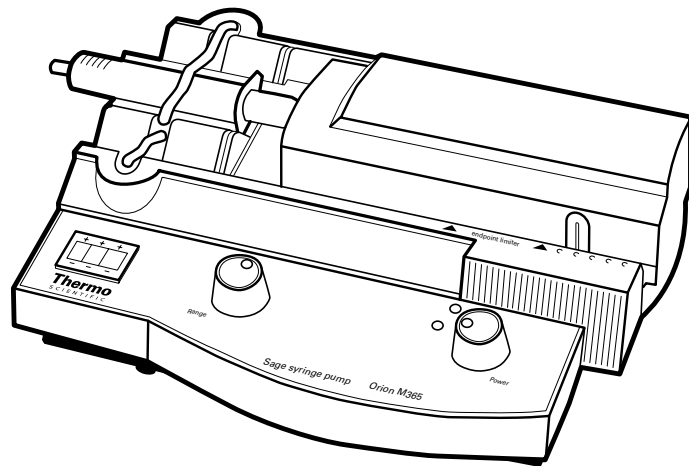


Thermo Scientific Orion Dynamic Calibrator

User Guide



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ionplus electrodes and Optimum Results solutions are protected by US Patent 5,830,338.

ROSS Ultra electrodes are protected by US patents 6,793,787.

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The specifications, descriptions, drawings, ordering information and part numbers within this document are subject to change without notice.

This publication supersedes all previous publications on this subject.

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Chapter 1 Introduction

General Information

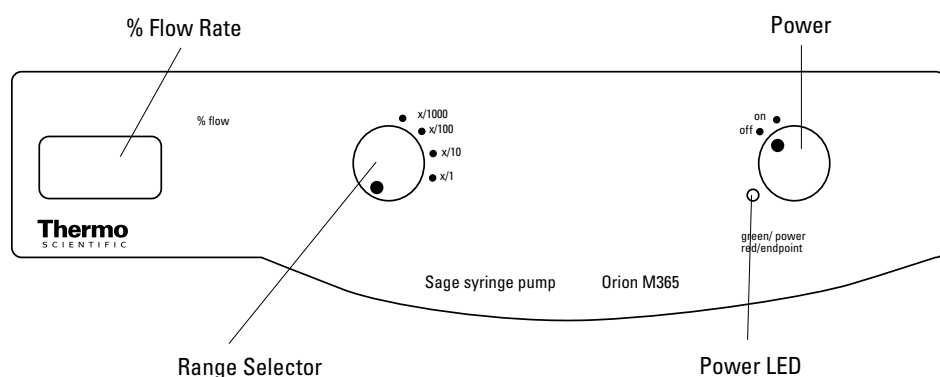
The dynamic calibrator syringe pump is rugged, reliable, easy to use and designed to meet most standard pumping needs. The pump has a durable molded case, tilt stand for easy viewing, spring loaded syringe holders and endpoint limiters to protect the syringes. The dynamic calibrator can perform multi-range, variable speed infusions and accepts syringes from 10 μ L to 100 mL.

Dynamic calibrators use precision stepper motor drives. The self-lubricating gears engage long wearing mating racks. Pumps are molded from high impact resin. All flow rates are based on B-D syringes, see the **Calculating Flow Rate** section for model numbers and sizes.

The dynamic calibrator can be installed on a mounting bracket for use with 1500, 1800 and 2100 series online monitors. Use 20 mL syringes with the 1800 and 2100 series online monitors and 60 mL syringes with the 1500 series online monitors.

Note: The dynamic calibrator pump is not intended for use on humans.

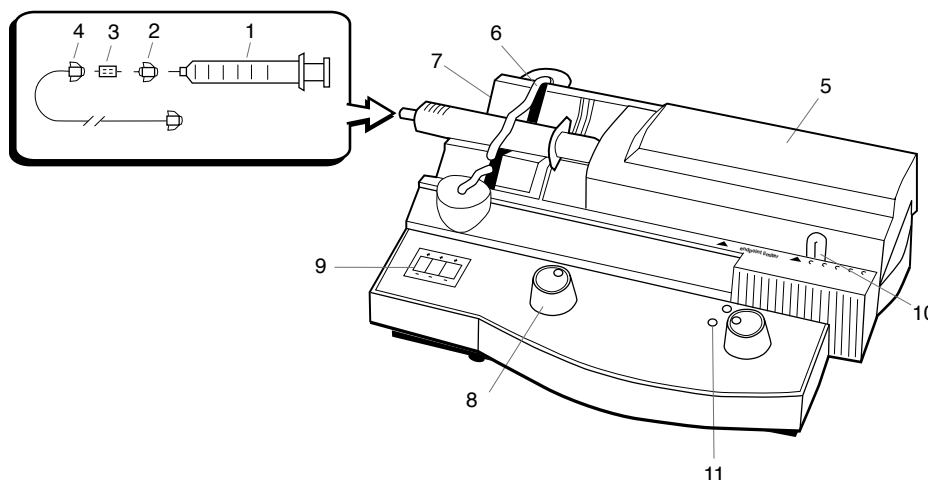
Figure 1
Dynamic Calibrator Front Panel



Dynamic Calibrator Components

1. Syringe kit – delivers standard solution to the monitor during a two point calibration. The syringe kit include a syringe, luer adaptor, coupling and tubing assembly. The dynamic calibrator contains two different syringe kits – the 20 mL syringe kit, Cat. No. 180096, and the 60 mL syringe kit, Cat. No. 150096. Use the 20 mL syringe kit with 1800 and 2100 series monitors. Use the 60 mL syringe kit with 1500 series monitors.
2. Luer adaptor
3. Coupling
4. Tubing assembly
5. Drive carriage – advances the syringe plunger.
6. Syringe holder – holds the syringe in place.
7. Blue knob – locks and unlocks the syringe holder, which holds the syringe in position.
8. Range selector switch – use to select the operating range. The four positions are x/1, x/10, x/100 and x/1000.
9. Flow rate dial (% flow) - use to adjust the flow rate within the selected range.
10. Endpoint limiter – protects the pump and syringe by preventing the syringe piston from being forced against the end of the syringe barrel.
11. Power LED – The green light indicates the power to the pump.

Figure 2
Dynamic Calibrator Components

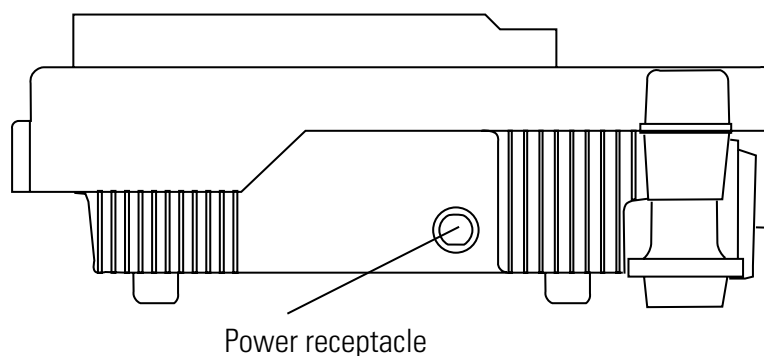


Chapter 2 Setup

Dynamic calibrators are powered by a wall mounted line adapter. To connect the pump to a power supply, insert the power plug into the jack on the back of the pump, see **Figure 3**, and then plug the wall adapter into a convenient electrical outlet.

The pump can be adjusted to the optimal viewing angle by using the flip stand. To adjust the viewing angle, gently lift the flip stand and rotate it approximately 90 degrees until the stand locks in place.

Figure 3
Dynamic Calibrator Rear Panel

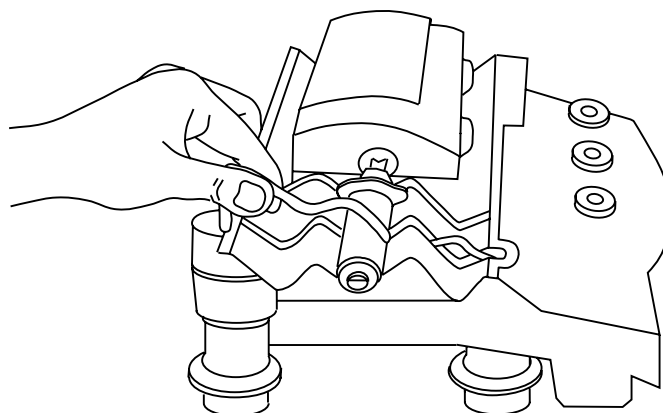


Installing a Syringe

To install a syringe on the pump:

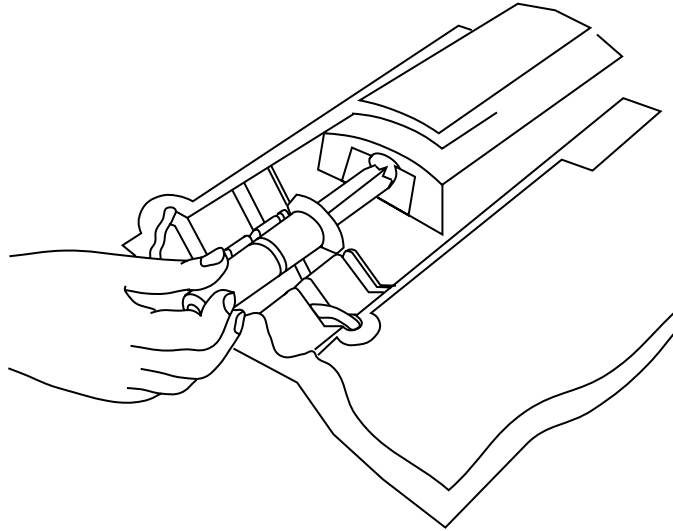
1. Remove the carriage by lifting it vertically from the gears.
2. Release the syringe holder by twisting the blue knob approximately 1/4 of a turn clockwise and pressing up on the bottom, inside part of the blue knob.
3. Lift up on the syringe holder and turn it away from the syringe cradle, see **Figure 4**.

Figure 4
Lifting Syringe Holder



4. Place the prepared syringe in the syringe cradle, see **Figure 5**. Rotate the syringe holder back into place across the syringe. Gently tighten the blue knob by twisting it 1/4 of a turn counter clockwise.

Figure 5
Placing Syringe



5. Replace the carriage on the gears. Advance the carriage to meet the syringe by momentarily turning pump on at high speed.

Note: Do not attempt to push the carriage manually. This may result in damage to the pump mechanism.

Setting Endpoint Limiters

The endpoint limiter is an infrared switch that protects the syringe and the pump by preventing the syringe piston from being forced against the end of the barrel, see **Figure 6**. Set the endpoint limiter by sliding the limiter along the carriage to the desired endpoint, see **Figure 7**. When the carriage reaches the set point of the endpoint limiter, designated by the white triangle on case, the carriage movement will stop. When the pump is not in use, set the endpoint limiters to the outer edge of travel, to the right.

Figure 6
Endpoint Limiter

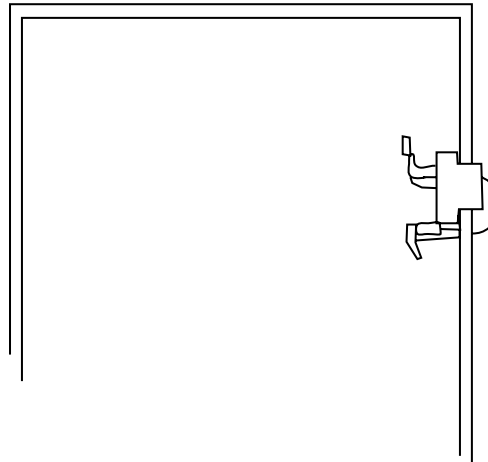
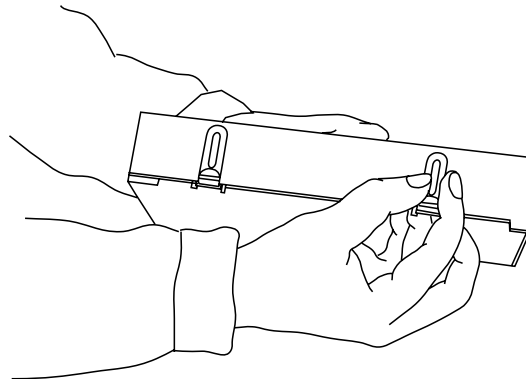


Figure 7
Setting Endpoint Limiter



Installing the Mounting Bracket

The dynamic calibrator mounting bracket, Cat. No. 219135-S01, is designed to conveniently hold the dynamic calibrator in place on when used with an online monitor. The mounting bracket consists of two metal sections, the accessory shelf and the extension plate. Only the accessory shelf is required for use on 1500 series monitors. The accessory shelf and extension plate are used together as an L-shaped mounting bracket on 1800 series monitors.

Place the pump on the appropriate mounting bracket. Plug the pump wall adapter into a conveniently located electrical outlet, close to the location of the monitor.

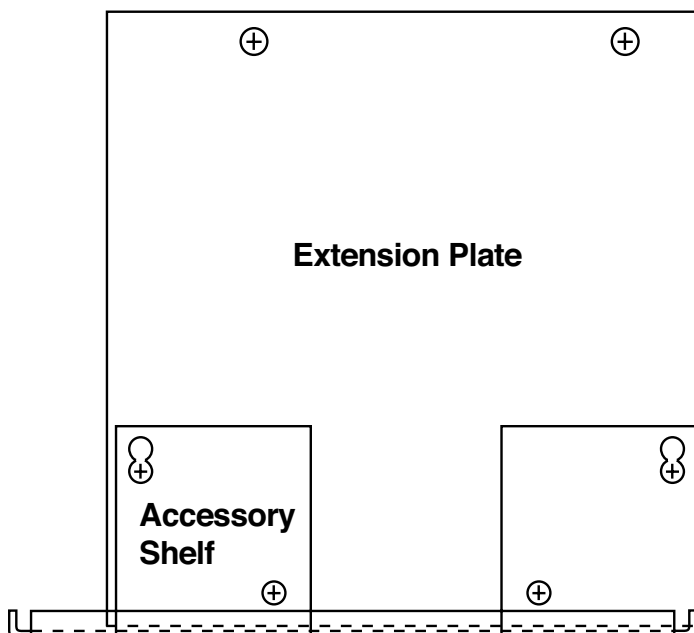
Installation on 1800 Series Monitors

Locate the top two 0.5" mounting holes on the extension plate and bolt to the bottom mounting holes of the 1800 series monitor. If required, mount the lower platform accessory shelf to the extension plate. Place the dynamic calibrator on the platform base underneath the monitor during (monthly) calibration. Ensure that the monitor drain does not obstruct the use of the calibration syringe.

Installation on 1500 Series Monitors

If required, remove the four 8-32 screws that connect the two halves of the L-shaped bracket. Mount the lower platform accessory shelf keyhole slots on the monitor standoffs.

Figure 8
Mounting Bracket



Chapter 3 Operation

Operating the Pump

The % flow rate for the dynamic calibrator syringe pump may be directly selected for infusion. Select the % flow rate value using the + and - keys on the % flow rate selector. The % flow dial allows virtually continuous variations of the flow rate in each range. This dial has been calibrated to have a minimum setting of 0.1%, and a maximum setting of 100% (99.9). However, for maximum accuracy it is recommended that the pump be operated between 30.0% (30.0) and 100% (99.9).

Choose the range multiplier using the range selector. The range selector has four settings. Switching from one flow setting to the next flow position will change the flow rate by a factor of 10. For instance, a flow rate of 15 mL/min at x/1 will be 0.15 mL/min at x/100.

Note: When switching the dynamic calibrator from one range or rate to another, always turn the pump off to prevent damage to the pump.

To calculate the flow rate, both the % flow selector and the range multiplier controls must be considered. See **Table 1** for syringe size and rate. If using a syringe size other than those indicated on the front panel or using multiple syringes, determine the flow rate by measuring the scale length and calculating the flow rate, see the **Calculating Flow Rate** section, or by measuring the volume of fluid delivered during a timed interval.

1. Place the filled syringe into the holder as described in the **Setup** section.
2. Set the endpoint limiter as described in the **Setup** section.
3. Replace the carriage on the gears. Advance the carriage to meet the syringe by momentarily turning pump on at high speed. Do not attempt to push the carriage manually. This may result in damage to the pump mechanism.
4. Turn the range selector and set the % flow rate selector to the required position as described in the online monitor user guide.
5. Turn the power switch on to begin the infusion.
6. The infusion run is complete when the endpoint is reached and the green power light turns red.

Table 1

Syringe Size	100 % Flow Rate
60 mL	77.4 mL/min
30 mL	51.0 mL/min
20 mL	39.7 mL/min
10 mL	22.8 mL/min
5 mL	15.7 mL/min
3 mL	8.1 mL/min

Example To obtain a flow rate of 2.0 mL/min for a total time of 15 min:

1. Select the syringe size.

$$\text{Total volume required} = (15)(2.0) = 30 \text{ mL}$$

Therefore, the syringe size is 30 mL, although a larger syringe could be used.

2. Select the flow range from flow rate chart on front panel.

$$99.9 \text{ \% flow at X/1} = 51 \text{ mL/min}$$

$$1.0 \text{ \% flow at X/1} = 0.51 \text{ mL/min}$$

Therefore, the X/1 setting can be used, but it would set the pump below the recommended rate for maximum accuracy.

$$99.9 \text{ \% flow at X/10} = 5.1 \text{ mL/min}$$

$$1.0 \text{ \% flow at X/10} = 0.051 \text{ mL/min}$$

Therefore, X/10 can be used and puts the rate between the recommended range of 30 to 100 %.

3. Select the percent flow.

$$\text{Percent flow} = \text{desired rate} / 99.9 \text{ \% rate at selected range}$$

$$\text{Percent flow} = (2 \text{ mL/min}) / (5.1 \text{ mL/min}) = 39 \text{ \%}$$

Therefore, enter 39.0 on the % flow selector and switch to X/10 on the range control.

General Operating Notes

When switching from one range or rate to another, always turn the pump off to prevent damage to the pump.

Three syringes of up to 60 mL each may be used simultaneously, although two of the three must be the same size. Alternately, a single syringe greater than 60 mL, up to 100 mL, may be used on each pump. It is recommended that when a syringe greater than 60 mL is used, the syringe should be placed in the center mounting position.

Caution: The pump exerts 35 pounds of linear force during travel. When using small glass syringes, operators should check with the syringe manufacturer for the maximum back pressure specifications.

Calculating Flow Rate

The flow rate must be calculated for non B-D syringes or syringe sizes that are not listed. All flow rates for the dynamic calibrators are based on B-D syringes. The following method may be used to calculate the flow rates for other syringes.

B-D Syringe	Size	Scale Length
9585	3 mL	2.040"
9603	5 mL	1.744"
9604	10 mL	2.408"
9661	20 mL	2.763"
9662	30 mL	3.226"
9663	60 mL	4.253"

1. Measure the scale length of the syringe with a caliper or precision ruler.

The scale length is the length from 0 mL to the syringe's full scale.

2. Use the formula: $(L_1 / V_1) * (V_2 / L_2) * F_1 = F_2$

where

L_1 = scale length of B-D syringe (inches)

L_2 = scale length of non B-D syringe (inches)

V_1 = B-D syringe size (mL)

V_2 = non B-D syringe size (mL)

F_1 = flow rate for B-D syringe mL/min or mL/hr

F_2 = flow rate for non B-D syringe mL/min or mL/hr.

The variables can be rearranged to find the B-D flow rate setting needed for the non B-D syringe: $F_1 = F_2 * (V_1 / L_1) * (L_2 / V_2)$

Example A 100 μL syringe set at position 1 will flow at what rate?

1. The scale length of the 100 μL syringe measures 2.379 inches.
2. The scale length of a B-D 60 mL syringe is 4.253 inches.
3. A B-D 60 mL syringe set at position 1 flows at 0.33 mL/min.

Using the formula from Step 2:

$$(4.253"/60 \text{ mL}) * (0.1 \text{ mL}/2.379") * (0.33 \text{ mL}/\text{min}) = 0.000983 \text{ mL}/\text{min}$$

A 100 μL syringe with a scale length of 2.379" set at position 1 will flow at a rate of 0.983 $\mu\text{L}/\text{min}$.

What should the setting be for a 100 μL syringe to flow at 10 $\mu\text{L}/\text{min}$?

1. The scale length of the 100 μL syringe measures 2.379 inches.
2. The scale length of a B-D 3 mL syringe is 2.040 inches.

Using the formula from Step 2:

$$(0.01 \text{ mL}/\text{min}) * (3 \text{ mL}/2.040") * (2.379"/0.1 \text{ mL}) = 0.3499 \text{ mL}/\text{min}$$

Set the pump for a flow rate of 0.3499 mL/min based on a 3 mL syringe.

Chapter 4 Customer Services

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Notice of Compliance

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and receiver.

Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio TV technician for help.

U.S. and Canadian Emissions

“This digital apparatus does not exceed the (Class B) limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.”

“Le present appareil numerique n’emet pas de bruits radioelectriques dépassant les limites applicables aux appareils numeriques (de la class B) prescrites dans le Reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada”.

Safety The dynamic calibrator syringe pumps have been certified to the C.S.A. Safety Standard for Laboratory Equipment C22.2 No. 151-M1986 under file # LR 26026.

European Emissions

Name of Grantee: Thermo Fisher Scientific
Orion or FCC Identifier: 360 Series
Applicable Regulation: Applicable to EC Directive 89/336/EEC
Equipment Class: Class B
Note: Verified to the limits and methods of EN 55011

European Susceptibility Testing

The 360 series of dynamic calibrators has met the guidelines of IEC 801-2, 801-3, 801-4 and EN 50082-1.

Service and Repair

After troubleshooting all components of your measurement system, contact Technical Support. Within the United States call 1.800.225.1480 and outside the United States call 978.232.6000 or fax 978.232.6031. In Europe, the Middle East and Africa, contact your local authorized dealer. For the most current contact information, visit www.thermo.com/water.

Warranty

For the most current warranty information, visit www.thermo.com/water.

Ordering Information

Cat. No.	Description
15DC15	Dynamic calibrator (115 V) with 20 mL and 60 mL syringes, luer adapter, coupling, tubing assembly and mounting bracket
15DC20	Dynamic calibrator (220 V) with 20 mL and 60 mL syringes, luer adapter, coupling, tubing assembly and mounting bracket
21DC00	Dynamic calibrator (115 V / 220 V) with 20 mL syringe, luer adapter, coupling, and tubing assembly
180096	Syringe kit, includes 20 mL syringe, luer adapter, coupling and tubing assembly
150096	Syringe kit, includes 60 mL syringe, luer adapter, coupling and tubing assembly
219135-S01	Mounting bracket

Specifications

Maximum Number and Size of Syringes	Up to three 60 mL syringes or one 100 mL syringe
Range using 60 mL Syringe	0 to 77.4 mL/min 4 ranges
Steps in Range	1000
Range Multiplication	x/1, x/10, x/100, x/1000
Maximum Back Pressure with 60 mL Syringe	1800 mm Hg (240 kPa)
Flow Accuracy	± 4 % of setting, ± 1 % full scale
Net Weight	4.5 kg (10 lbs)
Dimensions	33 cm x 26 cm x 13 cm (13" x 10.2" x 5")
Power Requirements	9 VDC converter for either 110 VAC or 220 VAC, 50/60 Hz wall outlet

Environmental Instruments

Water Analysis Instruments



North America

166 Cummings Center
Beverly, MA 01915 USA
Toll Free: 1-800-225-1480
Tel: 1-978-232-6000
Dom. Fax: 1-978-232-6015
Int'l Fax: 978-232-6031

Europe

Denmark House, Angel Drove
Ely, Cambridgeshire
England, CB7 4ET
Tel: 44-1353-666111
Fax: 44-1353-666001

Asia Pacific

Blk 55, Ayer Rajah Crescent
#04-16/24, Singapore 139949
Tel: 65-6778-6876
Fax: 65-6773-0836

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