



Safe Ignition System for 2-7/8" and Larger TAG/HSC/ Setting Tool Equipment

ADP-PX28-102

MAN-PX1-009 (R01)

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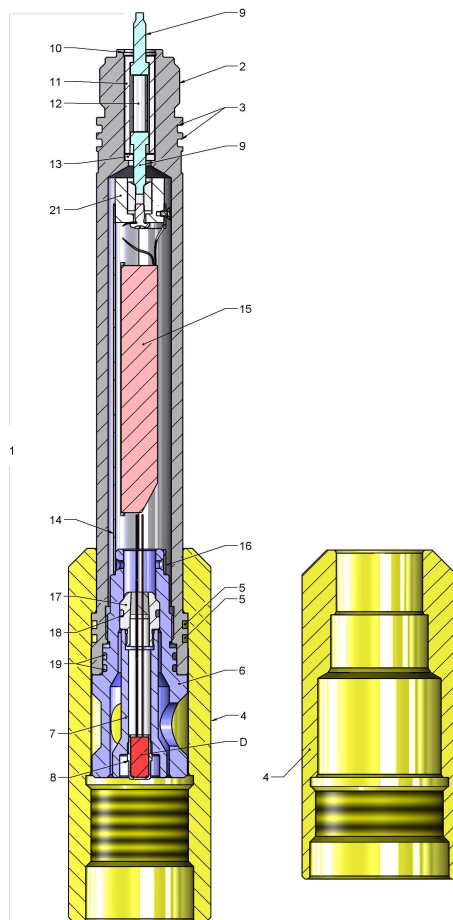
BOM and Schematic

Introduction

The ADP-PX28-102, Safe Fire PX-1 Initiation System utilize Exploding Bridgewire Technology to increase safety during firing operation.

Incorporation of the EBW into the Firing Systems adds increased safety against rig-site hazards such as RF transmitters, cathodic protection, and stray voltages. The PX-1 Fireset allows normal oil field operation to continue while perforating and other completion services are being performed.

All safety rules and regulations should be strictly followed when storing, handing, assembling, and using these tools and/or detonators. Safety precautions should be taken in accordance with your company's safety policies, governmental regulations, and the American Petroleum Institute Recommended Practice 67 (API RP-67).



Item	Part No.	Description
1	ADP-PX28-102	Assembly, TAG/HSC/SETTING TOOL, PX-1 Firing System
2	ADP-2875-600	Body, 1-5/8 - 6 Acme Thread
3	OOO-V569-222	O-Ring, 2 Required
4	ADP-2875-221	Sleeve, 2.88 Dia.
	ADP-3130-221	Sleeve, 3.13 Dia.
5	OOO-V569-223	O-Ring, 2 Required
6	ADP-2875-220	Firing Sub
7	ADP-PX16-116	Detonator Retainer
8	ADP-PX28-SQ80	Detonator Holder
9	AES-1-0033	Contact Pin, 2 Required
10	PUR-5000-062	Retaining Ring
11	ADP-1437-076	Insulator
12	SPG-0362-042	Spring - 1.63" Long
13	ADP-1437-077	Insulator Washer
14	SEV-1375-250	PX-1 Carriage
15	PUR-0610-007	PX-1 Fireset
16	PF-031-019F-038	Flat Head Screw, 2 Required
	PUR-0611-001	Connector, Spade, .25", 1 Required
17	ADP-PX16-120	Detonator Seal Nut
18	OOO-V569-114	O-Ring
19	OOO-V569-125	O-Ring, 2 Required
20	TAG-2875-078	2.88 Bull Plug for Safety Plug
	TAG-3125-162	3.13 Bull Plug for Safety Plug
21	ADP-PX16-107	Contact Assembly
D	EBW-RISI-800	EBW - RDX Detonator
	EBW-PSCI-401	EBW - CP Detonator
	EBW-RISI-SQ80	EBW - Ignitor
	ADP-PX28-112	Redress Kit, includes items: 3, 5, 7, 8, 14, 15, 16, 17, 18, and 19

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1.0 Pre-Assembly



Warning: *Explosives are destructive by nature! Do not attempt to disassemble or alter explosive products in any manner! Do not crush, hammer, pinch, impact, pull wires or abuse any explosive product!*



Warning: *Be sure to follow safe operating practices as found in API RP-67 in accordance with governmental regulations, company policies and manufacturer's recommendations!*



Note: *Before assembly, visually inspect all components for any defects.*

2.0 PX-1 Firing System - Assembly Procedures

2.1 Install O-ring on all appropriate components prior to assembly.

2.2 Screw DETONATOR SEAL NUT (17) into DETONATOR RETAINER (7) as shown in figure 1.

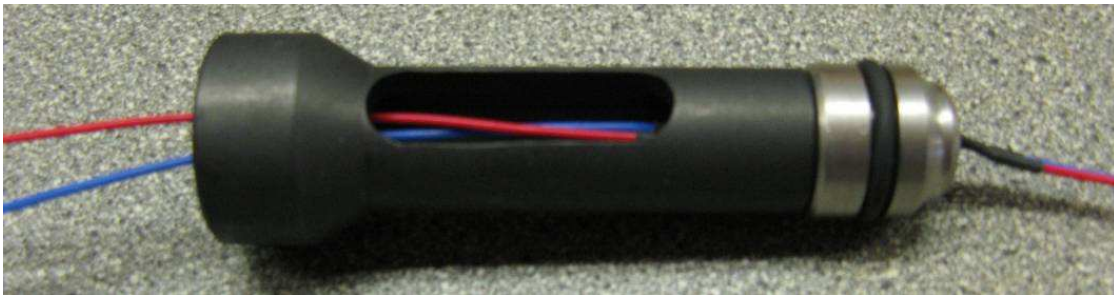


Figure 1

2.3 Insert DETONATOR RETAINER (7) with DETONATOR SEAL NUT (17) into FIRING SUB (6) from lower end of FIRING SUB (6). Align the DETONATOR RETAINER (7) slot with one of the side ports of the FIRING SUB (6) AS PER FIGURE 2.

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2.4 To help overcome the o-ring resistance, feed the DETONATOR SEAL NUT (17) lower wires out through the side port as shown in figure 3.

2.5 The FIRING SUB (6) can be stood upright and downward pressure can be exerted on the FIRING SUB (6) TO COMPLETE THE detonator retainer (7) installation. The FIRING SUB (6) and DETONATOR RETAINER (7) ends should be flush to each other.



Figure 2

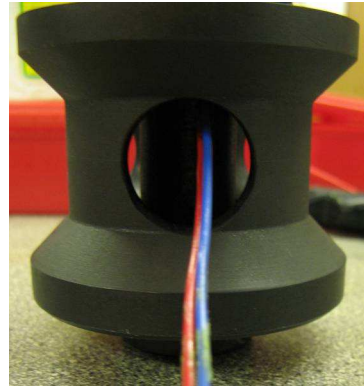


Figure 3

2.6 Install the PX-1 CARRIAGE (14) onto the FIRING SUB (6), taking care when feeding the DETONATOR SEAL NUT (17) upper wires through the lower end of the PX-1 CARRIAGE (14).

2.7 Secure the PX-1 CARRIAGE (14) to the FIRING SUB (6) using the 2 x FLATHEAD SCREWS (16) with no washers. See figure 4.

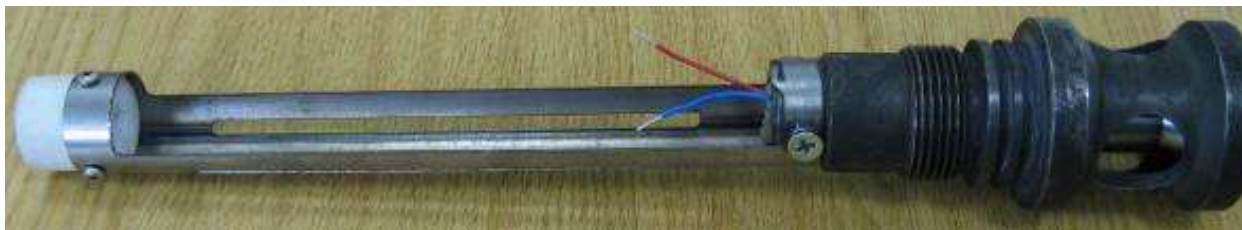


Figure 4

2.8 Mount the PX-1 FIRESET (15) into the PX-1 CARRIAGE (14). See figure 5.

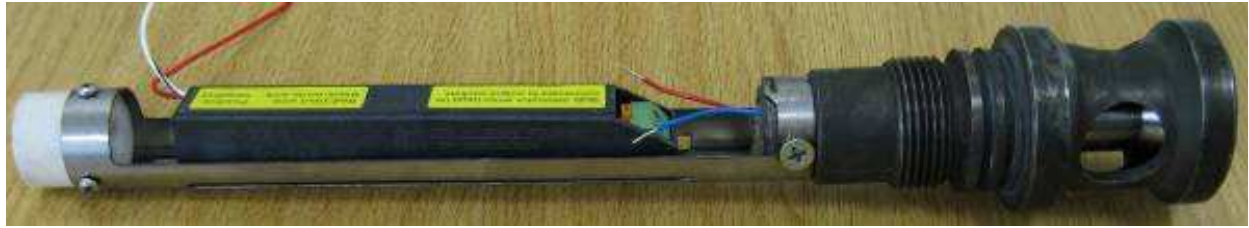


Figure 5

2.9 For Negative Firing. See figures 6a, 6b & 6c.

- A. Cut the PX-1 FIRESET (15) GND Wire (black/white) to approximately 2".
- B. Bare wire and install ring crimp.
- C. Install ring crimp under upper contact screw.
- D. Cut the PX-1 FIRESET (15) +ve Wire (red) to approximately 6".
- E. Bare wire and install crimp.
- F. Install crimp spade onto PX-1 CARRIAGE (14) crimp mount.



Figure 6



Figure 6b

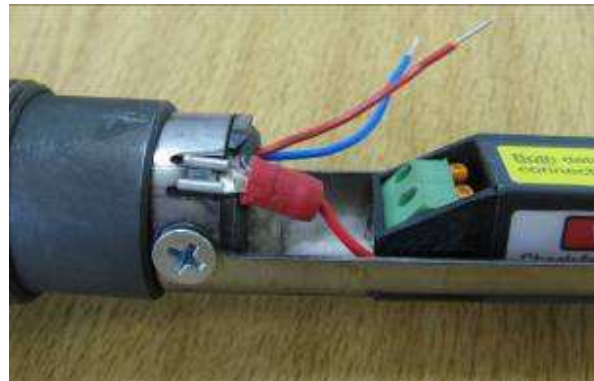


Figure 6c

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2.10 Apply High Temperature Tape to the wiring at both ends of the PX-1 FIRESET (15) to prevent damage during remaining build.

2.11 Cut the leads of the SEAL NUT (17) upper end wires to a length of 3 inches. See figure 5.

2.12 Bare back insulation of each wire by approximately 0.5". See figure 7.

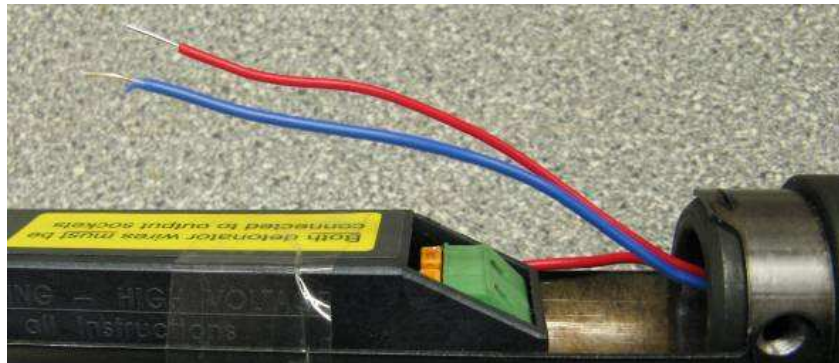


Figure 7.

2.13 Insert wires into lower end of PX-1 FIRESET (15). Each lead wire from the SEAL NUT must be inserted in a PX-1 socket: it is not permitted to connect either wire directly to ground. See figure 8.

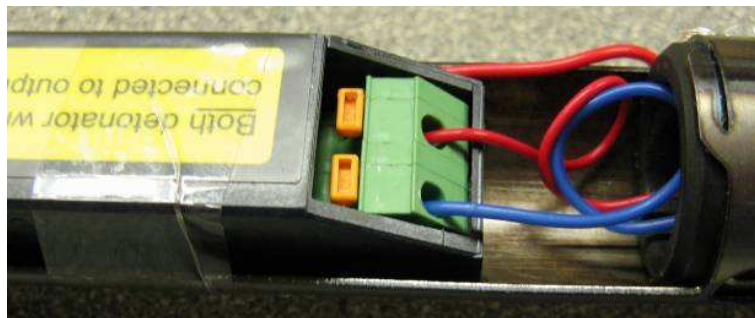


Figure 8

2.14 Inspect and apply grease to O-Rings (19) on the firing SUB (6).

2.15 Assembly is now ready to insert into the main BODY (2)...



Figure 9

2.16 Inspect and apply grease to O-Rings (5) on the BODY.

2.17 It is recommended to place DETONATOR/IGNITER into a DETONATOR SAFETY CHAMBER when making wiring connections. See figure 10

2.18 Install the INITIATOR (D) wires into the DETONATOR RETAINER (7) as positioned in the FIRING SUB (6).



Figure10

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2.19 Feed the INITATOR (D) wires out through the same side port as the DETONATOR SEAL NUT (17) wires as per figure 11.

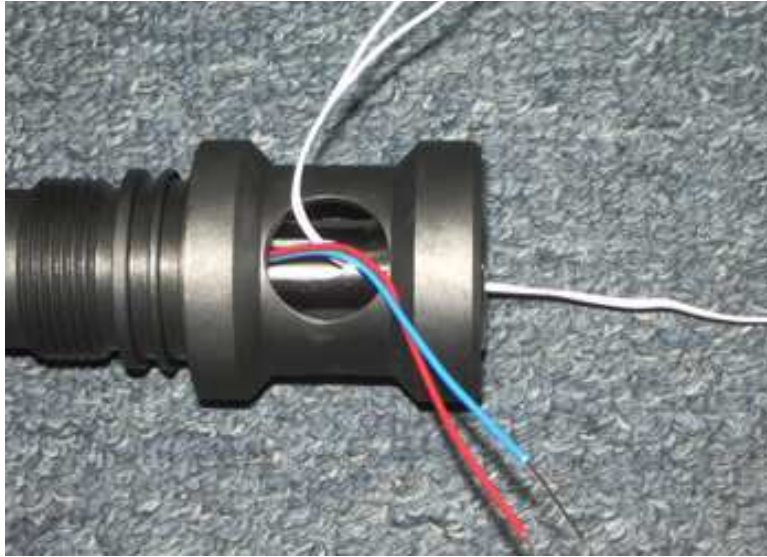


Figure 11

2.20 Cut all wires exiting the side port to approximately 3" in length. Detonator wires will be longer since in Safety Chamber.

2.21 Remove approximately 0.75" of insulation from each of the 4 wires.



Figure 12

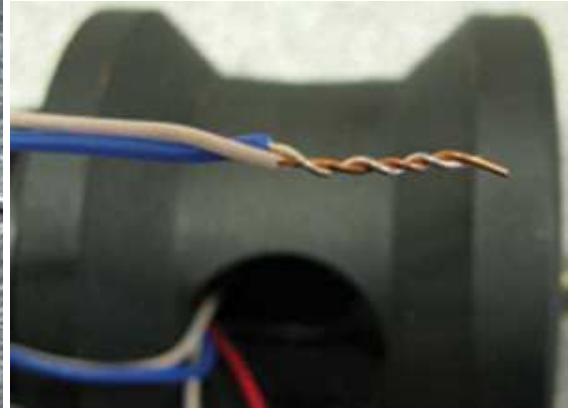


Figure 13

2.22 Twist together one INITATOR (D) wire to one DETONATOR SEAL NUT (17) wire as per figure 12. Ensure wires are tightly wound together, see figure 13.

2.23 Install rubber sleeve over each twisted pair of wires as per figure 14.



Figure 14

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2.24 Wrap twisted pairs in opposite directions around the FIRING SUB (6) using High Temperature tape as per figure 15.



Figure 15

2.25 Hold ignitor and Detonator in place with ADP-PX28-SQ80 DETONATOR HOLDER (8).

2.26 Install SLEEVE (4) either 2-7/8 or 3-1/8, depending on size needed.



Figure 16

2.27 Inspect and apply grease to O-Rings (3) on the BODY (2).

2.28 Thread a 2-7/8 or 3-1/8" TAG BULL PLUG into the bottom connection to use as a safety plug when connecting to wireline toolstring. See figure 16.

2.29 After connecting to toolstring, remove safety plug and Mechanically connect the Gun System (not shown) to the PX-1 Firing System.

2.30 Follow the standard running procedure for the Gun System you are using.

3.0 PX-1 Firing Instructions



Warning: *The PX-1 generates a high-voltage, high-current pulse that could be dangerous to personnel if the device is misused! Use caution at all times when handling the PX-1, and always use an approved meter to verify that no voltage is present on the output before attaching a detonator. NEVER attach a detonator to the PX-1 without first verifying that any attached power supplies are disabled!*



Caution: *These instructions only describe how to use the PX-1! They do not replace or override any of the operator's normal safety requirements and procedures! It is the operator's responsibility to ensure that all explosives and associated devices are handled in a safe manner!*



Note: *The PX-1 fireset is intended for one-time use to initiate EBW or EFI detonators. All firesets are test-fired by Ecosse before shipment, and to avoid misruns further test-firing prior to use is not permitted.*



Note: *PX-1 firesets are now packed in a clear plastic tube with a tamper-evident seal on the cap. The words "Ecosse Inc" are printed in blue on the seal. If these words are missing or the seal has been cut, it should be assumed that the PX-1 has already been fired, and that the fireset should not be used for critical applications.*

3.1 When ready to fire the detonator, slowly increase the applied voltage (positive DC to the red wire, negative DC to the black/white wire). At 200-230VDC cablehead voltage the PX-1 will switch on and draw current (160-260mA). Continue increasing the voltage quickly until the PX-1 fires, which should be almost immediately, then power down. Note that at downhole temperatures the PX-1 requires up to 30V more to switch on and fire than it does on the surface.



Note: *If the power supply being used does not provide a true DC output, see Q1/A1 and Q7/A7 on the other side of this page for power-up characteristics.*

4.0 Frequently Asked Questions

Q1 Is any special equipment required to use the PX-1?

A1 No equipment is required other than a DC power supply to activate the PX-1. However, the power supply needs to supply true DC to power the PX-1 efficiently. Many of the DC supplies used in perforating operations actually deliver unsmoothed full-wave-rectified AC, which is a series of 100-120 voltage "bumps" per second rather than flat DC. Although the PX-1 will work with this input it does so less efficiently, and it will not work above temperatures of about 290-300F with this kind of supply. Also, because of the way most volt meters work it will look as if the PX-1 is switching on at a lower voltage than it actually is (the voltmeter will indicate the average or RMS voltage, while the PX-1 will switch on with the peak voltage). You should be aware that if you are using the above type of unsmoothed power supply with a very short wireline (7000ft or less), it might be necessary to continue increasing the voltage quickly for a few seconds after the PX-1 switches on before it will fire. It is preferable to avoid this situation by using a true DC power supply to fire the PX-1. Filtering can be added to an unsmoothed shooting supply to provide a true DC output. In its simplest form this can be little more than a capacitor (1000-2000uF) and bleed resistors; if required Ecosse can supply a low-cost plug-in box to meet this need. Finally, the CCL and other downhole hardware must be capable of handling the cablehead voltage required by the PX-1 (see A4 below), and all electrical connections and insulation must be clean.

Q2 Can the PX-1 be test-fired prior to use?

A2 No. All PX-1s are test-fired by Ecosse prior to shipping, and further testing is unnecessary. Also, experience has shown that test-firing prior to use is more likely to cause an otherwise-good tool to fail than it is to detect a problem.

Q3 Can the PX-1 be test-fired for demonstration or troubleshooting purposes?



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A3 Yes, although any tools used for this purpose should be expected to fail quite quickly and must not be used afterward on a job. If test-firing is required it should be done into a low-inductance load resistor (solid ceramic type preferred) with a resistance of 100200S, minimum voltage rating of 6kV, and a minimum power rating of 10W; Ecosse can supply a suitable resistor. The general firing method is the same as described overleaf for downhole operation. At about 200-210VDC input voltage the PX-1 will draw current (160-260mA) and start firing rapidly; power down as soon as this happens to avoid overheating and damaging the tool. The power should be ramped down quickly, not toggled off, otherwise damage to the PX-1 might occur. The firing will be indicated by a series of pulsing sounds from the PX-1. Wait 2 minutes after powering down and disconnecting the PX-1 from the power supply, then remove the load resistor.

Q4 Is 260mA @ 210VDC all the surface-supplied power necessary to charge and activate the PX-1?

A4 At a minimum, yes. However, to allow for variations in firesets and a drop in efficiency at higher temperatures you really want a power supply that can provide at least 1A @ 250VDC downhole to give you some margin. At downhole temperatures, the PX-1 requires up to 30V more to switch on and fire than it does on the surface. Also, the coil in most shooting Casing Collar Locators (CCL) drops current to ground when you apply power to the line. With conventional detonators this usually isn't noticeable, as you will normally be applying only about 30V at the cablehead to fire a 55ohm detonator; if the CCL has a coil resistance of 1000ohm, the coil will draw 30mA versus about 500mA going to the detonator. With the PX-1 and a cablehead voltage of 220V, the PX-1 will be drawing maybe 200mA and the CCL coil will be drawing 220mA. So, your power supply has to be able to supply current to the CCL coil as well, and the engineer has to be aware that even although the PX-1 won't power up until the cablehead voltage is about 220V, the CCL will be drawing current immediately. Adding it all up, a power supply that can generate 750-1000mA @ 250VDC at the cablehead would be suitable for use with the PX-1. Depending on the type of wireline used and the CCL coil resistance, the voltage required at the surface from the power supply might be as high as 350-400VDC.

Q5 How is the PX-1 connected in the gun?

A5 There are two input wires to the PX-1 - a red wire (positive) and a black/white striped wire (negative). One of these wires is connected to ground and the other wire is connected to the gun through-wire; either wire can be the ground as long as the correct polarity is applied to the other wire when firing the PX-1. The detonator lead wires are plugged into two spring-loaded sockets at the output end of the PX-1.

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Q6 What is the firing procedure?

A6 It's the same as firing a conventional detonator, except that you're going for 200-230V at the cablehead rather than 20-30V; basically you hold down the fire button and increase the voltage until the detonator fires. A single sheet with operating instructions for the PX-1 is packed with each device. After firing the voltage should be ramped down quickly rather than switched off instantly, otherwise the rapidly collapsing electromagnetic field around the CCL coil might generate extremely high voltage spikes which can cause insulation problems elsewhere.

Q7 After the PX-1 switches on, how long does it take before the attached EBW/EFI is fired?

A7 With a true DC power supply the PX-1 will switch on and fire the attached detonator almost instantly (less than one second) after the voltage at the input leads reaches 200-230VDC. With an unsmoothed shooting power supply (see Q1/A1) or a long wireline, before the PX-1 will fire the detonator, it might be necessary to continue increasing the voltage quickly for a few seconds after it switches on.

Q8 Can the PX-1 be fired by toggling the necessary input voltage onto it rather than by ramping it up?

A8 Yes, the PX-1 has been tested successfully with this firing method, with up to 280VDC being switched to the input leads. However, whenever possible the PX-1 should be fired by ramping up the voltage as described earlier.

Q9 Can the PX-1 be fired with a capacitive-dump power supply?

A9 Probably not. The PX-1 has not been tested with this firing method, and it is not a recommended procedure.

Q10 How does the PX-1 work?



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A10 The PX-1 uses a capacitor discharge to fire the detonator, triggered by an over-voltage switch. Basically, the fireset has a safety circuit, a high voltage supply, an output capacitor, and a trigger mechanism.

Q11 Can the fireset be used in an exposed gun application?

A11 The PX-1 is not designed to withstand pressure directly, so it must be contained in a protective housing for exposed gun applications. Also, the EBW and EFI detonators currently available are not pressure-rated, so they must be protected as well. If you have a need in this area Ecosse can supply adapter hardware with a 5-6 week lead time (we would need to know your CCL connection looking down and your gun connection looking up). All of the hardware except the detonator housing would be reusable. Ecosse can also supply adapters to use the PX-1 with chemical cutters, setting tools, and cutting/severing tools, down to 1-3/8in. OD

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