Perfect Point™

e-drill™

Fastener Removal System
User Guide

SYSTEM PART NUMBERS

CP1-SY-001	**CP1-SY-012**
CP1-SY-003	**CP1-SY-020**
CP1-SY-010	**CP1-SY-021**
CP1-SY-011	**CP1-SY-031**

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WARNINGS

This fastener removal system should only be operated by factory trained authorized operators. Failure to properly operate this system can result in airframe damage, tool damage, personal injury, or death. Lethal high voltages are present throughout the Power Supply Cabinet. Follow all Warning and Caution statements outlined in this User Guide and all equipment Warning placards. Do not proceed with any periodic maintenance until factory trained and authorized, and this document has been thoroughly reviewed and understood. Only trained, authorized technicians should attempt tool use, tool selection, adjustments, dielectric system replenishment, and periodic maintenance. This unit is not field repairable; if any malfunctions are encountered please contact Perfect Point™ EDM Corporation immediately for service.

Contents and illustrations in this document are subject to change, and may not match the e•drill product exactly.

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Limited Warranty Statement

Perfect Point EDM Corp. warrants to the end user that its products will be free from defects in material and workmanship for a period of twelve (12) months from the date of delivery, but not more than eighteen (18) months after date of shipment, and the successful completion of operator equipment use and maintenance training. This warranty extends only to the original purchaser, is expressly in lieu of all other warranties, expressed or implied, and is further in lieu of all other liabilities or obligations for any consequential damages or losses incurred by the buyer in connection with the purchase or use of the product.

This warranty applies to systems subjected to normal operating conditions established by PPedm and explicitly excludes equipment subjected to:

- User alteration.
- Accident or damage caused by the end-user.
- Improper handling, installation, maintenance, application, or contamination as established by PPedm equipment operating instructions and preventative maintenance.
- Use with improper voltage.
- Use contrary to the operation instructions, and failure to properly service and maintain per PPedm instructions.
- Unauthorized disassembly, repair, or alteration by anyone other than PPedm Corp. No allowances will be made for repairs or alterations effected without specific written authorization from PPedm.

This warranty does not cover:

- Normal wear and tear of soft goods (seals, hoses, cables etc.), e•drill Adaptors, Guides, Locators, Punch Pins or Punch Guides and other fixtures or tools.

Credit will NOT be allowed nor shipment accepted on any machine or component thereof without Perfect Point's prior written consent and issuance of a PPedm Return Material Authorization (RMA).

PPedm will at its option, repair or replace any defective machine or component thereof for the specified warranty period. PPedm reserves the right to substitute new equipment and/or improve the part(s) on any machine or part thereof judged defective without further liability. Machines or components thereof will be repaired and the warranty time continued.

All machines or components thereof returned for warranty consideration MUST NOT HAVE BEEN TAMPERED WITH and all anti-tamper seals and/or striping must be intact. Removed or destroyed anti-tamper seals and/or striping will be cause to VOID these warranty terms and conditions.

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IMPORTANT- READ CAREFULLY: This End-User License Agreement ("EULA") is a legal agreement between the user (either an individual or a single entity) and Perfect Point EDM Corp. ("PERFECT POINT"), the manufacturer of the E•DRILL you have acquired, that includes certain Perfect Point software product(s) installed on the E•DRILL system and equipment ("PPEDM SOFTWARE"). The PPEDM SOFTWARE includes computer software, the associated media, any printed materials, any "on-line" or electronic documentation, upgrades and recovery media. By using the PPEDM SOFTWARE, you agree to be bound by the terms of this EULA. If you do not agree to the terms of this EULA, Perfect Point declines to license the PPEDM SOFTWARE to you. In such event, you may not use the PPEDM SOFTWARE, and you should promptly contact PERFECT POINT for instructions on return of the entire product.

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1. **GRANT OF LICENSE.** This EULA grants you the following rights:

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    - **Limitations on reverse engineering, Decompilation and Disassembly.** You may not reverse engineer, decompile, or disassemble the PPEDM SOFTWARE.

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    - **Rental.** You may not rent or lease the PPEDM SOFTWARE without prior written approval from PERFECT POINT.

    - **Software transfer.** You may permanently transfer all your rights under the EULA only as part of a sale or transfer of the E•DRILL, provided you retain no copies, b) transfer all of the PPEDM SOFTWARE (including all component parts, the media, any upgrades, and this EULA, c) you notify PERFECT POINT of the new user, and d) the recipient agrees to the terms of this EULA.

    - **Termination.** Without prejudice to any other rights, PERFECT POINT may terminate the EULA if you fail to comply with its terms and conditions. In such event, you must return the entire product to PERFECT POINT, and all its component parts.

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User Guide					
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OPERATING ENVIRONMENT

The Perfect Point e•drill system should be protected from freezing cold conditions that can crack or burst de-ionized water connections and plumbing. If the system is subjected to freezing temperatures, it should be thoroughly inspected by a trained technician for damage or leaks prior to use.

The Perfect Point e•drill system should not be operated in the rain or snow. If aircraft repairs necessitate outdoor operation in severe weather conditions it is recommended the Mobile Service Unit be positioned under a protective awning or positioned in a protected area under or in the airframe. Cable connections should not be left in pooled water and should be kept elevated.

LETHAL VOLTAGES PRESENT

All power supplies contain hazardous voltage and energy. The e•drill system should only be operated by qualified personnel who have read this operator's manual and are familiar with the operation, hazards, and application of the e•drill system. Proper care and judgment must always be observed.

1. Never attempt to operate the e•drill system in any manner not described in this manual.

2. Ensure all covers are in place and securely fastened and the required grounding is supplied before connecting the input AC power.

3. Proper grounding from the input AC power is required to reduce the risk of electric shock, and to comply with safety agency and code requirements.

4. Use extreme caution when connecting the input AC power and only apply the input voltage specified on the rating label.

5. Ensure power switch is in the OFF position prior to accomplishing any service procedures.

6. Never remove DANGER or WARNING labels from the power supply, and replace lost or damaged labels immediately.

7. The Mobile Service Unit, Compact e•drill, and Umbilical Cables, should only be serviced by Perfect Point Corp. factory qualified personnel.

8. Do not operate the system in the rain, snow, or freezing weather without providing proper environmental protection.

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CE Declaration of Conformity

Application of Counsel Directives: 2004/108/EC and 2006/95/EC	
Standard to which conformity is declared:	**EMC Directive 2004/108/EC** **EN61000-6-4:2007** **EN55011 Class A Group 2** **EN61000-6-2:2005** **EN61000-4-2** **EN61000-4-3** **EN61000-4-4** **EN61000-4-5** **EN61000-4-6** **EN61000-4-8** **LVD Directive 2006/95/EC** **EN60974-1:2005**
Manufacturer's Name:	**Perfect Point EDM Corp.**
Manufacturer's Address:	**1500 Bolsa Chica St. , Ste C** **Huntington Beach, CA 92649**
Equipment Description:	**Plasma Cutting Tool**
Equipment Class:	**Generic Standard Industrial Environment** **Class A Group 2**
Model Number:	**E-Drill**
I the undersigned hereby declare that the equipment specified above, conforms to the above Directives and Standards	

James T. Legge
signature:

JAMES T. LEGGE
full name:

CEO
Position:

CSA Certificate of Compliance

CSA INTERNATIONAL

Certificate of Compliance

Certificate: **Master Contract:** 250252

Project: 2402903 **Date Issued:** June 15, 2011

Issued to: **Perfect Point EDM Corporation**

15000 Bolsa Chica St
Huntington Beach, CA 92649
USA
Attention: Mervyn Rudgley

The products listed below are eligible to bear the CSA Mark shown with adjacent indicators 'C' and 'US' for Canada and US or with adjacent indicator 'US' for US only or without either indicator for Canada only.

C US

Dennis Smith

Issued by: Dennis Smith

PRODUCTS

CLASS 5611 83 - WELDING MACHINES - Certified to US Standards
CLASS 5611 03 - WELDING MACHINES

Fastener removal system, Model CP1-SY-01X, where X indicates the number of guns provided with the system. Rated 240 VAC, 50/60 Hz, 20 Amp. Mounted on wheels, unit is cord and plug connected with detachable cord.

APPLICABLE REQUIREMENTS

CAN/CSA-E60974-1-00 with Amendment 1:2002 Arc Welding Equipment; Part 1: Welding Power Sources

UL 60974-1 Arc Welding Equipment; Part 1: Welding Power Sources

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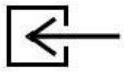
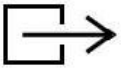
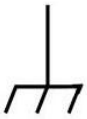
Description of Symbols Used in Product Labeling

Symbol	Publication	Description
	IEC 348	Attention, consult accompanying documents
	IEC 417-5036	Dangerous voltage
	ANSI Z535.4–2007	Read and understand manual before operation
	IEC70794	Input
	IEC70795	Output
	IEC5020	Chassis Ground
	IEC5007	ON Power
	IEC5008	OFF Power
	IEC5031	Direct Current (DC)

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1.0 PRODUCT OVERVIEW:

1.1 Major Components:

The e•drill system comprises; the Hand Held Terminal and Cable assembly, the Hand Tool and Umbilical Cable assembly, and the Mobile Service Unit control system. Various Tool Adaptors, Electrodes and Accessories are supplied for removal of specific fastener configurations and materials.

1.2 Technical Specifications:

Fastener Sizes:	CG Hand tool - 5/32”–3/8”, inc. oversize’s EG Hand Tool – 3/32”-1/4”, inc. oversize’s
Fastener Material:	Aluminum, Titanium, Stainless Steel, Alloy Steel, Inconel, Monel etc.
e•drill Hand Tool Dimensions (approx):	7.5” x 5” x 2”, 1.5 lb (plus 10 ft. umbilical)
Power Supply Cabinet Dimensions:	22” x 38” x 19”, 136 lb.
Umbilical and Control Extensions:	20 ft. long (optional extra)
System Power Cable Assembly:	12 AWG, L6-20P Twist-lock Plug (except Europe), 25 ft long
* Facility Power Requirements:	220/240VAC, Single Phase, 20 Amp, 50/60 Hz, L6-20 Twist-lock Receptacle Plug (except Europe)
Maximum Duty Cycle:	30 fasteners, or as many as possible with one electrode (whichever is the least), at the rate of 3 fasteners/minute (totaling 10 minutes). 1 minute minimum recovery time.
Crate Dimensions:	28” x 53” x 24”, 248 lbs.

1.3 Operating Principle:

Conventionally fasteners are removed by drilling out the head of the fastener with a hand drill and twist drill bit. This process is slow, requires significant strength from the operator, generates Foreign Object Debris (FOD), and involves a significant risk of damaging the airframe.

The Perfect Point e•drill system is a hand-held Electrical Discharge Machining (EDM) tool designed to aid in the removal of airframe fasteners. The e•drill device weakens the fastener by electrically eroding a circular groove through the fastener

head and a short distance into the stem (or pin) of the aircraft fastener. During cutting, a closed loop de-ionized water system is used as a Dielectric Fluid and circulated throughout the head of the device, in such a manner that the fastener and surrounding airframe do not heat up, and may be touched immediately after cutting.

The depth of cutting is controlled automatically, such that a thin wall remains holding the fastener head in place. The fastener head may then easily be severed by a sharp tap with a hammer and hand punch. When the device is positioned correctly the airframe is not damaged in any way, and the temperature rise in the airframe around the hole is insignificant. Due to the depth of the cut, the fastener stem has no remnant burr which may broach the hole in the airframe as the stem is driven out.

The photograph below shows a severed fastener with the groove and the fractured thin wall. Note that the cut is concentric with the stem; the wall thickness is uniform around the pin, the cut ends just below the head, and the fastener stem is burr free.

1.4 e•drill Hand Tool General Features and Controls:

e•drill Hand Tool

Interchangeable Adaptors:

The e•drill includes a kit of Interchangeable Adaptors suitable for different fastener types and removal processes. Depending on which size e•drill Hand Tool has been purchased, the adaptor kit may be one of two types (systems provided with both size of Hand Tool include both adaptor kits):

- EG Adaptor Kit – comprises button head and flush head adaptors and locators for 1/8" and 5/32" diameter fasteners.
- CG Adaptor Kit – comprises button head and flush head adaptors and locators for 3/16" and ¼" diameter fasteners.

Adapters and locators are intentionally manufactured from brighter colors, so they may be easier to find if dropped or mislaid. This is helpful in all shop environments, but especially in FOD-controlled situations.

*Note: *Since the range of fasteners in the aerospace industry is so large, it is not possible to provide adaptors for all types of protruding head fasteners that e•drill supports in the base product. Therefore prior to purchase of a system, please provide a list of button-head fasteners which you intend to use the e•drill with. Additional or custom adaptors are available on request.*

Trigger:

The trigger is depressed to initiate the cutting process, and is held depressed until the cut automatically completes. As a safety feature, should the trigger be released, the cutting process will be aborted immediately.

Retract Button:

The Retract Button recessed in the handle is used when necessary to retract the cutting electrode. Typically the retract button is only used when:

a) A new electrode has been installed and needs to be retracted, or …

b) When the trigger has been operated accidentally when not placed on a fastener and the electrode has moved forward as a result, or …

c) When the e•drill has been applied to a non-conductive surface and the electrode has extended in search of a conductive material.

The electrode retracts continuously while the button is held down. Retract stops when the button is released or the device reaches the retract limit.

Status Light:

The Status Light communicates various conditions during operation as follows:

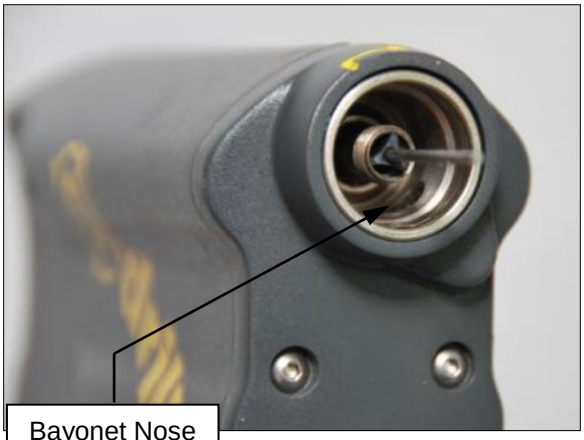
- Solid Green light upon cut completion – Cut was successfully completed.
- Solid Green while operating the retract button – Electrode is fully retracted.
- Flashing Green upon cut completion – Cut was completed successfully but the electrode needs replacement before next cut. The system is disabled until electrode has been replaced.
- Solid Red upon cut completion – Cut was completed with errors. Either the trigger was released before reaching depth, or the cut took excessively long. Which condition occurred will be reported by the terminal. Likely issues causing slow cutting are either (a) the head of fastener was not de-painted adequately, or b) wrong fastener type was programmed on the hand terminal, or c) the electrode is loose.
- Flashing Red (at any time) – An error has been identified, system is disabled. System error will be displayed on Hand Held Terminal. Typically the flashing red indicates a low water level, and a Top-Off needs to be performed.

Note: Solid lights are informational - The unit is still operational. Flashing Lights require user intervention - Unit is disabled until the condition is resolved.

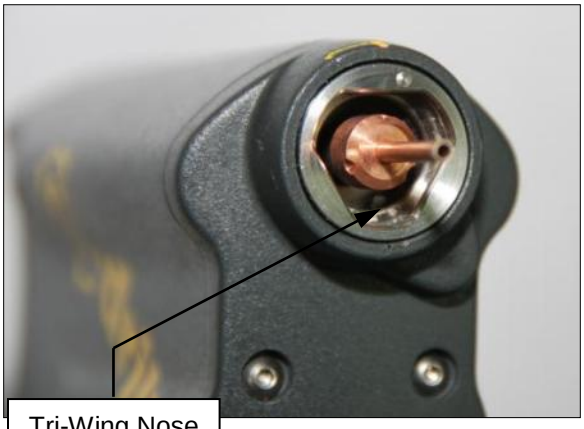
1.4.1 E•drill Hand Tool Configurations:

e•drill Hand Tools are currently provided in two different configurations to cover a wide spectrum of fastener sizes commonly encountered. Each Hand Tool has specific fastener size capabilities and features. This User Guide covers the use of all types of e•drill hand tools.

Each hand tool configuration uses a specific set of adapters that are described and identified throughout the sections of this user guide. The adapters are used for a specific set of electrode sizes with that particular hand tool configuration. Adaptors for some older hand tools use a different mounting method (Bayonet vs. Tri-Wing) so adaptors for a newer system may not fit the older system.



Bayonet Nose Hand Tool

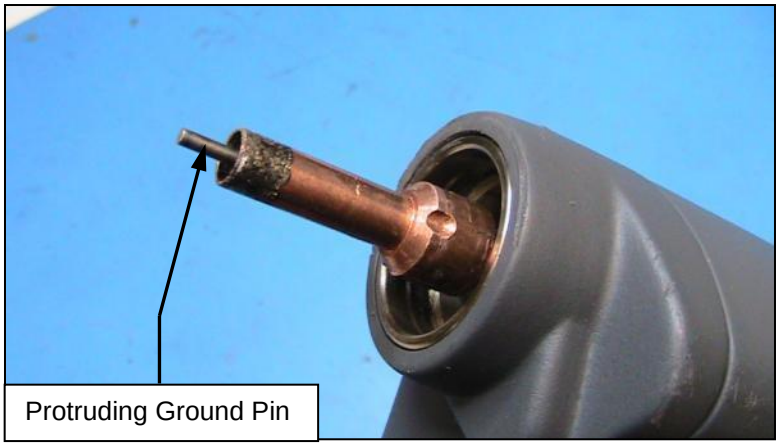


Tri-Wing Nose Hand Tool

1.4.2 Center Ground (CG) e•drill Hand Tool, Part No. CP1-CED-010:

This hand tool configuration is capable of removing fasteners from 5/32" Nominal Stem Size (-5) through 3/8", including oversize's. For fasteners smaller than these sizes the External Ground (EG) e•drill Hand Tool should be used.

This CG hand tool is Center Grounded by means of a Ground Pin that protrudes through the center of the cutting electrode. Hand tool visual identification can be quickly made by inspecting the nose of the hand tool. If the Ground Pin is visible protruding from the center of the electrode then this is a CG or Center Ground Hand Tool.

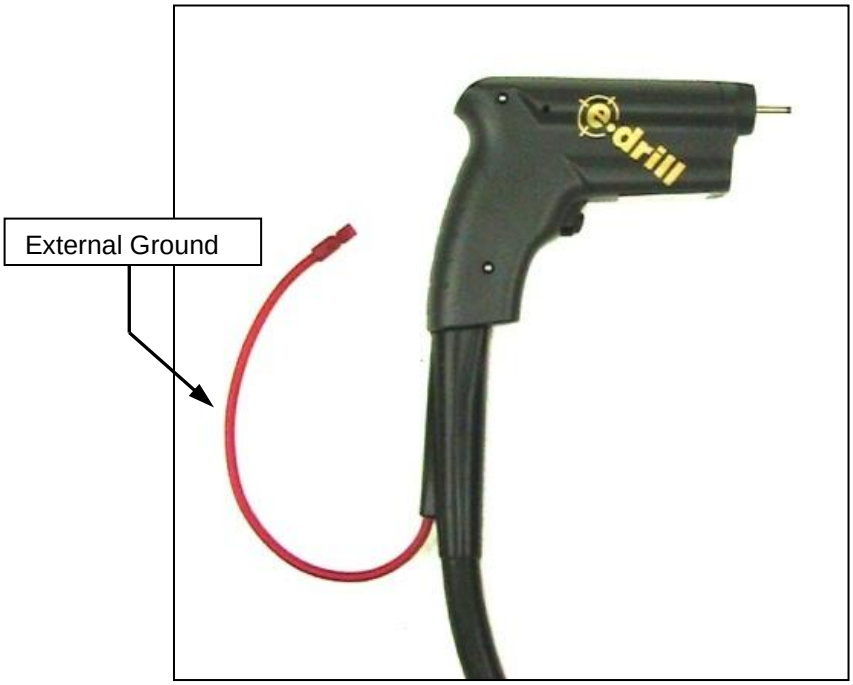


1.4.3 External Ground (EG) e•drill Hand Tool, Part No. CP1-CED-020:

This hand tool configuration is capable of removing fasteners from 3/32" Nominal Stem Size (-3) through ¼", including oversize's. For fasteners larger than these sizes the Center Ground (CG) e•drill Hand Tool should be used.

The EG e•drill Hand Tool is externally grounded by means of an External Ground lead and clamp. The Hand Tool Ground Lead and Grounding Clamp Assembly have a "break away" safety connector feature for operator safety and to prevent accidental cable breakage.

Hand tool visual identification can be made by inspecting the nose of the hand tool and its cable strain relief. The hand tool lacks a Ground Pin leaving the smaller electrode open for greater fluid flow. The hand tool cable strain relief has a Red Ground Cable Lead and Connector allowing for connection of the Ground Clamp Assembly Part No. EDT0301.



Ground Clamp Assembly

CAUTION

The External Ground (EG) Hand Tool will NOT operate without the system properly grounded by the Ground Clamp Assembly. Check for electrical ground prior to further system trouble shooting.

1.5 Mobile Service Unit Features, Controls, and Connections:

The Mobile Service Unit comprises the following primary components

1.5.1 Work Area:

The top of the Mobile Service Unit includes a recess for holding the Operator's Hand Held Terminal, a recess for interchangeable Adaptor storage, and a small work area to collect fastener remnants or small hand tools. The handle slot is intended to assist in moving the Mobile Service Unit around.

WARNING

The Mobile Service Unit handle should not be used as a means of lifting the unit.

1.5.2 Dielectric System:

The service unit includes a re-circulating dielectric fluid filtration and reconditioning system. This system requires regular service, as detailed in section 3.

1.5.3 Hand Held Terminal:

The Hand Held Terminal (HHT) provides an interface through which the user can select different fastener types to remove (as described in Section 2), and carry out maintenance functions (as described in Section 3). The terminal also displays status information including:

- Current fastener setting
- Cut time for last cut
- Current system status or error messages

The terminal operation is listed in more detail in Section 2.

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Power Supply Cabinet - Front View

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Power Supply Cabinet - Rear View

Power Supply Cabinet – Rear Connections

Connection of the various components together is self-evident. However certain key points should be noted:

1. The hand-tool connector installs in one vertical orientation, with the blue Vacuum dielectric connector at the top, and the black Pressure dielectric connector at the bottom (matching the cabinet connections). The black electrical connector locking bezel must be twisted until a definite click is felt. The Hand Held Terminal connection also installs in only one orientation, and includes a locking bezel.

2. When removing the hand-tool, the bezels around the Push-To-Connect™ fluid fittings on the Mobile Service Unit and Umbilical Cable must be pushed in to release the tubes.

3. When installing the hand-tool, the tubes should be pushed into the push-to-connect fittings and then lightly pulled such that they are “set”.

4. After installing or re-installing a hand-tool or installing the umbilical extension, it is good practice to bleed the pressure line to the hand-tool (see Section 3.7 for system bleeding and charging instructions).

Warning

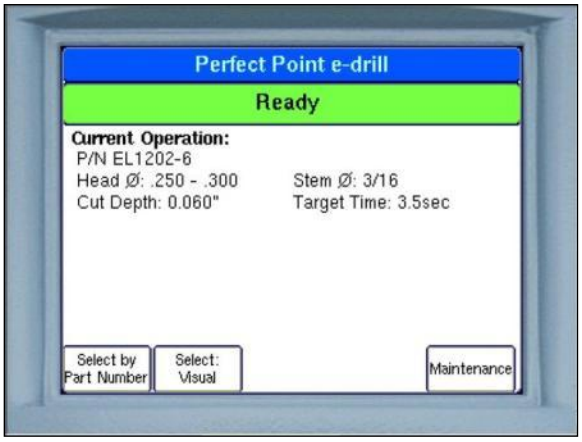
Under no circumstances should the electrical connectors be forced. If aligned correctly, minimal force is required. Excessive force will Damage the connectors, and will not be covered under warranty.

1.6 Operator’s Hand Held Terminal Command Screens:

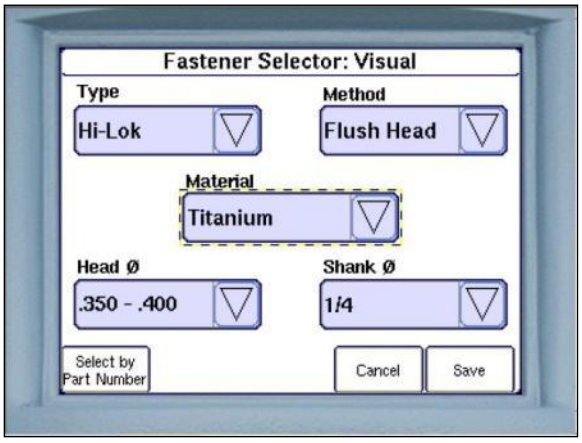
The Operator Hand Held Terminal is the device through which fastener types are selected and maintenance activities are performed. The terminal is a touch-screen device, so options may be selected by touching the screen or by using the function keys presented just below the screen. Under normal circumstances there is no need to use the alpha-numeric keypad.

There are three primary screens on the control terminal (contents of each screen may change slightly by customer):

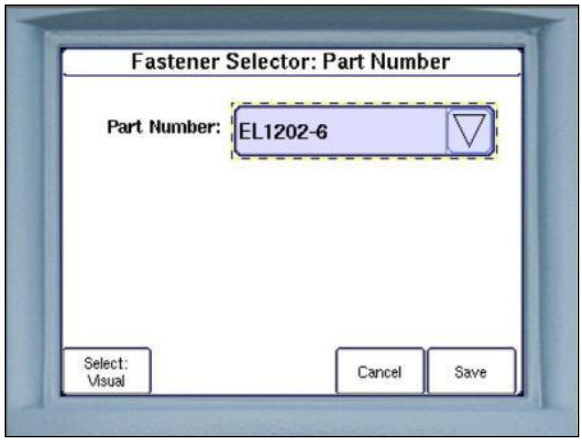
A) **Home Screen** – displays the current fastener selected, and the e•drill Adaptor and electrode which matches that selection.



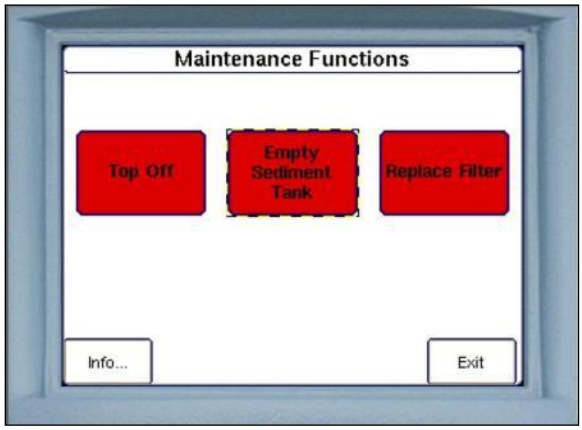
B) **Fastener Visual Selector Screen** – provides options to select a particular fastener by its physical characteristics; comprising type of fastener, removal method (flush, button, collar), fastener material, head diameter range and stem diameter. (This screen may be disabled by customer preference in some installations.)



C) **Part Number Selector Screen** – enables quick selection of a fastener by part number. Typically the menu of available part numbers is localized for the customer and project. The option is provided to switch between Visual Selector screen and Part Number Selector screen.



D) **Maintenance Screen** – provides options to Top Off the de-ionized water system, empty the Sediment Tank, or drain the system completely (for filter replacement – see Section 3).



E) All screens display the screen name along the top, and a command menu along the bottom, which corresponds to the function keys along the top of the keyboard. The Home screen displays the Perfect Point e•drill title, below which is the Status screen which communicates cut time, warnings and errors.

2.0 OPERATION:

2.1 Using the Part Number Selector:

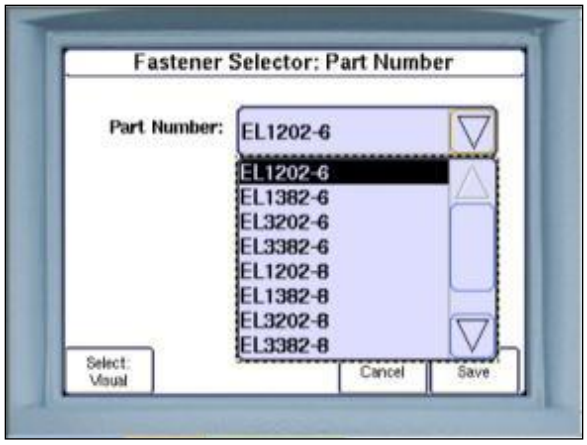
Setup for removal of any type of fastener may be carried out by one of two methods; either by using the Part Number Selector or by using the Visual Selector (if available). Either method may be used, or the user may switch between them at any time. However they are not interdependent, so the user cannot for example select *Type* in the Visual Selector menu and then switch to the Part Number Selector and see a sub-set of part numbers of that type.

To use the Part Number Selector:

Press *Select by Part Number* on the home screen.

1. Highlight the Part Number window and scroll down to the correct part number and select it by pressing it.

2. Hit *Save* to select that part number and load parameters from the library.

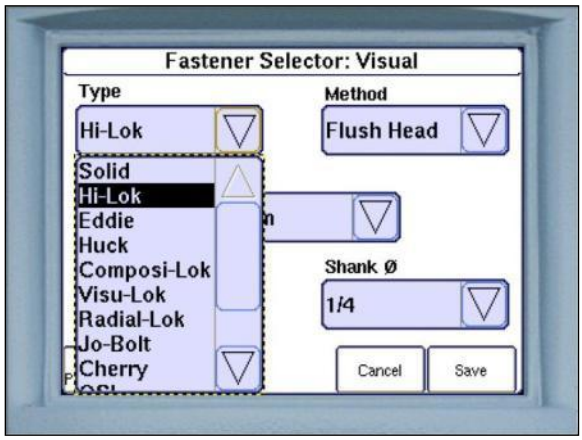


2.1 Using the Visual Selector:

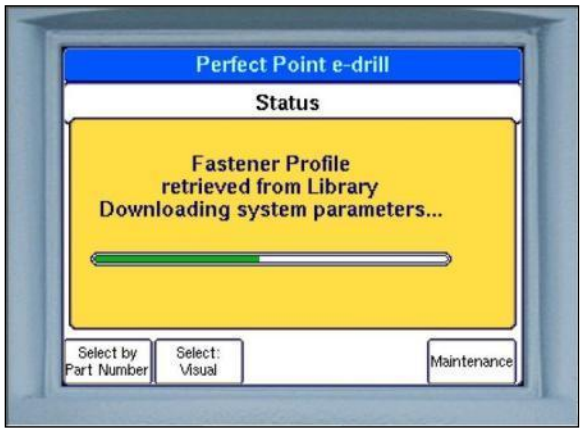
1. Press *Select Visual* on the home screen.

2. Progressing down the screen from top to bottom and left to right, in order highlight and select *Type, Method, Material, Head (or collar) Diameter range*, and *Stem Size*.

3. Hit *Save* to accept the selection and load parameters from library.



4. Whichever selection mode is chosen, once the *Save* button is pressed; the system will select the correct cutting and depth control parameters and download them from the library. Progress in loading parameters will be shown in a yellow panel (as shown below).



CAUTION

Since not all possible combinations may be in the fastener library, it is possible to pick a combination for which there is not a library entry. If that occurs, a Red panel will appear indicating that a library entry has not been found, and default values are being used. When this occurs the user should check the default values to ensure they will work or recheck their selection.

5. Before cutting, it is necessary to remove paint (or any other insulating layer) from the head of fasteners to be removed so that electrical conductivity through the head of the fastener is ensured. Since the surrounding surface is also used to seal in the Dielectric Water, rough surfaces around the fastener head should also be cleaned of any debris or smoothed by covering with tape.

6. Though it is not necessary for operation of the e•drill system, it is strongly recommended when using any electric device on the airframe to ensure the airframe is grounded.

CAUTION

Before cutting you must ensure that the hand-tool is correctly configured – failure to use the correct ADAPTOR AND ELECTRODE could result in damage to the airframe.

2.3 Cutting Electrode Sizes and Electrode Guide Color Matching:

There are 14 different standard Cutting Electrode O.D sizes available to cover 14 different diameter fasteners from 5/32" to 3/8". Electrodes are designed to remove nominal, X (1st Oversize) and Y (2nd Oversize) fasteners.

Cutting Electrodes are packaged with color coded inserts and provided in kits of 5 each to match their sizes. The e•drill Electrode Guides to be used in the e•drill Adaptors are color-coded to match. For convenience, each electrode is engraved with its Electrode Part Number. The chart and color legend below illustrates the size color coding.

Electrode Size	Adapter Electrode Guide	Electrode Packaging
3/32 Nominal	GREEN Electrode Guide	GREEN Cutout
3/32 1st Oversize	WHITE Electrode Guide	GREEN Cutout
1/8 Nominal	ORANGE Electrode Guide	ORANGE Cutout
1/8 1st Oversize	WHITE Electrode Guide	ORANGE Cutout
5/32 Nominal	BLUE Electrode Guide	BLUE Cutout
5/32 1st Oversize (X)	WHITE Electrode Guide	BLUE Cutout
3/16 Nominal	YELLOW Electrode Guide	YELLOW Cutout
3/16 1st Oversize (X)	WHITE Electrode Guide	YELLOW Cutout
3/16 2nd Oversize (Y)	TURQUOISE Electrode Guide	YELLOW Cutout
1/4 Nominal	BLACK Guide	BLACK Cutout
1/4 1st Oversize (X)	WHITE Guide	BLACK Cutout
1/4 2nd Oversize (Y)	TURQUOISE Guide	BLACK Cutout
5/16 Nominal	RED Guide	RED Cutout
5/16 1st Oversize (X)	WHITE Guide	RED Cutout
5/16 2nd Oversize (Y)	No Guide Required at this size	RED Cutout
3/8 Nominal	No Guide Required at this size	GRAY Cutout
3/8 1st Oversize (X)	No Guide Required at this size	GRAY Cutout
3/8 2nd Oversize (Y)	No Guide Required at this size	GEAY Cutout

Note: Guides should be regularly inspected for damage or wear. Guides with heavy usage should be replaced every 5000 cuts (see Hand Held Terminal for Cut Count).

CAUTION

Failure to replace worn electrode guides will have an adverse affect on the ability of the e•drill to accurately locate the center of the fastener being cut. Failure to replace

worn Electrode guides may cause damage to surrounding airframe if not properly maintained.

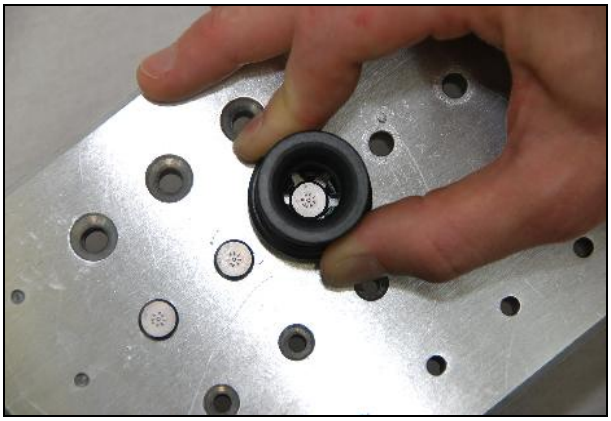
2.4 Removal of Button-Head Fasteners:

The first step before carrying out any operation with e•drill is to select the correct fastener in either the Part Number or Visual Selector libraries (see sections 2.1 and 2.2 respectively). Once the correct fastener has been selected in the Hand Held Terminal, the home screen will indicate the electrode size to use. Configure the e•drill hand tool with the correct electrode, button-head adapter (see section 5.4), and electrode guide (see previous section). Select the correct Button Head Locator which fits around the fastener head to be removed. For tight-access fastener situations the Button-head adapter and locator may be one piece (Slimline style). After the heads of the fasteners are de-painted (if necessary), the operator may proceed with the cutting process. Refer to Appendix 2 for further explanation.

A) If using an EG hand tool, ensure the EG ground clamp is attached to the airframe and the hand tool. Grip the e•drill lightly between the thumb and forefinger, nestling the tool between thumb and forefinger as shown below. Use your second finger to depress the trigger when ready.

Correct Grip of e•drill

B) Place the selected Button-head Locator over the fastener and press down to ensure it is secure and form a good water seal.



Correct grip of Button Locator

C) Guide the Adaptor installed on the e•drill into the Button Head Locator and press down firmly but lightly down onto the fastener, (compressing the central e•drill Ground Pin if using a CG hand tool), and sealing the Adaptor around the head of the fastener. Ensure the e•drill is held perpendicular to the surface.

e•drill Alignment

D) At this point the Adaptor should be located concentrically around and over the fastener, sealing to the surrounding airframe. If in doubt about e•drill placement and concentricity go back to step A and try again.

E) While holding the e•drill firmly but lightly against the fastener, wrap fingers around the e•drill grip and squeeze the trigger with your second finger. The device will then automatically go through the following sequence:

i. The Vacuum Pump will turn on to purge the area.

ii. The cutting electrode will advance until it detects the electrically conductive head to the fastener, whereupon it will calibrate itself.

iii. The cutting electrode will retract slightly, the system Water Pump will start and cutting will be initiated.

iv. Cutting will proceed until the prescribed depth is achieved (as defined by the fastener selection in the Hand Held Terminal), at which point the power will be shut off, the system Water Pump will stop, and the light on the back of the hand-tool will illuminate green. The system Vacuum Pump will continue to operate until the trigger is released.

CAUTION

Failure to establish electrical ground with the e•drill Ground Pin on the fastener head (or Ground Wire on the EG e•drill) will result in a failed cut cycle. If cutting does not occur, re-clean the fastener head and attempt to re-establish a proper system ground between the e•drill Grounding Pin (or the EG Grounding Clamp) and the Fastener Head. Avoid, striking, grinding, or scraping the e•drill CG Ground Pin on the fastener head. Abuse will result in damage and misalignment of the e•drill Ground Pin and system failure.

F) Remove the e•drill from the fastener, revealing the circular groove cut in the fastener head.

G) If the light on the back of the e•drill does not show green at the completion of the cut, then the cut may not have completed successfully to depth. If the light is showing a solid red then the likely cause is either a) bad electrical continuity resulting from paint or other coating, or b) the fastener material is not the same as was selected from the library. Ensure all paint or other coatings are removed, place the e•drill over the fastener and try again.

A flashing green light indicates the cutting electrode must be replaced. A flashing red light indicates a system error – see Operator hand Held Terminal for details.

H) Upon completion of the cut, select a proper size hand punch and center the punch in the fastener head. Sever the fastener head with a sharp blow on

the punch with a hammer. It may be necessary to strike the punch more than once. If the fastener head does not separate, the fastener is most likely an oversize stem. Select an oversize cutting electrode and setting. Re-cut the fastener and attempt to sever the fastener head again with a punch and hammer.

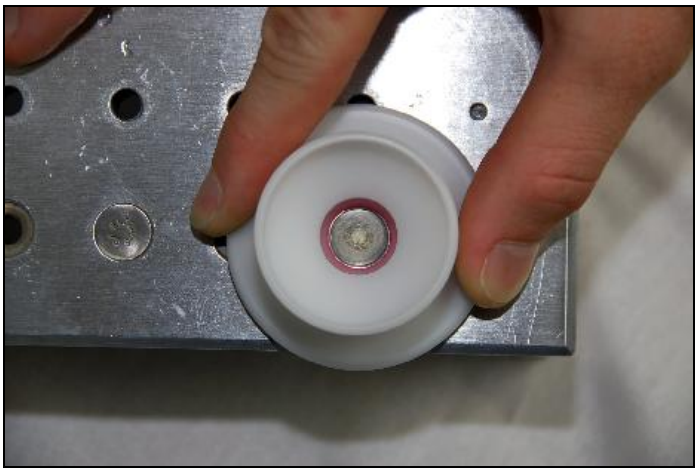
2.5 Removal of Flush-Head Fasteners:

For flush head fasteners the procedure is the same as for button-head fasteners except that a different e•drill Adaptor is used in conjunction with a Flush Head Locator (FHL). The photograph below depicts the FHL and proper alignment.

To configure the e•drill for removal of flush fasteners; select the correct fastener type on the Hand Held Terminal. Identify from the screen which Electrode and Electrode Guide are required, and install the electrode, adapter and guide on the hand tool (see section 6.3 for details). Clean off any paint or other coatings so that the e•drill will make good electrical contact, and you can clearly see the outline of the fastener head.

A) FHL's are provided with a range of sizes of sighting apertures suitable for different fastener head sizes. Select a suitable size FHL aperture.

B) Place the FHL over the fastener head, using the sighting aperture to ensure the FHL is concentric.



Flush Head Locator Alignment

C) While pressing the FHL firmly onto the airframe so that it does not move, insert the e•drill completely into the FHL. Concentricity and perpendicularity is critical to eliminating airframe damage; if in doubt remove the e•drill, check and adjust the FHL and re-insert the e•drill.

CAUTION

When using the CG Hand Tool failure to establish electrical ground with the e•drill Ground Pin and the fastener head will result in a failed cut cycle. Re-clean the fastener head and attempt to reestablish a proper system ground between the e•drill Grounding Pin and the fastener head. Avoid, striking, grinding, or scraping the e•drill Ground Pin on the fastener head. Abuse will result in damage and misalignment of the e•drill Ground Pin and system failure.

D) Squeeze the trigger until cutting sequence is completed, as with the button-head fastener removal.

E) Upon completion of the cut remove the FHL, select a proper size hand punch and center the punch in the cut. Sever the fastener head with a sharp blow on the punch with a hammer. It may be necessary to strike the punch more than once. If the fastener head does not separate, the fastener is most likely an oversize stem. Select an oversize cutting electrode and setting. Reapply the FHL and re-cut the fastener. Attempt to sever the fastener head again with a punch and hammer.

CAUTION

When removing Flush Fasteners from COMPOSITE structure, the Vacuum Flush Head Locator (VFHL) product is strongly recommended. Please visit WWW.PPEDM.COM or contact your e-drill representative for details.

2.6 Removal of Fastener Collars:

For fastener collars the greatest challenges are cleaning the relevant parts of the fastener to ensure good electrical contact. Specifically, remove the paint and sealants from around the collar so that the electrode can make contact. If using a CG Hand Tool, for fasteners such as Hi-Lok's which have a hexagonal hole in the shank, remove paint or debris from inside the hex hole so that the Ground Pin may make contact. It is recommended that these tasks are easiest achieved with an angle grinder and small drill, as shown below.

A) Configure the hand-tool for removal of the relevant collar, and select the correct collar removal operation from the library in the Hand Held Terminal interface. Please note that Huck Lockbolt collars are typically much longer than other collar types, so there is a special menu option specifically for Huck Lockbolts.

B) Using an angle-grinder, and the relevant personal safety equipment, remove the entire protrusion of the stem through the collar, thus ensuring a clean surface.

C) When using a CG system, using a small drill bit, clean out the hex hole if one exists. There is no need to remove metal – simply remove any loose debris or coatings inside the hole such that good electrical conductivity will occur.

D) Place the e•drill Adaptor lightly over the collar, completely enclosing it. Allow the Adaptor to determine the concentricity and alignment of the gun. Press down to make a seal and squeeze the trigger.

E) After cutting the collar it may need to be tapped or twisted sideways to release it since the pin has been thinned during the cutting process. To avoid splintering of the titanium, a brass punch (or drift) is recommended to drive out the shank, preferably with a correctly sized short blind hole drilled in the end of the punch such that it locates over and encloses the end of the pin.

2.7 Removal of Core-Bolt Fasteners (Cherry, OSI etc.):

Some fasteners have a separate core bolt, removal of which will facilitate disassembly, or a much simpler drilling operation. Monogram OSI fasteners are an example of the former, while Cherry fasteners are an example of the latter. Other types of fasteners may also benefit from similar techniques. Both OSI and Cherry fasteners have specific entries in the Hand Held Terminal fastener library, but both have specific techniques, listed below:

2.7.1 Monogram OSI Fasteners:

OSI-bolts, as they are known, rarely need to be removed. An OSI can easily be removed by removing the head off the core-bolt, then driving out the core and the tail, and then pulling out the body. Typically an electrode one size down from the fastener step size is used. So for example a 1/4” OSI fastener core-bolt would be removed using a 3/16” electrode.

2.7.2 Cherry Fasteners:

Cherry Fasteners, flush and protruding head, are removed in a simple one step process with the e•drill. The process of weakening the lock collar wall and creating a fracture point within the head is accomplished with one cut. The Cherry setting in the Hand Held Terminal, and accurate location of the gun to the fastener head will accommodate ease of Cherry Rivet removal. Cherry fasteners have a different set of parameters than other more standardized fasteners due to the nature of their construction. Known as an extremely high strength fastener they have a complex structure, therefore the set up will be different. Pay particular attention to the electrode recommendation on the terminal, since typically nominal Cherry fasteners require an oversize electrode.

Once the cut is completed, a parallel punch which equals the fastener nominal stem size should be used. One simple punch with a hammer will shear the fastener head and knock stem and sleeve out together.

2.8 Electrode Replacement:

Electrode replacement is necessary when either:

A) The current electrode is consumed as indicated by a flashing green light on the hand-tool and a message on the Hand Held Terminal, or…

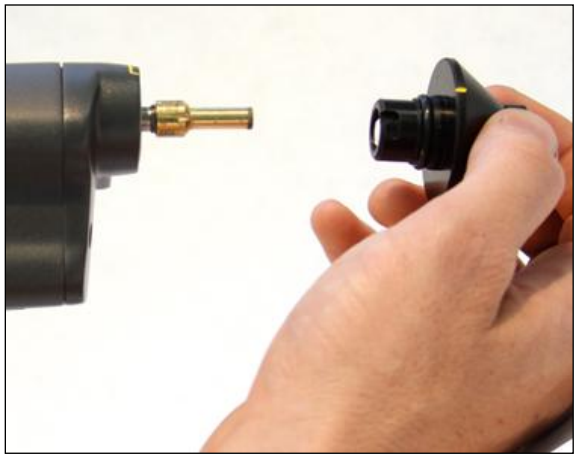
B) When changing to a different fastener with different stem diameter or oversize type.

CAUTION

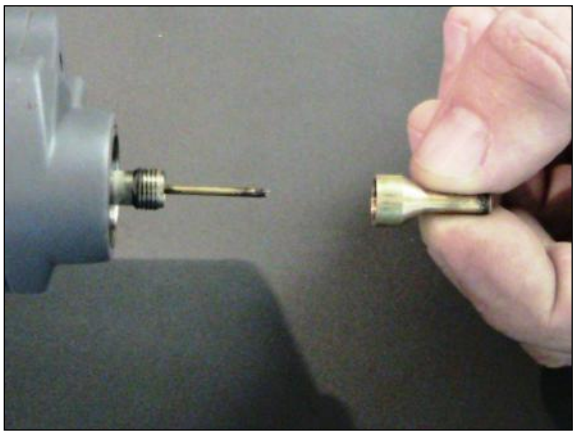
Each FASTENER SIZE and diameter, and oversize fastener has a matching electrode SIZE. When changing to a different stem diameter or oversize type Fastener, the proper corresponding electrode MUST BE INSTALLED for successful SYSTEM operation.

To replace an electrode, the procedure is as follows:

1. Unlock the e•drill Adaptor by twisting in a counter-clockwise direction (when viewed from the front of the e•drill), then pull the adapter straight off.



2. Unthread the existing electrode (it is hand-tight and should be removable without any tools. If necessary, use the torque-ring wrench)



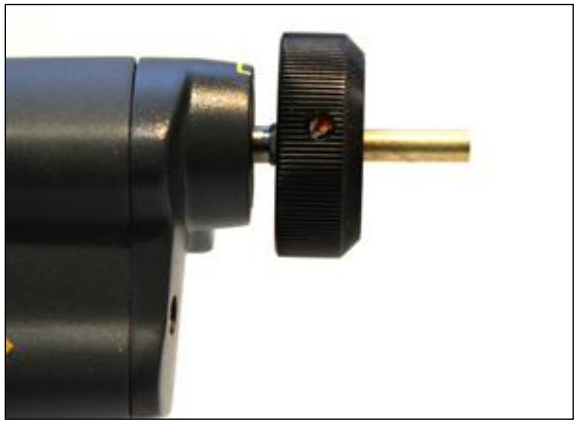
Note: The electrode may need to be advanced out of the device to make access easier. If this is necessary, then depress the trigger until the electrode is fully advanced.

Occasionally, when the electrode is depleted during a collar cutting operation (flashing green light) the electrode may still not be advanced enough. In this case the retract button should be pressed momentarily, then the trigger may be depressed and the electrode will advance completely.

If the cutting electrode is being changed because of a change of fastener type then it may be saved and used again later. If the electrode is consumed then it should be discarded.

3. Check that the threads are clean on the front of the hand-tool, and screw the replacement electrode hand-tight but firmly on to the front of the e•drill.

4. Push and engage the Torque-ring Wrench over the electrode and tighten. The torque-ring will “skip” when the required torque is reached. Remove the Torque-ring and replace the e•drill Adaptor over the electrode.



5. Retract the cutting electrode by pressing and holding down the retract button in the base of the grip until the green light illuminates indicating the electrode is fully retracted.

Note: If the cutting electrode is part-worn then it only needs to be retracted just inside the e•drill Adaptor. Then during the first cut it will reach its cutting position faster.

Note: Electrode Torque-Ring Wrench torque is factory set and identified as calibrated with locking compound. Do not attempt adjustment of the Torque-Ring Wrench setting screws.

2.9 Installing the Umbilical Extension:

The hand-tool is provided with a 10' umbilical connecting it to the Power Supply Cabinet. This configuration is intended for use when the MSU can be located in close proximity to the workplace, such as in a shop environment, and eliminates excess cable. For situations where the MSU cannot be located close to the workplace, such as removal of fasteners on top of wing sections or fuselage, or inside air-intakes, a 20' umbilical extension is provided, increasing the total length from Cabinet to hand-tool to 30'.

CAUTION

The system is optimized for no greater than 30' maximum distance between Cabinet and Hand-tool. Usage of multiple extension umbilical's will negatively impact cutting performance and will invalidate warranty and regulatory safety compliance.

To install the Umbilical Extension the procedure is as follows:

1. Disconnect the hand-tool from the back of the Power Supply Cabinet by rotating the twist-lock bezel in a counter-clockwise direction, then

depressing the barrel around the push-to-connect fluid fittings and pulling out the fluid hoses.

2. Transfer the fluid hoses and elbows from the hand-tool umbilical to the female end of the extension umbilical by depressing the barrel around the push-to-connect fittings.

3. Connect the umbilical extension to the rear of the Power Supply Cabinet by inserting the power connector and rotating the bezel clockwise firmly until a click is felt. The power connector can only be inserted one way – if it will not insert then rotate it until insertion is possible. Re-insert the fluid hoses between the Power Supply Cabinet and the extension umbilical.

4. Connect the hand-tool to the male end of the umbilical extension by lining up the electrical connection and the pre-installed fluid pipes and rotating the bezel to close. Take care that the fluid pipes insert into their respective couplings as the bezel is turned. Bleed the water line as described in Section 3.7.

5. Removal of the Umbilical Cable is the reverse of installation.

2.10 Keys to Successful Operation of the e•drill:

1. Select the right fastener setting on the Hand Held Terminal.

2. Ensure you are using the correct e•drill Adaptor and Electrode for the fastener you wish to remove.

3. Lightly locate the hand-tool concentric with the fastener and co-axial with it.

4. Using thumb and forefinger press the e•drill lightly down over the fastener in order to a) depress the central ground pin (CG hand-tool only), and b) minimize any water leaks which may occur during cutting.

5. Allow the e•drill to reach its own perpendicularity to the fastener as influenced by the e•drill Adaptor and its seal, and then wrap the fingers around the grip to hold securely during cutting.

6. Depress the trigger on the e•drill and keep the trigger depressed until the process is completed, as indicated by the status light on the back of the gun illuminating green.

7. Hold the hand-tool as steady as possible during the cutting process.

8. Hold the e•drill over the fastener for a second with the trigger depressed allowing the vacuum system to suck up any excess water left behind by the process. The vacuum will continue to operate for as long as the trigger is depressed.

3.0 SYSTEM MAINTENANCE:

Periodic simple maintenance is required to keep the system operating properly. System maintenance is controlled by internal cut cycle counters, that will advise the operator when maintenance is recommended. Once the predetermined cut cycles are reached operator intervention is required to perform maintenance and reset the counters.

3.1 Maintenance Warnings:

A) The **Sediment Tank Maintenance Counter** will provide a maintenance warning (see below) at 1000 cut cycles. The system will continue to operate, but maintenance is recommended before the next shift.

B) After the warning screen is activated, the system will allow an additional 500 cut cycles before the system will automatically shut down. It is recommended that sediment tank maintenance be completed prior to the system forcing a shutdown.

C) The **Filter Maintenance Counter** will provide a maintenance warning to replace the pleated filter (see below) at 5000 cut cycles. As with the Sediment Tank, the system will continue to operate, but maintenance is recommended before the next shift.

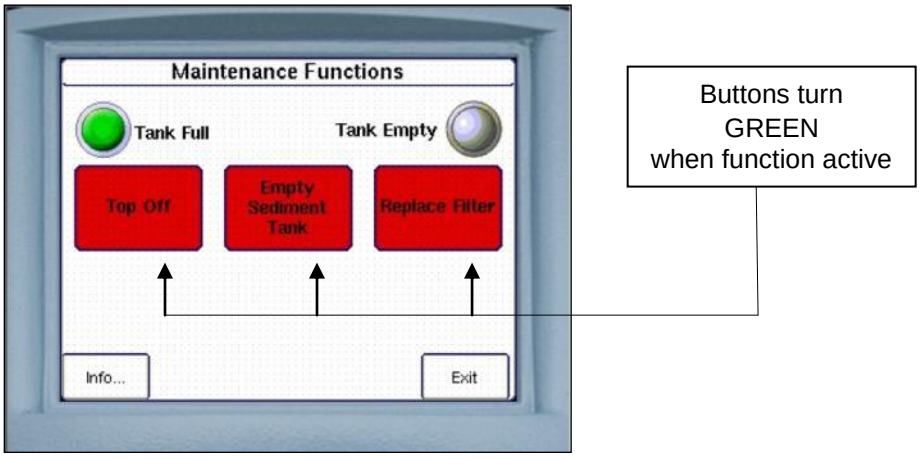
D) After the warning screen is activated, the system will count an additional 500 cut cycles before the system automatically shuts down at the mandatory 5500 cut cycle limit.

3.2 Reset Maintenance Counters:

If performed correctly, the Sediment Tank and Filter procedures (refer to sections 3.5 & 3.6 below), will automatically reset their respective counters. However, if the procedures are performed incorrectly, the counters will not be reset and the system will still be disabled. Both the Sediment Tank and Filter counters can be reset in Advanced Mode (see Appendix 1, Section 1.4 for reset instructions). It is not recommended that a counter be defeated by resetting it without servicing the system, and such activity will void the system warranty.

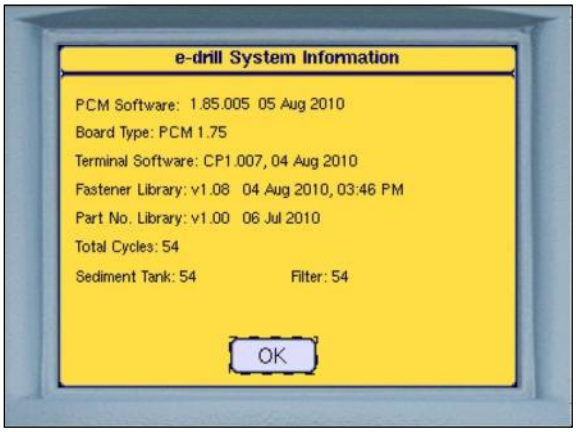
3.3 Maintenance Screens:

System maintenance functions are accessed through the System Maintenance Screen, by pressing the *Maintenance* button at the bottom right of the Home screen. The Maintenance screen is shown below.



Touching a button on the maintenance screen will turn the button on (green) activating the function. Touching the button again will turn the function off (red). The **Tank Full** and **Tank Empty** round indicator "lights" display system water level status in the Sediment Tank and will turn on and off automatically indicating water levels as the system is serviced.

The informational screen is accessed by touching the "**Info"** button in the lower left corner of the main maintenance screen. The information screen contains system configuration details and firmware revisions. The screen also contains the **Total Cycles**, **Sediment Tank**, and **Filter** counters.

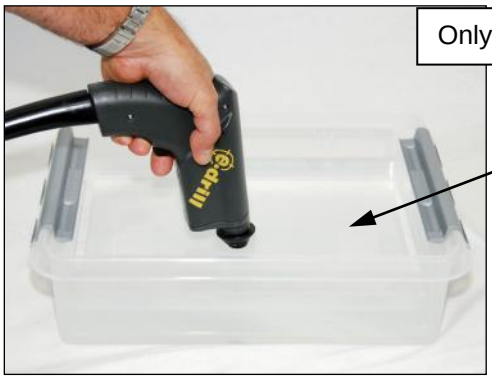


3.4 System "Top Off":

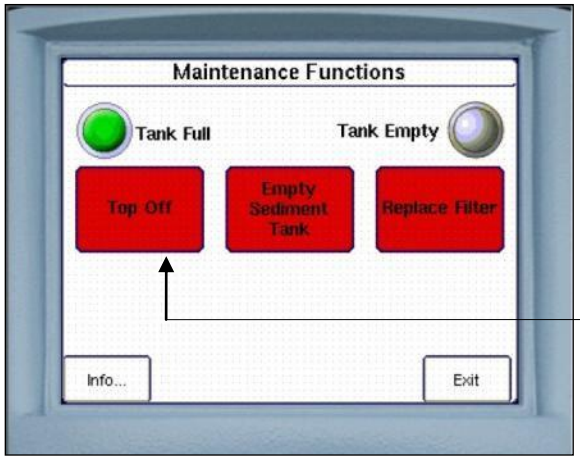
The DI water system requires periodic filling or "Top Off" to replace small amounts of DI water lost during the cutting cycle. Should the system run low on water during operation, the hand tool will indicate a flashing red light and the display will indicate a "low water level" condition. To "Top off", fill an open container with approximately 1 gallon of clean water, touch the **Top Off** function, and immerse the Adaptor of the e•drill in a vessel of water (do not submerge the entire drill, only the front of the e•drill Adaptor should be submerged).

CAUTION

Submersing the e•drill, its mechanism, or any parts other than the Adaptor will destroy the e•drill electronics, and void the system warranty. Submerging the e•drill in water may also cause operator injury due to electrical shock.



When the Tank is full the Full LED indicator will illuminate green and the pump will turn off automatically. The system is then ready for continued use.



*Note: The Top Off pump may be stopped manually by pressing the **Top-Off** button a second time. The Top Off function will not work if the tank is already full.*

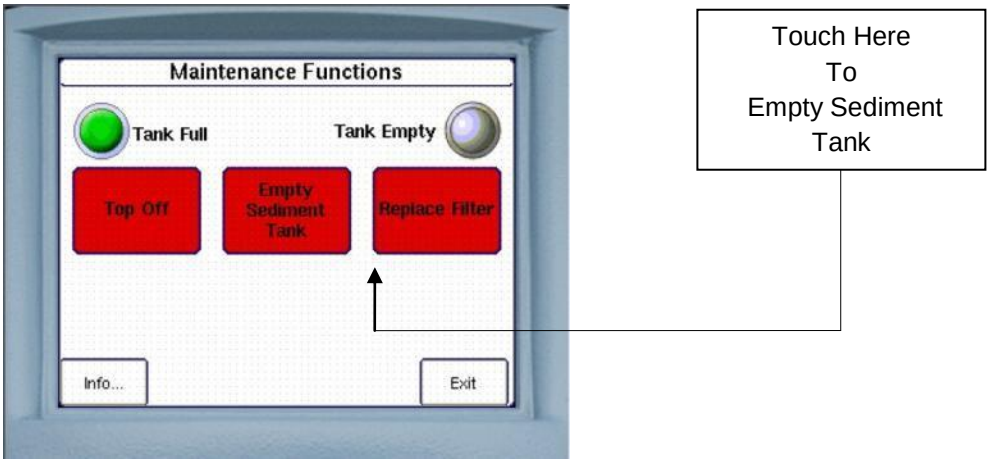
3.5 Empty Sediment Tank:

The e•drill is provided with a maintenance kit including a drain bowl, a Drain/Bleed Tube Pair and a Filter Bowl Wrench for the two water tanks. These tools are used when servicing the sediment tank or filter tank. Sediment tank cleaning is carried out as follows:

A) Disconnect the two Hand-Tool water connections on the back of the Power Supply Cabinet and connect one end of the Service Drain/Bleed Tube Pair to the Mobile Service Unit PRESSURE and VACUUM ports. Place the other end of the Drain/Bleed Tube Pair in a 1 gallon container (minimum).

B) Empty the system by pressing the **Empty Sediment Tank** button on the maintenance screen of the Hand Held Terminal. The button will change color to

green and the system will automatically pump out sufficient water for the Sediment Bowl to be removed and cleaned. The pump will terminate automatically when sufficient water has been removed.



C) When the Empty Sediment Tank function is selected, a “pop up” screen (below) will appear prompting the user to reset the Sediment Tank Counter.

This function allows the operator to determine if system maintenance is being performed, or other system bleed/charge procedures are being performed (see Section 3.7) and allow the cut cycle counter to be reset or ignored as appropriate. Press the *YES* button to proceed.

D) Loosen the Dielectric Lock-Bolt on the frame to the right of the entire Filter Assembly. Rotate the assembly until nearly horizontal (see photograph at the end of this section) and retighten the Lock-Bolt.

E) Using the Filter Bowl Wrench provided with the system, loosen the Sediment Bowl (bowl on the right, marked Sediment). Use caution; there will

be some residual water in the bowl. Unthread by hand; carefully remove the bowl without touching the pick-up tube or fragile level sensor assembly to its right. Clean out the Sediment Bowl with a clean, lint free shop towel. Do not attempt to clean the Level Sensor Sleeve.

F) Prior to reassembly, inspect the bowl to ensure the large O-ring seal is clean and undamaged, properly lubricated and seated before reinstalling. Hand-thread the tank onto the Filter Cap Assembly, taking care not to unseat the o-ring or touch the center pick-up tube or the level sensor assembly. Use the Filter Bowl Wrench provided with the system to lightly tighten the bowl.

Return the Bowl Assembly to vertical position and tighten the Dielectric Filter Assembly Lock Bolt.

G) Ensure that the end of the drain/bleed tube is submerged in water, then recharge system using Dielectric Top-Off button. Ensure that water is being drawn into the system by watching for movement of air-bubbles when the procedure is started. If water is not being drawn into the system it is likely that the o-ring is incorrectly installed. Re-tilt the assembly and re-install the bowl after o-ring seal is rectified.

H) When the tank is full the pump will automatically turn off. You may need to add more water to fully fill the tank.

*Note: The pump may be stopped manually by pressing the **Empty Sediment Tank** button a second time.*

Note: The Empty Sediment Tank function only drains the Sediment Tank only for servicing. It does not empty the entire system.

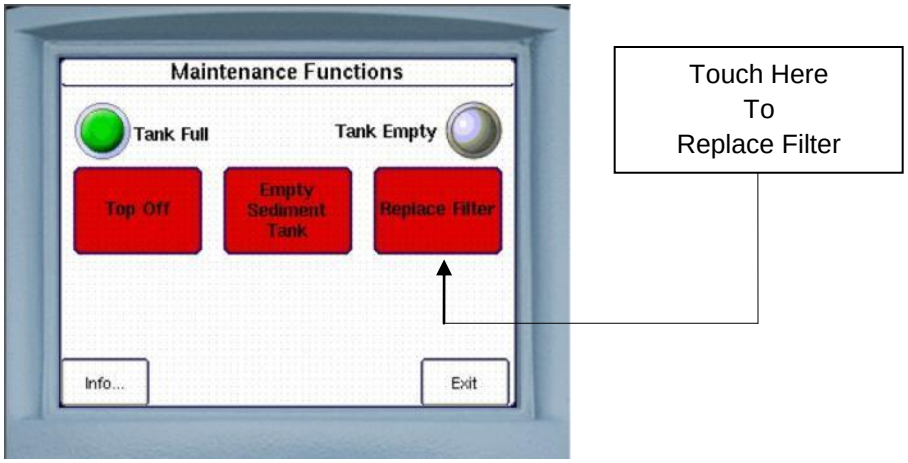
Rear of Power Supply Cabinet with Filter Assembly in rotated position

3.6 Replace Filter:

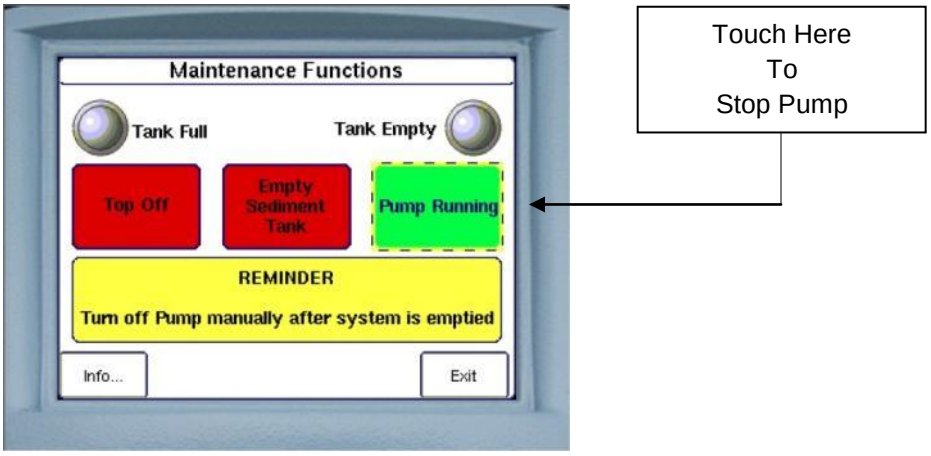
Completely emptying the system for replacement of the system filter is accomplished in the **Replace Filter** function. Procedure is as follows:

A) Connect the Fill/Drain Tubing to the Mobile Service Unit PRESSURE and VACUUM ports. Place the other end of the Drain/Bleed Tube Pair in a 2 gallon container (minimum).

B) Press the **Replace Filter** button to empty system.



The PUMP RUNNING message will display notifying the user that the function will run the fluid pump continuously until it is shut off manually by the operator. The pop up screen (below) reminds the operator that the running pump will need to be watched and shut off manually when no more water is being pumped out.



C) When the system is empty and pump is stopped, a “pop up” screen will appear prompting the user to reset the Filter Counter. This function allows the operator to determine if system maintenance is being performed or if other system Bleed/Charge operations are being performed (see Section 3.7), and allow the cut cycle counter to be reset or ignored as appropriate.

D) Loosen the Dielectric Lock-Bolt to the right of the entire Filter Assembly. Rotate the assembly until nearly horizontal (see photograph) and retighten the Lock-Bolt.

E) Using the Filter Bowl Wrench provided with the system, loosen the Filter Bowl. Use caution; there will be some residual water in the bowl. Unthread by hand and carefully remove the bowl and filter. Discard the old filter, clean out the bowl with a lint-free cloth, and install a new filter. (Do not attempt to wash out and re-use an old filter. It is a single-use device and will not re-seat correctly.)

F) Prior to reassembly, inspect the bowl to ensure the large o-ring seal is clean and properly lubricated and seated before reinstalling. Hand-thread the tank back onto the Filter Cap Assembly, taking care not to unseat the o-ring. Use the Filter Bowl Wrench provided with the system to tighten the bowl.

G) Return the Bowl Assembly to vertical position and tighten the Dielectric Filter Assembly Lock Bolt.

H) After filter replacement the system must be completely refilled and bled. Follow section 3.7 for recharge and bleed procedure. If water is not being drawn into the system it is likely that the o-ring is incorrectly installed. Re-tilt the assembly and re-install the bowl after o-ring seal is rectified.

3.7 System Bleeding and Charging Procedures:

System maintenance and connecting/disconnecting system components can cause air to become entrapped in the DI water system. Bleeding and charging is sometimes required to assure there is no trapped air in the DI system.

Note: During the following operations there may be some "screeching" from the Mobile Service Unit Pressure Regulator as the air is bled out of the system. This is normal and will disappear as system is successfully bled.

1. Enter maintenance mode on the Hand Held Terminal, attach the Fill/Drain Tubing and run the **Top Off** procedure (see Section 3.4) to assure the system is completely filled.

2. In the Maintenance mode on the Hand Held Terminal, run the **Empty Sediment Tank** function (see Section 3.5). Water and entrapped air will be expelled through the tubing, until you achieve a strong stream of water. After expelling approximately 1 gallon of water the pump will automatically stop. The system will prompt you to confirm that you are resetting the Sediment Tank Counter. Respond by pressing the *No* button.

3. Re-run the "Top Off" procedure to refill the system (see Section 3.4).

4. This procedure should be sufficient to clear excess air out of the system. Repeat this procedure as necessary to bleed air from the system.

3.8 Weekly Maintenance:

Visually inspect the e•drill for tightness of the cutting electrode, signs of excessive burning around electrode and Ground Pin (CG system only), or water leakage. The Ground Pin is of particular importance and the Ground Pin Insulation Sleeve on the tip of the Ground Pin should be intact (does not apply to EG hand tool).

3.9 Ground Pin Adjustment and Replacement (applies to CG and BG hand-tools only):

Ground Pin adjustment is a critical parameter in efficient operation of the device (much like the electrode in a TIG welder). As described in the Weekly Maintenance Schedule (Section 3.8), the Ground Pin should be regularly checked for excessive burning or damage and correct protrusion from the front of the e•drill. The procedure for checking and adjusting, and if necessary, replacing the ground pin is as follows:

1. Prior to Ground Pin inspection, advance Electrode to the full forward position; remove any installed Adaptor and the Electrode from the e•drill and inspect the Ground Pin for excessive burning and/or damage.

2. Place the Ground Pin Setting Tool over the end of the gun and across the Ground Pin tip. There should be no gap visible between the Gauge and the tip

of the Ground Pin.

3. If there is a gap the Ground Pin may be adjusted by loosening the internal Ground Pin Clamp Screw.

CAUTION

DO NOT COMPLETELY REMOVE THE CLAMP SCREW. Completely removing the screw will allow internal components to drop into the e•drill housing. Simply loosen the screw sufficiently to relieve the clamping force on the pin shaft.

4. Carefully pull the Ground Pin out incrementally (do not use any tools for this – if properly loosened, the Ground Pin should slide out relatively easily), recheck Pin length with the Pin Gauge allowing the Gauge to push the Pin back to the correct protrusion.

5. The Ground Pin shaft has an engraved ring indicating the go-no go line for the Ground Pin Gauge. If the engraved ring on the Ground Pin is still *on the e•drill side* of the REPLACE lines on the Gauge, then the Ground Pin is adjustable. If the plating line on the Ground Pin is *past* the REPLACE zone on the Pin Gauge, then all available adjustment has been used and the Ground Pin must be replaced.

6. To replace the Ground Pin, Grip Ground Pin Assembly firmly and pull it straight out of the nose of the e•drill taking care not to bend it during extraction. Make sure there is no remaining clamping force on the Ground Pin if removal is difficult. As the Ground Pin Assembly is extracted, the Ground Pin Centering Guide will come out with the Ground Pin. Discard Ground Pin and Centering Guide once removed.

7. Lightly coat the shaft of the new Ground Pin Assembly with a light coating of O-Ring Lube (do not over lubricate). Insert the prepared Ground Pin Assembly into the nose of the e•drill pressing it through the e•drill's internal seals. Use care not to bend the Ground Pin during insertion. Use Ground Pin Gauge to set the proper pin length and secure the Ground Pin Clamp Screw (do not use excessive torque).

   Press the Ground Pin Centering Guide on the Ground Pin Assembly into its seat in the Electrode Conducting Tube Bore using the tip of an Electrode. Install the required Electrode and Adaptor and resume e•drill operation.

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APPENDIX 1. Advanced Functions:

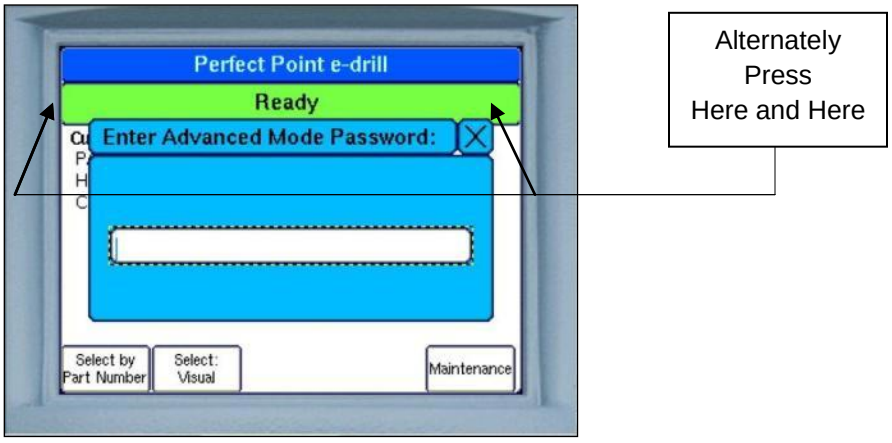
The Advanced Functions screen is provided to enable the system to be adjusted to remove non-standard fasteners, and to provide functions to assist in fault diagnosis. In order to access advanced functions, the user will need to obtain a password from Perfect Point service personnel.

Advanced functions include:

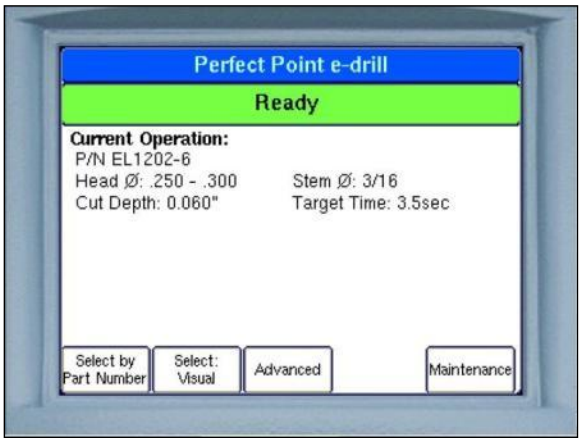
- Manual Setting of Depth of Cut and Cycle Time
- Manual Setting of Retract Distance
- Manual Extend & Retract of Electrode (May also be activated by function keys).
- Manual DI Pump and Vacuum Control
- Manual Spark Power Control

4.1 Password Entry:

To enable the advanced menu tab, return to the home screen, and then press in sequence the top left corner of the screen followed by the top right corner, within 2 seconds. A prompt for password will appear.



Enter the password provided by Perfect Point, followed by the *enter* button. If the procedure is completed correctly, the Advanced Mode will be enabled. While Advanced Mode is enabled, an **Advanced** tab is visible along the bottom of the screen.



4.2 Accessing Advanced Functions:

Pressing on the advanced tab (or pressing the F3 function key) will access the advanced functions. The advanced functions screen is divided into three tabs; **Current Part**, **System** and **Reset**.

In the **Current Part** screen (shown below) an advanced user may override the **Cut Depth** or the **Target Time** for the current fastener being removed. After the setting is saved, then the home screen will re-appear with the over-ridden parameters shown in red.

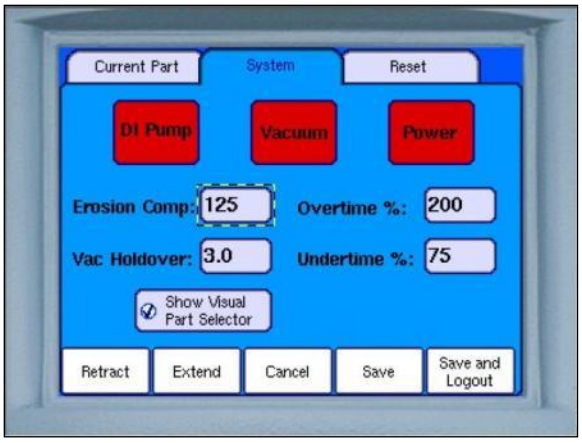
NOTE: The over-ridden values do not modify the library permanently, and the over-rides are only valid until another fastener is selected (or the current fastener re-selected). If you believe a library entry is incorrect please contact Perfect Point Technical Support hotline (714 891 6533).

4.3 Override System Cut Parameters:

In the **System** screen, an advanced user may override system cut related parameters, including Erosion Compensation, Vacuum Hold-Over (after trigger release), **Overtime,** and

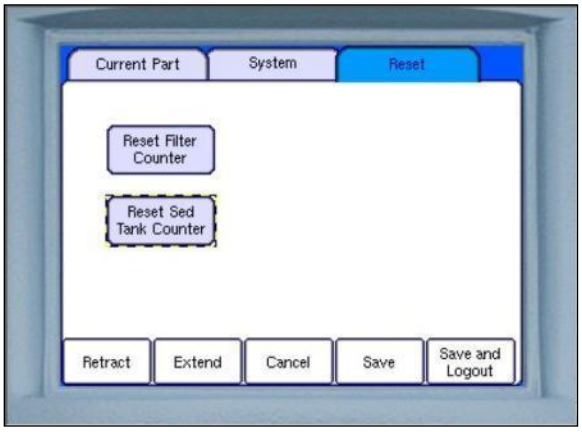
Undertime warning threshold settings. In addition there are manual controls used for error diagnosis and a check-box to control whether the visual selector is displayed (in some customer installations the visual selector is not displayed by default).

NOTE: Changes should only be made in the system screen by trained advanced users or service personnel. Incorrect usage of this screen could result in personal injury or damage to the equipment.



4.4 Reset System Counters:

In the **Reset** screen (shown below) an advanced user may reset the counters for Sediment Tank and Filter Servicing. This should be done after either service is performed.



When the advanced user is finished with the advanced functions screens, (note that cutting can only be carried out when the home screen is displayed), then the user may either **Cancel** (all changes are ignored and advanced mode is disabled), or **Save** the existing settings, (and return to Home Page but still in Advanced Mode), or **Save and Logout** (from advanced mode). So that the advanced functions are not left on permanently, the system will automatically disable the advanced tab after 10 minutes.

APPENDIX 2. Adaptor Charts and Cross Reference Data:

The following tables, charts and cross references are supplied to provide the user with additional information to assist with proper configuration of the e•drill system for a particular fastener removal project.

5.1 Electrodes:

Electrode Kits are packaged in quantities of 5 each. Each package is identified with colored card stock for quick identification of the size range.

Standard Electrode Packaging (5 each)

5.1.1 Electrode Information:

Electrodes come in a range of standard, first, and second, oversize. Each size is identified by a color and a “dash” size. The following chart depicts the Electrode size range. Each material is used for specific fastener material removal. Refer to the Operator Hand Held Terminal for recommended Electrode use.

ELECTRODE PACKAGE IDENTIFICATION		
Electrode Size	**Dash Size**	**Packaging color**
3/32 Nominal	-3	GREEN Cutout Label
3/32 1st Oversize	-3X	GREEN Cutout Label
1/8 Nominal	-4	ORANGE Cutout Label
1/8 1st Oversize	-4X	ORANGE Cutout Label
5/32 Nominal	-5	BLUE Cutout Label
5/32 1st Oversize (X)	-5X	BLUE Cutout Label
3/16 Nominal	-6	YELLOW Cutout Label
3/16 1st Oversize (X)	-6X	YELLOW Cutout Label
3/16 2nd Oversize (Y)	-6Y	YELLOW Cutout Label
1/4 Nominal	-8	BLACK Cutout Label
1/4 1st Oversize (X)	-8X	BLACK Cutout Label
1/4 2nd Oversize (Y)	-8Y	BLACK Cutout Label
5/16 Nominal	-10	RED Cutout Label
5/16 1st Oversize (X)	-10X	RED Cutout Label
5/16 2nd Oversize (Y)	-10Y	RED Cutout Label
3/8 Nominal	-12	GRAY Cutout Label
3/8 1st Oversize (X)	-12X	GRAY Cutout Label
3/8 2nd Oversize (Y)	-12Y	GRAY Cutout Label

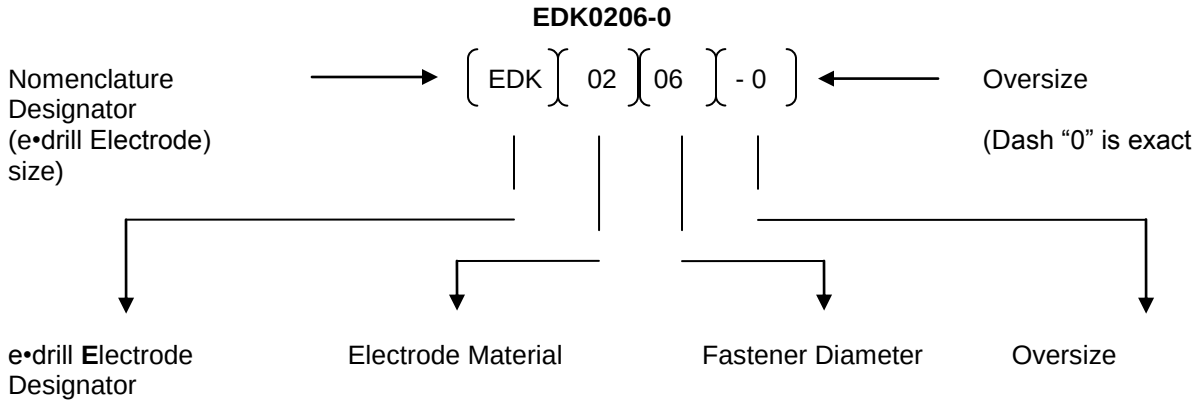
5.1.2 Electrode Material Usage:

EDK01 Series Brass Alloy Electrodes are used for Titanium fasteners above 3/16” only. BRASS ELECTRODES MUST NOT BE USED ON STEEL FASTENERS..

EDK02 Series Copper Alloy Electrodes are used for all other fastener materials and sizes. Refer to the home screen having selected a fastener to double-check the electrode recommendation.

5.1.3 Electrode Part Number Legend:

Electrodes are sold in packages of 5 each. The kit part numbers aid in the identification of electrode size, composition, and dimensions. This legend below depicts the composition of a cutting Electrode part number.



Nomenclature:

EDK:		=	e•drill electrode Kit (5 electrodes)
Electrode Material:	01	=	Brass Alloy (for most Ti fasteners)
	02	=	Copper Alloy (for Aluminum, Inconel, Monel, Stainless and Alloy Steel)
Fastener Diameter:	06	=	Fastener Stem Size Designator (3/16")
EXAMPLE:	05	=	5/32" Fastener
	06	=	3/16" Fastener
	08	=	1/4" Fastener

Size Designator:

All Electrodes part numbers carry a dash number indicating a nominal size (-0), or a letter designators (-X or –Y) for each of the two over size electrode OD's available.

- The Letter "X" depicts the fist oversize or, *plus 1/64th of an inch.*
- The Letter "Y" depicts the second oversize or, *plus 2/64^{ths} (or 1/32$^{nd)}$ of an inch).*

Examples: **EDK0106-0** (*3/16" nominal size, brass alloy electrode)*

EDK0106-X (*3/16"* size, *plus 1/64th of an inch, brass alloy electrode)*

EDK0206-Y (*3/16" size, plus 2/64^{ths} or 1/32nd of an inch, copper alloy electrode).*

For any fastener in the e•drill library, the correct electrode is displayed on the home screen after the fastener has been selected.

Note: For Cherry Max and other blind fasteners whose "nominal" shank size is dimensionally closer to an oversize, use one oversize above the fastener size.

For example:

A 3/16" (-6) nominal alloy steel Cherry Max should be removed with the 1st oversize electrode (0206-X).

A 3/16" (-6X) 1st oversize alloy steel Cherry Max should be removed with the 2nd oversize electrode (0206-Y).

5.2 Electrode Guides:

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Electrode guides are inserted into the Adaptors installed on the e•drill to steady and center the Electrode during the cutting process. Each Guide is sized to a specific electrode size and color coded for easy visual identification.

The same Electrode Guides are used in both the Flush Head Locator (FHL) and Button Head Locator (BHL) systems. Electrode guides are used with their respective Electrode applications as depicted in the chart below.

Electrode Guides

Note: Guides should be regularly inspected for damage or wear. Heavily used Guides should be replaced every 5000 cuts (see Hand held terminal for cut counts). Failure to replace worn guides may increase the potential for airframe damage.

This chart illustrates the Electrode Guide used with each size Electrode.

Electrode Guide and Electrode Usage		
Guide P/N	**Description**	**Electrode P/N**
EDG0103-0	3/32 Electrode Guide, Nominal-Green Body	EDK0203-0
EDG0103-X	5/32 Electrode Guide, 1 Oversize-White Body	EDK0203-X
EDG0104-0	1/8 Electrode Guide, Nominal-Orange Body	EDK0204-0
EDG0104-X	1/8 Electrode Guide, 1 Oversize-White Body	EDK0204-X
EDG0105-0	5/32 Electrode Guide, Nominal-Blue Body	EDK0105-0 / EDK0205-0
EDG0105-X	5/32 Electrode Guide, 1 Oversize-White Body	EDK0105-X / EDK0205-X
EDG0106-0	3/16 Electrode Guide, Nominal-Yellow Body	EDK0106-0 / EDK0206-0
EDG0106-X	3/16 Electrode Guide, 1 Oversize-White Body	EDK0106-X / EDK0206-X
EDG0106-Y	3/16 Electrode Guide, 2 Oversize-Turquoise Body	EDK0106-Y / EDK0206-Y
EDG0108-0	1/4 Electrode Guide, Nominal-Black Body	EDK0108-0 / EDK0208-0
EDG0108-X	1/4 Electrode Guide, 1 Oversize-White Body	EDK0108-X / EDK0208-X
EDG0108-Y	1/4 Electrode Guide, 2 Oversize- Turquoise Body	EDK0108-Y / EDK0208-Y
EDG0110-0	5/16 Electrode Guide, Nominal-Red Body	EDK0110-0 / EDK0210-0
EDG0110-X	5/16 Electrode Guide, 1 Oversize-White Body	EDK0110-X / EDK0210-X
No Guide	Electrode used without a guide installed	EDK0110-Y / EDK0210-Y
No Guide	Electrode used without a guide installed	EDK0112-0 / EDK0212-0
No Guide	Electrode used without a guide installed	EDK0112-X / EDK0212-X
No Guide	Electrode used without a guide installed	EDK0112-Y / EDK0212-Y

Electrode guides are also available in kits; EDG1000 is the complete electrode guide kit for the CG Hand Tool, and EDG1010 is for the EG Hand Tool. Contact the Perfect Point Support Hotline for details.

5.3 Flush Head Locator (FHL) System:

The FHL system is comprised of 4 basic components:

- The Universal Flush Head Locator (FHL).
- An Aperture seal installed in the FHL.
- The Flush Head Adaptor and Electrode guide, installed on the e•drill hand tool.

Flush Head Locating (FHL) System with Locator Base, Adaptor (Guide Installed), and Aperture Seals

5.3.1 Universal Flush Head Locator Base:

The Universal Flush head Locator Base Part Number EDF0120 is a standard size part used across the entire FHL system. The base has a large diameter foot to improve perpendicularity during cutting, and is recessed to accept the selected size Aperture Seal.

For environments such as fairings or wing root situations where the fasteners are close to the edge of a crease, an FHL locator may be modified to fit, as long as the inner-most seal is not violated.

5.3.2 Aperture Seals:

Aperture Seals are installed in the Universal Flush Head Locator and selected to most closely match the OD of the fastener to be removed. The seal contains the DI fluid during the cutting process. Aperture seals come in 5 different sizes depicted in the following chart.

Flush Head Locator Aperture Seals	
EDF0121-ES	Aperture Seal, Extra Small 0. 298 Bore
EDF0121-S	Aperture Seal, Small 0.400 Bore
EDF0121-M	Aperture Seal, Medium 0.450 Bore
EDF0121-L	Aperture Seal, Large 0.575 Bore
EDF0121-B	Aperture Seal, Bombsight

5.3.3 FHL Adaptor and Guide Assembly:

The FHL Adaptor and Guide Assembly is installed on the end of the e•drill for the selected fastener removal application. FHL Adaptors are supplied in both Bayonet and Tri Wing e•drill attachment configurations for EG and CG e•drill use. The table below depicts the Adaptor configuration and Electrode Guide size interchangeability for each specific application.

e•drill Flush Head Adaptor (with black EDG0208-0 Electrode Guide installed)

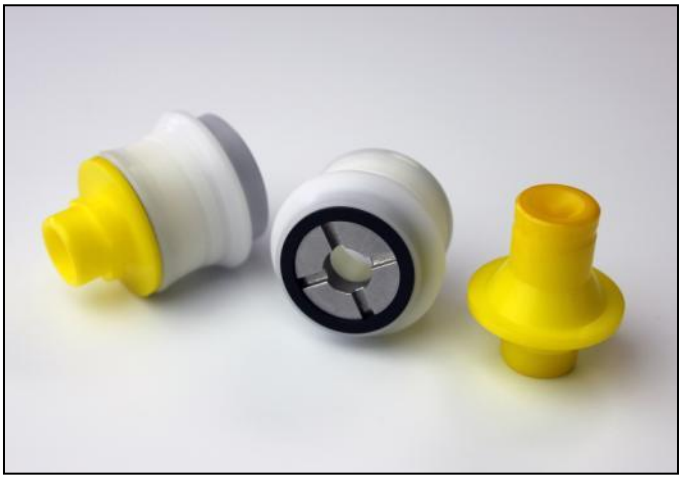
The table below illustrates the FHL Adaptor (both Bayonet and Tri Wing) and Guide interchangeability.

Electrode Size	Dash Sizes	e•drill Bayonet FHL Adaptor	e•drill Tri Wing FHL Adaptor	Installed Electrode Guide
3/32 Nominal	-03	EDF0112	EDF0125	EDG0103-0 Green Guide
3/32 1st Oversize (X)	-03	EDF0112	EDF0125	EDG0103-X WHITE Guide
1/8 Nominal	-04	EDF0112	EDF0125	EDG0104 Orange Guide
1/8 1st Oversize (X)	-04	EDF0112	EDF0125	EDG0104-X WHITE Guide
5/32 Nominal	-05	EDF0112	EDF0125	EDG0105-0 BLUE Guide
5/32 1st Oversize (X)	-05	EDF0112	EDF0125	EDG0105-X WHITE Guide
3/16 Nominal	-06	EDF0112	EDF0125	EDG0106-0 YELLOW Guide
3/16 1st Oversize (X)	-06	EDF0112	EDF0125	EDG0106-X WHITE Guide
3/16 2nd Oversize (Y)	-06	EDF0112	EDF0125	EDG0106-Y TURQUOISE Guide
1/4 Nominal	-08	EDF0112	EDF0125	EDG1008-0 BLACK Guide
1/4 1st Oversize (X)	-08	EDF0112	EDF0125	EDG0108-X WHITE Guide
1/4 2nd Oversize (Y)	-08	EDF0112	EDF0125	EDG0108-Y TURQUOISE Guide
5/16 Nominal	-10	EDF0112	EDF0125	EDG010-0 RED Guide
5/16 1st Oversize (X)	-10	EDF0112	EDF0125	EDG010-XWHITE Guide
5/16 2nd Oversize (Y)	-10	EDF0112	EDF0125	No Guide Required at this size
3/8 Nominal	-12	EDF0112	EDF0125	No Guide Required at this size
3/8 1st Oversize (X)	-12	EDF0112	EDF0125	No Guide Required at this size
3/8 2nd Oversize (Y)	-12	EDF0112	EDF0125	No Guide Required at this size

5.4 Button Head Locating System:

The BHL system is comprised of 3 basic components, the Button Head Locator, the e•drill Adaptor Assembly, including the required Electrode Guide.

- The BHL Locator is placed over the Button Head fastener on the work surface.
- The Button Head Adaptor is affixed to the nose of the e•drill hand tool.



Button Head Locating (BHL) System, shown assembled and disassembled with Button Head Locators and Adaptors (with yellow EDG0206-0 Electrode Guide Installed)

5.4.1 Newer Style Fixed diameter Button Head Locator (BHL assembly:

The Button Head Locator comprises a white plastic housing, metal insert, and three o-rings for sealing. The BHL assembly is available in two different sizes; EDB 0033 for fastener heads up to 0.5” (12.7 mm), and EDB0034 for fastener heads larger than that.

Button Head Locator Assembly, with fastener-specific inserts

The metal inserts are removable and each is intended to be pre-drilled to suit a specific fastener head diameter. The inserts may be supplied pre-drilled to a specific size upon request, or the customer may purchase piloted blanks either individually or pre-assembled, which they can drill themselves per their requirements. The blank order numbers for smaller fasteners are EDB0033-000 (complete BHL assembly) and EDB0013-000 (Insert only), and for large fasteners are EDB0034-000 and EDB0014-000. Hexagonal inserts are also available for specific hex-head blind fasteners, and removal of seized nuts and bolts.

The outside diameter of BHL assemblies is optimized to fit between fastener heads spaced per industry standard (typically greater than 4 to1, spacing to diameter), while maximizing the footprint to enhance perpendicularity. For fasteners which are located in tight areas (such as close to ribs or stringers), or are more tightly spaced than conventionally (engine applications), a family of “slimline” BHL’s is available. Please contact your distributor or the PPEDM hotline (714.891.6533) for more information.

Slimline and extended locator/adapters

5.4.2 Older style Button Head Locator (BHL) Assembly:

The Older Style Button Head Locator (BHL) uses a set of “fingers” to “snap” over the fastener button head thus locating the fastener center. The older style design caters for a range of fastener sizes per locator, but is less precise in concentricity. Each locator covers a 0.050” range of fastener head diameters with 2 Locators within the same color covering a 0.100 fastener head diameter range. The user will need to select and purchase the individual BHL needed for the specific fasteners being removed or BHL Kits that cover a range of fastener sizes may be procured

Two Sizes of older style Button Head Locators

For ease of quick visual identification, rings are machined into the body of each Locator within the same color range to indicate first and second size. One ring identifies the smaller size, 2 rings the larger size within the color

range. The following chart depicts the rings and sizes. See Section 2.5 of this User Guide for instructions on using the BHL system.

Button Heal Locator Assemblies		
Part Number	**Description**	**Ring ID.**
EDB0313-150	BHL Assembly-0.150 in to 0.200 in-Green Body	1 Ring
EDB0313-200	BHL Assembly-0.200 in to 0.250 in-Blue Body	1 Ring
EDB0313-250	BHL Assembly-0.250 in to 0.300 in-Blue Body	2 Rings
EDB0313-300	BHL Assembly-0.300 in to 0.350 in-Yellow Body	1 Ring
EDB0313-350	BHL Assembly-0.350 in to 0.400 in-Yellow Body	2 Rings
EDB0313-400	BHL Assembly-0.400 in to 0.450 in-Black Body	1 Ring
EDB0313-450	BHL Assembly-0.450 in to 0.500 in- Black Body	2 Rings
EDB0313-500	BHL Assembly-0.500 in to 0.550 in- Red Body	1 Ring
EDB0313-550	BHL Assembly-0.550 in to 0.600 in-Red Body	2 Rings
EDB0313-600	BHL Assembly-0.600 in to 0.650 in-Gray Body	1 Ring
EDB0313-650	BHL Assembly-0.650 in to 0.700 in-Gray Body	2 Rings

5.4.3 BHL Adaptor and Guide Assembly:

The BHL Adaptor and Guide Assembly is installed on the end of the e•drill for the selected fastener removal application. BHL Adaptors are supplied in both Bayonet and Tri Wing e•drill attachment configurations for EG and CG e•drill use. The table below depicts the Adaptor configuration and Electrode Guide size interchangeability for each specific application.

Button Head Adaptor Assembly with Electrode Guide Installed

Electrode Size	"Dash" Sizes	BHL Bayonet Adaptor	BHL Tri Wing Adaptor	Installed Electrode Guide
3/32 Nominal	-3	EDB0213	EDB0223	EDG0103-0 GREEN Guide
3/32 1st Oversize (X)	-3	EDB0213	EDB0223	EDG0103-X WHITE Guide
1/8 Nominal	-4	EDB0213	EDB0223	EDG0104-0 ORANGE Guide
1/8 1st Oversize (X)	-4	EDB0213	EDB0223	EDG0104-X WHITE Guide
5/32 Nominal	-05	EDB0213	EDB0223	EDG0105-0 BLUE Guide
5/32 1st Oversize (X)	-05	EDB0213	EDB0223	EDG0105-X WHITE Guide
3/16 Nominal	-06	EDB0213	EDB0223	EDG0106-0 YELLOW Guide
3/16 1st Oversize (X)	-06	EDB0213	EDB0223	EDG0106-X WHITE Guide
3/16 2nd Oversize (Y)	-06	EDB0213	EDB0223	EDG0106-Y TURQUOISE Guide
1/4 Nominal	-08	EDB0213	EDB0223	EDG1008-0 BLACK Guide
1/4 1st Oversize (X)	-08	EDB0213	EDB0223	EDG0108-X WHITE Guide
1/4 2nd Oversize (Y)	-08	EDB0213	EDB0223	EDG0108-Y TURQUOISE Guide
5/16 Nominal	-10	EDB0213	EDB0223	EDG010-0 RED Guide
5/16 1st Oversize (X)	-10	EDB0213	EDB0223	EDG010-XWHITE Guide
5/16 2nd Oversize (Y)	-10	EDB0213	EDB0223	No Guide Required at this size
3/8 Nominal	-12	EDB0213	EDB0223	No Guide Required at this size
3/8 1st Oversize (X)	-12	EDB0213	EDB0223	No Guide Required at this size
3/8 2nd Oversize (Y)	-12	EDB0213	EDB0223	No Guide Required at this size

Note: See Section 1.4 Guide Extraction for Guide replacement instructions.

5.5 Vacuum Flush Head Locator System:

The VFHL System is specifically developed for removing flush head fasteners from composite structure where cut accuracy is more critical than standard applications. The VFHL system is the only tool recommended for use to remove flush fasteners from composite structures.

The VFHL System is a completely self contained system that operates on standard 100 to 150 psi regulated shop air pressure. The system comes with a 3 suction cup Locator and special set of VFHL e•drill Adaptors and Locators that uses standard Electrode Guides for centering the Electrodes.

The Vacuum Flush Head Locator will operate on both convex and concave curved surfaces down to a radius of approximately 4 ft, and on fasteners greater than 2" from the edge of a panel. In situations with radius less than that (wing leading edge or lip seal leading edge as examples) or where fasteners are located on the edge of a panel, an alternative means of location might be more suitable.

5.6 Accessories - S-Blaster, Punches, Drill stands and Holsters, Toolboxes etc.

Perfect Point is continually adding accessories to the E-Drill product line, based on customer feedback. Please visit the PPEDM web site (www.ppedm.com) or ask your E-Drill representative for the current list of available accessories.

5.7 Custom adaptors and tooling

Custom made and specialty tools are also available from Perfect Point EDM Inc. for difficult, hard to reach fastener locations, fastener specific kits, pilot drilling or seized bolt removal. Contact the Customer Service number at (714-891-6533) for details about special or custom designed tooling.

APPENDIX 3. e•drill Quick Reference Guide:

Perfect Point™

15192 Triton Lane
Huntington Beach, CA 92649
Tel: 206-888-6251
www.ppedm.com

e•drill™ QUICK START & MAINTENANCE GUIDE

Document No.	61-101-A	Revision:	1	Date:	10/2/2014

INTRODUCTION:

The purpose of this quick-start guide is to assist the operator in setting up and operating the **e•drill** system in as little time as possible. Refer to User Guide for detailed programming and operation information. IMPORTANT!! Be sure ALL Installation procedures have been completed before operating the system.

⚠ **Prior to system use, is highly recommended the user be trained by PPedm in system use, service, and has read the operators manual completely.**

POWERING UP THE SYSTEM:

1. With the **e•drill** and Hand Held Terminal installed, and power connected to the Mobile Service Unit (MSU), locate the power switch on the back service panel of the MSU and turn it to the "ON" (up) position.
2. The system will power up and after a few seconds the Hand Held Terminal touch screen will illuminate and display the last fastener entry.

SELECTION OF PARAMETERS TO PERFORM A CUT:

1. Determine the type of fastener you are about to cut. If the screen of the Hand Held Terminal is not illuminated, touch the screen to awaken it. Go to bottom right tabs on screen and select visual or select by part number and from that selection in the next screen Input in the fastener part number or visual parameters.
2. Install the proper electrode into the **e•drill**. i.e. Brass or Copper and proper electrode O.D. (5/32",3/16" or -6.-8 etc.) and the correct adaptor for the fastener type to be removed.

REPLACING AND SETTING THE ELECTRODE:

Electrode replacement is necessary when either:

A) The current electrode is consumed and should be replaced when indicated by a flashing green light on the hand-tool and a message on the Hand Held Terminal, or

B) When changing to a different fastener with different stem diameter or oversize type.

⚠ **EACH FASTENER SIZE AND DIAMETER, AND OVERSIZE FASTENER HAS A MATCHING ELECTRODE SIZE. WHEN CHANGING TO A DIFFERENT STEM DIAMETER OR OVERSIZE TYPE FASTENER, THE PROPER CORRESPONDING ELECTRODE MUST BE INSTALLED FOR SUCCESSFUL SYSTEM OPERATION.**

1. Unlock the installed Adapter Tip by gripping and twisting it counter-clockwise (when viewed from the front of the e drill). Then pull the Adapter tip straight out.
2. Unthread the existing Electrode using the Torque-Ring Wrench by inserting it over the Electrode until it engages the Electrode detents. Remove the Electrode by turning it counter-clockwise. It may be necessary to advance the electrode: in which case, with system power on, advance the installed electrode completely forward by depressing gun trigger until the Electrode advances fully. When you have reached the forward limit the LED at the top of the **e•drill** will illuminate Red and the **e•drill** mechanism will stop automatically. If the electrode wont advance, and the system is indicating that the electrode should be replaced, press the green retract button briefly before attempting to advance the electrode.
3. Hand-thread the replacement Electrode onto the **e•drill**. Install the Torque-Ring Wrench by slipping it over the Electrode until it engages the Electrode detents. Tighten the replacement Electrode with the Torque -Ring until it "breaks" (or skips) when the required torque is reached. Remove the Torque-Ring and replace the required Adapter Tip over the Electrode.
4. Retract the Electrode by pressing and holding down the green retract button in the base of the e drill grip until the LED in the back of the **e•drill** handle illuminates Green indicating the Electrode is fully retracted.

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MAINTENANCE REQUIREMENTS:

Periodic maintenance is required to keep this system operating properly, most critical of which is gun maintenance, described below. System maintenance is controlled by internal firmware cut cycle counters that shut down the system for maintenance once a maintenance cycle is reached. Once the predetermined cut cycles are reached operator intervention is required to perform maintenance and reset the counters.

Gun Maintenance:

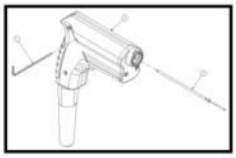
BG/CG GUNS ONLY: Properly setting and maintaining the Ground Pin is critical to proper e•drill operation. Failure to properly set and maintain the Ground Pin will cause poor e•drill performance and cutting results, and will potentially damage the system.

BG/CG GUNS ONLY: DAILY the condition of the end of the Ground Pin and its protrusion should be checked with the Ground Pin Setting Tool (P/N EDT0102) provided with the system. The ground pin is extremely fragile and an electrode should be attached at all times to protect the ground pin. The ground pin should not be bent and should be central inside the electrode, and it should still have its protective plastic sleeve intact. Adjust as necessary and dress with the abrasive pad located on the setting tool if the tip is fouled. Consult the User's Guide for further details.

ALL GUNS: Check Cable, Strain Relief and Case for damage. Check for water leaks out of Case. Check Electrode is tight. When cutting **steel** fasteners: At the end of a work session the tip of the gun should be dried, and if it has been used on a highly corrosive fastener material such as alloy steel, then the inside of the tip area should be lightly sprayed with a lubricant such as WD40.

Ground Pin Replacement:

BG/CG GUNS ONLY: If the ground pin is maintained as above, and fastener heads are cleaned before attempting to cut, ground pin replacement is only necessary after several thousand cut operations.



Refer to the User Guide - Ground Pin Replacement section for detailed instruction on replacing the Ground Pin.

System Maintenance Screen:

System maintenance functions are accessed through the System Maintenance Screen. Touching an LED button will turn the button green (on) and activating the function. Retouching the button will turn the function off and the button back to red (off). The **Tank Full** and **Tank Empty** LED's display system water level status in the Sediment Tank and turn on and off automatically as the system is serviced.

DI water system maintenance:

The DI water system requires periodic filling or "Top Off" to replace small amounts of DI water used in the cutting cycle. The system will indicate when that is necessary. To "Top Off", Immerse the tip of the e•drill™ (do not submerge the entire drill, only the Adapter Tip should be submerged).Touch the **Top Off** function. At the completion of the Top Off cycle the Tank Full LED button will illuminate green when the system is full and the pump will turn off automatically.

The system will also indicate when the sediment tank should be emptied or the filter replaced. Consult the Users Guide for the relevant procedures.

For additional support assistance call the Customer Service Line at: (714) 891-6533.

Note: This Quick Reference Guide is provided as a laminated sheet with the system documentation packet for ease of start up. This guide does not replace the requirement to completely review the User Guide.

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APPENDIX 4. Standard Packing List:

Mobile Service Unit module

Power Cord – 25’

Operator Hand Held Control Terminal with 10’ integral cord

Standard Fastener Removal Firmware

e•drill and 10’ integral umbilical cable (may be CG or EG configuration)

,

e•drill Adaptor Kit (CG or EG)

Starter pack of 30 electrodes

Document Kit:

- Packing List
- User Guide
- Quick Start Guide
- Product Change Request Form (PCR)
- Product Brochures

Service Kit:

- Service Kit /Water Container
- Fill/Drain Tube, Joined Clear
- Canister Wrench, Sediment and Filter Bowl
- Ground Pin Hex Wrench
- Filter Bracket Hex Wrench

APPENDIX 5. Trouble-Shooting Guide

This section of the User Guide lists common maintenance issues encountered and their solutions. It is recommended the following basic steps be accomplished before proceeding to a higher level of trouble shooting.

To avoid problems critical maintenance items which should be checked before each shift:

- Check for free movement of gun motion over full stroke.
- Tighten electrode using Electrode Torque Wrench.
- For Center Ground hand-tool check Ground Pin for proper protrusion, insulation and straightness. (Does not apply to EG Hand-tool.)
- For External Ground hand-tool check the Ground clamp and bullet connector condition.

In the event these basic steps do not remedy the issue, review the Troubleshooting Guide for helpful maintenance remedies.

If a solution cannot be found in this Trouble-Shooting Guide, do not hesitate to contact the Customer Service Hotline Phone at 714-891-6533. This number is located in 4 places on the system for ease of access.

1. Back-side of the Hand Held Terminal.
2. Mobile Service Unit directly above the system power switch.
3. The “Information” page of the “Maintenance” screen in the Hand Held Terminal software.
4. Printed in the header of this User Guide.

Mobile Service Unit General Fault		
Trouble	**Probable Cause**	**Remedy**
No activity, no display, cooling fans not working.	No input power.	Check power connection and voltage. Check power switch is in on position. Check facility circuit breakers.
System displays **Low Dielectric Level** error.	Dielectric water is below minimum level.	Top-up dielectric level as described in Section 3.4.
Initial **top up** routine ends prematurely. Pressing the button again causes more top up, as if previous top up ended prematurely.	Normal behavior. Since the top-up routine is vacuum driven, when the vacuum stops the level drops slightly below its previous height during filling. Level is ok after the initial automatic stop.	
Vacuum Pump does not run during cutting.	Supply voltage too low. Pump damaged by flooding.	Check facility power output. MSU requires service (see System Overflow entry on following page). Immediately contact PPedm for system service.
Mobile Service Unit makes loud screeching noise.	Air entrapped in the Mobile Service Unit Pressure Regulator.	Bleed DI system (See Ch. 3 System Maintenance, Section 3.7 System Bleeding and Charging)
System overflows during Top Off routine causing water puddle under the MSU.	System Sediment Tank Top Water Level sensor is jammed.	Immediately call the PPedm Customer Service Hotline for assistance.

e•drill General Fault		
Trouble	**Probable Cause**	**Remedy**
No cutting occurs, vacuum pump does not start.	Electrode needs replacement. Green light on hand-tool is flashing.	Replace electrode (see Section 2.1).
	System error. Flashing red light on hand-tool.	Observe error displayed on control terminal. Check water level. Contact the PPedm Customer Service Hotline for support.
	Hand-tool not connected to utility cabinet.	Recheck hand-tool connection on rear of cart. Ensure locking bezel is fully rotated.
No cutting occurs, vacuum pump starts but pressure pump does not start.	Fastener surface is not conductive.	Check that nose of hand-tool is placed over fastener, and all paint or sealant has been removed from fastener surface.
	CG Hand Tool will not cut.	Ground pin incorrectly adjusted or damaged.
	EG Hand Tool will not cut	Check for bad or loose ground clamp connection.
Cutting occurs but system shows red warning LED at end of cut.	Hand-tool trigger was released prematurely.	Re-cut fastener ensuring to hold down trigger until system finishes cutting.
	Cutting process ended prematurely.	Check library setting for correct fastener type. Make an additional cut by squeezing trigger a second time while still in-place over fastener. The system will likely repeat the same error since less cutting was required in the second cycle.

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e•drill General Fault		
Trouble	**Probable Cause**	**Remedy**
Cutting not to depth. Water leaking around tip.	Hand-tool not firmly and consistently held in contact with fastener and airframe surface throughout cut.	Press hand-tool firmly over fastener and maintaining pressure until cut is complete.
Cycle time excessively long. Cutting too deep.	Hand-tool is not held stable during cut. Electrode is not tight.	Hold hand-tool in a fixed position during cutting. Tighten electrode.
Cut slower than expected.	Electrode is not tight. Ground Pin protrusion not sufficient, restricting water flow and/or causing bad ground connection. Air in system. Wrong fastener selected. Wrong electrode type. Adaptor is not installed correctly.	Check electrode tightness with electrode torque wrench. Adjust Ground Pin protrusion with Ground Pin Setting Tool. Bleed DI system. Check fastener settings. Check electrode material application. User lifted or moved e•drill during cut sequence.
Water sprays excessively out of hand-tool. Hand-tool cannot be held easily against work surface	Dielectric vacuum and water connections incorrect.	Check water tube connections. Tube connections at back of utility cabinet should not be crossed.
No cutting occurs. No water evident. Burning smell around electrode	Wrong Adaptor in use for the fastener being removed resulting in the ground pin not being depressed sufficiently – typically a button-head tip is being used for a flush head fastener. Incorrectly adjusted or damaged Ground Pin.	Select the correct tip adaptor configuration for the fastener. If the wrong tip is used then the depression of the ground pin will not be sufficient for water flow, causing overheating and damage to the equipment.

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e•drill General Fault		
Trouble	**Probable Cause**	**Remedy**
e•drill stops within a second of starting, and does not go to cut depth.	Ground Pin protrusion significantly out of adjustment or worn beyond its life. Paint, corrosion, or sealant on fastener head.	Adjust Ground Pin protrusion with Ground Pin Setting Tool. Clean fastener head for proper grounding. Cutting a depressed center fastener (such as a Torx or Phillips head) without specially adjusting the Ground Pin protrusion to match the fastener depth.
Electrode advances to limit and Hand Tool emits a constant buzzing noise.	e•drill Trigger is stuck in the on position.	Power off system. Check operation of trigger, clean surrounding area to attempt to free the trigger assembly. Trigger should “click” when depressed. Contact PPedm Customer Service Hotline if the problem persists.
Cutting is intermittent and cutting time is longer than usual.	Electrode has come loose in e•drill.	Remove adaptor, drive electrode forward using the trigger and re-tighten with the electrode torque tool.
Water leaking from e•drill retract button or ground pin adjusting holes.	e•drill seal failure	Call the PPedm Customer Service Hotline and obtain an RMA and return e•drill to PPedm for service.
Vacuum pump does not stop operating after 3 seconds of trigger release. e•drill “buzzing” and does not stop automatically at the end of stroke.	Water inside of e•drill.	Call the PPedm Customer Service Hotline and obtain an RMA and return e•drill to PPedm for service.

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e•drill General Fault		
Trouble	**Probable Cause**	**Remedy**
Fastener does not punch out.	Wrong fastener settings. Wrong electrode type. Insufficient cut depth programmed in HHT library. Oversize fastener. User lifted gun during cut sequence.	Check all settings in the HHT. Check electrode application against fastener application. Check fastener size. If problem persists, contact PPedm Customer Service Hotline for assistance.

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APPENDIX 6. e•drill Quiz

1. How do you know when the electrode is worn out?

2. How do you know when the system needs more water?

3. If you want to change from one type of button-head fastener to another of the same stem size, what do you need to do?

4. How do you know if the fastener head is not cleaned enough?

5. Where in the menu system can you find out how many fasteners have been cut?

6. Why is it unwise to use e•drill on “buck-tails” of solid rivets?

7. Which fastener material requires brass electrodes (edk01**)?

8. When you have emptied the sediment tank, or replaced the filter, how can you tell if the o-ring seals are good?

9. What is the package color for -6 electrodes?

10. Do you always have to use the umbilical extension and the terminal extension cables?

11. How do you retract a new electrode into the gun after loading?

12. How does keeping your finger on the trigger after cutting is finished help?

13. How do you advance a partially used electrode when you need to replace it by a different size?

14. What information does the terminal display during normal operation?

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15. What color tube connects the vacuum (return) water line at the back of the service module on the gun connector?

16. When selecting a new fastener type from the library using the Visual Selector, what five things are you asked?

17. There are six keys to minimizing airframe damage from the e•drill. Name four?

18. What part of the e•drill gun should you regularly check for adjustment and damage (CG only)?

19. What is the white device called which you use to align the e•drill on a flush fastener?

20. There are four locations on an e•drill system where the customer service hotline number can be found, name two of those locations?