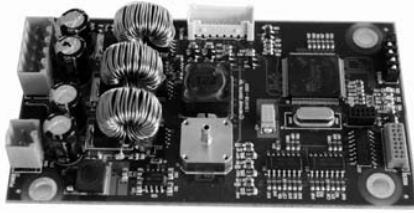


# DMX2 Plus DMX2 Pro



## Instruction

REF 2100202-0001/ENG



### English

**Medical devices entirely made in Switzerland by Bien-Air Dental SA.**

### Type

Electronic control for Bien-Air Dental micromotors. Brushless micromotors without sensors, with current limiting function, check of torque\* and speed.

### Intended use

Product intended for professional use only. Use in dentistry for prophylaxis, general dentistry and endodontic work\*. Any use other than that for which this device is intended is prohibited and may prove dangerous.

### Technical data

#### Classification

Class IIa in accordance with European Directive 93/42/EEC concerning medical devices.

#### Dimensions

102 x 58 x 27 mm

#### Weight

approx. 75 g

#### Voltage

32 Vdc ±10%

#### Description

For device references, see fig. 2 ⑥ and ⑦. MX2 system: consists of an MX2 motor, MX2-400 hose, and DMX2 Plus/DMX2 Pro electronic control.

#### Current limitation:

Micromotor MX2: 4.2 A

#### Electric power supply nominal power rating:

60 VA

#### Connectors and wiring diagram

see fig. 1 and fig. 2.

- ① Feed voltage
- ② Motor and light
- ③ Analogue inputs
- ④ DIP switches
- ⑤ Air pressure sensor

The general wiring diagram shows all the main connections of the complete MX2 system. The connections actually required depend on the integration of the MX2 system in the unit and the desired functions.

The table below describes the main characteristics of each connection described in the wiring diagram.

#### Precautions to be taken during integration

- During integration, only use a medical supply that conforms to standards EN / IEC 60601-1 and EN / IEC 60601-1-2, respecting the required withstand voltage, creepage distances and distances in air. Following integration, the complete assembly becomes an EM system.
- Connect the ground (GND) of all the electronic controls connected to the DMX2 Plus/DMX2 Pro. This also applies to digital interfaces.
- The motor light must be powered from the DMX2 Plus/DMX2 Pro. Do not use another power supply for the light.
- The input voltage levels can be configured via the RS-232 serial interface (document available on request).
- For more information or if you have any questions about the integration, wiring configuration

or programming of the MX2 system, please contact your Bien-Air Dental representative (addresses below).

- Only use accessories, transducers and cables specified by Bien-Air Dental SA.

#### Protection installed

##### Temperature

- The motor outer surface and electronic control temperatures are continuously controlled by the system.

##### Power supply

- The electronic control system is protected against over- and undervoltage, and also against short circuits on the feed input.

##### Motor and light

- The motor output (phases) is protected against short circuits.
- The light output is protected against short circuits.
- Interruption of one, two or three phases is detected by the system, and the motor either does not start or stops.

#### Exhaust air

REF 249.39.11: this system is only necessary if the device is pneumatically-controlled, with the air pedal in the raised position, and if the valve controlled by the pedal is not fitted with a vent. Contact your dealer for fitting.

#### Standards

This electronic control conforms to electrical safety standards in line with standard IEC 60601-1 and those governing electromagnetic compatibility in line with standard IEC 60601-1-2.

#### Electromagnetic compatibility

Corresponds to the electromagnetic compatibility in accordance with IEC 60601-1-2. Declaration by the manufacturer regarding electromagnetic compatibility: refer to the tables on pages 3-4.

#### Information

The technical specifications, illustrations and dimensions contained in these instructions are given only as a guide. They may not be the subject of any claim. The manufacturer reserves the right to make technical improvements to its equipment, without amending these instructions. For all additional information, please contact Bien-Air Dental SA at the address indicated on the back cover.

#### Options

#### Converter 24/32-24 REF 1500580-001

The DMX2 Plus/DMX2 Pro is fed by 32 Vdc +/-10%. If your system only has a 24 Vac feed, we recommend that you use this converter. This accessory enables you to obtain optimum performance from the MX2 system, by providing two stabilised voltages: 32 Vdc (60W continuous, 130W peak) for the MX2 motor feed.

#### Dual Motor Switch REF 1500554-001

We recommend this module when using 2 MX2 motors with a DMX2 Plus/DMX2 Pro board. It allows switching of the 3 motor phases, the 2 light connections. The relays are switched simultaneously and controlled by the MUX Control input (24 Vdc). To connect this electronic control to the MX2 system, please consult the wiring diagram.

Description	Diagram ref.	Specification	Notes
<b>DMX2 Plus REF 1501393-001 / DMX2 Pro REF 1501384</b>			
Voltage	Input -	32 Vdc +/- 10%	
Speed reference	Input	0 to 5 Vdc (linear)	Pull-down Input
MUX IN Motor	Input	0 or 5 Vdc (TTL)	Pull-down Input
Rotation (CW/CCW)	Input	0 or 5 Vdc (TTL)	Pull-down Input
Brightness	Input	0 to 5 Vdc (16 output levels)	Pull-up Input
Pneumatic pressure reference	Input	0 to 3 bar (0 to 300 kPa, 0 to 43.5 psi)	
Motor Power	Output	Phases A, B, and C	
Motor Light	Output	L+ / L-	
MUX OUT Motor	Output	24 Vdc, Max. current = 100mA	
RS-232		Digitale interface	

#### Voltage converter REF 1500580-001

Voltage	Input	22 to 27 Vac or 22 to 37 Vdc
Voltage	Output	24 Vdc (24W peak / 12W cont)
Voltage	Output	32 Vdc (130W peak / 60W cont)

#### Dual Motor Switch REF 1500554-001

IN motor	Input	3 motor phases: A, B, C (Max. current = 6A) 2 light connections L+, L- (Max. current = 3A)	Max. relay current
MUX Control	Input	24 Vdc, 200mW	Max. relay current
EV In	Input	Solenoid valve input (24 Vdc)	
OUT motor 1	Output	3 motor phases: A, B, C (Max. current = 6A) 2 light connections	Max. relay current
OUT motor 2	Output	3 motor phases: A, B, C (Max. current = 6A) 2 light connections	Max. relay current

#### Operating mode selection by DIP-Switches

The 4 DIP-Switches are used to configure the system, and in particular to select the operating mode (see table below). For more information and technical support, please contact your Bien-Air Dental SA dealer.

1	2	3	4
Mode		Function	

The serial mode protocols for mode 3 are available on request from your Bien-Air Dental SA dealer.

0 = OFF      1 = ON

Mode	Dip switches				Description
	1	2	3	4	
0	0	0	X	X	Electric mode from 100 rpm to 40 000 rpm
1	0	1	X	X	Pneumatic mode from 100 rpm to 40 000 rpm
2	1	0	X	X	Pneumatic mode with electric limitation
3	1	1	X	X	Serial mode (RS232)
All	X	X	1	X	Status frame auto-send (1 = enabled, 0 = disabled)
All modes except 3	X	X	X	1	Light delay (1 = enabled, 0 = disabled)
Mode 3 only	1	1	X	1	Frame check (0 = checksum, 1 = CRC)

#### Main functions and controls

- Pneumatic control.
- Electric control by analogue inputs or digital interface (RS-232)
- Control with up to two MX2 motors (using Dual Motor Switch REF 1500554)
- The system variable parameters are as follows:
  - Speed range 100 - 40.000 rpm (maximum torque of over 3.0 Ncm available across the full speed range)
  - Progressive or ON/OFF mode speed adjustment
  - Maximum torque adjustable from 10 to 100% in 1%\* stages
  - Brightness control (16 settings) or light ON/OFF
  - Reversal of rotation direction (clockwise/anti-clockwise)
  - Selection of 'Endodontics'\* modes:
  - Auto-reverse mode: direction of rotation reverses automatically as soon as the torque limit is reached (adjustable from 10% - 100% of maximum torque).
  - Auto-forward mode: direction of rotation reversed as in auto-reverse mode, in addition, the motor switches automatically to clockwise operation after an adjustable period of anti-clockwise rotation (from 0 - 25 seconds).

\*only DMX2 Pro

### Disposal

This device must be recycled. Electrical and electronic equipment may contain dangerous substances which constitute health and environmental hazards. The user must return the device to its dealer or establish direct contact with an approved body for treatment and recovery of this type of equipment (European Directive 2002/96/EC).

### Maintenance

Only use maintenance products and components from Bien-Air Dental. The use of other products and components can void the guarantee.

### Servicing

Never disassemble the device. For any modification and repair, we recommend that you contact your regular supplier or Bien-Air Dental directly. Bien-Air Dental asks the user to have its dynamic instruments checked or inspected at least once a year.

### Environment

#### Working

- Temperature: +10°C (50°F) to +40°C (104°F)
- Relative humidity: 30% to 80%, including condensation
- Atmospheric pressure: 700 hPa to 1060 hPa

### Transport and storage

Environmental conditions for a period of max. 15 weeks

- Temperature: -25°C (-13°F) to +70°C (158°F)
- Relative humidity: 10% to 95%, including condensation
- Atmospheric pressure: 500 hPa to 1060 hPa

### Other precautions for use

The device must be used by a qualified person in accordance with the current legal provisions concerning industrial safety, health and accident prevention measures, and these working instructions. In accordance with these requirements, the operators:

- must only use operating devices that are in perfect working order; in the event of irregular functioning, excessive vibration, abnormal heating or other signs indicating malfunction of the device, the work must be stopped immediately; in this case, contact a repair centre that is approved by Bien-Air Dental;
- must ensure that the device is used only for the purpose for which it is intended, must protect themselves, their patients and third parties from any danger, and must avoid contamination through the use of the product.

The device is not authorised for use in an explosive atmosphere (anaesthetic gas).  
Avoid any contact with liquids.

### Guarantee

#### Terms of guarantee

Bien-Air Dental grants the user a guarantee covering all functional defects, material or production faults. The device is covered by this guarantee for 12 months from the date of invoicing.

In the event of justified claim, Bien-Air Dental or its authorised representative will fulfil the company's obligations under this guarantee by repairing or replacing the product free of charge. Any other claims, of whatever nature, in particular in the form of a claim for damages and interest, are excluded.

Bien-Air Dental shall not be held responsible for damage or injury and the consequences thereof, resulting from:

- excessive wear and tear
- improper use
- non-observance of the instructions for installation, operation and maintenance
- unusual chemical, electrical or electrolytic influences

- poor connections, whether of the air, water or electricity supply.

The guarantee does not cover flexible "fibre optic" type conductors, or any parts made of synthetic materials.

The guarantee shall become null and void if the damage and its consequences are due to improper manipulation of the product, or modifications to the product carried out by persons not authorised by Bien-Air Dental.

Claims under the terms of the guarantee will be considered only on presentation, together with the product, of the invoice or the consignment note, on which the date of purchase, the product reference and the Serial No. should be clearly indicated.

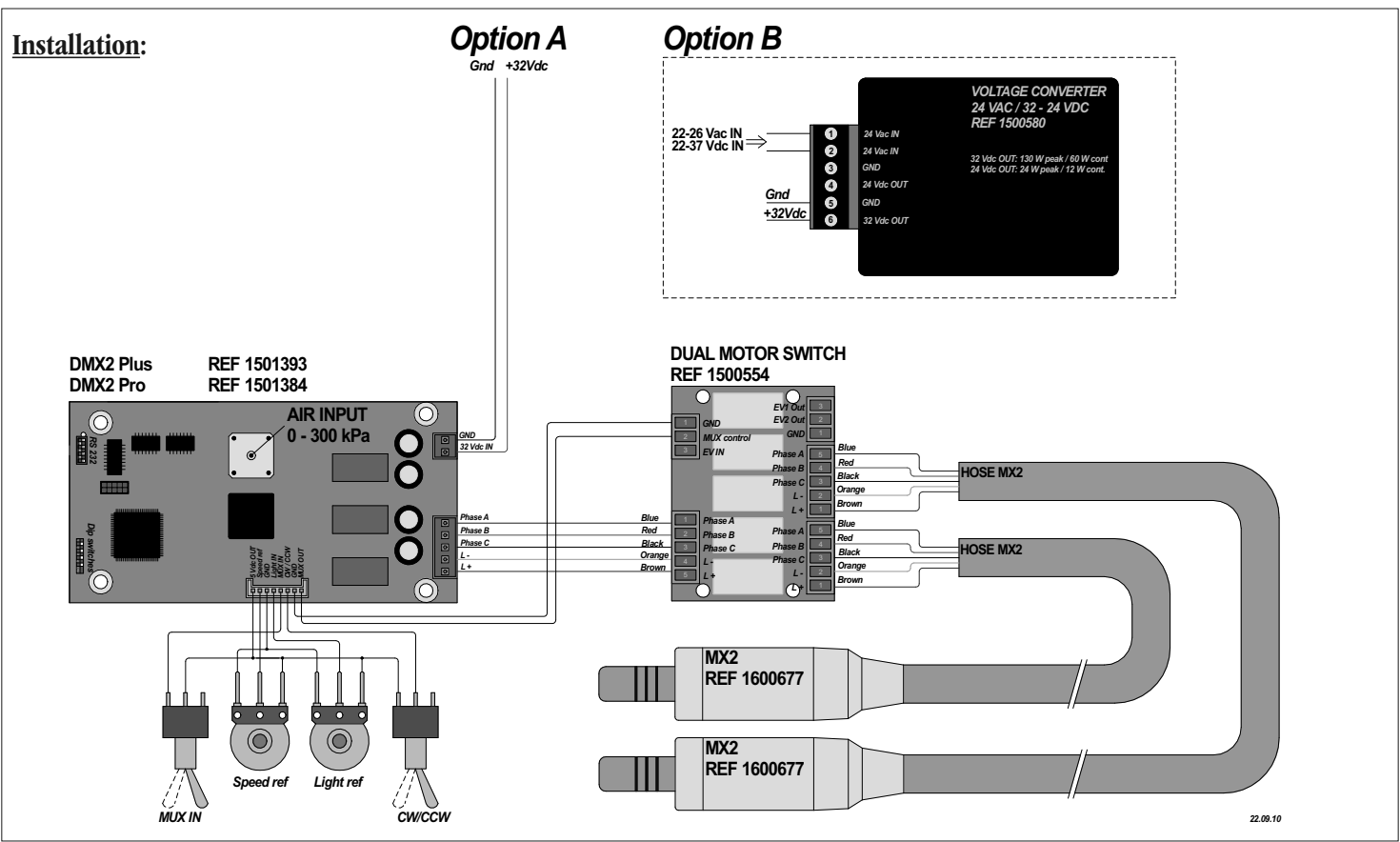


fig. 1

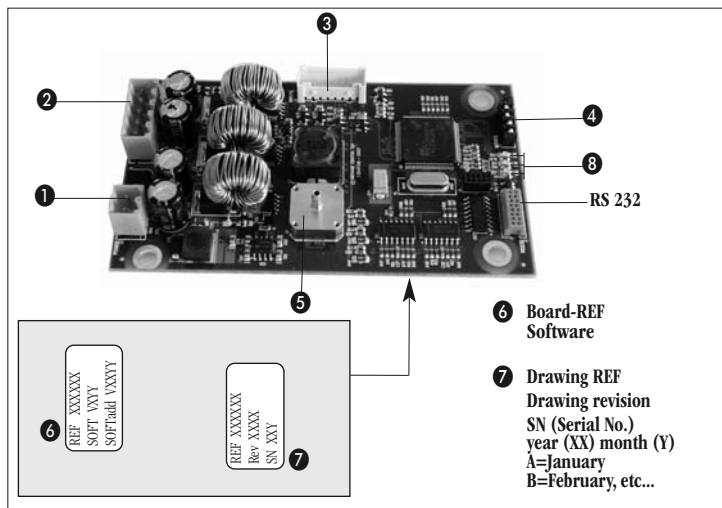


fig. 2

### 8 Diagnostic LEDs

**ON** The green LED is lit when the board is powered  
**DG** The red LED flashes (1-7 times) when a fault occurs (see fault list)  
**RS** The amber LED flashes during RS232 communication

### Fault list

**Fault 1:** Short circuit in motor or cord  
**Fault 2:** Motor live disconnected in motor or cord  
**Fault 3:** RS232 communication cut  
**Fault 4:** EEPROM memory fault  
**Fault 5:** Motor control overheating  
**Fault 6:** Motor control voltage too low  
**Fault 7:** Motor control voltage too high

### Precautions regarding Electromagnetic Compatibility (EMC)

Medical electrical equipment needs special precautions regarding EMC and needs to be installed and put into service according to the EMC information provided in the user's manual and in the present document.

The DMX2 Plus/DMX2 Pro complies with the EMC requirements according to IEC 60601-1-2. Radio transmitting equipment, cellular phones, etc. shall not be used in the close proximity of the device since this could influence the performance of the device. Particular precaution must be considered during use of strong emission sources such as High Frequency surgical equipment and similar so that e.g. the HF cables are not routed on or near the device. If in doubt, please contact a qualified technician or Bien-Air Dental.

The DMX2 Plus/DMX2 Pro should not be used adjacent or stacked with other equipment. If adjacent or stacked use is necessary, the DMX2 Plus/DMX2 Pro should be observed to verify normal operation in the configuration in which it will be used.

### WARNING!

**The use of accessories, transducers and cables other than those specified, with the exception of transducers and cables sold by Bien-Air as replacements parts for internal components, may result in increased emissions or decreased immunity of the DMX2 Plus/DMX2 Pro.**

### Guidance and manufacturer's declaration – electromagnetic emissions

The DMX2 Plus/DMX2 Pro is intended for use in the electromagnetic environment specified below. The customer or the user of the DMX2 Plus/DMX2 Pro should assure that it is used in such an environment.

Emissions test	Compliance	Electromagnetic environment - guidance
RF emissions CISPR 11	Group 1	The DMX2 Plus/DMX2 Pro uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class B	The DMX2 Plus/DMX2 Pro is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Not applicable	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Not applicable	

### Guidance and manufacturer's declaration – electromagnetic immunity

The DMX2 Plus/DMX2 Pro is intended for use in the electromagnetic environment specified below. The customer or the user of the DMX2 Plus/DMX2 Pro should assure that it is used in such an environment.


Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±2 kV contact ±4 kV contact ±6 kV contact ±2 kV air ±4 kV air ±8 kV air	±2 kV contact ±4 kV contact ±6 kV contact N.A. N.A. N.A.	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
Electrical fast transient/burst IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines N.A.	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±0.5 kV line to line ±1 kV line to line ±0.5 kV line to earth ±1 kV line to earth ±2 kV line to earth	±0.5 kV differential mode ±1 kV differential mode N.A. N.A. N.A.	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5 % <i>UT</i> (>95 % dip in <i>UT</i> ) for 0,5 cycle 40 % <i>UT</i> (60 % dip in <i>UT</i> ) for 5 cycles 70 % <i>UT</i> (30 % dip in <i>UT</i> ) for 25 cycles <5 % <i>UT</i> (>95 % dip in <i>UT</i> ) for 5 sec	<5 % <i>UT</i> (>95 % dip in <i>UT</i> ) for 0,5 cycle 40 % <i>UT</i> (60 % dip in <i>UT</i> ) for 5 cycles 70 % <i>UT</i> (30 % dip in <i>UT</i> ) for 25 cycles <5 % <i>UT</i> (>95 % dip in <i>UT</i> ) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user of the DMX2 Plus/DMX2 Pro requires continued operation during power mains interruptions, it is recommended that the DMX2 Plus/DMX2 Pro be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.

NOTE *UT* is the a.c. mains voltage prior to application of the test level.

**Essential performance:** The essential performance is the maintaining of the visual lighting intensity of the LED and the maintaining of motor speed. Maximum allowed speed deviation is ± 5%.

### Guidance and manufacturer's declaration – electromagnetic immunity

The DMX2 Plus/DMX2 Pro is intended for use in the electromagnetic environment specified below. The customer or the user of the DMX2 Plus/DMX2 Pro should assure that it is used in such an environment.

Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 V	Portable and mobile RF communications equipment should be used no closer to any part of the DMX2 Plus/DMX2 Pro, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter.  <b>Recommended separation distance</b>  $d = 1.2\sqrt{P}$ 80 MHz to 800 MHz $d = 1.2\sqrt{P}$ 800 MHz to 2,5 GHz $d = 2.3\sqrt{P}$
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	where <i>P</i> is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and <i>d</i> is the recommended separation distance in metres (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, <sup>a</sup> should be less than the compliance level in each frequency range. <sup>b</sup> Interference may occur in the vicinity of equipment marked with the following symbol: 

NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies.

NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

<sup>a</sup> Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and lan mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the DMX2 Plus/DMX2 Pro is used exceeds the applicable RF compliance level above, the DMX2 Plus/DMX2 Pro should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the DMX2 Plus/DMX2 Pro.

<sup>b</sup> Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.

## Recommended separation distances between portable and mobile RF communications equipment and the DMX2 Plus/DMX2 Pro

The DMX2 Plus/DMX2 Pro is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the DMX2 Plus/DMX2 Pro can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the DMX2 Plus/DMX2 Pro as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of the transmitter W	Separation distance according to frequency of transmitter m		
	150 kHz to 80 MHz $d = 1.2\sqrt{P}$	80 MHz to 800 MHz $d = 1.2\sqrt{P}$	800 MHz to 2.5 GHz $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

For transmitters rated at a maximum output power not listed above, the recommended separation distance  $d$  in metres (m) can be estimated using the equation applicable to the frequency of the transmitter, where  $P$  is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

### NOTE 1

At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

### NOTE 2

These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

This product may be covered by one or more of the following patents:

**EP Europe:** 745358 / 688539 / 948294 / 1145688 / 1563800 / 1563801 / 1675523 / 1753360 **DE Germany:** 29616023.7  
**DK Denmark:** 9600315 **FR France:** 2722972 **CH Switzerland:** 693922 **CN China:** 100528099 / 100522100 / 100522099 / 100553584 **JP Japan:** 3892485 / 4298933 / 7000419 **US United-States:** 5453008 / 6033220 / 6319003 / 7214060 / 7448870  
**RU Russia:** 2361540 / 2361541 / 2372046

REF 1600696-001 BOARD DMX2 Plus / REF 1600666-001 BOARD DMX2 Pro

## Set supplied

**Set DMX2 Plus**  
REF 1600696-001

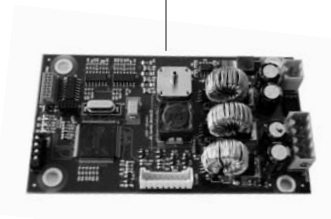
**Set DMX2 Pro**  
REF 1600666-001



REF 1302411

REF 1302410

REF 1501393 DMX2 Plus  
REF 1501384 DMX2 Pro



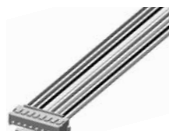
## Optional accessories



REF 1500580-001



L = 30 cm.  
REF 1500579-001



L = 30 cm.  
REF 1501418-001



REF 1500554-001



L = 1.7 m  
REF 1600700-001



REF 1600677-001

REF	Legend
1600696-001	Set DMX2 Plus
1600666-001	Set DMX2 Pro
1501393-001	Electronic DMX2 Plus
1501384-001	Electronic DMX2 Pro
1302410-001	Upper cover
1302411-001	Lower cover
1500554-001	Dual Motor Switch
1500579-001	Cable RS-232. L = 30 cm.
1501418-001	Analogue input cable. L = 30 cm.
1500580-001	Converter 24/32 Vdc and 24 Vdc
249.39.11-001	Exhaust air
1600677-001	Micromotor MX2, with internal spray and LED
1600700-001	MX2-400 hose, grey silicone, with rotating connector ( $\pm 200^\circ$ ). Length 1.7 m

## List of Bien-Air Dental SA registered trademark products @:

Aquilon®	Diamline®	Isolite®	PowerCare®
Bora®	Eolia®	Lubrifiuid®	Prestilina®
Boralina®	Gyro®	Lubrimed®	Spraynet®
ChiroPro®	Gyrolina®	MX®	

In these instructions, "Device" corresponds to the product described in the heading "Type". For example, turbine, contra-angle, handpiece, micromotor, tube, electronics, connectors, station etc.

## Symbols



Manufacturer.



CE Marking with number of the notified body.



Recyclable electrical and electronic material.



Light.



### Bien-Air Dental SA

Länggasse 60  
Case postale  
2500 Bienne 6, Switzerland  
Tel. +41 (0)32 344 64 64  
Fax +41 (0)32 344 64 91  
office@bienair.com

### Bien-Air Deutschland GmbH

Jechtinger Strasse 11  
79111 Freiburg, Deutschland  
Tel. +49 (0)761 45 57 40  
Fax +49 (0)761 47 47 28  
ba-d@bienair.com

### Bien-Air España, SA

Entença, 169 Bajos  
08029 Barcelona, España  
Tel. +34 934 25 30 40  
Fax +34 934 23 98 60  
ba-e@bienair.com

### Bien-Air USA, Inc.

Medical Technologies  
5 Corporate Park  
Suite 160  
Irvine, CA 92606 USA  
Phone 1-800-433-BIEN  
Phone 949-477-6050  
Fax 949-477-6051  
ba-usa@bienair.com

### Bien-Air France Sàrl

55-57, avenue Jean Lolive  
93508 Pantin Cedex, France  
Tel. +33 (0)1 41 83 60 70  
Fax +33 (0)1 48 96 07 40  
ba-f@bienair.com

### Bien-Air Italia s.r.l.

Via Vaina 3  
20122 Milano, Italia  
Tel. +39 (02) 58 32 12 51/52/54  
Fax +39 (02) 58 32 12 53  
ba-i@bienair.com

### Bien-Air UK Ltd

Arundel House  
Unit 1 - Ground Floor  
Amberley Court, Whitworth Road  
Crawley, West Sussex,  
RH11 7XL, England  
Telephone +44 (0)1293 550200  
Fax: +44 (0)1293 520481  
ba-uk@bienair.com

### Bien-Air Asia Ltd.

Nishi-Ikebukuro  
Daiichi-Seimei Bldg. 10F  
2-40-12 Ikebukuro, Toshimaku  
Tokyo, 171-0014, Japan

ビエン・エア・アジア株式会社  
〒171-0014  
東京都豊島区池袋2-40-12  
西池袋第一生命ビルディング10F

Tel. +81 (3) 5954-7661  
Fax +81 (3) 5954-7660  
ba-asia@bienair.com

### Beijing Bien-Air

Medical Instrument  
Technology Service Co. Ltd.  
Room 907, The Exchange Beijing,  
No 118 Jian Guo Lu Yi,  
Chao Yang District,  
Beijing 100022, China

北京彼岸医疗器械  
技术有限公司  
北京市朝阳区建国路  
乙118号招商局中心  
京汇大厦2106室

Tel. +86 10 6567 0651  
Fax +86 10 6567 8047  
ba-beijing@bienair.com