VBP
30V
TP1
C3
100nF
C2
220uF
LD1
GREEN
R5
27K
+12VBP
DSS6NZ82A103Q55B
FL1
TP14
+12
R56
6K8
C58
10uF
C57
100nF
C55
10uF
C56
100nF
LD6
GREEN
+12-PRES
30V
R40
15K
VCC
+3.83V
D9
BAS40-04
C29
100nF
R41
2K2
Test +30V
IC13B
OP295
R18
1K
30V_MON
+12
C23
100nF
IC13A
OP295
VCC
IC11
LM35/SO
VS+
VOUT
GND
C22
100nF
+12
C28
100nF
IC12A
OP295
IC12B
OP295
R17
1K
PCB-DRV-TEMP
R53
12K
R52
39K
Vout = 10mV/°C
Vout(T=0°C) = 0mV



TH=22n x (330K + 1K) x 0.693 = 5.05msec
TL=22n x 330K x 0.693 = 5.03msec
PERIOD=22n x (2x330K + 1K)x 0.693 = 10.0msec
PERIOD = 10.0msec x 4096 = 41 sec
TP15
TP24
IC16A 74HC02
IC22 4040
IC26 TLC555CD
R82 1K
R81 330K
C53 22n
C41 100nF
C51 10nF
C40 100nF
IC9D 74HC14
IC16B 74HC02
IC9C 74HC14
TUBE-EJECT-PWM
BLM21 L8
R65 10K
R45 10K
C33 1n
R10 2K2
Q5 BC847B
R6 5K1
R7 3K9
BC857BL Q3
R8 5K1
Q4 IRFZ44N
10uF C19
30V
EJECT-SOLENOID+
D3 MBR1645
EJECT-SOLENOID-
R23 5K1
R24 3K9
BC857BL Q8
Q9 IRFZ44N
R11 5K1
R33 2K2
Q13 BC847B
IC9E 74HC14
IC9F 74HC14
IC16C 74HC02
IC16D 74HC02
100nF C27
+12
IC10A AD822
TUBE-EJECT-SENS
R16 1K
R35 1M
C21 1n
R36 220K
IC10B AD822
R50 15K
R51 1K
R34 MP930 (R05)

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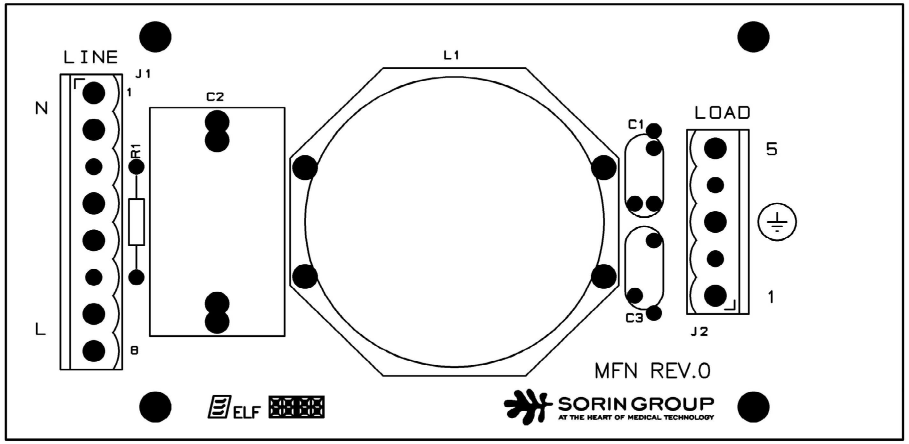
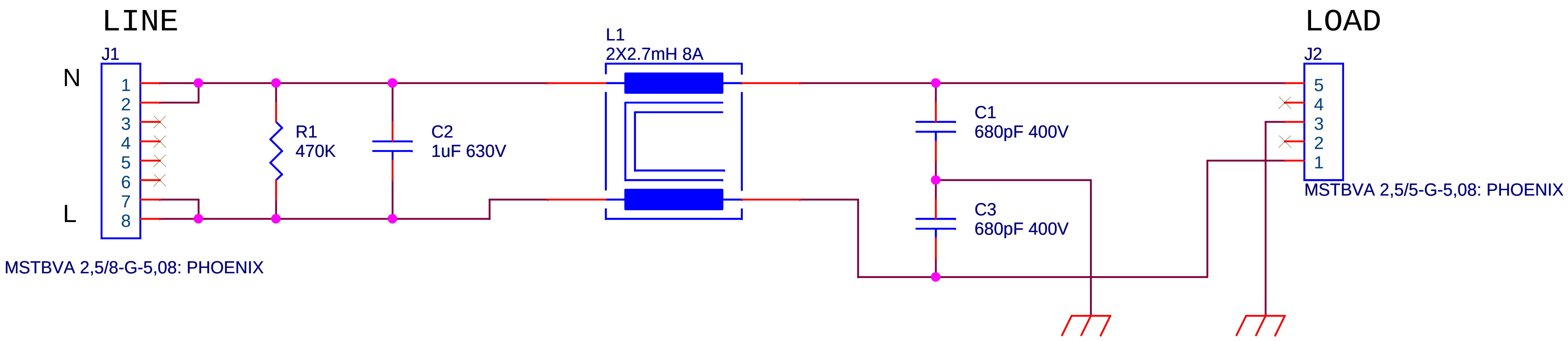
18.9 MFN p.c. board Schematics rev.00

18.9.1 About this card

The purpose of this card is to illustrate the **MFN p.c. board** schematics.


LINE
J1
N
1
R1
C2
L1
8
L
C1
LOAD
5
1
C3
J2
MFN REV.0
ELF
SORIN GROUP
AT THE HEART OF MEDICAL TECHNOLOGY



LINE
J1
N
L
1
2
3
4
5
6
7
8
MSTBVA 2,5/8-G-5,08: PHOENIX
R1
470K
C2
1uF 630V
L1
2X2.7mH 8A
C1
680pF 400V
C3
680pF 400V
LOAD
J2
5
4
3
2
1
MSTBVA 2,5/5-G-5,08: PHOENIX

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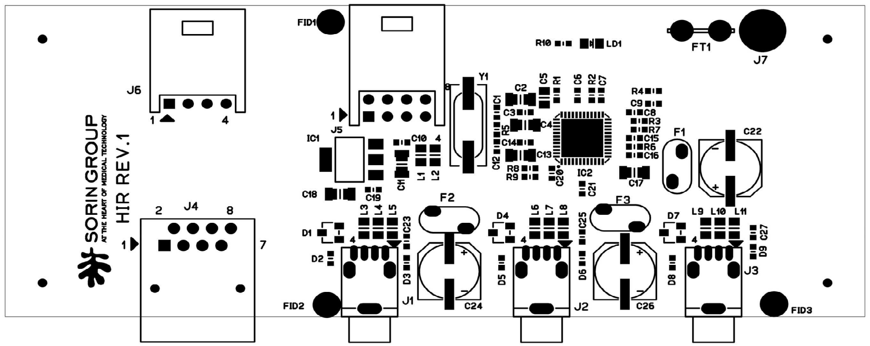
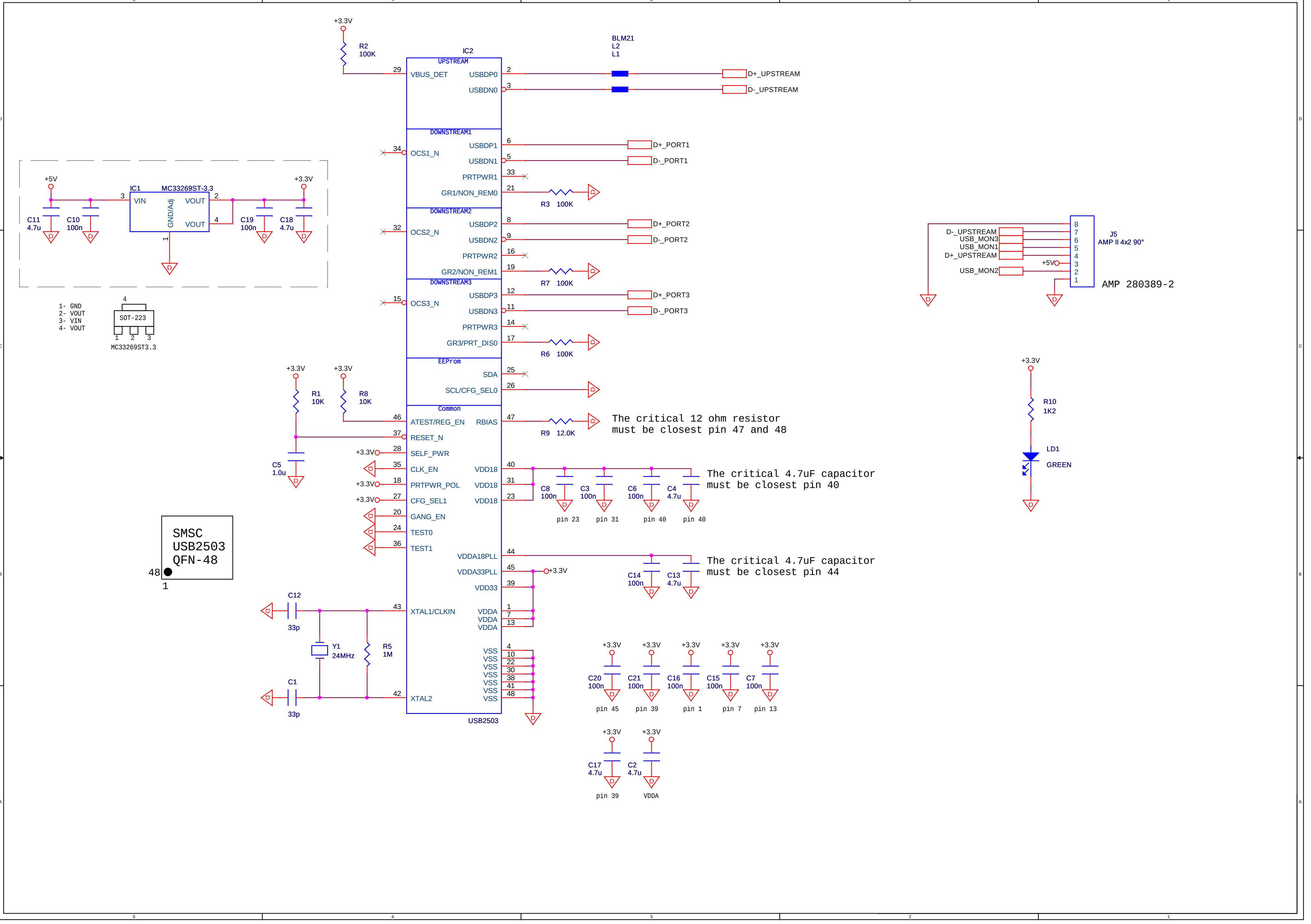
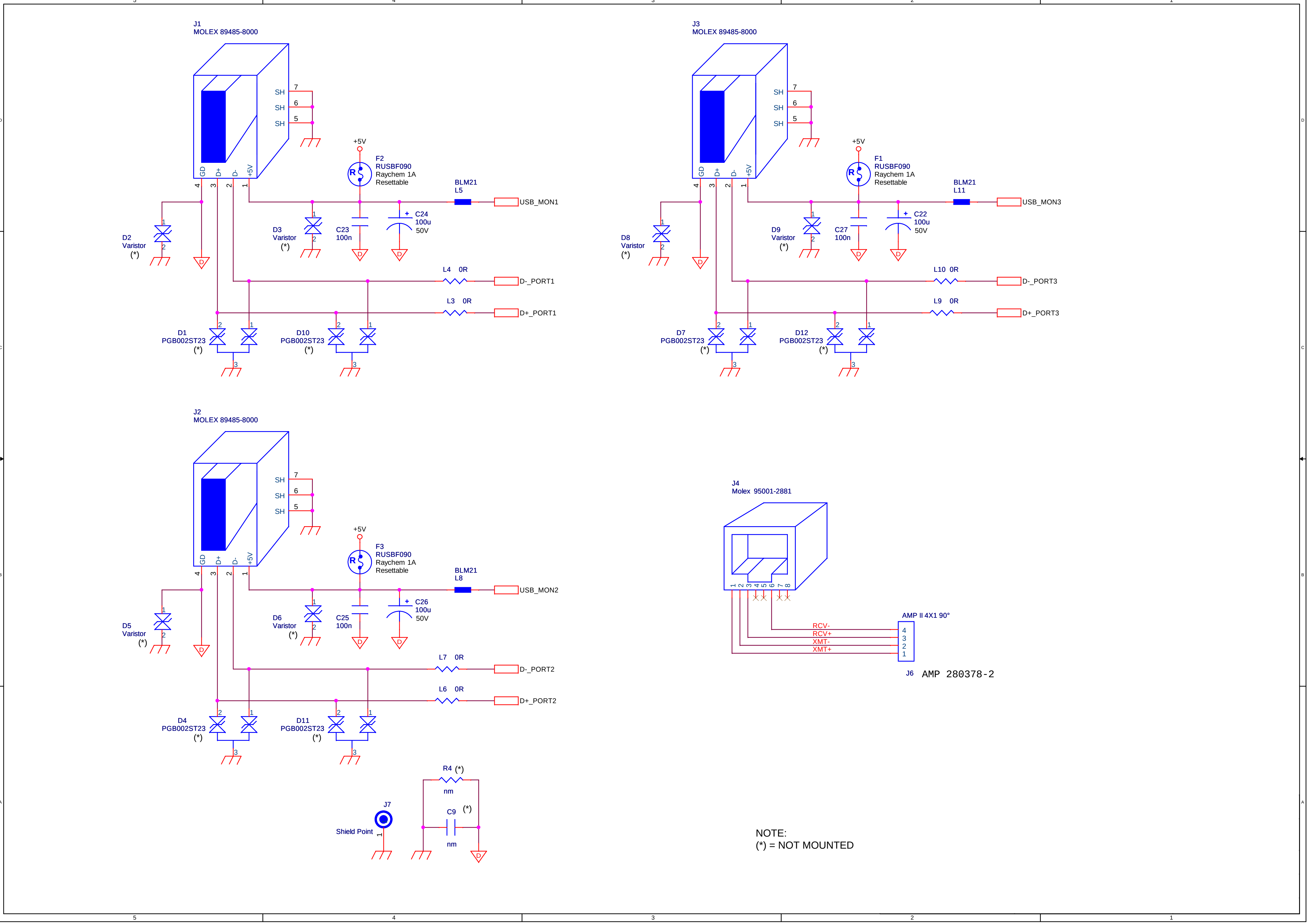
18.10HIR p.c. board Schematics rev.00

18.10.1 About this card

The purpose of this card is to illustrate the **HIR p.c. board** schematics.




IC2
UPSTREAM
VBUS_DET
USBDP0
USBDN0
D+_UPSTREAM
D-_UPSTREAM
BLM21
L2
L1
R2
100K
+3.3V
DOWNSTREAM1
OCS1_N
USBDP1
USBDN1
PRTPWR1
GR1/NON_REM0
D+_PORT1
D-_PORT1
R3 100K
DOWNSTREAM2
OCS2_N
USBDP2
USBDN2
PRTPWR2
GR2/NON_REM1
D+_PORT2
D-_PORT2
R7 100K
DOWNSTREAM3
OCS3_N
USBDP3
USBDN3
PRTPWR3
GR3/PRT_DIS0
D+_PORT3
D-_PORT3
R6 100K
EEProm
SDA
SCL/CFG_SEL0
Common
ATEST/REG_EN
RESET_N
SELF_PWR
CLK_EN
PRTPWR_POL
CFG_SEL1
GANG_EN
TEST0
TEST1
RBIAS
R9 12.0K
The critical 12 ohm resistor
must be closest pin 47 and 48
VDD18
VDDA18PLL
VDDA33PLL
VDD33
VDDA
VSS
XTAL1/CLKIN
XTAL2
USB2503
The critical 4.7uF capacitor
must be closest pin 40
The critical 4.7uF capacitor
must be closest pin 44
C8 100n
C3 100n
C6 100n
C4 4.7u
pin 23
pin 31
pin 40
pin 40
C14 100n
C13 4.7u
C20 100n
C21 100n
C16 100n
C15 100n
C7 100n
pin 45
pin 39
pin 1
pin 7
pin 13
C17 4.7u
C2 4.7u
pin 39
VDDA
R1 10K
R8 10K
C5 1.0u
C12 33p
C1 33p
Y1 24MHz
R5 1M
SMSC
USB2503
QFN-48
48
1
IC1
MC33269ST-3.3
VIN
VOUT
VOUT
GND/Adj
+5V
C11 4.7u
C10 100n
C19 100n
C18 4.7u
1- GND
2- VOUT
3- VIN
4- VOUT
SOT-223
MC33269ST3.3
J5
AMP II 4x2 90°
D-_UPSTREAM
USB_MON3
USB_MON1
D+_UPSTREAM
+5V
USB_MON2
AMP 280389-2
R10
1K2
LD1
GREEN

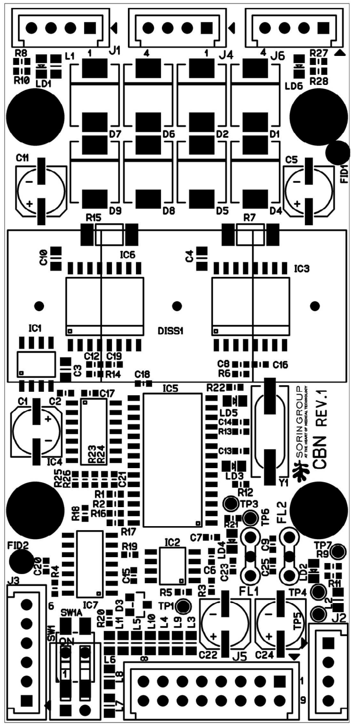


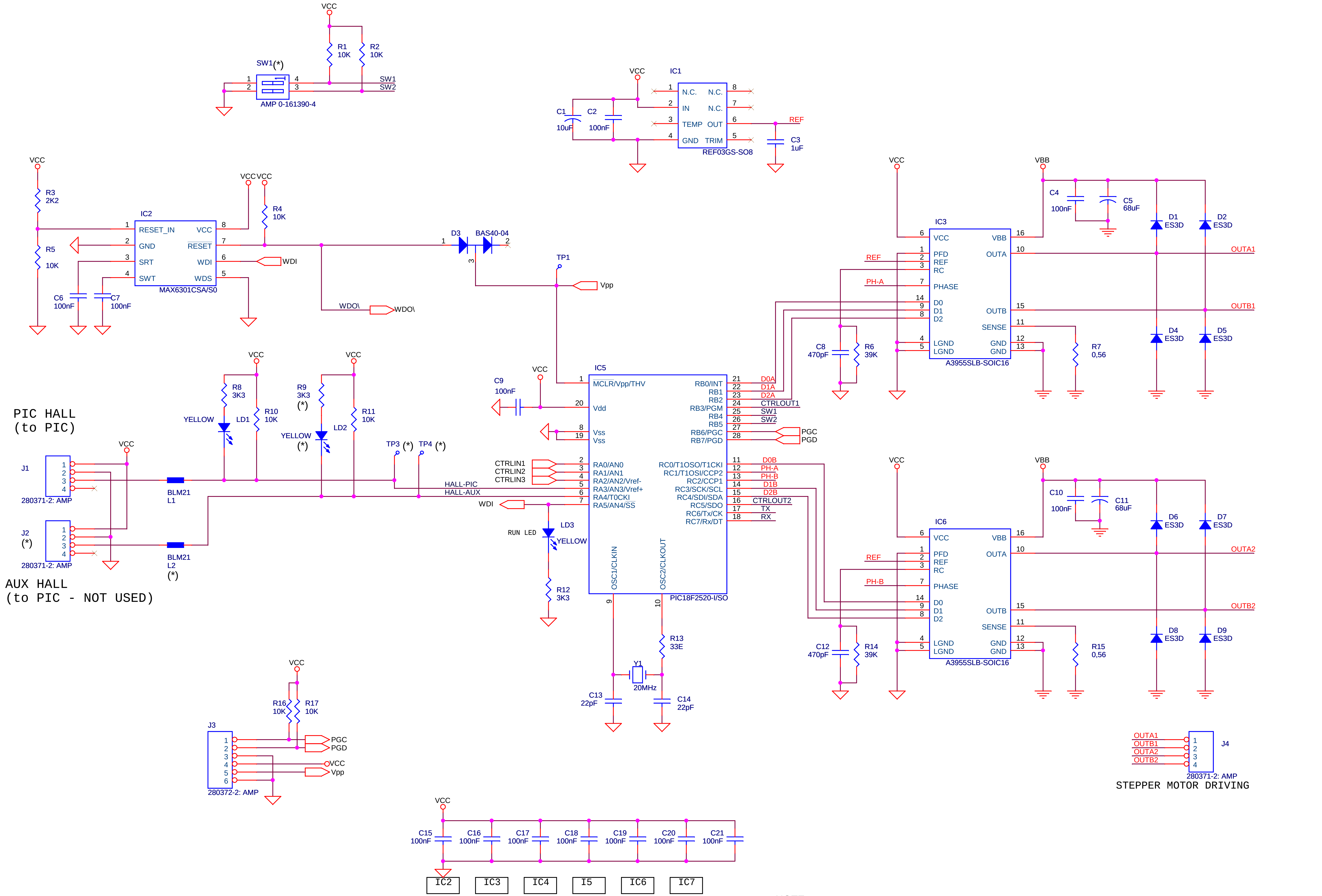
NOTE:
(*) = NOT MOUNTED

18.11 CBN p.c. board Schematics rev.00

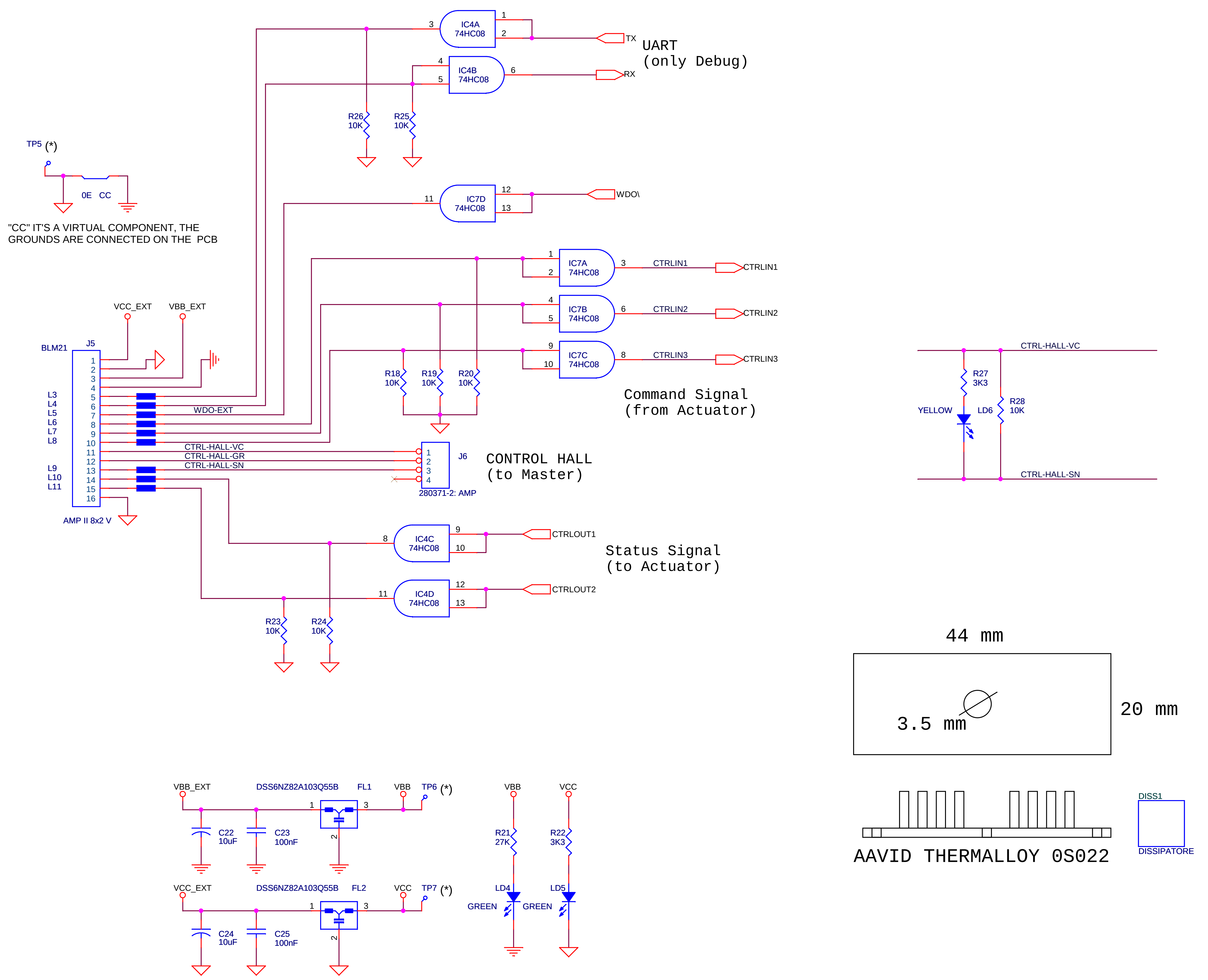
18.11.1 About this card

The purpose of this card is to illustrate the **CBN p.c. board** schematics.





NOTE:
(*) = NOT MOUNTED

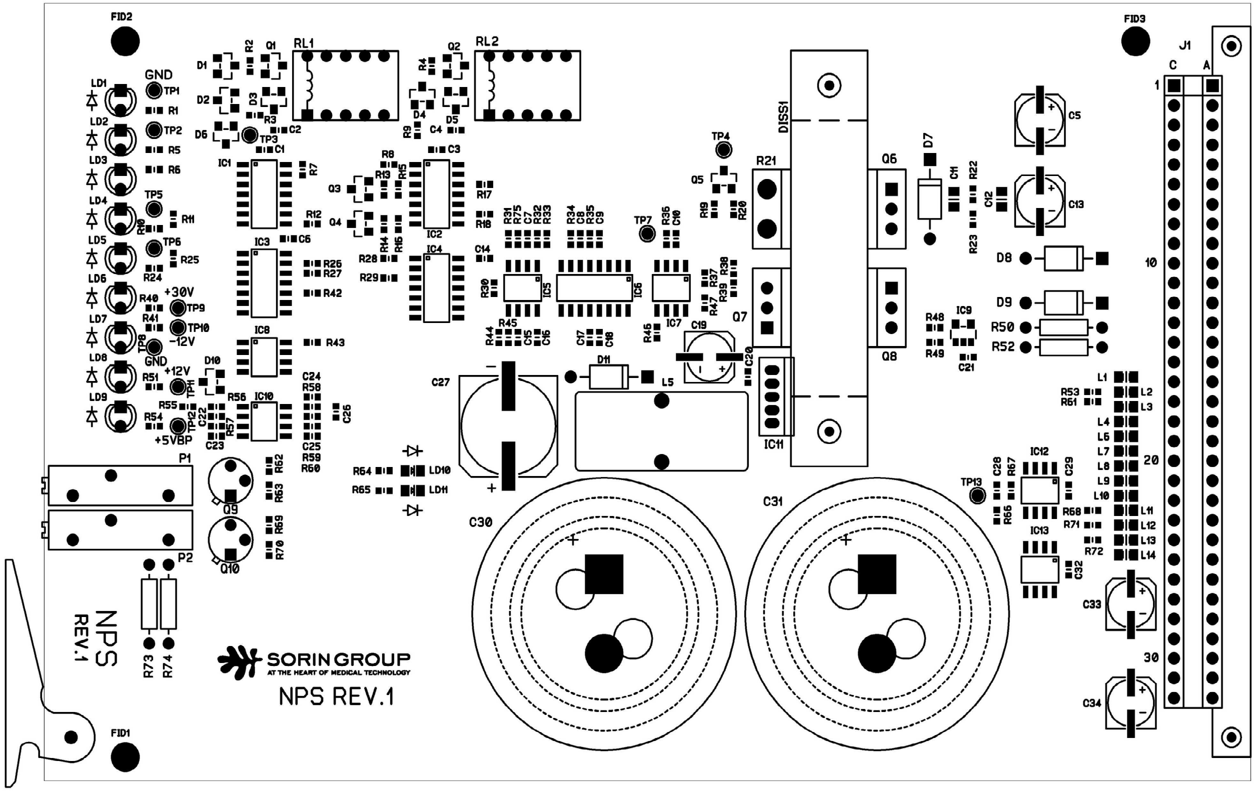


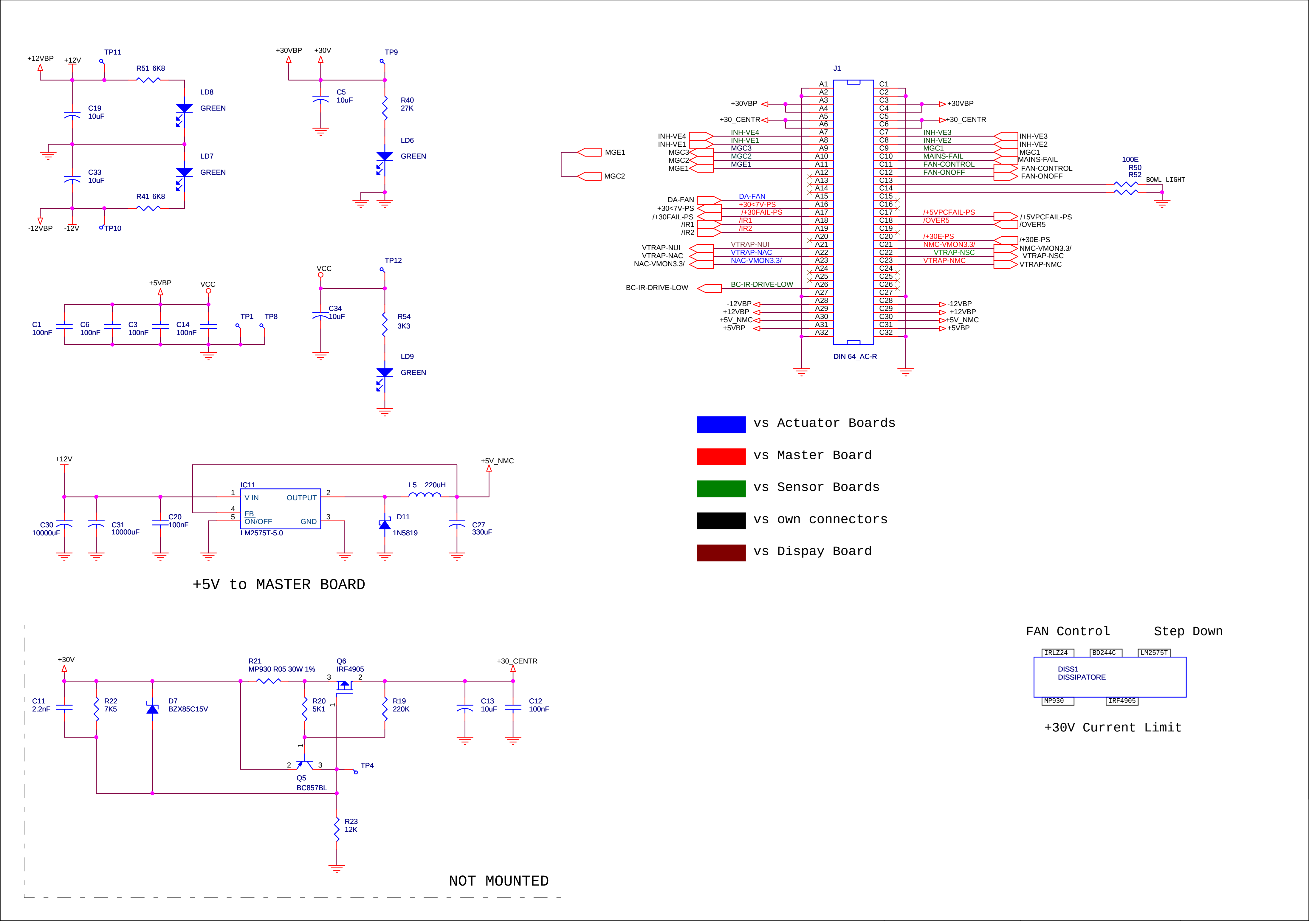
NOTE:
(*) = NOT MOUNTED

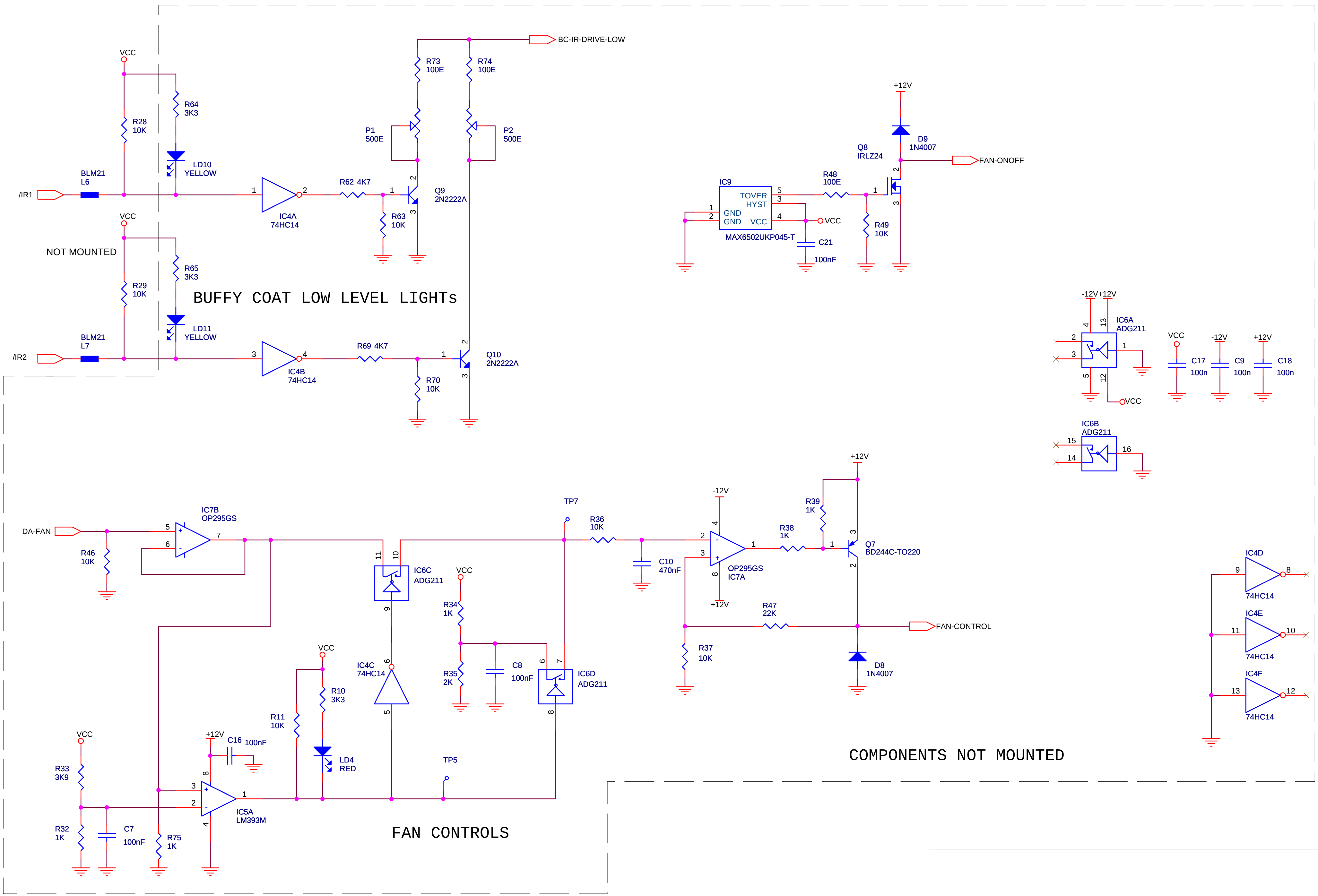
18.12 NPS p.c. board Schematics rev.00

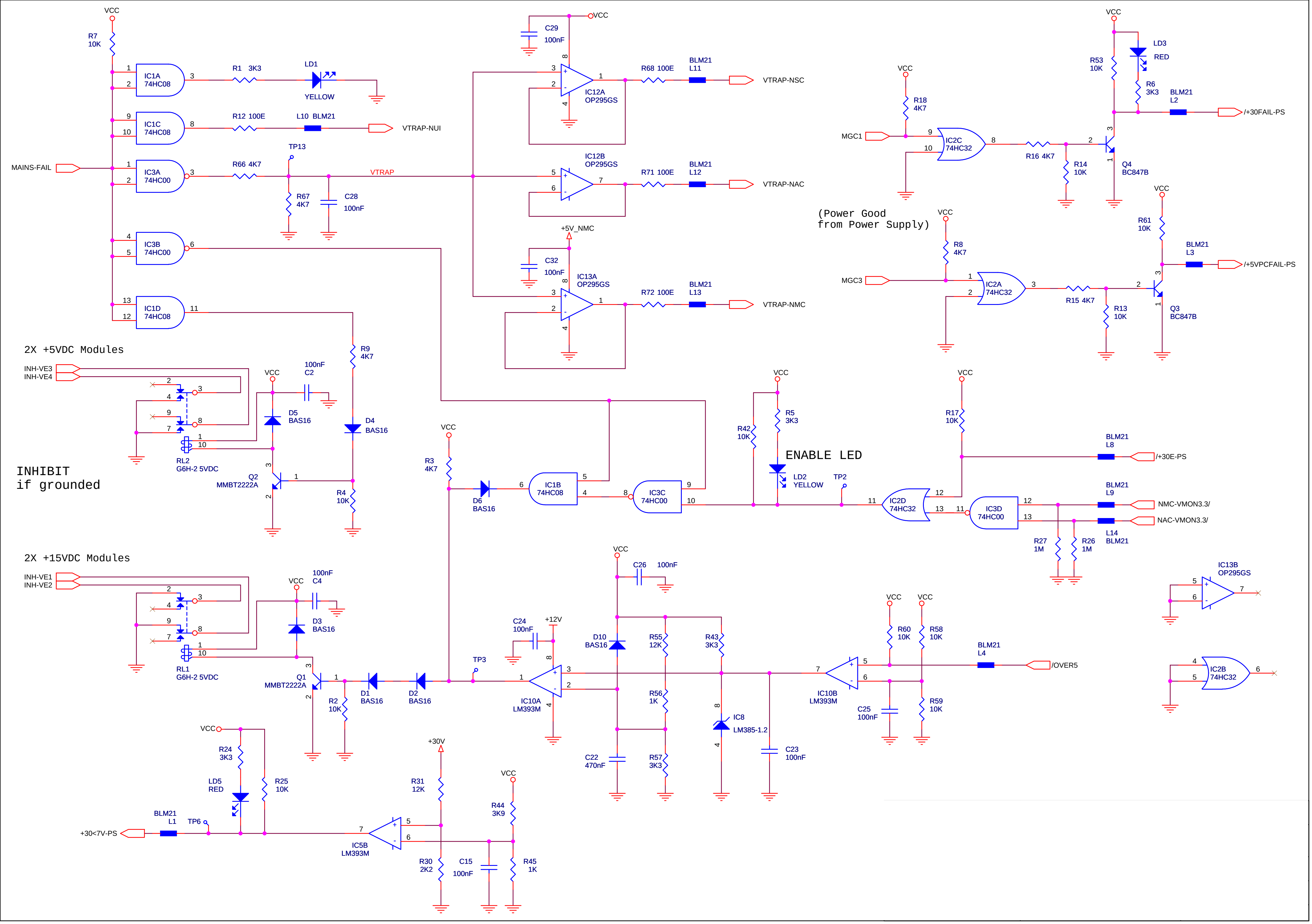
18.12.1 About this card

The purpose of this card is to illustrate the **NPS p.c. board** schematics.


NPS
REV.1
SORINGROUP
AT THE HEART OF MEDICAL TECHNOLOGY
NPS REV.1
RL1
RL2
DISS1
J1
C
A
GND
+30V
-12V
+12V
+5VBP
P1
P2
C27
C30
C31
L5
IC11
Q6
Q7
Q8
D8
D9
R50
R52
R21
R73
R74


+12VBP
+12V
TP11
R51 6K8
LD8
GREEN
C19
10uF
LD7
GREEN
C33
10uF
R41 6K8
-12VBP
-12V
TP10
+30VBP
+30V
TP9
C5
10uF
R40
27K
LD6
GREEN
+5VBP
VCC
C1
100nF
C6
100nF
C3
100nF
C14
100nF
TP1
TP8
VCC
TP12
C34
10uF
R54
3K3
LD9
GREEN
+12V
+5V_NMC
IC11
V IN
OUTPUT
FB
ON/OFF
GND
LM2575T-5.0
L5 220uH
D11
1N5819
C30
10000uF
C31
10000uF
C20
100nF
C27
330uF
+5V to MASTER BOARD
J1
DIN 64_AC-R
MGE1
MGC2
+30VBP
+30_CENTR
INH-VE4
INH-VE1
MGC3
MGC2
MGE1
DA-FAN
+30<7V-PS
/+30FAIL-PS
/IR1
/IR2
VTRAP-NUI
VTRAP-NAC
NAC-VMON3.3/
BC-IR-DRIVE-LOW
-12VBP
+12VBP
+5V_NMC
+5VBP
INH-VE3
INH-VE2
MGC1
MAINS-FAIL
FAN-CONTROL
FAN-ONOFF
100E
R50
R52
BOWL LIGHT
/+5VPCFAIL-PS
/OVER5
/+30E-PS
NMC-VMON3.3/
VTRAP-NSC
VTRAP-NMC
vs Actuator Boards
vs Master Board
vs Sensor Boards
vs own connectors
vs Dispay Board
+30V
R21
MP930 R05 30W 1%
Q6
IRF4905
+30_CENTR
C11
2.2nF
R22
7K5
D7
BZX85C15V
R20
5K1
R19
220K
C13
10uF
C12
100nF
TP4
Q5
BC857BL
R23
12K
NOT MOUNTED
FAN Control
Step Down
IRLZ24
BD244C
LM2575T
DISS1
DISSIPATORE
MP930
IRF4905
+30V Current Limit


BUFFY COAT LOW LEVEL LIGHTs
FAN CONTROLS
COMPONENTS NOT MOUNTED
NOT MOUNTED
VCC
+12V
-12V
/IR1
/IR2
BLM21 L6
BLM21 L7
R28 10K
R64 3K3
LD10 YELLOW
R29 10K
R65 3K3
LD11 YELLOW
IC4A 74HC14
IC4B 74HC14
R62 4K7
R69 4K7
R63 10K
R70 10K
Q9 2N2222A
Q10 2N2222A
R73 100E
R74 100E
P1 500E
P2 500E
BC-IR-DRIVE-LOW
IC9
TOVER
HYST
GND
GND
VCC
MAX6502UKP045-T
C21 100nF
R48 100E
R49 10K
Q8 IRLZ24
D9 1N4007
FAN-ONOFF
IC6A ADG211
IC6B ADG211
C17 100n
C9 100n
C18 100n
DA-FAN
IC7B OP295GS
R46 10K
TP7
R36 10K
C10 470nF
OP295GS IC7A
R39 1K
R38 1K
Q7 BD244C-TO220
R47 22K
FAN-CONTROL
R37 10K
D8 1N4007
IC6C ADG211
R34 1K
R35 2K
C8 100nF
IC6D ADG211
IC4C 74HC14
R10 3K3
R11 10K
LD4 RED
TP5
C16 100nF
IC5A LM393M
R33 3K9
R32 1K
C7 100nF
R75 1K
IC4D 74HC14
IC4E 74HC14
IC4F 74HC14


VCC
R7
10K
MAINS-FAIL
IC1A
74HC08
R1 3K3
LD1
YELLOW
IC1C
74HC08
R12 100E
L10 BLM21
VTRAP-NUI
TP13
IC3A
74HC00
R66 4K7
VTRAP
R67
4K7
C28
100nF
IC3B
74HC00
IC1D
74HC08
C29
100nF
IC12A
OP295GS
R68 100E
BLM21
L11
VTRAP-NSC
IC12B
OP295GS
R71 100E
BLM21
L12
VTRAP-NAC
+5V_NMC
C32
100nF
IC13A
OP295GS
R72 100E
BLM21
L13
VTRAP-NMC
MGC1
R18
4K7
IC2C
74HC32
R16 4K7
R14
10K
Q4
BC847B
R53
10K
LD3
RED
R6
3K3
BLM21
L2
/+30FAIL-PS
(Power Good
from Power Supply)
MGC3
R8
4K7
IC2A
74HC32
R15 4K7
R13
10K
Q3
BC847B
R61
10K
BLM21
L3
/+5VPCFAIL-PS
2X +5VDC Modules
INH-VE3
INH-VE4
RL2
G6H-2 5VDC
INHIBIT
if grounded
100nF
C2
D5
BAS16
Q2
MMBT2222A
R9
4K7
D4
BAS16
R4
10K
R3
4K7
D6
BAS16
IC1B
74HC08
IC3C
74HC00
R42
10K
R5
3K3
ENABLE LED
LD2
YELLOW
TP2
R17
10K
BLM21
L8
/+30E-PS
IC2D
74HC32
IC3D
74HC00
BLM21
L9
NMC-VMON3.3/
NAC-VMON3.3/
L14
BLM21
R27
1M
R26
1M
IC13B
OP295GS
2X +15VDC Modules
INH-VE1
INH-VE2
RL1
G6H-2 5VDC
100nF
C4
D3
BAS16
Q1
MMBT2222A
R2
10K
D1
BAS16
D2
BAS16
TP3
C24
100nF
+12V
IC10A
LM393M
C26
100nF
D10
BAS16
R55
12K
R43
3K3
R56
1K
IC8
LM385-1.2
C22
470nF
R57
3K3
C23
100nF
IC10B
LM393M
R60
10K
R58
10K
BLM21
L4
/OVER5
C25
100nF
R59
10K
IC2B
74HC32
R24
3K3
LD5
RED
R25
10K
BLM21
L1
TP6
+30<7V-PS
IC5B
LM393M
+30V
R31
12K
R30
2K2
C15
100nF
R44
3K9
R45
1K

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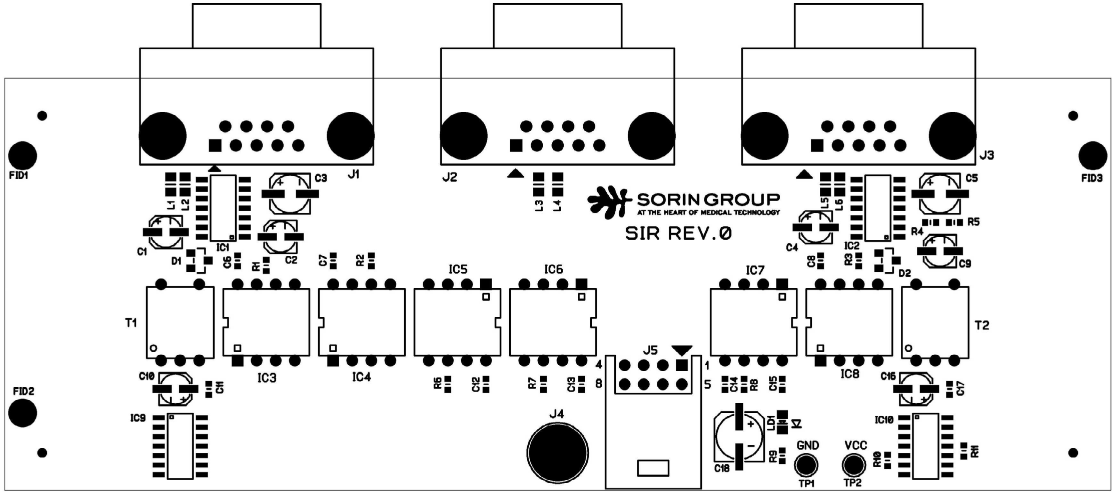
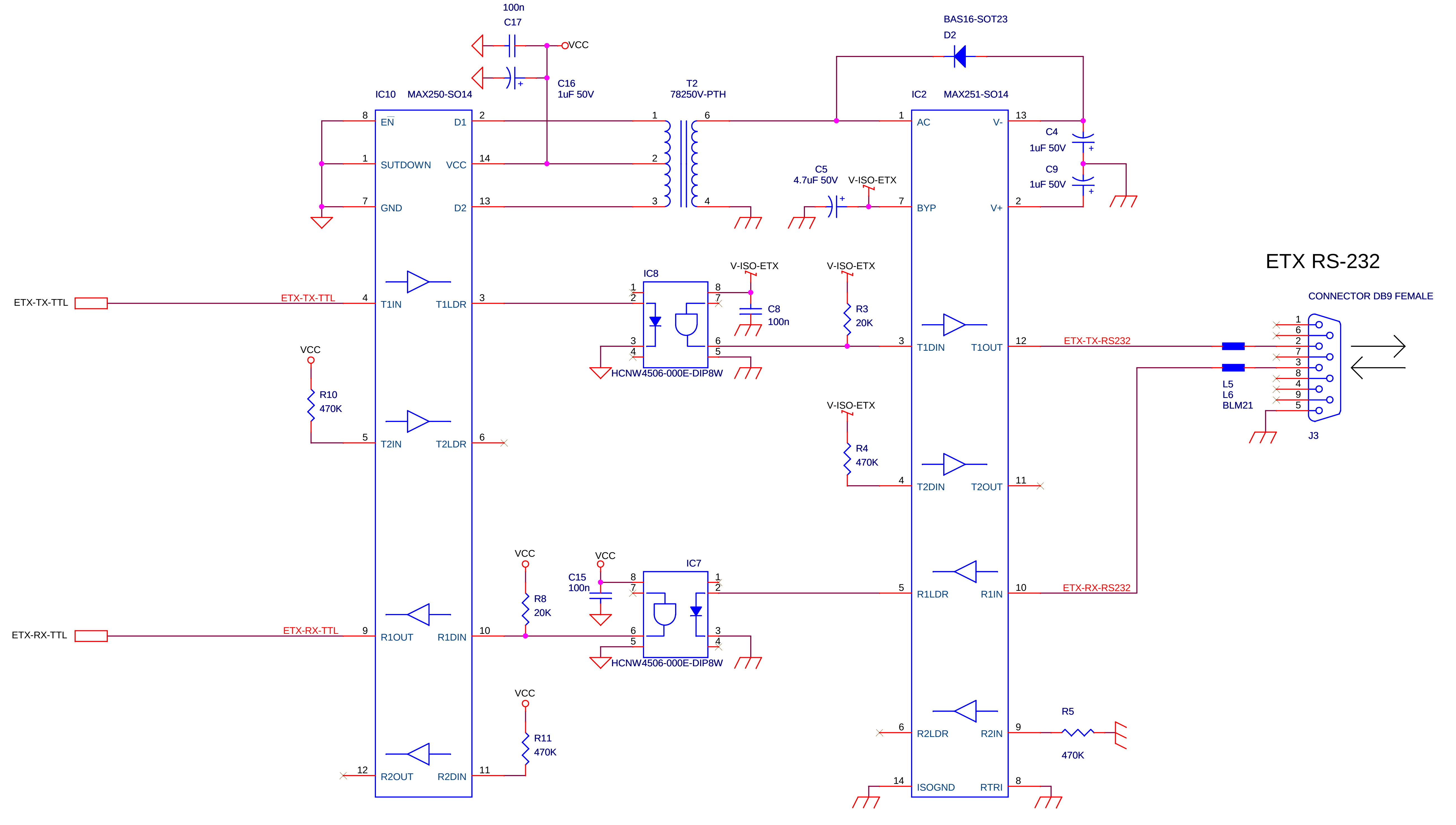
18.13 SIR p.c. board Schematics rev.00

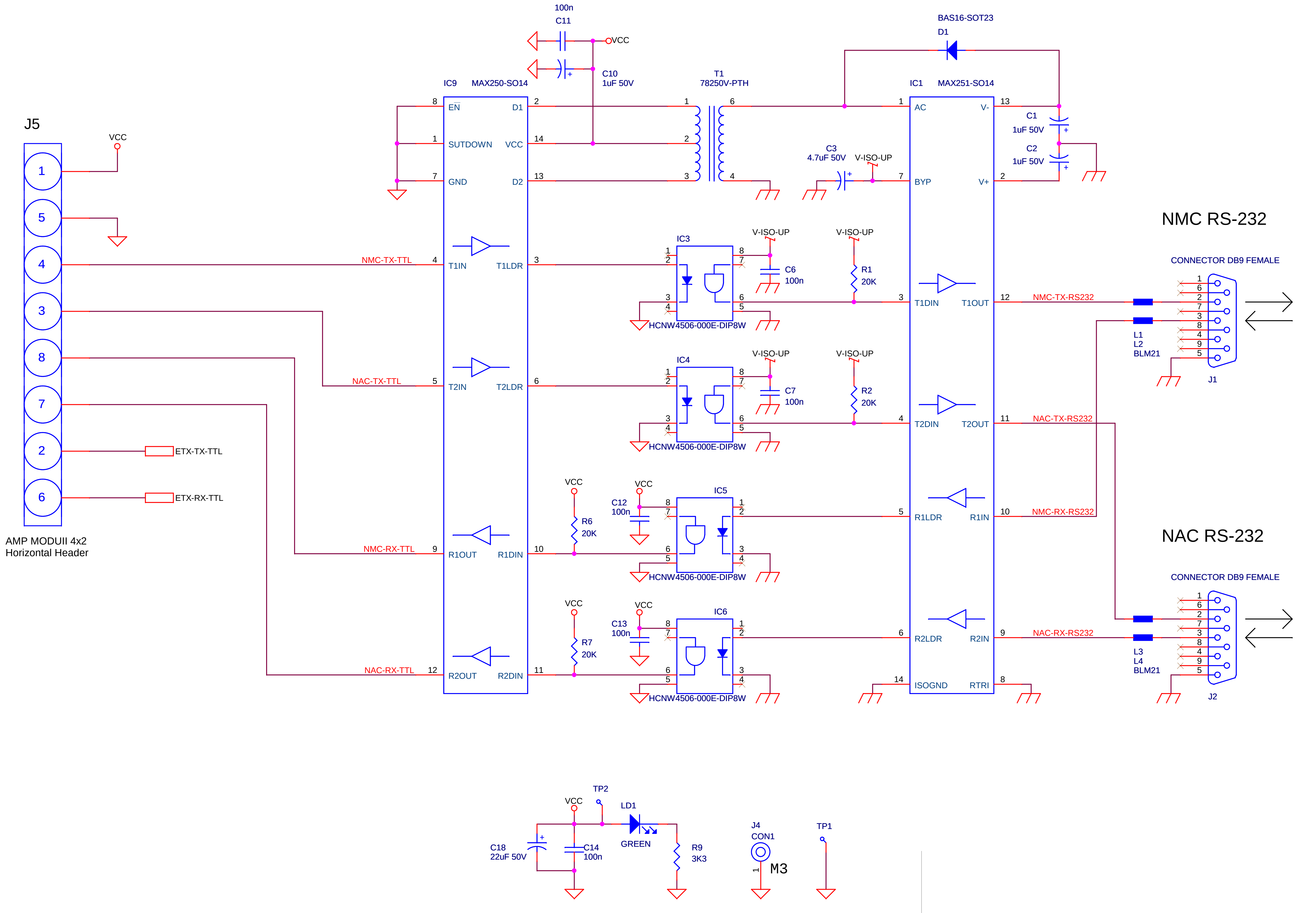
18.13.1 About this card

The purpose of this card is to illustrate the **SIR p.c. board** schematics.



J1
J2
J3
FID1
FID2
FID3
SORIN GROUP
AT THE HEART OF MEDICAL TECHNOLOGY
SIR REV.0
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
IC9
IC10
T1
T2
J4
J5
GND
VCC
TP1
TP2


ETX RS-232
IC10 MAX250-SO14
IC2 MAX251-SO14
T2 78250V-PTH
D2 BAS16-SOT23
C17 100n
C16 1uF 50V
C4 1uF 50V
C9 1uF 50V
C5 4.7uF 50V
V-ISO-ETX
VCC
IC8
IC7
HCNW4506-000E-DIP8W
C8 100n
C15 100n
R3 20K
R4 470K
R8 20K
R10 470K
R11 470K
R5 470K
ETX-TX-TTL
ETX-RX-TTL
ETX-TX-RS232
ETX-RX-RS232
L5
L6
BLM21
CONNECTOR DB9 FEMALE
J3
EN
SUTDOWN
GND
D1
VCC
D2
T1IN
T1LDR
T2IN
T2LDR
R1OUT
R1DIN
R2OUT
R2DIN
AC
V-
BYP
V+
T1DIN
T1OUT
T2DIN
T2OUT
R1LDR
R1IN
R2LDR
R2IN
ISOGND
RTRI

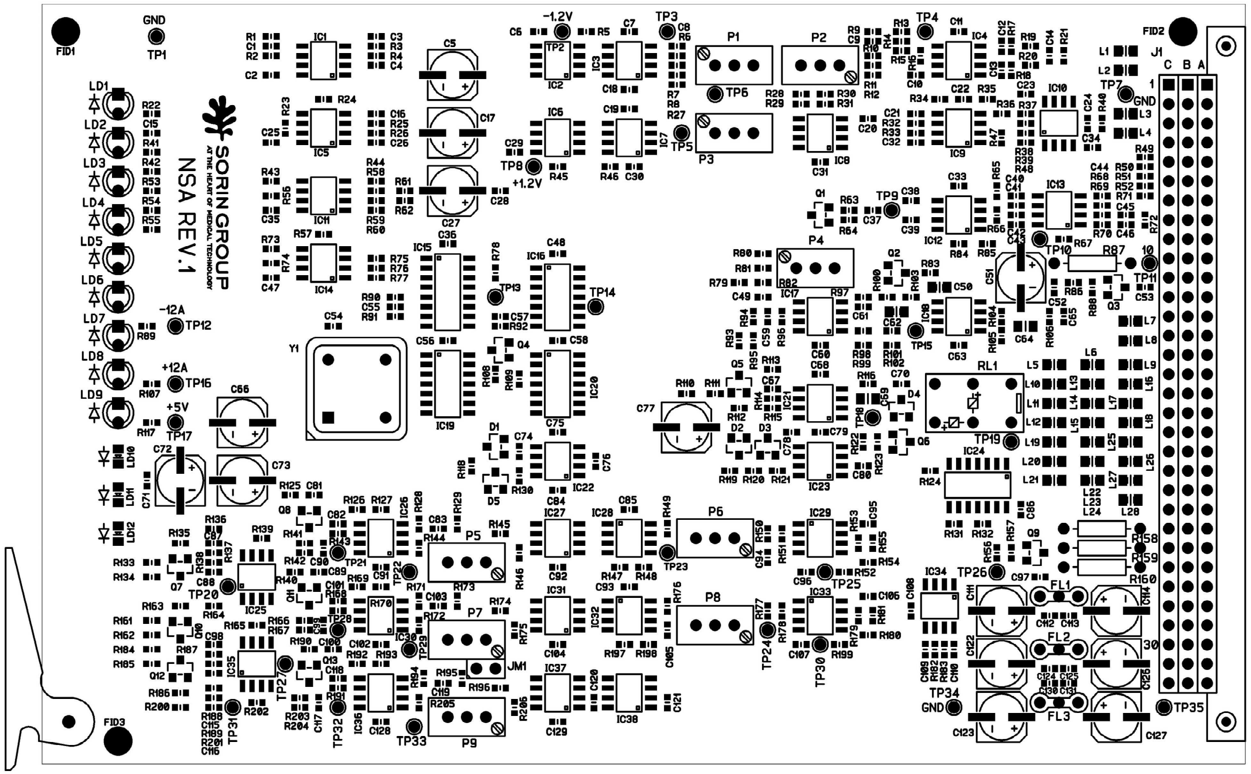


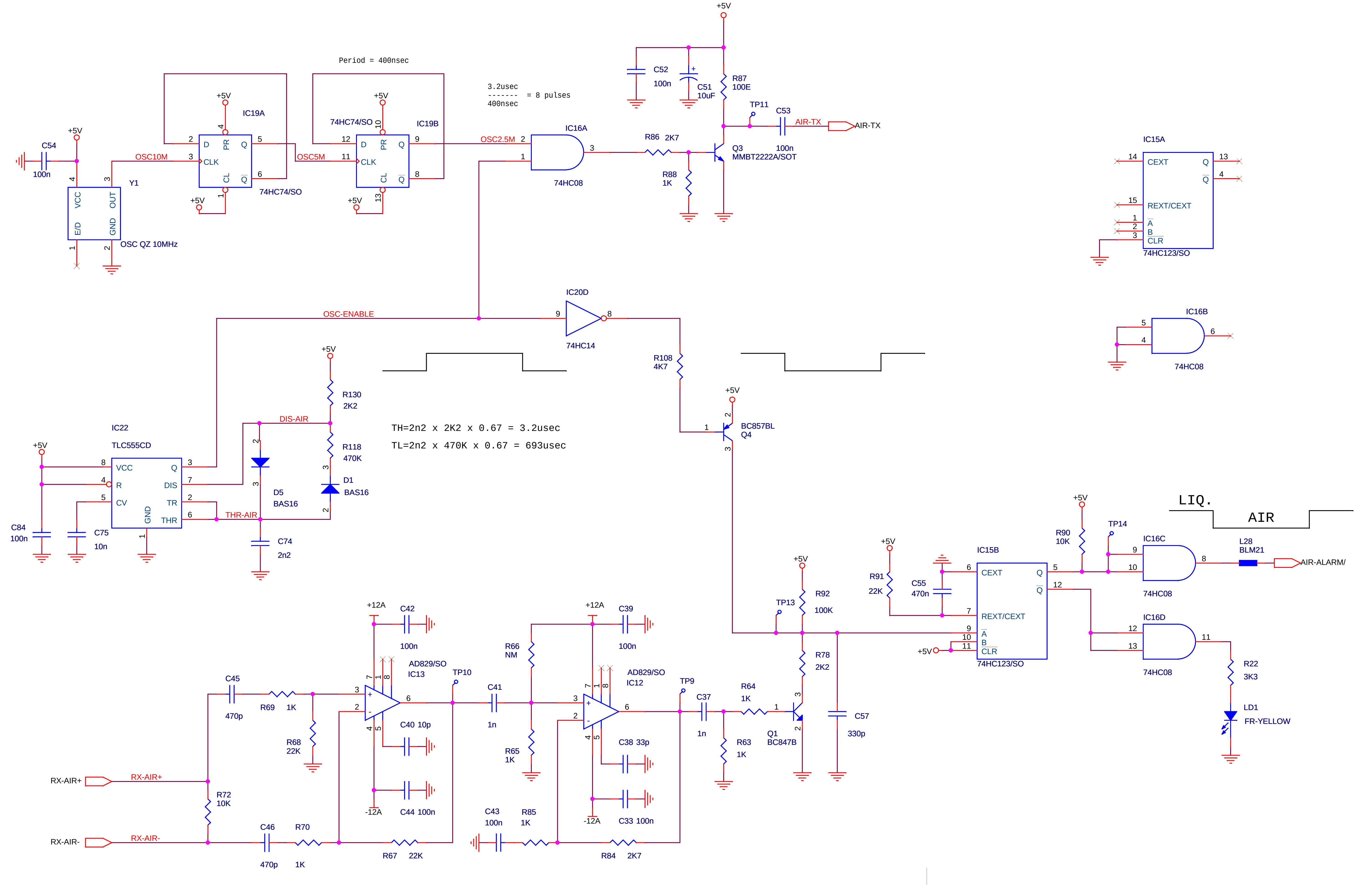
J5
AMP MODUII 4x2
Horizontal Header
VCC
ETX-TX-TTL
ETX-RX-TTL
NMC-TX-TTL
NAC-TX-TTL
NMC-RX-TTL
NAC-RX-TTL
IC9
MAX250-SO14
EN
SUTDOWN
GND
D1
VCC
D2
T1IN
T1LDR
T2IN
T2LDR
R1OUT
R1DIN
R2OUT
R2DIN
100n
C11
C10
1uF 50V
T1
78250V-PTH
BAS16-SOT23
D1
IC1
MAX251-SO14
AC
V-
BYP
V+
T1DIN
T1OUT
T2DIN
T2OUT
R1LDR
R1IN
R2LDR
R2IN
ISOGND
RTRI
C1
1uF 50V
C2
1uF 50V
C3
4.7uF 50V
V-ISO-UP
IC3
IC4
IC5
IC6
HCNW4506-000E-DIP8W
C6
100n
C7
100n
R1
20K
R2
20K
R6
20K
R7
20K
C12
100n
C13
100n
NMC RS-232
NAC RS-232
CONNECTOR DB9 FEMALE
NMC-TX-RS232
NAC-TX-RS232
NMC-RX-RS232
NAC-RX-RS232
L1
L2
BLM21
L3
L4
BLM21
J1
J2
TP2
LD1
GREEN
C18
22uF 50V
C14
100n
R9
3K3
J4
CON1
M3
TP1

18.14 NSA p.c. board Schematics rev.00

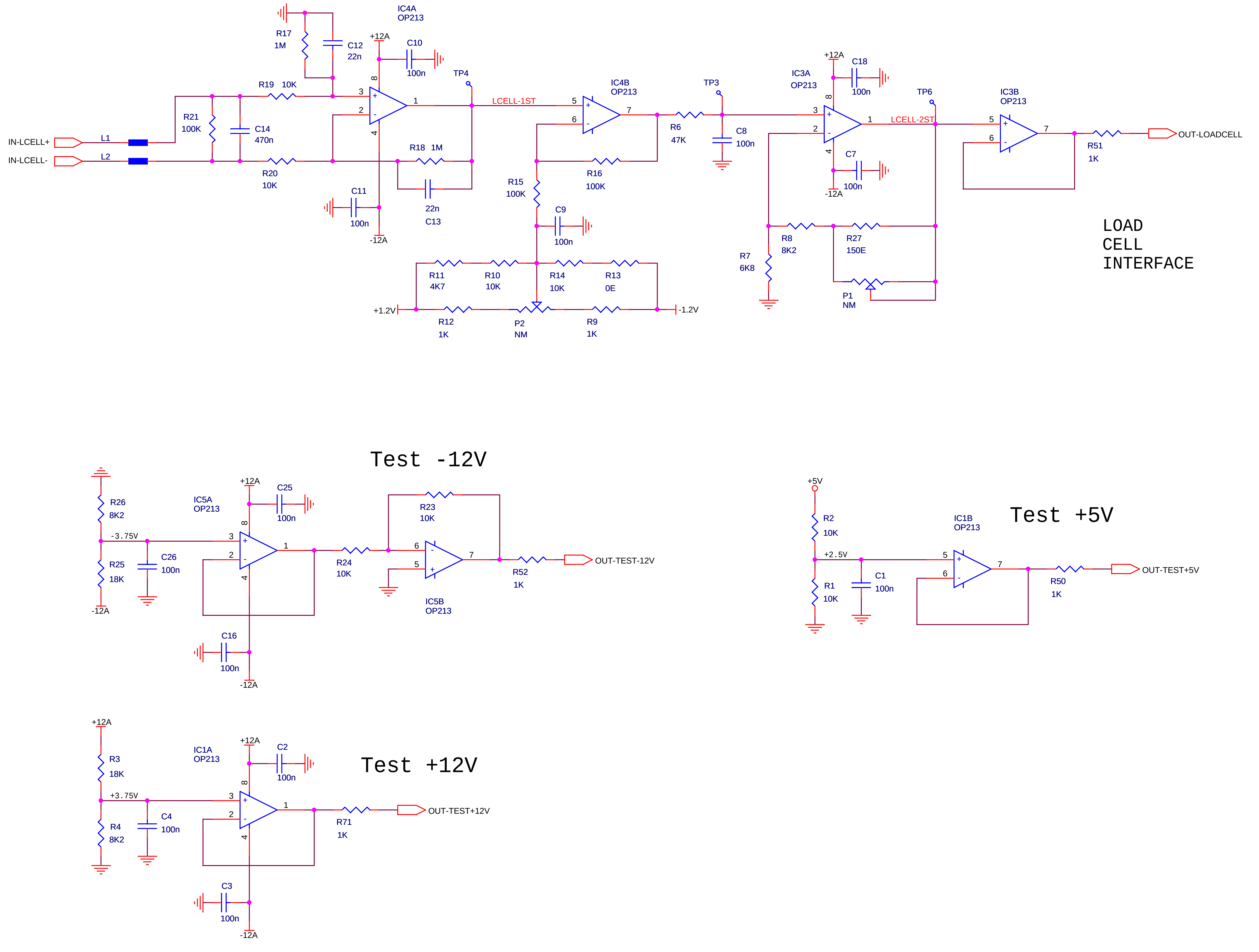
18.14.1 About this card

The purpose of this card is to illustrate the **NSA p.c. board** schematics.

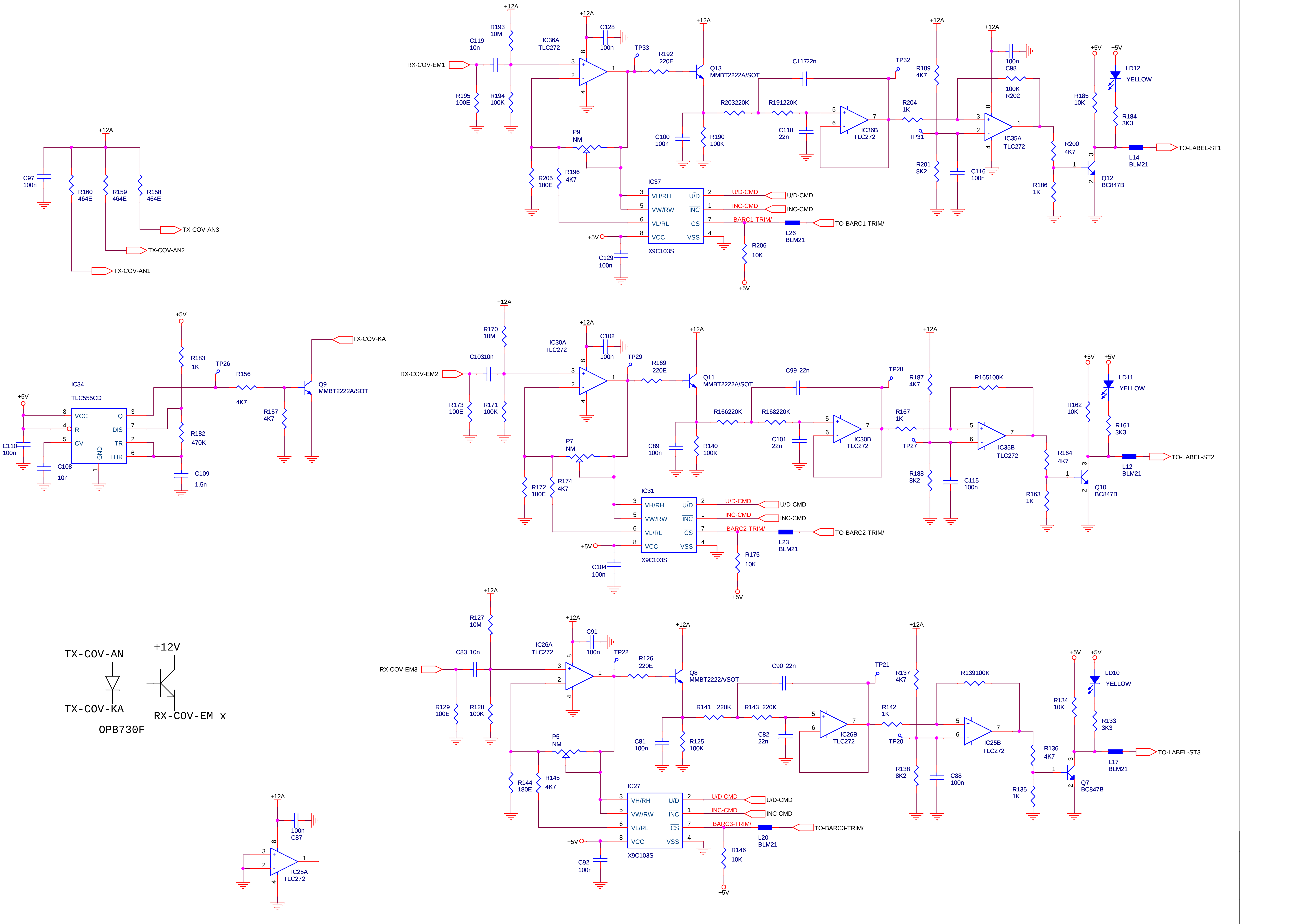

SORIN GROUP
AT THE HEART OF MEDICAL TECHNOLOGY
NSA REV.1

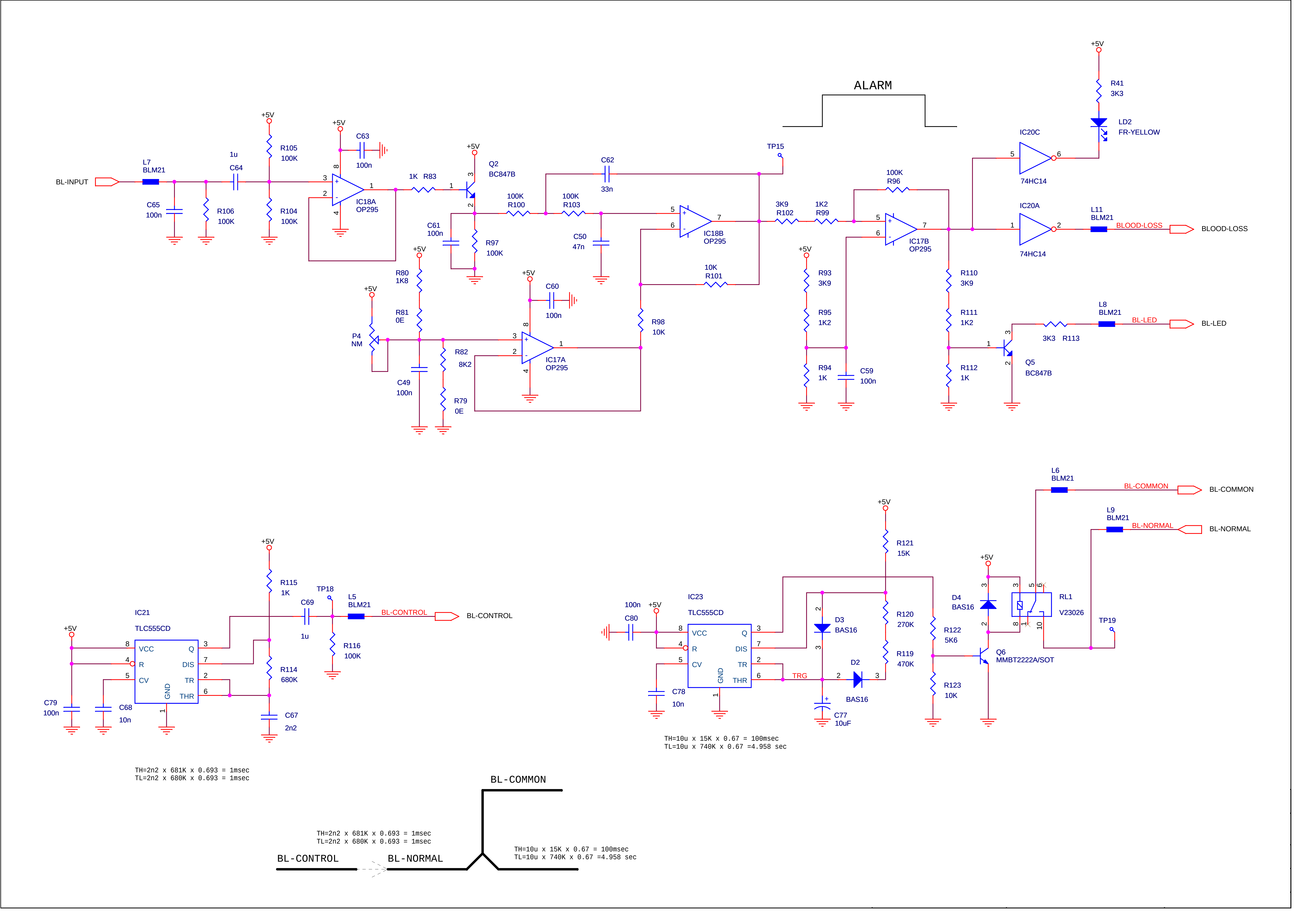


ALL COMPONTENTS IN THIS PAGE ARE NOT MOUNTED

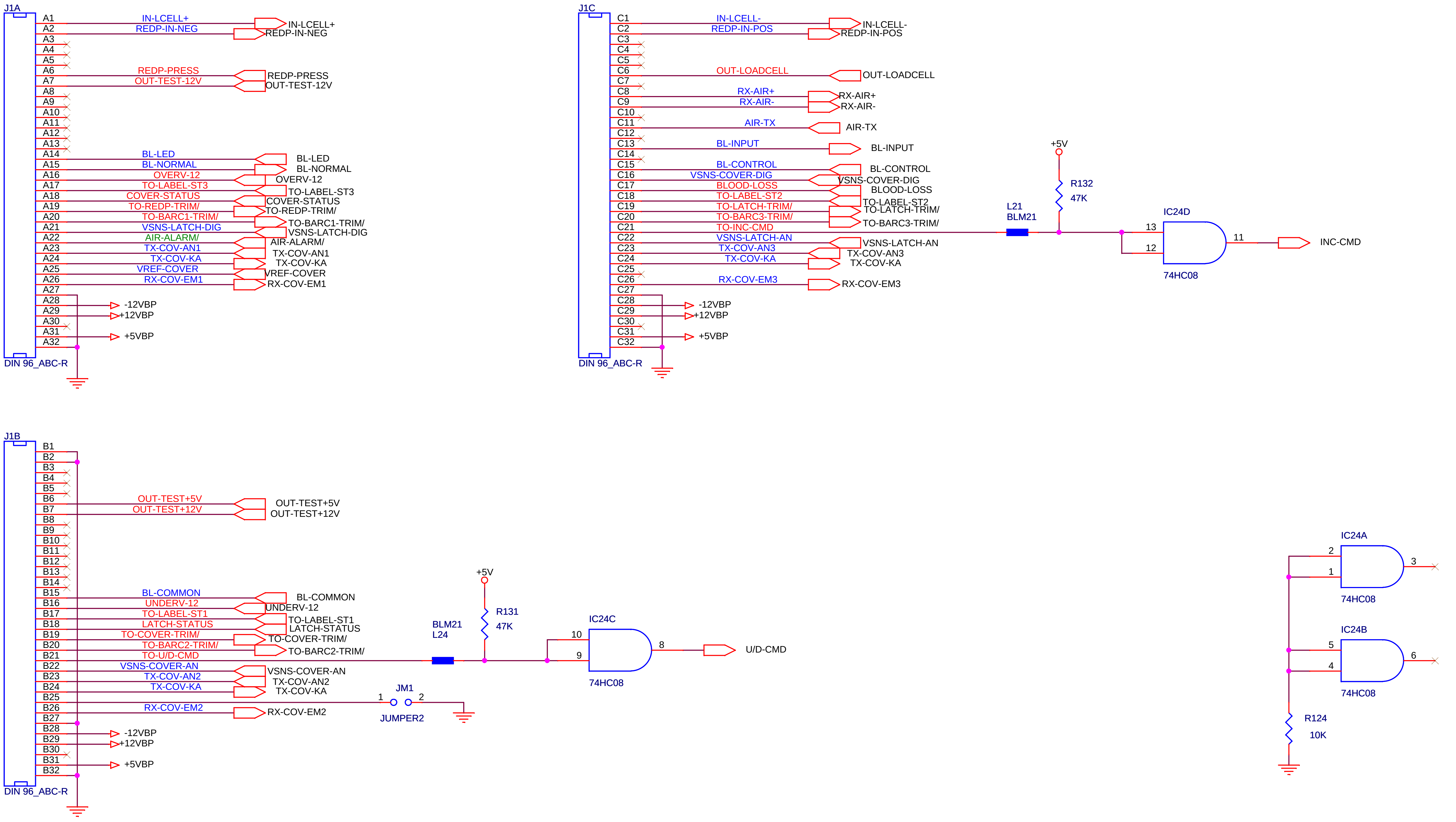


LOAD CELL INTERFACE
IN-LCELL+
IN-LCELL-
L1
L2
R21 100K
C14 470n
R19 10K
R20 10K
R17 1M
C12 22n
IC4A OP213
+12A
C10 100n
TP4
LCELL-1ST
R18 1M
C13 22n
C11 100n
-12A
IC4B OP213
R15 100K
R16 100K
C9 100n
R11 4K7
R10 10K
R14 10K
R13 0E
+1.2V
-1.2V
R12 1K
P2 NM
R9 1K
TP3
R6 47K
C8 100n
IC3A OP213
C18 100n
C7 100n
TP6
LCELL-2ST
IC3B OP213
R51 1K
OUT-LOADCELL
R8 8K2
R27 150E
R7 6K8
P1 NM
Test -12V
R26 8K2
R25 18K
-3.75V
C26 100n
IC5A OP213
C25 100n
C16 100n
R24 10K
R23 10K
IC5B OP213
R52 1K
OUT-TEST-12V
Test +5V
+5V
R2 10K
R1 10K
+2.5V
C1 100n
IC1B OP213
R50 1K
OUT-TEST+5V
Test +12V
R3 18K
R4 8K2
+3.75V
C4 100n
IC1A OP213
C2 100n
C3 100n
R71 1K
OUT-TEST+12V


RX-COV-EM1
RX-COV-EM2
RX-COV-EM3
IC36A TLC272
IC36B TLC272
IC35A TLC272
IC35B TLC272
IC30A TLC272
IC30B TLC272
IC26A TLC272
IC26B TLC272
IC25A TLC272
IC25B TLC272
IC37 X9C103S
IC31 X9C103S
IC27 X9C103S
IC34 TLC555CD
VH/RH
VW/RW
VL/RL
VCC
U/D
INC
CS
VSS
U/D-CMD
INC-CMD
BARC1-TRIM/
BARC2-TRIM/
BARC3-TRIM/
TO-BARC1-TRIM/
TO-BARC2-TRIM/
TO-BARC3-TRIM/
TO-LABEL-ST1
TO-LABEL-ST2
TO-LABEL-ST3
Q13 MMBT2222A/SOT
Q11 MMBT2222A/SOT
Q8 MMBT2222A/SOT
Q9 MMBT2222A/SOT
Q12 BC847B
Q10 BC847B
Q7 BC847B
LD12 YELLOW
LD11 YELLOW
LD10 YELLOW
L14 BLM21
L12 BLM21
L17 BLM21
L26 BLM21
L23 BLM21
L20 BLM21
P9 NM
P7 NM
P5 NM
TP33
TP32
TP31
TP29
TP28
TP27
TP26
TP22
TP21
TP20
+12A
+5V
TX-COV-AN1
TX-COV-AN2
TX-COV-AN3
TX-COV-KA
VCC
R
CV
GND
Q
DIS
TR
THR
C97 100n
R160 464E
R159 464E
R158 464E
C110 100n
C108 10n
R183 1K
R182 470K
C109 1.5n
R156 4K7
R157 4K7
R193 10M
C119 10n
R195 100E
R194 100K
C128 100n
R192 220E
C117 22n
R203 220K
R191 220K
C100 100n
R190 100K
C118 22n
R205 180E
R196 4K7
R206 10K
C129 100n
R189 4K7
R204 1K
R201 8K2
C116 100n
C98 100n
R202 100K
R200 4K7
R186 1K
R185 10K
R184 3K3
R170 10M
C103 10n
R173 100E
R171 100K
C102 100n
R169 220E
C99 22n
R166 220K
R168 220K
C89 100n
R140 100K
C101 22n
R172 180E
R174 4K7
R175 10K
C104 100n
R187 4K7
R167 1K
R188 8K2
C115 100n
R165 100K
R164 4K7
R163 1K
R162 10K
R161 3K3
R127 10M
C83 10n
R129 100E
R128 100K
C91 100n
R126 220E
C90 22n
R141 220K
R143 220K
C81 100n
R125 100K
C82 22n
R144 180E
R145 4K7
R146 10K
C92 100n
R137 4K7
R142 1K
R138 8K2
C88 100n
R139 100K
R136 4K7
R135 1K
R134 10K
R133 3K3
C87 100n
TX-COV-AN
TX-COV-KA
+12V
RX-COV-EM x
OPB730F



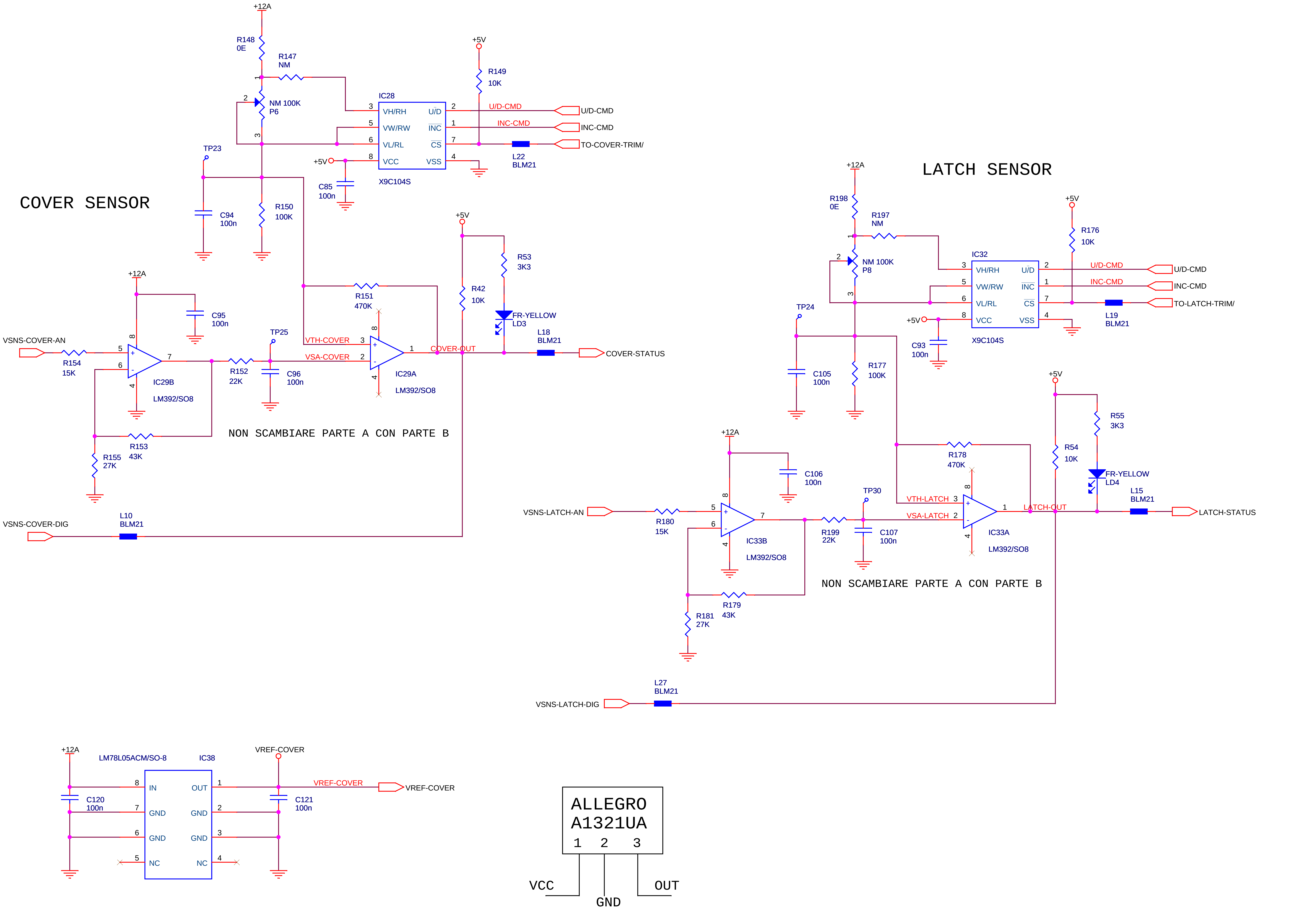
ALARM
BL-INPUT
L7 BLM21
C65 100n
R106 100K
1u C64
+5V
R105 100K
R104 100K
+5V
C63 100n
IC18A OP295
1K R83
+5V
Q2 BC847B
C61 100n
R97 100K
100K R100
100K R103
C50 47n
C62 33n
TP15
IC18B OP295
10K R101
R98 10K
+5V
R80 1K8
R81 0E
P4 NM
C49 100n
R82 8K2
R79 0E
+5V
C60 100n
IC17A OP295
3K9 R102
1K2 R99
100K R96
IC17B OP295
+5V
R93 3K9
R95 1K2
R94 1K
C59 100n
R110 3K9
R111 1K2
R112 1K
Q5 BC847B
3K3 R113
L8 BLM21
BL-LED
BL-LED
+5V
R41 3K3
LD2 FR-YELLOW
IC20C 74HC14
IC20A 74HC14
L11 BLM21
BLOOD-LOSS
BLOOD-LOSS
+5V
R115 1K
TP18
C69 1u
L5 BLM21
BL-CONTROL
BL-CONTROL
R116 100K
IC21 TLC555CD
+5V
VCC Q R DIS CV TR GND THR
C79 100n
C68 10n
R114 680K
C67 2n2
TH=2n2 x 681K x 0.693 = 1msec
TL=2n2 x 680K x 0.693 = 1msec
IC23 TLC555CD
100n C80
+5V
C78 10n
+5V
R121 15K
D3 BAS16
R120 270K
R119 470K
TRG
D2 BAS16
C77 10uF
R122 5K6
R123 10K
+5V
D4 BAS16
RL1 V23026
Q6 MMBT2222A/SOT
TP19
L6 BLM21
BL-COMMON
BL-COMMON
L9 BLM21
BL-NORMAL
BL-NORMAL
TH=10u x 15K x 0.67 = 100msec
TL=10u x 740K x 0.67 =4.958 sec
BL-COMMON
TH=2n2 x 681K x 0.693 = 1msec
TL=2n2 x 680K x 0.693 = 1msec
BL-CONTROL
BL-NORMAL
TH=10u x 15K x 0.67 = 100msec
TL=10u x 740K x 0.67 =4.958 sec

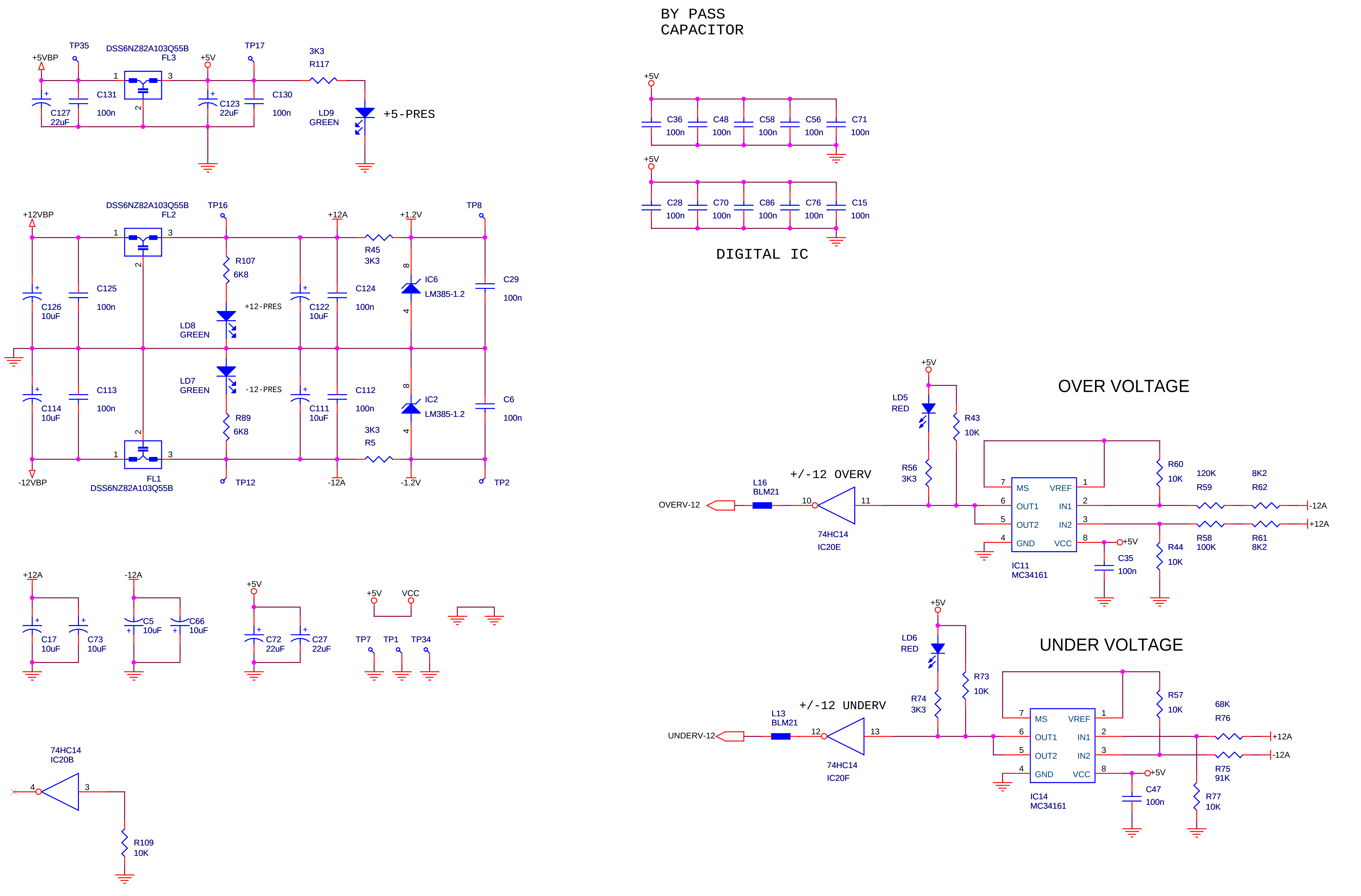


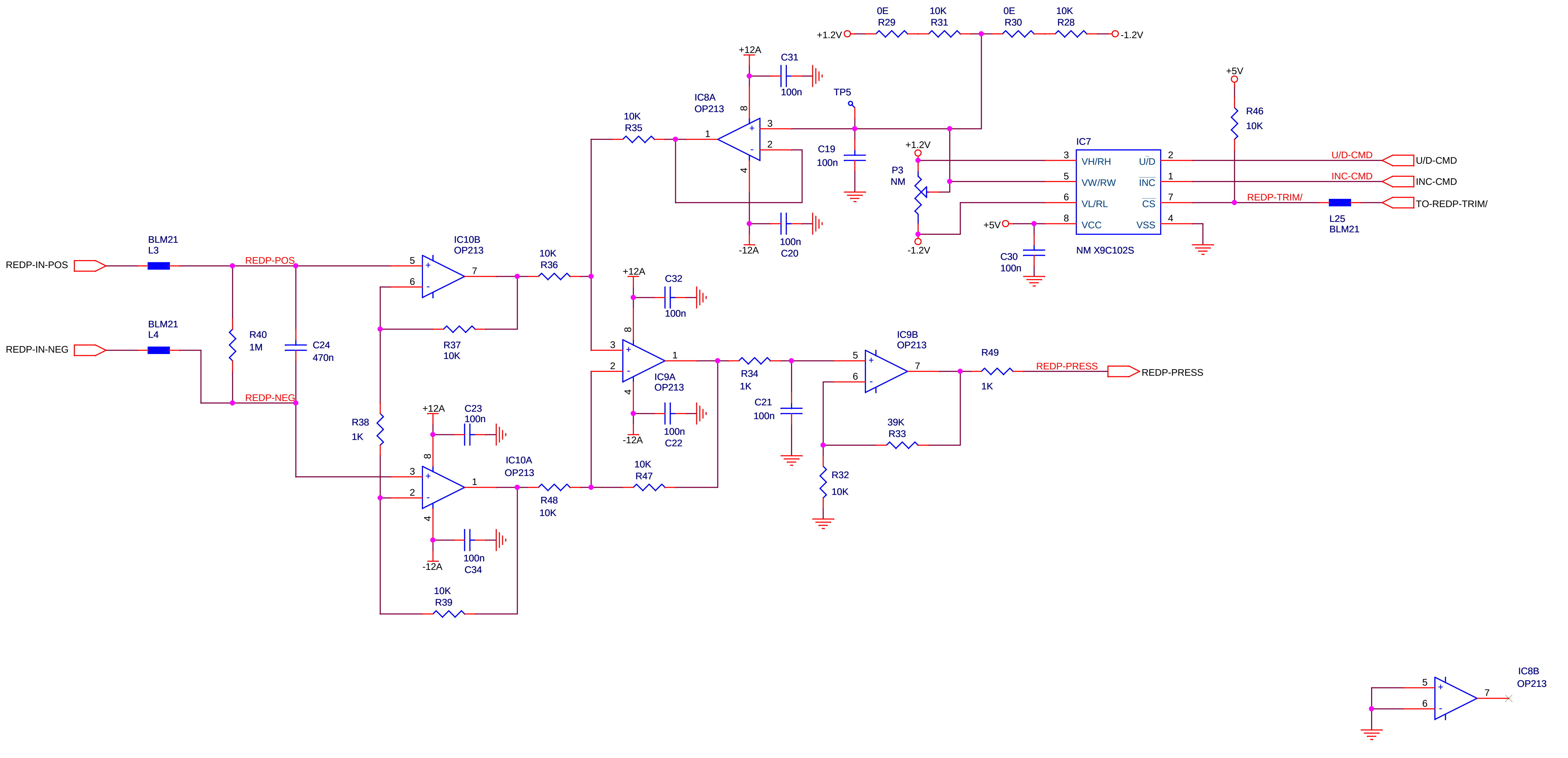
vs Signal Connector

vs NSC Board

vs other boards


COVER SENSOR
LATCH SENSOR
+12A
R148
0E
R147
NM
NM 100K
P6
IC28
VH/RH
VW/RW
VL/RL
VCC
U/D
INC
CS
VSS
X9C104S
+5V
R149
10K
U/D-CMD
INC-CMD
TO-COVER-TRIM/
L22
BLM21
TP23
C85
100n
C94
100n
R150
100K
R53
3K3
R42
10K
R151
470K
FR-YELLOW
LD3
L18
BLM21
COVER-STATUS
C95
100n
VSNS-COVER-AN
R154
15K
IC29B
LM392/SO8
TP25
VTH-COVER
VSA-COVER
COVER-OUT
R152
22K
C96
100n
IC29A
LM392/SO8
NON SCAMBIARE PARTE A CON PARTE B
R153
43K
R155
27K
VSNS-COVER-DIG
L10
BLM21
R198
0E
R197
NM
NM 100K
P8
IC32
R176
10K
TO-LATCH-TRIM/
L19
BLM21
TP24
C93
100n
C105
100n
R177
100K
R55
3K3
R54
10K
R178
470K
FR-YELLOW
LD4
L15
BLM21
LATCH-STATUS
C106
100n
VSNS-LATCH-AN
R180
15K
IC33B
LM392/SO8
TP30
VTH-LATCH
VSA-LATCH
LATCH-OUT
R199
22K
C107
100n
IC33A
LM392/SO8
NON SCAMBIARE PARTE A CON PARTE B
R179
43K
R181
27K
L27
BLM21
VSNS-LATCH-DIG
LM78L05ACM/SO-8
IC38
VREF-COVER
IN
OUT
GND
NC
C120
100n
C121
100n
ALLEGRO
A1321UA
1 2 3
VCC
GND
OUT

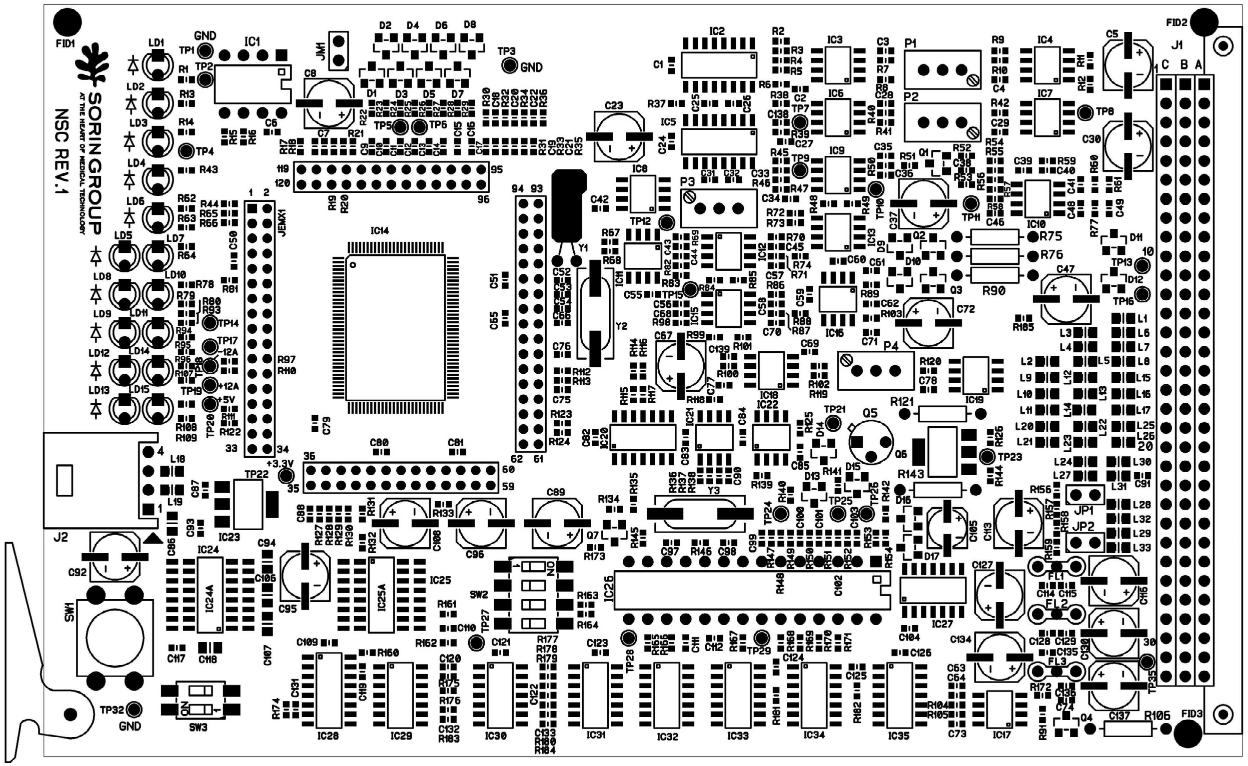

BY PASS
CAPACITOR
DIGITAL IC
OVER VOLTAGE
UNDER VOLTAGE
+5-PRES
+12-PRES
-12-PRES
+/-12 OVERV
+/-12 UNDERV
OVERV-12
UNDERV-12
DSS6NZ82A103Q55B
FL3
FL2
FL1
+5VBP
+12VBP
-12VBP
TP35
TP17
TP16
TP8
TP12
TP2
TP7
TP1
TP34
3K3
R117
LD9
GREEN
C127
22uF
C131
100n
C123
22uF
C130
100n
C126
10uF
C125
100n
R107
6K8
LD8
GREEN
C122
10uF
C124
100n
R45
3K3
IC6
LM385-1.2
C29
100n
C114
10uF
C113
100n
LD7
GREEN
R89
6K8
C111
10uF
C112
100n
3K3
R5
IC2
LM385-1.2
C6
100n
+12A
-12A
+1.2V
-1.2V
+5V
VCC
C36
C48
C58
C56
C71
C28
C70
C86
C76
C15
C17
10uF
C73
10uF
C5
10uF
C66
10uF
C72
22uF
C27
22uF
74HC14
IC20B
R109
10K
LD5
RED
R43
10K
R56
3K3
L16
BLM21
74HC14
IC20E
MS
VREF
OUT1
IN1
OUT2
IN2
GND
VCC
IC11
MC34161
R60
10K
120K
R59
8K2
R62
R58
100K
R61
8K2
R44
10K
C35
100n
LD6
RED
R73
10K
R74
3K3
L13
BLM21
74HC14
IC20F
IC14
MC34161
R57
10K
68K
R76
R75
91K
R77
10K
C47
100n

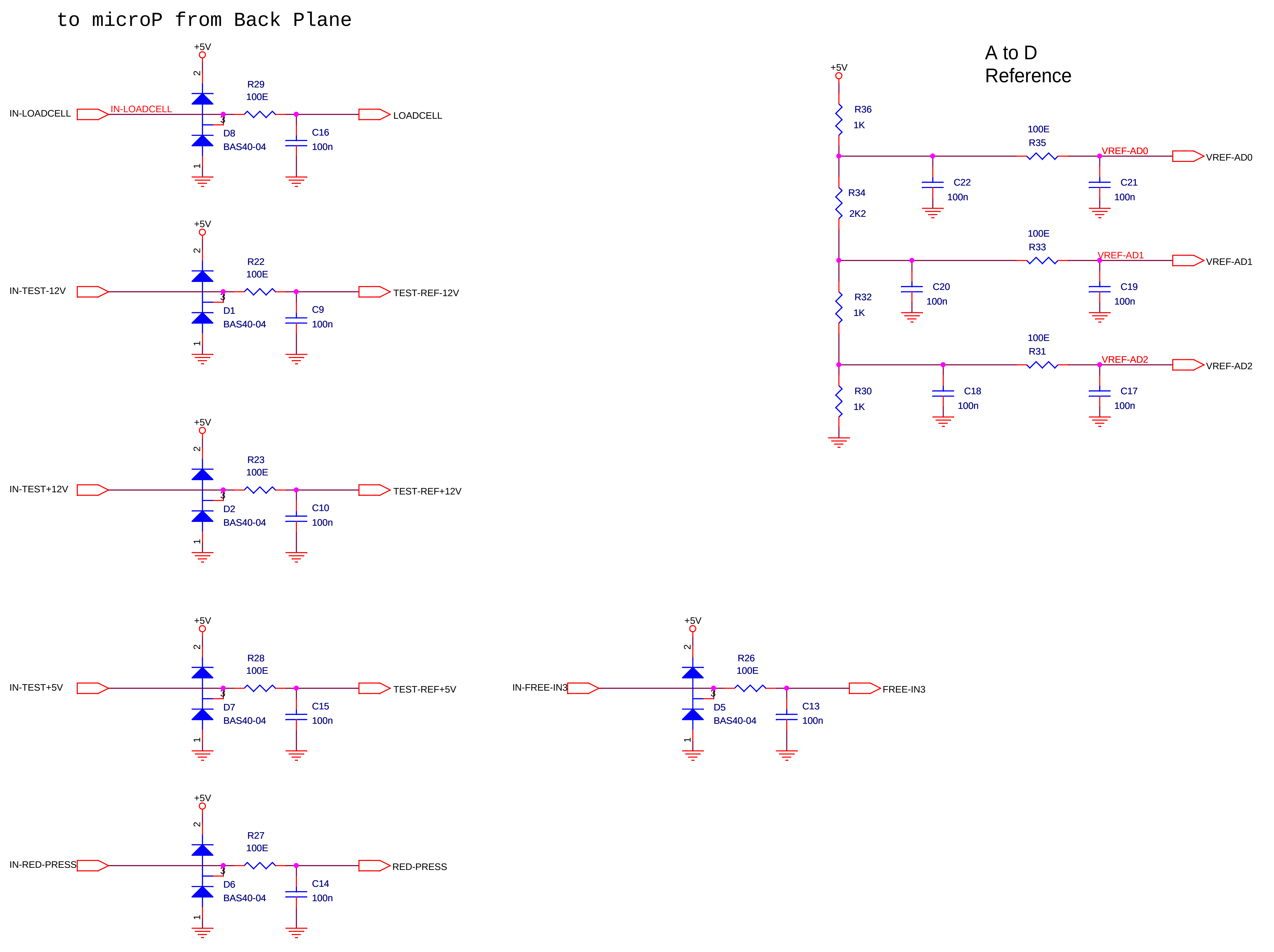

REDP-IN-POS
REDP-IN-NEG
BLM21 L3
BLM21 L4
REDP-POS
REDP-NEG
R40 1M
C24 470n
R38 1K
IC10B OP213
IC10A OP213
R37 10K
R39 10K
R36 10K
R48 10K
C23 100n
C34 100n
+12A
-12A
IC8A OP213
R35 10K
C31 100n
C20 100n
C19 100n
TP5
+1.2V
-1.2V
R29 0E
R31 10K
R30 0E
R28 10K
P3 NM
IC7
VH/RH
VW/RW
VL/RL
VCC
U/D
INC
CS
VSS
NM X9C102S
C30 100n
+5V
R46 10K
U/D-CMD
INC-CMD
REDP-TRIM/
TO-REDP-TRIM/
L25 BLM21
IC9A OP213
C32 100n
C22 100n
R47 10K
R34 1K
C21 100n
IC9B OP213
R33 39K
R32 10K
R49 1K
REDP-PRESS
IC8B OP213

18.15 NSC p.c. board Schematics rev.00

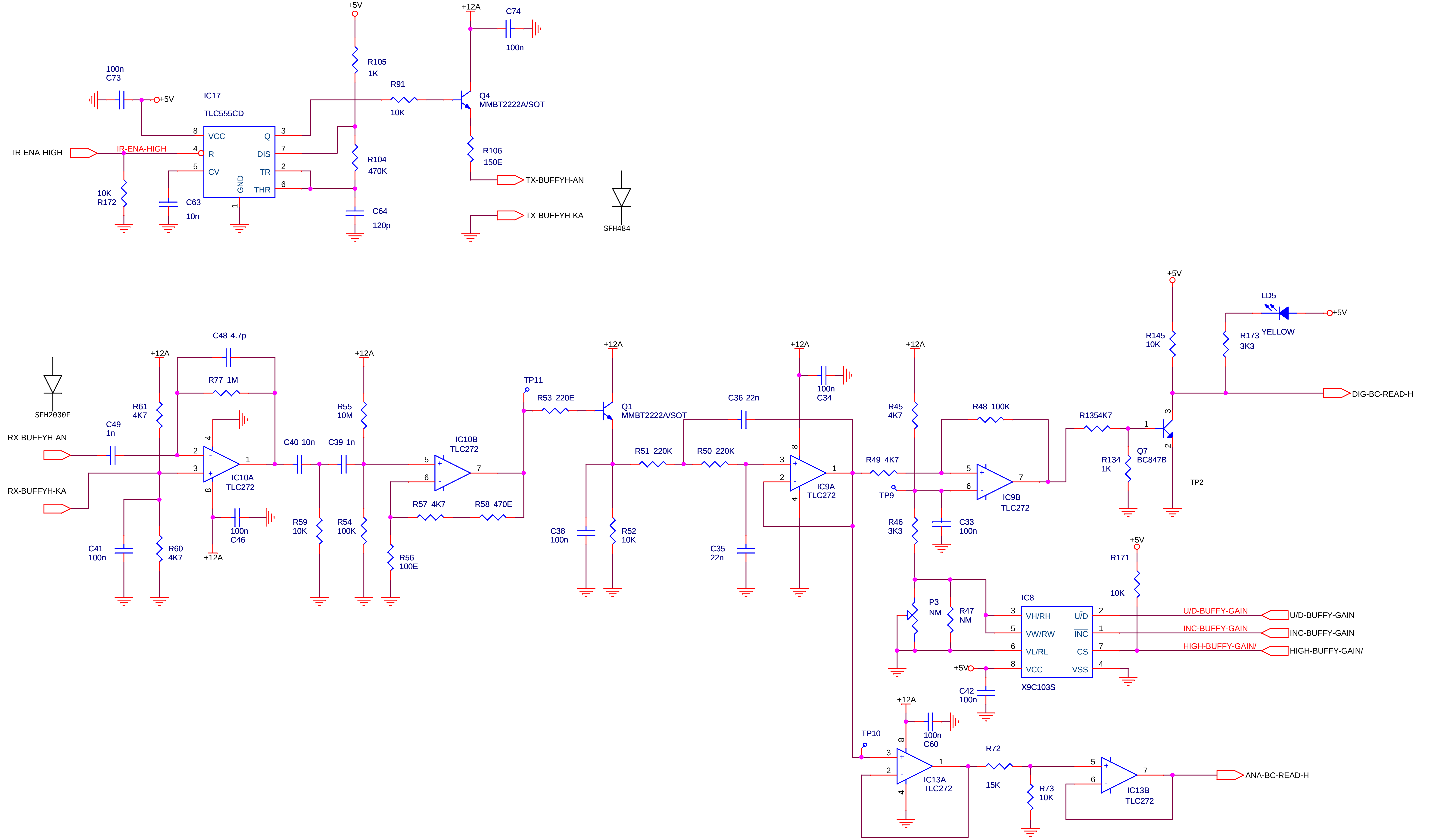
18.15.1 About this card

The purpose of this card is to illustrate the **NSC p.c. board** schematics.

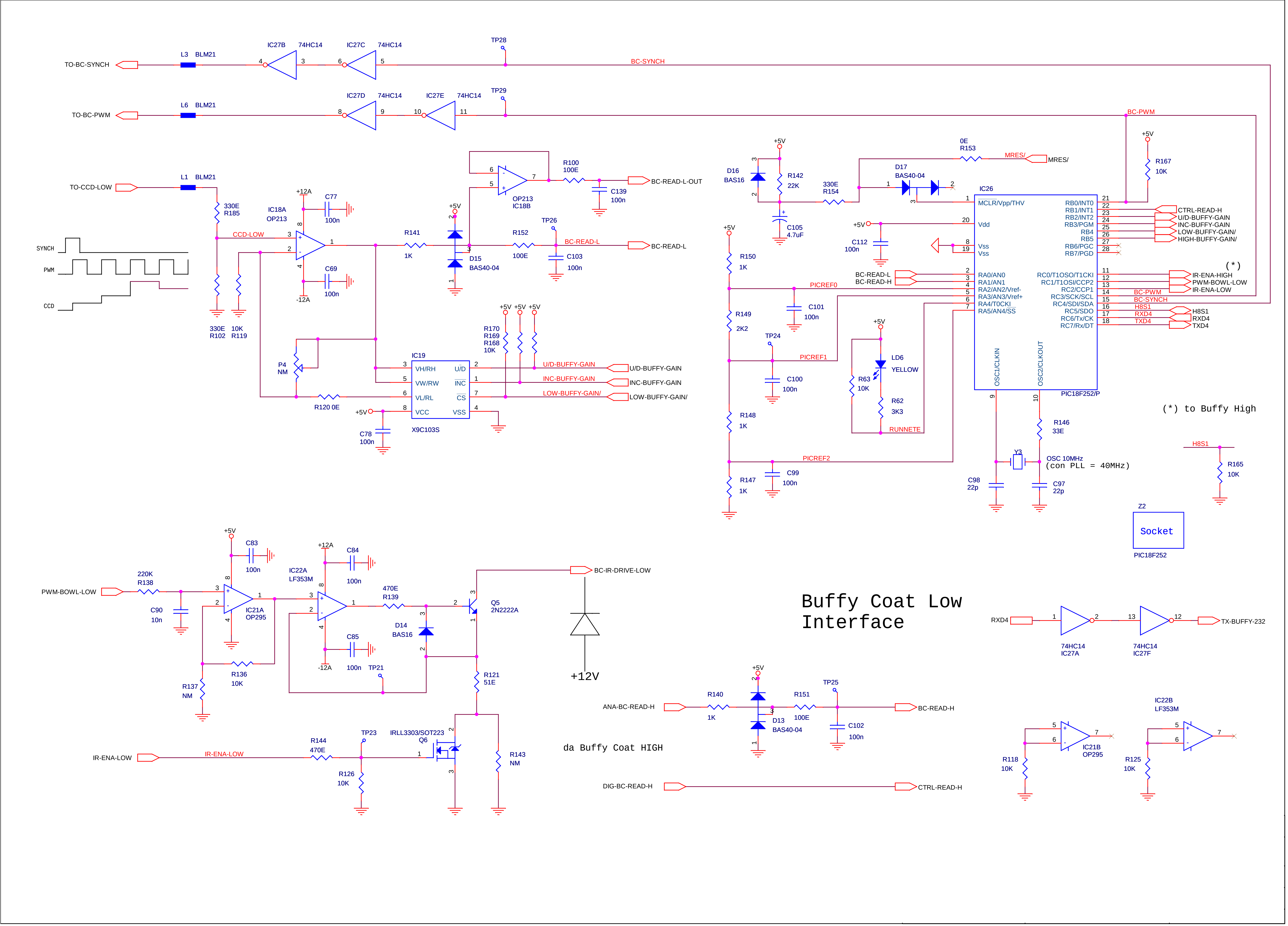

SORIN GROUP
NSC REV.1

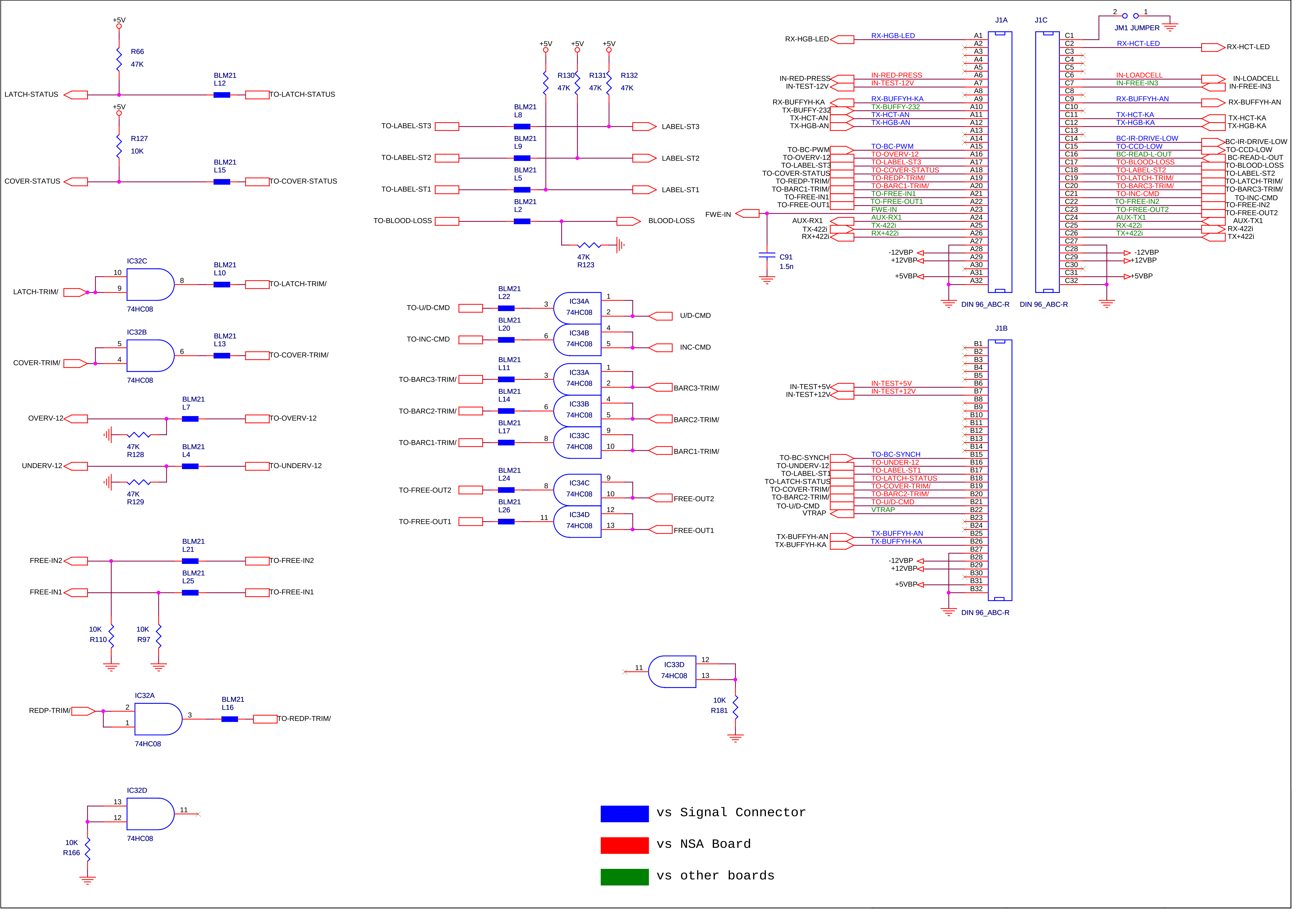


to microP from Back Plane
A to D
Reference
IN-LOADCELL
LOADCELL
R29
100E
D8
BAS40-04
C16
100n
IN-TEST-12V
TEST-REF-12V
R22
D1
C9
IN-TEST+12V
TEST-REF+12V
R23
D2
C10
IN-TEST+5V
TEST-REF+5V
R28
D7
C15
IN-RED-PRESS
RED-PRESS
R27
D6
C14
IN-FREE-IN3
FREE-IN3
R26
D5
C13
+5V
R36
1K
R34
2K2
R32
R30
R35
R33
R31
C22
C21
C20
C19
C18
C17
VREF-AD0
VREF-AD1
VREF-AD2

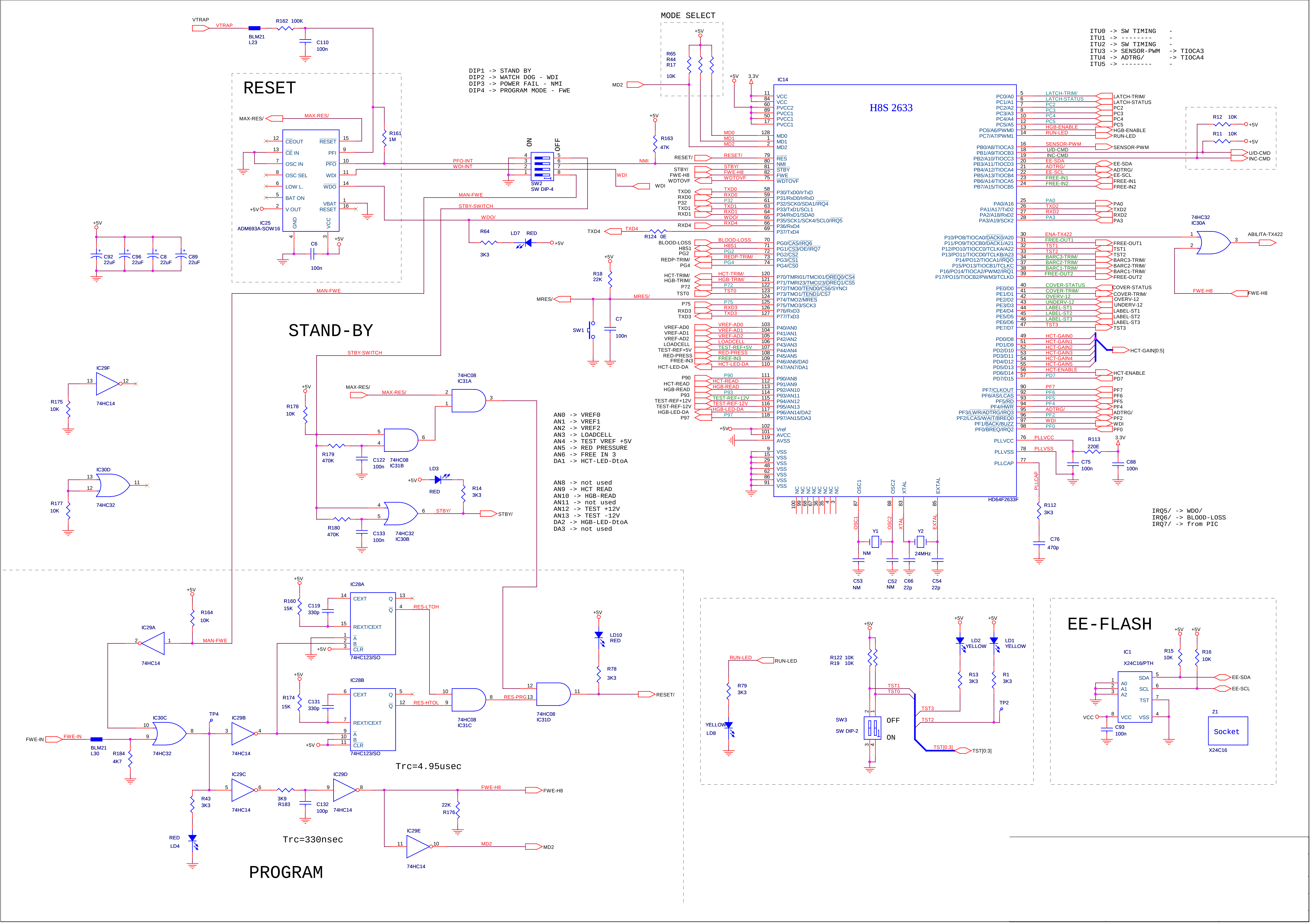


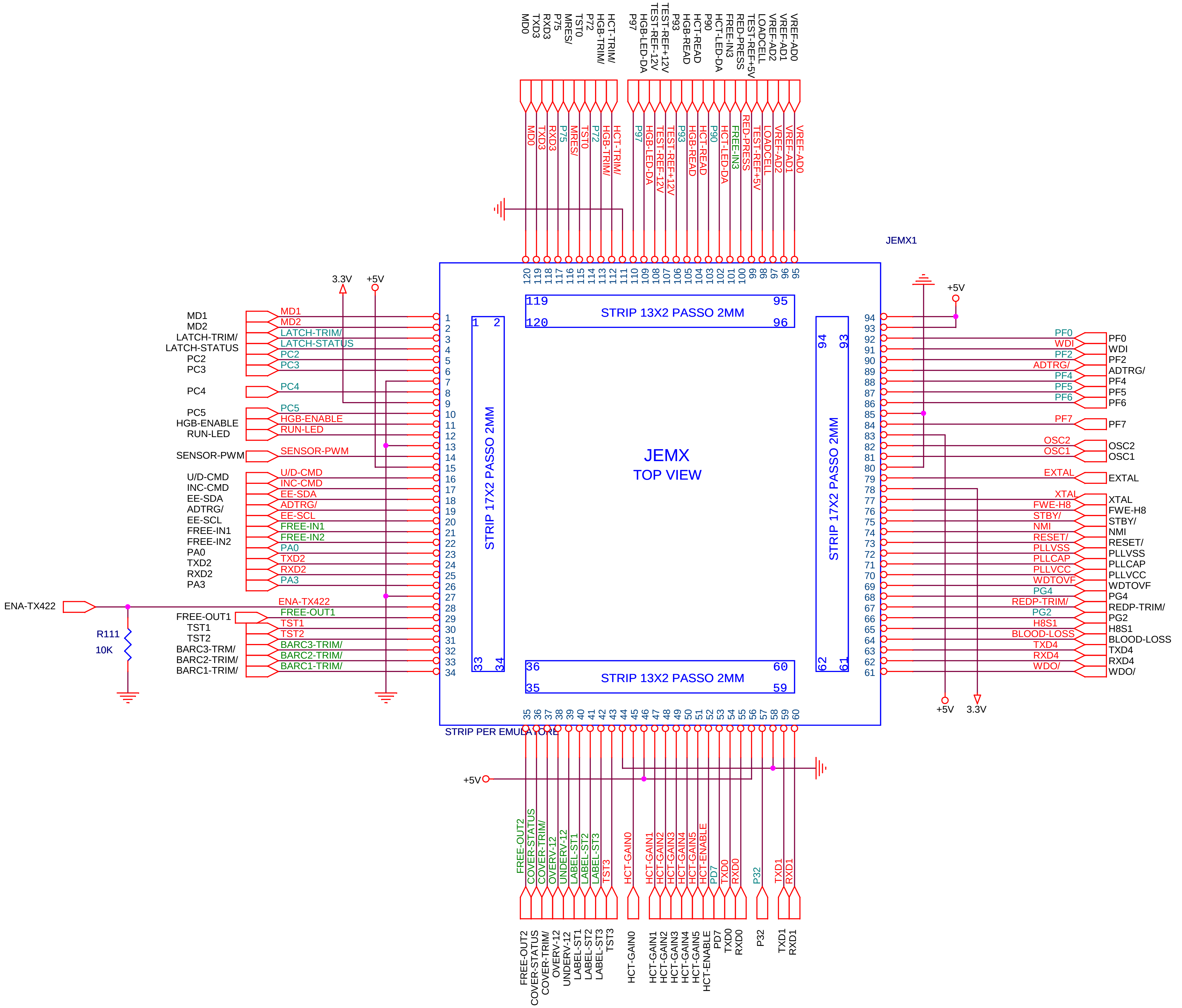
+5V
+12A
C74
100n
R105
1K
100n
C73
+5V
IC17
TLC555CD
R91
10K
Q4
MMBT2222A/SOT
VCC
Q
R
DIS
CV
TR
GND
THR
IR-ENA-HIGH
IR-ENA-HIGH
10K
R172
C63
10n
R104
470K
C64
120p
R106
150E
TX-BUFFYH-AN
TX-BUFFYH-KA
SFH484
SFH2030F
+12A
C48 4.7p
R77 1M
R61
4K7
C49
1n
RX-BUFFYH-AN
RX-BUFFYH-KA
IC10A
TLC272
100n
C46
C41
100n
R60
4K7
C40 10n
C39 1n
R55
10M
R59
10K
R54
100K
IC10B
TLC272
R57 4K7
R58 470E
R56
100E
TP11
R53 220E
Q1
MMBT2222A/SOT
R51 220K
R50 220K
C36 22n
C38
100n
R52
10K
C35
22n
100n
C34
IC9A
TLC272
R45
4K7
R49 4K7
TP9
R46
3K3
R48 100K
IC9B
TLC272
C33
100n
+5V
R145
10K
LD5
YELLOW
R173
3K3
DIG-BC-READ-H
R1354K7
Q7
BC847B
R134
1K
TP2
R171
10K
P3
NM
R47
NM
IC8
VH/RH
U/D
VW/RW
INC
VL/RL
CS
VCC
VSS
X9C103S
U/D-BUFFY-GAIN
U/D-BUFFY-GAIN
INC-BUFFY-GAIN
INC-BUFFY-GAIN
HIGH-BUFFY-GAIN/
HIGH-BUFFY-GAIN/
C42
100n
TP10
100n
C60
IC13A
TLC272
R72
15K
R73
10K
IC13B
TLC272
ANA-BC-READ-H

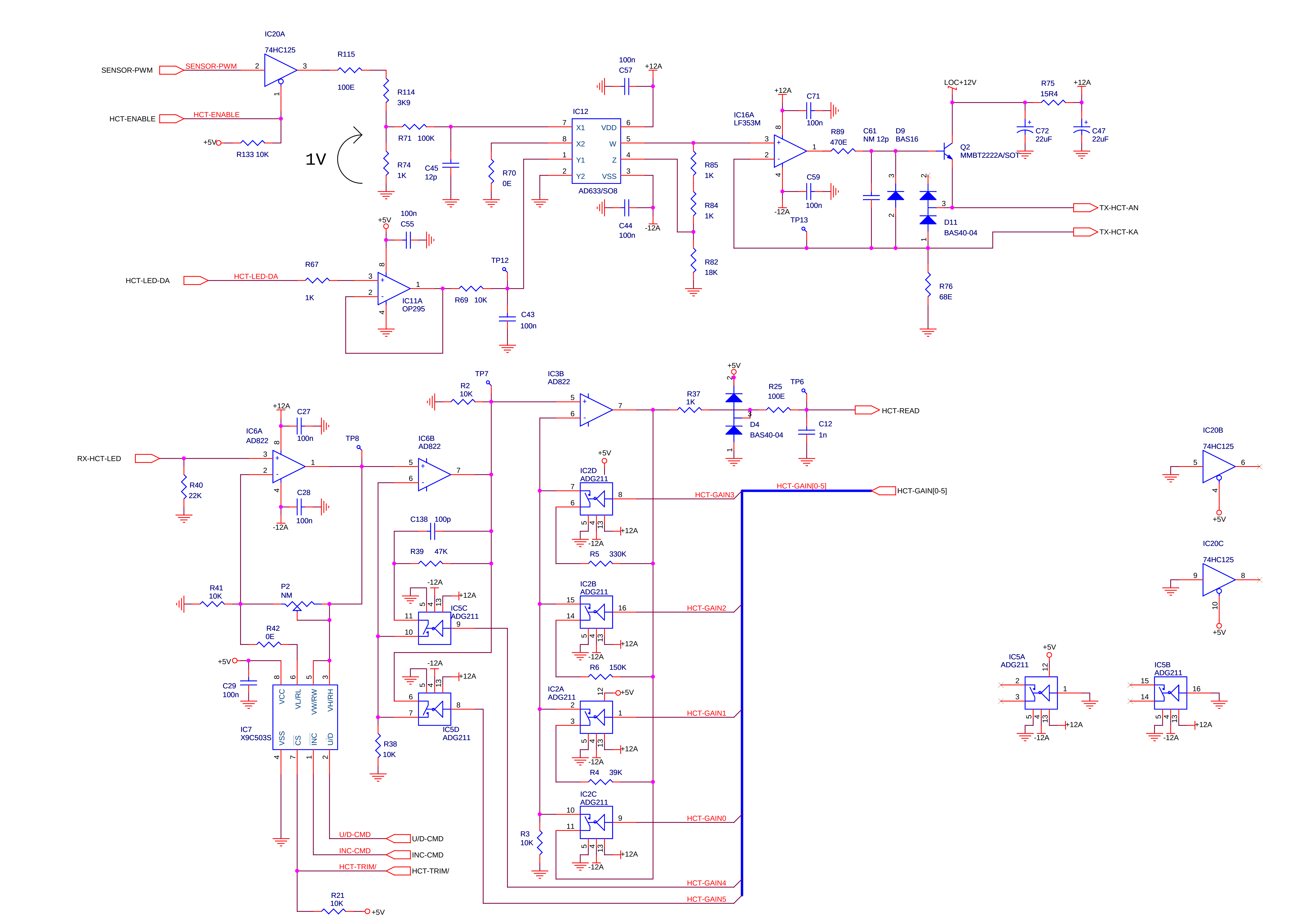

TO-BC-SYNCH
L3 BLM21
IC27B 74HC14
IC27C 74HC14
TP28
BC-SYNCH
TO-BC-PWM
L6 BLM21
IC27D 74HC14
IC27E 74HC14
TP29
BC-PWM
TO-CCD-LOW
L1 BLM21
330E R185
SYNCH
PWM
CCD
CCD-LOW
IC18A OP213
+12A
C77 100n
C69 100n
-12A
330E R102
10K R119
P4 NM
R120 0E
R141 1K
D15 BAS40-04
R152 100E
TP26
BC-READ-L
C103 100n
OP213 IC18B
R100 100E
C139 100n
BC-READ-L-OUT
R170 R169 R168 10K
IC19
VH/RH
VW/RW
VL/RL
VCC
U/D
INC
CS
VSS
X9C103S
C78 100n
U/D-BUFFY-GAIN
INC-BUFFY-GAIN
LOW-BUFFY-GAIN/
D16 BAS16
R142 22K
C105 4.7uF
330E R154
0E R153
MRES/
D17 BAS40-04
IC26
MCLR/Vpp/THV
Vdd
Vss
RA0/AN0
RA1/AN1
RA2/AN2/Vref-
RA3/AN3/Vref+
RA4/T0CKI
RA5/AN4/SS
RB0/INT0
RB1/INT1
RB2/INT2
RB3/PGM
RB4
RB5
RB6/PGC
RB7/PGD
RC0/T1OSO/T1CKI
RC1/T1OSI/CCP2
RC2/CCP1
RC3/SCK/SCL
RC4/SDI/SDA
RC5/SDO
RC6/Tx/CK
RC7/Rx/DT
OSC1/CLKIN
OSC2/CLKOUT
PIC18F252/P
C112 100n
R167 10K
CTRL-READ-H
U/D-BUFFY-GAIN
INC-BUFFY-GAIN
LOW-BUFFY-GAIN/
HIGH-BUFFY-GAIN/
(*)
IR-ENA-HIGH
PWM-BOWL-LOW
IR-ENA-LOW
BC-PWM
BC-SYNCH
H8S1
RXD4
TXD4
BC-READ-L
BC-READ-H
R150 1K
PICREF0
C101 100n
R149 2K2
TP24
PICREF1
C100 100n
LD6 YELLOW
R63 10K
R62 3K3
RUNNETE
R148 1K
PICREF2
C99 100n
R147 1K
R146 33E
Y3
OSC 10MHz
(con PLL = 40MHz)
C98 22p
C97 22p
(*) to Buffy High
H8S1
R165 10K
Z2
Socket
PIC18F252
PWM-BOWL-LOW
220K R138
C90 10n
C83 100n
IC21A OP295
R136 10K
R137 NM
IC22A LF353M
C84 100n
C85 100n
470E R139
D14 BAS16
TP21
Q5 2N2222A
BC-IR-DRIVE-LOW
+12V
R121 51E
IR-ENA-LOW
R144 470E
TP23
IRLL3303/SOT223 Q6
R126 10K
R143 NM
Buffy Coat Low
Interface
da Buffy Coat HIGH
ANA-BC-READ-H
R140 1K
D13 BAS40-04
R151 100E
TP25
C102 100n
BC-READ-H
DIG-BC-READ-H
CTRL-READ-H
RXD4
74HC14 IC27A
74HC14 IC27F
TX-BUFFY-232
IC21B OP295
R118 10K
IC22B LF353M
R125 10K



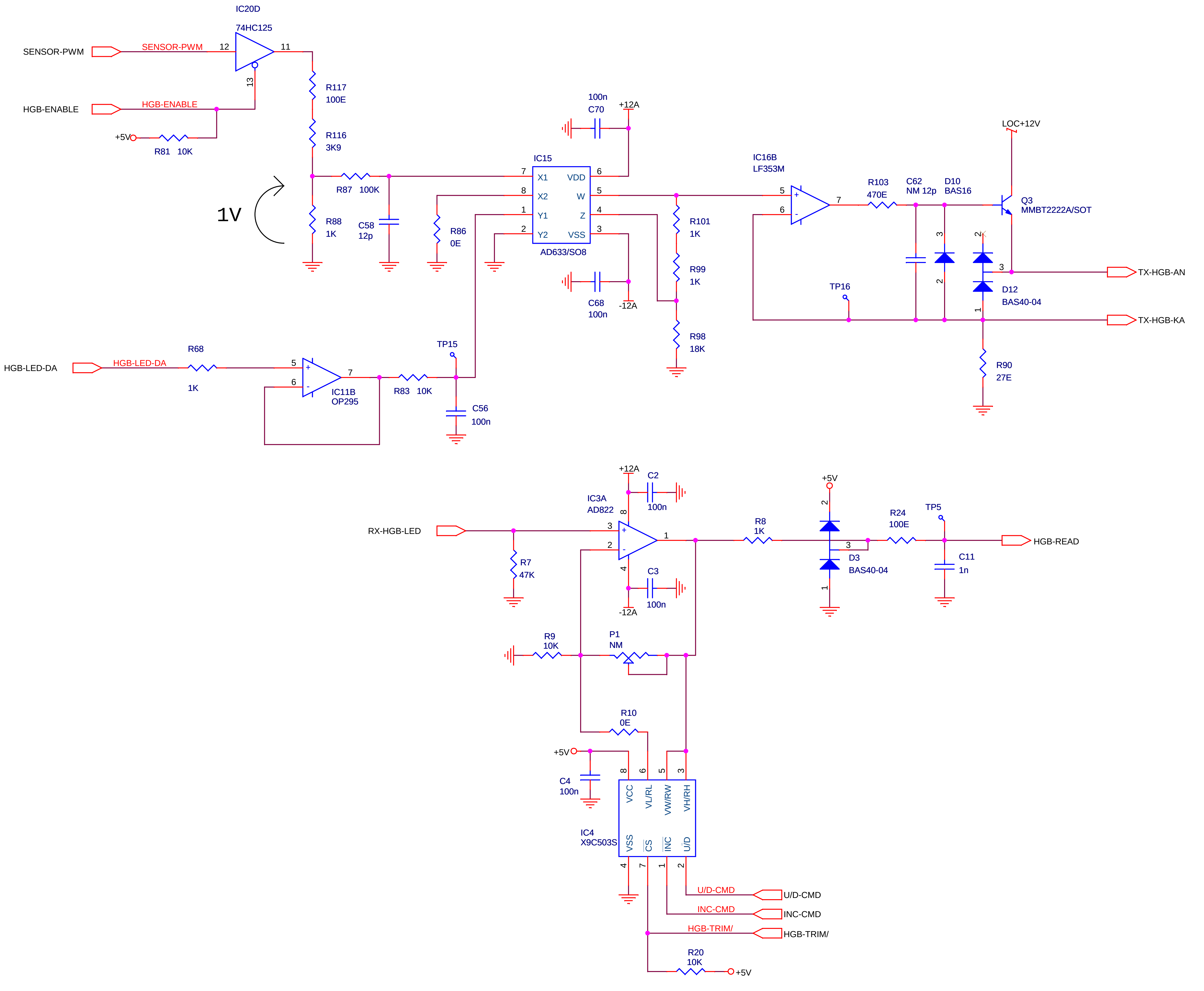
+5V
R66
47K
LATCH-STATUS
BLM21
L12
TO-LATCH-STATUS
R127
10K
COVER-STATUS
L15
TO-COVER-STATUS
IC32C
74HC08
LATCH-TRIM/
L10
TO-LATCH-TRIM/
IC32B
COVER-TRIM/
L13
TO-COVER-TRIM/
OVERV-12
L7
TO-OVERV-12
47K
R128
UNDERV-12
L4
TO-UNDERV-12
R129
FREE-IN2
L21
TO-FREE-IN2
FREE-IN1
L25
TO-FREE-IN1
10K
R110
R97
IC32A
REDP-TRIM/
L16
TO-REDP-TRIM/
IC32D
R166
R130
R131
R132
TO-LABEL-ST3
L8
LABEL-ST3
TO-LABEL-ST2
L9
LABEL-ST2
TO-LABEL-ST1
L5
LABEL-ST1
TO-BLOOD-LOSS
L2
BLOOD-LOSS
R123
TO-U/D-CMD
L22
IC34A
U/D-CMD
TO-INC-CMD
L20
IC34B
INC-CMD
TO-BARC3-TRIM/
L11
IC33A
BARC3-TRIM/
TO-BARC2-TRIM/
L14
IC33B
BARC2-TRIM/
TO-BARC1-TRIM/
L17
IC33C
BARC1-TRIM/
TO-FREE-OUT2
L24
IC34C
FREE-OUT2
TO-FREE-OUT1
L26
IC34D
FREE-OUT1
IC33D
R181
FWE-IN
C91
1.5n
J1A
J1B
J1C
JM1 JUMPER
DIN 96_ABC-R
RX-HGB-LED
IN-RED-PRESS
IN-TEST-12V
RX-BUFFYH-KA
TX-BUFFY-232
TX-HCT-AN
TX-HGB-AN
TO-BC-PWM
TO-OVERV-12
TO-LABEL-ST3
TO-COVER-STATUS
TO-REDP-TRIM/
TO-BARC1-TRIM/
TO-FREE-IN1
TO-FREE-OUT1
AUX-RX1
TX-422i
RX+422i
-12VBP
+12VBP
+5VBP
RX-HCT-LED
IN-LOADCELL
IN-FREE-IN3
RX-BUFFYH-AN
TX-HCT-KA
TX-HGB-KA
BC-IR-DRIVE-LOW
TO-CCD-LOW
BC-READ-L-OUT
TO-BLOOD-LOSS
TO-LABEL-ST2
TO-LATCH-TRIM/
TO-BARC3-TRIM/
TO-INC-CMD
TO-FREE-IN2
TO-FREE-OUT2
AUX-TX1
RX-422i
TX+422i
IN-TEST+5V
IN-TEST+12V
TO-BC-SYNCH
TO-UNDERV-12
TO-UNDER-12
TO-LABEL-ST1
TO-LATCH-STATUS
TO-COVER-TRIM/
TO-BARC2-TRIM/
TO-U/D-CMD
VTRAP
TX-BUFFYH-AN
TX-BUFFYH-KA
vs Signal Connector
vs NSA Board
vs other boards

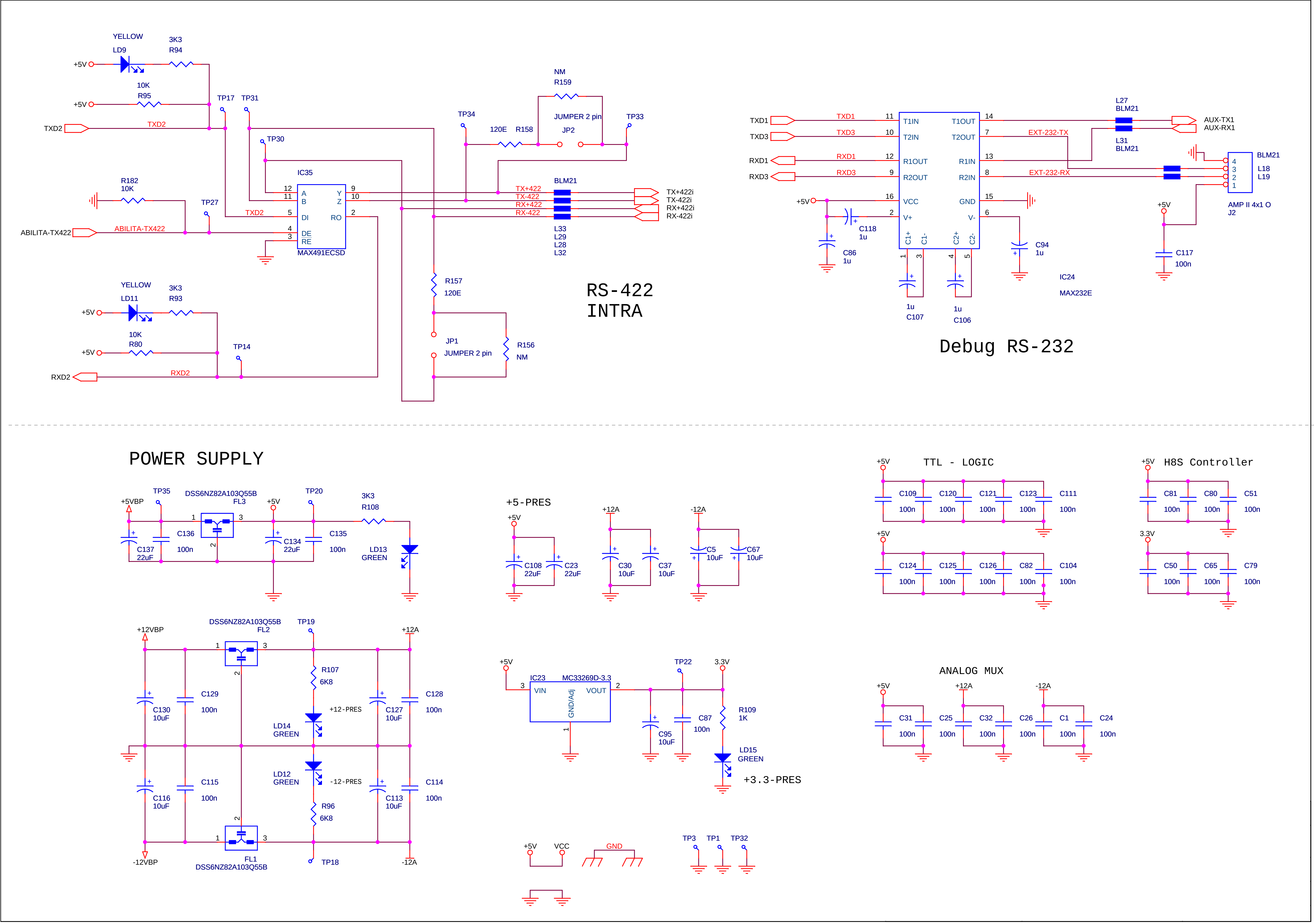

MODE SELECT
RESET
STAND-BY
PROGRAM
EE-FLASH
H8S 2633
HD64F2633F
DIP1 -> STAND BY
DIP2 -> WATCH DOG - WDI
DIP3 -> POWER FAIL - NMI
DIP4 -> PROGRAM MODE - FWE
ITU0 -> SW TIMING -
ITU1 -> -------- -
ITU2 -> SW TIMING -
ITU3 -> SENSOR-PWM -> TIOCA3
ITU4 -> ADTRG/ -> TIOCA4
ITU5 -> -------- -
AN0 -> VREF0
AN1 -> VREF1
AN2 -> VREF2
AN3 -> LOADCELL
AN4 -> TEST VREF +5V
AN5 -> RED PRESSURE
AN6 -> FREE IN 3
DA1 -> HCT-LED-DtoA
AN8 -> not used
AN9 -> HCT READ
AN10 -> HGB-READ
AN11 -> not used
AN12 -> TEST +12V
AN13 -> TEST -12V
DA2 -> HGB-LED-DtoA
DA3 -> not used
IRQ5/ -> WDO/
IRQ6/ -> BLOOD-LOSS
IRQ7/ -> from PIC
Trc=4.95usec
Trc=330nsec
ADM693A-SOW16
SW DIP-4
SW DIP-2
74HC14
74HC32
74HC08
74HC123/SO
X24C16/PTH
X24C16
Socket


JEMX
TOP VIEW
JEMX1
STRIP 13X2 PASSO 2MM
STRIP 17X2 PASSO 2MM
STRIP PER EMULATORE
3.3V
+5V
ENA-TX422
R111
10K
MD1
MD2
LATCH-TRIM/
LATCH-STATUS
PC2
PC3
PC4
PC5
HGB-ENABLE
RUN-LED
SENSOR-PWM
U/D-CMD
INC-CMD
EE-SDA
ADTRG/
EE-SCL
FREE-IN1
FREE-IN2
PA0
TXD2
RXD2
PA3
FREE-OUT1
TST1
TST2
BARC3-TRM/
BARC2-TRM/
BARC1-TRIM/
PF0
WDI
PF2
ADTRG/
PF4
PF5
PF6
PF7
OSC2
OSC1
EXTAL
XTAL
FWE-H8
STBY/
NMI
RESET/
PLLVSS
PLLCAP
PLLVCC
WDTOVF
PG4
REDP-TRIM/
PG2
H8S1
BLOOD-LOSS
TXD4
RXD4
WDO/
MD0
TXD3
RXD3
P75
MRES/
TST0
P72
HGB-TRIM/
HCT-TRIM/
P97
HGB-LED-DA
TEST-REF-12V
TEST-REF+12V
P93
HGB-READ
HCT-READ
P90
HCT-LED-DA
FREE-IN3
RED-PRESS
TEST-REF+5V
LOADCELL
VREF-AD2
VREF-AD1
VREF-AD0
FREE-OUT2
COVER-STATUS
COVER-TRIM/
OVERV-12
UNDERV-12
LABEL-ST1
LABEL-ST2
LABEL-ST3
TST3
HCT-GAIN0
HCT-GAIN1
HCT-GAIN2
HCT-GAIN3
HCT-GAIN4
HCT-GAIN5
HCT-ENABLE
PD7
TXD0
RXD0
P32
TXD1
RXD1



IC20A
74HC125
SENSOR-PWM
HCT-ENABLE
+5V
R133 10K
R115
100E
R114
3K9
R71 100K
R74
1K
1V
C45
12p
R70
0E
IC12
X1
X2
Y1
Y2
VDD
W
Z
VSS
AD633/SO8
100n
C57
+12A
C44
100n
-12A
R85
1K
R84
1K
R82
18K
IC16A
LF353M
+12A
C71
100n
C59
100n
-12A
TP13
R89
470E
C61
NM 12p
D9
BAS16
LOC+12V
R75
15R4
+12A
C72
22uF
C47
22uF
Q2
MMBT2222A/SOT
D11
BAS40-04
TX-HCT-AN
TX-HCT-KA
R76
68E
HCT-LED-DA
R67
1K
+5V
100n
C55
IC11A
OP295
TP12
R69 10K
C43
100n
TP7
R2
10K
IC3B
AD822
+5V
R37
1K
R25
100E
TP6
D4
BAS40-04
C12
1n
HCT-READ
RX-HCT-LED
R40
22K
IC6A
AD822
+12A
C27
100n
C28
100n
-12A
TP8
IC6B
AD822
C138 100p
R39 47K
IC2D
ADG211
+5V
R5 330K
HCT-GAIN3
HCT-GAIN[0-5]
IC2B
ADG211
R6 150K
HCT-GAIN2
IC2A
ADG211
R4 39K
HCT-GAIN1
IC2C
ADG211
HCT-GAIN0
R3
10K
HCT-GAIN4
HCT-GAIN5
IC5C
ADG211
IC5D
ADG211
R38
10K
R41
10K
P2
NM
R42
0E
+5V
C29
100n
IC7
X9C503S
VCC
VL/RL
VW/RW
VH/RH
VSS
CS
INC
U/D
U/D-CMD
INC-CMD
HCT-TRIM/
R21
10K
+5V
IC20B
74HC125
IC20C
74HC125
IC5A
ADG211
IC5B
ADG211


SENSOR-PWM
HGB-ENABLE
+5V
R81 10K
IC20D
74HC125
12
11
13
R117
100E
R116
3K9
1V
R88
1K
R87 100K
C58
12p
R86
0E
IC15
X1
X2
Y1
Y2
VDD
W
Z
VSS
AD633/SO8
100n
C70
+12A
C68
100n
-12A
R101
1K
R99
1K
R98
18K
IC16B
LF353M
R103
470E
C62
NM 12p
D10
BAS16
LOC+12V
Q3
MMBT2222A/SOT
D12
BAS40-04
TX-HGB-AN
TX-HGB-KA
TP16
R90
27E
HGB-LED-DA
R68
1K
IC11B
OP295
TP15
R83 10K
C56
100n
RX-HGB-LED
R7
47K
IC3A
AD822
+12A
C2
100n
C3
100n
-12A
R8
1K
+5V
D3
BAS40-04
R24
100E
TP5
HGB-READ
C11
1n
R9
10K
P1
NM
R10
0E
+5V
C4
100n
VCC
VL/RL
VW/RW
VH/RH
VSS
CS
INC
U/D
IC4
X9C503S
U/D-CMD
INC-CMD
HGB-TRIM/
R20
10K
+5V



RS-422
INTRA
Debug RS-232
POWER SUPPLY
+5-PRES
TTL - LOGIC
H8S Controller
ANALOG MUX
+3.3-PRES
YELLOW
LD9
3K3
R94
10K
R95
TXD2
TP17
TP31
TP30
TP34
TP33
NM
R159
JUMPER 2 pin
JP2
120E
R158
R182
10K
TP27
IC35
MAX491ECSD
ABILITA-TX422
BLM21
TX+422
TX-422
RX+422
RX-422
TX+422i
TX-422i
RX+422i
RX-422i
L33
L29
L28
L32
R157
120E
JP1
JUMPER 2 pin
R156
NM
YELLOW
LD11
3K3
R93
10K
R80
TP14
RXD2
TXD1
TXD3
RXD1
RXD3
T1IN
T2IN
R1OUT
R2OUT
VCC
V+
T1OUT
T2OUT
R1IN
R2IN
GND
V-
EXT-232-TX
EXT-232-RX
L27
BLM21
L31
BLM21
AUX-TX1
AUX-RX1
L18
L19
AMP II 4x1 O
J2
C118
1u
C86
1u
C94
1u
C117
100n
IC24
MAX232E
C107
C106
+5VBP
TP35
DSS6NZ82A103Q55B
FL3
C137
22uF
C136
100n
C134
22uF
TP20
C135
100n
3K3
R108
LD13
GREEN
C108
22uF
C23
22uF
+12A
C30
10uF
C37
10uF
-12A
C5
10uF
C67
10uF
C109
C120
C121
C123
C111
C124
C125
C126
C82
C104
C81
C80
C51
3.3V
C50
C65
C79
+12VBP
DSS6NZ82A103Q55B
FL2
TP19
R107
6K8
+12-PRES
LD14
GREEN
C130
10uF
C129
100n
C127
10uF
C128
100n
LD12
GREEN
-12-PRES
R96
6K8
C116
10uF
C115
100n
C113
10uF
C114
100n
-12VBP
FL1
DSS6NZ82A103Q55B
TP18
IC23
MC33269D-3.3
VIN
VOUT
GND/Adj
TP22
C95
10uF
C87
100n
R109
1K
LD15
GREEN
C31
C25
C32
C26
C1
C24
VCC
GND
TP3
TP1
TP32

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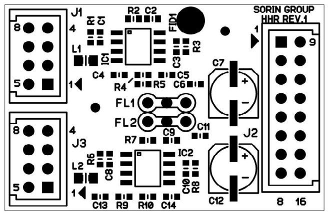
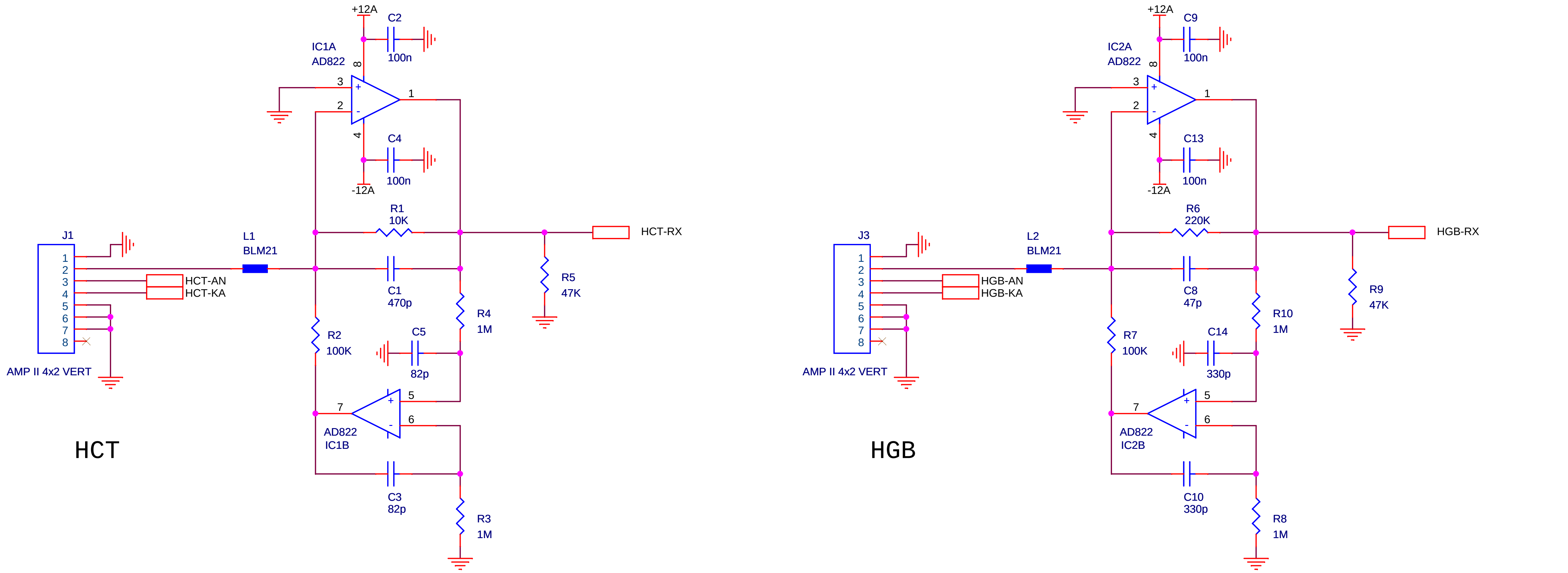
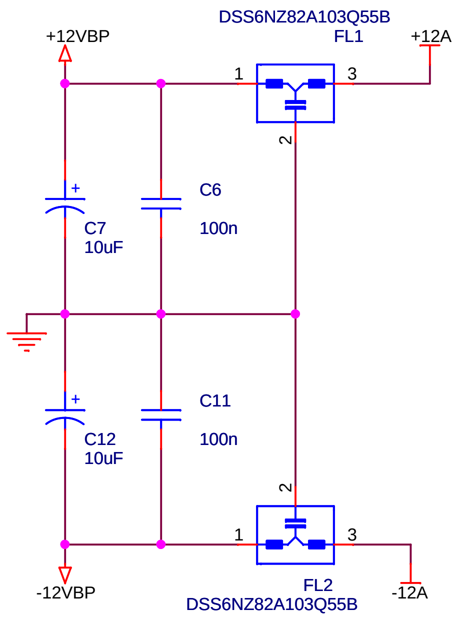
18.16 HHR p.c. board Schematics rev.00

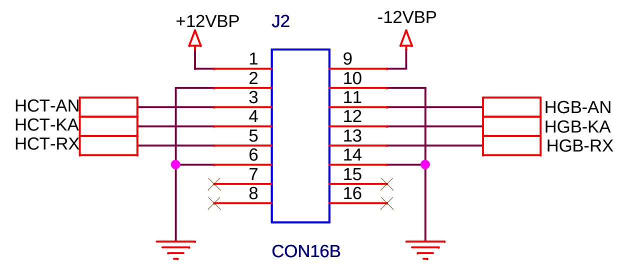
18.16.1 About this card

The purpose of this card is to illustrate the **HHR p.c. board** schematics.


SORIN GROUP
HHR REV.1
J1
J2
J3
FL1
FL2
IC2







AMP MODU II VERT. Component Side
OR
STRIP VERT. Solder Side

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