Keeler

Cryomatic

‘Cryomatic’ Console Service Manual for:

2509-P-1000-JPN

2509-P-1000 September 2011 onwards

Contents

Safety Considerations

The system has been designed to comply with the following regulatory standards for Safety and Electromagnetic Compatibility:

- EN60601-1, UL60601-1 & CAN/CSA-C22.2 No 601.1
- EN60601-1-2

Although compliant with applicable EMC directives, this equipment may still be susceptible to excessive emissions and/or may interfere with other more sensitive material.

For your own safety and the safety of the equipment, always take the following precautions:

- Keep the console away from sources of liquids and do not spray with water.
- Switch off the electrical supply and disconnect from the mains supply before cleaning and inspection.
- Do not use hypercarbonate or phenolic based cleaning solutions or disinfectants containing cationic surfactants (e.g. Dettox) to clean the console.
- Ensure that the system is clean and dry prior to storage.
- Observe the usual safety precautions, associated with the use of medical gases, at all times. Copies of these guidelines will be available from the gas supplier.
- Ensure the correct disposition of gas exhausted from the system so as to minimise the exposure to nitrous oxide. This is the responsibility of the user.
- Ensure that the system is inspected by properly trained personnel once per annum for performance and safety checks.

SAFETY WARNINGS

Electrical equipment may be hazardous if misused. The equipment covers should only be removed by authorised technical personnel.

Do not use the system in the presence of flammable gases such as anaesthetic agents.

1. Introduction

About this Manual

This manual covers all aspects of servicing the Cryomatic System (models from June 2011 onwards).

This manual is for use only by properly trained Keeler service engineers.

This manual assumes that the Cryomatic system has been correctly installed following the guidelines in the Cryomatic Instructions For Use.

Good Working Practices

Potentially dangerous voltages are present inside the equipment – care should be observed when operating the equipment with the front cover removed.

The Cryomatic contains several components/sub-assemblies which are sensitive to electrostatic discharge (ESD) and relevant precautions should be taken when handling such components.

2. Scheduled Maintenance

The Cryomatic system should ideally be inspected and serviced annually by Keeler trained personnel.

The following service points should be covered:

a) General inspection of console for any signs of damage.
b) Inspection of mains cord for signs of damage – replace if necessary.
c) Inspection of high pressure gas hose for signs of damage – replace if necessary.
d) Inspection of footswitch for signs of damage – replace if necessary.
e) Inspection of exhaust hose assembly for signs of damage – replace if necessary.
f) Replace gas inlet filter.
g) Check probe couplings for signs of wear or damage.
h) Check probe coupling electrical contacts – clean if necessary.
i) Performance check using test probe.

2. Enclosure & Fittings

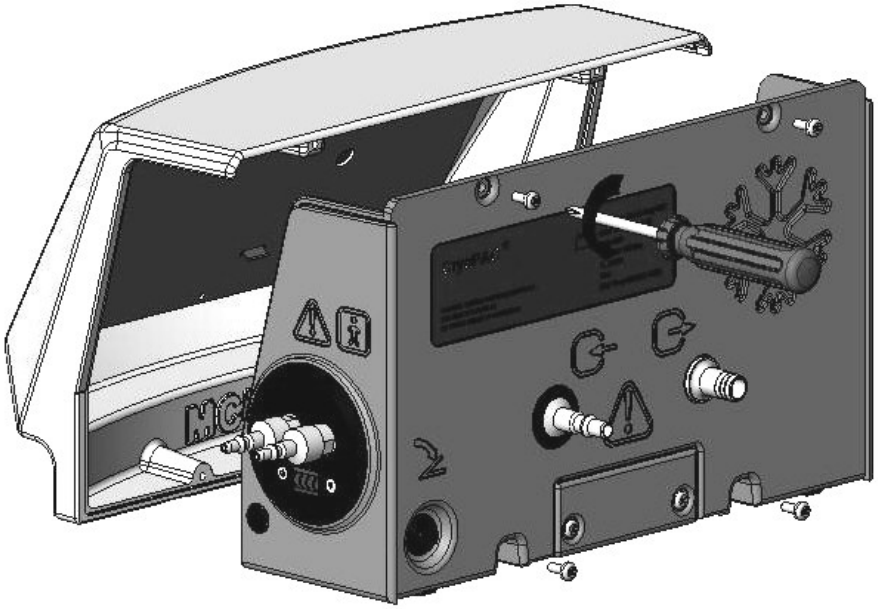
Programming Port Cover

The programming port cover may need to be removed in the event of a firmware upgrade (see Section 6). This is secured at the rear of the unit by 2 small screws.

Removal of Front Cover

Almost all of the servicing and/or rectification will require the removal of the front cover. This can be carried out as follows.

a) Remove the cryoprobe (if fitted).
b) Switch off and disconnect gas supply.
c) Disconnect Cryomatic from the mains electrical supply.
d) Disconnect footswitch.
e) Remove 4 tamper-proof fixings at the rear of the enclosure using the appropriate tooling.
f) Withdraw the front cover and carefully disconnect all connections to the Controller PCB Assembly.
g) Completely withdraw the front cover.
h) Re-fitting is the reverse of removal.



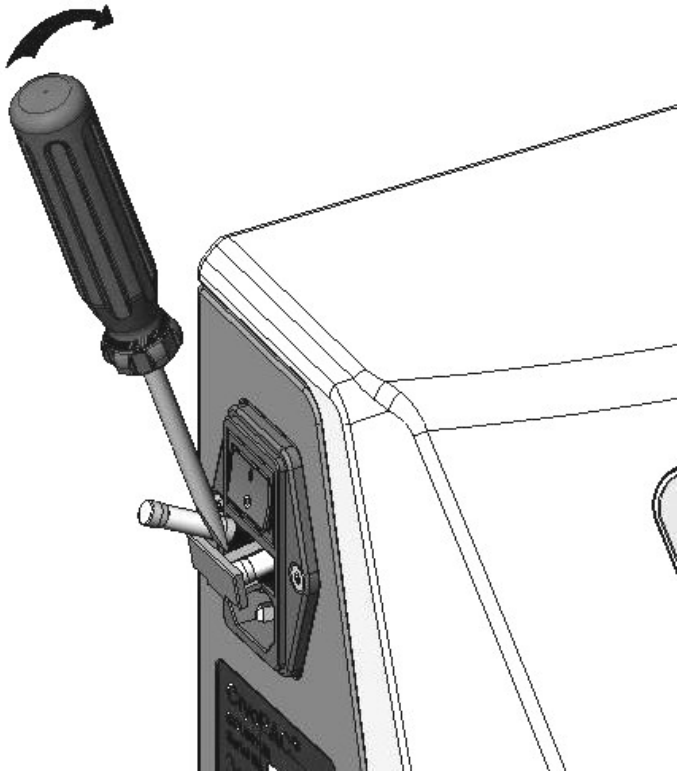
Rubber Feet

The rubber feet are secured to the base of the enclosure by an adhesive layer. They are very robust. If they should become detached due to rough handling they should be replaced. Any residual adhesive should be removed using an alcohol based cleaner before the new foot is firmly pressed into the square locating recess on the base of the enclosure.

Replacing Mains Fuses

The Cryomatic must be disconnected from the mains before attempting to replace the mains fuses.

The mains fuses are housed in the small drawer below the rocker switch on the side of the unit. A screwdriver (or similar) should be used to unlatch the drawer to gain access to the fuse compartment.



Fuses should only be replaced with the same type and rating.

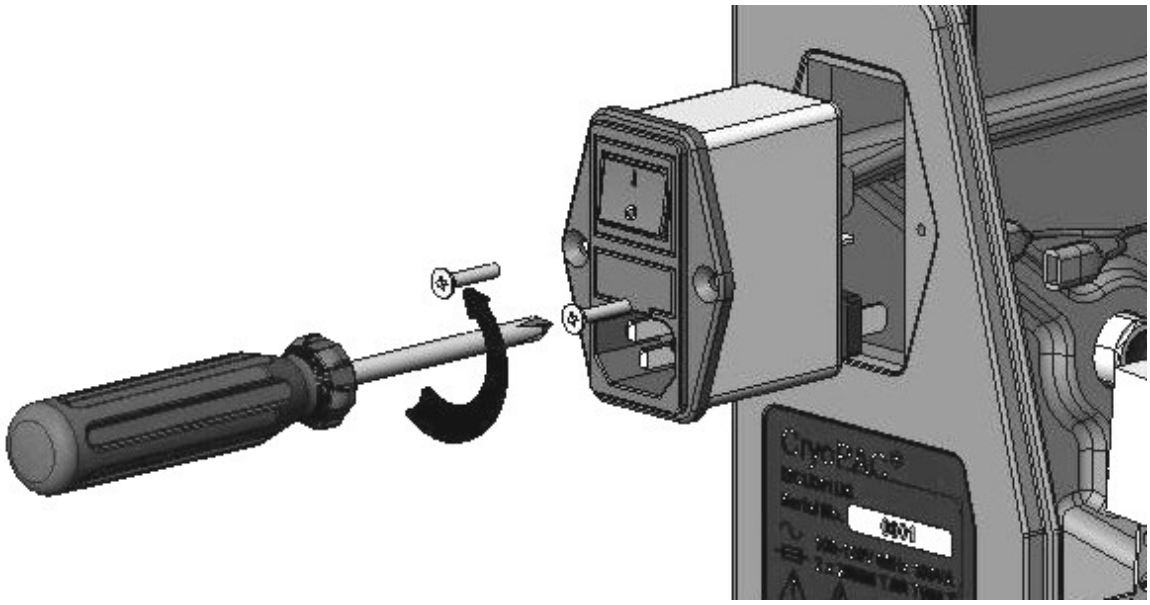
Mains Cord

The mains cord should be replaced if there are any signs of damage upon inspection. The mains cord is of medical grade and replacements should be obtained from the manufacturer.

Mains Inlet

The mains inlet unit can be removed in the following manner.

a) Remove the crimped electrical connections from the rear of the unit (make a note of the correct orientation).
b) Remove the 2 countersunk screws which are accessed from the outside of the unit.
c) Carefully withdraw the mains inlet unit from the enclosure.
d) Re-fitting is the reverse of removal.



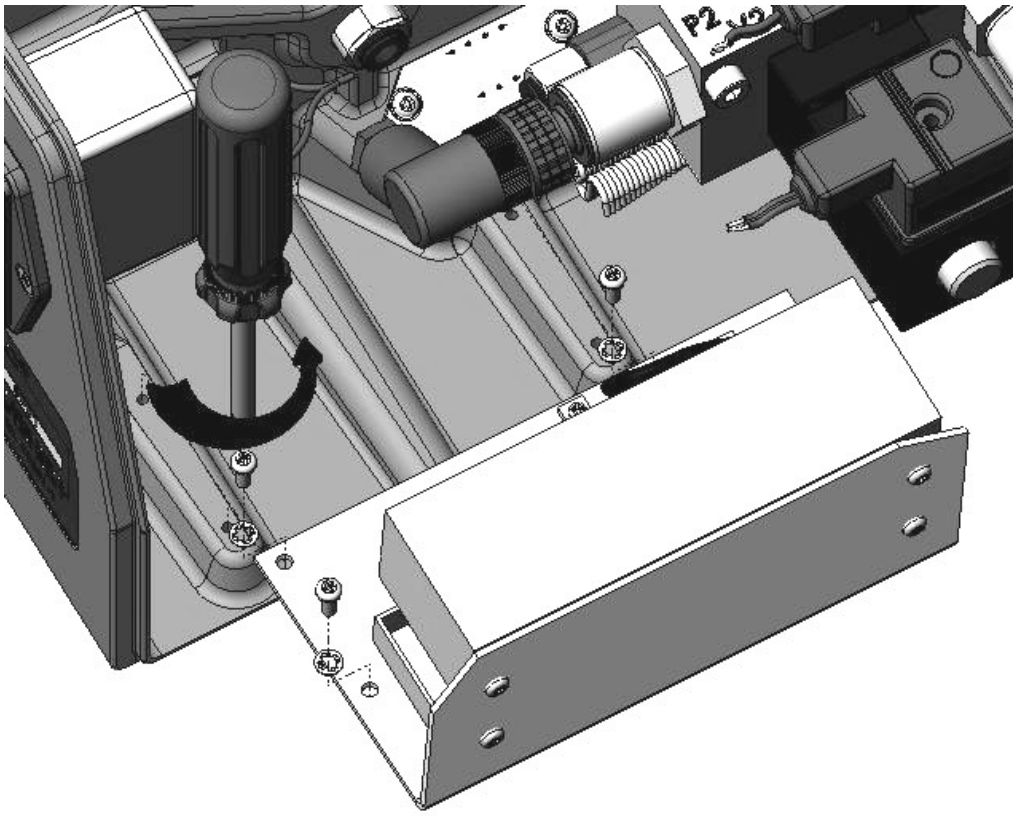
Power Supply Sub-assembly

Disconnect the power connection from CN3 on the Controller PCB. Use a digital multi-meter to check the output of the power supply. Verify that the following dc voltages can be measured with respect to the black connection (pin 4):

red	(pin 1)	+5 V
yellow	(pin 2)	+24 V
white	(pin 3)	-12 V

The entire power supply sub-assembly can be removed as follows.

a) Remove the inlet connection from the power supply.
b) Remove the 3 pan head screws which secure the component plate. Note that these fixings also provide secure protective earth points.
c) Carefully remove the sub-assembly from the enclosure.
d) Re-fitting is the reverse of removal (ensuring that earth connections are re-instated correctly).

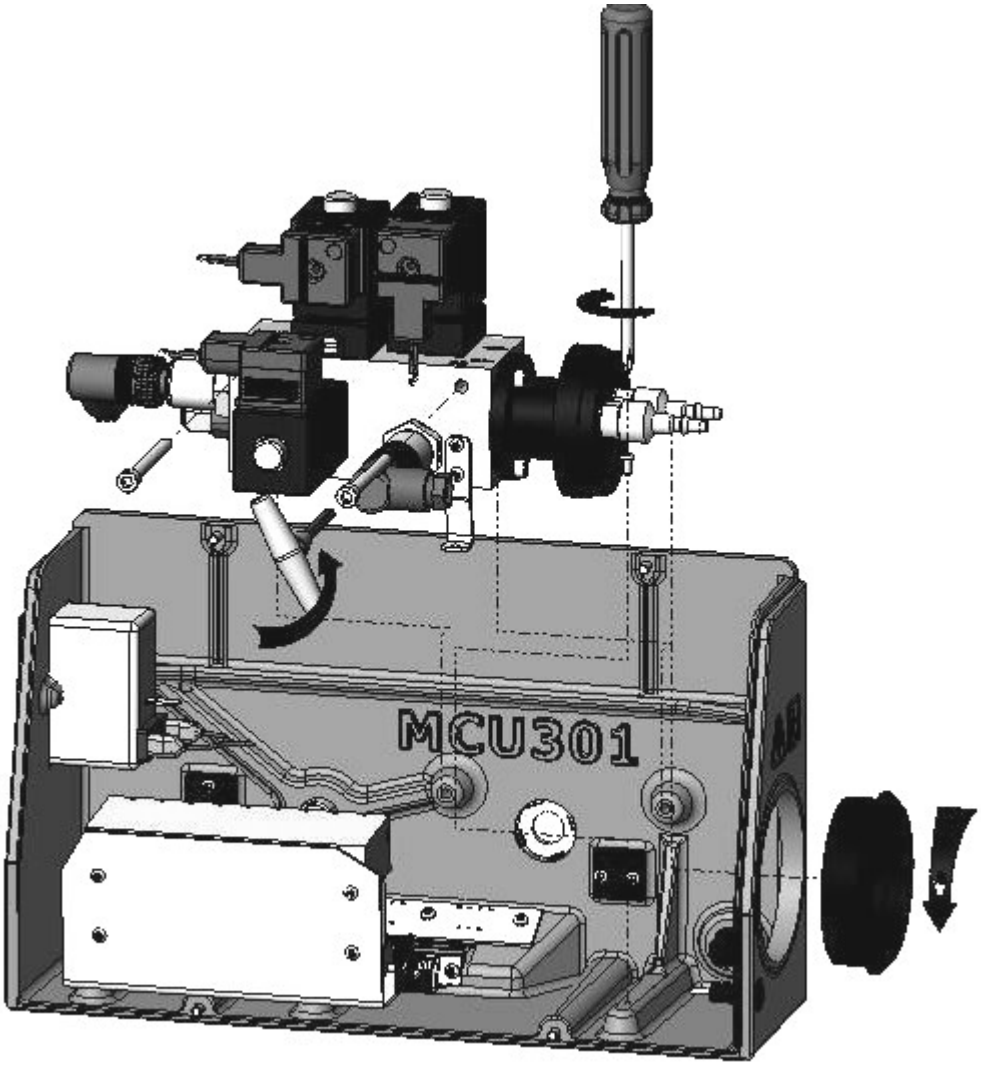


4. Pneumatic System

Pneumatic Module Sub-assembly

The complete pneumatic module sub-assembly can be removed as follows.

a) Loosen and remove the bezel from the probe connector.
b) Push back the collar and remove the flexible exhaust connection from the module.
c) Remove the pneumatic module support bracket.
d) Carefully remove the cap-head screws that secure the module to the rear enclosure.
e) Withdraw the pneumatic module from the enclosure.
f) Re-fitting is the reverse of removal.



Replacing the Inlet Filter

The inlet filter is included to prevent any minute particulate debris from entering the pneumatic system. This component should be inspected and replaced as part of the routine maintenance schedule.

The inlet filter is situated within the manifold block. It can be accessed by removing the inlet adapter (refer to GA in Appendix 2). Once the adapter has been removed, the filter can be unscrewed using a flat bladed screwdriver. Re-fitting is the reverse of removal. A new ‘Dowty’ seal should be fitted when the inlet adapter is replaced.

Solenoid Valves

Should the need arise, solenoid valves can be replaced without removing the pneumatic module from the enclosure.

Remove the electrical connector (noting orientation) by undoing the central retaining screw. Remove the solenoid valve coil (noting orientation). Remove the 2 countersunk fixing screws. The solenoid valve can now be removed. Care must taken to note the orientation of the valve as they have an arrow on the body denoting the direction of flow. Re-fitting is the reverse of removal taking care to install the valve in the correct orientation (refer to GA in Appendix 2).

5. Electronic System

Footswitch

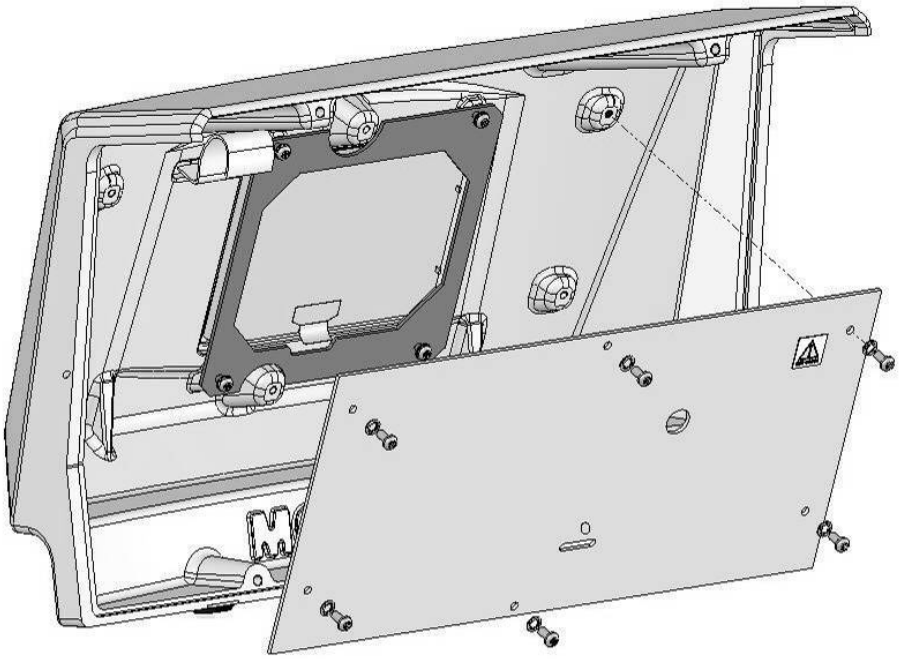
The footswitch is connected to the Cryomatic at the rear of the console. The footswitch is not a serviceable item and if it is faulty then it should be returned to the manufacturer for replacement.

Controller PCB Assembly

Observe proper precautions for the prevention of damage to static sensitive devices.

The Controller PCB Assembly can be removed in the following manner.

a) Unlatch the connection for the LCD panel in position CN1. Carefully withdraw the flexible cable assembly.
b) Unplug the front panel membrane connector in position CN13.
c) Remove the 6 pozi pan-head screws that secure the PCB to the enclosure (being careful to retain all washers).
d) Withdraw the PCB from the enclosure.
e) Re-fitting is the reverse of removal. Care should be taken when re-connecting the LCD flexible cable assembly as this is easily damaged. Ensure that the latch is closed properly.

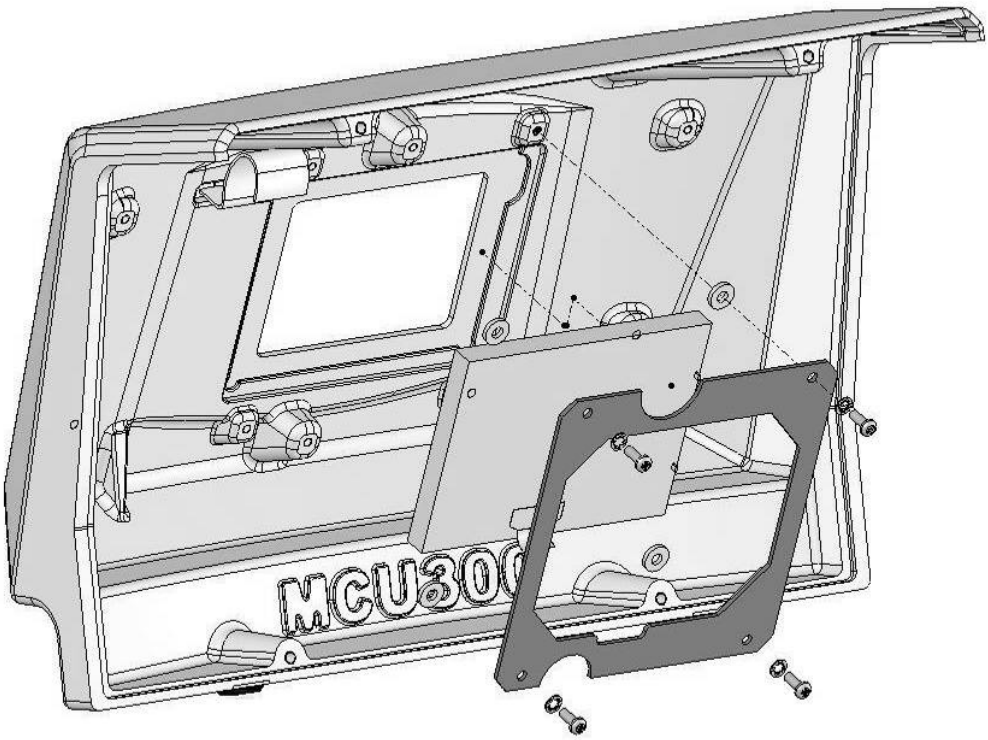


LCD Panel

Observe proper precautions for the prevention of damage to static sensitive devices.

It is unlikely that the LCD panel will fail but should the need arise, the LCD panel can be removed in the following manner.

a) Remove the Controller PCB Assembly (see previous section).
b) Remove 4 pan-head screws which secure the LCD retaining bracket. Ensure that the 4 spacers are retained.
c) Carefully remove the LCD Panel.
d) Re-fitting is the reverse of removal – ensure that the panel is centred correctly before finally tightening the retaining bracket.

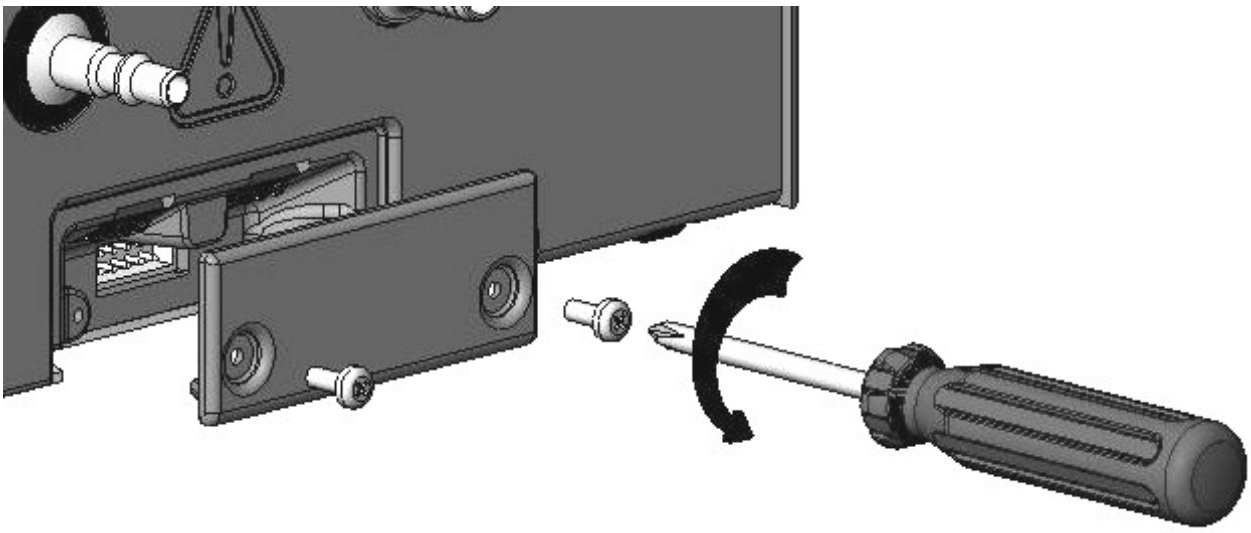


6. Firmware Upgrades

Firmware upgrades can easily be performed using the In System Programming (ISP) facility which is incorporated in the Cryomatic.

Programming Adaptor

A special programming adaptor is required to connect a PC or laptop to the Cryomatic. This can be obtained from the manufacturer. The programming port is accessed at the rear of the equipment and is located behind a small removable cover.



Download Utility ('FLIP')

The 'FLIP' programming application from Atmel is available as shareware. This is available as a free download from the Atmel website or alternatively a copy can be obtained from the manufacturer. This application software is required to control the communication between the PC/laptop and the Cryomatic.

The software can be downloaded by the using the following link:
http://www.atmel.com/dyn/products/tools_card.asp?tool_id=2767

ISP Procedure

The exact procedure may vary slightly depending on the version of 'FLIP' that is being used.

The following procedure should be followed when performing a firmware upgrade in the field.

a) The Cryomatic should be powered up.
b) Launch the FLIP application.
c) Press **F2** for Device Selection. Select **T89C51AC2** from the list then select **OK**.
d) Connect the ribbon cable connector into the ISP programming port on the Cryomatic.
e) Press **F3** for Communication Settings. If using the computers serial port select **COM1** and **19200** baud from the drop down lists. Check the **manual sync** box.
f) **OR** if using the **USB** adapter, select **COM3** and **19200** baud from the drop down lists. Check the **manual sync** box.
g) Press **Connect** then press the reset button on the ISP adapter. Press the **Sync** button (the system will respond by automatically filling in the device information).
h) Select the **Device** drop down menu and select **Erase**.
i) On the Erase dialogue box select **Full Chip Erase** and press **Erase**. Wait until this action has been completed.
j) On the **File** drop down menu select **Load Hex**. Use the browser to select the appropriate file and select **Open** to load the program into the buffer. Wait until this action has been completed.
k) Select the **Device** drop down menu and select **Program**.
l) When this has completed remove the ribbon cable connector from the ISP header port on the target system.
m) If accessible press the reset button on the target system to start the application, alternatively turn the machine off at the main switch and then back on again.

Occasionally, as with any RS232 communication system, the data transfer fails. A time-out message usually results. If any operation fails, simply try again until proper communication is established. Consult the FLIP User Manual if problems persist.

7. Faultfinding Chart

Problem/Fault		Possible Cause		Corrective Action	Section
1	system does not power up	a	mains fuse in plug blown	replace with correct rating and type	
		b	inlet fuse(s)	replace with correct rating and type	3
		c	mains inlet module faulty	check for mains voltage on output terminals – replace if necessary	3
		d	power supply faulty	Check for correct voltages on output connector – replace if necessary	3
2	system appears to power up but LCD screen is blank	a	contrast setting incorrect	adjust contrast level to correct setting	5
		b	LCD module faulty	check that LCD flat ribbon is connected properly – replace if necessary	5
3	system appears to power up but nothing happens	a	firmware corrupted	re-install firmware	6
		b	faulty controller PCB	replace controller PCB	5
4	no gas supply indicated on LCD screen	a	gas cylinder not connected or valve not open	connect cylinder and open valves	
		b	insufficient cylinder pressure	replace cylinder	
		c	inlet filter clogged	replace inlet filter	4
		d	faulty pressure sensor	replace pneumatic module	4
5	system will not recognise probe	a	faulty memory IC in probe coupling	replace/re-program	
		b	possible damage to electrical contacts of console or probe - dirty or oxidised probe contacts	inspect contacts and clean carefully if necessary	
6	probe does not freeze properly (low or zero flow)	a	residual moisture in probe following sterilisation	re-purge probe	
		b	probe blocked with particulate matter	replace/repair probe	
		c	gas supply insufficient	check cylinder, connection and valve – replace cylinder if necessary	
		d	faulty/blocked control valve	replace pneumatic module	4
		e	exhaust hose is blocked or occluded.	check the exhaust hose for blockages or occlusions - replace if necessary	
		f	faulty pressure sensor	replace pneumatic module	4
		g	faulty controller PCB	replace controller PCB	5
7	probe defrosts slowly	a	probe fault – possible internal leak	replace probe	
		b	faulty/leaking control valve	replace valve or pneumatic module	4
		c	leak internal to console	check for internal gas leaks – repair leak(s) or replace pneumatic module	4
8	excessive flow rate from exhaust	a	faulty/leaking control valve	replace valve or pneumatic module	4
9	gas leaks from coupling when probe is disconnected	a	faulty ‘o’ rings in QR connectors	replace pneumatic module	4
10	mute control does not function	a	faulty membrane label	replace enclosure front	2

8. Spare Parts Listing

The following spare parts are available from the distributor.

Description	*Part Number*
Controller PCB Assembly	KCU050
Pneumatic Module Assembly	MCU051
Power Supply Assembly	MCU054
High Pressure Hose Assembly	MCU065
Mains Inlet	CST261
Case Front Assembly	MCU068
Case Rear	MCU301
Cover Plate	MCU302
LCD Panel	MCU204
Solenoid Valve N/C 0.8mm Orifice 24V/10W	MCU205
Solenoid Valve N/O 0.5mm Orifice 24V/14.5W	MCU206
Footswitch Assembly	MCU217
2A Anti-surge Fuse	MIS094
Rubber Foot	MCU213
1/8” Dowty Seal	FAS014
Inlet Filter	MCU219
M4 x 10 Tamperproof Pan-head Screw	FAS055
M3 x 16 Pozi Countersunk Screw	FAS044
M3 x 6 Pozi Pan-head Screw	FAS031
M3 x 8 Pozi Pan-head Screw	FAS054
M3 Shake-proof Washer	FAS033
M3 Plain Washer	FAS032
Mains Cord	various
Exhaust Hose (5m)	CST267
Exhaust Silencer	MIS104
Cryomatic Console Carton	PKG015
Cryomatic Probe Carton	PKG004/S
Cryomatic Instructions For Use	KCU400
Cryomatic Service Manual	KCU401
Programming Adapter	

9. Warranty

The Cryomatic and its components are covered by warranty that they meet their performance standards and are free from any defects in materials or workmanship. Within 12 months from delivery by Keeler, the manufacturer shall at no charge to the customer, upon written notice from the customer, repair or replace any components which are defective in material or workmanship.

The customer agrees that it shall have no remedy in the event of any breach of the foregoing warranty other than as provided above. This warranty is exclusive and in lieu of all other warranties, expressed or implied, and all implied warranties of merchantability or fitness for a particular purpose are expressly disclaimed.

The obligations of the manufacturer as set forth in this warranty are expressly conditioned on the following:-

(i) No alterations or repairs of any malfunction of the system shall be made to the system except by the manufacturer or his authorized representative, without the prior written approval of the manufacturer or his authorized representative (and in no case will the manufacturer assume responsibility for repairs or alterations made by those other than the manufacturer or his authorized representative).

And

(ii) The customer shall give notice to the manufacturer or their authorized representative of any malfunction of the system and shall not use the system in any surgical operation after they are aware of any malfunction.

(iii) The customer complies with manufacturer's recommended Preventative Maintenance (see Section 8) and can provide proof of such action.

10. Disposal

Ensure that this equipment is disposed of in accordance with local regulations. Please contact the supplier if in doubt.

11. Technical Data

Cryogenic System

Gas Specification:	Medical Grade Nitrous Oxide (N_2O) or Carbon Dioxide (CO_2) in non-syphon cylinders.
Operating Pressure Range:	3100 – 5860 kPa (450 – 850 PSI)
Maximum Pressure	8275 kPa (1200 PSI)
Freeze Control	Footswitch (press to freeze, release to defrost)

Electrical Ratings

Input Voltage Range:	110-240Vac (50/60Hz)
Power Rating:	100VA
Fuses:	T2AH 250V

Dimensions

Width:	305mm (12”)
Depth:	200mm (8”)
Height:	190mm (7.5”)
Weight:	2.5kg (6lbs)

Classification & Safety Standards

Complies with:	EN60601-1, UL60601-1 & CAN/CSA-C22.2 No 601.1
Equipment Classification:	Class 1, Type BF (Applied Part)
Mode of operation:	Continuous
Protection against ingress:	Console IPx0 Footswitch IP68

Environmental Conditions

	Storage	Operating
Temperature Range	-20°C to +50°C	+10°C to +40°C
Relative Humidity	10% to 80%	30% to 70%
Atmospheric Pressure	500hPa to 1060hPa	700hPa to 1060hPa

Symbols used on the equipment

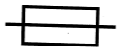
All symbols used are in accordance with BS EN60417-2:1999 (Graphical Symbols for use on Equipment).


BF (Applied Part)

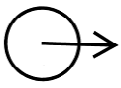

Refer to the User Manual

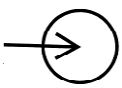

Dangerous voltages present inside the equipment


AC voltage input

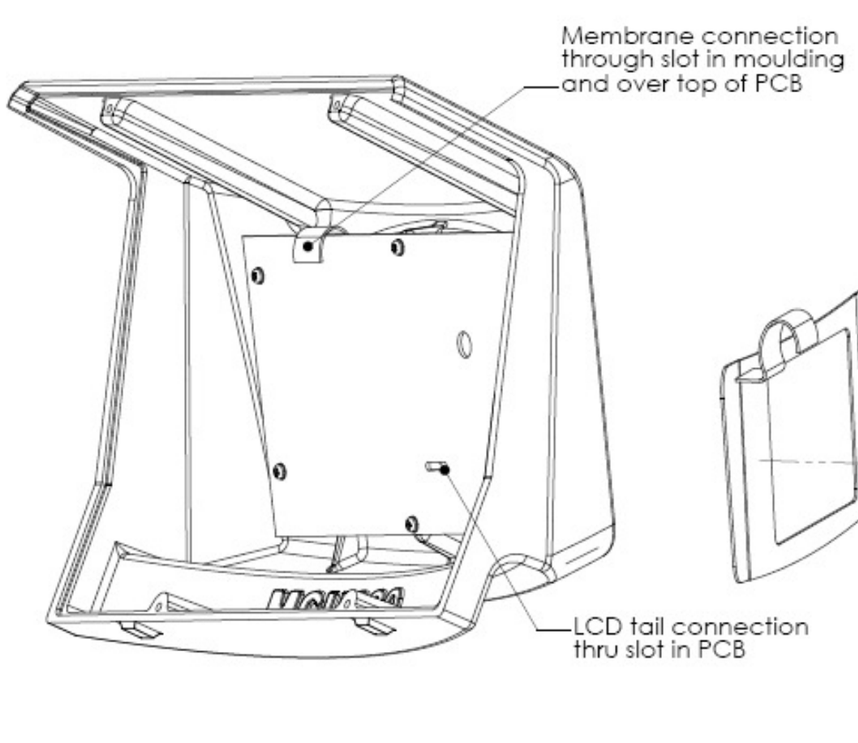

Fuse rating

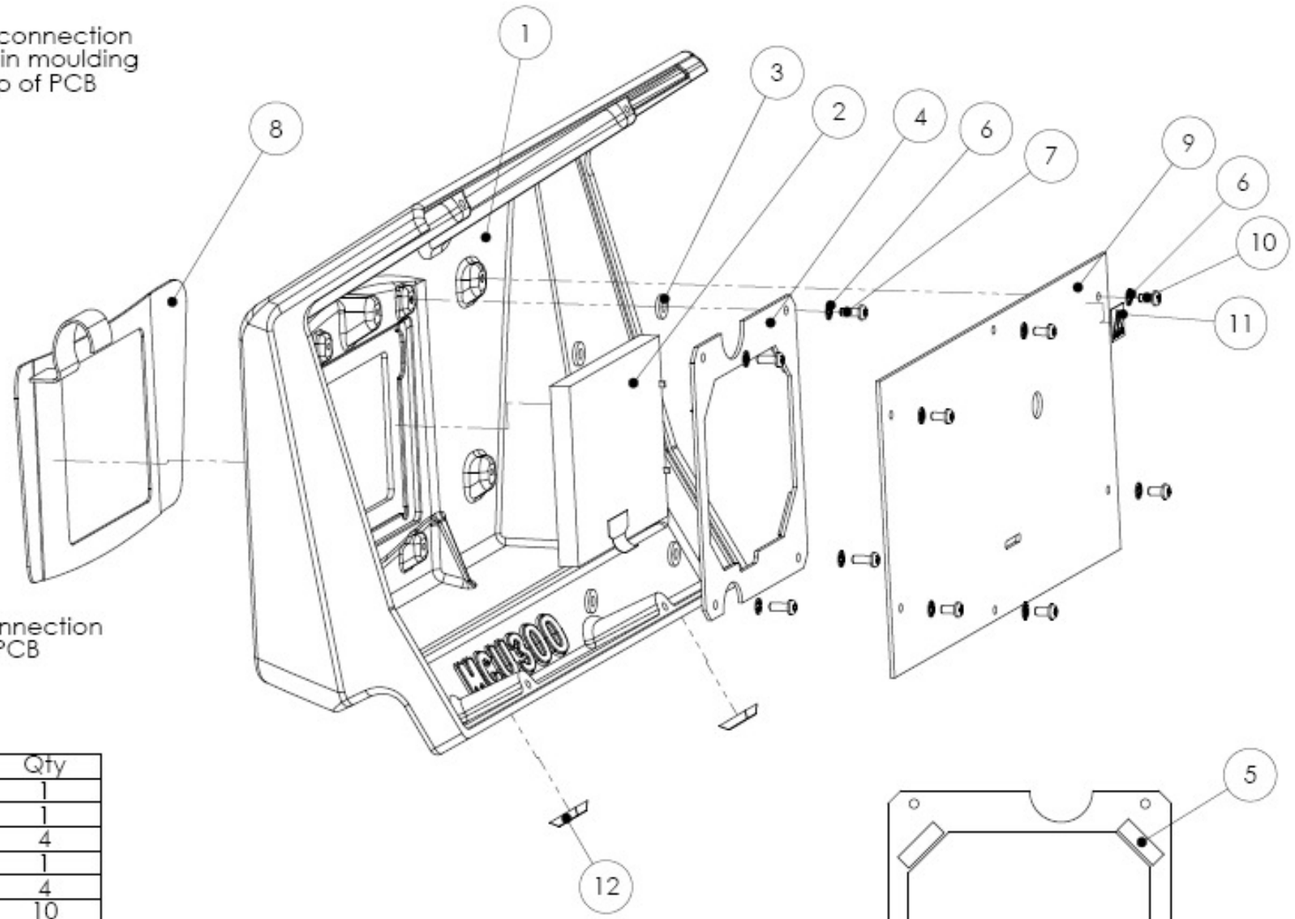

Footswitch connection


Exhaust connection

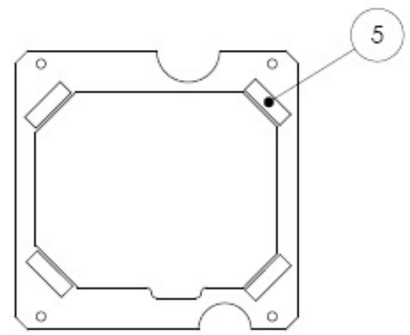

Gas inlet connection

Appendix 1 – Console General Arrangement





Item	Part Number	Description	Qty
1	MCU330/2	Enclosure Front (Silver)	1
2	MCU204	QVGA LCD Module	1
3	MCU331	LCD Spacer	4
4	MCU327	LCD Retaining Plate	1
5	RP99-99253	Foam Pad (19x6x3)	4
6	FAS033	M3 Shakeproof Washer S/S	10
7	FAS053	M3 x 8 Pozi Panhead Screw S/S	4
8	KCU203	Cryomatic Membrane Label	1
9	MCU052/2	Controller PCB Assembly	1
10	FAS054	M3 x 6 Pozi Panhead Screw S/S	6
11	EP39-49888	IEC60348 Warning Label	1
12	MCU213	Rubber Foot	2



View on rear of LCD Retaining Plate showing approximate position and orientation of Foam Pads

Apply Foam Pads to LCD Retaining Plate prior to assembly into the moulding

Zone	Issue	Description	Date	CR
	3	LCD and retainer amended & general simplification	15/02/11	10024
	2	PCB warning label added & V3 coil orientation amended	14/07/10	10022
	1	First issued	31/03/08	

3rd Angle Projection | dims in mm

Material:

Tolerance: X.X +/-0.2, X.XX+/-0.1, ANG +/-0.5 deg

Size: A4

Finish: clean

Machining: 1.6

Scale: 1:2

Nu Perspectives Limited
Tel/Fax 01962 761080
www.nu-perspectives.co.uk

Keeler Cryomatic Console

DRWN	APRD		sheet
GC		KCU051	1 of 3

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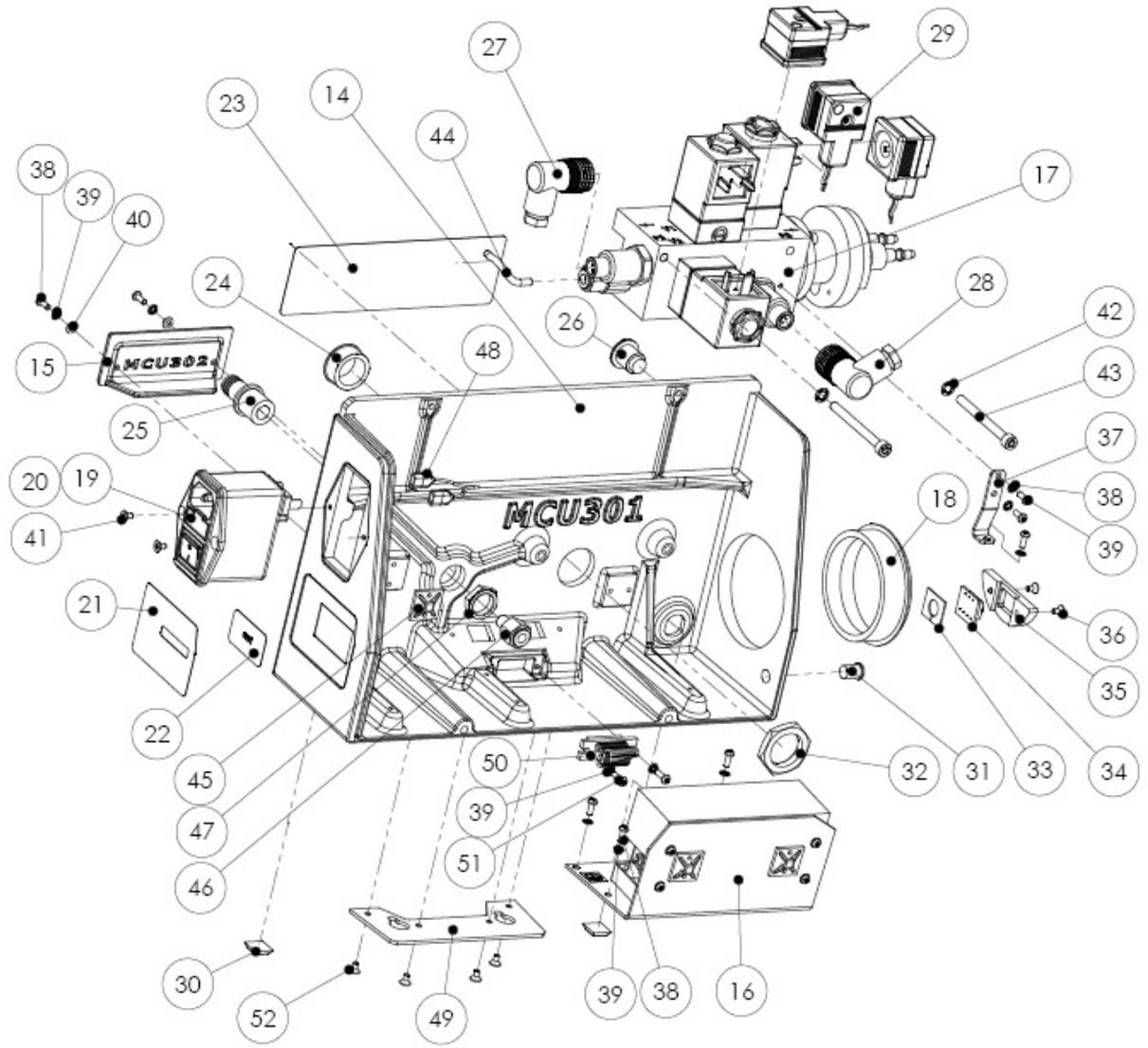
Item	Part No.	Description	Qty
14	MCU301	Enclosure Rear	1
15	MCU302	Cover Plate	1
16	MCU054	PSU Sub-assembly	1
17	MCU051	Pneumatic Module	1
18	MCU322	Coupling Bezel	MCU051
19	CST261	Switched Fused Inlet	1
20	MIS094	2A Anti-surge Fuse	2
21	KCU200	Rating Label	1
22	MIS099	Serial Number Label	1
23	KCU201	Rear Label	1
24	MCU325	Input Dress Collar	1
25	MCU313	Exhaust Hosetail	1
26	MCU059	Footswitch Loom	1
27	MCU063/1	P2 Sensor Loom	1
28	MCU063/2	P3 Sensor Loom	1
29	MCU064	Solenoid Loom	1
30	MCU213	Rubber Foot	2
31	MIS098	Blanking Plug	1
32	MCU326	Dress Collar Nut	1
33	MCU350	Gasket	1
34	MCU066	Probe Contact Loom	1
35	CST264	Retaining Plate	MCU051
36	FAS040	M3x10 Csk Pozi Screw S/S	MCU051
37	MCU323	Support Bracket	1
38	FAS054	M3x8 Pozi Panhead Screw S/S	8
39	MCU033	M3 Shakeproof Washer S/S	10
40	FAS032	M3 Plain Washer S/S	2
41	FAS040	M3x10 Csk Pozi Screw S/S	2
42	FAS042	M5 Spring Washer S/S	2
43	FAS058	M5x60 Caphead Screw S/S	2
44	MCU215	PU Tube, 4mm	0.06
45	MIS061	Tie Wrap Base	1
46	MCU214	1/8BSP-4mm Push-In Stud Conn.	1
47	MCU329	Exhaust Locking Nut	1
48	MCU055	Mains Input Loom	1
49	MCU312	Key Plate	1
50	MCU061	Programming Port Loom	1
51	FAS038	M3x10 Pozi Panhead Screw S/S	2
52	FAS031	M3x6 Csk Pozi Screw S/S	4



Zone	Issue	Description	Date	CR
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3rd Angle Projection | dims in mm

Material:

Tolerance: X.X +/-0.2, X.XX+/-0.1, ANG +/-0.5 deg

Size: A4

Finish: clean

Machining: 1.6

Scale: 1:3

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Keeler Cryomatic Console

DRWN	APRD	KCU051	sheet
GC			2 of 3

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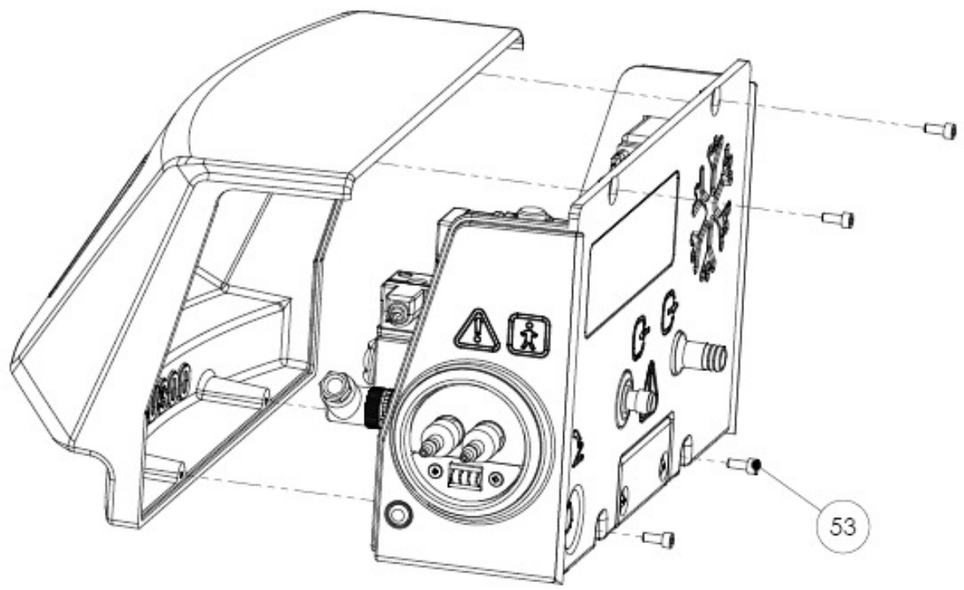

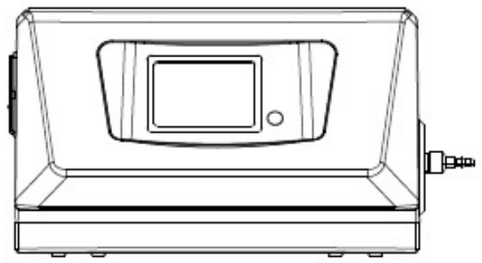

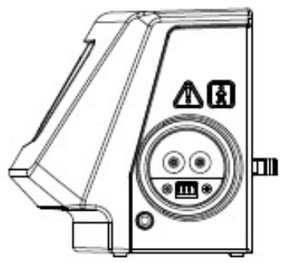

Item	Part No.	Description	Qty
53	FAS055	M4x10 Button Head Screw S/S	4

Wiring Connections Between Front & Rear Assemblies		
Description		PCB Connector
MCU061	Programming Port Loom	CN5
MCU059	Footswitch Loom	CN7
MCU063/1	P2 Sensor Loom	CN2
MCU063/2	P3 Sensor Loom	CN10
MCU062	SMPS Output Loom	CN3
MCU064	Solenoid Loom	CN4
MCU066	Probe Contact Loom	CN8

Zone	Issue	Description	Date	CR
	3	LCD and retainer amended & general simplification	15/02/11	10024
	2	PCB warning label added & V3 orientation amended	14/07/10	10022
	1	First issued	31/03/08	

3rd Angle Projection | dims in mm

Material:

Tolerance: X.X +/-0.2, X.XX+/-0.1, ANG +/-0.5 deg

Size: A4

Finish: clean

Machining: 1.6

Scale: 1:2.5

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Keeler Cryomatic Console

DRWN	APRD		sheet
GC		KCU051	3 of 3

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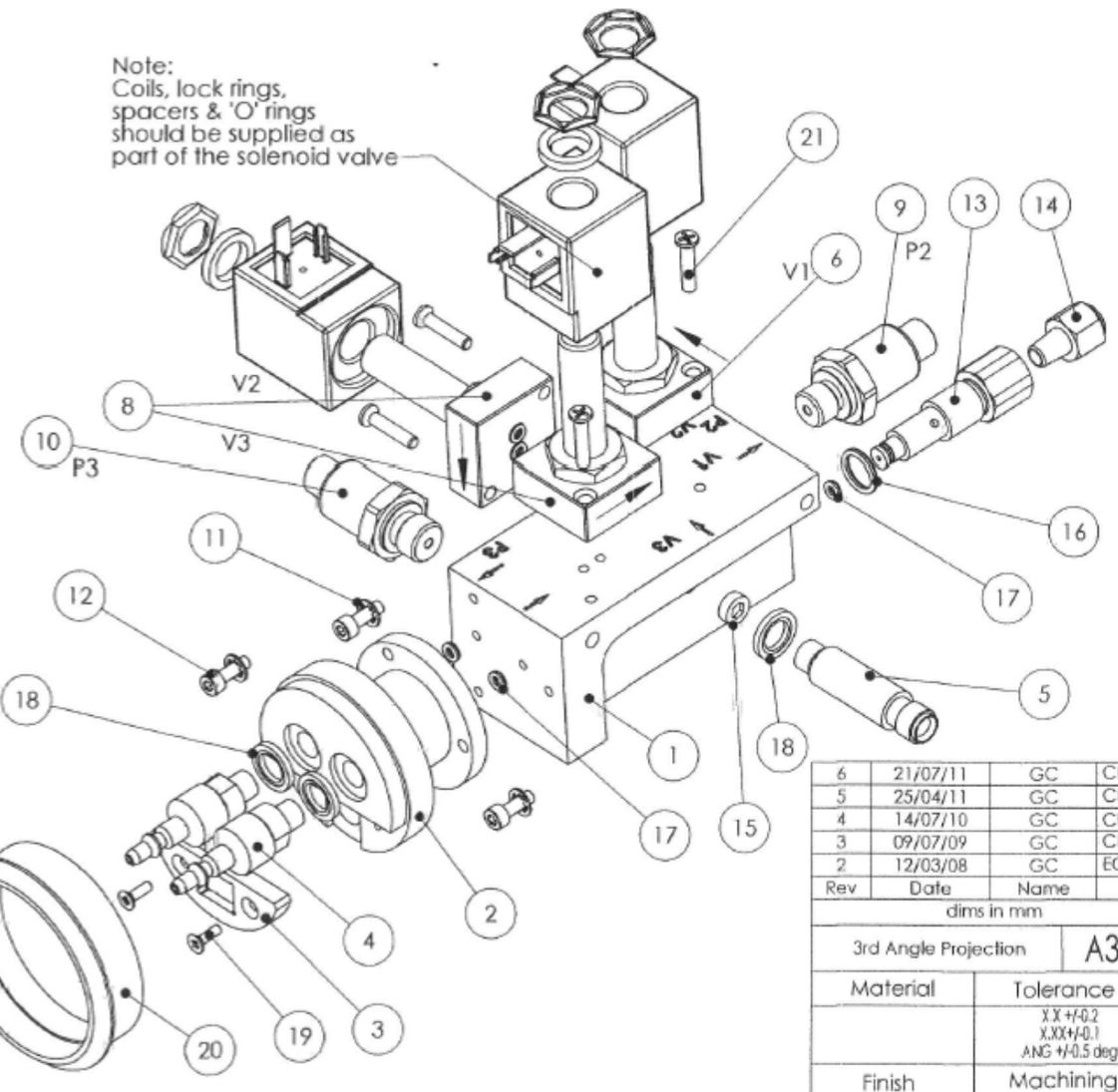
Appendix 2 – Pneumatic Module General Arrangement

1. Ensure that items 1 & 2 are clean and free from contamination before commencing assembly.
2. Ensure that 2 'O' rings are in place on underside of items 6, 7 & 8 before securing to manifold.
3. Ensure that orientation of all solenoid valves is correct (as indicated by arrows).
4. Items 5,9 and 10 should be tightened to a torque of 27 N-m.
5. Items 4 should be tightened to a torque of 1.7 N-m.
6. Items 3, 19 & 20 shown for reference only as they are fitted at a later assembly stage.
7. No thread sealants should be used during the assembly process.



ITEM	PART NO	DESCRIPTION	QTY
1	MCU308	Pneumatic Manifold	1
2	MCU314	Coupling Interface	1
3	CST264	Retaining Plate	1
4	CST258	3mm 1/8 BSPM Valved Plug	2
5	MCU315	Inlet Adapter	1
6	MCU205	Solenoid Valve, N/C 0.8mm, 24VDC/10W	1
8	KCU204	Solenoid Valve, N/O 1.0mm, 24VDC/14W	2
9	MCU220	Pressure Transducer, 100Barg	1
10	MCU221	Pressure Transducer, 16 Barg	1
11	FAS056	Shakeproof Washer, ST. Stl. M4	3
12	FAS052	Caphead Screw, St. Stl. M4 x 12	3
13	MCU324	Exhaust Stem	1
14	MCU214	Push-in Stud Connector, 1/8 BSPP x 4mm	1
15	MCU219	Sintered Filter, 1/8 BSP	1
16	MIS084	'O' Ring, NBR 70 Shore, 10.82 x 1.78	1
17	MIS025	'O' Ring, NBR 70 Shore, 3.5 x 1.5	3
18	FAS014	Bonded Seal, 1/8"	3
19	FAS040	Pozi Csk. Screw, St. Stl. M3x10	2
20	MCU322	Couping Interface Bezel	1
21	FAS098	Screw, Pozi Csk, St/Stl, M4 x 20	6

Rev	Date	Name	Description
6	21/07/11	GC	CR10032 - V2 specification changed
5	25/04/11	GC	CR10029 - valve fixings separated on BOM
4	14/07/10	GC	CR10022 - orientation of V3 coil amended.
3	09/07/09	GC	CR10014 - Recessed feature on MCU314 added pictorially.
2	12/03/08	GC	ECN030 (General update for drawing)

dims in mm | 3rd Angle Projection | A3

Material | Tolerance: X.X +/-0.2, X.XX+/-0.1, ANG +/-0.5 deg

Finish: clean | Machining: 1.6

Cryogenic Technology Limited

Pneumatic Module Assembly | Sht 1 OF 1

Dwn.	Date	Ckd.	App.	Scale	Drawing No.	Iss.
NB	18-11-04			N/A	MCU051	6

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