MICHELL Instruments

PCR
Portable Calibration Rig
User's Manual

97326 Issue 2
April 2017

Please fill out the form(s) below for each instrument that has been purchased.

Use this information when contacting Michell Instruments for service purposes.

Instrument	
Code	
Serial Number	
Invoice Date	
Location of Instrument	
Tag No	

Instrument	
Code	
Serial Number	
Invoice Date	
Location of Instrument	
Tag No	

Instrument	
Code	
Serial Number	
Invoice Date	
Location of Instrument	
Tag No	

Portable Calibration Rig

For Michell Instruments' contact information please go to
www.michell.com

Contents

Figures

Tables

Appendices

Safety

Michell Instruments has designed this equipment to be safe when operated using the procedures detailed in this manual. The user must not use this equipment for any other purpose than that stated. Do not apply values greater than the maximum value stated.

This manual contains operating and safety instructions, which must be followed to ensure the safe operation and to maintain the equipment in a safe condition. The safety instructions are either warnings or cautions issued to protect the user and the equipment from injury or damage. Use qualified personnel and good engineering practice for all procedures in this manual.

Manual Handling

The PCR weighs approximately 23kgs (50lbs). Personnel must observe suitable lifting and handling precautions.

Electrical Safety

The instrument is designed to be completely safe when used with options and accessories supplied by the manufacturer for use with the instrument. The input power supply voltage limit is 15 V DC from a mains powered adaptor.

Pressure Safety

DO NOT permit pressures greater than the safe working pressure to be applied to the instrument. The specified safe working pressure is 3 barg (43.5 psig).

Toxic Materials

The use of hazardous materials in the construction of this instrument has been minimized. During normal operation it is not possible for the user to come into contact with any hazardous substance which might be employed in the construction of the instrument. Care should, however, be exercised during maintenance and the disposal of certain parts.

Repair and Maintenance

The instrument must be maintained either by the manufacturer or an accredited service agent. Refer to www.michell.com for details of Michell Instruments' worldwide offices contact information.

Calibration

The recommended calibration interval for the PCR is 12 to 18 months, unless otherwise specified by Michell Instruments Ltd. The instrument should be returned to the manufacturer, Michell Instruments for re-calibration (go to www.michell.com for contact information).

Safety Conformity

This product meets the essential protection requirements of the relevant EU directives.

Abbreviations

The following abbreviations are used in this manual:

DC	direct current
barg	pressure unit (=100 kP or 0.987 atm) gauge
°C	degrees Celsius
°F	degrees Fahrenheit
MFC	Mass Flow Controller
l/min	normal liters per minute
lb	pound
PCR	Portable Calibration Rig
psig	pound(s) per square inch gauge
V	Volts

Warnings

The following general warnings listed below are applicable to this instrument. They are repeated in the text in the appropriate locations.

Where this hazard warning symbol appears in the following sections, it is used to indicate areas where potentially hazardous operations need to be carried out.

1 INTRODUCTION

Gas analyzers require regular calibration (adjustment) to negate any drift from the factory calibration that will occur over time. Process analyzer users may not want to return their analyzers to Michell Instruments for major overhauls as this could lead to several weeks without a critical measurement.

The PCR has been primarily designed to allow our subsidiary offices and field service engineers to carry out calibrations or 'factory' calibrations on most analyzers in the country of operation. The unit is designed for use in Safe Areas only, so, unless a Hot Work Permit is granted, the PCR will have to be operated in the site's laboratory or workshop.

Read this manual carefully before operating the PCR as the blending of gases could lead to explosive or toxic mixtures.

2 INSTALLATION

The PCR is housed in a rugged flight case

Exterior dimensions are 62.4 x 49.8 x 29.7cm (24.5 x 19.6 x 11.6")

The PCR weighs approximately 23kgs (50lbs)

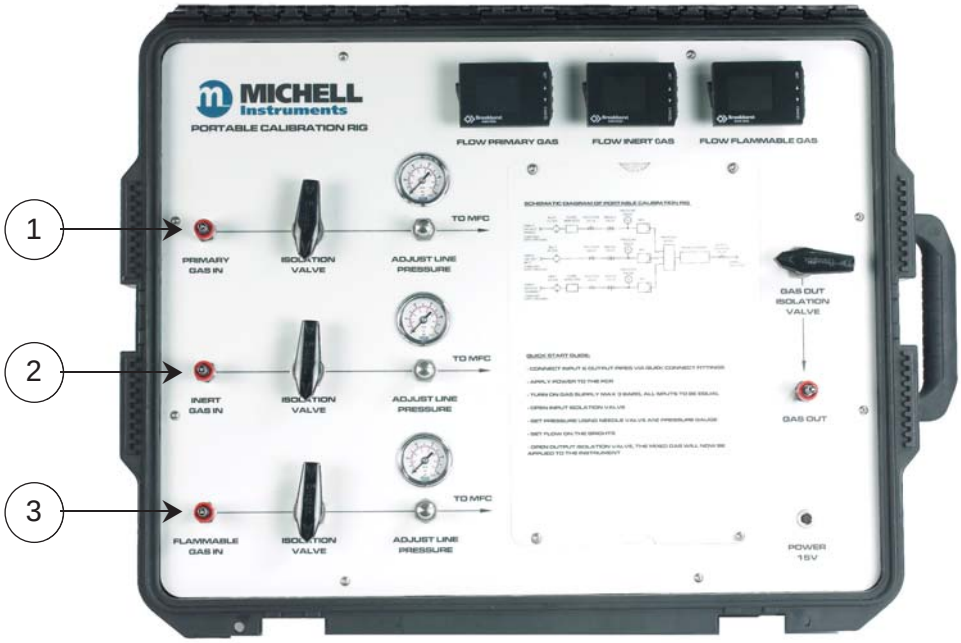

Figure 1 *PCR Faceplate*

There are three gas inlets for

1. Primary Gas (Air CO_2 or O_2)
2. Blend 1 (N_2 CO_2 CH_4 or H_2)
3. Blend 2 (N_2 CO_2 CH_4 or H_2)

Each stream is equipped with a mass flow controller (MFC). These MFC's are programmed with the above gases which may be selected by the user at any time. Unless otherwise requested, the unit will be supplied with MFC's set to Air, N_2 and CO_2.

The schematic printed on the face of the PCR is shown below:

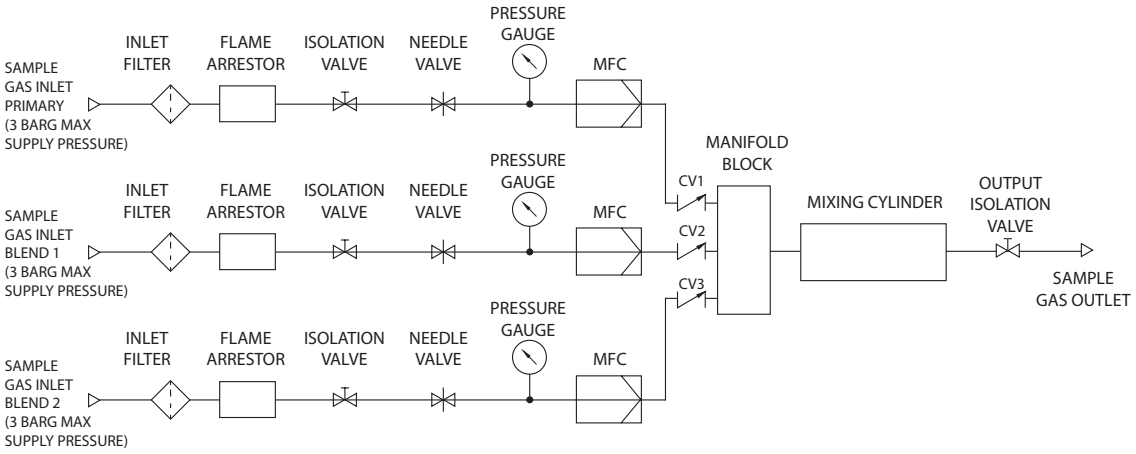

Figure 2 *PCR Schematic*

Each gas stream consists of the following:

1. Quick-connect fitting on the gas inlet
2. Inlet filter
3. Isolation valve
4. Pressure gauge and needle valve
5. Mass flow controller (MFC)
6. Inlet to manifold block

All three inlets have a flame arrestor, for added protection, just after the inlet filter.

After the manifold block there is a mixing cylinder, an outlet isolation valve and a quick-connect fitting on the sample outlet.

Each of the MFC's has a BRIGHT Controller to set the flow of gas on each stream.

The unit has a 15 V DC input to power the MFCs. A universal power supply is included.

Four quick connect adaptors are supplied, two of which are cleaned for oxygen use. The oxygen-cleaned connectors should be used on the **PRIMARY GAS IN** and **GAS OUT** quick-connect fittings.

For operator and plant safety

Never use the PRIMARY GAS IN channel for flammable gases and never use the BLEND 1 or 2 channels for oxygen!

Always purge the BLEND 1 and 2 channels with inert gas prior to, and after using, flammable or toxic gases.

The PRIMARY GAS IN channel should always be purged with an inert gas or air if enriched oxygen has been used.

Inlet pressure should be set to 3 barg (43.5 psig) maximum. Ensure a suitable cylinder regulator is fitted.

If flammable or toxic gases are used, ensure the outlet is connected to a safe vent.

Pressure relief is advisable on the inlet pipes.

Bottle regulators with built-in pressure relief valves are recommended. The inlet pressure must not exceed 3 barg (43.5 psig) and the whole system must be drained, BEFORE the quick-connect hoses are removed, to avoid damage or injury.

3 OPERATION

Ensure the isolation valves are closed and all pressure regulators are wound completely out before connecting the calibration gases.

Connect the appropriate gas cylinders to the correct channels using 6mm stainless steel tube (O_2 cleaned) or one of the hoses recommended by Michell Instruments - part number PCR-BH / Swagelok® NLDND_2346-1. Quick connect part numbers are as follows:

O_2 cleaned PCR-QC / Swagelok® SS-QC4-B-6MØ-SC11

Standard PCR-QCO2 / Swagelok® SS-QC4-B-6MØ

Set the outlet pressure on the calibration cylinder regulators to 3 barg (43.5 psig) maximum.

Plug in the power supply for the PCR.

The BRIGHT Controllers and the MFC's require a 30 minute warm-up time.

3.1 Pressure Test

The PCR should be tested prior to use to ensure that no leaks have been introduced during transport.

1. Connect the 6mm pipe connection from a nitrogen or air line to the inlets of the PCR, via the pressure regulator. Test **PRIMARY GAS IN** first.
2. Connect the output of the PCR to a suitable vent line. Use the 6mm tube with the quick connector.
3. Set the **FLOW PRIMARY GAS** BRIGHT Controller (see Section 3.2) so the flow rate (setpoint) through the MFC is 0.4 l/min.
4. Make sure the **ADJUST LINE PRESSURE** needle valve is fully closed.
5. Open the air line and very slowly apply gas pressure until 3 barg (43.5 psig) is indicated on the supply pressure gauge. Allow a few moments for the pressure to settle.
6. Open the inlet **ISOLATION VALVE**.
7. Slowly open the **ADJUST LINE PRESSURE** needle valve until 3 barg (43.5 psig) is displayed on the **ADJUST LINE PRESSURE** gauge.
8. Close the **GAS OUT ISOLATION VALVE**. The gas will now start to fill the mixing cylinder. When the flow on the MFC starts to drop below the set 0.4 l/min close the inlet **ISOLATION VALVE**.
9. The pressure on the **ADJUST LINE PRESSURE** gauge should now indicate 3 barg (43.5 psig). The gas is locked within the primary line.
10. Leave the PCR for a minimum of 1 minute and assess the system for leaks. If leaks are found, slowly de-pressurize the system and solve the leak. Repeat the above steps to re-pressurize the system.

11. If no leak is found, slowly reduce the system pressure and move the input connection pipe to the next inlet.

12. Repeat steps to pressurize the system for the **BLEND 1** and/or the **BLEND 2** lines.

13. If no leak is found, close the air line on the input and vent the complete system.

If an air line is used for the pressure test, ensure the unit is purged with nitrogen (or other inert gas) before using any flammable gases.

Set the MFC to the desired setpoint (flow rate) and alternate gas data by following the instructions in Section 3.2.

3.2 Mass Flow Controller

The only changes that should be made through the Mass Flow Controller are to edit the setpoint (flow rate) or change the Fluid Selection. **NOTE: All other settings should be left as they were set-up in the factory in order for the Portable Calibration Rig to operate correctly.**

The **SET**, ▼, ▲ and **CONTROL** buttons are operated by pushing the buttons located down the right hand side of the BRIGHT Controllers.

3.2.1 Edit Setpoint

The setpoint can only be edited when the setpoint parameter is displayed in custom readout 1 or 2 on the BRIGHT Controllers.

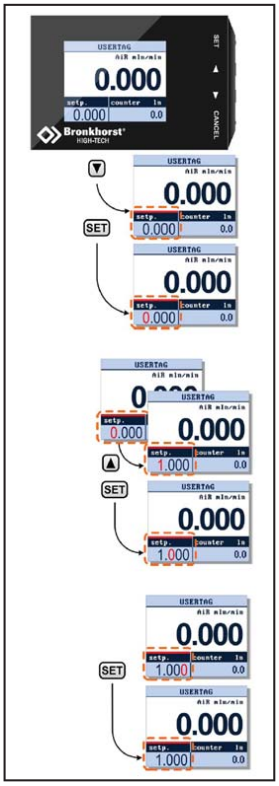

Figure 3 *Edit Setpoint*

Security settings can be set to avoid unauthorized access to the setpoint.

Refer to Section 3.2.2.

1. To edit the setpoint press ▼ from the Main Screen to select the readout area in which this parameter is displayed.
2. Press **SET** to enter the edit mode - the first digit will lighten.
3. Use ▼ or ▲ to change the digits, press **SET** to confirm and select the next digit.
4. After the last digit is confirmed, the setpoint will be sent to the instrument.
5. The **CANCEL** button can be used to exit the edit mode and cancel the changes.

3.2.2 Mass Flow Controller Security Settings

The Security Settings Screen allows the user to define the access to menu items of the BRIGHT Controllers.

For each item the following access modes can be chosen:

Item	Accessibility
enable	Item is accessible without any restrictions
passw	Item is accessible after entering a password
disable	Item is not accessible

Table 1 Menu Item Accessibility

3.2.2.1 Enter the Security Settings Screen

1. From the Main Screen press both ▼ and ▲ for 5 seconds until the **enter password** display appears.

2. The default password is **abc**. The password can consist of a maximum of 8 characters. For less characters press **SET** until the end of the edit field. Refer to Section 3.2.2.2 to change password.

   If you enter a wrong password **invalid password!** will appear.

   If necessary, refer to Section 3.2.2.3 to reset the password to its default value.

When you enter the Security Screen, the following display will appear.

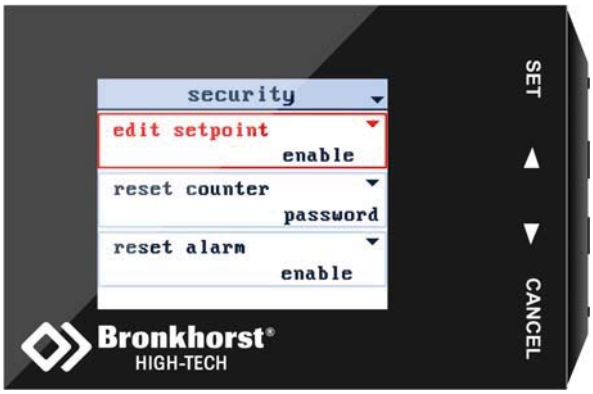

Figure 4 *Security Screen*

▼ or ▲ in the upper right corner indicates that you can scroll this menu using the ▼ and ▲ buttons to select more items.

The following items can be edited:

Item	Description
edit setpoint	Edit mode of the setpoint in both custom readout 1 and 2
reset counter	Counter reset in custom readout 2
reset alarm	Alarm reset displayed in custom readout 2
select instrument	Selecting another instrument on the flowbus
settings menu	Settings Menu
advanced	Advanced Sub Menu in the Settings Menu

Table 2 Security Screen Settings

3.2.2.2 Change Password

1. To change the password, press ▼ until you can select the option **new password** and press **SET**.
2. Press **SET** again to enter the new password edit mode.
3. Enter a maximum of 8 characters. If using less characters, press **SET** until the end of the edit field is reached.
4. After changing the password press ▼ to select **confirm**. Then press **SET**. The new password is now stored and should be used to enter the password protected items.
5. Press any key to return to Security Settings Screen.

3.2.2.3 Reset Password

1. From the Main Screen press both ▼ and ▲ for 5 seconds until the **enter password** display appears.
2. Press both ▼ and ▲ for 5 seconds until the **reset password** display appears.
3. The **reset password** display will show a 10 character long bht key. This is your encrypted password. Send this key to your local agency and they will send you, after validation of your request, a reset key. Enter this 10 character reset key in the reset key field. The password will now be reset to its default value **abc**.

   If you enter the wrong key, **invalid reset key!** will appear.

   Check the key and try again.
4. Press any key to return to the Main Screen

3.2.3 Download Alternate Gas Data

Use the BRIGHT Controllers to set the required gas on each line.

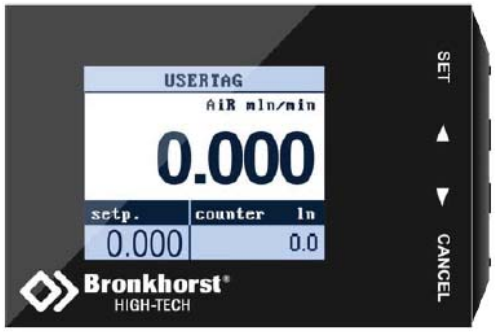

Figure 5 *Main Screen*

1. From the Main Screen press the **SET** button. The Password Screen will be displayed.

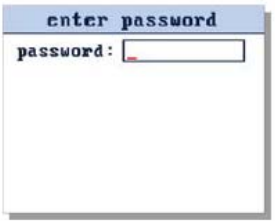

Figure 6 *Password Screen*

2. Enter the password **abc** (or user-specified password) - scroll using ▼ or ▲ and press **SET** to move to the next letter.
3. Once the password is entered press **SET** until the Settings Screen, is shown.

Figure 7 *Settings Screen*

4. With **readout** highlighted, press **SET** to enter the Readout Screen.
5. From the Readout Screen press **SET** to enter the Readout Options Screen.
6. Press ▼ to select **fluid selection** and press **SET** to enter the Fluid Selection Screen.

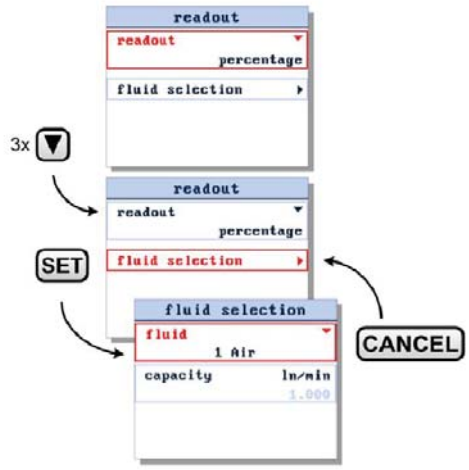

Figure 8 *Readout/Fluid Selection Screen*

7. Press **SET** again to enter the edit mode of the fluid field.
8. Use ▲ or ▼ to select one of the available fluid sets.
9. Press **SET** to confirm.

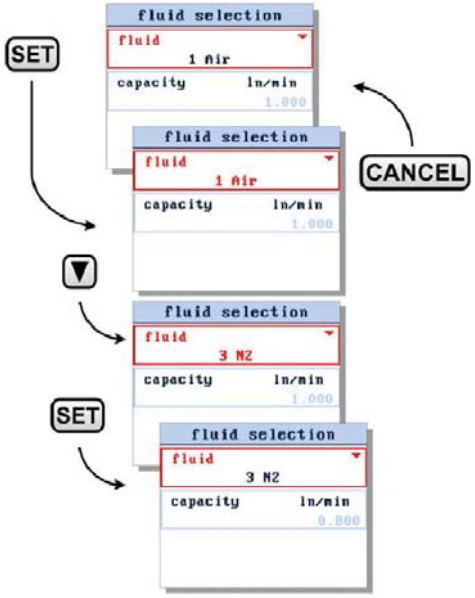

Figure 9 *Fluid Selection*

10. Press **CANCEL** three times to return to the Readout Screen.

3.3 Calibrating an Instrument

1. Open the isolation valves on the streams in use and the outlet isolation valve.
2. Set the pressure gauges equally by opening the regulators and ensure the pressure is the same as the measurement pressure (do not exceed 3 barg (43.5 psig).

   NOTE: The metering valves are sensitive, therefore small adjustments are advised.

3. Set the flow rate on the Blend channels to the desired flow rate (e.g. 300ml). This is effectively the **zero** point.
4. Allow at least 5 minutes for each blend to stabilize and flush through the mixing chamber before calibrating each point on the instrument.

   NOTE: Always pre-set the next flows. Reduce the flow on one before increasing the flow on the others. This will prevent too much flow from cooling the analyzer cell.

5. Pre-set the flow rate of the Primary Gas (e.g. 300ml) and then shut the Zero Isolation Valve just before opening the Primary Gas Valve. This is now the **span** calibration point.
6. If intermediate points or concentrations that require blending are needed, ensure that the total flow of the MFC's is set to the same flow as the **zero** and **span.**

Appendix A

Technical Specifications

Appendix A Technical Specifications

General			
Gases Available *	Air, O_2, N_2, CO_2, CH_4 & H_2		
Flow Rate	30 - 1500 ml/min per MFC		
Blend Time	Allow 5 minutes for each blend to stabilize and flush through the mixing chamber Blend and purge of 1m line achieved in less than 5 minutes		
Ambient Temperature	0 to 45°C (+32 to 113°F)		
Ingress Protection	IP66 with lid closed and locked		
Warm-Up Time	30 minutes		
Dimensions	62.4 x 49.8 x 29.7cm (24.5 x 19.6 x 11.6") (w x h x d) (with lid closed)		
Weight	23kgs (50lbs) approximately		
Pressure	Safe working pressure: 3 barg (43.5 psig)		
Power Supply	15 V DC from a universal power supply		
Gas Connections	QC4 bulkhead stem with shut off - 6mm Primary + O/P SCII cleaned		
Quick Connect Part Numbers	O_2 cleaned	Michell Swagelok®	PCR-QC02 SS-QC4-B-6MØ-SC11
	Standard	Michell Swagelok®	PCR-QC SS-QC4-B-6MØ

* Other gases may be programmed by the user if required.

A.1 Dimensions

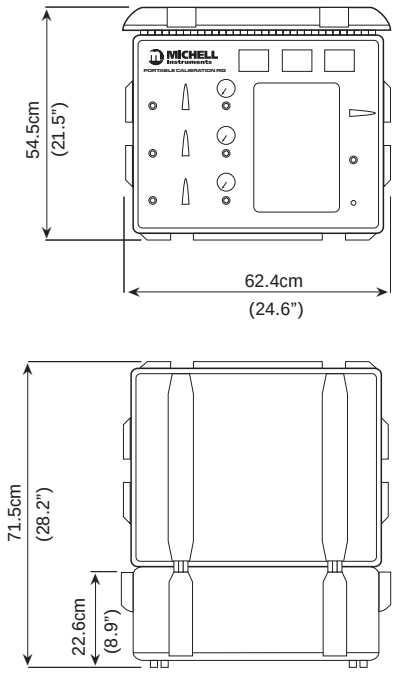

Figure 10 *Dimensions*

A.2 Blend Accuracy

	2 MFC	3 MFC
Total Flow (ml/min)	Blend Accuracy (±)	Blend Accuracy (±)
300	1.10%	1.19%
600	0.78%	0.80%
900	0.68%	0.68%
1200	0.63%	0.63%
1500	0.60%	0.60%
2000	0.57%	0.57%
2500	0.56%	0.56%
3000	0.55%	0.55%
4500	XXX	0.53%

Table 3 Blend Accuracy per Total Flow

NOTE: Sometimes it is necessary to blend a greater total flow than the analyzer requires. In this case the flow to the analyzer should be set as per the analyzer data sheet and any excess flow should be vented through a bypass.

Appendix B

Quality, Recycling & Warranty Information

Appendix B Quality, Recycling & Warranty Information

Michell Instruments is dedicated to complying to all relevant legislation and directives. Full information can be found on our website at:

www.michell.com/compliance

This page contains information on the following directives:

- ATEX Directive
- Calibration Facilities
- Conflict Minerals
- FCC Statement
- Manufacturing Quality
- Modern Slavery Statement
- Pressure Equipment Directive
- REACH
- RoHS2
- WEEE2
- Recycling Policy
- Warranty and Returns

This information is also available in PDF format.

Appendix C

Return Document & Decontamination Declaration

Appendix C Return Document & Decontamination Declaration

Decontamination Certificate

IMPORTANT NOTE: Please complete this form prior to this instrument, or any components, leaving your site and being returned to us, or, where applicable, prior to any work being carried out by a Michell engineer at your site.

Instrument			Serial Number	
Warranty Repair?	YES	NO	Original PO #	
Company Name			Contact Name	
Address				
Telephone #			E-mail address	
Reason for Return /Description of Fault:				
Has this equipment been exposed (internally or externally) to any of the following? Please circle (YES/NO) as applicable and provide details below				
Biohazards	YES	NO		
Biological agents	YES	NO		
Hazardous chemicals	YES	NO		
Radioactive substances	YES	NO		
Other hazards	YES	NO		
Please provide details of any hazardous materials used with this equipment as indicated above (use continuation sheet if necessary)				
Your method of cleaning/decontamination				
Has the equipment been cleaned and decontaminated?	YES	NOT NECESSARY		
Michell Instruments will not accept instruments that have been exposed to toxins, radio-activity or bio-hazardous materials. For most applications involving solvents, acidic, basic, flammable or toxic gases a simple purge with dry gas (dew point <-30°C) over 24 hours should be sufficient to decontaminate the unit prior to return. **Work will not be carried out on any unit that does not have a completed decontamination declaration.**				
Decontamination Declaration				
I declare that the information above is true and complete to the best of my knowledge, and it is safe for Michell personnel to service or repair the returned instrument.				
Name (Print)		Position		
Signature		Date		

EU Declaration of Conformity

MICHELL Instruments

Manufacturer: **Michell Instruments Limited**
48 Lancaster Way Business Park
Ely, Cambridgeshire
CB6 3NW. UK.

CE

On behalf of the above named company, I declare that, on the date that the equipment accompanied by this declaration is placed on the market, the equipment conforms with all technical and regulatory requirements of the directives.

PCR Portable Calibration Rig

and complies with all the essential requirements of the EU directives listed below.

2014/30/EU **EMC Directive**
2014/35/EU **Low Voltage Directive (LVD)**

and (effective from 22nd July 2017)
2011/65/EU **Restriction of Hazardous Substances Directive (RoHS2)**
RoHS2 EU Directive 2011/65/EU (Article 3, [24]) states, *"industrial monitoring and control instruments means monitoring and control instruments designed exclusively for industrial or professional use".* (mandatory compliance effective date 22nd July 2017).

and has been designed to be in conformance with the relevant sections of the following standards or other normative documents.

EN61326-1:2006	Electrical equipment for measurement, control and laboratory use – EMC requirements –Class B (emissions) and Industrial Locations (immunity).
EN61010-1:2010	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use - Part 1: General Requirements

2014/68/EU **PE Directive**
This product and sample systems & accessories that may be supplied with them do not bear CE marking for the Pressure Equipment Directive, and are supplied in accordance with Article 4, paragraph 3 of 2014/68/EU by using SEP (sound engineering practice) in the design and manufacturer and are provided with adequate instructions for use.

Andrew M.V. Stokes, Technical Director

December 2016

http://www.michell.com