X-SMART®

ENDO MOTOR



DENTSPLY
TULSA DENTAL
SPECIALTIES

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Thank you for purchasing the X-***SMART***® Endo Motor

Indications

X-***SMART*** Endo Motor is an endodontic micromotor to drive NiTi instruments. This motor should be used only in hospital environments, clinics, or dental offices by qualified dental personnel. Read this Operation Manual carefully before use for operation instructions, care and maintenance. Keep this Operation Manual for future reference.

Contraindications

In cases where a patient has been fitted with an implanted heart pacemaker (or other electrical equipment) and has been cautioned against the use of small electrical appliances (such as electric shavers, hair dryers, etc.) it is recommended that the X-***SMART*** Endo Motor not be used.

This motor should not be used for severe curved root canal preparation. Do not use the X-***SMART*** Endo Motor for implant or any other dentist procedure outside endodontics.

Warnings

- Use the specified batteries for this product. Do not use any other batteries than those that DENTSPLY Tulsa Dental Specialties specifies.
- Do not disassemble or alter the motor handpiece.
- Do not expose X-***SMART*** Endo Motor unit, motor handpiece or battery charger to any liquid.
- If you should notice battery fluid leak, deformation of the motor handpiece casing or partial discoloring, immediately stop use and contact your dealer.
- Should the leaking battery fluid get into your eyes, immediately wash eyes thoroughly with clean water and see your doctor. Failure to do so may result in loss of sight.
- Should the battery fluid leak onto skin or clothing, immediately wash the exposed skin thoroughly with clean water and completely wash away the fluid. Failure to do so may result in skin complications.
- If you will not use the product for a long period of time, remove the batteries to avoid fluid leak.
- The system may present the possibility of malfunction when used in the presence of electromagnetic interference waves. Do not install the system in the vicinity of a device which emits magnetic waves.
- Do not use in the presence of flammable products.
- This motor is equipped with an electronic circuit to limit file breakage. Nevertheless, files may still break due to higher torque conditions or to fatigue resistance.

Precautions

- Use the DENTSPLY Tulsa Dental Specialties AC adapter for this product. Do not use any other AC adapters.
- The RPM number indicates true instrument speed when the appropriate reduction rate is selected. Make sure the selected reduction matches the ratio of the contra-angle handpiece.
- If the motor stops or runs too fast, discontinue use and call for assistance.
- After sterilization, make sure the motor has reached a temperature below 40°C before use.
- Do not introduce any oil into the micromotor.
- The system functions normally in the environment where the temperature is at 10 - 40°C (50 - 104 °F), humidity at 10 - 85% RH, atmospheric pressure at 500-1060hPa, and no moisture condensation in the Control Unit. Any use outside these limits may cause malfunction.
- Do not use a bent, damaged, deformed or non-ISO-conforming file. Using such a file may result in personal injury due to its unexpected breaking or "flying off" during rotation.
- Check the product before use by rotating it, paying attention to looseness, vibration, noise and temperature (heat generation). If any abnormal condition is found even slightly at that time, immediately stop use and contact the Technical Service Department.
- Always clean the shank of the file to be installed. Allowing dirt to enter the chuck could cause loss of concentricity and deterioration of chucking force.
- Before changing the head or bur, turn off the power of the motor handpiece. Changing with the power kept on may cause unintended rotation by accidental touch of the ON/OFF button.
- Pay attention to the direction of batteries when setting. Forcible setting in the wrong direction may cause damage and fluid leakage due to a short circuit.
- Not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.
- When the reverse rotation (R) is set, the auto reverse function is not activated.

Notice

- Fully-charged rechargeable batteries generally discharge gradually over time even though the motor handpiece is not used. It is recommended to recharge the batteries just before use.
- When the motor handpiece stops automatically by detecting a low battery voltage, turning on the power again after a while may not detect the low voltage immediately. This is not a failure, but due to battery characteristics. Since the voltage drop does not coincide with the remaining battery capacity, consider it only as a yardstick.

- Recharge batteries after they discharge as much as possible. Repeated shorttime use and subsequent recharging may shorten their operating time due to the "memory effect." Batteries may recover after repeating complete discharge and full charge for a few times. (This product is equipped with a "Refresh Mode" for this purpose.).
- The used nickel metal hydride batteries are recyclable, but their disposal may sometimes not be permitted by local regulations. Return them to the Technical Service Department.
- When disposing of the control unit and foot pedal (optional), follow the instructions of your local government for disposal, as they contain materials which may be considered industrial waste.
- When discarding the contra-angle head and motor handpiece, dispose of them as medical waste.
- Users are responsible for operational control, maintenance and inspection.
- Store the system in a location where the temperature is at -10 - 50 °C (14 - 122°F), humidity at 10 - 85% RH, atmospheric pressure at 500 - 1060 hPa, and the system is not subject to air with dust, sulfur or salinity.

Adverse reactions: none known

Classifications of equipment

- Type of protection against electric shock:
  - Class II equipment: 
- Degree of protection against electric shock:
  - Type B applied part: 
- Method of sterilization or disinfection recommended by the manufacturer:
  - See Sterilization procedure:
- Degree of protection against ingress of water as detailed in the current edition of IEC 529:
  - Foot Pedal (Option): IPX1 (Protected against vertically falling water drops)
- Degree of safety of application in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide:
  - X-***SMART*** Endo Motor complies to IEC60601-1 safety standard and the requirement of CE Marking of Conformity.

A> Contents

Before use, please refer to the packaging labels.

B> Product Main Specifications

X-***SMART*** Endo Motor control unit

Rated input	DC20V 0.5A
Output	DC7V 0.4A
Charging time	5 hours approx.
Dimensions	W98 x D152x H139mm
Weight	456g

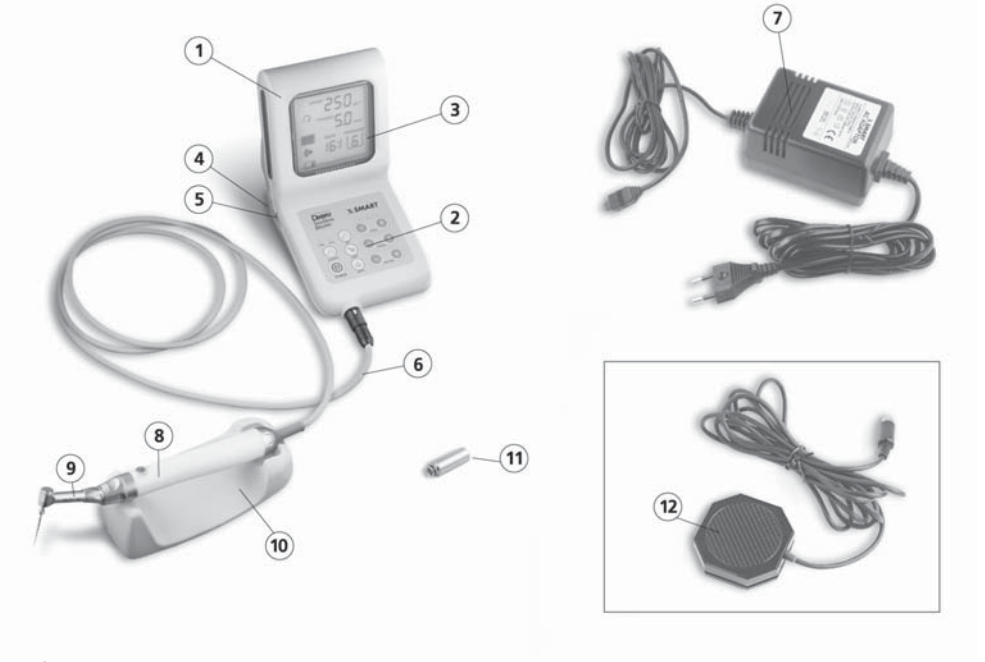
X-***SMART*** Endo Motor AC adapter

Rated input	AC120V 50/60Hz 27VA AC230V 50/60Hz 27VA
Dimensions	W70 x D110 x H58mm
Weight	120V: 934g 230V: 974g

X-***SMART*** Endo Motor handpiece

Rated input	DC7V 0.4A
Dimensions	Ø 20 x L108mm
Weight	92g (including motor handpiece cord)

C> Product Description



1) Control Unit

2) Operation Panel

- See Fig. 2 “Operation Panel and LCD Panel.”

3) LCD Panel

- See Fig. 2 “Operation Panel and LCD Panel.”
- Error codes are displayed.

4) Power Cord Connector

5) Foot Pedal Connector

6) Motor Handpiece Connector

7) AC Adapter

8) Motor Handpiece

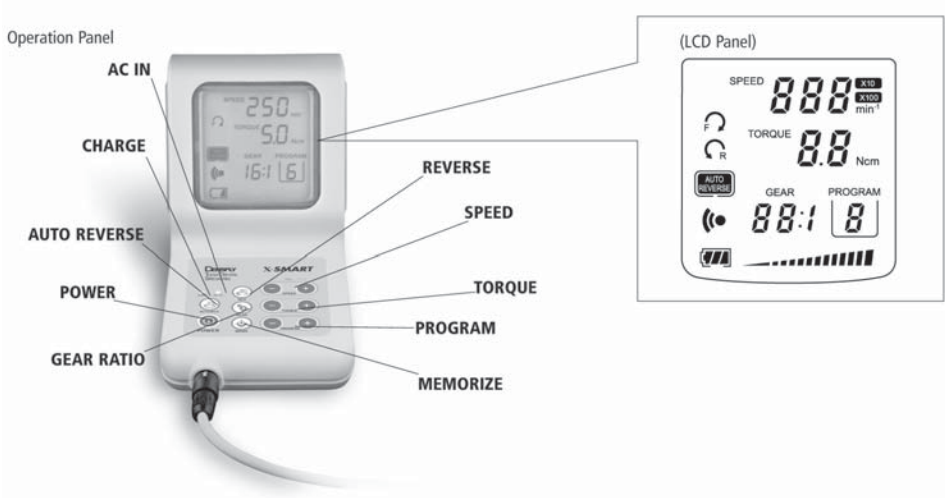
9) Contra-Angle

10) Handpiece Stand

11) F-type Spray Nozzle (used for lubrication)

12) Foot pedal (Option)

*** Operation Panel and LCD Panel.**



• POWER

- Holding down the POWER key for more than one second turns on the power and the LCD panel lights.
- Holding down the POWER key for more than one second while the power is on turns off the power and the LCD display turns off.

• SPEED

- The rotation speed can be adjusted.
- If the speed is to exceed the upper limit or fall below the lower limit, the alarm sounds.



The present rotation speed is displayed. The unit is rpm (min-1).“ **X10** or **X100** ” is displayed depending on the rotation speed.

• TORQUE

- The torque limit values can be adjusted.
- If the speed is to exceed the upper limit or fall below the lower limit, the alarm sounds.
- Speed and torque settings can vary based on the specific instrument. Consult the instrument manufacturer for suggested ranges.

LCD



The present torque limit value is displayed. The unit is (Ncm). When it reaches the maximum value, " - - " is displayed.

• PROGRAM

LCD



The Program button is also used to manage the alarm sound.

• REVERSE

- The rotational direction of the file can be changed by this key. It can also be changed while the file is in motion.
- The alarm sounds during reverse rotation.

LCD

The mark of the current rotational direction is displayed.



Forward Rotation (F).



Reverse Rotation (R).

• GEAR RATIO

- A gear ratio can be selected by this key. If the correct gear ratio is selected according to the contra-angle head in use, an adequate rotation speed and torque limit value can be set.
- The gear ratio cannot be changed while the file is in motion.

LCD



The present gear ratio is displayed. The gear ratio is available at (1:1, 4:1, 10:1, 16:1 and 20:1).

• **AUTO REVERSE**

The auto reverse mode can be selected by this key. (See "Auto Reverse Function.")

LCD

The present auto reverse mode mark is displayed.



AUTO REVERSING — If the load is removed after auto reverse rotation, it returns to the normal rotation again.



AUTO STOP — If the load is removed after auto reverse rotations, it stops.



AUTO REVERSE OFF — Auto reverse rotation is not activated.

(Non display)

• **MEMO**

Press this key if you want to change the present program setting (rotation speed, torque limit value, gear ratio, auto reverse mode) and these changes will be memorized. (See "Program")

• **CHARGE Lamp (Orange)**

This lamp lights or flashes while the batteries are being charged or in the refresh mode, (See "Battery Refresh") and in an error condition, regardless of the ON or OFF position of the power.

LCD

The mark of the present remaining amount of the batteries is displayed regardless of the ON or OFF position of the power. The mark will be animated when the batteries are being charged or in the refresh mode (See "Battery Refresh").



Full charge



Approximately 30-80% remains



Less than 30% remains. In case of this condition, the auto reverse function may not activate. (See "*Auto Reverse Function")



Batteries are drained or in a remarkably low voltage. Charge the batteries.



NOTICE

The remaining amount of batteries mark indicates a voltage. When load is applied to the motor handpiece, the remaining amount of batteries mark appears to become lower.

• AC IN Lamp (Green)

This lamp lights when the power is supplied from the AC adapter, regardless of the ON or OFF position of the power.

• Bar Display





It displays the bar graph which shows the degree of load applied to the motor while the file is in motion.

D> How to connect each part

(1) Connecting Motor Handpiece

Align the ⇨ mark of the cord plug of the motor handpiece with the ▲ mark of the motor handpiece connector and insert the plug until it locks. (Fig. 3)



Fig. 3

NOTICE

To remove the plug, hold the plug ring and pull it out.

(2) Connecting AC Adapter

Securely insert the jack of the AC adapter into the power connector with the ⇨ mark of the jack cast down. (Fig. 4)



Fig. 4

(3) Connecting Foot Pedal (Optional)

Securely insert the plug of the foot pedal (Optional) into the foot pedal connector with the ▲ mark of the plug cast down. (Fig. 5).

- You do not have to connect the foot pedal, if you intend to use this product without the foot pedal.



Fig. 5

E> Main Directions For Use

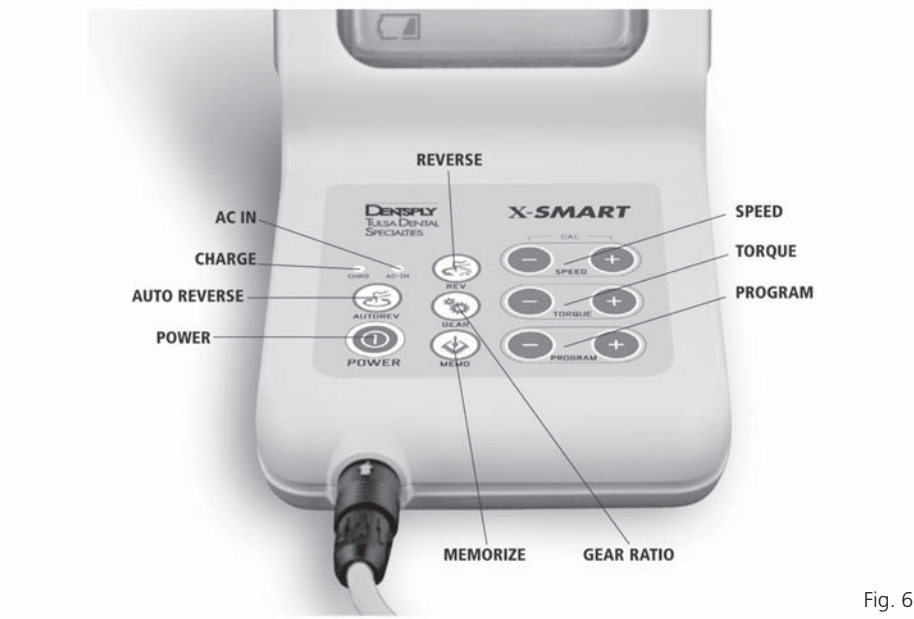


Fig. 6

(1) Charge (if batteries are used)

1. Securely insert the plug of the AC adapter into a power supply.
2. The AC IN lamp lights in green.
3. The internal microcomputer checks the voltage of the batteries and starts charging, if necessary. If it starts charging, the CHARGE lamp lights, and the remaining amount of the batteries mark on the LCD panel will be animated.
   • There is no need to turn on the power.
4. When the CHARGE lamp turns off, charging has been completed.

CAUTION

- **Connect to AC120V or AC230V power supply only. Otherwise, malfunctions will occur.**
- **Since the AC IN lamp lights to indicate that the supply power is on, it does not go out even after a charge is completed. See the CHARGE lamp to check the charging conditions.**
- **The standard charging time is about 5 hours, but it varies depending on use, condition of batteries, temperature and whether the batteries are new or old. Please note, older batteries may remarkably shorten both the charging and operating time.**

- **When charging a battery, the temperature of the battery is measured. Therefore, if this product is placed in an environment where the temperature changes rapidly (for example, near to a window exposed to sunlight, near the outlet of an airconditioner, or heater), the battery cannot be properly charged. Put this product in a place where the temperature varies little.**
- **In the following cases, it may not start charging:**
  - **The temperature of a battery is too low or too high. (less than 0°C (32°F or more than 40°C (104°F)).**
  - **The voltage of a battery is sufficient. (This does not necessarily mean fully charged).**
  - **A battery is not connected.**
  - **The voltage of a battery is abnormal. (See "ERROR CODE").**
- **Batteries are automatically charged depending on conditions, even when the power is on. But when the motor handpiece is used, charging is suspended to protect the battery.**

(2) Changing the Contra-Angle

- The contra-angle could be connected with the motor handpiece at 6 adjustable head positions. Align the positioning pins of the contra-angle head with the positioning slots of the motor handpiece and insert the head until they click.
- When removing the contra-angle head, pull it out axially. (Fig. 7)

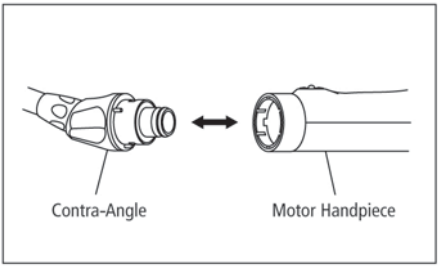


Fig. 7

CAUTION

- **When attaching and detaching the contra-angle head, turn the power off beforehand.**
- **Check that the contra-angle head is securely assembled to the motor handpiece.**

AUTO REVERSING

The file rotates in reverse. When a load is removed, the file returns to normal rotation (forward rotation) automatically.

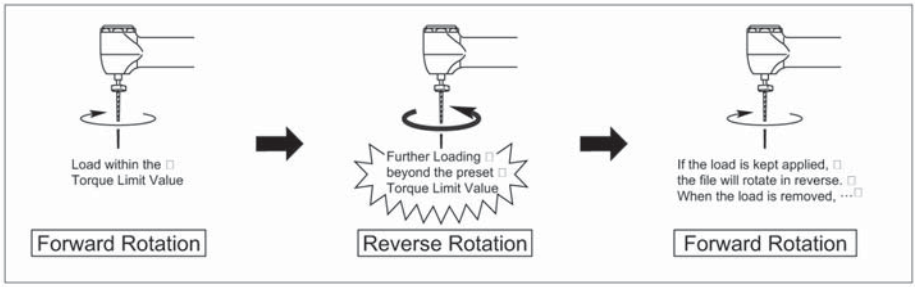


Fig. 8

AUTO STOP

The motor handpiece starts in reverse. When a load is removed, the motor handpiece stops. If you want it to rotate (forward-rotate) again, re-press the ON/OFF button or re-step on the foot pedal (Optional).

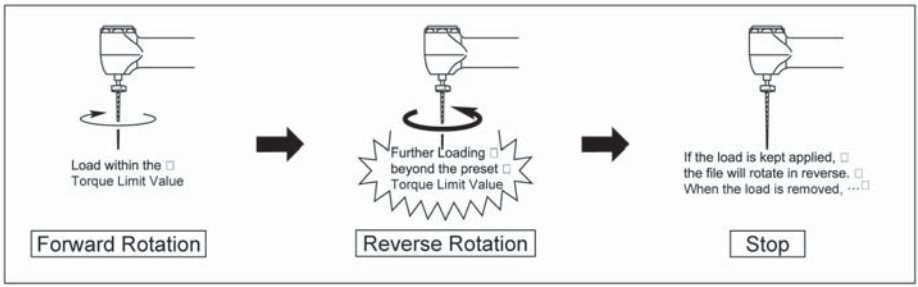


Fig. 9

AUTO REVERSE OFF

The motor handpiece stops without reverse rotation. In this instance, the LCD panel shows " - - - " and the rotation speed alternately.

(3) Mounting and Removing File

1. Insert the file into the chuck until it stops.
2. Lightly turn the file until it engages with the latch mechanism. Push inwards to click.

- File Removal:
  Depress the push-button and pull out the file.

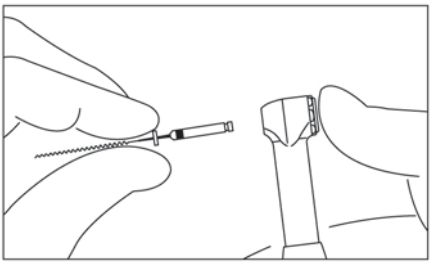


Fig. 10

CAUTION

- **When attaching and detaching the file, turn the power off beforehand.**
- **After the file is locked in place, lightly pull out the file to make sure the file is locked.**
- **Always clean the shank of the file to be installed. Allowing dirt to enter the chuck could cause loss of concentricity and deterioration of chucking force.**

(4) Preparatory Operations

1. Charge the batteries (See "Charge (if batteries are used)") or securely insert the plug of the AC adapter into a power supply.
2. Hold down the POWER key for more than one second to turn on the power.
3. Press the PROGRAM key to select the program number suitable for the file being used.
4. Select the rotational direction by pressing the REVERSE key. The key changes over to the forward rotation (F) and reverse rotation (R) each time it is pressed.
5. Select the auto reverse mode by pressing the AUTO REVERSE key. The key changes over to AUTO REVERSING, AUTO STOP and AUTO REVERSE OFF each time it is pressed. (See "*Auto Reverse Function")

NOTICE

The PROGRAM key is fast-forwarded, when it is continuously held down.

(5) Operation

- If you press the ON/OFF button briefly, the motor handpiece starts. If you re-press the button, it stops.
- If you hold down the ON/OFF button for more than one second, the motor handpiece starts while the button is pressed. If you release the button, it stops.
- If the foot pedal (Optional) is connected, stepping on the pedal starts the motor handpiece. Releasing the pedal stops it.



Fig. 11

If you want to make fine adjustments on the rotation speed and torque limit value, press the SPEED key and TORQUE key respectively.

NOTICE

- **If the SPEED key and TORQUE key are continuously held down, they are fastforwarded.**
- **If both ON/OFF button and foot pedal (Optional) are equipped, the one which rotation instruction is shown first has priority. For example, if you step on the foot pedal (Optional) to start the motor handpiece, you cannot stop it by the ON/OFF button.**

*** Auto Reverse Function**

When the motor handpiece starts and its load reaches approximately half of the preset torque limit value, the alarm sounds. (at the time of on the bar display). The alarm sound changes when the load approaches the torque limit value. (at the time of on the bar display).

When a further load exceeds the torque limit value, the following 3 modes can be selected:

NOTICE

- **When the reverse rotation (R) is set, this auto reverse function is not activated.**
- **When the batteries go down (when the remaining amount of the batteries mark indicates "[ ] [ ]"), the actual load may not reach the preset torque limit value. In this case (in the case of operation by batteries), this auto reverse function will not be activated. When high torque is required, use the AC adapter or use this product in a condition where the batteries are not significantly consumed (when the mark of the remaining amount of the batteries indicates "[ ] [ ]").**
- **If a load is continuously applied to the motor handpiece, it may automatically stop to prevent overheating. (The torque limit value indicates "0X" on the LCD panel). In this case, leave the motor handpiece for a while until it cools down. When the display returns to normal, the motor handpiece can be used.**

(6) Completion of Medical Treatment

When the treatment is completed, return the motor handpiece to the handpiece stand and hold down the POWER key for more than one second to turn off the power.

NOTICE

If 10 minutes pass without operation of the ON/OFF button and foot pedal (optional), the power turns off automatically (auto power off function). However, the power does not turn off automatically if the motor handpiece is in motion, even if it is not used.

F> Additional Directions For Use

(1) Program

This product is programmed in advance with 1 to 9 programs according to various files to be used. You can change any preset values and have them saved to your desired settings (rotation speed, torque limit value, gear ratio and auto reverse mode).

1. Press the PROGRAM key until it turns to the program number that you want to memorize.
2. Adjust the rotation speed, torque limit value, gear ratio and auto reverse mode by each key according to your needs.
3. Hold down the MEMORIZE key for more than one second. When the alarm sounds, memorization is completed.

NOTICE

- **The program cannot be memorized while the motor handpiece is in motion.**
- **The rotational direction is not memorized in the program. The program cannot be memorized if the rotational direction is set to the reverse rotation (R).**
- **If the PROGRAM key is held down, it is fast-forwarded.**
- **The program is not memorized unless the MEMORIZE key is held down for more than one second. If the program number is changed by the PROGRAM key without pressing the MEMORIZE key, the initially memorized preset values remain (cancel function).**

(2) Initialization of Program (Factory-set configuration)

The program can be returned to the original state configured at the time of factory shipment, if setup becomes confusing.

1. Turn off the power, when the power is on.
2. Connect the AC adapter and confirm that the AC IN lamp lights up.
3. Hold down the POWER key for more than one second, while pressing the AUTO REVERSE key and MEMORIZE key at the same time.
4. Release the keys when the LCD panel indicates "SET" and re-press the MEMORIZE key while this is displayed.
5. Initialization is completed, when "F IN" is displayed.



NOTICE

- **This function is not activated unless this product is powered by the AC adapter.**
- **If this function is used, all programs will disappear and return to the original set values. Record the present program details accordingly, as needed.**

(3) Battery Refresh

Nickel metal hydrate batteries may result in a decrease in charging capacity, if additional charging (repeating a cycle of short-time use and recharging) is made. (Generally, this phenomenon is called a "memory effect"). This Battery Refresh function is used to resolve this phenomenon.

1. Turn off the power if the power is on.
2. Connect the AC adapter and confirm that the AC IN lamp lights.
3. Hold down the POWER key for more than one second, while pressing the REVERSE key.
4. The alarm sounds for a length of time, and the refresh mode is activated. At this time, the remaining amount of the batteries mark on the LCD panel is animated in the direction opposite to display at the time of charging. At the same time, the CHARGE lamp flashes slowly.
5. The batteries are discharged and recharged automatically.
6. Hold down the POWER key for more than one second, when you want to stop this process. (At this time, the power does not turn on.)



NOTICE

- **This function is not activated, if not driven by the AC adapter.**
- **It takes a maximum of 5 hours to discharge batteries.**
- **It takes 5 hours to discharge and 5 hours to recharge, therefore, approximately 10 hours are required. For example, if a dental treatment is finished at 7 p.m. and the refresh mode is set, the batteries will be fully charged by 5 a.m. the next morning.**
- **This function is not required for each charging. This function should be used if the operating time is shortened (even if the batteries are relatively new).**
- **Do not repeat activation and deactivation of the refresh mode in a short time. It may result in enhancement of the memory effect.**
- **This function is fully effective for solution of a "memory effect." However, it cannot be solved completely at one time due to the characteristics of batteries. We recommend you repeat this process a few times according to your needs.**

(4) Calibration

This function is to decrease fluctuation in the rotation speed of the motor handpiece and the difference in torque by the contra-angle.

1. **Lubricate the contra-angle with an appropriate spray (see "Lubricating Contra-Angle Head").**
2. Turn the power off if the power is on.
3. Connect the AC adapter and confirm that the AC IN lamp lights.
4. Turn on the power.
5. Hold down both buttons of the SPEED key simultaneously for more than one second.
6. The LCD panel displays "CAL" with the alarm sound.
7. Attach the contra-angle head to the motor handpiece and press the MEMO key.
8. The motor handpiece begins to rotate: leave it as it is until it stops.
9. This process ends, if the rotation stops and the LCD panel display returns to its original state.
10. If you want to stop this process, turn the power off.

NOTICE

- **Lubricate the contra-angle before Calibration.**
- **This function does not operate if AC adapter is not used.**
- **Do not touch or apply a load to the rotating shaft of the contra-angle head it obstructs.**
- **This function cannot completely absorb the individual difference of the actual motor handpiece and contra-angle.**

(5) Alarm Sound Volume Control

The alarm sound volume can be controlled by using "BIG VOLUME, SMALL VOLUME and LIMITED OFF". With "LIMITED OFF", the alarm sounds with a small sound volume at the time of confirmation and error, while it does not sound at the time of reverse rotation and attainment of the torque limit value.

1. Keep holding down both buttons of the PROGRAM key simultaneously.
2. The alarm mark on the LCD panel changes, and the sound volume changes.
3. Release the PROGRAM key when the sound volume reaches your required level and the required sound level is set up.

NOTICE

- **The sound level is retained, even if the power is turned off.**
- **If "Initialization of Program (Factory-set configuration)" is executed, the sound is set to "BIG VOLUME."**

G> Cleaning

(1) Lubricating Contra-Angle

- **Lubricate the contra-angle head only.**
- After each use and/or before each autoclaving.

1. Screw the spray nozzle onto the spray can by approx. 10 turns.
2. Insert the spray nozzle into the rear part of the contra-angle head and lubricate the head for 2-3 seconds. (Fig. 12)

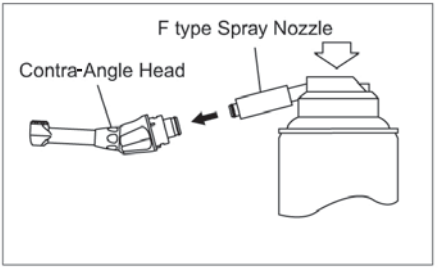


Fig. 12

(2) Cleaning Motor Handpiece

When the motor handpiece becomes dirty, wipe off with a cotton cloth moistened with rubbing alcohol.

(3) Cleaning Control Unit

When the control unit becomes dirty, wipe it off with a cotton cloth moistened with rubbing alcohol.

CAUTION

- **Do not lubricate the motor section of the motor handpiece.**
- **To clean the motor handpiece, do not use any solvent such as benzine and/or a thinner.**
- **Before mounting the lubricated contra-angle head to the motor handpiece, wipe off extra oil. Stand on its end or lean it in the proper position for gravity draining. Mount it after excess oil has been drained.**
- **Hold the contra-angle head securely to prevent it from flying off by the pressure of the spray.**
- **Supply lubricant until it comes out of the handpiece head (for approx. 2 seconds).**
- **Do not use a spray can upside down. In such a case, only spray gas comes out and oil is not sprayed.**
- **Do not clean any plastic component (control unit, motor handpiece,…) with aldehydes.**

H> Sterilization

- **Sterilize the contra-angle only.**
- For the sterilization method, we recommend the autoclave sterilization method.

- **Autoclaving**

1. Brush the dirt off the surface of the contra-angle head, and wipe off with a cotton cloth moistened with rubbing alcohol. Do not use a metal brush.
2. Lubricate the head with an appropriate spray.
3. Insert the head into an autoclave pouch and seal it.
4. Autoclave for 18 min. at 134°C (274°F).



CAUTION

- **Do not apply high-temperature sterilization methods such as autoclave sterilization to any part other than the contra-angle head.**
- **Skip dry cycle if the temperature could exceed 135°C (275°F).**
- **Since the bottom tray inside the chamber of the autoclave is close to a heater and the temperature in that place may locally exceed 135°C (275°F), place the head on the central or upper tray.**

The control unit, the micromotor (handpiece), including all wires may be wiped with a cloth slightly dampened with water or non-alcohol based disinfectant.

I> Changing batteries

X-***SMART*** Endo Motor uses rechargeable batteries. They can be recharged 300-500 times, depending on the conditions of the motor handpiece. If the operating time or recharging time becomes shorter or the rotation power becomes weaker, although the "memory effect" described in "⚠ NOTICE" is not applicable, the life of the batteries is suspect. In such a case, replace batteries (refer to the " ■ Changing Batteries"). When replacing, be sure to observe the following "⚠ CAUTIONS ON CHANGING BATTERIES". Note that DENTSPLY Tulsa Dental Specialties shall not be held liable for any malfunction or failure resulting from not following the "⚠ CAUTIONS ON CHANGING BATTERIES".

⚠ CAUTIONS ON CHANGING BATTERIES

- **Do not open any part other than the battery cover.**
- **Be sure to purchase and use only the recommended batteries. Otherwise, batteries may cause damage, fluid leakage or explode.**
- **Do not work with wet hands. This may cause trouble due to short-circuiting of batteries and moisture infiltrating this product.**

- **Changing Batteries**

1. Turn off the power. Remove the AC adapter.
2. Remove the batteries after sliding the battery cover on the back of the control unit in the direction of the arrow. (Fig. 13)



Fig. 13

⚠ CAUTION

Ensure removal of the AC adapter before changing batteries, as it may cause a malfunction.

3. Take out the old batteries, and pull out the cord, holding it at the connector.

 **CAUTION**

Ensure you pull out the cord by holding the connector. Failure to do so may cause a break in the cord.

4. Insert the connector of the cord of new batteries into the connector in accordance with the polarity indication label inside the battery chamber, and place the batteries into the chamber with care so as not to catch the cord.

 **CAUTION**

In case of difficulty inserting the connector onto the battery, the polarity may be incorrect. Do not force the insertion.

5. Close the battery cover. Ensure that you have charged the batteries before use.

 **NOTICE**

The used nickel metal hydride batteries are recyclable, but their disposal may sometimes not be permitted by local regulations.

J> Error Code

If the motor handpiece stops due to an abnormality such as a malfunction, overload, breakage or misuse, it automatically checks the state of the control unit and detects the cause of the abnormality, displaying an error code on the LCD panel. If an error code is displayed, turn on the power again and check whether the same error code is displayed. If the same error code is displayed, take action by referring to the instructions provided in the "Check/Remedy" column in the following table.



NOTICE

If batteries are replaced while the AC adapter is connected, an incorrect error code may be displayed.

	Error code	Error	Cause	Check/Remedy
During rotation of the motor handpiece	E-0	Self-Check error	Malfunction of circuit.	Contact your Technical Service Department.
	E-1	Overcurrent	The motor handpiece is locked (at the time of the auto reverse mode).	Remove load.
	E-2	Overvoltage	Malfunction of circuit.	Contact your Technical Service Department.
	E-4	Overheating of motor	High load was continuously applied to the motor handpiece for a relatively long time.	Leave it as it is until it cools down.
	E-5	Error of the brake circuit	Malfunction of circuit.	Contact your Technical Service Department.
	E-6	The axle locks up	The motor handpiece is locked (at the time of startup).	Remove load.

	Error code	Error	Cause	Check/Remedy
At the time of charging	E-C	Low voltage of batteries	The voltage of batteries is too low (The batteries are flat or not inserted).	Put the batteries into the battery chamber, or replace with new batteries.
	E-d	High voltage of batteries	The voltage of batteries is too high (Malfunction of circuit).	Contact your Technical Service Department.
	E-E	Beyond the range of working temperature	Beyond the range of working temperature or break in the thermistor in the battery section.	Use within the range of working temperature, or replace the batteries.
At the time of calibration	CE0	Beyond the upper limit	The operating life of the motor handpiece or contra-angle has expired.	Replace the motor handpiece or contra-angle head.
	CE1	Below the lower limit		
Other	E-F	Abnormal heat generation from batteries	The batteries generate abnormal heat.	Replace the batteries. If the heat generates from the new set of batteries, malfunction of the circuit may be suspected. Contact Dentsply Tulsa Dental Specialties.

K> Troubleshooting

When trouble is found, check the following again before contacting DENTSPLY Tulsa Dental Specialties. If none of these are applicable or the trouble is not remedied even after action has been taken, the product may have failed. Contact Technical Service Department. Phone: 1-800-662-1202.

X-***SMART*** Endo Motor Control unit and AC adapter

Problem	Cause	Check/Remedy
The power is not turned on.	The AC adapter is not connected.	Check the connection.
	The plug of the AC adapter is not inserted into the outlet, or there is no electricity in the outlet.	Check the connection.
	The batteries are empty.	Charge the batteries or use the AC adapter.
	No batteries are inserted.	Insert batteries, or use the AC adapter.
	The internal fuse has burnt.	Contact Technical Service Department.
AC IN lamp does not light	The AC adapter is not connected.	Check the connection.
	The plug of the AC adapter is not inserted into the outlet, or there is no electricity in the outlet.	Check the connection.
	The internal fuse has burnt.	Contact Technical Service Department.
	The AC adapter fuse has burnt.	Contact Technical Service Department.

Problem	Cause	Check/Remedy
The battery charger does not work. (The CHARGE lamp does not light.)	No batteries are inserted.	Insert batteries.
	The batteries are fully charged or in a state near full charge.	No problem.
	The temperature of batteries is low.	If the temperature of batteries is less than 0 °C (32°F), the batteries are not rechargeable. Charge the batteries in a warm room. (Be careful about moisture condensation.)
	The temperature of batteries is high.	It is normal for the batteries to become slightly warm right after charging. If the batteries are hot under normal operating conditions, but not right after charging, there may be an abnormality. Contact Contact Technical Service Department.
	An error code is displayed.	See ERROR CODE.

Problem	Cause	Check/Remedy
The motor handpiece does not rotate.	The motor handpiece cord is not connected.	Check the connection.
	The foot pedal (Optional) is not connected.	Check the connection.
	There is a break in the motor handpiece or the motor handpiece cord.	Contact your Technical Service Department.
The motor handpiece does not rotate. (The error code "E-1" is displayed.)	The contra-angle head is clogged.	Clean or replace the contra-angle head.
	There is a short circuit inside the motor handpiece or the motor handpiece cord.	Contact your Technical Service Department.
The motor handpiece does not rotate. ("- - -" and the rotation speed are displayed alternately.)	The contra-angle head is clogged.	Clean or replace the contra-angle head.
	There is a short circuit inside the motor handpiece or the motor handpiece cord.	Contact your Technical Service Department.
When turning on the power, the alarm sounds, and the motor handpiece does not rotate.	The power is turned on while pressing the ON/OFF button.	Check the ON/OFF button.
	There is a short circuit inside the ON/OFF button.	Contact your Technical Service Department.
	The power is turned on while pressing the foot pedal (Optional).	Check the foot pedal (Optional).
	There is a short circuit inside the foot pedal.	Remove the foot pedal, and rotate the motor handpiece by the ON/OFF button, or contact your dealer.
The motor handpiece keeps rotating. (The foot pedal (Optional) does not react.)	It is rotated by the ON/OFF button.	Stop the rotation by the ON/OFF button.
The motor handpiece keeps rotating.	(The ON/OFF button does not react.) It is rotated by the foot pedal (Optional).	Release your foot from the foot pedal (Optional) to stop, or pull out the plug of the foot pedal (Optional).

L> Warranty

Manufacturers warrant the product to the original purchaser against defects in material and workmanship under normal practices of installation, use and servicing. The X-***SMART*** Endo Motor control unit, motor and contra-angle are guaranteed for 24 months from the date of purchase.

The accessories (battery, stand) are not covered under the warranty.
In case the product fails within 30 days from the date of installation, immediately contact your Technical Service Department (have relevant proof of purchase ready).

M> Disposing Product

- Please consult with dealer from whom you purchased it about waste disposal.
- The used nickel metal hydride batteries are recyclable, but their disposal may sometimes not be permitted by local regulations. Return them to your service vendor.

Specifications may be changed without notice.

Manufactured for:

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608 Rolling Hills Dr.
Johnson City, TN 37604
1-800-662-1202
1-800-597-2779 (fax)
For the latest information consult
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