BPSU36-2

BPSU36-2
User Manual

Version 003

The information in this manual may be altered without notice.

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CE

DECLARATION OF CONFORMITY

The undermentioned product

BPSU36-2 PEAK SAMPLING UNIT H10044

conforms to the main requirements
set by the commission for the
Harmonization of Regulations of the EU Member States
with regards to electromagnetic compatibility
(EMI 89/336/ECC) and safety (Low Voltage Electrical
Equipment: 72/23/ECC) regulations.

For the assessment the following norms were applied:

EMI: EN 61326-1: 2001
Test report: Nemko FS-0211-03948
Safety: EN 61010-1: 2nd ed. (2001)
Test report: Nemko EL-0212-04080

Documentation: Z31704 Docu Standard: BPSU36-2 Peak Sampling Unit

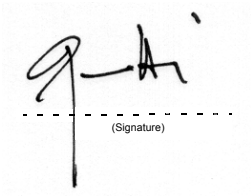
Manufacturer's Name: BRUKER BIOSPIN GmbH
Manufacturer's Address: 76287 Rheinstetten, Silberstreifen,
Germany

Declaration approved by:

Dr. Tonio Gianotti

Head of Development

Rheinstetten 27.01.2004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About This Manual 1

Introduction 1.1

This manual is included in delivery of the BPSU36-2 unit
It instructs how to:

- install and configure the BPSU36-2 Unit
- operate the Unit

Disclaimer 1.2

The Unit should only be used for its intended purpose as described in this manual. Use of the unit for any purpose other than that for which it is intended is taken only at the users own risk and invalidates any and all manufacturer warranties.

Service or maintenance work on the unit must be carried out by qualified personnel.

Only those persons schooled in the operation of the BPSU36-2 should operate the unit.

Read this manual before operating the unit. Pay particular attention to the warnings in the chapter ’Service Information’.

Warnings and Notes 1.3

There are two types of information notices used in this manual. These notices highlight important information or warn the user of a potentially dangerous situation. The following notices will have the same level of importance throughout this manual.

Note: Indicates important information or helpful hints

WARNING: Indicates the possibility of severe personal injury, loss of life or equipment damage if the instructions are not followed.

Contact for Additional Technical Assistance 1.4

For further technical assistance on the BPSU36-2 unit, please do not hesitate to contact your nearest BRUKER dealer or contact us directly at:

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D-76287 Rheinstetten
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Internet: www.bruker.de

Terms and Definitions

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• BPSU36	Bruker Peak Sampling Unit used to store up to 36 HPLC separations for later analysis in an NMR and/or an MS System.
• BPSU36-2	Successor to the Bruker Peak Sampling Unit used to store up to 36 HPLC separations for later analysis in an NMR and/or an MS System. Uses High pressure valves, has a 100Mbit Ethernet Interface and operates with an 8Mb Storage Cassette.
• BNMI	Bruker NMR-MS Interface
• BSFU-O	Bruker Stopped Flow Unit (Oven). Used in conjunction with an HPLC Pump and the BPSU36 to perform HPLC.
• BMSO	Bruker Multi Column Switching Oven: Successor to the BSFU-O Operates together with the BPSU36-2 or in 'Stand-Alone' mode.
• Esquire	Bruker Ion Trap MS System
• Esquire 3000	Successor to the Esquire
• HPLC	High Pressure Liquid Chromatography
• LCNMR	Combined HPLC and NMR analysis
• NMR	Nuclear Magnetic Resonance
• MS	Mass Spectroscopy
• HyStar	Bruker PC (Window 2000) Program integrating control of the BPSU36, BSFU, BNMI and Esquire (MS) systems.
• UV	Ultra Violet
• Peak	A peak is an HPLC separation which has been identified either as a UV absorptions peak or as an MS Peak.

BPSU36-2

3

Purpose 3.1

Like its successor, the BPSU36, the primary purpose of the BPSU36-2 is to store HPLC Peaks in the Storage Cassette for later analyses in MS and/or NMR systems. The BPSU36-2 uses pneumatically driven high pressure valves to provide fast reliable switching of the fluid flow. Although the BPSU36-2 can work in stand-alone mode it is primarily intended to operate as part of an LC-NMR (-MS) system controlled by HyStar. The BPSU36-2 is connected to the system via an Ethernet Interface.

LC-NMR-MS 3.2

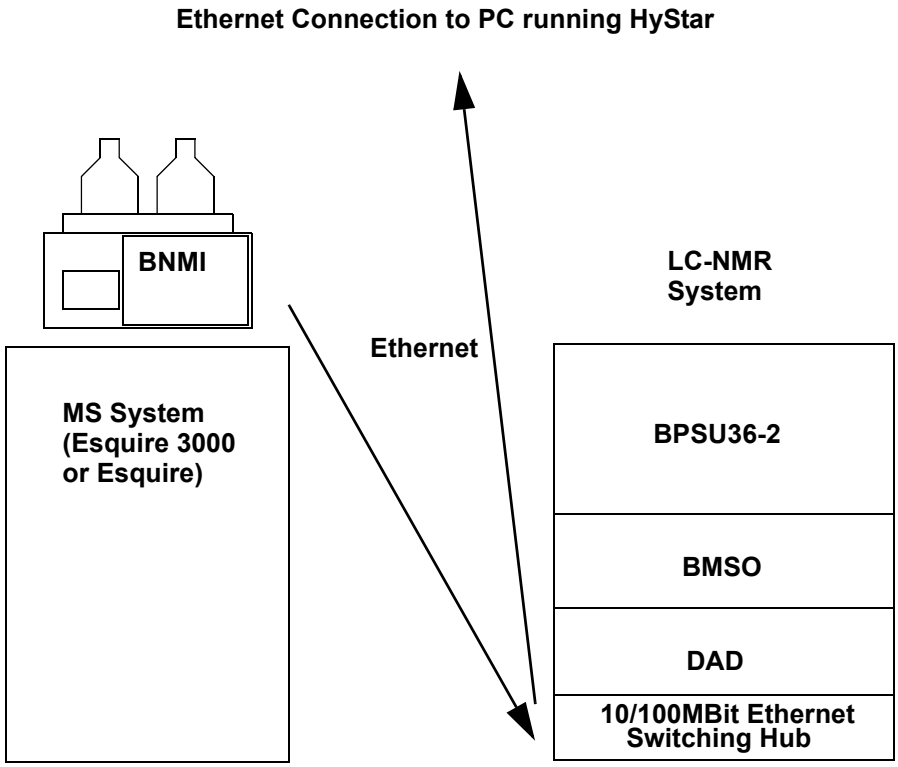


Figure 3.1. LC-NMR-MS System

BPSU36-2 Hardware *3.3*

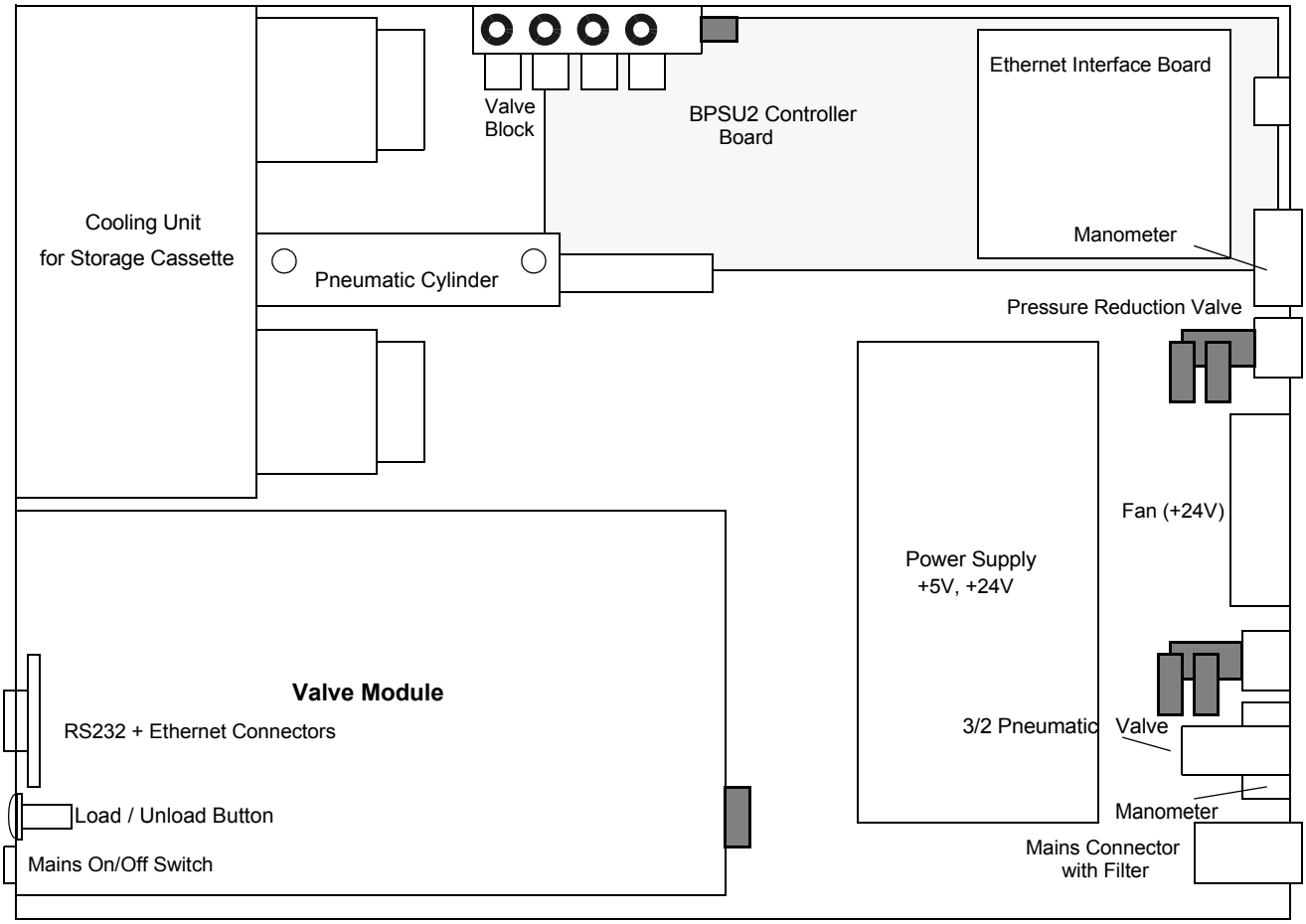


Figure 3.2. BPSU36-2 Internal Layout

The Unit consists of:

A Valve Module containing 4 pneumatically operated high-pressure rotational valves used to control the fluid flow.

A Cooling Unit in which the storage cassette can be cooled to 4°C (to keep the stored peaks stable longer) or heated to 40°C. The Cassette is loaded and unloaded by means of a pneumatic cylinder.

A Power Supply: +24V and +5V

The BPSU36-2 Control Board which is used to control the internal functions of the unit.

The BPSU36-2 100Mbit Ethernet Board which communicates control commands received over the ethernet interface to the control board and returns status information from the control board back over the ethernet interface.

Two Nitrogen/Compressed air inputs. The valves can be operated by either nitrogen or oil free dry compressed air. However, nitrogen ***must*** be used when flushing the cassette and the probe.

A 24V DC fan for cooling purposes.

Nitrogen /Compressed Air Connections: 3.4

The external connection to the left (viewed when facing the rear panel) is used to flush the probe with gas. This is intended for nitrogen (or argon etc. if you so wish) and ***not*** for compressed air.

The connection to the right can be connected to either nitrogen or to dry, filtered compressed air. This is only used for the rotational valves and the drive cylinder to load and unload the cassette.

Both connections take 4mm tubing. The input pressure to both can be in the range 3 - 10Bar. The internal pressure to the valve actuators should be set using the pressure regulators to 2.5±0.3 Bar (= factory setting)

The internal N_2 pressure to the probe can be set to 1- 4Bar. The maximum pressure allowed is dependent on the probe used: Higher pressure means shorter probe flush time.

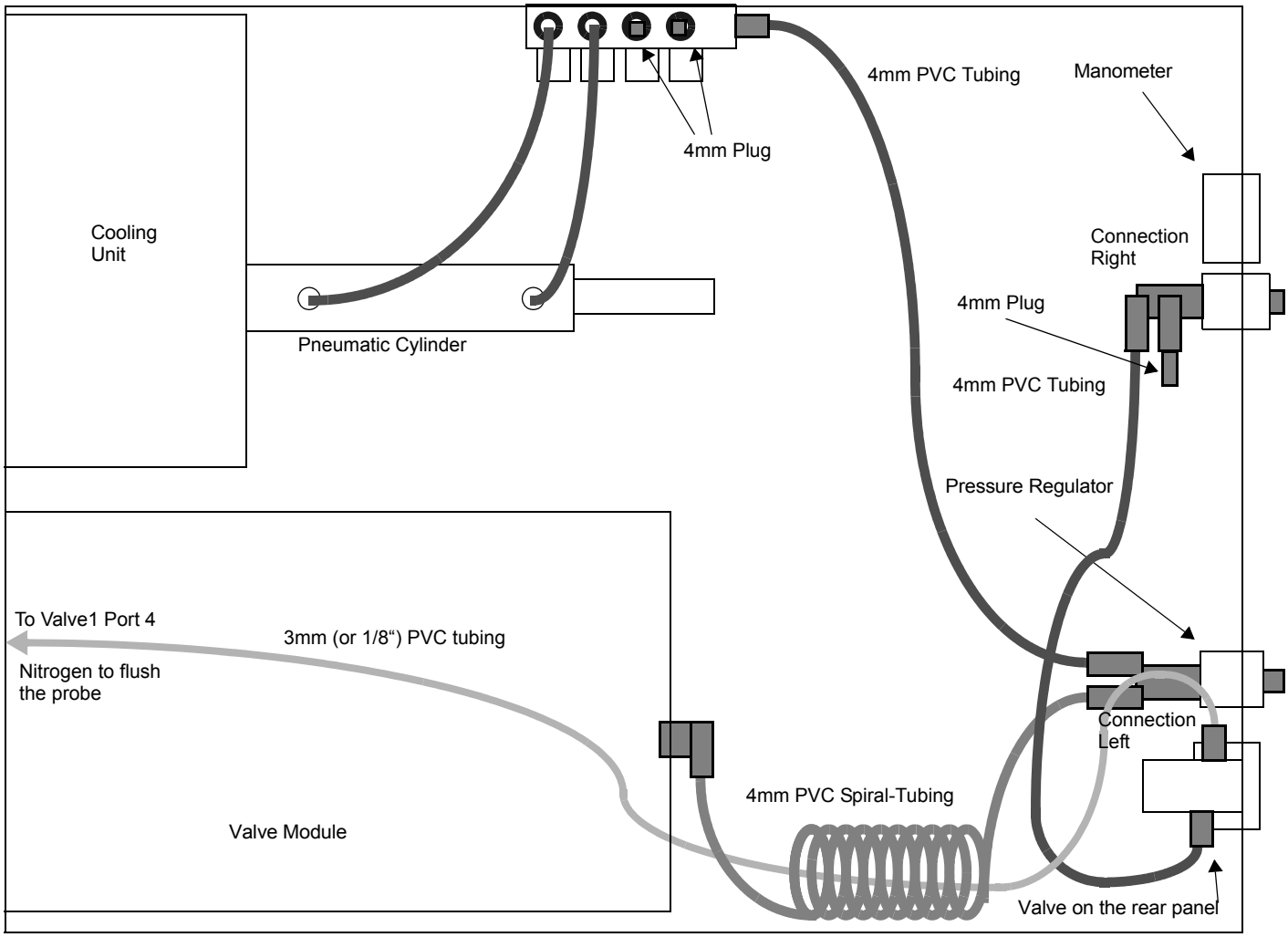


Figure 3.3. Connection Plan:Nitrogen and Compressed Air

The Valve Module *3.5*

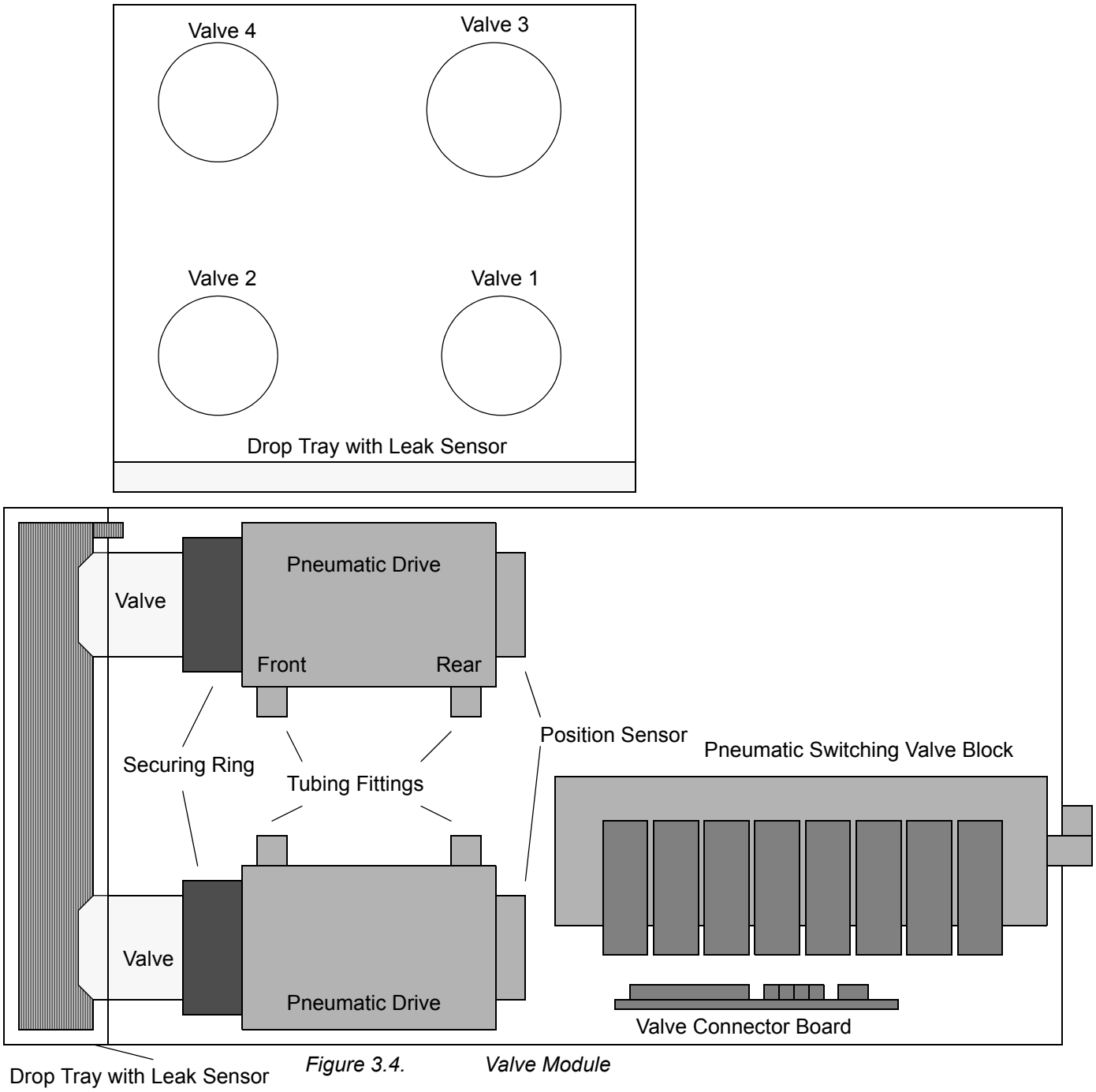


Figure 3.4. Valve Module

The Valve Module consists of:

-4 Pneumatically driven rotary valves with position sensors.

-an 8 way valve block to switch the air to the valve drives. (See ***"8 Way Valve Block" on page 36***)

-A Connector Board to interface between the Controller Board and the Valve Module.

-A Leak Sensor to detect if any of the rotary valve connections are leaking

Rotary Valve Positions 3.6

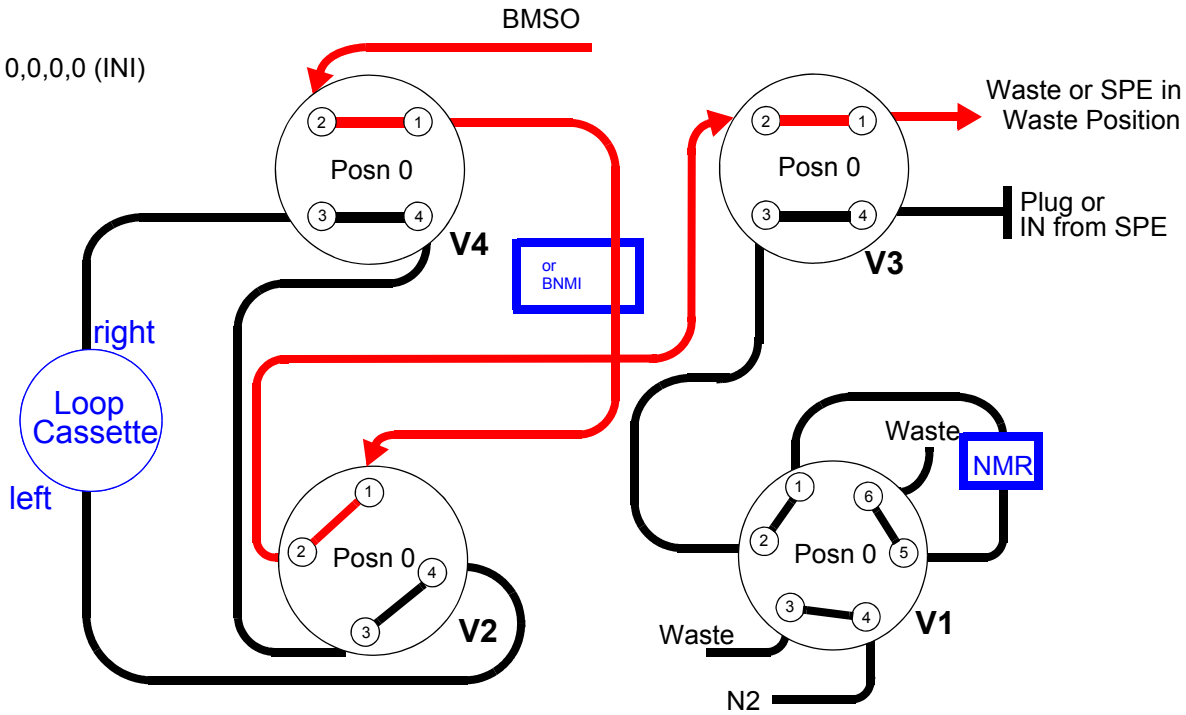
The four rotary valves, labelled Valve 1 to Valve 4, are 2 position valves which can either be moved to Posn 0 or Posn 1. Posn 0 is where the valves are rotated counterclockwise (when viewed from in front of the valve module) against the valve internal endstop. Posn 1 is where the valves are rotated clockwise against the valve internal endstop. Valve 1 also has Posn 2 where the valve sits between the endstops such that all ports are blocked.

The fluid path through each valve for both Posn 0 and Posn 1 and the tube connections to the valves are shown in the following diagrams.

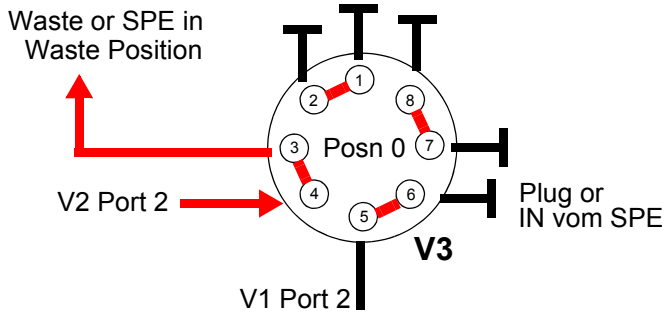
These valve positions have been pre-defined in the control firmware and can be accessed directly by sending the appropriate command. (See ***"The 'Valve Configuration' Page: valves.html" on page 48***). Further positions may be defined later if and as required

Initialise Position 3.6.1

(= direct to Waste) All Valves at Position 0.



NOTE: *In the first Units (to S/N 18) V3 is an 8-Port Valve. As only 4 of the 8 Ports are used, the valve functions as a 4-Port valve. The connections to the 8-Port Valve are shown to the right.*



Direct Flow On *3.6.2*

The Fluid Path leads directly to the NMR probe. This setting is used for 'Stopped Flow' experiments. In this setting the probe cell is filled directly.

Probe Wash. *3.6.3*

This setting is identical to 'Direct Flow On'. In this case, however, pure solvent is pumped through the probe in order to wash it

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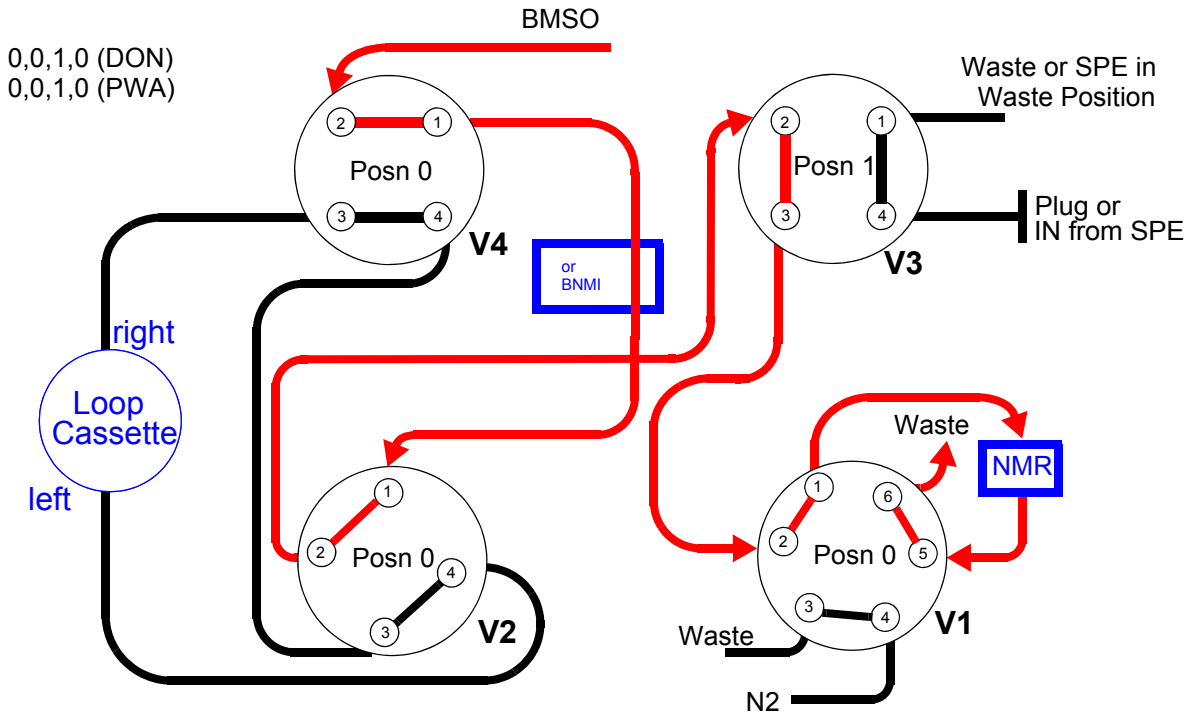
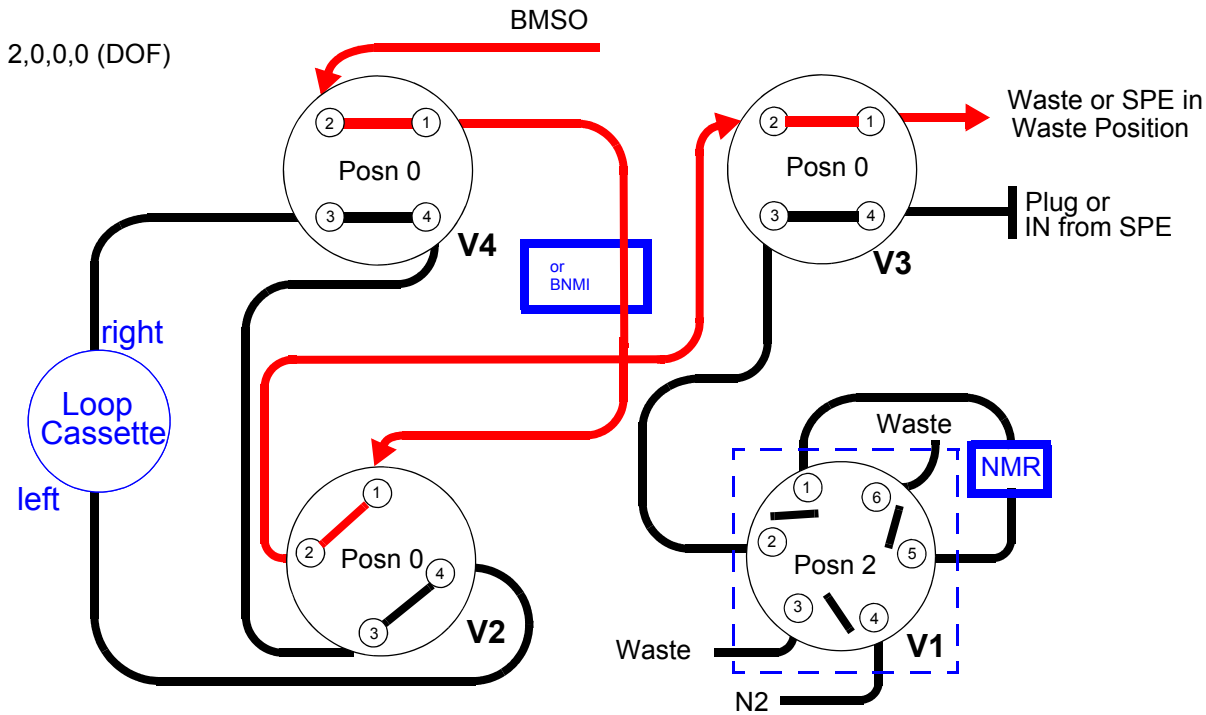


Direct Flow Off. ***3.6.4***

The fluid flows directly to Waste. The flow to/from the probe is blocked

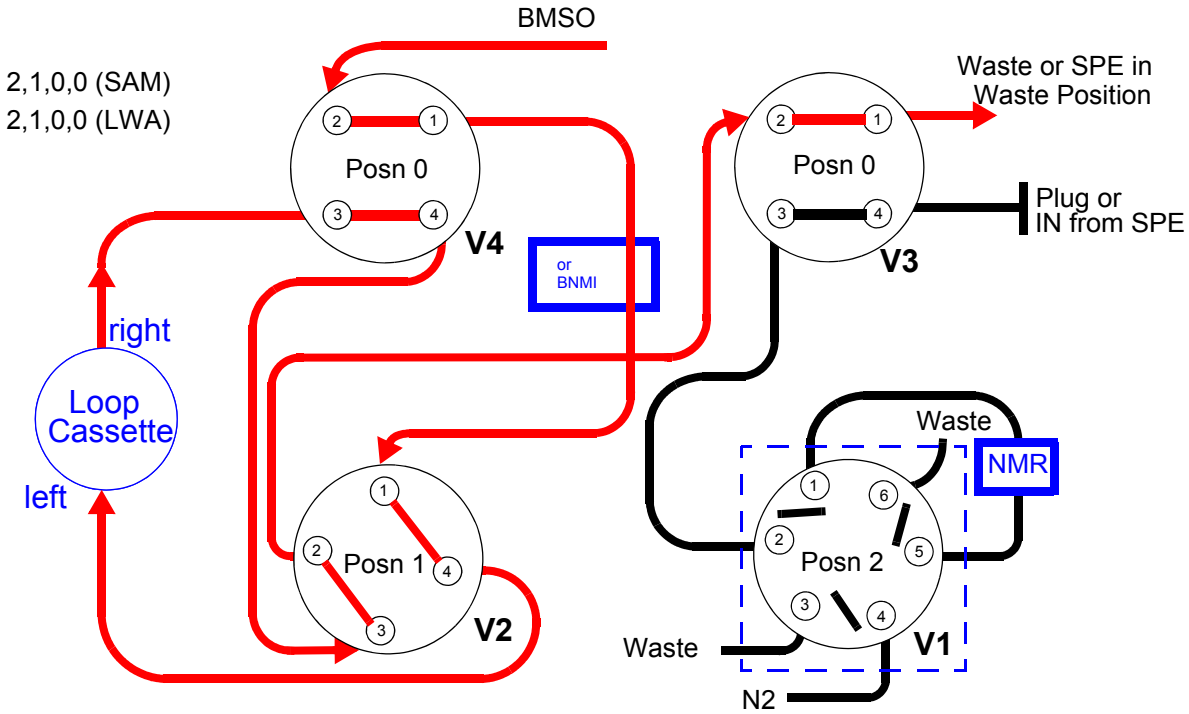


Sample Position. *3.6.5*

The fluid flows into the Loop Cassette. The flow to/from the probe is blocked.

Loop Wash Position *3.6.6*

This setting is identical to 'Sample Position'. Here, however, pure solvent is pumped through the cassette to wash it.



Transfer Preflow / Dry Probe. ***3.6.7***

This is the first part of the 'Transfer loop' Operation. The fluid path is filled with the same solvent as was used for the loop to be transferred. The fluid at present in the probe is flushed out with N_2 (backwards flush) and the cell dried. During this period the cassette can be moved to the next loop position.

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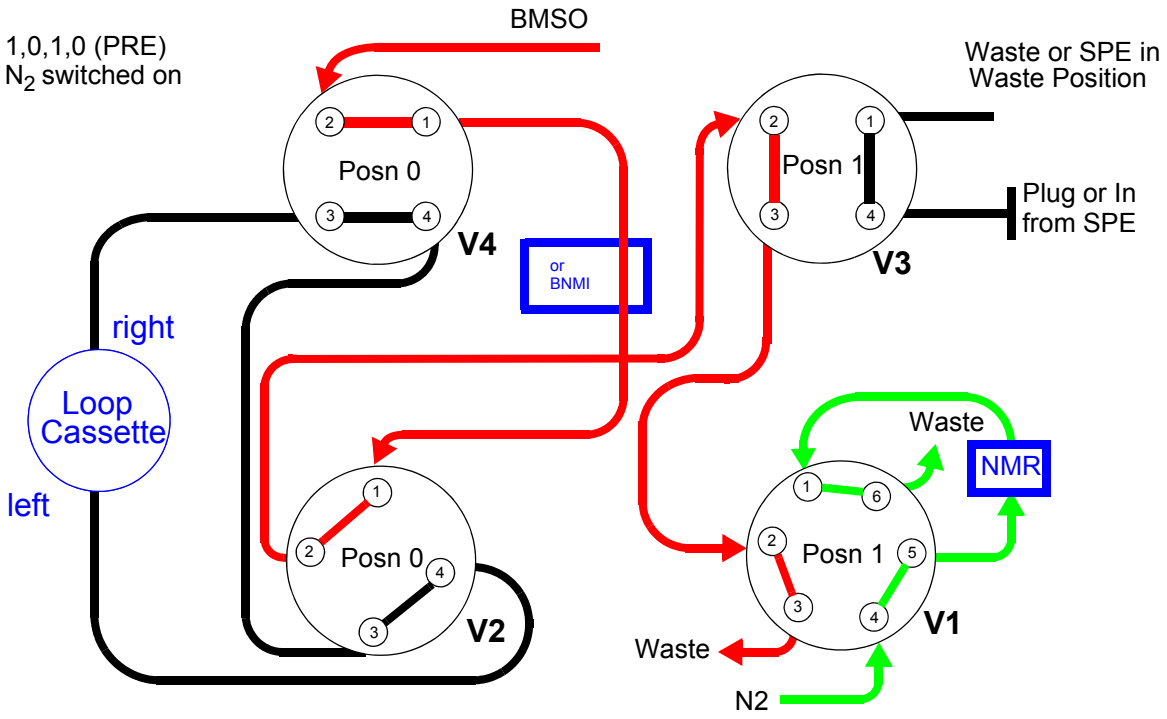

Transfer to Waste (reverse flow). *3.6.8*

This is the second part of the 'Transfer Loop' Operation. During 'Transfer Preflow' the path from Valve V1 through the cell in the probe was filled with N_2 and the Loop Cassette was been moved to the loop to be transferred.

Now the peak is pumped out of the loop. The fluid in the path in front of the loop is directed to waste until the front of the peak reaches position '**X'** just before V1. At this point V1 is switched to Posn 0 and the 'Transfer Loop' to probe phase is in operation. (see ***"Transfer to Waste (reverse flow)." on page 20***)

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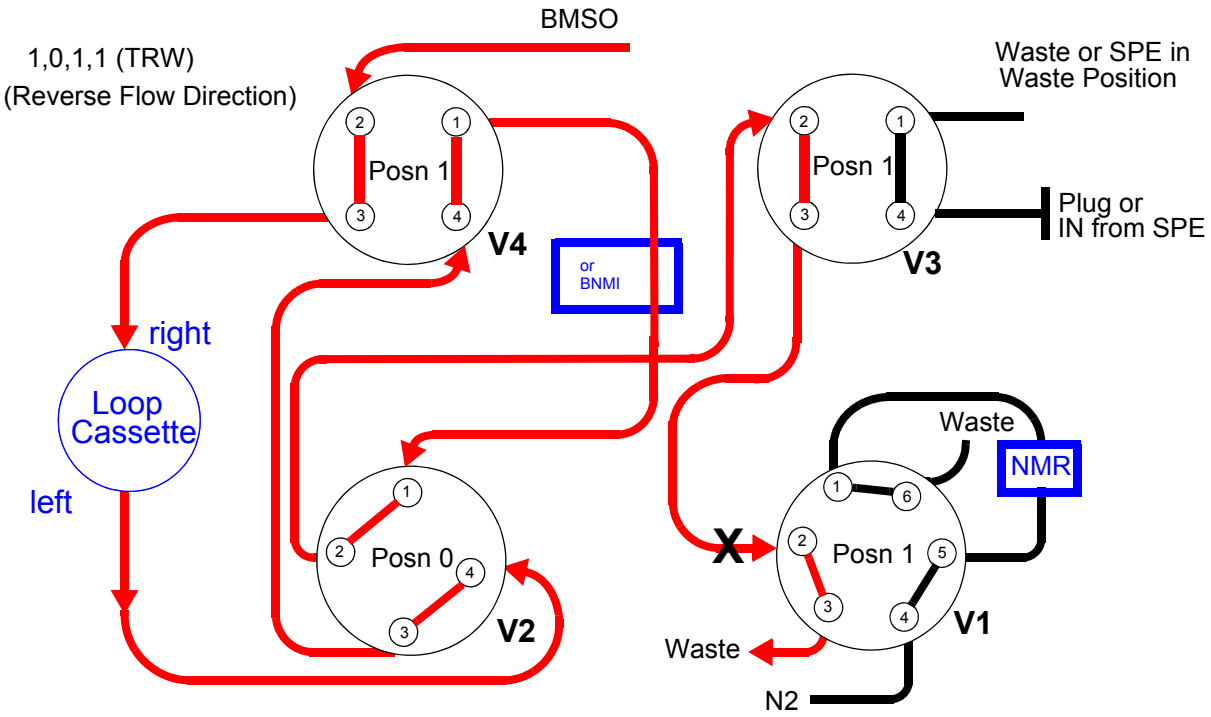

Transfer Loop (reverse flow) *3.6.9*

This is the third and final phase of the 'Transfer Loop' operation. Once the peak has reached Valve 1 the fluid path is then switched to the probe. This path had previously been flushed with N_2

This ensures that effectively an undiluted sample goes directly to the probe via a clean path.

The peak is pumped in the opposite direction from 'Sample Loop' from the loop with the fluid in the path ahead of the peak being directed to waste (see ***"Transfer to Waste (reverse flow)." on page 20***) until HyStar determines that the start of the peak has reached position '**X**' just before Valve 1.

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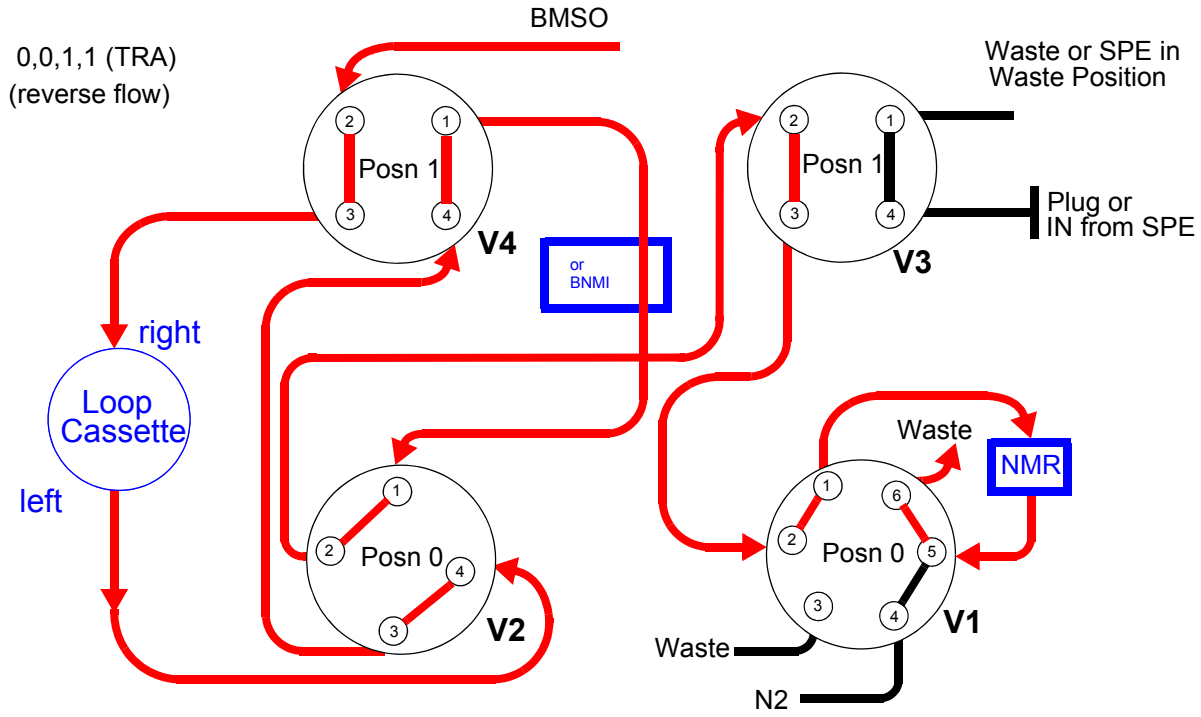


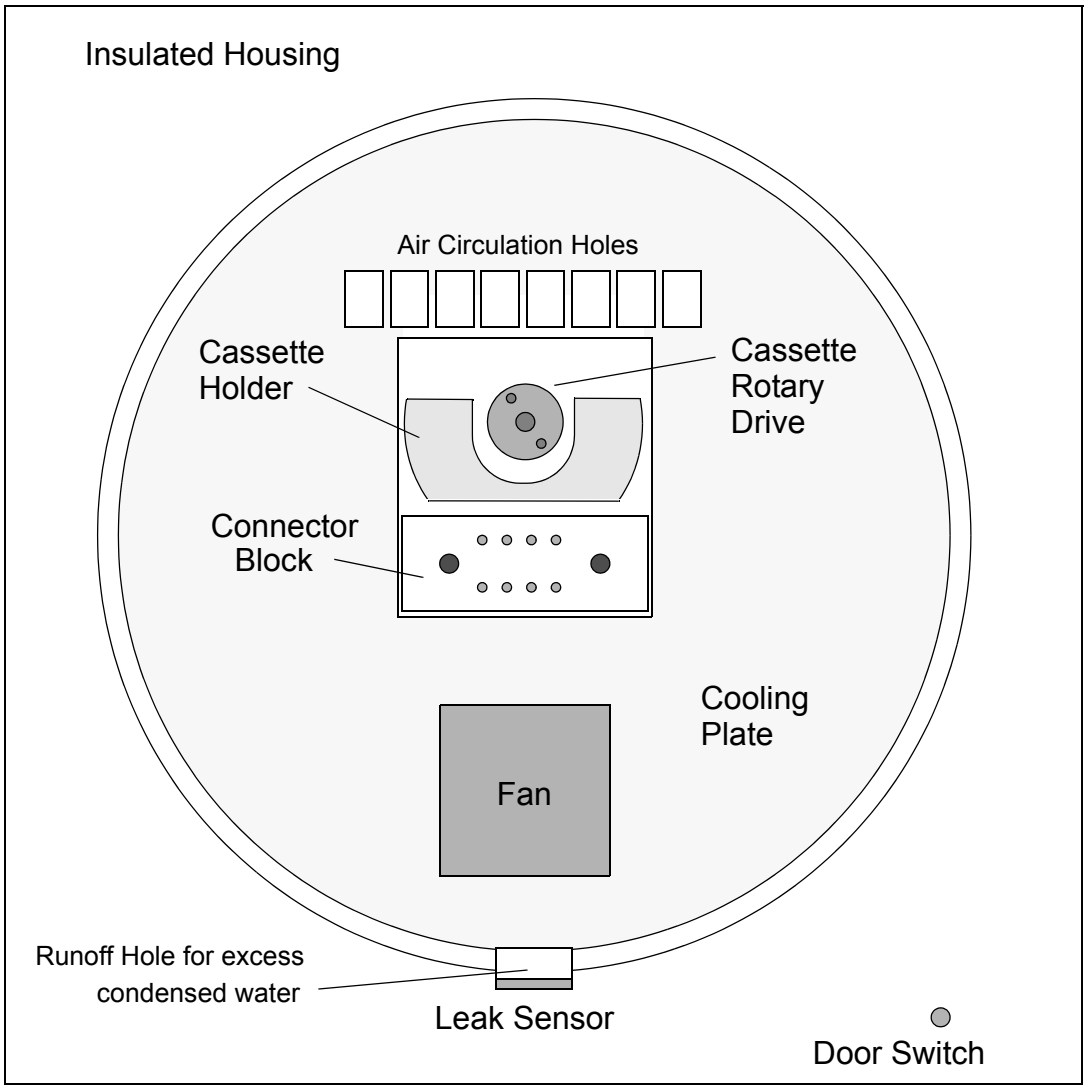


Figure 3.5. Cooling Unit Front View

The Cooling Unit consists of:

- an insulated housing.
- an insulated door
- a cooling (or heating) plate.
- a fan to circulate the air.
- a cassette connector block to connect both the electrical and fluid paths to the cassette.
- a leak sensor to detect fluid leaks from the cassette
- a cassette holder in which the cassette is loaded.

- a rotary drive to the cassette to allow the cassette to be moved to the various loop positions.

When the cassette holder is in the out (unloaded) position DO NOT put fingers or any other body part behind the cassette holder or behind the cassette should one be in place. The 'cassette load' operation is carried out by a pneumatic cylinder which pulls with a force of approx. 150Newton (= ca. 15kg) with the operating pressure set to 2.5Bar. This could cause severe injury to any body parts unintentionally placed behind the cassette holder when a 'load cassette' (with or without cassette) is initiated.

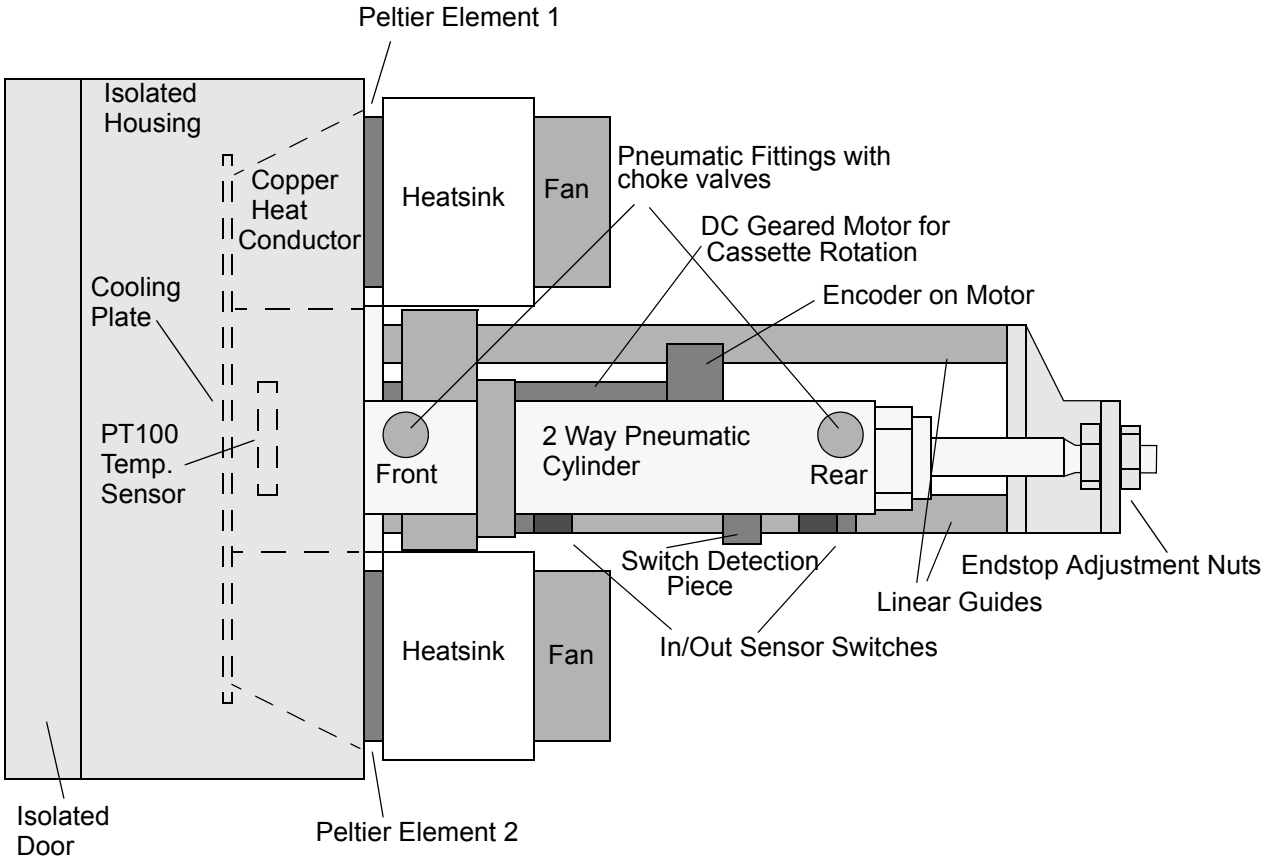


Figure 3.6. *Cooling Unit Viewed from Above*

- a door switch to detect if the door is closed or open
- 2 Peltier elements to cool or heat the cooling unit
- a copper heat conductor between the cooling plate and each of the Peltier elements (inside the insulated housing)
- aheatsink on the outside of each of the Peltier elements

- a fan mounted on each of the heatsinks
- a pneumatic cylinder to load and unload the cassette
- 2 x linear bearing guides connected at one end to the cassette holder and at the other end to the pneumatic cylinder.
- a PT100 temperature sensor mounted behind the circulation fan. The air is sucked in here, blown over the PT100 and through a channel in the housing to come out of the circulation holes at the top of the cooling plate.
- a condensed water runoff hole leading to a moisture collection tray at the rear of the cooling unit. Due to its proximity to the air flow at the heatsinks any moisture collected here readily evaporates.

Adjustment of the Endstop Adjustment Nuts *3.7.1*

The endstop adjustment nuts (***"Cooling Unit Viewed from Above" on page 23***) are set such that the storage cassette is pulled in to the correct depth when loaded. This adjustment is factory set and can only be done with the unit removed from the rack and with its top cover removed. This should only be performed by trained personell. (See ***"Disclaimer" on page 7*** and the warning on the previous page)

Initiate a 'Load In' command with the cassette removed.

The cassette holder moves in until the pneumatic cylinder reaches its internal endstop. As no cassette is detected the system turns off the air to the cylinder. Adjust the nuts until the front face of the cassette holder is 1mm-1.5mm deeper into the cooling unit than the front face of the white plastic connector block. (see ***Figure 3.7.*** left). As the cylinder is not held in position by air pressure you have to ensure that it is against its endstop by pushing the cassette holder fully in to the cooling unit.

Tighten both nuts and check this spacing again.

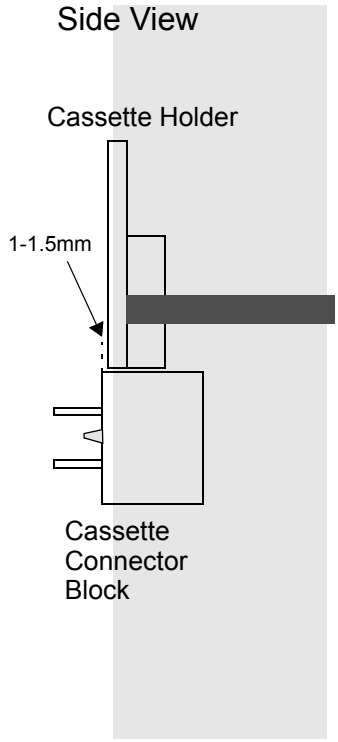


Figure 3.7. Cassette load depth adjustment

Cooling Unit Wire Harnesses *3.7.2*

The 3 Fans, the door switch, the PT100 and the leak sensor are all connected to the sensor connector block mounted at the bottom rear of the cooling unit. A wire harness then connects this connector block to the control board.

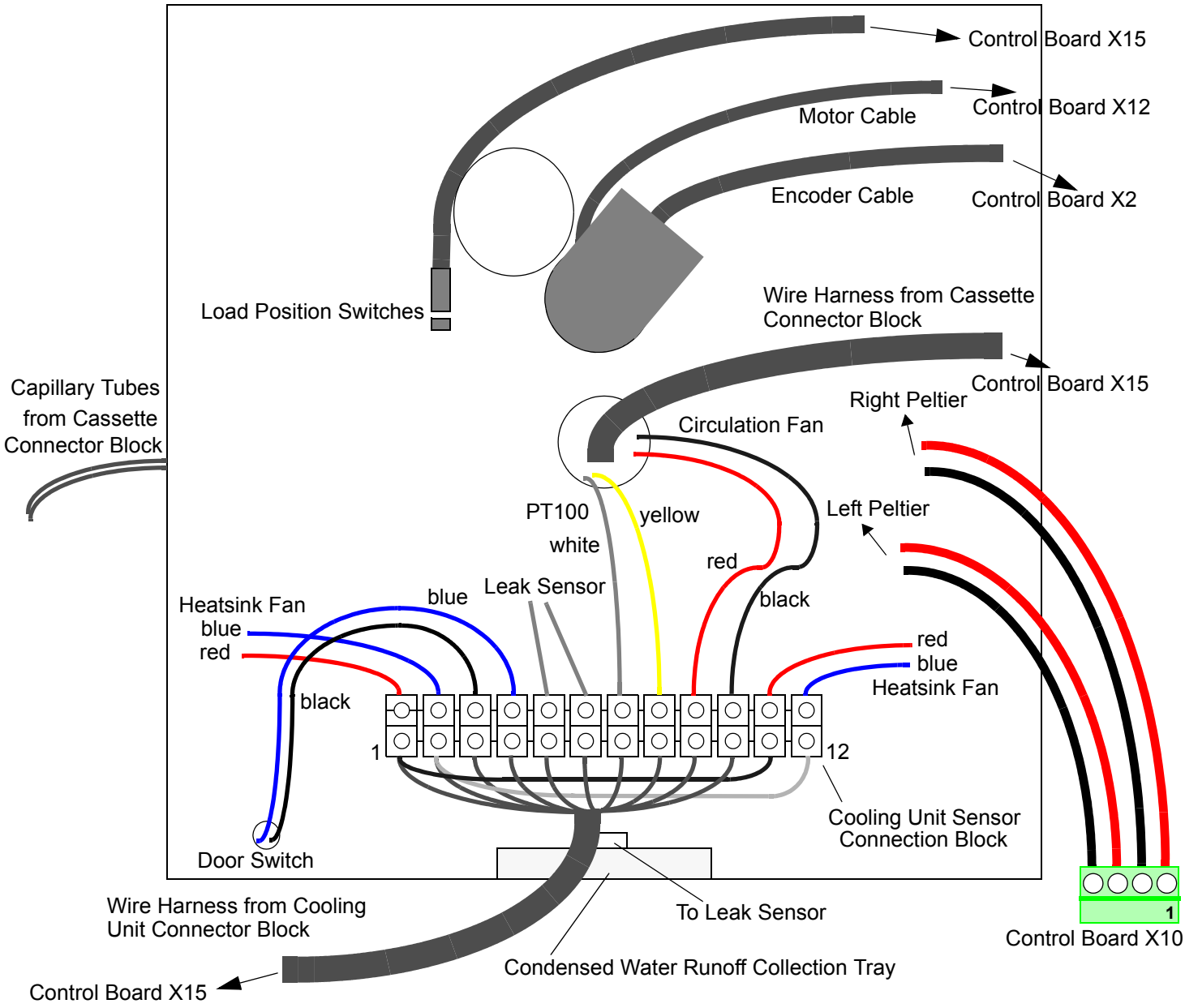


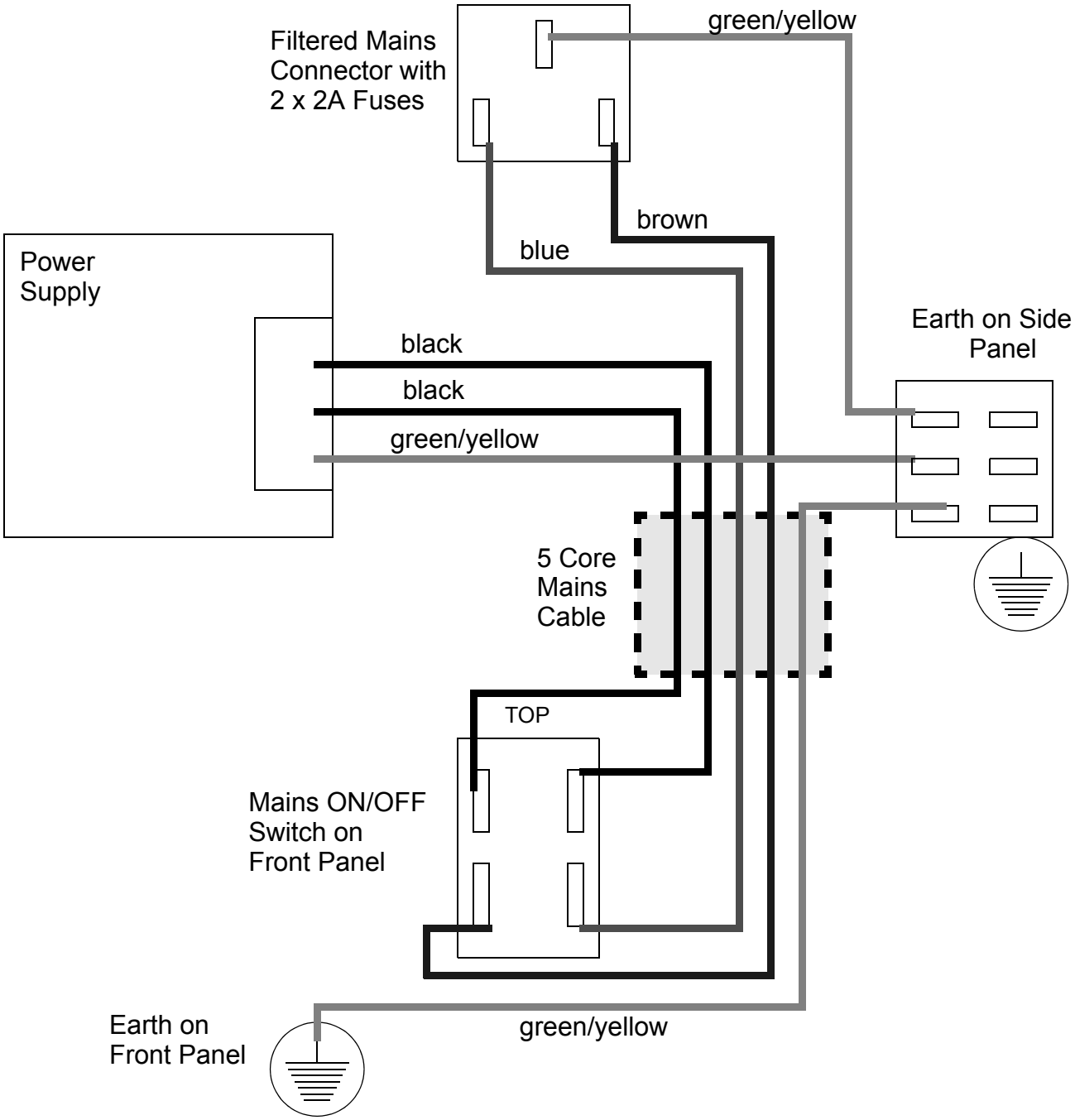
Figure 3.8. Cooling Unit Rear View

The cooling plate is connected to ground to give added E.S.D protection.

Wiring

4

Mains AC Wiring 4.1



Wire Harnesses and Board Layouts *4.2*

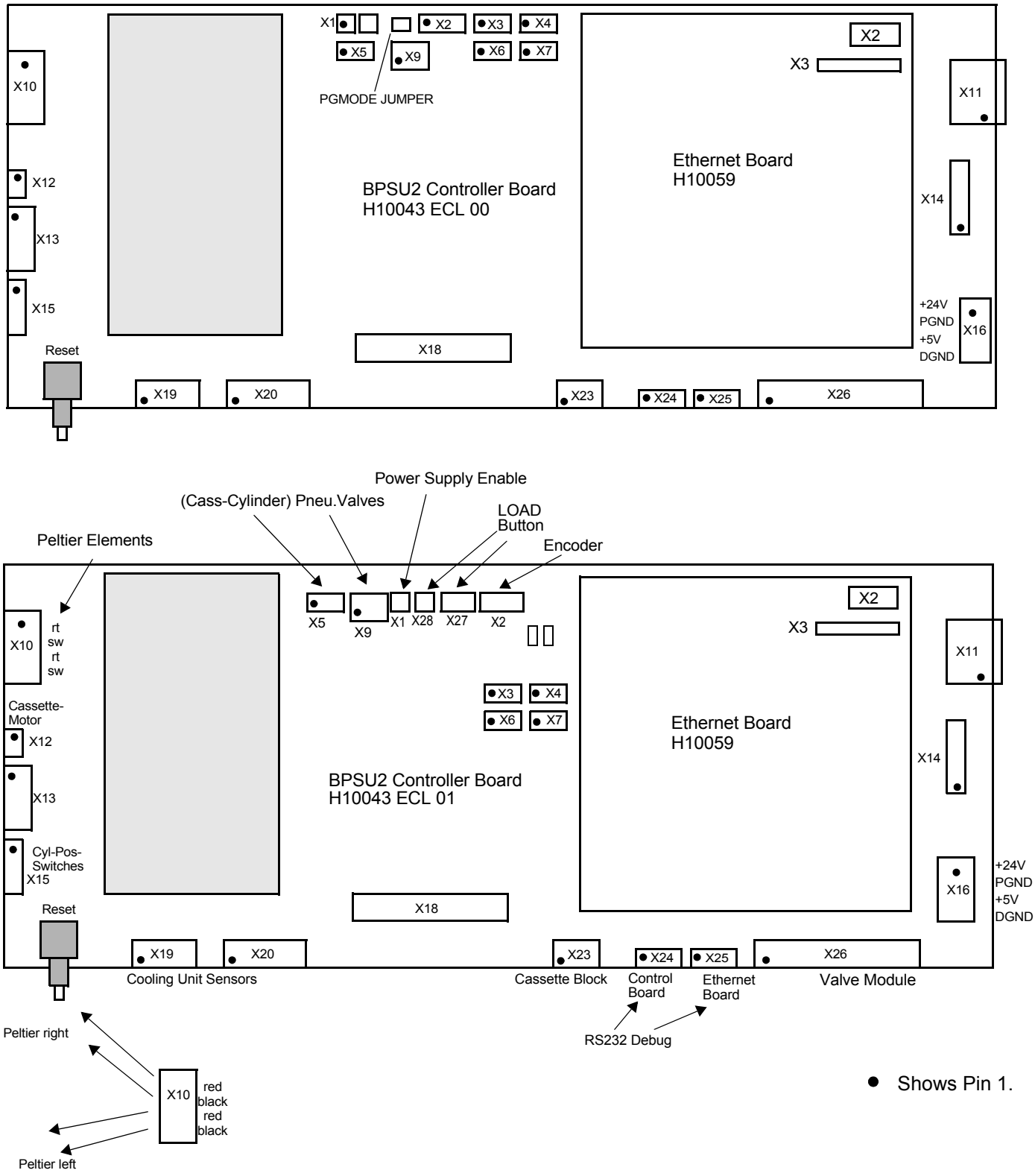


Figure 4.1. Control Board Layout

Wire Harnesses to Control and Ethernet Boards: *4.2.1*

X1 (P1,P2)	+24V Enable Signal to PSU
X1 (P3,P4: ECL00 X28 (ECL01)	Load Signal, Load LED on Front Panel Load Button Is only needed when using old Load Button Harness.
X4 (ECL00) X27 (ECL01)	+5V and GND to Front Panel Load Button Also has Signal to X28 for new Load Button Harness.
X2	Motor Encoder in Cooling Unit
X5	4 Valve Block, Load Cylinder In/Out
X9	4 Valve Block, Rear Panel Valve
X10	Peltier Elements in Cooling Unit
X11	Rear Panel Ethernet Connection
X12	Motor Drive in Cooling Unit
X15	Load/Unload Sensors in Cooling Unit
X16	DC Power
X19	Cooling Unit Sensor Connector Block
X23	Cassette Connector Block in Cooling Unit
X24	RS232 (Debug Only)
X25	RS232 (Ethernet Board Debug Only)
X26	Valve Module
X2 (Ethernet Board)	Front Panel Ethernet Status Leds
X3 (Ethernet Board)	Front Panel Ethernet RJ45 Connector

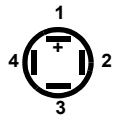
Harness Pin Connections 4.3

Table 4.1. +24V Enable (HZ10272)

From	To	Colour	Function
X1 P1	PSU Enable	Blue	None
X1 P2	PSU Enable	Orange	Enable +24V, Active Low

Table 4.2. Load/Unload Button on Front Panel (HZ10334)

From	To	Colour	Function
X1 P3	Button P 4	white	Load Signal, Active Low
X1 P4	Button P3	green	LED, Active Low
X4 P1	Button P1	brown	+5V thru' 220R to LED
X4 P4	Button P2	yellow	DGND



Load Button Pins viewed from rear.

Figure 4.2. Load Button Pinout

Table 4.3. Motor Encoder in Cooling Unit (HZ10325)

From	To	Colour	Function
X2 P1	Encoder P1	black	DGND
X2 P2	Encoder P2	white	Not Connected
X2 P3	Encoder P3	grey	Encoder Phase A
X2 P4	Encoder P4	violet	+5V
X2 P5	Encoder P5	blue	Encoder Phase B

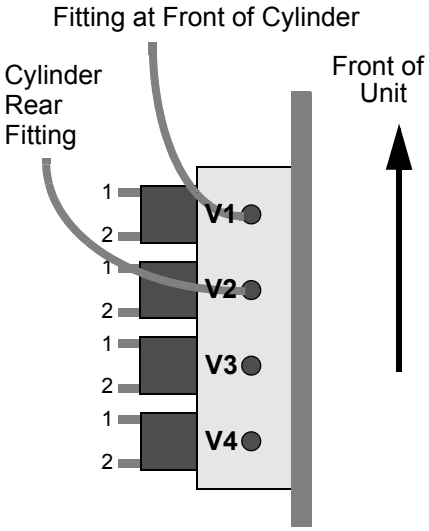


Figure 4.3. 4 Way Valve Block

Table 4.4. Pneumatic Valves for Cassette Load/Unload (HZ10279)

From	To	Colour	Function
X5 P1	V1 P1	Brown/Red	+24V
X5 P2	V1 P2	white	Air On: Move Cass. In
X5 P3	V2 P1	Brown/Red	+24V
X5 P4	V2 P2	black	Air On: Move Cass. Out

Figure 4.4. Valves for N2 Switching (HZ10305)

From	To	Colour	Function
X9 P1	Valve 4 P2	red	N_2 to Rear Panel Valve
X9 P2	Valve 4 P1	Brown/Red	+24V
X9 P3	Valve 3 P2	blue	Spare
X9 P4	Valve 3 P1	Brown/Red	+24V
X9 P5	Valve Rear Panel	brown	N_2 to Rotational Valves
X9 P6	Valve Rear Panel	white	+24V

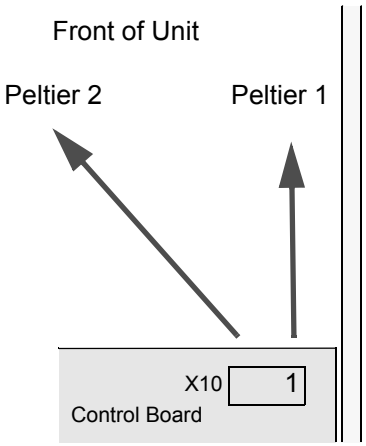


Figure 4.5. Connections to Peltier Elements

Table 4.5. Peltier Elements in Cooling Unit

From	To	Colour	Function
X10 P1	Peltier 1	red	+24V or PWM (Active Low)
X10 P2	Peltier 1	black	Is linked to X10 P3
X10 P3	Peltier 2	red	In Series with Peltier 1
X10 P4	Peltier 2	black	+24V or PWM (Active Low)

Table 4.6. Cassette Motor Drive in Cooling Unit (HZ10270)

From	To	Colour	Function
X1 P1	Motor	orange	+24V or PWM (Active Low)
X1 P2	Motor	black	+24V or PWM (Active Low)

Table 4.7. Load/Unload Sensors in Cooling Unit (HZ10278)

From	To	Colour	Function
X15 P1	Rear µSwitch	black	DGND to Load Sensor
X15 P2	Front µSwitch	black	DGND to Unload Sensor
X15 P3	Front µSwitch	blue	Load Detect (Active Low)
X15 P4	Rear µSwitch	blue	Unload Detect (Active Low)

Table 4.8. DC Power to Control Board (HZ10307)

From	To	Colour	Function
X16 P1	Power Supply	brown/red	+24V
X16 P2	Power Supply	yellow	PGND
X16 P3	Power Supply	red/blue	+5V
X16 P4	Power Supply	yellow/blue	DGND

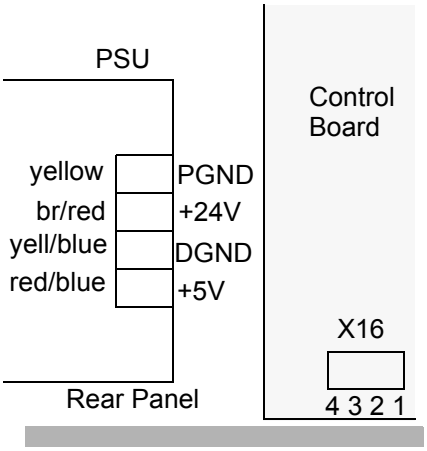


Figure 4.6. DC Connections

Table 4.9. Cooling Unit Sensor Connector Block (HZ10268)

From	To	Colour	Function
X19 P1	Conn.Block P3	yellow/black	Door Switch GND
X19 P2	Conn.Block P4	red/black	Door Switch (Low = Open)
X19 P3	Conn.Block P5	green	Leak Sensor
X19 P4	Conn.Block P6	brown	Leak Sensor
X19 P5	Conn.Block P7	pink	PT100
X19 P6	Conn.Block P7	pink	PT100
X19 P7	Conn.Block P8	yellow	PT100
X19 P8	Conn.Block P8	yellow	PT100
X19 P9	Conn.Block P11 &P1	brown/red	+24 to both Heatsink Fans
X19 P10	Conn.Block P10	violet	Circulation Fan (Active Low)
X19 P11	Conn.Block P9	pink/red	+24V thru' 220R to Fan
X19 P12	Conn.Block P12 & P2	black	Heatsink Fans (Active Low)

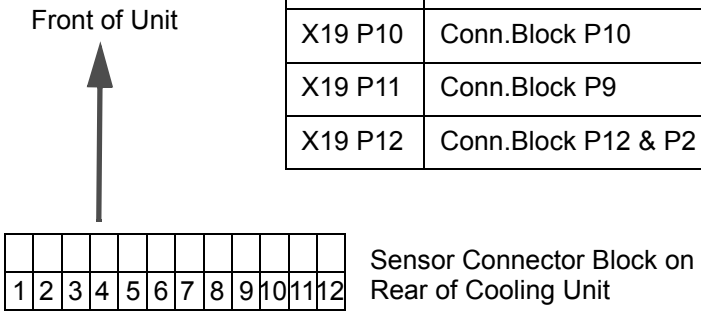


Figure 4.7. Sensor Connector Block

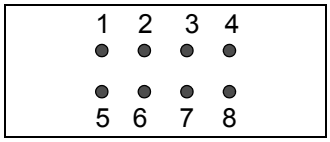
Table 4.10. RS232 Debug Connector (HZ10340)

From	To	Colour	Function
X24(X25) P1	Mini D P2	green	RxD
X24(X25) P2	Mini D P7	white	RTS
X24(X25) P4	Mini D P3	brown	TxD
X24(X25) P5	Mini D P5	yellow	PGND

Table 4.11. Cassette Connector Block in Cooling Unit (HZ10267)

From	To	Colour	Function (Memory Board)
X23 P1	Conn.Block P1	rot	SDOUT / I2C SDAT
X23 P2	Conn.Block P2	red/orange	DGND
X23 P3	Conn.Block P3	green	$\overline{\text{SPI\_CS}}$ / DGND
X23 P4	Conn.Block P4	red/orange	+5V
X23 P5	Conn.Block P5	yellow/blue	DGND
X23 P6	Conn.Block P6	grey	SCLK
X23 P7	Conn.Block P7	violet	HOME (Light Barrier)
X23 P8	Conn.Block P8	brown	SDIN / LED GND

Cassette Connector Block



Rear View
(Cable Connection Side)

Figure 4.8. Cassette Connector Block

Connections Within the Valve Module *4.3.1*

The valve position sensors are reed relay type switches. Sensor A is switched ’ON’ when the valve rotates clockwise (when viewed from valve head) and sensor B when the valve rotates counterclockwise. However the actual switchpoints for each relay are somewhere in the middle. The low/high status to the control board is achieved by having a pullup at each of the associated port inputs and by switching the relays to ground to give a low signal. In the software and also in the valve position definitions ’0’ and ’1’ are used instead of ’B’ and ’A’ respectively. This was how it was defined in the original BPSU36 and this convention has been continued here.

The ’A’ and ’B’ positions are, however, marked as such on the Valve position sensors. All signals to the air solenoids V1A... V4B are active Low.

Table 4.12. Connector to Valve Module (HZ10269)

From	To (Valve Board)	Colour	Function (Rotary Valves)
X23 P1	X6 P1	brown/red	+24V
X23 P2	X6 P2	brown/red	+24V
X23 P3	X6 P3	red/blue	Valve 1A (Low = Move ↷)
X23 P4	X6 P4	red	Valve 1A Posn Sensor (Low)
X23 P5	X6 P5	brown/black	Valve 1B (Low = Move ↶)
X23 P6	X6 P6	brown	Valve 1B Posn Sensor (Low)
X23 P7	X6 P7	green/black	Valve 2A (Low = Move ↷)
X23 P8	X6 P8	green	Valve 2A Posn Sensor (Low)
X23 P9	X6 P9	blue/black	Valve 2B (Low = Move ↶)
X23 P10	X6 P10	blue	Valve 2B Posn Sensor (Low)
X23 P11	X6 P11	red/blue	Valve 3A (Low = Move ↷)
X23 P12	X6 P12	red	Valve 3A Posn Sensor (Low)
X23 P13	X6 P13	brown/black	Valve 3B (Low = Move ↶)
X23 P14	X6 P14	brown	Valve 3B Posn Sensor (Low)
X23 P15	X6 P15	green/black	Valve 4A (Low = Move ↷)
X23 P16	X6 P16	green	Valve 4A Posn Sensor (Low)
X23 P17	X6 P17	blue/black	Valve 4B (Low = Move ↶)
X23 P18	X6 P18	blue	Valve 4B Posn Sensor (Low)
X23 P20	X6 P20	yellow	DGND
X23 P22	X6 P22	violet	Leak Sensor
X23 P24	X6 P24	violet	Leak Sensor
X23 P25	X6 P25	red/blue	+5V
X23 P28	X6 P28	white	TxD
X23 P30	X6 P30	black	RxD
X23 P31	X6 P31	yellow	PGND
X23 P32	X6 P32	yellow	PGND

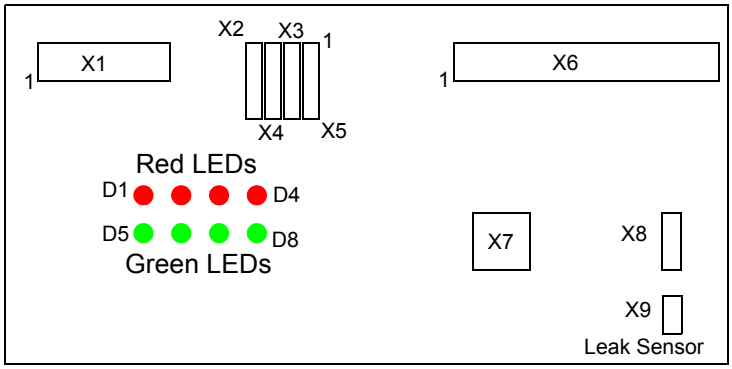
Table 4.13. Valve Connector Board to 8 Way Valve Block (HZ10280)

From	To	Colour	Function (Rotary Valves)
X1 P1	V1 P2, V2 P2, V3 P2, V4 P2 V1 P5, V6 P2, V7 P2, V8 P2	white	+24V to each of the 8 solenoid air valves
X1 P3	V8 P1	black	Move Valve 4 to Posn 0
X1 P4	V7 P1	brown	Move Valve 4 to Posn 1
X1 P5	V6 P1	red	Move Valve 3 to Posn 0
X1 P6	V5 P1	orange	Move Valve 3 to Posn 1
X1 P7	V4 P1	yellow	Move Valve 2 to Posn 0
X1 P8	V3 P1	green	Move Valve 2 to Posn 1
X1 P9	V2 P1	blue	Move Valve 1 to Posn 0
X1 P10	V1 P1	violet	Move Valve 1 to Posn 1

Table 4.14. Rotary Valve Position Sensors (HZ10281)

From	To	Colour	Function
X2 P1	Sensor at Valve 4	yellow	Position 0 when Low
X2 P2	Sensor at Valve 4	orange	Gnd
X2 P3	Sensor at Valve 4	red	Position 1 when Low
X2 P4	Sensor at Valve 4	brown	Gnd
X3 P1	Sensor at Valve 3	yellow	Position 0 when Low
X3 P2	Sensor at Valve 3	orange	Gnd
X3 P3	Sensor at Valve 3	red	Position 1 when Low
X3 P4	Sensor at Valve 3	brown	Gnd
X4 P1	Sensor at Valve 2	yellow	Position 0 when Low
X4 P2	Sensor at Valve 2	orange	Gnd
X4 P3	Sensor at Valve 2	red	Position 1 when Low
X4 P4	Sensor at Valve 2	brown	Gnd
X5 P1	Sensor at Valve 1	yellow	Position 0 when Low
X5 P2	Sensor at Valve 1	orange	Gnd
X5 P3	Sensor at Valve 1	red	Position 1 when Low
X5 P4	Sensor at Valve 1	brown	Gnd

Figure 4.9. Valve Connector Board



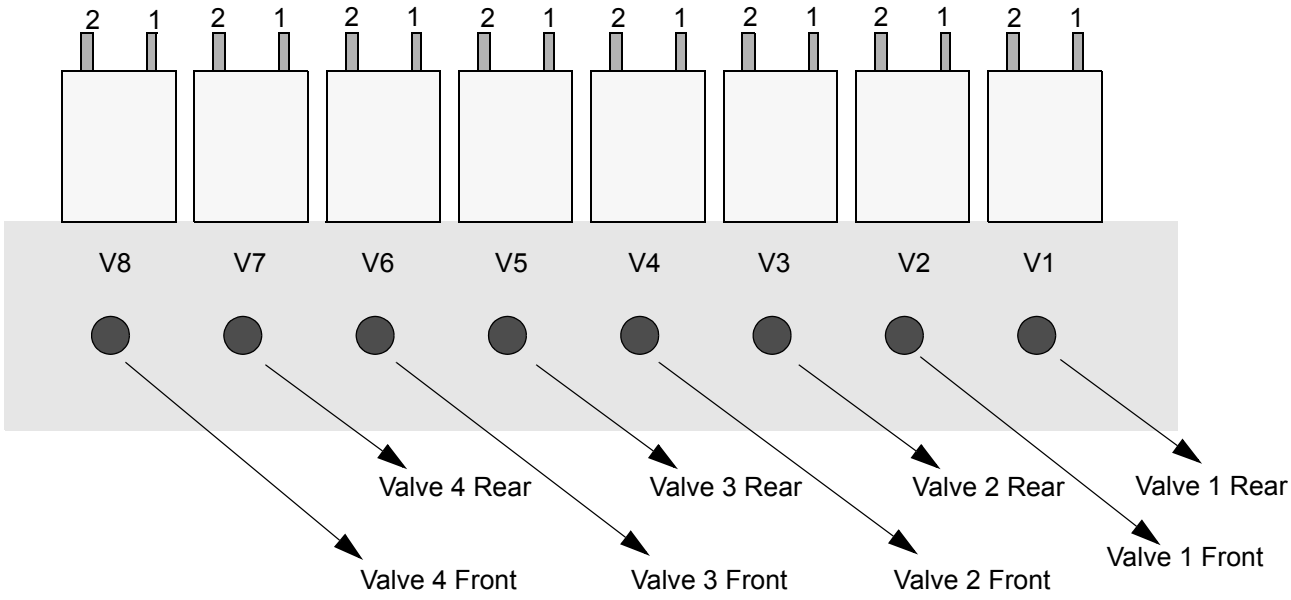


Figure 4.9. 8 Way Valve Block

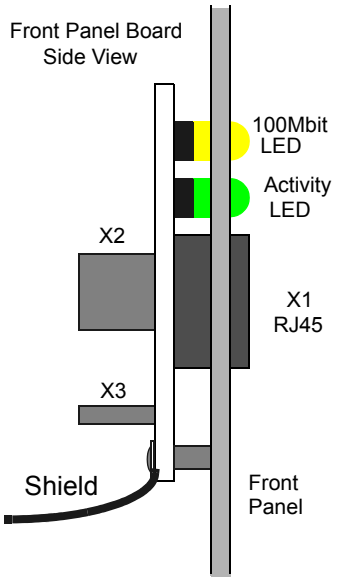
A red LED from D1...D4 lights when the corresponding rotary valve 4 to valve 1 respectively is at position 1. A green LED from D5...D8 lights when the corresponding rotary valve 4 to valve 1 respectively is at position 0. The leak sensor at the front of the valve module is connected to X9.

See ***"Valve Module" on page 14***

NOTE: The valve sensors at the rear of the valves are marked ’A’ and ’B’. These correspond to ’1’ and ’0’. ie Position ’0’ is when the valve has rotated counterclockwise (viewed from the front of the unit) until reaching the endstop

Table 4.15. Front Panel Ethernet Status Leds (HZ10306)

From	To (Front Panel Board)	Colour	Function
X2 P1	X2 P1	white	LED 100 (Anode)
X2 P4	X2 P4	brown	Activity LED (Anode)
X2 P6	X2 P6	green	+3.3V
X2 P7	X2 P7	yellow	DGND



The BPSU36-2 also has an ethernet connector on the Control Board which is accessable from the rear of the unit.

NOTE: Only one of these 2 Ethernet connections can be used at any time. If the rear connection is used (default) then the connector on cable HZ10308 (below) **MUST** be removed from the Ethernet Board. If the Front Panel Connection is to be used then this connector **MUST** be reconnected to the the Ethernet Board.

In both cases the LEDs show the Ethernet connection status.

Figure 4.10. Front Panel Board

Table 4.16. Front Panel Ethernet Connector(HZ10308)

From	To (Front Panel Board)	Colour	Function
X3 P1	X3 P1	white/orange	TX+
X3 P2	X3 P2	orange	TX-
X3 P3	X3 P3	white/green	RX+
X3 P4	X3 P4	blue	TX-CT
X3 P5	X3 P5	white/blue	TX-CT
X3 P6	X3 P6	green	RX-
X3 P7	X3 P7	white/brown	RX-CT
X3 P8	X3 P8	brown	RX-CT
	Front Panel Ground	black	Shield

Embedded Web Server

5

The Home Page 5.1

The BPSU36-2 is controlled via its ethernet interface. The unit responds either to commands from HyStar, in which case it responds with the Home Page (page whereby only the IP address is required to define the page) or to form selections in the service pages. The Home Page is an XML page containing status information. This page can also be accessed at *ip-address/status.xml*

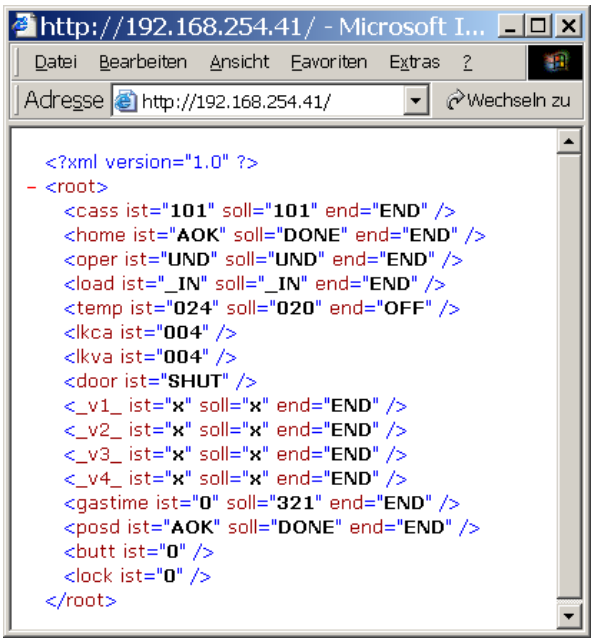


Figure 5.1. Home (Status) Page

The factory set IP address used in an LC-NMR system is:
192.168.254.41

Meaning of the Status Page Data *5.1.1*

The 'ist' value is the present status of the associated component.

The 'soll' value is the demand or target value of that component

The 'end' value indicates if the last function for this component is completed:

'**END**' means the operation has been completed (successfully).
'**ERR**' means an error has occurred and the operation has aborted.
'**RUN**' means that the operation is still in progress

Status for the following components is displayed:

cass	shows the position of the storage cassette
home	indicates if the home position was found
oper	shows the rotary valve status
INI	Initialised
DON	Direct On-Flow
DOF	Direct Off-Flow
SAM	Sample Position
PRE	Transfer Preflow
TRW	Transfer to Waste
TRA	Transfer Loop
LWA	Wash Loops
PWA	Wash Probe
UND	Undefined (or unknown)
load	shows if the storage cassette is loaded
_IN	the cassette is loaded
OUT	the cassette is not loaded
xxx	the status of the cassette is unknown
temp	shows the temperature in Celsius in the cooling unit
lkva	shows the status of the leak sensor under the rotary valves
lkca	shows the status of the leak sensor under the cassette
door	shows if the door to the cooling unit is OPEN or SHUT
_v1_	shows the position of Valve 1 (6 way valve) 0 = 
_v2_	shows the position of Valve 2 (4 way valve) 0 = 
_v3_	shows the position of Valve 3 (4 way valve) 1 = 
_v4_	shows the position of Valve 4 (4 way valve) x= unknown.
gastime	**ist** shows the number of seconds till the N_2 turns off. **soll** shows the preset N_2 'on' time.
posd	shows if the cassette position calibration data is loaded.
butt ist	'1'' means the front panel 'Load' button is being pressed. '0' means it is not being pressed
lock ist	'1' means the 'Unload Block' is active. '0' means the 'Unload Block' is inactive.

HyStar would normally poll this page about twice per second. The unit responds to any commands sent by HyStar by sending this Home Page. In this case the 'end' status for any command operation sent contains 'AOK' simply to indicate that a command has been received.

Cassette Serial Number (S/N) Page 5.2

This page can be accessed at *ip-address/sernr.xml.* It shows the S/N and memory type for the cassette which has been loaded. It also displays the various firmware and Engineering Change (eclev) versions in use in the unit. All Cassette types at present in use in the older version of the BPSU36 can be used in the BPSU36-2. The cassettes with an 8MB Memory Board can only be used in the BPSU36-2 and not in the older BPSU36 system.

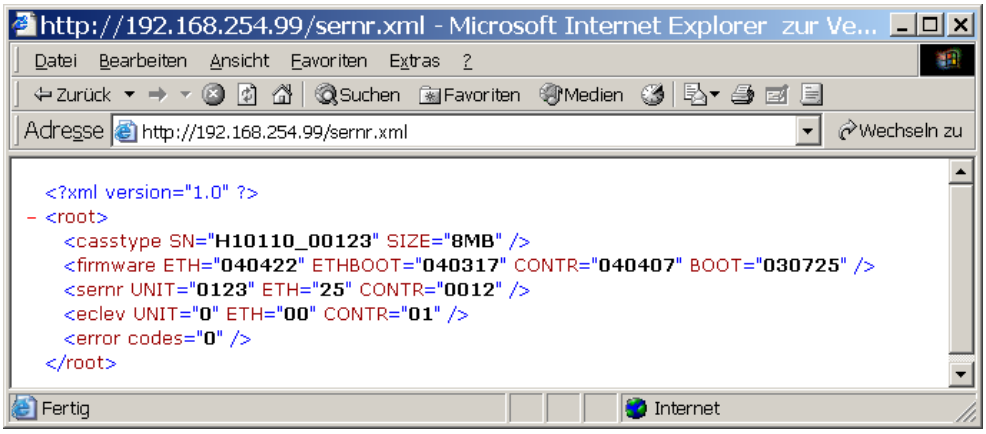


Figure 5.2. Cassette S/N Page

Cassette File List Page 5.3

This page can be accessed at *ip-address/files.xml.* It shows a list of the files (normally loop data but here simply test files) on the cassette. These files can be written to or read from the unit using an FTP transfer. (user: sys, password: sys)

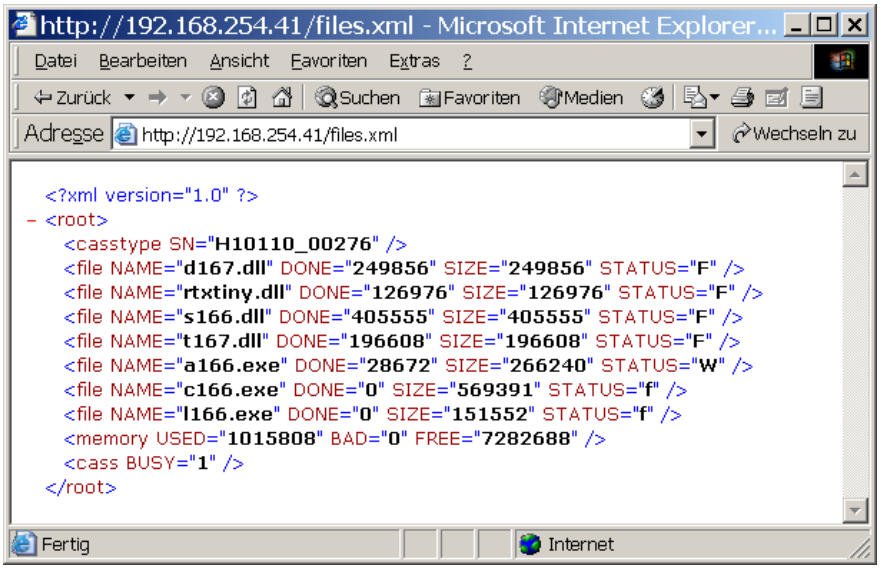


Figure 5.3. Cassette Files List

SN	cassette S/N (here for an 8MB cassette)
NAME	shows the file name
DONE	shows the number of bytes of this file already written to or read from the cassette.
SIZE	shows the size of the file in Bytes
STATUS	'w' : the PC is still writing the file to the unit 'f' : the PC has written the entire file to the unit 'W' : the unit is writing the file to the cassette. (ca. 40kB/s to the 8MB Cassette, 2kB/s to the old 64KB/128K cassette) 'F' : the file on the (8MB) cassette = file on unit's ftp server. 'r' : the unit is reading the file from the cassette. (ca. 120kB/s from the 8MB Cassette, 4kB/s from the 64KB/128K cassette. 'I' : the file on the old cassette = file on the unit's ftp server.
MEMORY	USED: total cassette memory used by all files. BAD: cassette memory lost to faulty sectors. FREE: unused cassette memory
BUSY	'1' write/read accesses to the cassette are in progress '0' write/read accesses to the cassette are not in progress

On an old style cassette only 1 file can be read from or written to the cassette. This file is always called *cass_sn*.dat, where *cass_sn* is the serial number read from the cassette (eg. H9599__00077.dat). This file is always 63KB in size and is written to / read from the first 63KB of the cassette's memory. HyStar ensures that the format of the file is identical to the original BPSU36 cassette data format to maintain the backwards compatability.

The above XML pages are really intended for use by HyStar to monitor the status of the BPSU36-2. They can, however, be monitored in a suitable browser.

Similarily, files are normally only transferred by HyStar but for test purposes can be written to or read from the unit (and cassette) using a suitable FTP client program. The user and password required are **sys** and **sys**.

The Service Pages 5.4

For test, monitor or service a number of service pages are available. The start page for these service pages is *ip-address/ews.html*

These pages can be viewed on a PC, Laptop, Mac etc. using a standard browser (Internet Explorer, Netscape, Mozilla etc.)

The 'Main' page: ews.html 5.4.1

Figure 5.4. Embedded Web Server (EWS) Start Page

Links from this page take you to the other service pages. From any of the following service pages you can return here by clicking on the link Main.

The 'Device Information' page: info.html *5.4.2*

From the 'Main' page click on the link Device Information to reach this page:

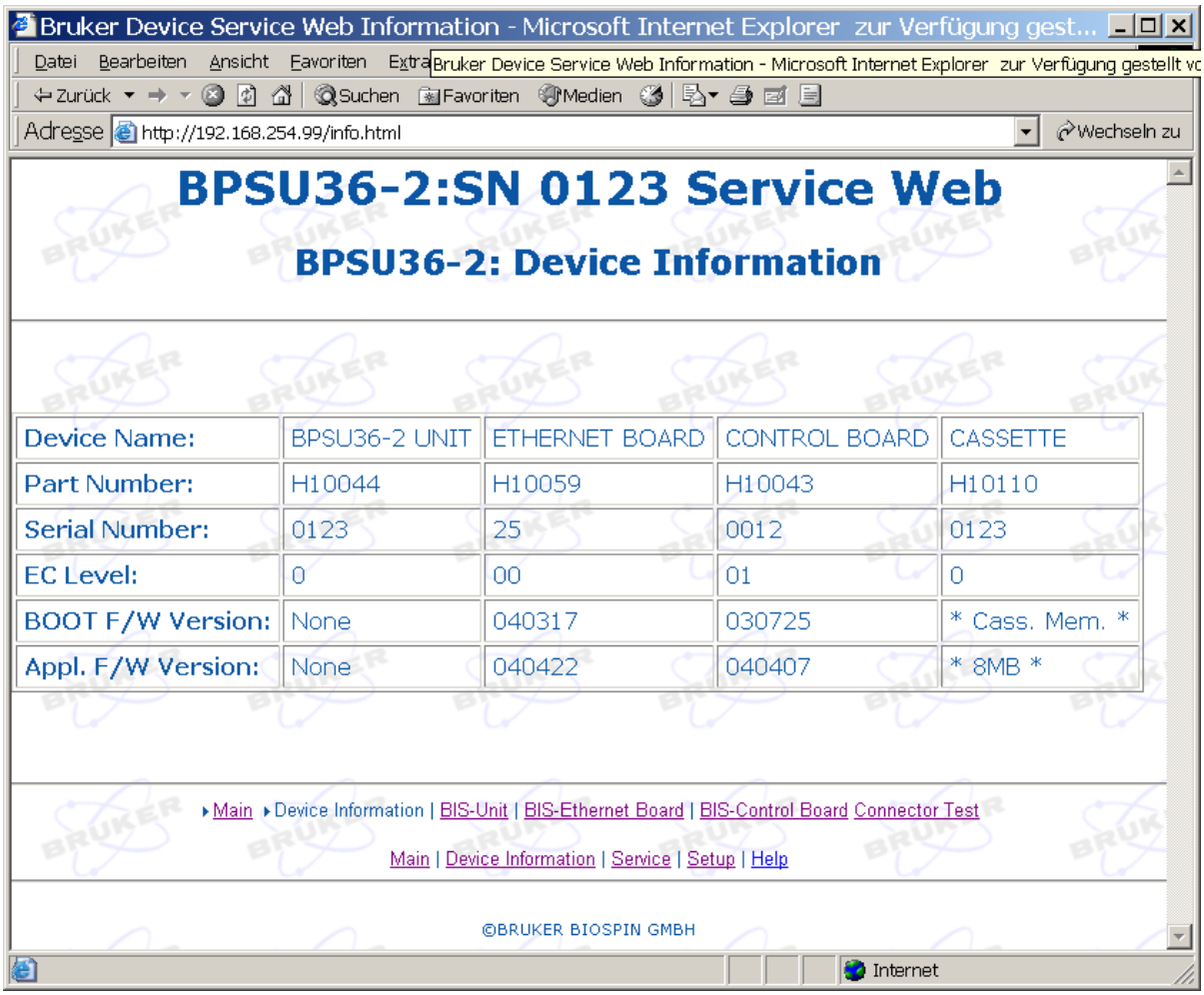


Figure 5.5. Device Information Page

This page shows information about the part numbers, ec levels and the various firmware levels in use on the major components of the BPSU36-2.

From here the BIS information for the system can be accessed. This is password protected and is intended for production and service use only.

The 'Service' Page': service.html *5.4.3*

From the 'Main' page click on the link Service to reach this page'.

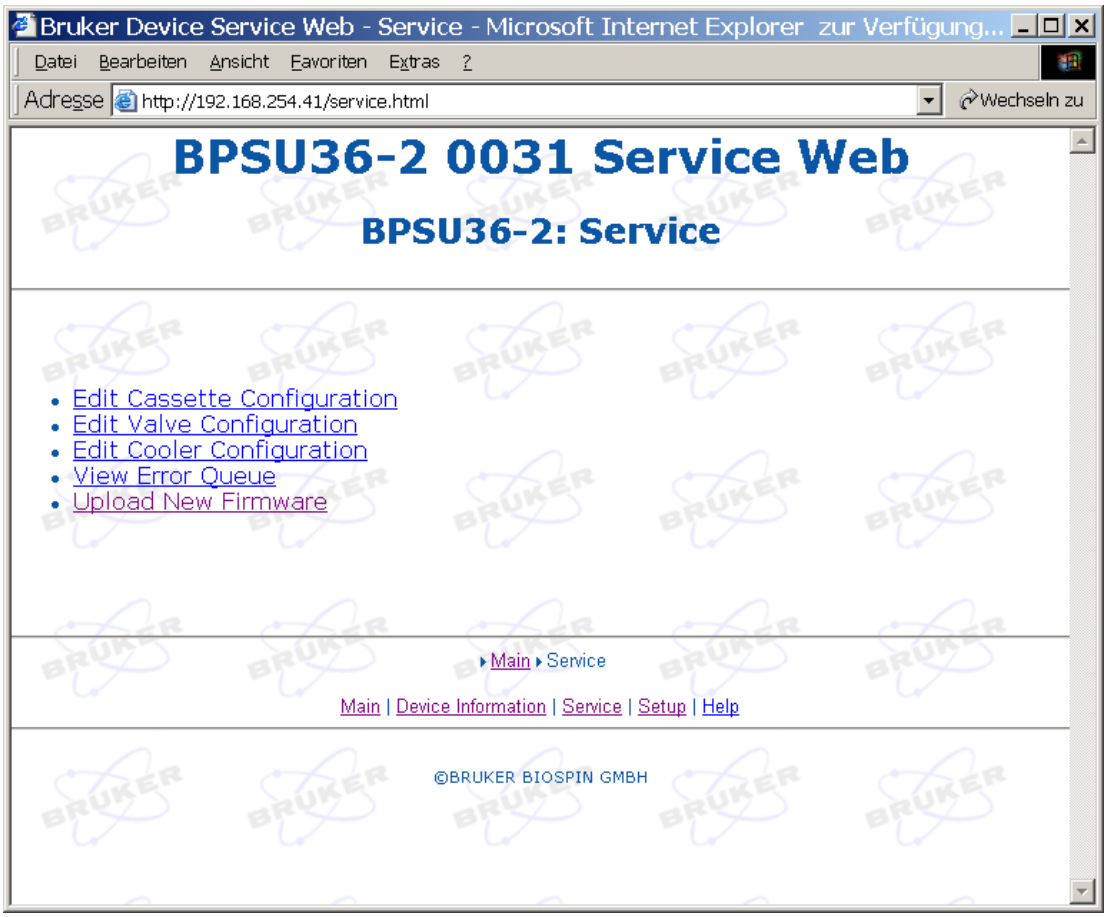


Figure 5.6. Service Page

This page has a number of links to pages in which the individual functions of the BPSU36-2 can be initiated and the status checked.

The 'Cassette Configuration' Page: cassette.html *5.4.4*

From the 'Service' page click on the link Edit Cassette Configuration to reach this page

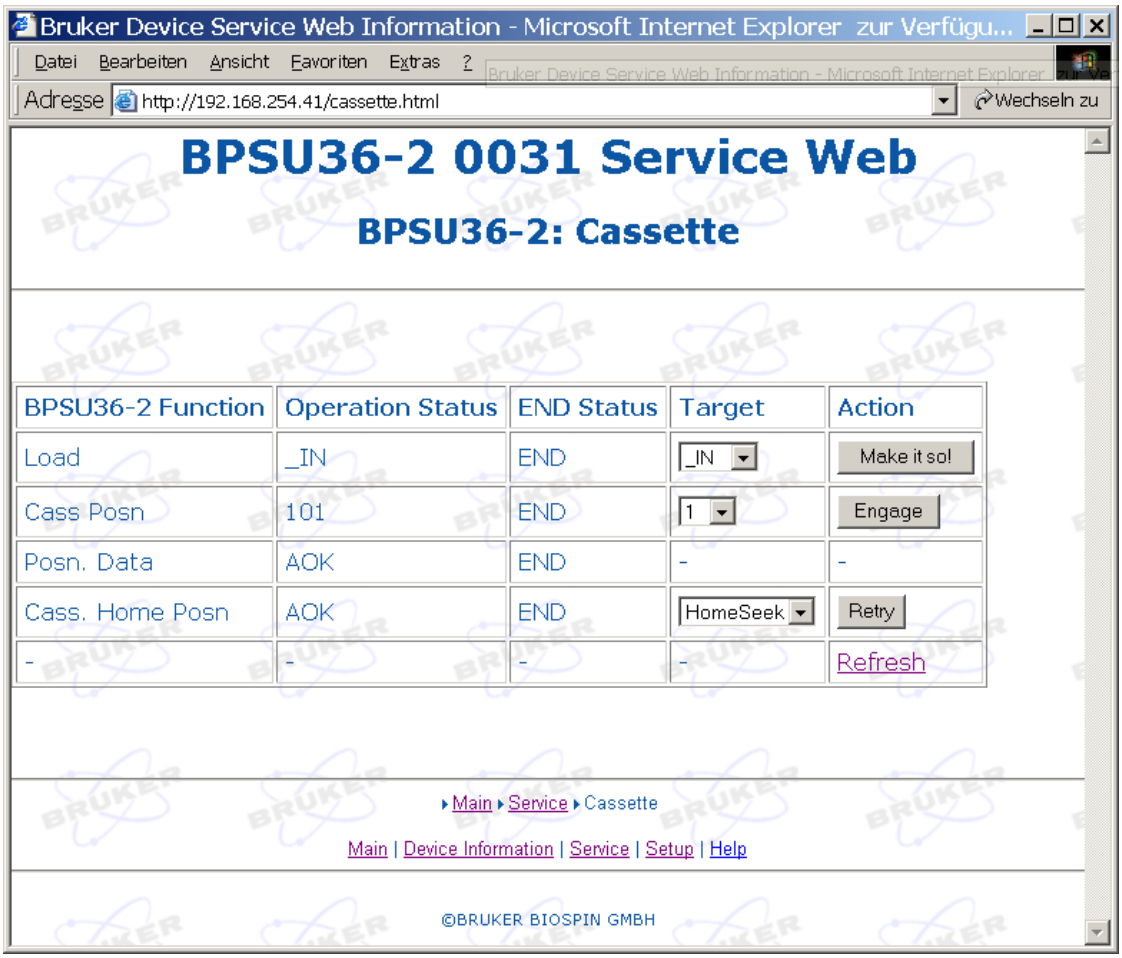


Figure 5.7. Cassette Configuration Page

The target or demand values for the associated operation can be selected in the Target column. Clicking on the button in the Action column sends the command to the BPSU36-2. The BPSU36-2 responds by sending the above page again. This time the END Status column value should have 'AOK' in the command row to indicate that the command was received OK. To monitor the status of an operation click on the Refresh link. ***Do not*** use the page refresh button on the browser as this may simply try to read the response page from the form which is only valid at the time an Action button was pressed!

Cassette Load / Unload *5.4.5*

The load/unload operation can ONLY be carried out using the load/unload button on the front panel. The only exception to this is when the cassette is already in the loaded position (but not loaded) and the door is closed. In which case the load operation will be initiated. If the cassette is already completely loaded then the

command is ignored. Otherwise, selecting the function here simply enables the operation of the front panel button which lights to indicate that it is active. After the cassette is loaded, if the *Load-In* function had already been or is now selected, then the front panel button is locked out. Select the *Load-Out* function above to re-enable the button. The Button is, in any case, disabled while the door is closed. While the load/unload operation is in progress the LED on the button blinks.

The function of the button swaps between load and unload (and abort). The load operation can only be started when the cassette load mechansim is in the fully unloaded position otherwise it simply unloads further. While loading you MUST keep the button depressed for at least 3 seconds or else the operation will abort. If after this time you release the button and then press it again while the operation is still in progress (blinking LED), it will also abort.

While loading, the 2-way air cylinder has air enabled to both sides of its piston. As the side to load the cassette has a larger surface area than the side to unload the cassette, it slowly moves in. Only after a cassette (or dummy) has been successfully recognised and after the rotation mechanism has locked properly onto the cassette, is the air for the 'out' direction removed. The cassette is now firmly held in place.

If no cassette is found then all air pressure is removed from both sides of the cylinder.

While HyStar is communicating with the unit the *Unload* operation is automatically blocked. Selecting *'Cassette Unload'* in HyStar or selecting Load OUT and clicking '**Make it so**' frees the block. If Communication with HyStar is broken (ethernet cable removed, PC powered down, HyStar killed etc) then the block is automatically removed ca. 5 seconds later. The Cassette cannot be unloaded while the door is closed.

If you attempt to unload the cassette while the unload block is in place the LED on the Load button flashes 5 times quickly, pauses and repeats as long as the button is depressed.

The load switch LED lights continuously to indicate that the *Load/Unload* operations can be activated.

NOTE: While the cassette is loading or loaded do not touch the cassette itself. An electrostatic discharge from you to the cassette may cause the control processor to be reset. This will not cause any damage and communication with HyStar or the control PC continues unaffected. However, the load operation would have to be restarted

See also ***"Safely Loading and Unloading the Cassette" on page 66***

The 'Valve Configuration' Page: valves.html *5.4.6*

From the 'Service' page click on the link Edit Valve Configuration to reach this page

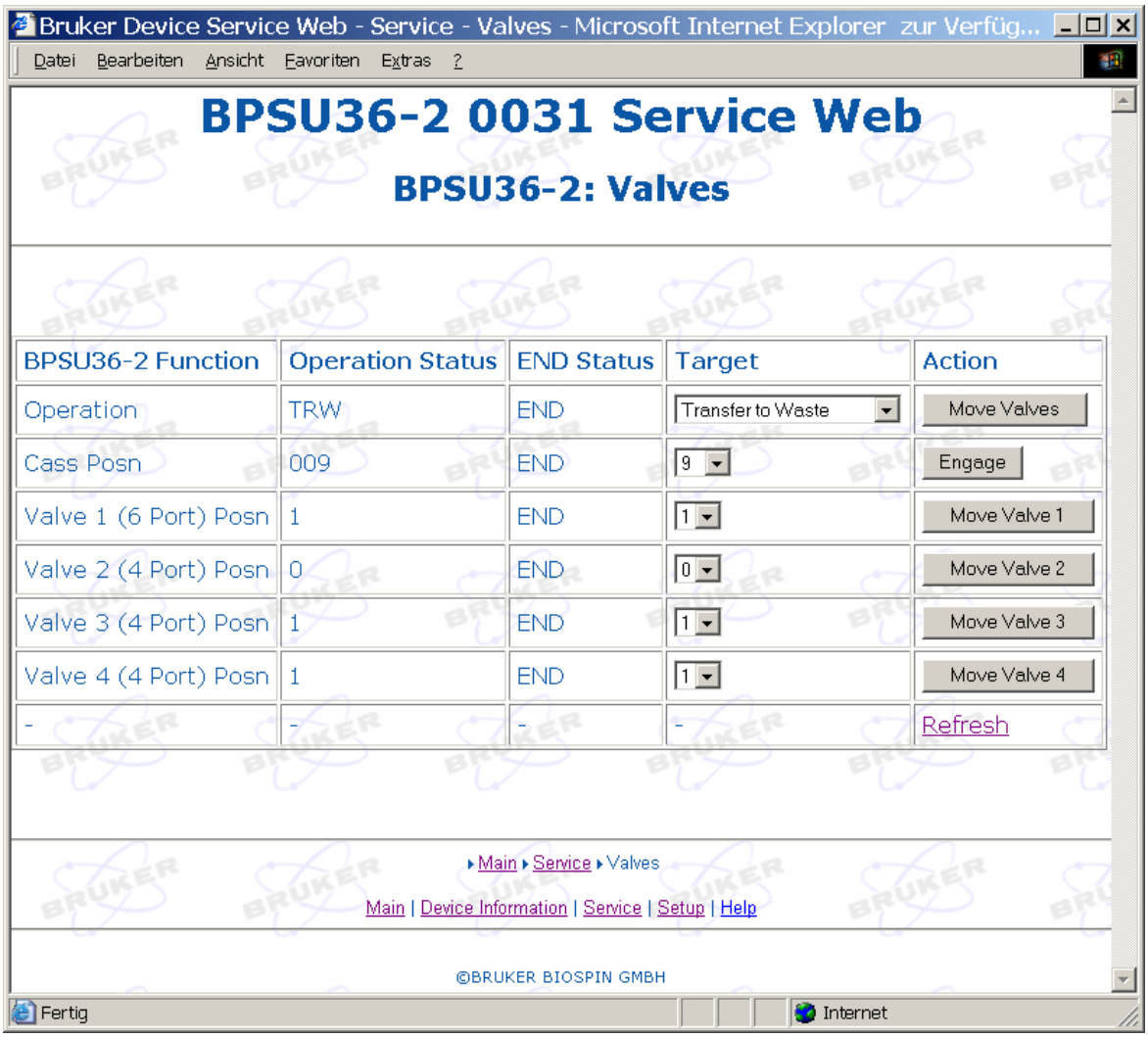


Figure 5.8. Rotary Valve Configuration Page

The valve positions are described in ***"Rotary Valve Positions" see page 15***. The desired position is selected from the **Operation/Target** Field and initiated by clicking on the **Move Valves** button. The valves then move to this position. If the present position of the valves is unknown (eg after a reset) the valves first of all move back and forth until a change in the state of the position sensor is detected to ensure that the compressed air is connected.

To move the cassette to a desired position: Select the target position in the **Cass Posn/Target** field and click on **Engage** to start the cassette movement.

To move individual valves to a desired position: Select the valve position in the **Valve x Posn/Target** field and click on **Move Valve x**.

To monitor the status of an operation click on the Refresh link. ***Do not*** use the page refresh button on the browser.

The 'Cooler Configuration' Page: cooler.html *5.4.7*

From the 'Service' page click on the link Edit Cooler Configuration to reach this page

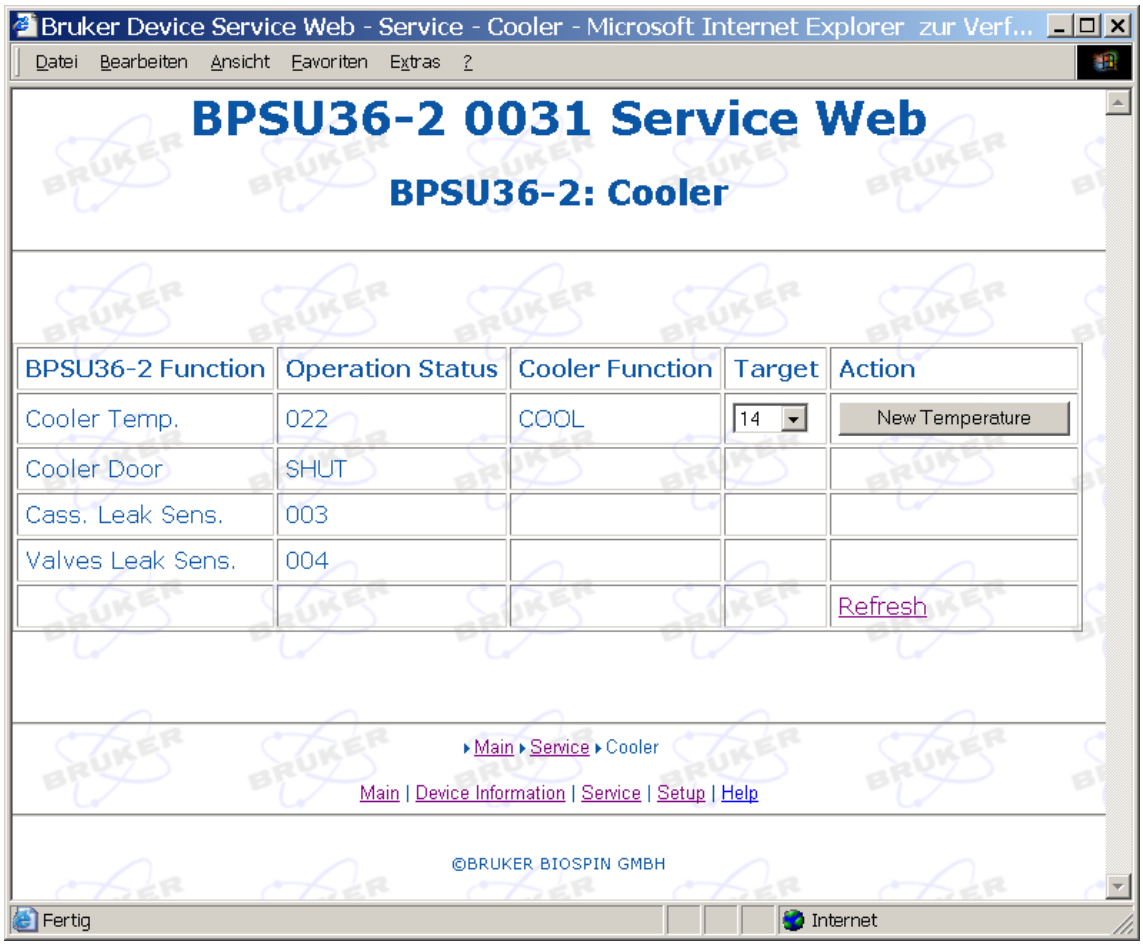


Figure 5.9. Cooler Configuration Page

The target or demand temperature for the cooling unit can be selected in the Target column. Clicking on the button in the Action column sends the command to the BPSU36-2. The BPSU36-2 responds by sending the above page again. The new target temperature is displayed in the Target column. To monitor the status of an operation click on the Refresh link. The cooling unit will only cool if the door is SHUT. Do not use the page refresh button on the browser as this may simply try to read then response page from the form which is only valid at the time an Action button was pressed.

The 'View Error Queue' Page: errors.html *5.4.8*

From the 'Service' page click on the link View Error Queue to reach this page

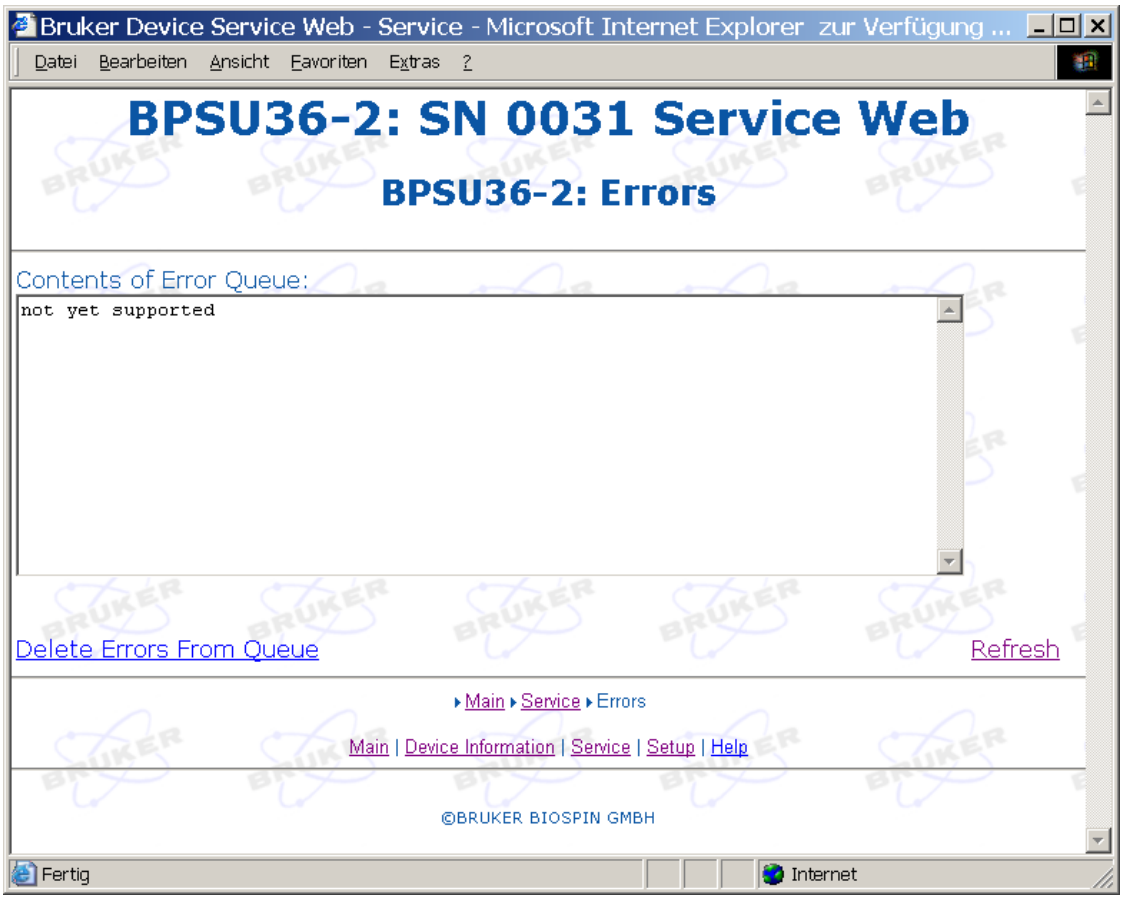


Figure 5.10. View Error Queue Page

The Error Queue display is not supported at present.

FTP Download

6

Ethernet Program Download 6.1

All BPSU36-2 (and BMSO) units are download capable. The download program is stored in a separate flash memory area from the application program.

To initiate a download the unit has to be switched into download mode. This can be done using the EWS. On the service page (see ***"The 'Service' Page': service.html" on page 45***) click on the link Upload New Firmware. Enter the user name 'upload' and password 'firmware' to display the following page:

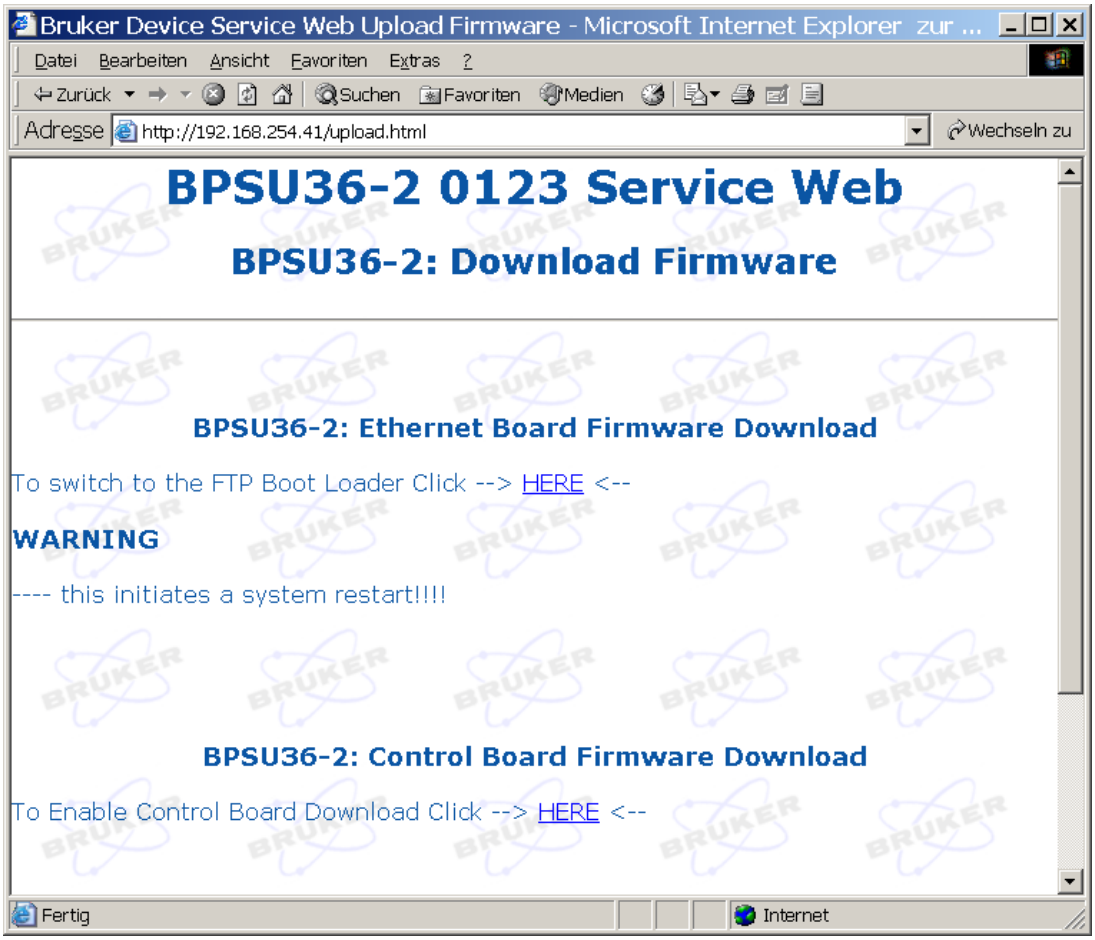


Figure 6.1. Firmware Download Page

Now click on the upper link HERE to switch to the boot loader. The unit replies with the following page: ***Switching to Boot Mode Using the EWS see page 52***

and restarts in Boot Mode.

.

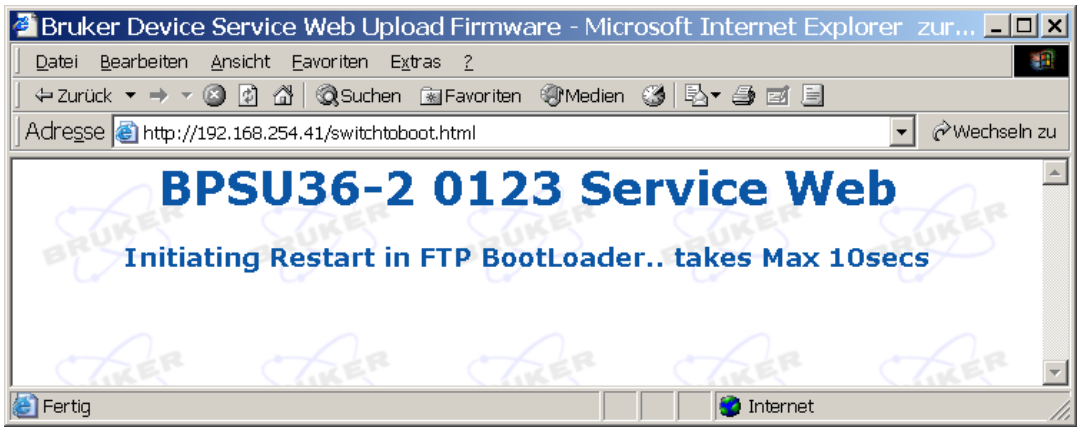


Figure 6.2. Switching to Boot Mode Using the EWS

It takes 4 - 10 secs for the unit to restart in Boot Mode. You can simply ping the IP address until the unit responds: In a DOS Window enter the following:

```
ping 192.168.254.41 -n 2000 -l 1400
```

This pings the unit 2000 times with data blocks of 1400 bytes. With this you can observe when the program is running again.

Approx. 4-10secs after the restart the unit responds as follows:

```
Reply from 192.168.254.41: Bytes=1400 Time<10ms TTL=60
```

See Picture below.

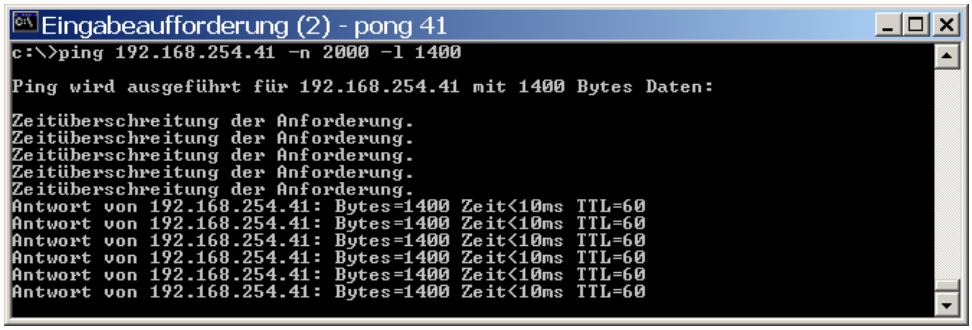


Figure 6.3. Ping the Unit

Home Page in Boot Mode *6.1.1*

Now you can check the status page.

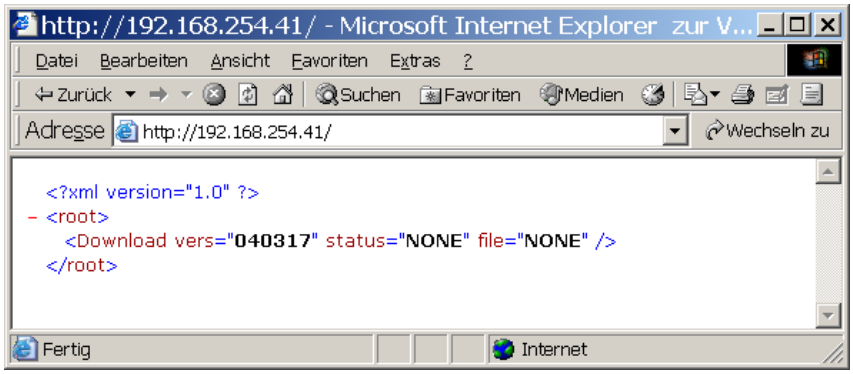


Figure 6.4. Boot Mode Status Page

Here you can read the firmware version of the bootloader as well as the download status and the filename of the file being downloaded

Copy the new Program via FTP. *6.1.2*

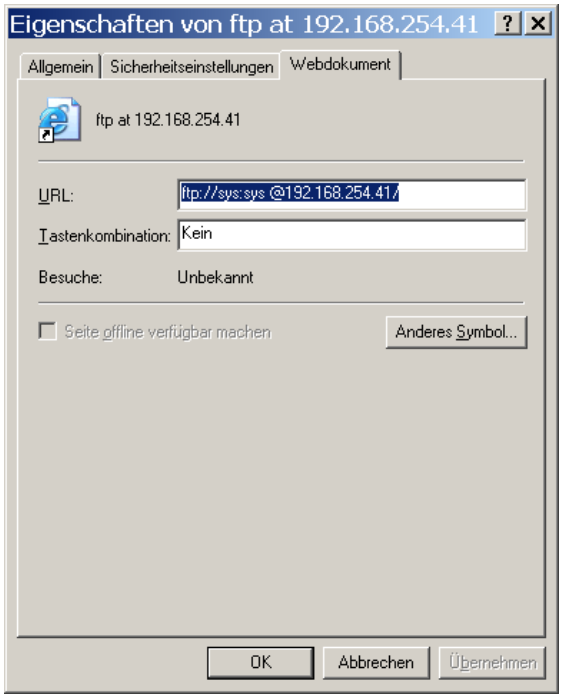
Start a suitable FTP Program and make a connection to the BPSU36-2. (e.g. the Freeware Program FTP Commander 7.0). You can also use Internet Explorer for the FTP transfer if you have nothing better. Setup as follows:

Server Address: 192.168.254.41
Port 1 - 999 (don't care, default 25)

(User: sys, Password: sys)

You can save this into your Internet Explorer favorites:

Figure 6.5. Setup in Internet Explorer Favorites



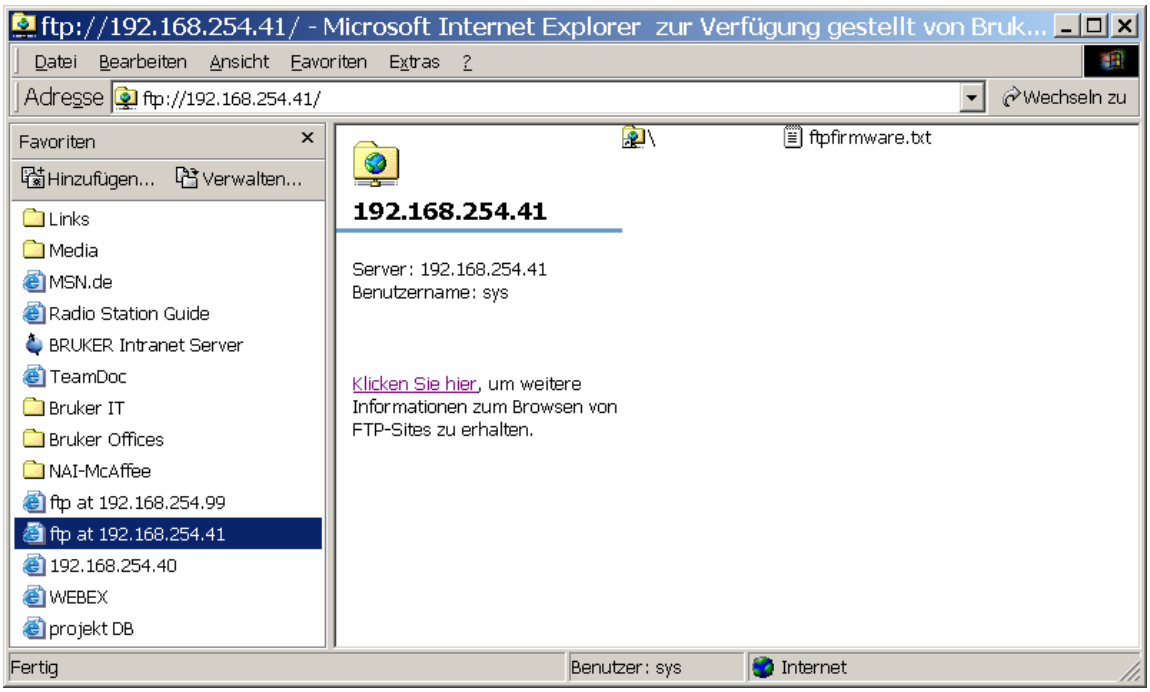


Figure 6.6. FTP Connection using Internet Explorer

The new program file must be called 'xxxxxxrom.bin'. "xxxxx...xx" is normally the unit ID + Firmware Release Date. (e.g. bpsu_051203_rom.bin)

Copy the file to the Ethernet Board FTP server to start the download.

During the download you can poll the status page

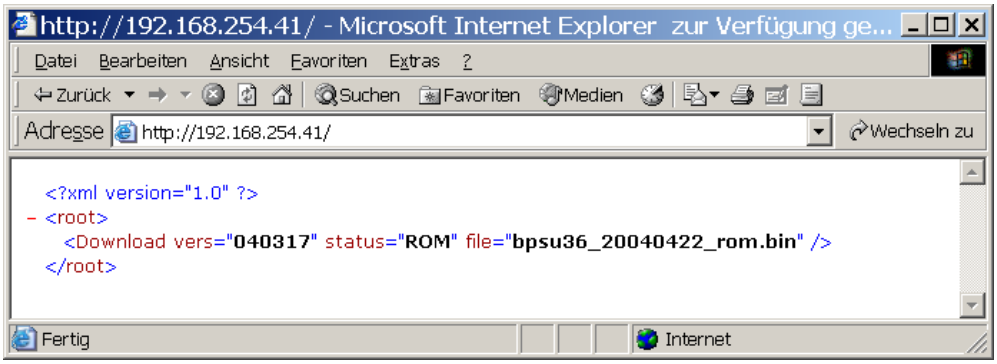


Figure 6.7. Status Page in Boot Mode

Poll slowly (ca. 1 - 2 /sec) otherwise the download runs very slowly! The time needed for the FTP transfer is ca. 15 secs.

Once the download is complete (ca. 4 sec after the FTP Transfer is finished), the new application program is copied to RAM. The program then restarts from RAM.

NOTE: If you send an invalid file, the Status Page appears as follows:

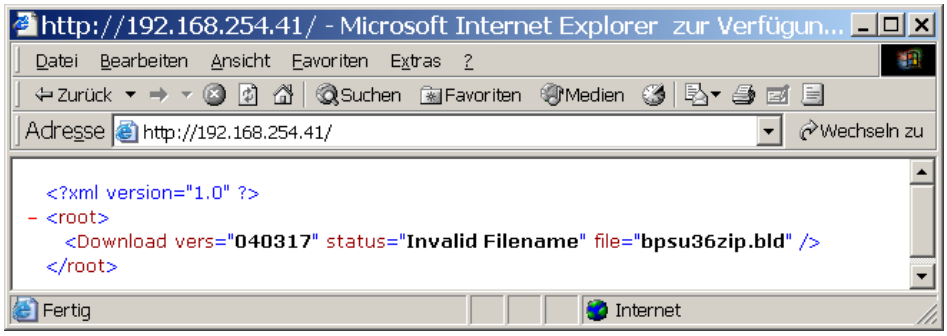


Figure 6.8. Status Page for an Invalid File

This file will, of course, not be programmed.

Should something go wrong during the download you simply have to switch the unit off and then on again. It will start up in download mode ready for a new application program. You may have to do this twice before it restarts!

The only exception to this would be if you happened to be downloading an update to the download program and something were to go wrong. In this case the board would no longer operate and would have to be returned to Bruker.

After the FTP Transfer is done you can ping the unit as before. After a few seconds the unit stops responding. Some 3-8 secs after this the unit will be running in application mode and will respond once more.

The Ethernet Board download has now been completed.

It is also possible to initiate a download using a command in the *url Address* (intended for automatic download from HyStar):

Using a browser display the BPSU36-2 Home page. (..*IP-Address/*)

Enter the command **$BOOT=B**. The unit responds with the page: ***Switch to Boot Mode see page 56*** and switches shortly afterwards into 'Boot' Mode.

The download itself as described above is unchanged.

Alternatively you can force the unit to start in Boot mode by populating the jumper J4 P7-P8 on the Ethernet Board (***Boot Jumper on the Ethernet Board see page 56***) and pressing the reset switch on the Control Board. If no spare jumper is available the one used at J4 P5-P6 can be used. After the download is done this must be replaced and the unit reset once again.

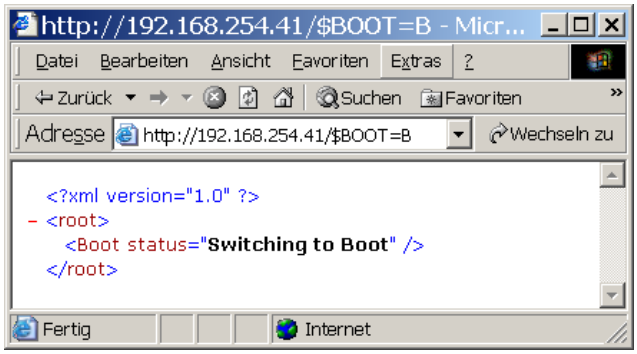


Figure 6.9. Switch to Boot Mode

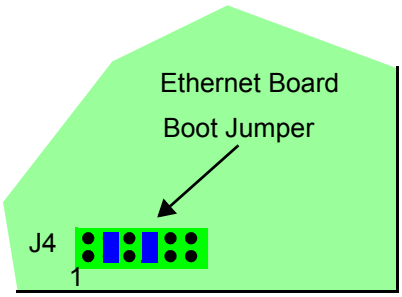


Figure 6.9. Boot Jumper on the Ethernet Board

Control Board Program Download 6.2

This can only work if a valid BPSU36-2 application program is running on the Ethernet Board. This can also be initiated either using the EWS or with a command over the url address line. This second mode is intended to allow HyStar to automate the download process.

Control Board Download using EWS 6.3

From the 'Service' page (see ***"The 'Service' Page': service.html" on page 45***) click on the link Upload new Firmware and enter the user name 'upload' and password 'firmware'.

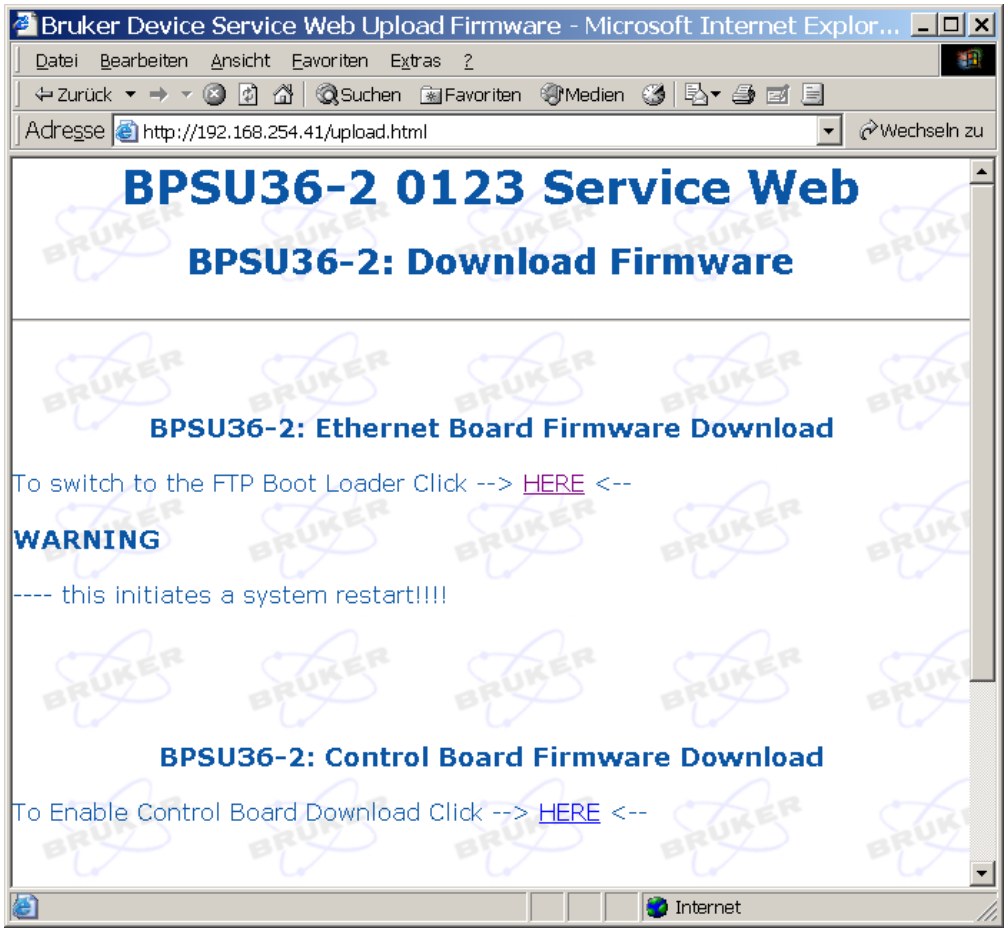


Figure 6.10. Control Board File Found

Now click on the lower link HERE to enable the Control Board download mode.

This returns the following page:

Figure 6.11. Switching to Control Board Download Mode

It also kills the communication with any cassette which may be loaded and deletes the record of the files on the cassette. The data on the cassette itself is not affected in any way.

Now open an FTP connection to the unit (see ***"Copy the new Program via FTP." on page 53***) and copy the most recent Control Board application program to the unit (e.g. p040407.H86: the name must always end with .h86 or .hex).

Click on refresh on the page and it will now indicate that a valid file was found: In this case p040407.h86. (***File ready to be downloaded to Control Board see page 59***)

Figure 6.12. File ready to be downloaded to Control Board

At this point you can still abort the download by clicking on RESTORE to return to normal operation. The system exits download mode, restores communication with the cassette and rereads its contents.

Click on the link START DOWNLOAD to start the download and display this page:

Figure 6.13. Start of Download

Control Board Download in Progress 6.4

This displays the name of the file being downloaded, the number of lines from the total already downloaded and the download status. You can click on refresh to monitor the status of the download.

Figure 6.14. Control Board in Boot Modus: Flash Erase

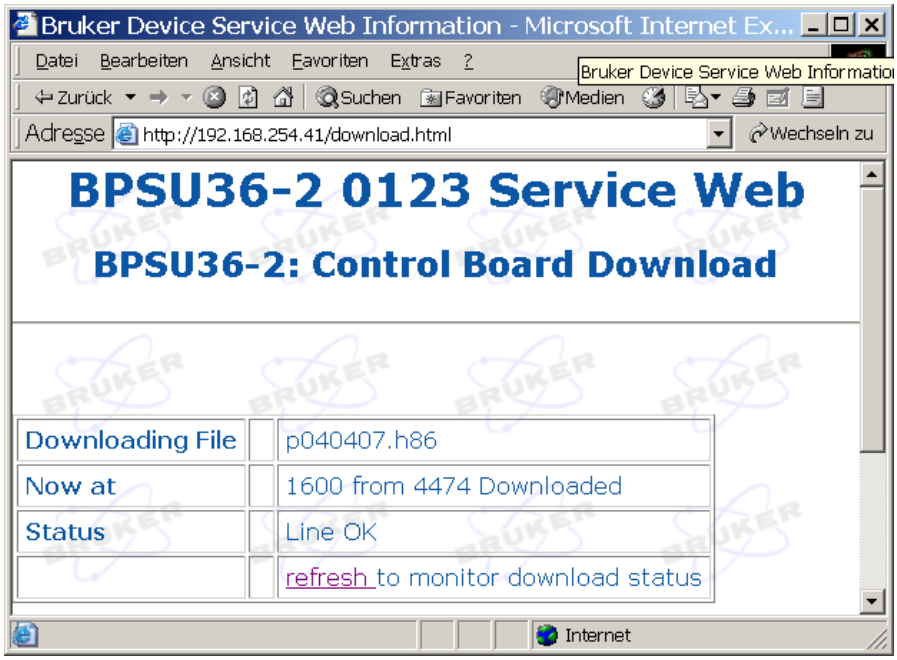


Figure 6.14. Control Board in Boot Modus: Programming Data

When the download is over the text 'in Appl Mode' appears in the Status row to indicate the download is done and the application program is running again.

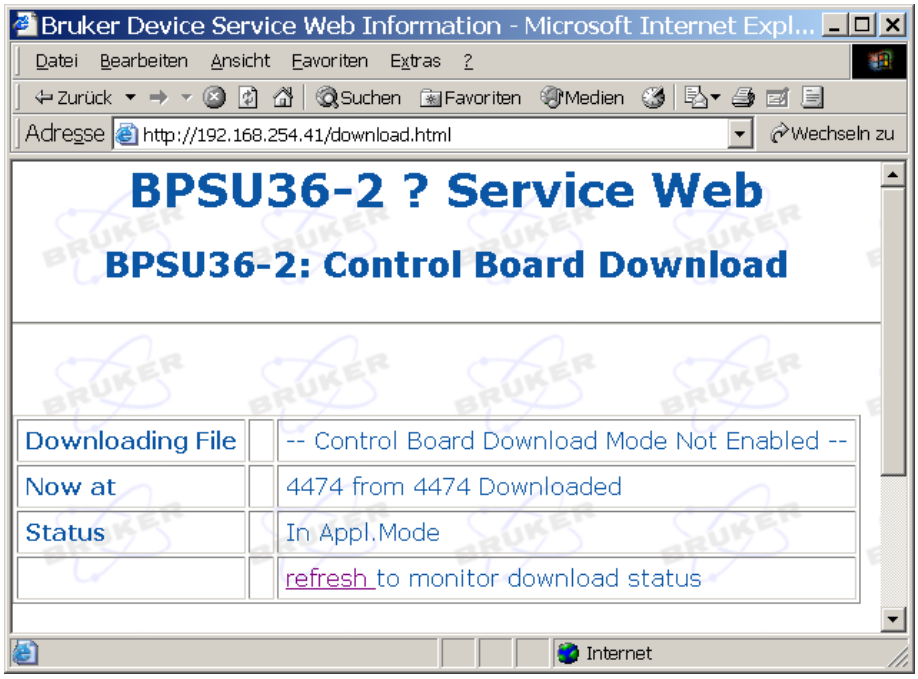


Figure 6.15. Download Over, Control Board now in Appl. Mode

At this stage the download is over and the unit returns to normal operation mode.

Control Board Download using url Address line Commands *6.5*

Using a browser display the home page (*..IP-Address/*)

Enter the command **$DOWN=I**. (= Download Initialise). The unit responds with the down.html page (below) and deletes all files from the FTP server.

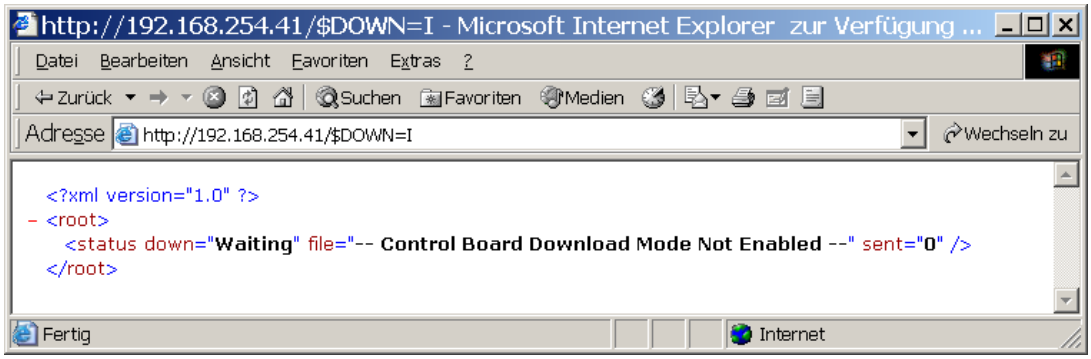


Figure 6.16. Initialise Control Board Boot

You can monitor the download status in the page down.xml l

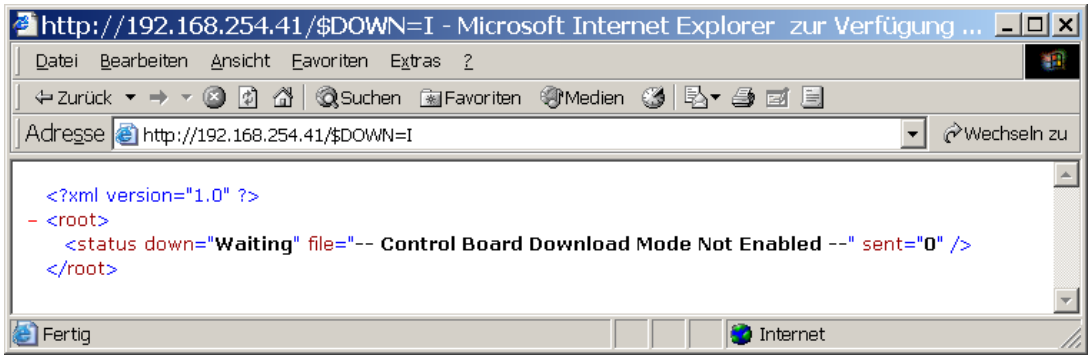


Figure 6.17. Monitor the Control Board Download Status

Now open an FTP connection to the FTP server on the unit (see ***"Copy the new Program via FTP." on page 53***) and copy the most recent Control Board application program to the unit (eg p040407.H86: the name always ends with .h86 or .hex)

Now if you poll the down.xml page it looks like:

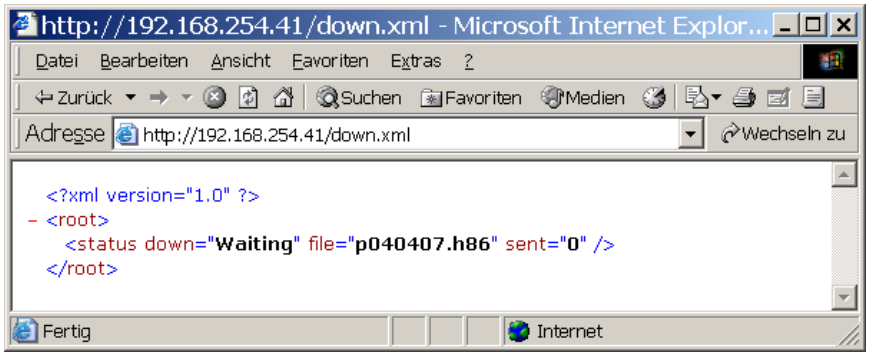


Figure 6.18. down.html Page after Copying a Program File

To switch the Control Board into download mode and start the download you have to enter the command $DOWN=S (=Download Start). The unit responds with the down.xml Page again. Continue to poll the down.xml page until the download is complete.

In this page the value 'x' at sent="x" lies between 0 and 100 and corresponds to the percentage of the program file which has been programmed to the flash memory on the Control Boardt

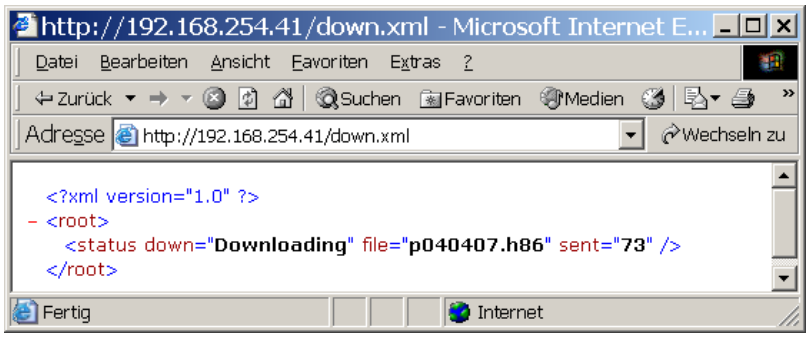


Figure 6.19. Control Board Download in Progress

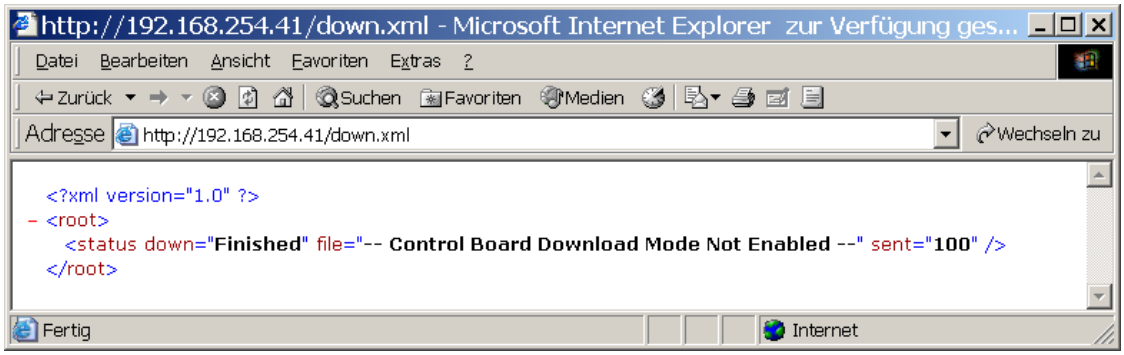


Figure 6.19. Control Board Download Finished

Poll the down.xml Page to monitor this status. The value of 'x' stays at 0 for the first 5 - 10Sec, as the flash must first be deleted before the new program can be written to it.

Once 'x' reaches 100, the download is complete. The Control Board restarts in application mode and the Ethernet Board program does a partial restart to allow the Ethernet Board - Control Board settings to be re-initialised.

FTP Download

Service Information

7

General Information 7.1

Before opening the unit the power cable and must be removed. The Unit should only be opened by experienced service personnel.

Liquids used in chromatography (e.g Acetonitril, Methanol,...) are extremely hazardous. Wear proper skin- and eye-protection, avoid contact and inhalation. Liquids may be pressurized. Take care when opening capillary connections.

All user serviceable components are accessible on the Valve Module. The Module is secured with two quick remove screws located top right and left of the module. These require a 1/4 turn counterclockwise to loosen them. The capillary connections to the cassette block have deliberately been kept very short. These connections MUST be removed before moving the Valve Module out.

Before completely removing the Valve Module, the power cable, the compressed Air/Nitrogen connections to the rear panel and any capillary connections to other units must first be disconnected. Also the 32pin connector to the valve connector board (mounted at the right hand side of the valve module) and the 4mm flexible tube (secured at the rear of the 8way valve block) must be removed. These can be accessed once the module has been moved out. The Valve Module may be moved out (but NOT removed) without having to disconnect power or compressed air

Cleaning *7.1.1*

To avoid electric shock do not clean in the region of the mains switch or mains connection cable without first removing the mains cable from the rear of the unit.

The parts accessible from the front of the Valve and Pump Module are resistant to those solvents normally used in HPLC and may be cleaned with a cloth moistened with water, methylated spirit or similar solvent with low toxicity. While the leak sensor is damp the unit will indicate a leak. This must be dried thoroughly with a dry, lint free cloth. This may be done with the unit powered on. Ensure that no liquid gets into the mains switch.

Safely Loading and Unloading the Cassette *7.2*

When the cassette holder is out DO NOT put fingers or any other body part behind the cassette holder or behind the cassette should one be in place. The 'cassette load' operation is carried out by a pneumatic cylinder which pulls with a force of approx. 150Newton (= ca. 15kg) for the normal operating pressure of 2.5Bar. This could cause severe injury to any body parts unintentionally placed behind the cassette holder when a 'load cassette' (with or without cassette) is initiated.

A storage cassette can only be removed or inserted when the cassette holder is in the unload or OUT position. The cassette should always be lifted from or placed in the holder while gripping the cassette at the bottom and sides. Fingers should at no time be between the cassette and the cooling unit.

Maintenance: Valve Head Replacement *7.3*

The Storage Cassette is not user serviceable. In case of malfunction, replacement/repair should be carried out by Bruker Service Personnel. In the event of a leak being detected in the system, check the fittings and tubing to the rotary valves. Clear any blockages in the tubing.

Should the problem lie in one of the rotary valves refer to the Vici (valve manufacturer) technical note 801 (tn801.pdf) regarding disassembly and cleaning instructions. This pdf file is available on the HyStar CD or directly from the Vici web site. (see http://www.vici.com/support/tn/tn801.pdf)

If you have to replace a valve it is usually only necessary to replace the valve head and not the complete valve and pneumatic assembly. A faulty valve head may **ONLY** be replaced with an identical one.

Disconnect all capillary connections to the valve module. Turn the 2 module securing screws (top left and right of module) a 1/4 turn counterclockwise and move the module a few cm out of the BPSU36-2. Remove the front panel from the module (4 x Phillips **+**headed screws).

The Unit can stay attached to mains and compressed air. **DO NOT insert your hands into the unit behind the valve module!**

Now you MUST move the valve to be replaced to position 0. (see ***"The Service Pages" on page 43*** and ***"The 'Valve Configuration' Page: valves.html" on page 48***)

Using a 9/64“ hex driver loosen the screw of the securing ring (see ***Figure 3.4.***) of the valve to be replaced. Remove the valve.

On the new valve use a pair of pliers or similar to grip the coupling to the valve. Turn the valve shaft here until the valve is also at the endstop for position 0. (endstop counterclockwise when viewed from the valve head, clockwise when facing the coupling)

Mount the new valve in place of the old one ensuring that the capillary port connection labelled ’1’ is at the top. (the valve can be mounted in increments of 90°) ***Very lightly*** turn the valve clockwise until the play in the coupling has been taken up then tighten the screw on the securing ring once more. If this is not done correctly it can result in the pneumatic drive reaching its endstop before the valve reaches its own endstop when moving in this direction. In which case the fluid flow will be partly or wholly blocked!

Mount the module front panel again. Push the module fully into the BPSU36-2 being very careful not to damage the capillaries from the cassette block. Secure the module in place by turning the securing screws a 1/4 turn clockwise.

Refer to the tubing diagram and reconnect the tubing ensuring always that the tubing is correctly seated in the valves. It may (but shouldn’t usually) be necessary to replace the ferrules as these can be malformed when the fitting is securely tightened. A selection of spare fittings and ferrules is supplied with the unit. Spares can be obtained from Bruker or Vici.

Physical Specifications *7.4*

BPSU36-2

Height:	6HE (ca.26.5mm)
Width:	19“ (for mouning in a 19“ rack system)
Depth:	588mm (+35mm for the pressure regulators)
Weight:	27kg

Power Requirements	Minimum 110V ac. Maximum 240V ac 50 - 60Hz 250VA
Fuses:	2 x 2A, 230V

The main earth connection to the Unit is supplied via the largest pin in the Euro-Standard 3 Pin connector and must be connected to ground using either the mains cable supplied or one of similar specifications. Incorrect earthing of the unit can be very dangerous.

Compressed Air Requirements

1. To the left connector (when viewed from rear)
   4mm connector, max external pressure 8Bar set to 2.5Bar (±0.3) on the manometer
   This can be clean, oil-free dry compressed air or N_2 (preferred)
2. To the right connector (when viewed from rear)
   4mm connector, only clean dry N_2 at max 8Bar nominally set to 2.5Bar (±0.3) on the manometer. This gas connection is used to flush the cassette and the NMR probe. This value may be set in the range 0-4Bar. In any case it must **NOT** be set to a value higher than is allowed for the probe.

Using normal compressed air to this connector could cause irreparable and hence very expensive damage to the NMR probe and the cassette!

Operational Environment

10°C to 40°C Non Condensing Air Humidity

Figures

Tables

THE END