EVIDENT™

FOCUS PX
Phased Array and Conventional Ultrasonic Data Acquisition Instrument

User's Manual

This instruction manual contains essential information on how to use this Evident product safely and effectively. Before using this product, thoroughly review this instruction manual. Use the product as instructed.

Keep this instruction manual in a safe, accessible location.

Table of Contents

List of Abbreviations

DC	direct current
EFUP	environment-friendly use period
HD	high definition
LPS	limited power source
P/C	pitch-catch
P/E	pulse-echo
PA	phased array
PLC	programmable logic controller
PRF	pulse repetition frequency
SELV	safety extra low voltage
TCG	time-corrected gain
UT	ultrasonic testing

Important Information — Please Read Before Use

Intended Use

The FOCUS PX is designed to perform nondestructive inspections on industrial and commercial materials.

WARNING

Do not use the FOCUS PX for any purpose other than its intended use. It must never be used to inspect or examine human or animal body parts.

Instruction Manual

This instruction manual contains essential information on how to use this product safely and effectively. Before using this product, thoroughly review this instruction manual. Use the product as instructed. Keep this instruction manual in a safe, accessible location.

IMPORTANT

Some of the details of components illustrated in this manual may differ from the components installed on your device. However, the operating principles remain the same.

Device Compatibility

Only use this device with the approved ancillary equipment provided by Evident. Equipment provided by Evident and approved for use with this device is described later in this manual.

![Warning symbol] **CAUTION**

Always use equipment and accessories that meet Evident specifications. Using incompatible equipment could cause equipment malfunction and/or damage, or human injury.

Repair and Modification

This device does not contain any user-serviceable parts. Opening the device might void the warranty.

![Warning symbol] **CAUTION**

In order to prevent human injury and/or equipment damage, do not disassemble, modify, or attempt to repair the device.

Safety Symbols

The following safety symbols might appear on the device and in the instruction manual:

![Warning symbol] General warning symbol

This symbol is used to alert the user to potential hazards. All safety messages that follow this symbol shall be obeyed to avoid possible harm or material damage.

⚡ High voltage warning symbol

This symbol is used to alert the user to potential electric shock hazards greater than 1000 volts. All safety messages that follow this symbol shall be obeyed to avoid possible harm.

Safety Signal Words

The following safety symbols might appear in the documentation of the device:

⚠ **DANGER**

The DANGER signal word indicates an imminently hazardous situation. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, will result in death or serious personal injury. Do not proceed beyond a DANGER signal word until the indicated conditions are fully understood and met.

⚠ **WARNING**

The WARNING signal word indicates a potentially hazardous situation. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in death or serious personal injury. Do not proceed beyond a WARNING signal word until the indicated conditions are fully understood and met.

⚠ **CAUTION**

The CAUTION signal word indicates a potentially hazardous situation. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, may result in minor or moderate personal injury, material damage, particularly to the product, destruction of part or all of the product, or loss of data. Do not proceed beyond a CAUTION signal word until the indicated conditions are fully understood and met.

Note Signal Words

The following note signal words could appear in the documentation of the device:

IMPORTANT

The IMPORTANT signal word calls attention to a note that provides important information, or information essential to the completion of a task.

NOTE

The NOTE signal word calls attention to an operating procedure, practice, or the like, which requires special attention. A note also denotes related parenthetical information that is useful, but not imperative.

TIP

The TIP signal word calls attention to a type of note that helps you apply the techniques and procedures described in the manual to your specific needs, or provides hints on how to effectively use the capabilities of the product.

Safety

Before turning on the device, verify that the correct safety precautions have been taken (see the following warnings). In addition, note the external markings on the device, which are described under "Safety Symbols."

Warnings

⚠️ **WARNING**

General Warnings

- Carefully read the instructions contained in this instruction manual prior to turning on the device.
- Keep this instruction manual in a safe place for further reference.

- Follow the installation and operation procedures.
- It is imperative to respect the safety warnings on the device and in this instruction manual.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment could be impaired.
- Do not install substitute parts or perform any unauthorized modification to the device.
- Service instructions, when applicable, are for trained service personnel. To avoid the risk of electric shock, do not perform any work on the device unless qualified to do so. For any problem or question regarding this device, contact Evident or an authorized Evident representative.
- Do not touch the connectors directly by hand. Otherwise, a malfunction or electric shock may result.
- Do not allow metallic or foreign objects to enter the device through connectors or any other openings. Otherwise, a malfunction or electric shock may result.

⚠️ **WARNING**

Electrical Warning

The device must only be connected to a power source corresponding to the type indicated on the rating label.

⚠️ **CAUTION**

If a non-approved power supply cord not dedicated to Evident products is used, Evident will not be able to ensure the electrical safety of the equipment.

Battery Precautions

⚠️ **CAUTION**

- Before disposing of a battery, check your local laws, rules, and regulations, and follow them accordingly.

- Transportation of lithium-ion batteries is regulated by the United Nations under the United Nations Recommendations on the Transport of Dangerous Goods. It is expected that governments, intergovernmental organizations, and other international organizations shall conform to the principles laid down in these regulations, thus contributing to worldwide harmonization in this field. These international organizations include the International Civil Aviation organization (ICAO), the International Air Transport Association (IATA), the International Maritime Organization (IMO), the US Department of Transportation (USDOT), Transport Canada (TC), and others. Please contact the transporter and confirm current regulations before transportation of lithium-ion batteries.

- For California (USA) only:

  The device may contain a CR battery. The CR battery contains perchlorate material, and special handling may be required. Refer to http://www.dtsc.ca.gov/hazardouswaste/perchlorate.

- Do not open, crush, or perforate batteries; doing so could cause injury.

- Do not incinerate batteries. Keep batteries away from fire and other sources of extreme heat. Exposing batteries to extreme heat (over 80 °C) could result in an explosion or personal injury.

- Do not drop, hit, or otherwise abuse a battery, as doing so could expose the cell contents, which are corrosive and explosive.

- Do not short-circuit the battery terminals. A short circuit could cause injury and severe damage to a battery making it unusable.

- Do not expose a battery to moisture or rain; doing so could cause an electric shock.

- Only use an external charger approved by Evident to charge the batteries.

- Only use batteries supplied by Evident.

- Do not store batteries that have less than 40 % remaining charge. Recharge batteries to between 40 % and 80 % capacity before storing them.

- During storage, keep the battery charge between 40 % and 80 %.

- Do not leave batteries in the FOCUS PX unit during device storage.

Regulations for Shipping Products with Lithium-Ion Batteries

| IMPORTANT |

When shipping a Li-ion battery or batteries, be sure to follow all local transportation regulations.

⚠️ **WARNING**

Damaged batteries cannot be shipped through normal routes — DO NOT ship damaged batteries to Evident. Contact your local Evident representative or material disposal professionals.

Equipment Disposal

Before disposing of the FOCUS PX, check your local laws, rules, and regulations, and follow them accordingly.

BC (Battery Charger - California, USA Community)

The BC marking indicates that this product has been tested and complies with the Appliance Efficiency Regulations as stated in the California Code of Regulations Title 20, Sections 1601 through 1608 for Battery Charger Systems. The internal battery charger within this device has been tested and certified pursuant to the California Energy Commission's (CEC) requirements; this device is listed on the online CEC's (T20) database.

CE (European Community)

This device complies with the requirements of directive 2014/30/EU concerning electromagnetic compatibility, directive 2014/35/EU concerning low voltage, and directive 2015/863 which amends 2011/65/EU concerning restriction of hazardous substances (RoHS). The CE marking is a declaration that this product conforms to all the applicable directives of the European Community.

UKCA (United Kingdom)

This device complies with the requirements of the Electromagnetic Compatibility Regulations 2016, the Electrical Equipment (Safety) Regulations 2016, and the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012. The UKCA marking indicates compliance with the above regulations.

RCM (Australia)

The regulatory compliance mark (RCM) label indicates that the product complies with all applicable standards, and has been registered with the Australian Communications and Media Authority (ACMA) for placement on the Australian market.

WEEE Directive

In accordance with European Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE), this symbol indicates that the product must not be disposed of as unsorted municipal waste, but should be collected separately. Refer to your local Evident distributor for return and/or collection systems available in your country.

China RoHS

China RoHS is the term used by industry generally to describe legislation implemented by the Ministry of Information Industry (MII) in the People's Republic of China for the control of pollution by electronic information products (EIP).

The China RoHS mark indicates the product's Environment-Friendly Use Period (EFUP). The EFUP is defined as the number of years for which listed controlled substances will not leak or chemically deteriorate while in the product. The EFUP for the FOCUS PX has been determined to be 15 years.

Note: The Environment-Friendly Use Period (EFUP) is not meant to be interpreted as the period assuring functionality and product performance.

电器电子产品有害物质限制使用标志

本标志是根据 " 电器电子产品有害物质限制使用管理办法 " 以及 " 电子电气产品有害物质限制使用标识要求 " 的规定，适用于在中国销售的电器电子产品上的电器电子产品有害物质使用限制标志。

（注意）电器电子产品有害物质限制使用标志内的数字为在正常的使用条件下有害物质等不泄漏的期限，不是保证产品功能性能的期间。

产品中有害物质的名称及含量

部件名称		有害物质					
		铅及其化合物 (Pb)	汞及其化合物 (Hg)	镉及其化合物 (Cd)	六价铬及其化合物 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
主体	机构部件	×	○	○	○	○	○
	光学部件	×	○	○	○	○	○
	电气部件	×	○	○	○	○	○

产品中有害物质的名称及含量

部件名称	有害物质					
	铅及其化合物 (Pb)	汞及其化合物 (Hg)	镉及其化合物 (Cd)	六价铬及其化合物 (Cr(Ⅵ))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
附件	×	○	○	○	○	○
本表格依据 SJ/T 11364 的规定编制。						
○：表示该有害物质在该部件所有均质材料中的含量均在 GB/T26572 规定的限量要求以下。						
×：表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T26572 规定的限量要求。						

Korea Communications Commission (KCC)

Seller and user shall be noticed that this equipment is suitable for electromagnetic equipment for office work (class A) and it can be used outside the home. This device complies with the EMC requirements of Korea.

The MSIP code for the device is the following:
MSIP-REM-OYN-FOCUSPX.

이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다 .

EMC Directive Compliance

This equipment generates and uses radio-frequency energy and, if not installed and used properly (that is, in strict accordance with the manufacturer's instructions), may cause interference. The FOCUS PX has been tested and found to comply with the limits for an industrial device in accordance with the specifications of the EMC directive.

FCC (USA) Compliance

<div style="border:1px solid">NOTE</div>

This product has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the product is operated in a commercial environment. This product generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instruction manual, might cause harmful interference to radio communications. Operation of this product in a residential area is likely to cause harmful interference, in which case you will be required to correct the interference at your own expense.

<div style="border:1px solid">IMPORTANT</div>

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the product.

FCC Supplier's Declaration of Conformity

Hereby declares that the product,

Product name: FOCUS PX
Model: FOCUS PX-MR/FOCUS PX-CW

Conforms to the following specifications:

FCC Part 15, Subpart B, Section 15.107 and Section 15.109.

Supplementary information:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference.

(2) This device must accept any interference received, including interference that may cause undesired operation.

Responsible party name:

EVIDENT CANADA, INC.

Address:

3415, Rue Pierre-Ardouin, Québec (QC) G1P 0B3 Canada

Phone number:

+1 781-419-3900

ICES-001 (Canada) Compliance

This Class A digital apparatus complies with Canadian ICES-001.

Cet appareil numérique de la classe A est conforme à la norme NMB-001 du Canada.

Warranty Information

Evident guarantees your Evident product to be free from defects in materials and workmanship for a specific period, and in accordance with conditions specified in the Terms and Conditions available at https://www.olympus-ims.com/en/terms/.

The Evident warranty only covers equipment that has been used in a proper manner, as described in this instruction manual, and that has not been subjected to excessive abuse, attempted unauthorized repair, or modification.

Inspect materials thoroughly on receipt for evidence of external or internal damage that might have occurred during shipment. Immediately notify the carrier making the delivery of any damage, because the carrier is normally liable for damage during shipment. Retain packing materials, waybills, and other shipping documentation needed in order to file a damage claim. After notifying the carrier, contact Evident for assistance with the damage claim and equipment replacement, if necessary.

This instruction manual explains the proper operation of your Evident product. The information contained herein is intended solely as a teaching aid, and shall not be used in any particular application without independent testing and/or verification by the operator or the supervisor. Such independent verification of procedures becomes increasingly important as the criticality of the application increases. For this reason, Evident makes no warranty, expressed or implied, that the techniques, examples, or procedures described herein are consistent with industry standards, nor that they meet the requirements of any particular application.

Evident reserves the right to modify any product without incurring the responsibility for modifying previously manufactured products.

Technical Support

Evident is firmly committed to providing the highest level of customer service and product support. If you experience any difficulties when using our product, or if it fails to operate as described in the documentation, first consult the user's manual, and then, if you are still in need of assistance, contact our After-Sales Service. To locate the nearest service center, visit the Service Centers page on the Evident Scientific Web site.

Introduction

The FOCUS PX phased array and conventional ultrasonic data acquisition instrument is a high-performance acquisition unit that uses phased array and conventional ultrasound to perform nondestructive inspections. It is designed to be controlled from the PC-based FocusPC software, which can manage up to five FOCUS PX instruments in parallel (up to four active FOCUS PX instruments and one passive FOCUS PX).

FOCUS PX key features include:

- 16 or 32 focusing channels
- 64 or 128 phased array (PA) channels with linear amplifiers
- 4 conventional ultrasonic (UT) channels with linear amplifiers
- Real-time data compression
- High pulsing rate
- High data throughput (up to 20000 12-bit A-scans/second, each containing 750 points)
- Flexible interface with scanners and manipulators
- Convenient PLC integration

The FOCUS PX was designed with flexible programmable logic controller (PLC) and software integration features to enable easy integration into automated inspection systems (Figure i-1 on page 24).

Figure i-1 Example of a fully automated inspection system[1]

For PLC and scanner integration, the connectors on the rear panel allow the FOCUS PX to be interfaced with a PLC or a scanner to exchange the following commands (Figure i-2 on page 25).

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1. Photo courtesy of SCLEAD.

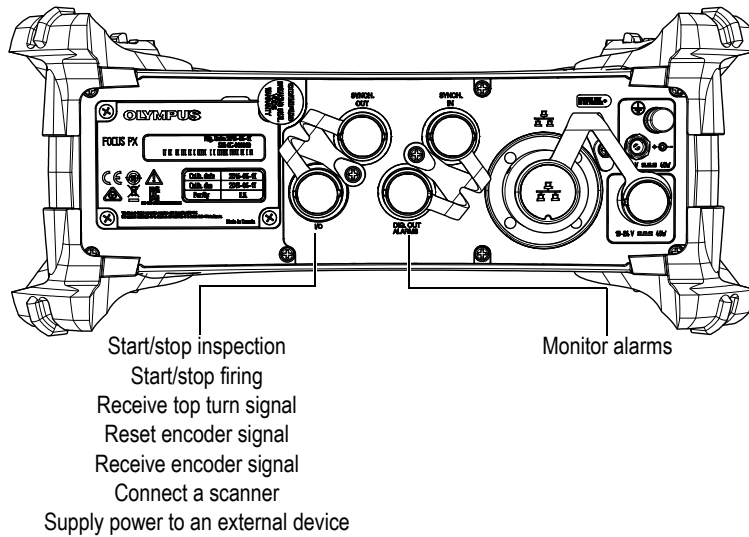**Figure i-2 FOCUS PX rear panel**

For software integration, the flexibility of FocusPC, FocusControl, and FocusData enables the creation of fully customized applications designed to precisely match your inspection requirements (Figure i-3 on page 25) [refer to the *FocusPC UT and Phased Array Data Acquisition and Analysis Software User's Manual* for more details].
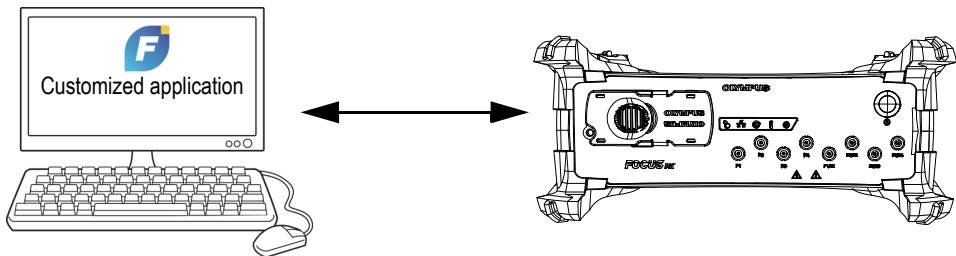

Figure i-3 Software integration

1. Package Contents

The FOCUS PX phased array and conventional ultrasonic data acquisition instrument is available in four different models:

- 32:128PR

  32:128PR phased array (PA) acquisition instrument, including four multiplexed conventional ultrasonic (UT) HD channels (P/E or P/C)

- 16:64PR

  16:64PR phased array acquisition instrument, including four multiplexed conventional ultrasonic (UT) HD channels (P/E or P/C)

- 16:128PR

  16:128PR phased array acquisition instrument, including four multiplexed conventional ultrasonic (UT) HD channels (P/E or P/C)

- 4UT

  Conventional ultrasonic acquisition instrument including four multiplexed conventional ultrasonic (UT) HD channels (P/E or P/C)

The FOCUS PX comes standard with the following accessories:

- Transport case
- DC power adaptor (power supply)
- Power cord (model varies according to country)
- USB flash drive, which contains:
  - FocusPC software
  - Calculator software
  - FocusPC Viewer
  - FocusControl software development kit
  - FocusData software development kit

- — *FocusPC UT and Phased Array Data Acquisition and Analysis Software User's Manual*
- — FocusPC *UT and Phased Array Data Acquisition and Analysis Software Advanced User's Manual*
- — FOCUS PX *Getting Started Guide*
- — FOCUS PX *Phased Array and Conventional Ultrasonic Data Acquisition Instrument User's Manual*
- Crossover Ethernet cable (category 5e or higher) [5 m] (16.4 ft)
- Screwdriver for bumper removal
- Digital input cable (5 m) [16.4 ft]
- Digital output cable (5 m) [16.4 ft]
- Calibration certificate

NOTE

Make sure that the contents of the package are complete before using the FOCUS PX. If any items are missing or damaged, contact Evident.

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2. FOCUS PX Overview

This chapter describes the FOCUS PX phased array and conventional ultrasonic data acquisition instrument.

2.1 Hardware Configuration

Figure 2-1 on page 29 shows the hardware architecture of the FOCUS PX.
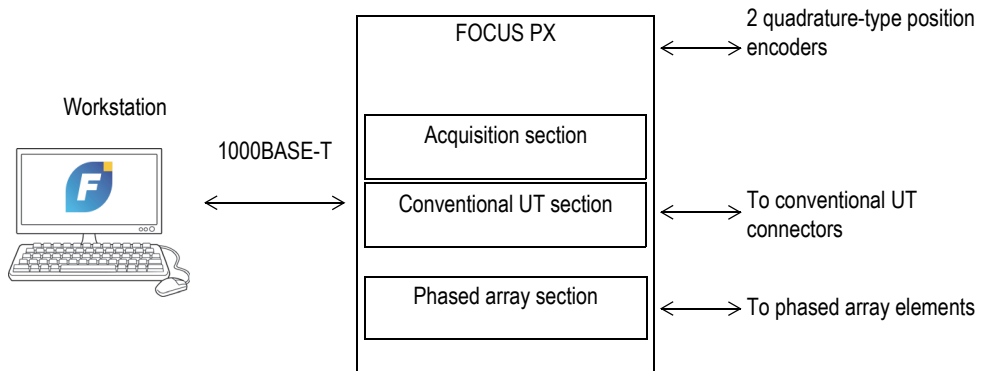
Figure 2-1 Hardware architecture of the FOCUS PX

2.2   FOCUS PX Instrument

The FOCUS PX is a phased array and conventional ultrasonic data acquisition instrument adapted for bidirectional communications through an Ethernet link. The FOCUS PX is composed of three sections: the acquisition section, the conventional UT section, and the phased array section.

The acquisition section synchronizes the acquisition, collects the UT data (A-scan, C-scan), collects the I/O data (encoders), and sends the data to the computer.

The conventional UT section manages the conventional UT HD channels.

The phased array section manages the focal laws (transmission delay, reception delay, and signal summing).

2.3   Front Panel

Figure 2-2 on page 31 shows the FOCUS PX front panel, which enables you to do the following:

- Connect a PA probe (or multiple PA and UT probes using a splitter)
- Connect up to 8 conventional UT probes
- Turn on and off the FOCUS PX
- Get the FOCUS PX status using the indicators
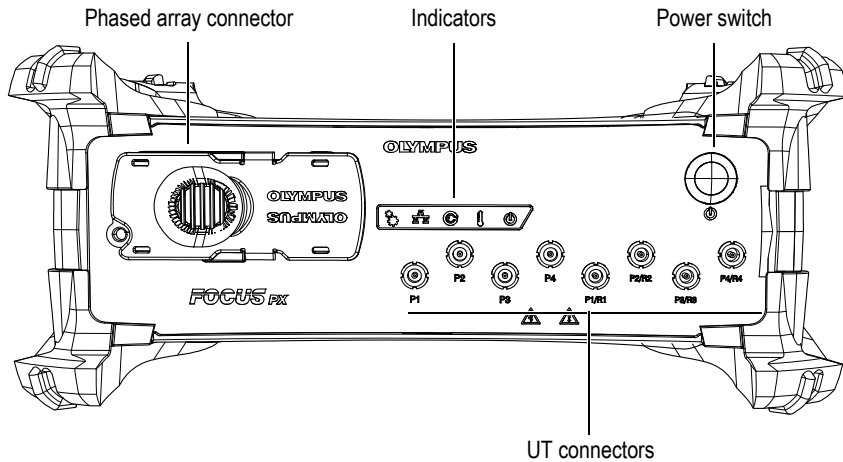
Figure 2-2 FOCUS PX front panel

The FOCUS PX front panel contains the following connectors, indicators, and switch:

Phased array connector

> This 160-pin connector is used to connect the FOCUS PX to a phased array probe. It enables access to up to 128 channels. To use a Hypertronics phased array probe with the FOCUS PX, connect a Hypertronics-MINIDOCK adaptor to this connector.

P1, P2, P3, P4, P1/R1, P2/R2, P3/R3, P4/R4 connectors

> These LEMO connectors are used to connect the FOCUS PX with conventional UT probes. See "Conventional UT Channel Usage" on page 48.

![Caution icon] **CAUTION**

When the FOCUS PX is used in conventional ultrasonic mode with the P1, P2, P3, P4, P1/R1, P2/R2, P3/R3, and P4/R4 connectors, the voltage present on the P and P/R connectors can be dangerous, and it represents a shock hazard.

Indicators

Mechanical indicator (⚙)

This indicator is reserved for future use.

Ethernet indicator (⛀)

When this indicator lights up green or orange, it indicates that the Ethernet link is established.

When this indicator flashes green or orange, it indicates there is activity on the Ethernet link. A green indicator corresponds to a 1000 megabits per second (Mbps) Ethernet connection, while an orange indicator corresponds to a 100 Mbps connection.

Power supply status indicator (⟳)

When this indicator lights up green, it indicates that the FOCUS PX is powered by direct current through the DC power adaptor (primary DC input connector).

When this indicator lights up red, it indicates that the primary DC power supply is outside the 10 VDC to 24 VDC range. If the input voltage is found to be outside the allowable limits, contact the After-Sales Service.

When this indicator is turned off, it indicates that no power is available.

Temperature indicator (🌡)

When this indicator lights up green, it indicates that the internal temperature is within the operating temperature range.

When the indicator lights up red, it indicates that the internal temperature is above the upper limit. The FOCUS PX will automatically shut down. You must wait for the FOCUS PX to cool down before turning it back on.

Power indicator (⏻)

When this indicator lights up green, it indicates that the FOCUS PX is turned on.

When this indicator flashes green, it indicates that the FOCUS PX is either starting up or shutting down.

When this indicator flashes red three times after the power button has been pressed, it indicates that the FOCUS PX instrument's internal temperature is above the upper temperature limit. Wait for the FOCUS PX to cool down.

When this indicator flashes red continuously, it indicates that the FOCUS PX is in safe mode (flash memory error). Contact the After-Sales Service.

Power switch

This switch is used to turn on and off the FOCUS PX.

2.4 Rear Panel

Figure 2-3 on page 33 shows the FOCUS PX rear panel, which enables you to do the following:

- Connect a scanner
- Connect input and output signals (encoders, alarms, etc.)
- Connect the FOCUS PX to an Ethernet network
- Connect the FOCUS PX to a table top power supply
- Connect the FOCUS PX to a power source
- Synchronize multiple FOCUS PX instruments
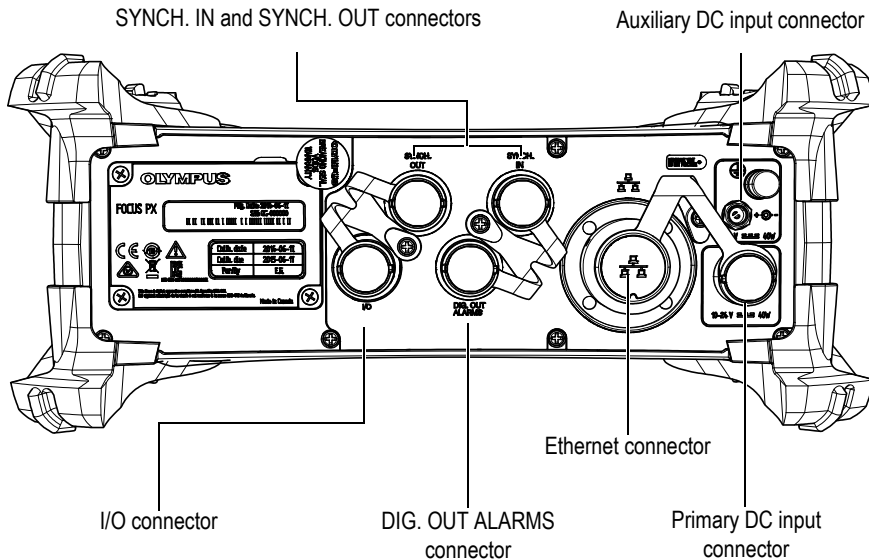
Figure 2-3 FOCUS PX rear panel

The rear panel of the FOCUS PX contains the following connectors:

I/O (black)

This connector is used to connect digital input and output signals. See "I/O Connector" on page 67 for more details.

SYNCH. IN (yellow)

This connector is used to connect an input synchronization signal. See "SYNCH. IN Connector" on page 72 for more details.

IMPORTANT

Make sure that you connect the yellow end of the cable to the SYNCH. IN connector (Figure 2-4 on page 35).

SYNCH. OUT (red)

This connector is used to connect an output synchronization signal. See "SYNCH. OUT Connector" on page 74 for more details.

IMPORTANT

Make sure that you connect the red end of the cable to the SYNCH. OUT connector (Figure 2-4 on page 35).
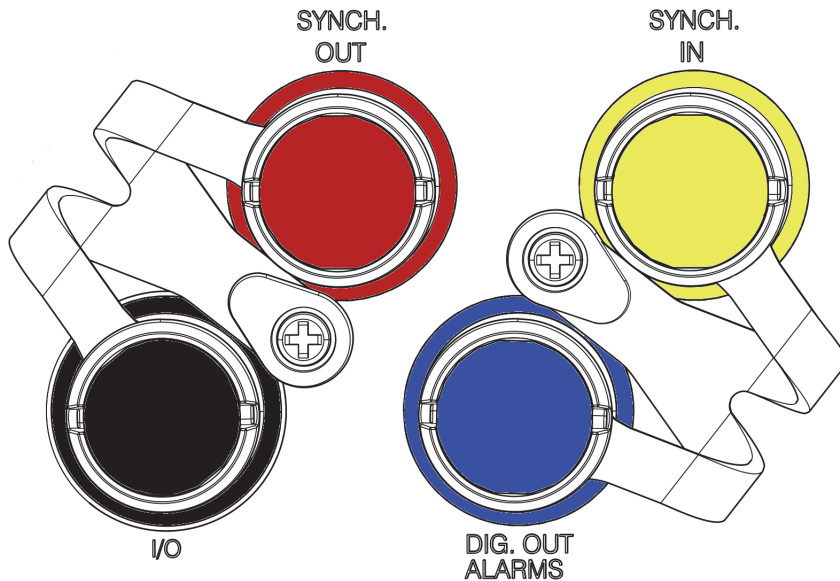
Figure 2-4 Connector colors

DIG. OUT ALARMS (blue)

This connector provides digital alarm output signals. See "DIG. OUT ALARMS Connector" on page 73 for more details.

Ethernet connector

This 8-position modular connector is used to connect the FOCUS PX to an Ethernet network. During normal operation, an indicator flashes green when the Ethernet link is established. See "Ethernet Connector" on page 75 for more details.

Auxiliary DC input

This connector is used to connect the FOCUS PX to a DC power source with a voltage range of 15 VDC to 18 VDC, rated at 40 W maximum. See "Auxiliary DC Input Connector" on page 78 for more details.

Primary DC input

This connector is used to connect the FOCUS PX to a DC power source with a voltage range of 10 VDC to 24 VDC, rated at 40 W maximum. See "Primary DC Input Connector" on page 76 for more details.

2.5   Removing Protective Bumpers and Installing FOCUS PX

The main function of the protective bumpers shown in Figure 2-5 on page 36 is to protect the FOCUS PX. The bumpers are also there to provide enough clearance that the heat sinks can properly cool the FOCUS PX. The protective bumpers are removable to allow easy installation on a scanner.

To remove the protective bumpers

1. Remove the protective plastic buttons located on the bumper screws.
2. Remove the screws using a Phillips screwdriver.
3. Pull off the bumper, starting from one end.
4. Repeat the procedure for the other bumpers.
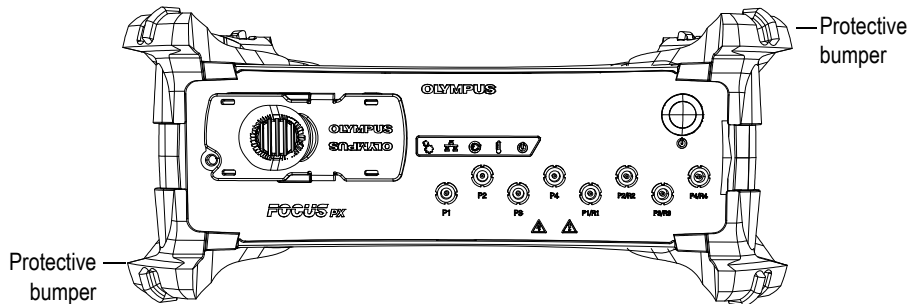
Figure 2-5 Protective bumpers

To install FOCUS PX on a scanner

◆ Fix the FOCUS PX unit to the scanner using four of the M5 screws that come installed in holes on both the top and bottom of the instrument (Figure 2-6 on page 37). The thread depth is 9 mm.
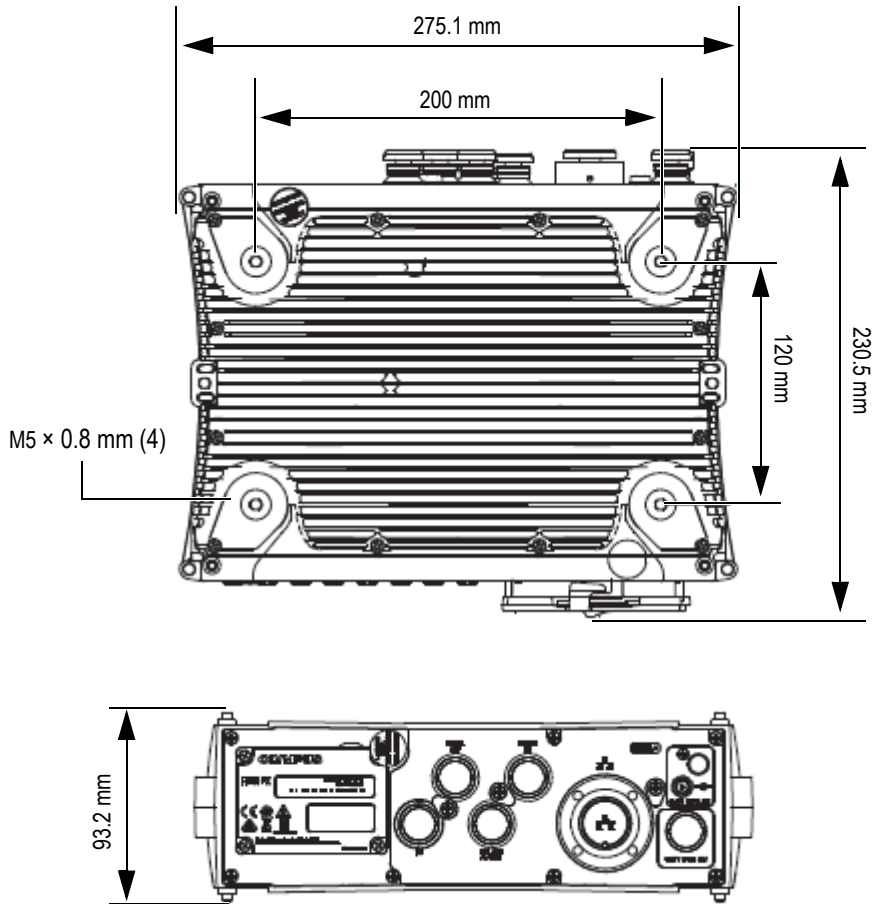
Figure 2-6 Mounting threads and measurements

2.6   Heat Sinks

The FOCUS PX must be properly ventilated to prevent overheating and ensure that it continues to function properly. To cool the internal components, heat sinks are located on the top, the bottom, and both sides of the FOCUS PX (Figure 2-7 on page 38).

![Caution icon] **CAUTION**

Be sure to use the FOCUS PX in a well-ventilated area and avoid obstructing the heat sinks located on the top, bottom, and both sides of the FOCUS PX; otherwise, the instrument could overheat and stop functioning properly.
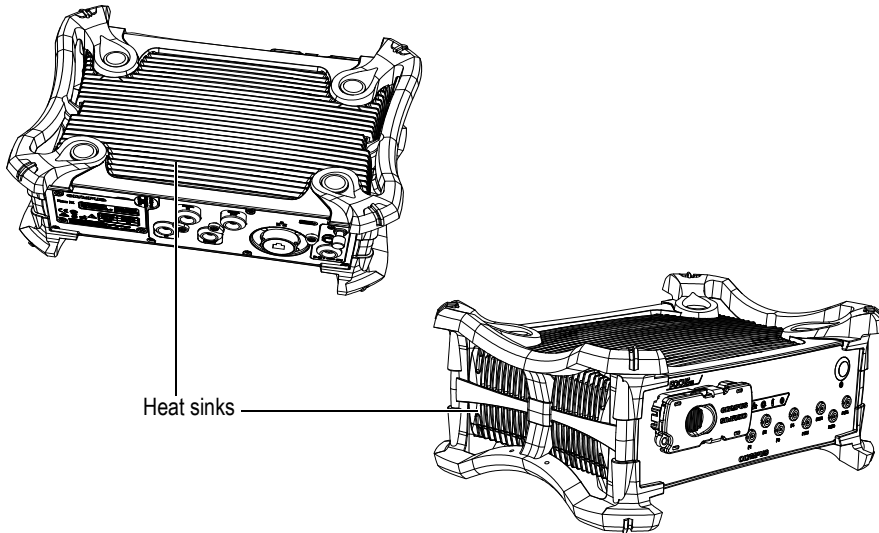
Heat sinks

Figure 2-7 FOCUS PX heat sinks

2.7   Workstation

The workstation is a computer adapted for bidirectional communications through an Ethernet link. It hosts the FocusPC acquisition software on either Windows 7 or Windows 8. The workstation has the following functions:

• Hosting the FocusPC software

• Hosting the FOCUS PX configuration file

• Controlling the acquisition and receiving data from the FOCUS PX through an Ethernet link

- Processing and displaying UT data collected by the FOCUS PX
- Saving UT acquisition data acquired during an inspection on files stored on internal or external data storage units

3. FOCUS PX Integration

This chapter explains the procedures for integrating the FOCUS PX phased array and conventional ultrasonic data acquisition instrument into an inspection system.

3.1 FOCUS PX Installation

This section explains how to install the FOCUS PX. Probe connectors are located on the front panel and the DC input connector is located on the rear panel.

⚠ **CAUTION**

When three or more FOCUS PX instruments are stacked on top of each other, they must be supported by a rack or an appropriate mechanical device. If no such support is used, the assembly is unstable and may fall over, which could cause human injury or equipment damage.

⚠ **CAUTION**

When attaching the instrument to a support structure, only use the instrument's bottom screw holes. Do not use the top screw holes. Otherwise, equipment damage or injuries may result.

To install the FOCUS PX

1. Install the FOCUS PX away from heat sources, leaving a minimum clearance of 5 cm (2 in.) on each side to allow for heat dissipation.

⚠️ **CAUTION**

To prevent water infiltration, use waterproof cables. Water infiltration could damage the FOCUS PX.

---

2. Using a category 5e Ethernet crossover cable, connect the FOCUS PX Ethernet connector to the network card of the inspection computer. The cable supplied with the FOCUS PX is a category 5e Ethernet crossover cable (Evident P/N: 60ND0001).

NOTE

To use the FOCUS PX in harsh environment, select an Ethernet cable that has a high resistance to friction, tensile stress, and torsion.

---

3. Install FocusPC on the computer, and then follow the wizard steps to configure the network card for connection to the FOCUS PX (see "To install FocusPC" on page 45).

⚠️ **WARNING**

To prevent the risk of an electric shock, Evident strongly recommends turning off the FOCUS PX before connecting and disconnecting the probes.

⚠️ **CAUTION**

Probes can suffer permanent damage if fired without couplant. If the probes are not being used for inspection, the FOCUS PX should be turned off.

---

4. Using the appropriate cables, connect the probes to the phased array connector and/or to the UT connectors.

5. Using the appropriate cables, connect each of the components required by your setup and your needs to the corresponding FOCUS PX connector (for ex., encoders, alarms, etc.).

| NOTE |

For all the details on the connectors, see "Front Panel" on page 30 and "Rear Panel" on page 33.

---

6. Connect the power earth connection to an appropriate cable or to a cable equipped with a lug, and then connect the other end in a cabinet or on a suitable grounded structure.

7. Connect the DC power adaptor to the FOCUS PX instrument's DC input connector. Connect the other end of the DC power adaptor to a suitable power source.

   A suitable power source is a dedicated safety extra low voltage (SELV) limited power source (LPS) in the range of 10 VDC to 24 VDC for the primary power source, and in the range of 15 VDC to 18 VDC for the auxiliary power source.

8. Turn on the FOCUS PX by pressing the power switch.

3.2   Installation in a Closed Environment

You can position the FOCUS PX on any of its six faces. When installing the FOCUS PX in a closed environment (such as a cabinet), make sure that the environment is well-ventilated to prevent overheating.

⚠️   **CAUTION**

Be sure to use the FOCUS PX in a well-ventilated area while avoiding the obstruction of the heat sinks located on the top, on the bottom, as well as on both sides of the FOCUS PX, to prevent overheating and ensure an appropriate operation.

---

4.   FOCUS PX Connection

This chapter describes the connection of the FOCUS PX phased array and conventional ultrasonic data acquisition instrument. The FOCUS PX is controlled by a computer called the *workstation*, on which the FocusPC software must be installed. This workstation controls the acquisition process and analyzes the ultrasonic data collected by the FOCUS PX.

4.1   FocusPC Installation

Perform the following procedure to install FocusPC.

To install FocusPC

1. On the computer on which you want to install FocusPC, log on with a user account that has administrator rights.
2. Run the FocusPC installer program included on the Evident distribution disk.
3. Follow the FocusPC installer wizard steps that appear on the screen.
    The wizard installs FocusPC and the Calculator.
4. Disable the sleep mode on the computer to prevent losing the connection with the FOCUS PX:
    a) On the taskbar, in the **Search** box, type **Edit Power Plan**, and then select **Edit Power Plan**.
    b) In the dialog box **Edit Plan Settings,** select **Never** for **Turn off the display** and **Put the computer to sleep** (Figure 4-1 on page 46).
    c) Click **Save changes**.
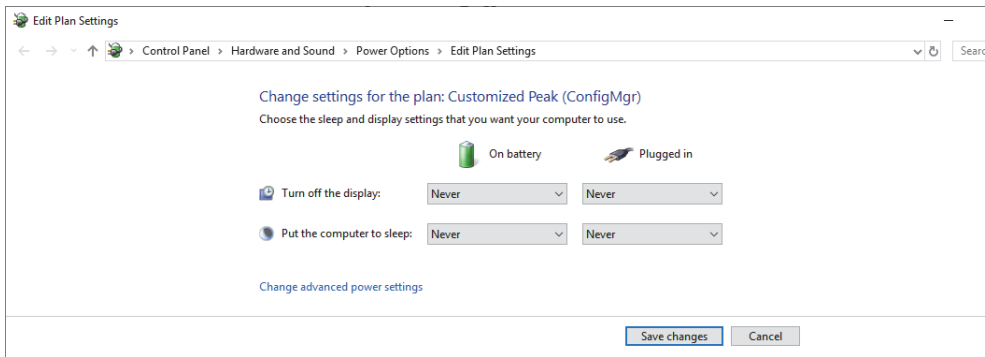
Figure 4-1 Edit Plan Settings dialog box

NOTE

The FocusPC installer configures the Windows firewall to allow communication between the FOCUS PX and the FocusPC and Bootp Server programs. If you use a third-party firewall on the computer running FocusPC, refer to *FocusPC Advanced User's Manual* for configuration information.

4.2   Ethernet Link

The FOCUS PX must be linked to the computer through an Ethernet network. To make this possible, the FOCUS PX is equipped with internal Ethernet hardware. For a network configuration using a network switch, you can use a standard Ethernet cable. For a point-to-point configuration, use an Ethernet crossover (category 5e or higher) cable.

The FOCUS PX is designed to be used with a 1000BASE-T Fast Ethernet network.

The FOCUS PX has no internal disk drive. The FOCUS PX must therefore be linked, through an Ethernet network, to a computer running the FocusPC software before it can be turned on, so that all the necessary data for proper functioning can be loaded. Once booted, the FOCUS PX connects through the Ethernet network.

IMPORTANT

The FOCUS PX must be linked to an Ethernet network located inside a building.

NOTE

For more details on installing and using the FocusPC software, refer to the *FocusPC User's Manual* and *FocusPC Advanced User's Manual*.

4.2.1   Connecting a FOCUS PX to a Computer

Perform the following procedure to connect your FOCUS PX to a computer.

To connect a FOCUS PX to a computer

1. Install FocusPC on the inspection computer, and then follow the wizard steps to configure the network card for connection to the FOCUS PX (see "To install FocusPC" on page 45).
2. Using a category 5e Ethernet crossover cable, connect the FOCUS PX Ethernet connector to the network card of the inspection computer.
3. Turn on the FOCUS PX.

4.2.2   Connecting Multiple FOCUS PX Instruments to a Computer

⚠ CAUTION

When three or more FOCUS PX instruments are stacked on top of each other, they must be supported by a rack or an appropriate mechanical device. If no such support is used, the assembly is unstable and may fall over, which could cause human injury or equipment damage.

Perform the following procedure to connect multiple FOCUS PX instruments to the inspection computer.

To connect multiple FOCUS PX instruments to a computer

1. Install FocusPC on the inspection computer, and then follow the wizard steps to configure the network card for connection to the FOCUS PX instruments (see "To install FocusPC" on page 45).

2. Using category 5e Ethernet crossover cables, connect each FOCUS PX Ethernet connector to an input port of a gigabit Ethernet switch, and then connect the switch to the inspection computer.

NOTE

When using FOCUS PX instruments in harsh environments, select Ethernet cables that have a high resistance to friction, tensile stress, and torsion.

---

3. Turn on each FOCUS PX.

4.3   Automatic Start-Up Mode

The FOCUS PX has an automatic start-up mode (auto-boot) that can be used to remotely start the FOCUS PX. When this mode is enabled, you do not need to press the power switch to start the FOCUS PX. When this mode is enabled, the FOCUS PX starts up automatically when connected to the DC power adaptor. This mode is disabled by default.

To activate the auto-boot

1. Turn off the FOCUS PX, and then disconnect the DC power adaptor.
2. While pressing the power switch, connect the FOCUS PX to the DC power adaptor.
3. Wait for 5 to 10 seconds, and then release the power switch.
    The power indicator light will blink two times.
4. To deactivate the auto-boot, repeat steps 1 to 3.

4.4   Conventional UT Channel Usage

You can use conventional UT channels in either pulse-echo (P/E) or pitch-catch (P/C) configurations.

4.4.1   Pulse-Echo Configuration

For pulse-echo configurations, the P1/R1, P2/R2, P3/R3, and P4/R4 connectors can be used to pulse and receive ultrasonic signals on the same connector (Figure 4-2 on page 49).
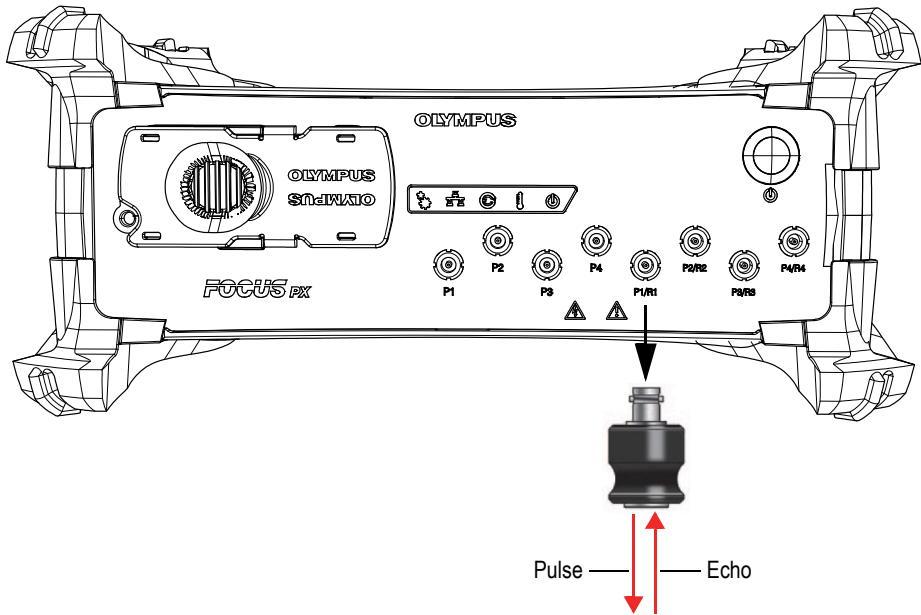
Figure 4-2 Pulse-echo configuration

4.4.2   Pitch-Catch Configuration

For pitch-catch configurations, the P1, P2, P3, P4, P1/R1, P2/R2, P3/R3, and P4/R4 connectors can be used to pulse ultrasonic signals, and the P1/R1, P2/R2, P3/R3, and P4/R4 connectors can be used to receive ultrasonic signals (Figure 4-3 on page 50).
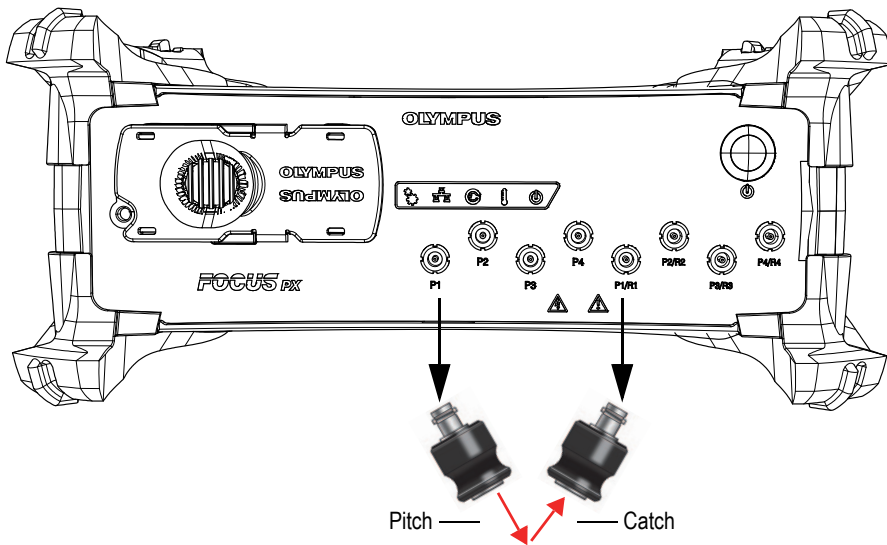
Figure 4-3 Pitch-catch configuration

4.5   Phased Array Element Usage

The 128 elements of a phased array (PA) probe can be used in either a pulse-echo or pitch-catch configuration. With the 16:128PR model, up to 16 consecutive elements can be used anywhere on the probe to pulse and receive. With the 32:128PR model, up to 32 consecutive elements can be used anywhere on the probe to pulse and receive (Figure 4-4 on page 51).

Blue elements are used for emission.
Red elements are used for reception.
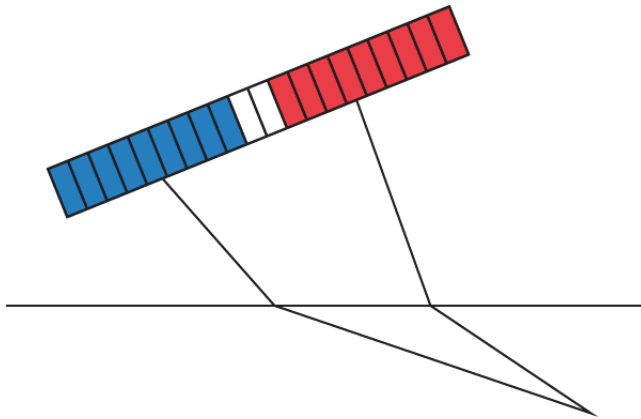
Figure 4-4 Phased array element usage

5.   Maintenance

This chapter describes the basic maintenance for the FOCUS PX phased array and conventional ultrasonic data acquisition instrument. The maintenance operations explained below help keep the FOCUS PX in good physical and working condition. The FOCUS PX has been designed so that it only requires minimal maintenance.

5.1   Preventative Maintenance

The FOCUS PX does not have many moving parts, and therefore only requires minimal preventative maintenance. Simply perform regular inspections to keep the FOCUS PX in proper working order.

5.2   Cleaning

The external surfaces of the FOCUS PX should be cleaned as needed. This section provides the appropriate procedure for cleaning the FOCUS PX.

To clean the FOCUS PX

⚠️ **WARNING**

To prevent the risk of an electric shock, first disconnect the power cord from the power outlet, and then disconnect the power cord from the FOCUS PX.

1.   Make sure that the FOCUS PX is turned off and that the power cord is disconnected.

2. Disconnect all cables and connectors, and make sure that all external ports on the FOCUS PX have been covered.

3. To restore the instrument's original finish, clean the casing with a soft cloth.

⚠️ **WARNING**

Do not clean the FOCUS PX with a water jet, spray can, or spray bottle. Liquid could seep in and damage the FOCUS PX, or the connector contacts could stay wet and produce a short circuit when cables are connected to them.

4. To remove persistent stains, use a damp cloth with a mild, soapy solution. Do not use abrasive products or powerful solvents because they could damage the finish.

5. Remove the protective caps from the connectors, and then clean the connectors with a dry cloth if necessary.

6. Make sure the connectors are dry before connecting anything to them. If they are wet, dry them with a soft, dry cloth, or let them air dry.

6.   Troubleshooting

This chapter will help you resolve minor problems that could occur during operation of your FOCUS PX phased array and conventional ultrasonic data acquisition instrument. This troubleshooting guide has been prepared based on the assumption that the FOCUS PX has not been modified and that all cables and connectors used are those provided and documented by Evident.

Table 1 Troubleshooting guide

Problem	Cause	Solution
The FOCUS PX does not start.	Power does not properly reach the FOCUS PX.	Check that the DC power adaptor is connected to both the FOCUS PX and a power outlet with the proper voltage. Use only the adaptor supplied with the FOCUS PX. Press and hold the power switch for three seconds or longer.
The power indicator flashes red three times after I press the power switch.	The FOCUS PX internal temperature is over the temperature limit.	Wait for the FOCUS PX to cool down.
At start-up, the power indicator flashes red continuously.	The FOCUS PX is in safe mode (flash memory error).	Contact Evident After-Sales Service.

Table 1 Troubleshooting guide *(continued)*

Problem	Cause	Solution
Communication problems occur between the inspection computer and the FOCUS PX.	The computer and the FOCUS PX are not connected with the proper Ethernet cable type.	Ensure that the FOCUS PX and the computer are directly connected by a category 5e crossover Ethernet cable.
	FocusPC is not properly installed on the computer.	Uninstall and reinstall FocusPC on the computer (see "To install FocusPC" on page 45).
	The network card is not properly configured.	In the FOCUS PX Configuration tool, click the **Configure Network Card** button and configure the network card that is used to communicate with the FOCUS PX instrument(s).
	The firewall is blocking the connection to the FOCUS PX.	Make sure that all firewalls are deactivated.
	Windows is shutting down the network card to save power.	Make sure that the power saving mode is disabled for the network card that is used to communicate with the FOCUS PX instrument(s).
	The switch being used is not a 1 GB Ethernet switch (if applicable).	Make sure that you are using a 1 GB Ethernet switch.
	Other units are connected to the Ethernet switch (if applicable).	Make sure that only FOCUS PX acquisition units and computer are connected to the 1 GB Ethernet switch.

Table 1 Troubleshooting guide *(continued)*

Problem	Cause	Solution
The encoders, alarms, digital inputs or outputs do not work properly.	The I/O cable has been damaged.	Use a different cable.
	The pinout of the I/O cable is incorrect.	Validate the cable pinout (see "Connector References" on page 67).
The FOCUS PX instruments do not synchronize.	The synchronization cable or cables have been damaged.	Change the cable(s).
The PA connector does not function properly.	The connector is dirty.	Wash the connector with a 99 % alcohol solution (alcohol: P/N: 16BA0058; brush: P/N: 17BB0004; container for alcohol: P/N: 38CC0003).
	The probe or probe cable is damaged and does not work properly.	Use a different probe and cable.
One or several UT connectors do not work properly.	The probe or probe cable is damaged and does not work properly.	Use a different probe and cable.

7. Specifications

This chapter presents the general specifications (size, operating temperature, power requirements) of all FOCUS PX phased array and conventional ultrasonic data acquisition instrument models. It also presents the operating specifications, specifications of recorded data, specifications of the Ethernet link, and safety standards.

7.1   General Specifications

Table 2 on page 59 details the general specifications of the FOCUS PX.

<div align="center">

Table 2 General specifications

</div>

Category	Specification	Value
Housing	Size (W × H × D)	With bumpers: 30.7 cm × 13.5 cm × 23.6 cm (12 in. × 5.3 in. × 9.3 in.) Without bumpers: 27.6 cm × 9.2 cm × 23.1 cm (10.9 in. × 3.6 in. × 9.1 in.)
	Net weight	With bumpers: 4778 g (10.5 lb) Without bumpers: 4180 g (9.2 lb)

Table 2 General specifications *(continued)*

Category	Specification	Value
Environment	Storage temperature	−20 °C to 70 °C (−4 °F to 158 °F)
	Operating temperature	0 °C to 45 °C (32 °F to 113 °F)
	Maximum relative humidity	90 %, noncondensing
	Pollution degree	2
	Altitude	Up to 2000 m (6561 ft)
	IP rating	Designed and tested for IP65 by an independent lab Not rated in CB scheme IPX0
	Indoor/outdoor use	For indoor use only Not tested for extended outdoor use or prolonged exposure to snow, ice, and UV rays
	Drop test rating	Drop tested according to MIL-STD-810G (Method 516.6, Procedure IV)
Connectivity	Ethernet interface	1000BASE-T (bandwidth of 1000 Mbps)[a]
	Ethernet cable (category 5e or higher) length	1000BASE-T: 100 m max. (328 ft)
DC power requirements	Voltage	10–24 VDC for primary power 15–18 VDC for auxiliary power

a.   The FOCUS PX is not intended to be connected to an outdoor LAN or an outdoor Ethernet network.

7.2   Pulser and Receiver Specifications

Table 3 on page 60 and Table 4 on page 61 detail the pulser and receiver specifications of the FOCUS PX.

Table 3 Pulser specifications

Parameter	PA	UT HD
Number of focal laws	1024	N/A

Table 3 Pulser specifications *(continued)*

Parameter	PA	UT HD
Pulse output (into a 50 Ω) ±10 %	P/E: 1.37/4.0/10.9/22.0/39.4/49.8 V P/C: 1.61/4.64/12.6/26.0/51.2/68.5 V	P/E: 30/71/144 V P/C: 32/75/152 V
Pulse output (in high impedance) ±10 %	4 V, 9 V, 20 V, 40 V, 80 V, and 115 V	50 V, 100 V, and 190 V
Number of pulsers	16:64PR = 16 consecutive pulsers on the 64 elements 16:128PR = 16 consecutive pulsers on the 128 elements 32:128PR = 32 consecutive pulsers on the 128 elements	4 pulsers
Number of elements	64 (16:64PR) or 128 (16:128PR and 32:128PR)	N/A
UT channels	N/A	4 UT channels
Pulse width/step (precision of 5 ns or ±10 %, whichever is greater)	30 ns to 500 ns (steps of 2.5 ns)	30 ns to 1000 ns (steps of 2.5 ns)
Fall time	<10 ns	<16 ns
Pulse shape	Negative square pulse	Negative square pulse
Output impedance	P/E = 33 Ω P/C = 27 Ω	≈8 Ω

Table 4 Receiver specifications

Parameter	PA	UT HD
Gain range/increment	0 dB to 80 dB (46 dB analog + 34 dB digital)	0 dB to 120 dB (digital)
Gain resolution	0.1 dB	0.1 dB
Maximum input signal	920 mVp-p	24 Vp-p
Input impedance ±10 %	P/E = 55.9 Ω P/C = 98.9 Ω	P/E = 52 Ω // 230 pF P/C = 52 Ω // 174 pF
Gain precision between channels (measured at 20 dB)	0.5 dB	N/A

Table 4 Receiver specifications *(continued)*

Parameter	PA	UT HD
Crosstalk isolation between channels	>50 dB at 5 MHz	>80 dB (P/R)
Bandwidth of the system (−3 dB) ±10 %	0.9 MHz to 17.8 MHz for high-pass and band-pass filters. 0.6 MHz to 12.6 MHz for low-pass filters	0.25 MHz to 28 MHz
Pulse shape	Negative square pulse	Negative square pulse
Equivalent input noise	<35 nV/√Hz	<35 nV/√Hz

7.3   Beam Specifications

Table 5 on page 62 details the beam specifications of the FOCUS PX.

Table 5 Beam specifications

Parameter	PA	UT HD
Scan type	Linear, azimuthal, depth	N/A
Aperture quantity	1	1
Aperture size	32:128PR = 1 × 32 16:128PR = 1 × 16 16:64PR = 1 × 16	1
Element	64 (16:64PR) 128 (16:128PR and 32:128PR)	1
Delay range transmission	10 µs	N/A
Delay range reception	6.4 µs	N/A
Delay precision	2.5 ns	N/A

7.4   Data Specifications

Table 6 on page 63, Table 7 on page 63, and Table 8 on page 64 detail the data specifications of the FOCUS PX.

Table 6 Data acquisition specifications

Parameter	Specification
Elementary A/D converter	PA: 12 bits, 80 MSPS UT: 23 bits, 100 MSPS
Display A-scan resolution	8 bits
Amplitude resolution	8 bits / 12 bits
Global data throughput	Up to 30 MB/s (1 FOCUS PX) Up to 60 MB/s (2 to 4 FOCUS PX)
Maximum pulse repetition frequency (PRF)	20 kHz 25 kHz (optional)
Number of FOCUS PX in parallel	Up to 4 active FOCUS PX and 1 passive FOCUS PX
Acquisition delay	0 ms to 10 ms (steps of 10 ns) Available between FOCUS PX
Maximum number of A-scan samples	16380
Acquisition depth	163.8 µs without compression or decimation
Compression	1 to 2000
Digitizing frequency (decimation)	100, 50, 25, 12.5, 6.25, 3.125, 1.56 MHz

Table 7 Data processing specifications

Parameter	PA	UT HD
Averaging	1, 2, 4, 8, 16, 32, 64	1, 2, 4, 8, 16, 32, 64
Rectifier	RF/FW/HW+/HW−	RF/FW/HW+/HW−

Table 7 Data processing specifications *(continued)*

Parameter	PA	UT HD
Digital filtering	Band-pass 10 MHz (5–16 MHz)	Band-pass 10 MHz (5–16 MHz)
	Band-pass 12 MHz (6–18 MHz)	Band-pass 12 MHz (6–18 MHz)
	Band-pass 2 MHz (1–3.5 MHz)	Band-pass 2 MHz (1–3.5 MHz)
	Band-pass 4 MHz (2–6.5 MHz)	Band-pass 4 MHz (2–6.5 MHz)
	Band-pass 5 MHz (2.5–8 MHz)	Band-pass 5 MHz (2.5–8 MHz)
	Band-pass 8 MHz (4–12 MHz)	Band-pass 8 MHz (4–12 MHz)
	High-pass 10 MHz	High-pass 10 MHz
	High-pass 4 MHz	High-pass 4 MHz
	High-pass 6 MHz	High-pass 6 MHz
	High-pass 8 MHz	High-pass 8 MHz
	Low-pass 10 MHz	Low-pass 10 MHz
	Low-pass 2 MHz	Low-pass 2 MHz
	Low-pass 4 MHz	Low-pass 4 MHz
	Band-pass 13 MHz 5–20.5 MHz (optional)	Wide-band 13 MHz (1–25 MHz
	Band-pass 13 MHz 6–20.5 MHz (optional)	Wide-band TOFD 13 MHz (1–25 MHz)
	Band-pass 13 MHz 9.5–20.5 MHz (optional)	Low-pass TOFD 2 MHz
		Low-pass TOFD 4 MHz
		Low-pass TOFD 10 MHz

Table 8 Data synchronization specifications

Parameter	Specification
Internal clock	1 Hz to 20 kHz, 1 Hz resolution
External pace	1 Hz to 20 kHz, 1 Hz resolution
On encoder	On 2 axes divided (1 to 65 536 steps)
Conditional A-scan	Yes
Free running	1 Hz to 20 kHz, 1 Hz resolution

7.5   TCG Specifications

Table 9 on page 65 details the TCG specifications of the FOCUS PX.

Table 9 TCG specifications

Parameter	PA	UT HD
Inflexion points	32	32
Gain range / resolution	Full range: 80 dB, 0.1 dB steps High resolution: 80 dB, 0.1 dB steps	100 dB, 0.1 dB steps
Reference	Pulser or interface	Pulser or interface
Type	Full range: analog and digital High resolution: digital	Digital
TCG time range / increment	Full range: maximum slope of 20 dB/µs High resolution: maximum slope of 40 dB/10 ns	Maximum slope of 100 dB/10 ns

7.6   Specifications of the Ethernet Link

The FOCUS PX must be linked to the computer with a category 5e Ethernet cable made of unshielded twisted pairs. The maximum cable length depends on the link speed (Table 10 on page 65).

Table 10 Ethernet cable parameters and specifications

Parameter	Specification
Description	—Crossover Ethernet cable for direct connection to the computer —Standard Ethernet cable for connection to the computer through a network switch
Evident part number	Crossover cable: 60ND0001
Cable type	EIA/TIA standard, 150 Ω, unshielded, category 5e

Table 10 Ethernet cable parameters and specifications *(continued)*

Parameter	Specification
Minimum distance between nodes	0.6 m (2 ft)
Maximum cable length	1000BASE-T: 100 m (328 ft)

Precautions to be taken with the Ethernet cable

To ensure that the Ethernet cable functions properly, the untwisted portion of the twisted pairs must be kept to a maximum of 12.7 mm (0.5 in.) from the tip of the connector (Figure 7-1 on page 66).
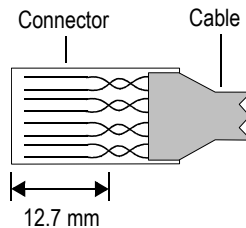

Figure 7-1 Twisted pairs in an Ethernet cable

7.7   Pulser/Receiver Differences

The pulser/receiver specifications are given by model type. The main differences between the FOCUS PX 16:128PR and 32:128PR models is the number of elements that can be used to pulse and receive signals (16 or 32). Note that these 16 or 32 elements have to be sequentially positioned on the probe for the pulse and receive element formation, but these formations can be positioned on different elements. For example, a FOCUS PX 32:128PR can pulse using elements 1 to 32 and receive using elements 33 to 64.

8.   Connector References

This chapter presents the technical description of the FOCUS PX phased array and conventional ultrasonic data acquisition instrument connectors. For each connector, you will find the following information: a brief description; the manufacturer number; the number of the corresponding cable connector; an illustration; and a table giving the specifications or the signal pinouts for the connector.

8.1   I/O Connector

Description

　　LEMO 16-pin female circular connector, IP68 rated

Manufacturer, number

　　LEMO; EEG.1K.316.CLL

　　Evident; 21AB5450

Suggested cable connector

　　LEMO; FGG.1K.316.CLAC65Z

Figure 8-1 I/O LEMO connector (weld view side)

Table 11 Pinout for the I/O LEMO connector

Pin	I/O	Signal	Description	Cable color
1	N/A	N.U.[a]	N.U.	
2	Out	ENC_+5VOUT	Open or +5 V / 300 mA max. power output	Brown
3	In	DIN1	Digital input 1 (encoder reset feature), 10K pulled high to 5 V. Resets one or both encoders as long as the input is kept high (configurable in FocusPC).	Yellow
4	In	DIN2	Digital input 2 (top turn feature), 10K pulled high to 5 V. Resets the Scan encoder when the input is pulled high (configurable in FocusPC).	Violet
5	In	DIN3	Digital input 3 (start/stop firing feature), 10K pulled high to 5 V. Stops pulsing on all groups as long as the input is kept high (configurable in FocusPC).	Gray

Table 11 Pinout for the I/O LEMO connector *(continued)*

Pin	I/O	Signal	Description	Cable color
6	In	DIN4	Digital input 4 (start/stop inspection feature), 10K pulled high to 5 V. Starts the inspection when the input is pulled high and stops the inspection when the input is pulled low (configurable in FocusPC).	Pink
7	Out	DOUT1/PaceOut	Digital output 1/pace output Dedicated pin for synchronization of pace between multiple FOCUS PX instruments	Tan
8	Out	DOUT2	Digital output 2	Red/green
9	In	PhA axis 1	Encoder 1: phase A/clock/up/down, 10K pulled high to 5 V	Red/yellow
10	In	PhB axis 1	Encoder 1: phase B/direction, 10K pulled high to 5 V	Red/black
11	In	PhB axis 2	Encoder 2: phase B/direction, 10K pulled high to 5 V	Blue
12	In	PhA axis 2	Encoder 2: phase A/clock/up/down, 10K pulled high to 5 V	White
13	Out	DOUT3	Digital output 3	Green
14	N/A	N.U.	N.U.	
15	N/A	N.U.	N.U.	

Table 11 Pinout for the I/O LEMO connector *(continued)*

Pin	I/O	Signal	Description	Cable color
16	—	Gnd	Ground	Orange

a.   N.U. = Not used

The input and output circuits and thresholds are illustrated in Figure 8-2 on page 71.

NOTE

The outputs are activated only when the FOCUS PX instrument is connected to the FocusPC software.

NOTE

It is strongly recommended to use an optocoupler with he I/O connector.
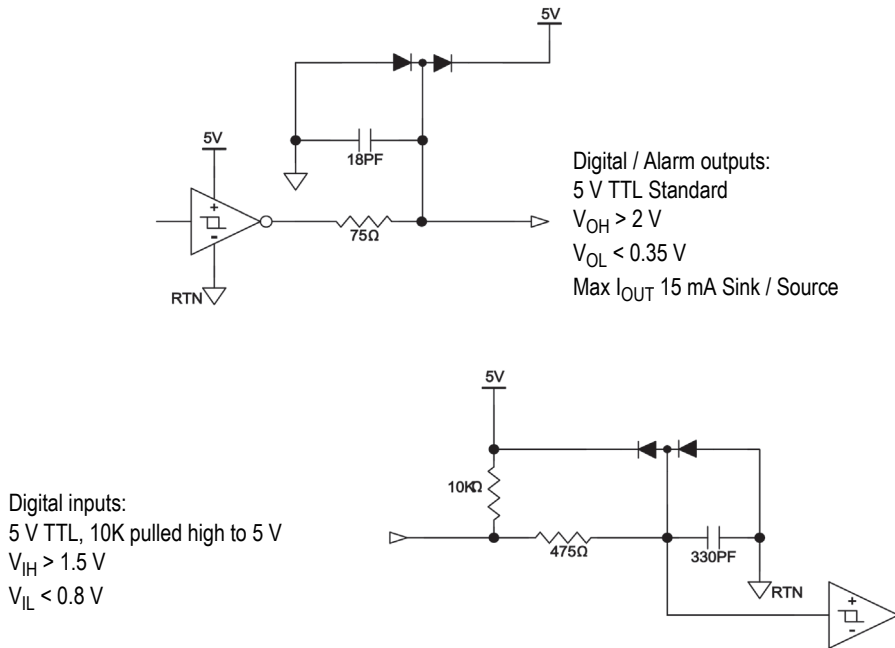
Figure 8-2 Input and output circuits and thresholds

Encoder input limit

Line driver encoder
    Rise time/fall time <300 ns

Maximum frequency
    150 kHz

Amplitude
    5 Vpp

Duty cycle
    45 %–55 %

Open collector encoder

Maximum frequency
> 40 kHz (Limited by the time constant of the input filter combined with internal 10 kΩ pull-up resistor.)

Duty cycle
> 45 %–55 %

8.2   SYNCH. IN Connector

Description
> Mixed connector (3 pins and 1 coaxial)

Manufacturer; number
> LEMO; EGG.1K.803.CLL2
> Evident; 21AB5452

Suggested cable connector; number
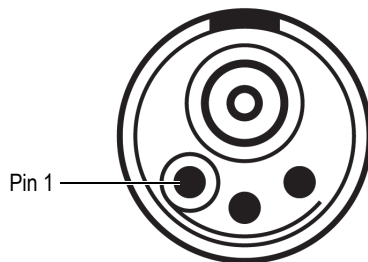> LEMO; FGG.1K.803CLAC50Z2
> Evident; 21AB5464
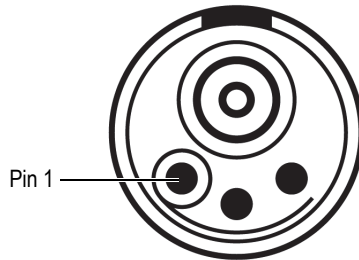
Figure 8-3 SYNCH. IN connector

Table 12 Pinout for the SYNCH. IN connector

Pin	Description
Coaxial signal	Synchronization clock input
Coaxial shield	Synchronization clock shield
1	External pace input
2	Ground
3	Reserved

8.3   DIG. OUT ALARMS Connector

Description

10-pin, female circular connector

Manufacturer; number

LEMO; EGA.1K.310.CLL
Evident; 21AB5474

Suggested cable connector; number

LEMO; FGA.1K.310.CLAC65Z
Evident; 21AB5475
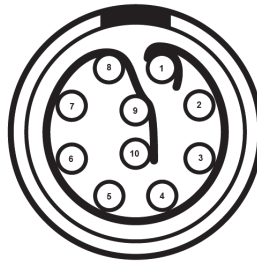
Figure 8-4 DIG. OUT ALARMS connector

Table 13 Pinout for the DIG. OUT ALARMS connector

Pin	Description	Cable color
1	System ground (return)	Brown
2	Digital output 1	Blue
3	Digital output 2	Orange
4	Digital output 3	Green
5	Digital output 4 Heartbeat signal (configurable in FocusPC software)	White
6	System ground (return)	Gray
7	Alarm output 1	Violet
8	Alarm output 2	Yellow
9	Alarm output 3	Red
10	Alarm output 4	Black

8.4 SYNCH. OUT Connector

Description

Mixed connector (3 pins and 1 coaxial)

Manufacturer; number

LEMO; EGG.1K.803.CLL2
Evident; 21AB5452

Suggested cable connector; number

LEMO; FGG.1K.803CLAC50Z2
Evident; 21AB5464

Figure 8-5 SYNCH. OUT connector

Table 14 Pinout for the SYNCH. OUT connector

Pin	Description
Coaxial signal	Synchronization clock output
Coaxial shield	Synchronization clock shield
1	External pace output
2	Ground
3	Reserved

8.5   Ethernet Connector

Description

RJ-Field RJ-45 sealed connector

Manufacturer; number

Amphenol; RJF21N
Evident; 21AC6009
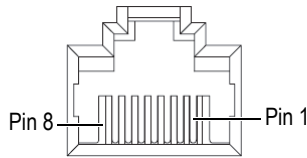
Figure 8-6 Ethernet connector

Table 15 Pinout for the Ethernet connector

Pin	Name	Description	Cable color
1	TX_D1+	Data transmission +	White and green
2	TX_D1−	Data transmission −	Green
3	RX_D2+	Data reception +	White and orange
4	BI_D3+	Bidirectional data +	Blue
5	BI_D3−	Bidirectional data −	White and blue
6	RX_D2−	Data reception −	Orange
7	BI_D4+	Bidirectional data +	White and brown
8	BI_D4−	Bidirectional data −	Brown

8.6   Primary DC Input Connector

Description

    5-pin, hermaphroditic (male and female) connector

Manufacturer; number

    LEMO; ERA.1E.305.CLL
    Evident; 21AB5449

Suggested cable connector; number

    LEMO; FFA.1E.305.CLAC65
    Evident; 21AB5455
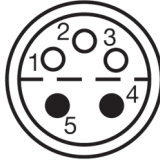
Figure 8-7 Primary DC input connector

Table 16 Pinout for the primary DC input connector

Pin	Name and voltage level	Wire gage (AWG)	Rated pin max. current (A)
1 (F)	SMB clock signal, 3.3 V LVTTL	26	7
2 (F)	SMB data signal, 3.3 V LVTTL	26	7
3 (F)	SMB alert signal, 3.3 V LVTTL	26	7
4 (M)	Positive (+) power supply, 9 V to 24 V	22	10
5 (M)	Negative (−) power supply. Also ground or return.	22	10

8.7   Auxiliary DC Input Connector

⚠️ **CAUTION**

Evident does not recommend using this connector to supply the FOCUS PX in a system or an industrial situation for permanent installation. It is mainly provided for testing purposes and lab situations. Because the auxiliary DC input connector is not waterproof, using this connector in a system or permanent environment could cause damage to the FOCUS PX.

Description

1-pin connector, male

Manufacturer; number

Molex; 73415-6580
Evident; 21AM5026
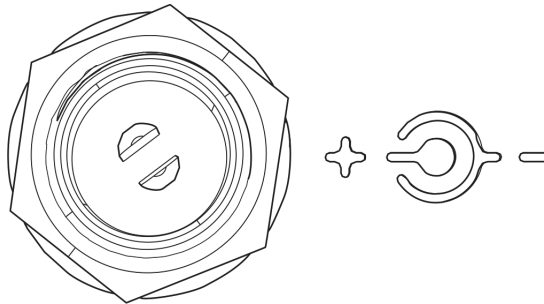
Figure 8-8 Auxiliary DC input connector

8.8   Phased Array Connector

Description

160-pin, female, MINIDOCK connector

Manufacturer; number

I-PEX; 30033-160T
Evident; 21AI0170

Suggested cable connector; number

Framatome; 89649-002
Evident; 21AI0153
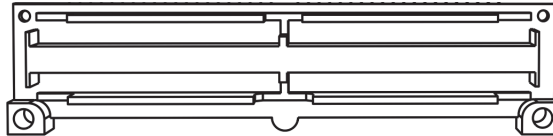
Figure 8-9 Phased array connector

8.9   UT Connectors

Description

Female, coaxial

Manufacturer; number

LEMO; VPS.00.250.CTLE31
Evident; 21AB5413

Suggested cable connector; number
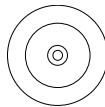
LEMO; FFC.00.250.CTAC31
Evident; 21AB0016

Figure 8-10 UT connector

Table 17 Pinout for the P and P/R connectors

Connector	I/O	Signal	Description
P1/R1 to P4/R4 P1 to P4	Input/Output	RF	The P and P/R connectors are used to transmit and receive the RF signals of four conventional ultrasound probes.

⚠️ **CAUTION**

When the FOCUS PX is used in conventional ultrasonic mode with the P and P/R connectors, the voltage present on the P and P/R connectors can be dangerous, and it represents a shock hazard.

Appendix: Software, Parts, and Accessories

⚠ **CAUTION**

Always use equipment and accessories that meet Evident specifications. Using incompatible equipment can result in a malfunction, equipment damage, or injury.

This appendix presents the software, parts and accessories that are compatible with the FOCUS PX phased array and conventional ultrasonic data acquisition instrument (see Table 18 on page 81 to Table 20 on page 87).

IMPORTANT

The software versions mentioned in Table 18 on page 81 were the versions available at the time of the publication. Subsequent qualified versions will also be compatible.

Table 18 FOCUS PX software compatibility

Model	Acquisition	Analysis
32:128PR	FocusPC 1.0	FocusPC 1.0
16:64PR	FocusPC 1.0	FocusPC 1.0
16:128PR	FocusPC 1.0	FocusPC 1.0
4UT	FocusPC 1.0	FocusPC 1.0

Table 19 FOCUS PX kits and warranties

Part number	Q number	Description
FPX-UT4	Q7750033	• FOCUS PX high performance 4-channel conventional UT acquisition instrument compatible with FocusPC 1.0 (full version) • Transport case, DC power adaptor, power cord, crossover Ethernet cable, screwdriver for bumper removal, digital input cable (5 m) [16.4 ft], digital output cable (5 m) [16.4 ft], and calibration certificate • USB flash drive which contains: — FocusPC software — Calculator software — FocusPC Viewer — FocusControl software development kit — FocusData software development kit — *FocusPC UT and Phased Array Data Acquisition and Analysis Software User's Manual* — *FocusPC UT and Phased Array Data Acquisition and Analysis Software Advanced User's Manual* — FOCUS PX *Getting Started Guide* — FOCUS PX *User's Manual*

Table 19 FOCUS PX kits and warranties *(continued)*

Part number	Q number	Description

FPX-1664PR	Q7750034	• FOCUS PX high performance 16:64 pulser receiver (PR) phased array acquisition instrument compatible with FocusPC 1.0 (full version)
		• Transport case, DC power adaptor, power cord, crossover Ethernet cable, screwdriver for bumper removal, digital input cable (5 m) [16.4 ft], digital output cable (5 m) [16.4 ft], and calibration certificate
		• USB flash drive which contains:
		  — FocusPC software
		  — Calculator software
		  — FocusPC Viewer
		  — FocusControl software development kit
		  — FocusData software development kit
		  — *FocusPC UT and Phased Array Data Acquisition and Analysis Software User's Manual*
		  — *FocusPC UT and Phased Array Data Acquisition and Analysis Software Advanced User's Manual*
		  — FOCUS PX *Getting Started Guide*
		  — FOCUS PX *User's Manual*

Table 19 FOCUS PX kits and warranties *(continued)*

Part number	Q number	Description
FPX-16128PR	Q7750035	• FOCUS PX high performance 16:128 pulser receiver (PR) phased array acquisition instrument compatible with FocusPC 1.0 (full version) • Transport case, DC power adaptor, power cord, crossover Ethernet cable, screwdriver for bumper removal, digital input cable (5 m) [16.4 ft], digital output cable (5 m) [16.4 ft], and calibration certificate • USB flash drive which contains: — FocusPC software — Calculator software — FocusPC Viewer — FocusControl software development kit — FocusData software development kit — *FocusPC UT and Phased Array Data Acquisition and Analysis Software User's Manual* — *FocusPC UT and Phased Array Data Acquisition and Analysis Software Advanced User's Manual* — FOCUS PX *Getting Started Guide* — FOCUS PX *User's Manual*

Table 19 FOCUS PX kits and warranties *(continued)*

Part number	Q number	Description

FPX-32128PR	Q7750036	• FOCUS PX high performance 32:128 pulser receiver (PR) phased array acquisition instrument compatible with FocusPC 1.0 (full version)
		• Transport case, DC power adaptor, power cord, crossover Ethernet cable, screwdriver for bumper removal, digital input cable (5 m) [16.4 ft], digital output cable (5 m) [16.4 ft], and calibration certificate
		• USB flash drive which contains:
		  — FocusPC software
		  — Calculator software
		  — FocusPC Viewer
		  — FocusControl software development kit
		  — FocusData software development kit
		  — *FocusPC UT and Phased Array Data Acquisition and Analysis Software User's Manual*
		  — *FocusPC UT and Phased Array Data Acquisition and Analysis Software Advanced User's Manual*
		  — FOCUS PX *Getting Started Guide*
		  — FOCUS PX *User's Manual*

FPX-OPT-2	Q7750043	Multiple instrument options including one synchronization cable, one Ethernet switch 8 ports, and one additional Ethernet cable for connection between Ethernet and PC
FPX-OPT-3	Q7750044	Multiple instrument options including two synchronization cables, one Ethernet switch 8 ports, and one additional Ethernet cable for connection between Ethernet and PC

Table 19 FOCUS PX kits and warranties *(continued)*

Part number	Q number	Description
FPX-OPT-4	Q7750045	Multiple instrument options including three synchronization cables, one Ethernet switch 8 ports, and one additional Ethernet cable for connection between Ethernet and PC
FPX-UPG-UT4-1664PR	Q7750037	Upgrade from FPX-UT4 to FPX-1664PR (instrument must be returned to factory for upgrade)
FPX-UPG-UT4-16128PR	Q7750038	Upgrade from FPX-UT4 to FPX-16128PR (instrument must be returned to factory for upgrade)
FPX-UPG-UT4-32128PR	Q7750039	Upgrade from FPX-UT4 to FPX-32128PR (instrument must be returned to factory for upgrade)
FPX-UPG-1664PR-16128PR	Q7750040	Upgrade from FPX-1664PR to FPX-16128PR (instrument must be returned to factory for upgrade)
FPX-UPG-1664PR-32128PR	Q7750041	Upgrade from FPX-1664PR to FPX-32128PR (instrument must be returned to factory for upgrade)
FPX-UPG-16128PR-32128PR	Q7750042	Upgrade from FPX-16128PR to FPX-32128PR (instrument must be returned to factory for upgrade)
FPX-W3-UT4	Q7750046	FPX-UT4: Two-year extended warranty contract on parts and labor. Does not include customs and duty fees. Must be purchased with equipment or during original warranty period.
FPX-W3-1664PR	Q7750047	FPX-1664PR: Two-year extended warranty contract on parts and labor. Does not include customs and duty fees. Must be purchased with equipment or during original warranty period.

Table 19 FOCUS PX kits and warranties *(continued)*

Part number	Q number	Description
FPX-W3-16128PR	Q7750048	FPX-16128PR: Two-year extended warranty contract on parts and labor. Does not include customs and duty fees. Must be purchased with equipment or during original warranty period.
FPX-W3-32128PR	Q7750049	FPX-32128PR: Two-year extended warranty contract on parts and labor. Does not include customs and duty fees. Must be purchased with equipment or during original warranty period.

Table 20 Accessories

Part Number	Q number	Description
FPX-ADP-IO-BF-LM	Q7750141	I/O connector adaptor to connect a FOCUS LT accessory on a FOCUS PX (Bendix female connector to LEMO male connector).
FPX-TC	Q7750142	FOCUS PX transport case
FPX-PC-LAPTOP-R	Q7750097	Preconfigured rugged laptop computer for connection to one or multiple FOCUS PX (including FocusPC, FocusControl, and FocusData — software licenses must be purchased separately).
FPX-PC-BENCHTOP	Q7750098	Preconfigured benchtop computer for connection to one or multiple FOCUS PX (including FocusPC, FocusControl, and FocusData — software licenses must be purchased separately).
FPX-CABLE-SYNC	Q7750143	FOCUS PX multiple instrument synchronization cable
FPX-PWR-L	Q7750144	FOCUS PX power supply with LEMO connector (country-based)

Table 20 Accessories *(continued)*

Part Number	Q number	Description
FPX-CABLE-DOUT	Q7750145	FOCUS PX digital output cable (5 m) [16.4 ft], LEMO connector on one side and open-ended on the other side
FPX-CABLE-DIN	Q7750031	FOCUS PX digital input cable (5 m) [16.4 ft], LEMO connector on one side and open-ended on the other side

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