

# AML 真空メカトロニクス

## 【AML社のご案内】

AML社は1986年に超高真空用のステッピングモーターを開発し、世界で最初に販売を開始した英国のベンチャー企業です。AMLモーターは世界最高水準の技術で多くの販売実績を持ち、これらの商品は世界中の最新式超高真空システムで活躍しています。

システム構成も特注の製作が可能ですので是非、貴社のシステムに世界が認めるAMLを御採用頂き、使いやすく信頼性の高い最新システムを構築して、技術的にも経済的にもより多くの成果を上げられますよう、ご案内申し上げます。

## 超高真空用ステッピングモーター

AML超高真空用ステッピングモーターは長年の研究と改良を重ね、特に熱特性とアウトガスに関して抜群の性能を持つ、完成された商品です。正確な位置決めや微細な動きについて、外付け駆動機構よりも経済的で信頼性があります。

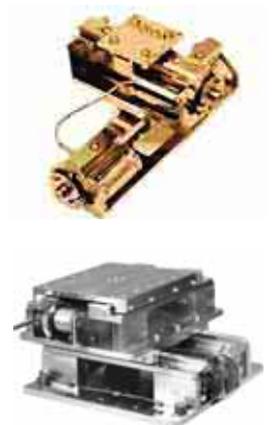
- ◆ AMLモーターは1986年以来使用されています確立された技術です。
- ◆ 徹底的なコストダウンを実行したパフォーマンス製品です。
- ◆ 絶縁材料はアウトガス並びに絶縁性が良いポリイミドとPEEK材を使用しています。
- ◆ 実証済みの長寿命ハイブリッドセラミックス製ベアリングはベークの繰り返しでも摩擦が少なく塵埃が少ない。
- ◆ 電線の接続はわずか6ヶ所その絶縁に強力なポリイミドが塗布されています。
- ◆ アウトガスを少なくし、温度の上昇をおさえるため斬新な設計と部品、表面処理がされています。内部スペースは排気のために解放構造としてあります。
- ◆ 表面はエッチングされDLF処理で活性化し、アウトガスを小さくしてあります。
- ◆ ガス放出の少ない材料、表面処理、ガス抜き構造、温度上昇を小さくした設計としてあります。
- ◆ 真空中で高いトルクで且つ高ステップでSMD2を使って連続運転による評価で出荷しています。
- ◆  $1 \times 10^{-8}$  Pa以下の超高真空中で使用可能。200°Cにベークブル。77Kで使用できます。
- ◆ 対放射線用製品を用意しています(オプション)。
- ◆ 在庫品の中からトルクが30%増しの製品を選択して提供できます。
- ◆ 摩擦部分が少ない故、微粒子の生成が極めて少ない。



## 超高真空用リニアスライダー

LCTは簡易型で経済性に優れています。  
LPVはコンパクトなメカニズムで長い移動距離を走行できます。  
LPXはより優れた強度を持たせたタイプで、別のスライダーを積み重ねたり、重心が外れている場合や試料台がメカニズムの端から突き出している場合でも大丈夫です。

- ◆ AMLは1986年以来同様の多くのトランスファー製品を納入した確立された技術です。
- ◆  $1 \times 10^{-8}$  Pa以下の超高真空度で使えます。
- ◆ ベーク温度は200°Cです。
- ◆ 材料はステンレス鋼を使い全ての部品の内部空間は空気抜き穴付き構造です。
- ◆ 部材は超高真空の材料で組み立ててあります。アルミ合金ナットの他非磁性のステンレス鋼を使用しています。表面処理はDLC(diamond-like)処理をしリードネジはMoS<sub>2</sub>潤滑フィルムを焼き付けしてあります。摺動面はTiN処理です。
- ◆ 真空中で高速移送の場合はドライバーSMD2をご使用願います。
- ◆ 潤滑剤は使用していません。
- ◆ 任意の方向で使用できます。
- ◆ B14.1Rモーターは放射線( $1 \times 10^9$  rad(1 107 × Sv/Gy))に強い。



## 超高真空用多軸駆動機構

AMLはUHVステッピング・モーターを搭載したリニア・スライダーを組み合わせたXYZステージ、このステージに自転機構を搭載した4軸駆動機構、更に公転機能を持たせた5軸駆動機構やあおり角度調節機能を付加した6軸駆動機構等、ユニット化された機器要素の組み上げで、UHV用のゴニオメーターが大気中駆動機構と全く同じ感覚で、超精密で且つ低価格でご使用になれます。



## 超高真空用精密回転ステージとリニアスライダー

特注の真空用ゴニオメータについては低コストで対応しています。大気圧側より操作する方法に比べ低コストで高精度となります。

- ◆より高い信頼性、正確さ精度及び、より長いストロークは、大気側から操作するよりも真空中駆動モーターを使用することにより達成されます。使いやすさと安全性が多くの場合に改善されます。AML真空メカトロニクス製品は全て200℃でベークブルです。
- ◆0.001° の回転精度及び1 μmの移送精度は容易に達成されます。反復精度とバックラッシュは可能なレベルで調整することが出来ます。より高い仕様も受けられますがコストとの兼ね合いです。精密な停止は全ての位置でできます。
- ◆サンプルの加熱・冷却に対応できます。サンプル交換手段および挿入用ロードロック機構は供給できます。真空中配線はすべて真空用コネクタで取り付けられます。コントローラーと付属品はそのまま利用できます。



## 超高真空ステッピングモーター用2連ドライバー

超高真空用SMD2ステッピングモーター用ドライバーは、AMLモーターに適合します。2つのモーターを全面パネルスイッチ又はポータブル操作盤から内蔵プログラムによって、ホストコンピュータ管理の下で連続して運転できます。ドライバーは大気用モーターにも使えます。

- ◆1Uラックマウント型で2台のモーターを逐次駆動できます。
- ◆ドライブモード分割ステップは(8,4,ハーフ,フル)で自動走行ができます。
- ◆相間電流は0.1~1Aにセットできます。
- ◆低電力ドライブ技術でモーターの温度上昇やアウトガスを小さくし高速運転ができます。
- ◆保持トルクパワーを小さくするためプログラム制御でダイナミック・トルクと切り離せます。
- ◆モーターのベークの制御と保護のためモーターの温度を表示(タイプK)します。
- ◆ホストコンピュータ制御のためのRS232Cインターフェースが付いています。ドライブ・プログラムはコンピュータ・コンソール(遠隔のプログラム制御)から制御しています。
- ◆モーターは、全面パネル「STEP」および「DIRECTION」スイッチ又は手動操作盤で操作できます。
- ◆選択した速度で滑らかな加速をするため単パルス・ステップあるいはマルチ・ステップで運転できます。



## システム設計・製造・技術サポート

### 株式会社ビーム精工

〒144-0052 東京都大田区蒲田2丁目10番1号  
大田区産学連携施設102号

TEL: 03-5480-6057 FAX: 03-5480-6067

E-mail: beamseiko@nifty.com

URL: <http://www.homepage2.nifty.com/beseko>

- ◆当社では、モーター駆動をシステム化することが出来ます。真空容器の製作から出来ますので詳細は左記にお尋ね下さい。

### 八坂テクノス株式会社

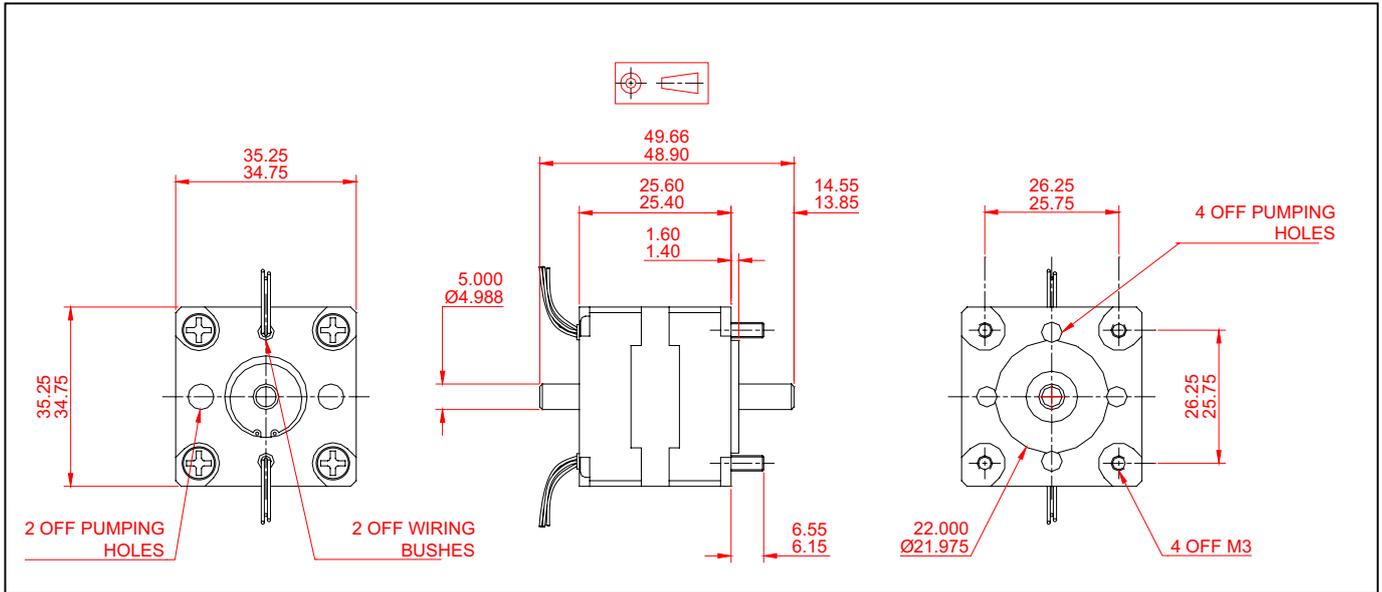
〒116-0011 東京都荒川区西尾久7-26-8

TEL:(03)5926-5619(代表) FAX:(03)3893-5621

<http://www.yasaka-tec.co.jp> E-mail: [contact@yasaka-tec.co.jp](mailto:contact@yasaka-tec.co.jp)

## Third - Generation UHV STEPPER MOTORS - Model C14.1

The C14.1 UHV-compatible stepper motor has 50% more output torque than the B14.1 motor it replaces. It is exactly the same size. The efficiency has been optimised so that the temperature rise is reduced at all power outputs and consequently outgassing is significantly less.



- ◆ Significantly higher torque. Drop-in replacement for B14.1 in all cases, resulting in significantly reduced gas load for the same power output.
- ◆ Proven technology: similar AML motors have been in constant use since 1986. Warranty returns are less than 0.2%
- ◆ Hybrid ceramic bearings for long life and reduced friction after multiple bakeouts.
- ◆ Greatly reduced outgassing and temperature rise due to advanced design, materials, surface finish and construction.
- ◆ All insulating materials are self-coloured polyimide or PEEK, with exceptional outgassing and insulating performance.
- ◆ Surfaces are etched and coated with DLC for increased emissivity and reduced outgassing.
- ◆ Open construction with all internal spaces ventilated.
- ◆ Very low particulate generation due to the absence of sliding metal contacts.
- ◆ Suitable for use below  $1 \times 10^{-10}$  mB.
- ◆ Bakeable to 200°C.
- ◆ Suitable for use in vacuum at 77°K.
- ◆ Radiation-hard versions are available.
- ◆ Electrical connections reduced to only 6 durable polyimide film-coated wires.
- ◆ Simplified connection with MLF18 bakeable lead, feedthrough and internal connector. Motors are supplied pre-wired to 1.5mm socket connectors compatible with MLF18.
- ◆ Dedicated drive, AML type SMD2 is available.
- ◆ Standard and radiation-hard motors are normally available from stock.

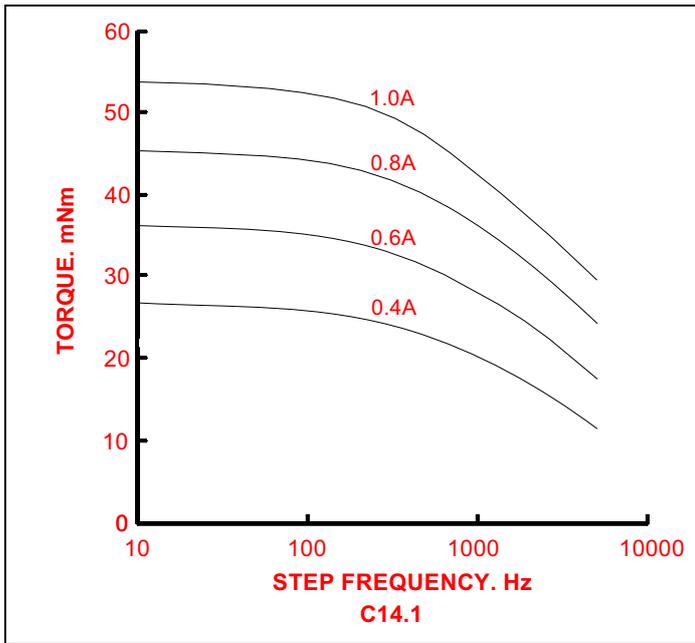
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## SPECIFICATION



The performance shown on the graph was obtained using an SMD2 drive operating with standard settings for step division. SMD2 is a switch-mode, bipolar, current-regulating drive with a nominal source of 67volts, optimised for use with vacuum stepper motors. At low speeds where step division is active the RSS (root sum of squares) of phase current is set to the nominal current. Over most of the speed range the drive operates in wave mode with nominal set current in only one energised phase.

Different drives will produce different speed/torque curves and different temperature rise. Drives capable of producing a total phase current of more than 1A RSS may damage the insulation, even if the current is claimed to be adjustable. Drives with significantly lower source voltages will result in poor high-speed performance. Sufficient data are given below for drive selection. Use of the embedded thermocouple is essential for motor protection. AML do not recommend any drive other than SMD2.

Bakeout temperature	200°C	Phase resistance at 20°C	3.0Ohms
Operating temperature	-196°C to +175°C	Phase inductance	3.25mH
Step angle	1.8°	Holding torque (2 x 1A)	75mNm
Step angle tolerance (unloaded)	5%	(N.B Holding with two phases energised at 1A is not a recommended operating condition: see above)	
Power leads (Cu+Ag + Polyimide + FEP)	0.6mm φ	Detent Torque	5.5mNm
Power leads, rad-hard (Cu + Polyimide)	4 x 0.3mm φ	Weight	150g
K t/c leads (Polyimide)	0.2mm φ	Rotor inertia	10gcm <sup>2</sup>
Lead length	1.35m	Motional voltage @ 1kHz(p-p)	4.2V
Shaft end-float	0.1 to 0.2 mm		

## INSTALLATION / APPLICATION NOTES

The screws are fitted with metered torque. Do not disturb. Do not drop, demagnetise, disassemble, modify, touch or overheat the motor or allow particles to enter the bearings or pumping ports. AML will supply modified-shaft motors.

Identify the two power windings with a resistance meter. Reverse the connection of either winding to reverse rotation. The thermocouple alumel® wire (negative) is magnetic. A small magnet is provided for identification. AML will pre-wire motors to MLF18 VCF connectors at low cost.

The shaft end-float-control compression spring is fully exercised with an axial force of 3kg toward the rear of the motor. In linear mechanisms use gravity and/or apply an opposite axial pre-load to avoid adding end-float to backlash.

The bearings are silicon nitride balls in stainless steel with maximum static axial or radial load of 10kg.

Design mechanisms with balanced rotating loads and/or friction to maintain position with zero (or reduced) phase current for minimum outgassing. Use ministep only to smooth transitions: increase resolution by reduction gearing

Ensure ice cannot form in the motor if testing at low temperature in air. Avoid thermal shocks e.g. plunging in liquid nitrogen.

Motors are supplied pre-baked at HV. They will adsorb water in storage and handling. A 24-hour self-bake by SMD2, with an adequate pump, will achieve UHV-compatibility.

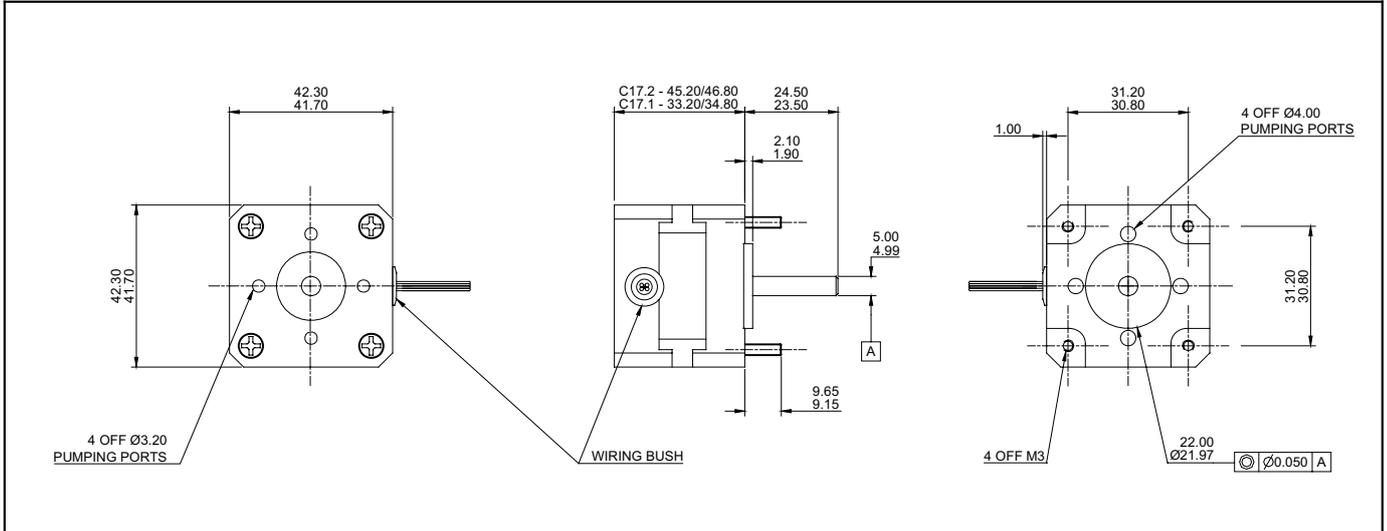
### ORDERING INFORMATION: C14.1

add suffix **R** for radiation hardness to  $1 \times 10^7$  Sv  
 add suffix **X** for shaft modification e.g. cross-hole, flat etc. Provide a sketch.



## Third - Generation UHV STEPPER MOTORS - Models C17.1 and C17.2

The C17.1 UHV-compatible stepper motor has 50% more output torque than the B17.1 motor it replaces, for a very small increase in overall size. The efficiency has been optimised so that the temperature rise is reduced at all power outputs and consequently outgassing is significantly less. The C17.2 permits a convenient upgrade for applications where more torque is required.



- ◆ Significantly higher torque. Drop-in replacement for B17.1 in most cases, resulting in significantly reduced gas load for the same power output.
- ◆ Very low particulate generation due to the absence of sliding metal contacts.
- ◆ Suitable for use below  $1 \times 10^{-10}$  mB.
- ◆ Bakeable to 200°C.
- ◆ Suitable for use in vacuum at 77°K.
- ◆ Electrical connections reduced to only 6 durable polyimide film-coated wires.
- ◆ Simplified connection with MLF18 bakeable lead, feedthrough and internal connector. Motors are supplied pre-wired to to 1.5mm socket connectors compatible with MLF18.
- ◆ Dedicated drive, AML type SMD2 is available.
- ◆ Open construction with all internal spaces ventilated.
- ◆ Easy upgrade from C17.1 to C17.2 for higher power: only 12mm additional space is required.
- ◆ Proven technology: similar AML motors have been in constant use since 1986. Warranty returns are less than 0.2%
- ◆ Hybrid ceramic bearings for long life and reduced friction after multiple bakeouts.
- ◆ Greatly reduced outgassing and temperature rise due to advanced design, materials, surface finish and construction.
- ◆ All insulating materials are self-coloured polyimide or PEEK, with exceptional outgassing and insulating performance.
- ◆ Surfaces are etched and coated with DLC for increased emissivity and reduced outgassing.
- ◆ Radiation-hard versions are available.
- ◆ Standard and radiation-hard motors are normally available from stock.

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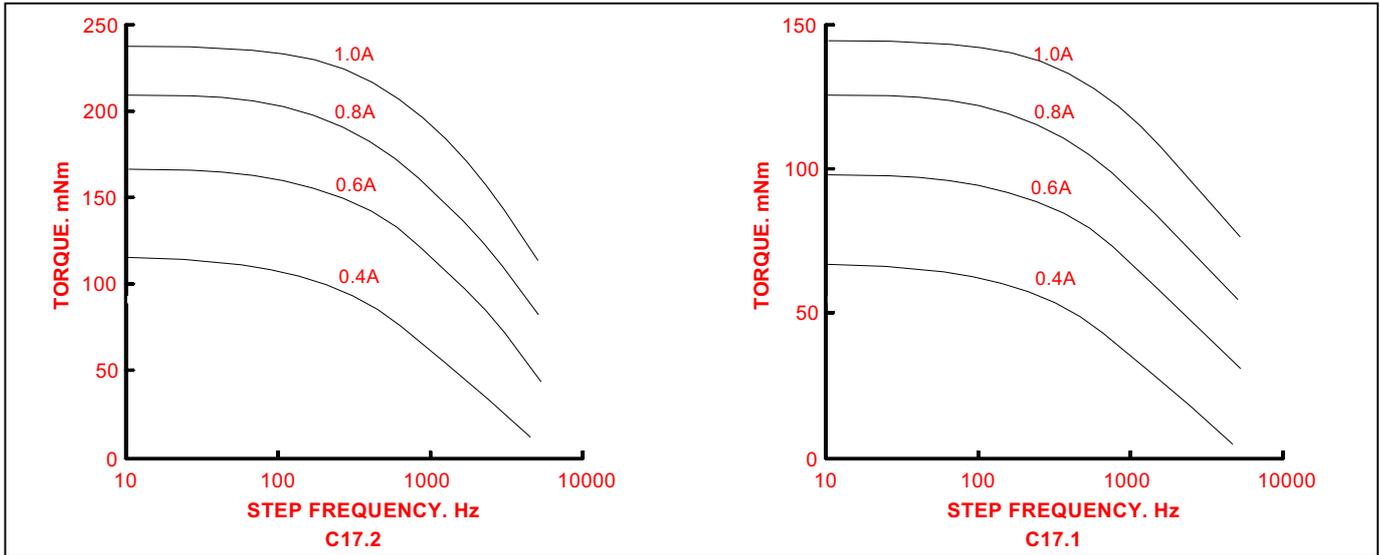
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# SPECIFICATION

## AML DATA SHEET: C17 Issue C



The performance shown on the graphs above was obtained using an SMD2 drive operating with standard settings for step division. SMD2 is a switch-mode current-regulating drive with a nominal source of 67volts, optimised for use with vacuum stepper motors. Different drives will produce different speed/torque curves. Drives capable of producing a total phase current of more than 1A RSS (root sum of squares) may damage the insulation, even if the current is claimed to be adjustable. Drives with significantly lower source voltages will result in poor high-speed performance. Sufficient data are given below for drive selection. Use of the embedded thermocouple is essential for motor protection. AML do not recommend any drive other than SMD2.

Bakeout temperature	200°C	Phase resistance at 20°C	<b>C17.1</b> 4.0Ohms	<b>C17.2</b> 6.0Ohms
Operating temperature	-196°C to+175°C	Phase inductance	4.5mH	11mH
Step angle	1.8°	Holding Torque (2 x 1A)	100mNm	200mNm
Step angle tolerance (unloaded)	5%	(N.B. Holding with two phases energised at 1A is not a recommended operating condition: see above.)		
Power leads ( Cu+Ag+Polyimide+FEP)	0.6mm $\phi$	Detent torque	5mNm	7mNm
Power leads, rad-hard (Cu+Polyimide)	4 x 0.3mm $\phi$	Weight	210g	320g
K t/c leads (Polyimide)	0.2mm $\phi$	Rotor inertia	30gcm <sup>2</sup>	55gcm <sup>2</sup>
Lead length	1.35m	Motional Voltage @ 1kHz(p-p)	2.0V	4.0V
Shaft end-float	0.2 to 0.4 mm			

### INSTALLATION / APPLICATION NOTES

The screws are fitted with metered torque. Do not disturb. Do not drop, demagnetise, disassemble, modify, touch or overheat the motor or allow particles to enter the bearings or pumping ports. AML will supply modified-shaft motors.

Identify the two power windings with a resistance meter. Reverse the connection of either winding to reverse rotation. The thermocouple alumel® wire (negative) is magnetic. A small magnet is provided for identification. AML will pre-wire motors to MLF18 VCF connectors at low cost.

The shaft end-float-control compression spring is fully exercised with an axial force of 3kg toward the rear of the motor. In linear mechanisms use gravity and/or apply an opposite axial pre-load to avoid adding end-float to backlash.

The bearings are silicon nitride balls in stainless steel with maximum static axial or radial load of 15kg.

Design mechanisms with balanced rotating loads and/or friction to maintain position with zero (or reduced) phase current for minimum outgassing. Use ministep only to smooth transitions: increase resolution by reduction gearing

Ensure ice cannot form in the motor if testing at low temperature in air. Avoid thermal shocks e.g. plunging in liquid nitrogen.

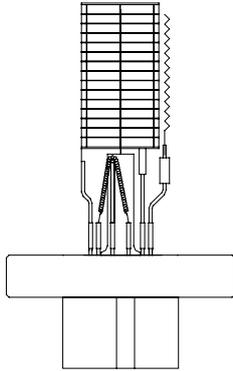
Motors are supplied pre-baked at HV. They will adsorb water in storage and handling. A 24-hour self-bake by SMD2, with an adequate pump, will achieve UHV-compatibility.

**ORDERING INFORMATION:** C17.1 or C17.2 add suffix **R** for radiation hardness to  $1 \times 10^7$ Sv  
add suffix **X** for shaft modification e.g. cross-hole flat etc. Provide a sketch.

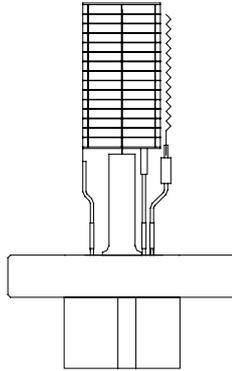


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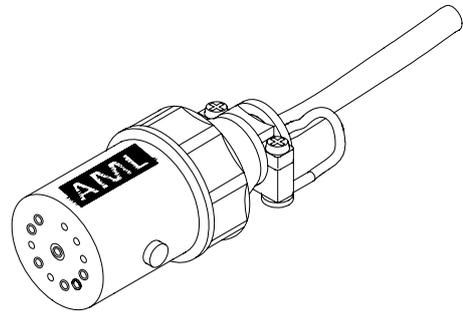
IMPROVED BAYARD-ALPERT GAUGEHEADS AND LEADS FOR UHV.  
MODELS AIG17P, AI17G AND AIGLx



AIG17P



AIG17G



AIGL3 and AIGL3P

Bayard-Alpert Gaugeheads and leads for Ultrahigh Vacuum.

AML BA gauges and leads are widely acknowledged as the best available in the industry. New-product introductions and enhancements confirm and extend this lead. The use of AML double-screened BA gauge leads is essential to ensure that AML Pressure Gauge Controller installations comply with EU EMC Directive.

- **AIG17G** is a nude UHV Bayard-Alpert gauge intended for electron-bombardment degas. It has an individual glass compression seal around each feedthrough pin. These glass seals are more economical and robust than ceramic, resulting in a less expensive and more rugged gaugehead, with the central collector pin inherently guarded against leakage currents by the grounded bulk of the flange. Twin tungsten filaments are standard. AML have improved the construction and method of attachment of the Molybdenum grid. The grid has a closed-end, light, rigid structure, resulting in high sensitivity. The X-Ray-induced electron desorption current at the collector is minimised by geometry and screening. The connector pins are **gold-plated**, shrouded and polarized. Sensitivity is 19 per millibar for nitrogen. Sensitivity for other gases is tabulated overleaf. X-Ray asymptote is  $3 \times 10^{-11}$  millibar. Maximum bakeout temperature is 250°C. Mounting flange is NW35CF.

- **AIG17P** incorporates a Pirani gauge on the same flange as the BA gauge. To use the Pirani gauge it must be connected to the PGC with an AIGL3P lead. The use of this combination gauge leads to significant cost-saving and eliminates a port on the vacuum chamber.

- **FIL17** is a replacement twin-tungsten filament assembly. The assembly is held by Allen set screws in socket receptacles and a key and replacement screws are provided. **FIL19** is a twin yttria-coated iridium filament assembly. Yttria is a safe and equivalent alternative to the toxic and radioactive thoria formerly used.

- **AIGL3** is a 250°C-bakeable 3-metre lead for use with AIG17G and similar ionisation gauges connected to AML controllers. **AIGL6** and **AIGL9** are 6 and 9 metre versions. AML use gold-plated connectors exclusively: these are essential for reliable long-term measurement of the ion current after baking. The cable is rated for the worst-case operating conditions of 50 watt degas with a new tungsten filament during a 200°C bake. This product uses an entirely PTFE-insulated custom cable and incorporates an overall electrical screen and fully screened and guarded collector with  $>1 \times 10^{15} \Omega$  insulation. The connector housing is machined from PEEK and the cable clamp is a bright nickel-plated casting.

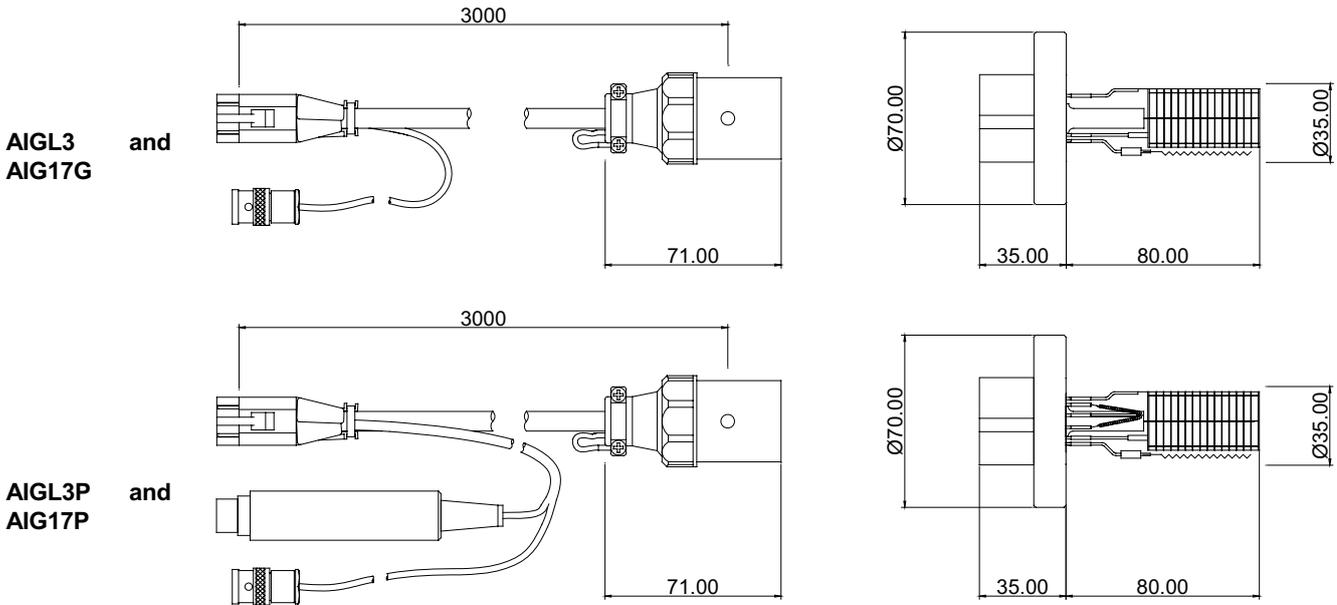
- **AIGL3P** has an additional connector incorporating calibration adjustments for the integral Pirani gauge on AIG17P.

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**AML DATA SHEET: AIG Issue H**



**Recommended Operating Conditions**

	Emission	Degas
Collector	+0V	+0V
Grid	+200V	+500V
Filament bias	+50V	+0V
Max. Emission	10mA	100mA W, 60mA Ir

**Sensitivity, S, mBar<sup>-1</sup>**

H <sub>2</sub> O	19	N <sub>2</sub>	19
O <sub>2</sub>	21	CO	19
H <sub>2</sub>	6.2	CO <sub>2</sub>	27
He	2.4	Ne	5.4
Ar	21	CH <sub>4</sub>	27

These bias conditions produce sensitivity shown in the table on the right.

Divide S by 100 for Pa<sup>-1</sup>; multiply by 1.33 for Torr<sup>-1</sup>.

**Filament Types**

Filament power varies over the useful life of a filament, due to gradual erosion of bare tungsten or loss of the oxide coating. In general, yttria-coated iridium filaments require about one quarter the power of tungsten at mid-life. Thoria is radioactive, toxic and no longer recommended. Yttria has similar properties and runs less than 50°C hotter in normal emission. Yttria also has better adhesion and consequently longer life. Oxide-coated filaments adsorb water in storage and may require more power initially to evaporate it.

The filament power supply must be capable of providing high currents to develop adequate power in the low resistance of a cold filament and sufficient voltage to compensate for drops in a long, hot cable. A power-limited supply of 40 watts capable of providing up to 12 volts and up to 4 amps will drive any AIG17G gauge operating under any conditions, (including degassing during bakeout at 250°C) with an AIGL9 lead. AML BA gauge controllers exceed these requirements and include comprehensive filament protection features.

**EU EMC Directive 89/336/EEC**

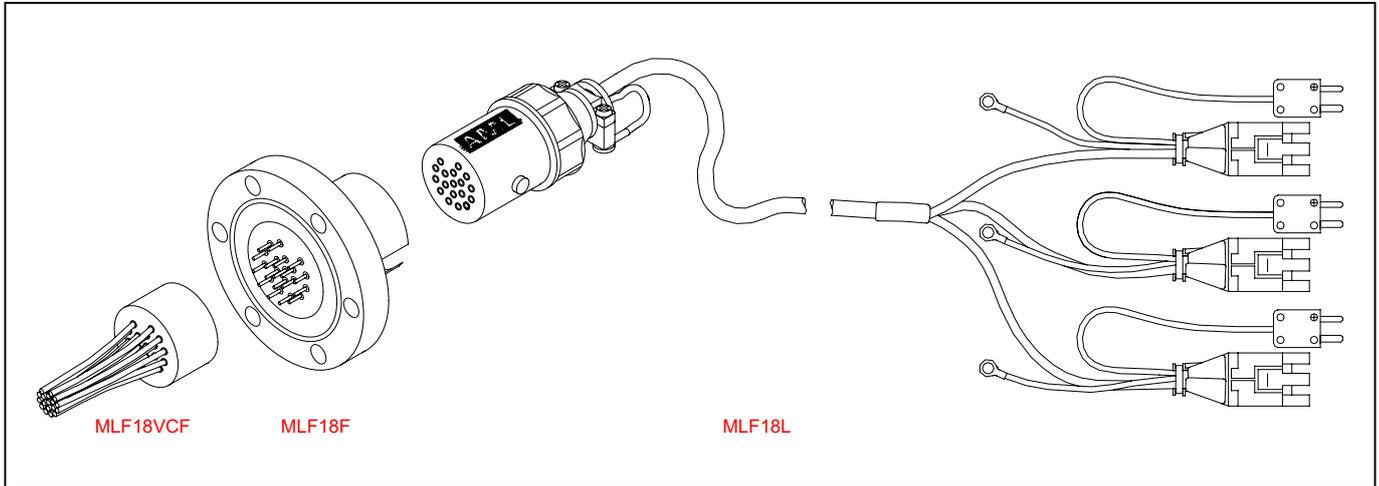
AML Pressure gauge controllers were tested for compliance with AIGLx cables and AML screened Pirani gauges. Installations using other cables without overall screens and controlled-grounding may not comply with legal requirements in the EU.

<b>Ordering information:</b>	<b>AIG17G</b> <b>AIG17P</b>	UHV BA Gauge, twin tungsten filaments. UHV BA Gauge, twin tungsten filaments with integral Pirani gauge.
	<b>AIGL3</b> or <b>AIGL6</b> or <b>AIGL9</b> <b>AIGL3P</b>	Lead for AIG17, bakeable, 3m / 6m / 9m Lead for AIG17P, bakeable, 3m
	<b>FIL17</b> <b>FIL19</b>	Twin tungsten filament assembly Twin yttria-coated iridium filament assembly



**CONNECTORS, LEADS, FEEDTHROUGHS AND WIRING ACCESSORIES  
FOR UHV STEPPER MOTORS AND OTHER ELECTRICAL VACUUM DEVICES**

AML produce a range of wiring accessories to complement their UHV compatible Stepper motors. These components make installation of motors and other electrical items in vacuum much easier. The preferred components are now based on 18 pin feedthrough, but the 12 way types remain available. The 18 and 12-way types cannot be mated, because the pin diameters are different.

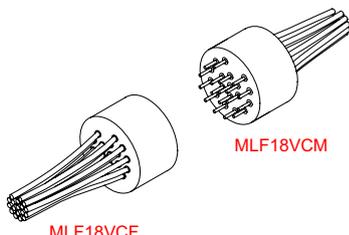


**MLF18VCF** is a 18-way electrical female connector for use in UHV and is bakeable to 250°C. It mates with the MLF18F feedthrough and the MLF18VCM male connector. The insulated body is PEEK, which has exceptional outgassing performance. All internal spaces are well-ventilated. The gold-plated, barbed crimp-contacts are attached to wires **before** insertion into the body and removed with a standard pin extraction tool, if required. Individual contacts can be inserted or removed without disturbing others. It may be ordered pre-wired to one, two or three vacuum stepper motors.

**MLF18F** 18-way feedthrough on a NW35CF (70mm OD) flange which mates with the MLF18VCF UHV connector, MLF18L lead or MLF18AC air-side connector. It has individual glass compression seals which are much more robust than ceramic seals and is bakeable to 250°C. The 1.5mm diameter pins are gold-plated. For non-motor applications observe the maximum ratings of 200V, 5A maximum per pin and 15A maximum per feedthrough.

**MLF18L** is a 3 metre 250°C-bakeable lead for use with AML stepper motor drives and up to 3 motors installed in one vacuum chamber. It mates with the MLF18F feedthrough.

**MLF18AC** is the bakeable air side connector which mates with the MLF18F feedthrough. Use this for non-motor applications or for connecting to other manufacturer's drives.



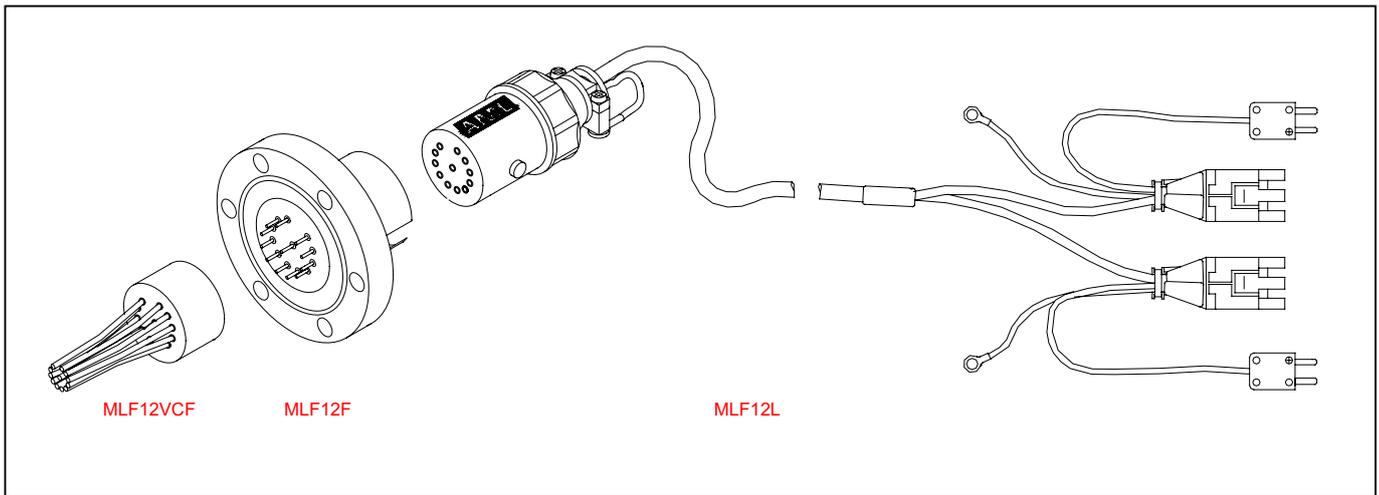
**MLF18VCM** is the male counterpart of MLF18VCF. It is useful for extension cables or on de-mountable sub assemblies. This item may be ordered pre-wired to one, two or three vacuum stepper motors.

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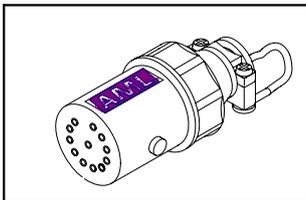
## AML DATA SHEET: MLF Issue F



**MLF12VCF** is a 12-way electrical connector for use in UHV and is bakeable to 250°C. The insulated body is PEEK, which has exceptional outgassing performance. All internal spaces are well ventilated. The proprietary AML barbed-crimp contacts are gold-plated and may be attached to individual wires **before** insertion into the body and removed with a standard pin extraction tool, if required. Individual contacts can be inserted or removed without disturbing others. This item may be ordered pre-wired to one or two vacuum stepper motors.

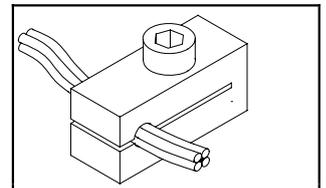
**MLF12F** 12-way feedthrough on a NW35CF (70mm OD) flange. It has individual glass compression seals which are much more robust than ceramic seals and is bakeable to 250°C. The 1mm diameter pins are gold-plated. For non-motor applications observe the maximum ratings of 150V, 5A maximum per pin and 15A maximum per connector.

**MLF12L** is a 3 metre 250°C-bakeable lead for use with AML stepper motor drives and one or two motors installed in one vacuum chamber. It mates directly with the MLF12F feedthrough.



**MLF12AC** is the bakeable air side connector which mates with the MLF12F feedthrough. Use this for non-motor applications or for connecting to other manufacturers' drives.

**PWB** is a set of 4 PEEK wiring bushes and M3 x 10mm vented screws. The four phase wires and thermocouple from a single motor are a light fit in the hole in the bush. Use one in situations where a 'P' clip would be used in air. The wiring hole may be reamed out with hand tools for other wiring applications. Bakeable to 250°C.

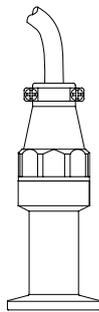


The AML logo, consisting of the letters 'AML' in a bold, white, sans-serif font inside an orange rectangular box.

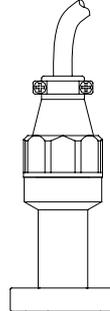
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## PIRANI GAUGEHEADS FOR ULTRAHIGH VACUUM MODELS PVU PVB

Aml produce a range of Pirani gaugeheads to complement their Pressure Gauge Controllers.  
All models include an integral lead for convenience and economy in installation.



PVU2



PVB2

### PIRANI GAUGES

Pirani gauges detect the cooling effect of residual gas molecules on a heated filament. The rate of heat transfer to the gas is related to pressure and causes a change in the electrical resistance of the filament or the amount of power required to maintain it at constant temperature. The filament is normally connected in a bridge circuit.

#### General Features of AML Pirani Gauges

- ◆ AML Pirani gaugeheads are intended for use in constant-voltage bridge circuits, which reduces the filament temperature and the rate of filament corrosion or contamination at high pressures.
- ◆ Range: 1 bar to  $1 \times 10^{-3}$  millibars.
- ◆ May be interchanged between any AML PGC series or equivalent controllers without re-calibration. Extension cables do not affect the calibration.
- ◆ Supplied calibrated for vertical installation in dry nitrogen. Internal calibration adjustments enable them to be used with other orientations and gases.
- ◆ Materials exposed to the vacuum are stainless steel, nickel-cobalt-iron, glass and tungsten.

#### Features of specific AML Pirani Gauges

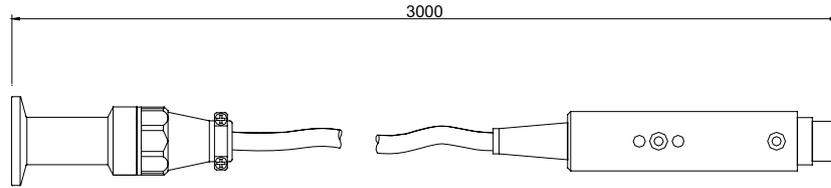
- ◆ **PVU2** is a low-cost non-bakeable gaugehead with an integral 3-metre lead and connector. The feedthroughs use matched glass-to-metal seals which have better life and leak performance than the epoxy or compression seals used on other low-cost Pirani gaugeheads. The standard flange is NW16KF.
- ◆ **PVB2** is a UHV-compatible stainless-steel Pirani gauge with an integral 3-metre lead and connector which can be baked at 250°C. The standard flange is NW16CF.
- ◆ **PVX10** is a 10 metre extension cable for use with PVU2 or PVB2. These cables extend the Kelvin sensing of AML PGCs, so that the extension does not affect the calibration.

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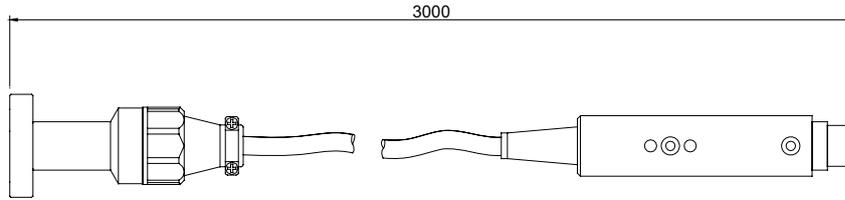
AML

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## GAUGEHEAD DIMENSIONS / ORDERING INFORMATION



**PVU2**

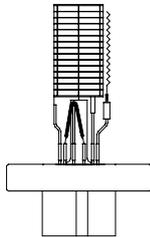


**PVB2**

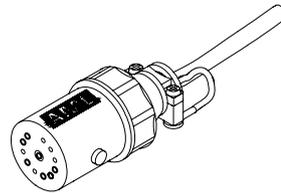
Gauges are supplied calibrated for dry nitrogen. Calibration instructions are supplied with all gauges. AML Pirani gauges are intended for use with AML Pressure gauge controllers and 1U-high controllers manufactured by AML for other vendors. Such controllers may be identified by the AML copyright marks on the printed circuit boards.

<b>Ordering information:</b>	<b>PVU2</b>	Pirani Gauge, non-bakeable , 3m lead
	<b>PVB2</b>	Pirani Gauge, bakeable , 3m lead
	<b>PVX10</b>	Pirani Extension lead, non- bakeable, 10 metres
<b>Related Products:</b>	<b>AIG17P</b>	BA gauge with Integral Pirani Gauge
	<b>AIGL3P</b>	Lead for AIG17P, bakeable 3m

For new installations the use of combination gauges will save cost and reduce the number of ports required.



**AIG17P**



**AIGL3P**



## UHV BAYARD-ALPERT GAUGE CONTROLLER MODEL NGC2



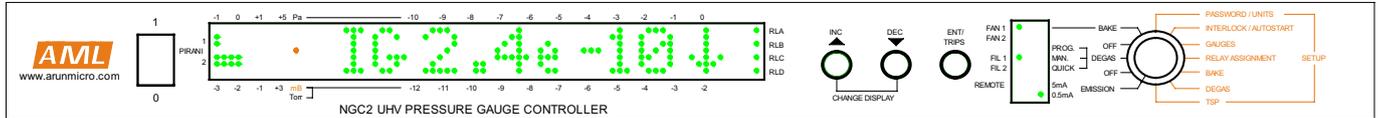
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## UHV BAYARD-ALPERT GAUGE CONTROLLER MODEL NGC2

AML's NGC2 UHV BA controller is a powerful new-generation instrument, which has improved performance compared to PGC1 and PGC2, which it replaces. In 98% of cases it is a direct, plug-in replacement. Operation is even simpler, and more resistant to student-abuse. It has a longer, brighter LED display. All functions and setup are available from the front panel. Two fans are fitted, used alternately and monitored for performance.



- ◆ 1U high full-width, steel-cased instrument for easy rack-mounting. Operates on 100 to 240v, 50/60Hz lines without adjustment.
- ◆ Controls 1 BA gauge plus 2 AML Pirani gauges plus a Capacitance Manometer simultaneously.
- ◆ Continuous measurement range: 1 Bar to  $3 \times 10^{-11}$  millibar.
- ◆ AML and approved equivalent gaugeheads may be exchanged or lead lengths altered without adjustment. Many other BA gauges are suitable.
- ◆ Filament current limit automatically set for filament material. Filament in use selected from the front panel. Ion gauge is grounded when not operating.
- ◆ Variable BA gauge sensitivity.
- ◆◆ Reduced emission current. Instrument advises optimum emission current at low pressure.
- ◆ Automatic start of BA gauge in pump-down.
- ◆ BA gauge interlock by Pirani or external signal (contact closure).
- ◆◆ Electron-bombardment degas program with independent adjustment of ramp, power and dwell time. Variable "quick" degas program with ramped start. Manual degas. Excessive or inappropriate degas is limited or inhibited.
- ◆◆ Pirani gauges may be switched on or off from the front panel.
- ◆◆ Comprehensive temperature management, with early indication of the need to replace a fan. Failure of a single fan does not inhibit use.
- ◆ Bright green LED display shows bargraph or numeric pressure, trend, diagnostics, etc.. Display in mBar, Torr or Pascal. Permanent bargraph of Pirani pressures.
- ◆ Simple, guided-setup is re-entrant and divided by function. Setup can be password-protected.
- ◆◆ Preset adjustable bakeout program with control of temperature, time and overpressure limit. Integral K-thermocouple amplifier.
- ◆◆ Automatic control of sublimation pump with countdown/cancellation of imminent firing.
- ◆ Integral, variable-sensitivity leak detector with audio output on Pirani1 or ion gauge.
- ◆◆ 4 internal power relays (5A, 240V) flexibly-assignable to gauges from the front panel. All external relay wiring is connected through a pluggable screw terminal block, which has a retaining safety shield.
- ◆◆ Non-volatile relay setpoints with manual override and inhibit facility. Simple setpoint adjustment and interrogation while measuring pressure.
- ◆◆ RS232-compatible interface for data-logging and control (cost - option).
- ◆ Recorder output 1.0 volt/decade on pluggable, 4-way screw terminal block with capacitance manometer and inhibit signals.
- ◆ Supplied with a mains lead, relay and auxiliary connectors, spare fuse and brief user manual.
- ◆◆ Cost-saving packages including gauges, leads and extended warranty are available.

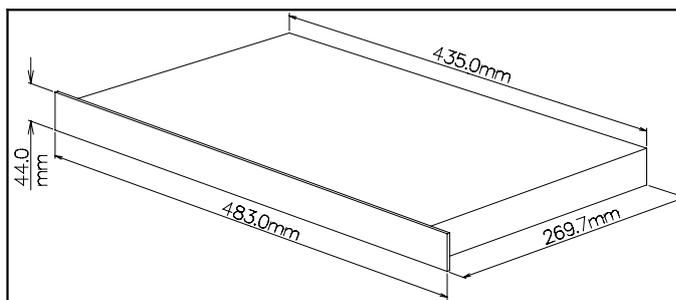
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## SPECIFICATION

<b>DIMENSIONS</b>	
<b>Nett Weight</b>	<b>3.5 kg</b>
<b>Shipping Weight</b>	<b>5.0 kg</b>
<b>Carton Dimensions</b>	<b>60 x 40 x 13 cm</b>



### BAYARD ALPERT GAUGE

- Types:** AML AIG17G is recommended. BA gauges from many other manufacturers are suitable, without adjustment other than sensitivity. A list of tested and approved gauges is available from AML. The use of non-approved gauges and leads may result in unstable emission or non-compliance with EU legal requirements and is not covered by AML's warranty.
- Range:** From  $1 \times 10^{-3}$  to below  $3 \times 10^{-11}$  mB with a UHV gaugehead with tungsten filaments. The low limit is dependent on gaugehead, cable construction and length and conditions of use. The upper limit is determined by the acceptable life of the filament and may be extended by the use of thoria or yttria-coated iridium filaments.
- Accuracy and Repeatability:** Determined principally by the gaugehead: controller errors are much smaller. Emission at 0.5mA is recommended. Electrometer logarithmic conformance <1% within any decade from 0.1 mA to 10 pA, <5% to 1 mA and <20% to 2 pA at 25°C incoming air temperature. Slope temperature compensation <0.02% per degree Celsius. Differential linearity of the 12-bit A to D converter is less than 0.1 LSB. Emission current initial accuracy <2%, stability <1%.
- Gauge Supplies:** Grid: +200 volts in emission, +500 volts at  $\leq 60$  mA in degas.  
Filament: +50 volt bias,  $\leq 12$  volts at  $\leq 4.2$  A (Tungsten)  $\leq 2.6$  A (Yttria) with filament power limited at > 30 watts.

### CAPACITANCE MANOMETER ( CM )

Capacitance Manometers of any manufacture having a +10 volt full-scale output at 1, 10, 100 or 1000 Torr or millibar and which are self-powered are suitable. Pressure indication can be in units different to the full-scale units defined for the Capacitance Manometer.

### PIRANI GAUGES.

AML types PVU2 and PVB2. A constant-voltage bridge circuit reduces contamination at high pressures. AML Pirani gaugeheads may be exchanged or extension leads may be connected without adjustments being necessary.

### GENERAL

- Pressure Display:** Scientific notation with a 2-digit mantissa for all gauges. Bargraph displays may be selected.
- Operating Temperature:** 5° to 35° Celsius for specified performance. Incoming air temperature is measured and displayed and operation is inhibited at >40°C.
- Supply Voltage:** 100 V to 240 V nominal at 48 to 65 Hz, without adjustment.
- Power Consumption:** <20 watts idling, <75watts in emission.
- EMC Compliance:** **Compliance with EU EMC Directive 89/336/EEC can only be guaranteed if AML BA gauge leads and screened Pirani gauges are used.**

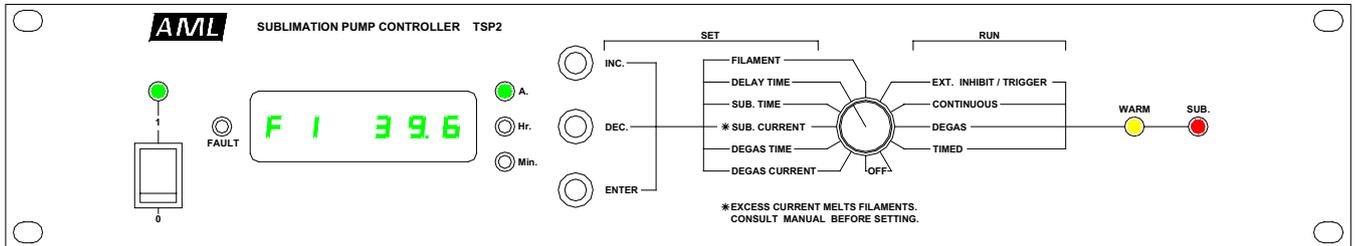
AML pursues a policy of continuous product improvement and reserves the right to make detail changes to specifications without consultation. Unless otherwise stated all specifications are typical and at 25° Celsius, after 1 hour operation. E and OE.

<b>Ordering information:</b>	<b>NGC2</b>	Pressure Gauge Controller
<b>Related products:</b>	<b>AIG17G</b>	UHV Bayard-Alpert gauge, twin tungsten filaments
	<b>AIGL3,(6),(9)</b>	3, (6), (9) metre, screened, bakeable BA gauge lead
	<b>PVU2</b>	Pirani gauge, non-bakeable, with integral, screened 3 metre lead
	<b>PVB2</b>	Pirani gauge, bakeable, with integral, screened 3 metre lead
	<b>AIG17P</b>	UHV Bayard-Alpert gauge, twin tungsten filaments with integral Pirani gauge
	<b>AIGL3P</b>	Lead for AIG17P, screened, bakeable, 3metre
	<b>PVX10</b>	10 metre, non-bakeable, screened Pirani extension lead



## TITANIUM-SUBLIMATION PUMP CONTROLLER MODEL TSP2

The AML Titanium Sublimation Pump Controller regulates the quantity of material sublimated from the filaments, compensating for changing conditions and eliminating the need for operator attendance or adjustment.



- ◆ 2U (88mm) high full-width instrument for easy rack-mounting.
- ◆ Low cost. Simple, robust and reliable design, which is easy to service. All output switching is by semiconductor devices.
- ◆ Low-noise. Complies with EC EMC and LV Directives. Power factor >0.97.
- ◆ Sublimation current settable over the range 30 to 55A in increments of 0.1A. Suits 85% Ti, 15% Mo filaments from 1.8 to 2.1mm diameter.
- ◆ Filaments are warmed and cooled gently to avoid thermal shocks. The sublimation current contains minimal harmonics to reduce the risk of early filament failure due to magnetostrictive stress or mechanical resonance.
- ◆ Pump current is accurately regulated in order to automatically compensate for mains variations and pump cables warming.
- ◆ No in-service adjustment is required.
- ◆ Self-timed delay between getter renewal adjustable from 1 minute to 9.9 hours.
- ◆ Filaments may be run for degassing at currents between 5 and 25A to prevent overloading the ion pump. Filaments can be kept warm at the end of a system bake.
- ◆ Sublimation inhibit/trigger function by external switch or relay.
- ◆ Suitable for a wide range of cartridges with up to 4 filaments.
- ◆ Indicates open-circuit filament, shorted cable/filament, inhibit, overtemperature. Thermal overload protection.

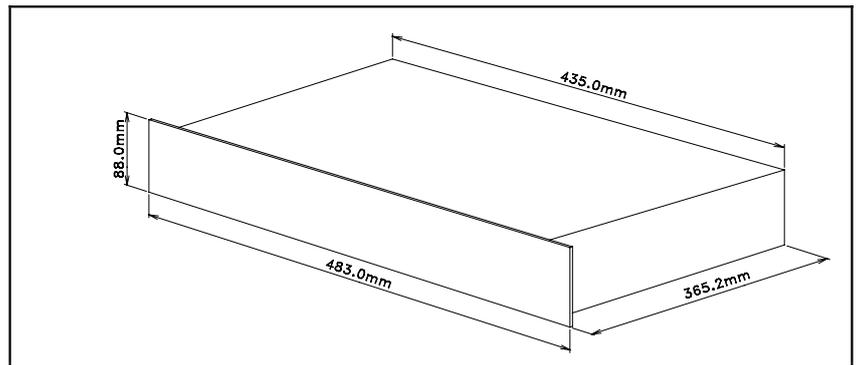
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## SPECIFICATION

Dimensions:	
Width	483mm
Depth	365.2mm
Height	88mm
TSP2 weight	11kg
TSP2 shipping weight	13kg
TSP2L6 weight	2.5kg
Dimensions are nominal, weights approximate.	



<b>Operating Temperature:</b>	10 to 40°C for rated performance. Operation up to 50°C is possible at longer sublimation intervals, i.e. below 10 <sup>-6</sup> millibar.
<b>Supply Voltage:</b>	100/110V (Option L) <b>OR</b> 220/230V RMS (Option H) 50 or 60Hz, to order.
<b>Power Consumption:</b>	Less than 20 watts when idling, less than 700 watts when sublimating at 55A with a maximum-length cable.
<b>Power Factor:</b>	> 0.97 at maximum output power.
<b>Output Current:</b>	Regulated at 30 to 55A RMS x 0.1A in sublimation, 5 to 25A RMS x 5A in degas.
<b>Output Voltage:</b>	The output voltage is determined by the lead and cartridge resistance. Maximum output voltage is ≥9.5 V RMS at 45A.
<b>Timing:</b>	Sublimation period 0.1 to 3 minutes x 0.1 min.. Delay interval 1 to 59 minutes, 1 to 9.9 hours. Degas time 1 to 99 minutes. All timing is derived from the mains supply frequency.
<b>Output Duty Cycle:</b>	100% at 300w output power and less than 30°C ambient temperature.
<p>AML pursues a policy of continuous product improvement and reserves the right to make detail changes to specifications without consultation. Unless otherwise stated all specifications are typical and at 25° Celsius. E and OE.</p>	

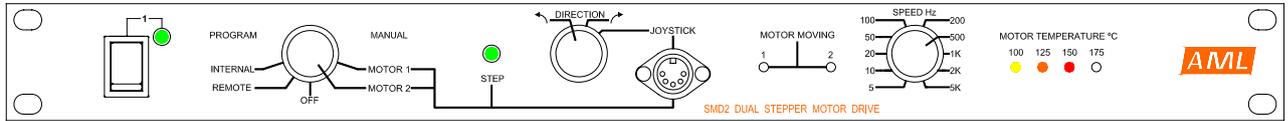
**Ordering information:** **TSP2** Titanium Sublimation Pump Controller  
 add suffix **H** for 220/240 volt mains supply  
 add suffix **L** for 100/110 volt mains supply

**TSP2L6** 6 metre non-bakeable pump lead  
**TSP2BL6** 6 metre pump lead with 1 metre 200°C-bakeable section



# DUAL UHV STEPPER MOTOR DRIVE MODEL: SMD2

AML's SMD2 Vacuum-Compatible Stepper Motor Drive is designed to match AML motors. Two motors may be driven sequentially either under host computer control, by an internally stored program, from the front panel switches or a hand-held joystick. This drive is also economical for use with compatible air-side motors.



◆◆ Denotes features which have recently been included or improved.

- ◆ 1U high full-width, steel-cased instrument for easy rack-mounting.
- ◆ Drives 2 UHV stepper motors sequentially.
- ◆ Automatic transition between drive modes (step ÷8, ÷4, half and full) at user-selected speeds to control resonances.
- ◆◆ Phase currents can be set from 0.1 to 1A in increments of 0.1A.
- ◆◆ Advanced low-power drive techniques for minimum motor temperature rise and outgassing and maximum operating time.
- ◆◆ Holding torque can be controlled independently of dynamic torque under program control, to reduce power.
- ◆ Thermocouple amplifiers (type K) for motor temperature indication, protection and control of motor bakeout.
- ◆ RS232C interface for host computer control. Drive programs can be developed and run from the computer console (Remote Program Control) or downloaded for stand-alone operation (Internal Program Control).
- ◆ Motors may be operated manually with the front panel 'STEP' and 'DIRECTION' switches or with the joystick. Single-step or multiple-step operation with smooth acceleration to the selected speed.
- ◆ 3 user inputs for interaction with program execution, in addition to two "End of travel" inputs for each motor.
- ◆ 3 user outputs for switching under program control.
- ◆◆ Simple control language has many powerful commands which allow control of all aspects of motion or position. Conditional operation, loops and jumps are possible. All commands consist of single characters, followed by numbers, where appropriate. Summary overleaf.
- ◆◆ Program development is simplified by improved development software with on-line help and debugging facilities.
- ◆ Displays temperature of the motor being driven or baked.
- ◆◆ Supplied with all connectors, mains lead, fuses, joystick, comprehensive manual, interface cable and software for program development on any IBM-compatible PC.
- ◆◆ Simplified connection with MLF18 bakeable lead, feedthrough and connection kit. ( Not included. )
- ◆ Economical with standard stepper motors e.g. with motorised motion feedthroughs.
- ◆ Operates on any supply from 100 to 240V, 50/60 Hz without adjustment.

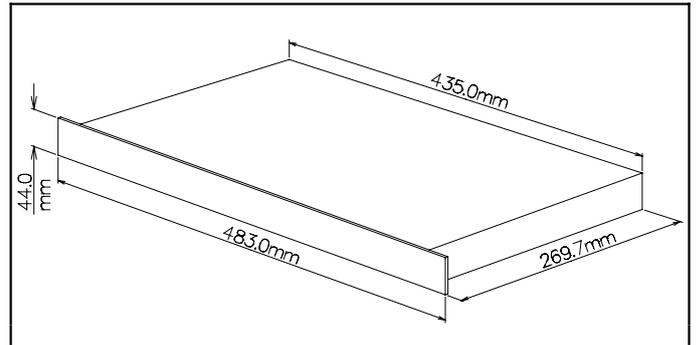
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**SPECIFICATION**

DIMENSIONS	
<b>Nett Weight</b>	<b>4 kg</b>
<b>Shipping Weight</b>	<b>6 kg</b>
<b>Carton Dimensions</b>	<b>60 x 40 x 13cm</b>



**Host Computer Command Summary:**

<b>Ax</b>	Set user output x.
<b>Bx</b>	Select motor x.
<b>b</b>	Bakeout selected motor. ( 175°C ).
<b>Cx</b>	Clear user output x.
<b>Dx</b>	Delay x milliseconds, where x is 1 to 65535.
<b>E</b>	Start execution of a downloaded program.
<b>F</b>	Status request. (Busy, ready or error condition.)
<b>fx</b>	Preset position counter to x. ( Sets a reference location at x=0 )
<b>G±x</b>	Go to a defined location x steps from a reference location.
<b>g±</b>	Rotate at preset speed indefinitely in the direction specified by the sign.
<b>H±</b>	Go to a location 8 steps inside the specified (EOT+ or EOT-) limit switch.
<b>hx,x</b>	Set the power reduction parameters (time and phase current after hold time).
<b>In</b>	Initialise user output or position counter, as defined by n.
<b>J,j</b>	Jump to another part of the program. Conditional jumps are determined by user inputs.
<b>K</b>	Abort program execution.
<b>Ln</b>	Loop through a sequence n times, where n is 1 to 255.
<b>M</b>	Set the step rates for automatic ministep mode transition.
<b>P</b>	Enter or exit the programming mode of operation.
<b>Q</b>	Read the program resident in memory back via RS232C.
<b>Tx</b>	Define the current slew speed in steps per second, where x is between 10 and the maximum rate defined by the X command ( <6000).
<b>Ux</b>	Until. Continue executing the saved program until user input x is "low".
<b>Vx</b>	Status request (Position, user inputs, temperature, software version, dynamic parameters).
<b>Wx</b>	Wait for user input p to go "low" before executing the next instruction.
<b>Xx,y,z,</b>	Define the acceleration / retardation parameters, where x is the start speed, y is the maximum slew speed and z is the number of steps in the acceleration or retardation ramp.
<b>Z</b>	Reduce speed to zero with the defined retardation.
<b>±x</b>	Rotate xx steps in the defined direction, where x is between 1 and 10 <sup>6</sup> .

The above is given for information purposes only and is not intended to be a rigorous specification for programming purposes.  
 AML pursues a policy of continuous product improvement and reserves the right to make detail changes to specifications without consultation. E and OE.

**Ordering information: SMD2**

Dual UHV-Compatible Stepper Motor Drive

**Related products: C14.1, C17.1, C17.2  
 B23.1, B23.2**

UHV-Compatible Stepper Motors

**MLF18**

Feedthrough, lead and connector kit.

**LPXxx**

UHV Low-Profile Sample Transporter, 1 or 4µm resolution

**LPVxx**

UHV Low-Profile Sample Transporter, 1 or 4µm resolution

**CRSxx**

UHV Rotation Stages

