INSTRON®

Industrial Products Group

Model KPX Static Hydraulic Universal Testing System

System Concepts Manual

M47-17036-EN Revision A

www.instron.com

The difference is measurable®

Electromagnetic Compatibility

Where applicable, this equipment is designed to comply with International Electromagnetic Compatibility (EMC) standards.

To ensure reproduction of this EMC performance, connect this equipment to a low impedance ground connection. Typical suitable connections are a ground spike or the steel frame of a building.

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Original Instructions

Corporate Headquarters

Instron
825 University Avenue
Norwood, MA 02062-2643
United States of America

European Headquarters

Instron
Coronation Road
High Wycombe, Bucks HP12 3SY
United Kingdom

Industrial Products Group

Instron
900 Liberty Street
Grove City, PA 16127
United States of America

General Safety Precautions

Materials testing systems are potentially hazardous.

Materials testing involves inherent hazards from high forces, rapid motions, and stored energy. You must be aware of all moving and operating components in the testing system that are potentially hazardous, particularly force actuators or a moving crosshead.

Carefully read all relevant manuals and observe all Warnings and Cautions. The term Warning is used where a hazard may lead to injury or death. The term Caution is used where a hazard may lead to damage to equipment or to loss of data.

Instron products, to the best of its knowledge, comply with various national and international safety standards, in as much as they apply to materials and structural testing. We certify that our products comply with all relevant EU directives (CE mark).

Because of the wide range of applications with which our instruments are used, and over which we have no control, additional protection devices and operating procedures may be necessary due to specific accident prevention regulations, safety regulations, further EEA directives or locally valid regulations. The extent of our delivery regarding protective devices is defined in your initial sales quotation. We are thus free of liability in this respect.

At your request, we will gladly provide advice and quotations for additional safety devices such as protective shielding, warning signs or methods of restricting access to the equipment.

The following pages detail various general warnings that you must heed at all times while using materials testing equipment. You will find more specific Warnings and Cautions in the text whenever a potential hazard exists.

Your best safety precautions are to gain a thorough understanding of the equipment by reading your instruction manuals and to always use good judgment.

It is our strong recommendation that you should carry out your own product safety risk assessment.

Warnings

Hazard - Press the Emergency Stop button whenever you consider that an unsafe condition exists.

The Emergency Stop button removes hydraulic power or electrical drive from the testing system and brings the hazardous elements of the system to a stop as quickly as possible. It does not isolate the system from electrical power, other means are provided to disconnect the electrical supply. Whenever you consider that safety may be compromised, stop the test using the Emergency Stop button. Investigate and resolve the situation that caused the use of the Emergency Stop button before you reset it.

Flying Debris Hazard - Make sure that test specimens are installed correctly in grips or fixtures in order to eliminate stresses that can cause breakage of grip jaws or fixture components.

Incorrect installation of test specimens creates stresses in grip jaws or fixture components that can result in breakage of these components. The high energies involved can cause the broken parts to be projected forcefully some distance from the test area. Install specimens in the center of the grip jaws in line with the load path. Insert specimens into the jaws by at least the amount recommended in your grip documentation. This amount can vary between 66% to 100% insertion depth; refer to supplied instructions for your specific grips. Use any centering and alignment devices provided.

Hazard - Protect electrical cables from damage and inadvertent disconnection.

The loss of controlling and feedback signals that can result from a disconnected or damaged cable causes an open loop condition that may drive the actuator or crosshead rapidly to its extremes of motion. Protect all electrical cables, particularly transducer cables, from damage. Never route cables across the floor without protection, nor suspend cables overhead under excessive strain. Use padding to avoid chafing where cables are routed around corners or through wall openings.

High/Low Temperature Hazard - Wear protective clothing when handling equipment at extremes of temperature.

Materials testing is often carried out at non-ambient temperatures using ovens, furnaces or cryogenic chambers. Extreme temperature means an operating temperature exceeding 60 °C (140 °F) or below 0 °C (32 °F). You must use protective clothing, such as gloves, when handling equipment at these temperatures. Display a warning notice concerning low or high temperature operation whenever temperature control equipment is in use. You should note that the hazard from extreme temperature can extend beyond the immediate area of the test.

Warnings

Crush Hazard - Take care when installing or removing a specimen, assembly, structure, or load string component.

Installation or removal of a specimen, assembly, structure, or load string component involves working inside the hazard area between the grips or fixtures. When working in this area, ensure that other personnel cannot operate any of the system controls. Keep clear of the jaws of a grip or fixture at all times. Keep clear of the hazard area between the grips or fixtures during actuator or crosshead movement. Ensure that all actuator or crosshead movements necessary for installation or removal are slow and, where possible, at a low force setting.

Hazard - Do not place a testing system off-line from computer control without first ensuring that no actuator or crosshead movement will occur upon transfer to manual control.

The actuator or crosshead will immediately respond to manual control settings when the system is placed off-line from computer control. Before transferring to manual control, make sure that the control settings are such that unexpected actuator or crosshead movement cannot occur.

Robotic Motion Hazard - Keep clear of the operating envelope of a robotic device unless the device is de-activated.

The robot in an automated testing system presents a hazard because its movements are hard to predict. The robot can go instantly from a waiting state to high speed operation in several axes of motion. During system operation, keep away from the operating envelope of the robot. De-activate the robot before entering the envelope for any purpose, such as reloading the specimen magazine.

Hazard - Set the appropriate limits before performing loop tuning or running waveforms or tests.

Operational limits are included within your testing system to suspend motion or shut off the system when upper and/or lower bounds of actuator or crosshead travel, or force or strain, are reached during testing. Correct setting of operational limits by the operator, prior to testing, will reduce the risk of damage to test article and system and associated hazard to the operator.

Electrical Hazard - Disconnect the electrical power supply before removing the covers to electrical equipment.

Disconnect equipment from the electrical power supply before removing any electrical safety covers or replacing fuses. Do not reconnect the power source while the covers are removed. Refit covers as soon as possible.

Warnings

Rotating Machinery Hazard - Disconnect power supplies before removing the covers to rotating machinery.

Disconnect equipment from all power supplies before removing any cover which gives access to rotating machinery. Do not reconnect any power supply while the covers are removed unless you are specifically instructed to do so in the manual. If the equipment needs to be operated to perform maintenance tasks with the covers removed, ensure that all loose clothing, long hair, etc. is tied back. Refit covers as soon as possible.

Hazard - Shut down the hydraulic power supply and discharge hydraulic pressure before disconnection of any hydraulic fluid coupling.

Do not disconnect any hydraulic coupling without first shutting down the hydraulic power supply and discharging stored pressure to zero. Tie down or otherwise secure all pressurized hoses to prevent movement during system operation and to prevent the hose from whipping about in the event of a rupture.

Hazard - Shut off the supply of compressed gas and discharge residual gas pressure before you disconnect any compressed gas coupling.

Do not release gas connections without first disconnecting the gas supply and discharging any residual pressure to zero.

Explosion Hazard - Wear eye protection and use protective shields or screens whenever any possibility exists of a hazard from the failure of a specimen, assembly or structure under test.

Wear eye protection and use protective shields or screens whenever a risk of injury to operators and observers exists from the failure of a test specimen, assembly or structure, particularly where explosive disintegration may occur. Due to the wide range of specimen materials, assemblies or structures that may be tested, any hazard resulting from the failure of a test specimen, assembly or structure is entirely the responsibility of the owner and the user of the equipment.

Hazard - Ensure components of the load string are correctly pre-loaded to minimize the risk of fatigue failure.

Dynamic systems, especially where load reversals through zero are occurring, are at risk of fatigue cracks developing if components of the load string are not correctly pre-loaded to one another. Apply the specified torque to all load string fasteners and the correct setting to wedge washers or spiral washers. Visually inspect highly stressed components such as grips and threaded adapters prior to every fatigue test for signs of wear or fatigue damage.

Table of Contents

Chapter 1
Introduction

About these instructions

These instructions provide additional information beyond what is necessary to operate the various models of the KPX testing systems. These instructions are intended for a laboratory or facilities supervisor, or Instron service personnel.

These instructions assume the following:

- You are an operator familiar with the operation of materials testing systems in general.
- Your system has been installed in its final location according to the requirements outlined in the system's Pre-Installation Manual.
- Your system consists of a frame, a hydraulic power supply, a control unit, a computer system with an Instron materials testing software package, and any testing accessories necessary to secure the specimen in the test space.
- Software test methods that are appropriate for your testing requirements are available.

These instructions do not include the development of test methods within the materials testing software. This is covered in more advanced training that can be provided by Instron Service and Training departments.

Throughout your documentation are NOTE, CAUTION and WARNING statements that alert you to important information. They appear as follows:

Notes provide further clarification on particular issues.

Caution

Cautions alert the user to situations that may cause equipment damage.

Warning

Warnings alert the user to situations that may cause serious personal injury or death.

System overview

Purpose

Warning

If the equipment is used in a manner not specified by Instron, the protection provided by the equipment may be impaired. Injury to personnel or damage to the system may result. Be sure to read and understand the material presented in these instructions and in any other accompanying instructions.

The Instron Model KPX Static Hydraulic Universal Testing Systems are available in a variety of capacities. They are ideally suited for tension, compression, bend, shear, flexure and static cyclic testing on high strength materials. These frames feature a single, large test space and long test stroke that, together, provide users with great flexibility in the specimen size that can be tested and in the grips, fixtures and extensometry that can be used for the test.

System components

Model KPX systems consist of:

- Frame
- Hydraulic Power Supply (HPS)
- 59 Series control unit and other system controls and electronics
- Instron approved computer system with Instron materials testing software

Figure 1 identifies the system components and various frame configurations (see “Frame configuration options” on page 12).

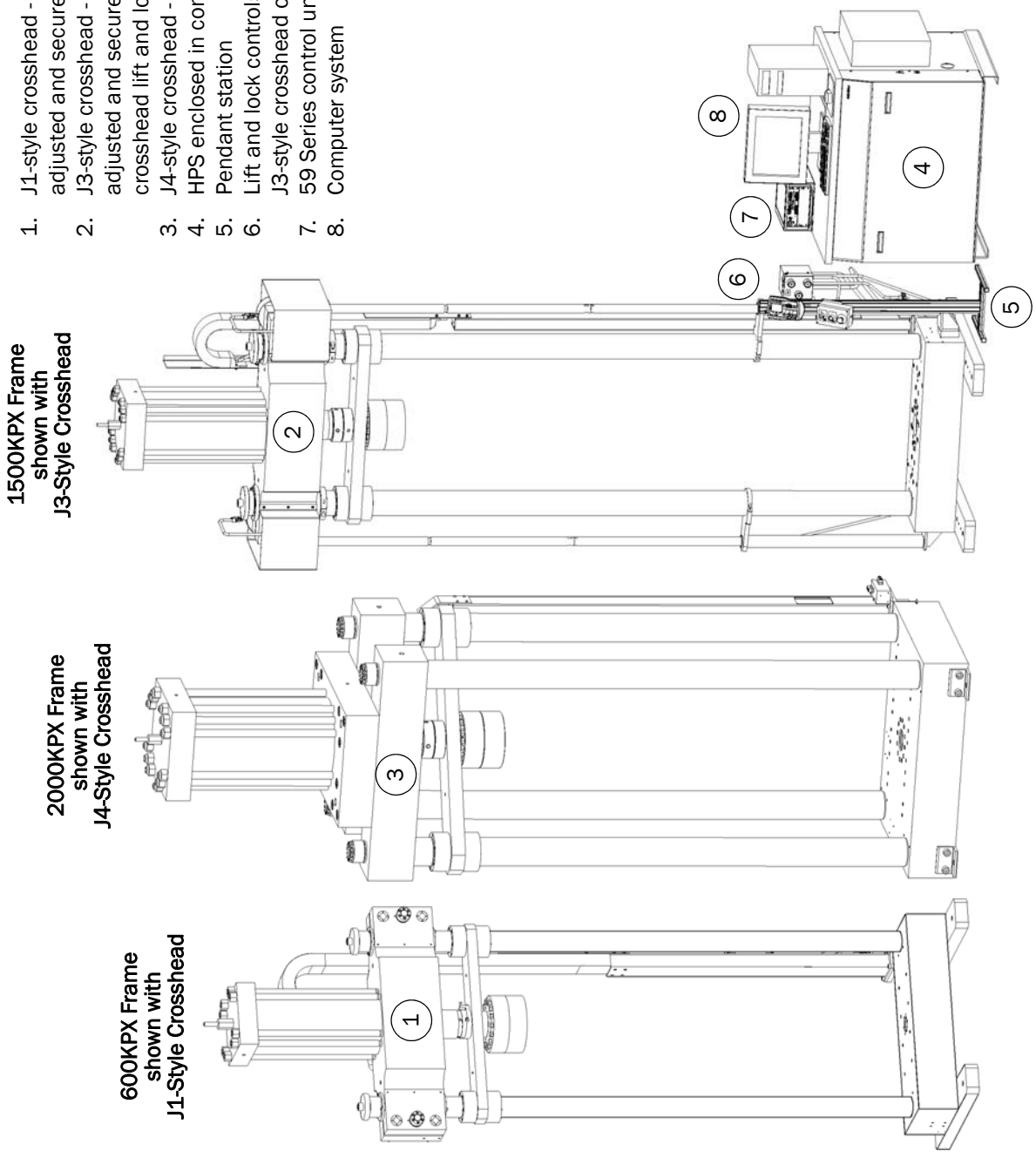

Figure 1. KPX testing systems - various configurations shown.

Frame configuration options

Frames can be configured with a variety of options. These options include:

- Crosshead variations:
  - J1-style crosshead - Crosshead adjusted and secured manually
  - J3-style crosshead - Crosshead adjusted and secured with hydraulic crosshead lift and lock cylinders
  - J4-style crosshead - Fixed crosshead
- Test opening variations:
  - A - Basic test opening
  - B - Increase vertical test space by 305 mm (12 in)
  - C - Increase vertical test space by 610 mm (24 in)
  - D - Increase vertical test space by 915 mm (36 in)
- Load cell options for 600KPX:
  - L1 - Tension/compression load cell with capacity of 300 kN (67,500 lbf)
  - L2 - Tension/compression load cell with capacity of 400 kN (90,000 lbf)
  - L3 - Tension/compression load cell with capacity of 600 kN (135,000 lbf)

The configuration options selected for your frame are identified in the complete model number of the frame. The complete model number is defined as:

{Capacity (in kN)}{Model family}-{Crosshead style option}{Test opening option}-{Load cell option}

Some examples would be:

600KPX-J1D-L2, 600KPX-J3B-L3, 1000KPX-J3D, 1500KPX-J1D, 2000KPX-J3D

It is very important to be aware of and understand the configuration of your frame as you perform various operations and procedures so that they can be performed correctly - the complete model number (in whole or in part) is used throughout this manual to identify specifications and procedures appropriate for your frame configuration. Knowing the complete model number of your frame is critical. To determine the complete model number (and thus configuration) of your frame, refer to one of the following:

- The frame serial tag (see “System identification” on page 13)
- The Instron quote

Testing accessories

Testing accessories are purchased separately from the frame. Testing accessories either provide a means to secure the specimen in the test space or provide additional functionality to the frame. Instructions on the installation, use and maintenance of Instron testing accessories are provided separately with each testing accessory. A variety of testing accessories are available. Contact your Instron Sales Representative for more information.

System identification

Your system has been given a unique serial number for system identification. This serial number can be found on the serial tag located on the rear of the frame (i.e. the frame serial tag). A duplicate serial tag can also be found on the rear of the HPS console.

In addition, the following components have also been given a unique serial number:

- **59 Series control unit** - This serial number can be found on the rear of the control unit.
- **HPS** - This serial number can be found on the rear of the HPS (rear cover of console must be removed).

The frame serial tag includes other important system information, including information on your frame's configuration. Frame configuration information can also be found on your Instron quote. Refer to "Frame configuration options" on page 12 for explanation of frame configuration.

Product support

Instron provides documentation, including manuals and online help, that can answer many of the questions you may have. It is recommended that you review the documentation sent with the system you purchased for possible solutions to your questions.

If you cannot find answers in these sources, contact Instron's Services department directly. A list of Instron offices is available on our website at www.instron.com. You may email your questions to service_support@instron.com (if your system is still in warranty, please include "IPG Warranty" in the subject line). In the US and Canada, you can call directly at 1-800-473-7838.

Product documentation

Instron offers a comprehensive range of documentation to help you get the most out of your Instron products. Depending on what you have purchased, your documentation may include some or all of the following:

Pre-Installation Manual	Information about preparing your site for installation of the system, receiving the system, and lifting and handling of the system.
Operating Instructions	How to use your system components and controls, and other frequently performed operating tasks.
System Concepts	Additional information about your system.
Online Help	Software products come complete with context sensitive help, which provides detailed information on how to use all software features.
Accessory Equipment Reference	How to set up and use any accessories you have purchased, for example grips, fixtures, extensometers, transducers, hydraulic power units, non-standard actuators, and environmental chambers.

We welcome your feedback on any aspect of the product documentation. Please email info_dev@instron.com with your comments.

Calibration and verification

Before shipment from the factory, your system is calibrated and tested to ensure that it meets its performance specifications. The factory calibration is traceable to national standards, but is not a full calibration meeting all the requirements of the relevant ISO and ASTM standards. ISO 7500-1 and ASTM E4 both state that a calibration must be performed after installation for it to meet their standard. This helps ensure that any changes in calibration during shipment are corrected before any test data is taken. These standards also recommend that verifications are performed annually or whenever the system is moved.

Service Agreements/Contracts

In many countries and territories Instron Service offers a variety of service agreements and contracts to cover such things as annual verification, maintenance, repair coverage, and hotline support for your system. Contact your local Instron office for details on a service agreement or contract that best matches your needs. A listing of Instron offices can be found on the Instron web site at www.instron.com.

Calibration Upon Installation

ASTM, ISO, and EN standards require the system be calibrated when it is installed or when it is moved or relocated. Instron calibrates the system at the factory, and provides a record of readings for the load cell. This frame may be verified on-site to ASTM E-4, BS 1610, DIN 51221, ISO 7500/1, EN 10002-2, JIS B7721, JIS B773 or AFNOR A03-501 standards. The factory calibration is not a complete verification to any current version of any of the above standards. Installation and Basic Software training are included with the purchase of your system. Verification services are available at a reduced rate if performed as part of the installation, but must be purchased separately. Contact your local Instron office for more information about our on-site verification services. Refer to “Calibration Services” below for more information about Instron’s calibration services.

Calibration Services

In addition to the initial calibration service available at installation, Instron recommends verifying your transducers on a regular schedule (at least annually) to ensure that your system operates properly and meets ISO and ASTM standards.

Instron’s Professional Services Department provides a wide range of calibration services including:

- Force
- Strain
- Torsion
- Temperature
- Crosshead displacement
- Crosshead speed

Contact your local Instron office for more information about our on-site verification services. Refer to “Product support” on page 14 for Instron’s contact information.

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Chapter 2
Installation Notes

Existing transducer rationalization

If you will be using existing extensometers or low-range load cells with your new system, the additional transducers may need to be rationalized in order to work correctly with the new system. Contact your local Instron office for more information about our on-site rationalization services. Refer to "Product support" on page 14 for Instron's contact information.

If factory rationalization was purchased, these transducers will be requested 2-3 weeks prior to shipment of the system in order to integrate them. Some instruments can be rationalized separately from the shipment of the system, if necessary, to maintain your testing commitments. Contact your local Instron office for more information.

Field rationalization of some transducers is also available, though it is a more expensive option. This is often preferable because it will allow using the instrument on your existing system until the new system is installed.

Computer system - ethernet card availability

The system uses an Ethernet Frame Interface (EFI) to provide communication between the 59 Series control unit and the computer system. The EFI is housed inside the 59 Series control unit. Use of this EFI requires an Ethernet card in the computer system:

- If a new computer system is purchased as part of the testing system and is supplied from the factory, then the computer includes two Ethernet ports - one for use with the EFI and one for normal network use. The computer system is ready for use and no preparation is required.
- If the computer system is customer supplied, then it must include at least one Ethernet port for use with the EFI and, if the computer will be connected to a network, then it must include a second Ethernet port. Be sure the Ethernet cards/ports are installed in the computer.

The second Ethernet port must be used exclusively for communications between the computer and the 59 Series control unit. If you want to connect the computer to a network, you will need to use the first (Motherboard) Ethernet port or install an additional Ethernet card. Contact your IT department or Instron service for assistance if required.

Interconnections

The following interconnection information is provided for reference. It is not intended to be a complete step-by-step installation procedure, but it does provide a general guideline of what and how system components should be interconnected. Depending on the components supplied with your system, all the interconnections listed may not be necessary for your system. This list may also be used as a reference if it becomes necessary to move the system or frame at a later date.

Hydraulic interconnections

It is necessary to connect the supplied hydraulic hoses between the HPS and the frame. Multiple connections may be necessary depending on system configuration or options purchased. Table 1 provides the connection information.

Table 1. Hydraulic connections between frame and HPS.

Make Connections For:	Hose Description	Connection on Frame Manifold (See Figure 2)	Connection on HPS Panel (See Figure 3)
All frames	Hydraulic cylinder pressure/return hose (rod end)	A	2
	Hydraulic cylinder pressure/return hose (piston end)	B	4
Frames with hydraulic crosshead lift and lock cylinders (J3 option)	Lift and lock pressure hose	PRESSURE	1
	Lift and lock return hose	RETURN	3
Frames with optional high capacity hydraulic grips	Grips pressure hose	Refer to the grip's "Installation Drawing" (supplied separately) for connections	5
	Grips return hose		6

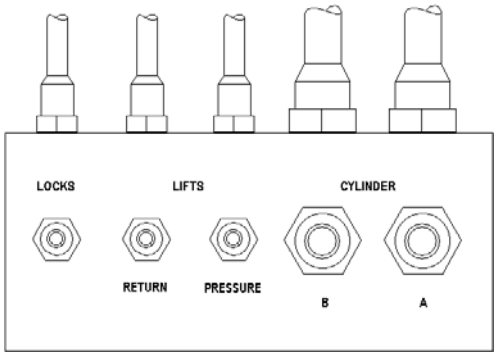
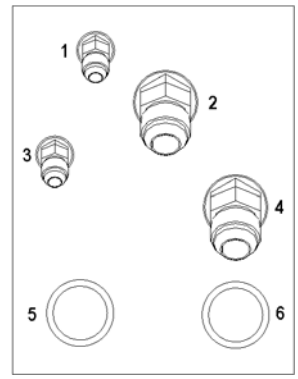
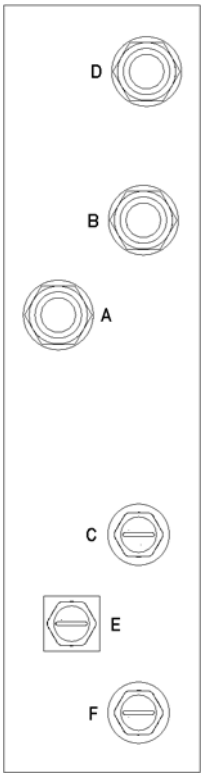


Figure 2. Frame manifold connections - located on base of frame.



Hydraulic connections
1 through 6
(typical connections
shown, not all connections
may be used by your
system)



Electric connections
A through F

Figure 3. HPS connection panels.

Electrical interconnections

Before making electrical interconnections, all system components (including the 59 Series control unit, pendant station and computer system) should be unpacked and in place at the installation site. Also, the computer system components can and should be interconnected as outlined by the computer manufacturer. Check the electrical nameplate of each computer component and connect to an appropriate power source.

Refer to Table 2, Figure 3 and Figure 4 as you step through the interconnection process.

Electrical cables that connect to components on the frame are routed through the flexible track that is mounted at the rear of the frame, so these connections are made at the bottom of the flexible track.

Table 2. Electrical connections required.

Cable	Connect From	Connect To
Ethernet crossover cable, male RJ45	Auxiliary Ethernet connection on rear of computer	Ethernet connection on front of 59 Series control unit (see Figure 4)
User control panel cable, female 7-pin	User control panel (typically hardwired)	Connection **N** on rear of 59 Series control unit
HPS control box cable, male 15-pin	HPS control box (typically hardwired)	Connection **M** on rear of 59 Series control unit
HPS emergency stop cable, male 6-pin	HPS control box (typically hardwired)	Connection **F** on HPS connection panel
HPS cable, male 14-pin	Connection **A** on rear of 59 Series control unit	Connection **A** on HPS connection panel
Frame cable, male 10-pin	Junction box on frame (typically hardwired)	Connection **R** on rear of 59 Series control unit
Load transducer cable, male 25-pin	**LOAD** connection on front of 59 Series control unit	Load transducer on frame
Position cable, male 9-pin	Connection **H** on rear of 59 Series control unit	Position encoder on frame[1]
For systems that include an optional enclosure Interlock cable	Junction box on frame - usually needs to be hardwired	Enclosure interlocks - typically routed along inside of enclosure to its exit point
Ground cable	Ground stud on rear of 59 Series control unit	Ground stud on frame
Power cable for 59 Series control unit	Power module on rear of 59 Series control unit	Appropriate outlet or power strip
HPS main power cable	Connection **D** on HPS connection panel	Customer power supply of appropriate rating
For systems that include an optional AVE video extensometer Coaxial cable, male BNC	**SYNC** (BNC) connection on front of 59 Series control unit (see Figure 4)	BNC connection on AVE extensometer
For systems that include the optional Versachannel or Multichannel Coaxial cable, male BNC	**SYNC** (BNC) connection on front of 59 Series control unit (see Figure 4)	BNC connection on the Versachannel or Multichannel box

Table 2. Electrical connections required. (Continued)

Cable	Connect From	Connect To
For systems that include the optional Expansion Channel Module 68-Way mini-D cable	Expansion port on front of 59 Series control unit (see Figure 4)	X1 connection on rear of Expansion Channel Module box

1. If the position cable was not connected to the position encoder as stated in Chapter 4 of the System Pre-Installation Manual (supplied separately), then the position cable must be connected now.

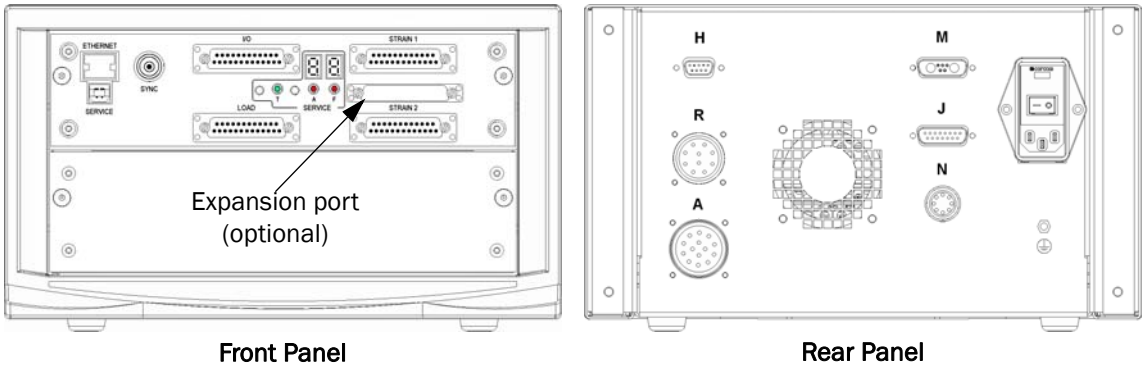


Figure 4. 59 Series control unit connection panels.

Software and computer setup

When a new computer system is purchased as part of the testing system and is supplied from the factory, or if a customer supplied computer was returned to the factory for integration with the system, then the computer system and controlling software were set up at the factory before shipment. If either of these is the case with your system, this portion of the installation procedures is not required, continue system installation with "Initial startup" on page 27.

If the computer system is supplied such that it will be integrated into the system at the customer's facility, then it is necessary to load and set up the controlling software and to set up the computer system for communication.

Load software

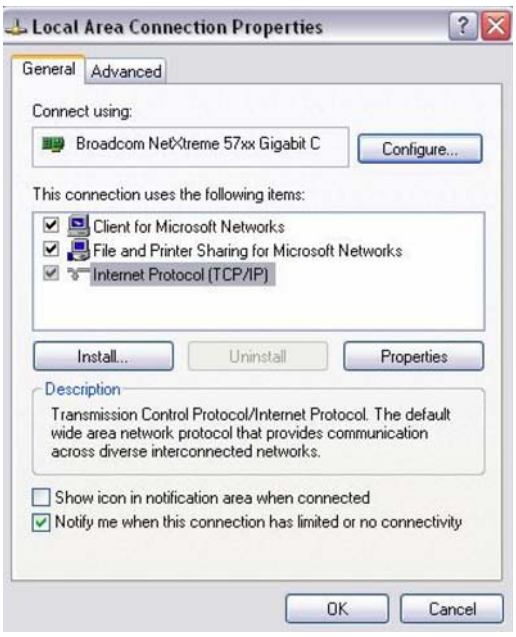
Follow procedures provided with the Materials Testing Software CD.

Communication setup

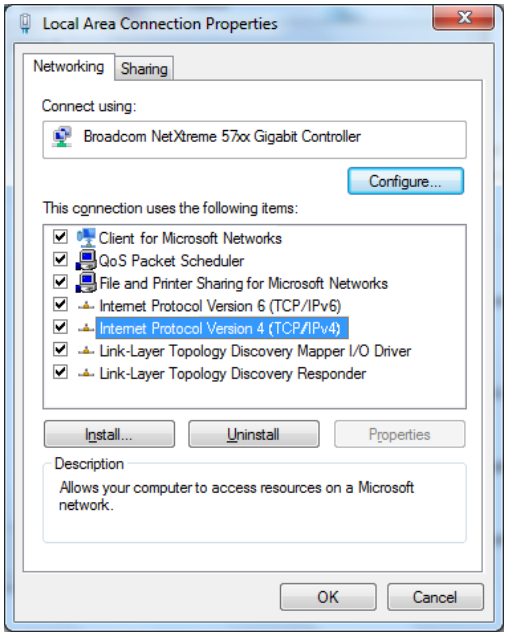
Recommended procedure:

1. Turn the power switch on the rear of the 59 Series control unit to ON (|).
2. Turn on the computer and perform the following to set up the network:
   a. In Windows, choose the network connections tool per your operating system:
      i. In **Windows XP** it is found under **Start/Control Panel**. Select the network card associated with the EFI; right click on it and select **Properties**. The Properties window will open. Select "Internet Protocol (TCP/IP)" and click on ***Properties*** (Figure 5).
      ii. In **Windows 7** it is found under **Start/Control Panel/Network and Internet/Network and Sharing Center**. Click the **Local Area Connection** link for the network card associated with the EFI. The Properties window will open. Select "Internet Protocol Version 4 (TCP/IPv4)" and click on ***Properties*** (Figure 5).
   b. On the Internet Protocol (TCP/IP) Properties window (see Figure 6) you must manually assign an IP address to the NIC card installed in the PC. Select the "Use the following IP address" radio button. Set the IP address to **169.254.1.2**. The Subnet mask should populate with **255.255.255.0**; if it does not, manually type it into the Subnet mask field. The Default gateway field can remain blank.
   c. Click ***OK*** to exit the window.
3. Check that the lights on the front of the 59 Series control unit are illuminated as follows:
   - **T** indicator of the **SERVICE** display is green
   - **A** indicator of the **SERVICE** display is blinking red

If the **SERVICE** *display flashes the letter "F" during startup, it indicates that an error has occurred. Refer to "Troubleshooting" on page 47 for more information.*



Windows XP operating system



Windows 7 operating system

Figure 5. Local area connection properties.

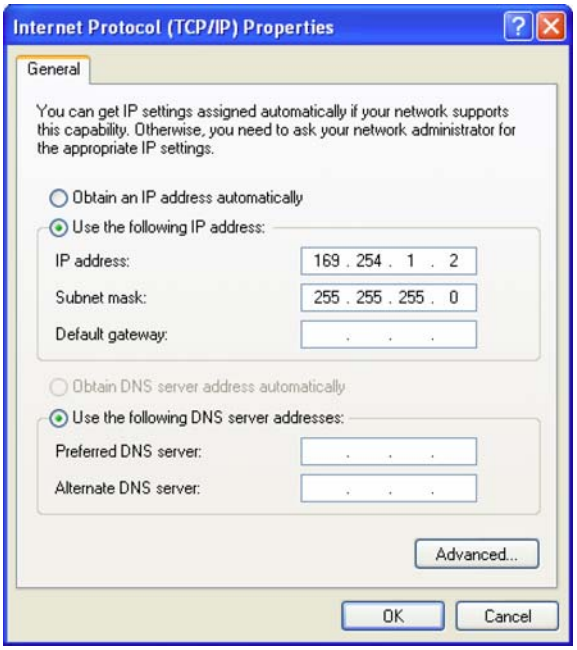


Figure 6. Internet protocol properties.

4. Check that the lights on the user control panel are illuminated as follows:
   - **POWER** is green
   - **FRAME STANDBY** is red
   - **TEST STOPPED** is red
5. Set up the controlling software to communicate via the Ethernet card that was previously installed. The procedure is dependent on which controlling software is used with the system, Partner or Bluehill. Perform the procedure for your software:
   a. For systems with **Partner** software, perform the following:
      i. Start Partner.
      ii. From the Home screen, select **Tools** in the menu. (Ensure no procedures are open.)
      iii. Select **Configure** from the drop-down menu.
      iv. Select **Controller** to view the controller setup window.
      v. On the General tab, verify the correct controller is selected (Figure 7).

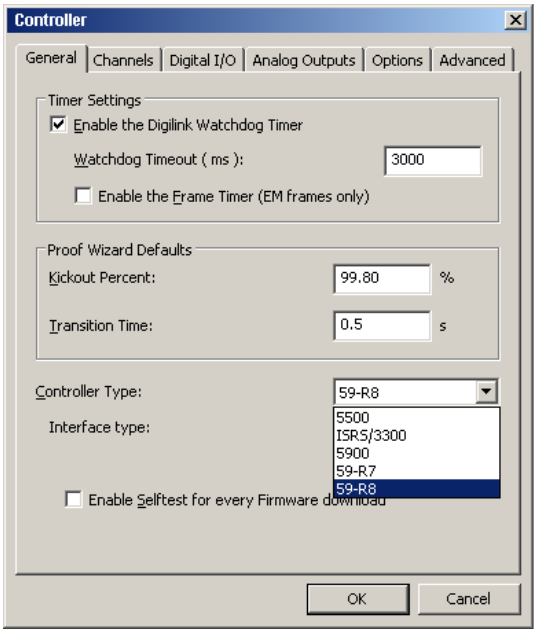


Figure 7. Partner controller type selection.

      vi. Select **Ethernet** as the Interface type (Figure 8); a third box appears for the MAC address.
      vii. In addition to an IP address, the EFI uses a unique MAC address. Click the Find button next to the MAC address field; the software will search for the device, get the MAC address and populate the field. Alternately, you can enter the MAC address manually. The MAC address can be found on the label affixed to the front of the 59-Series control unit (usually below the Ethernet connection). The MAC address is case sensitive. The first six digits (00-90-C2) indicate that the EFI is an Instron device. The last six digits are unique to that EFI to ensure that Partner only communicates with that specific EFI (Figure 9).
      viii. Click ***OK*** to exit the window.
      ix. Exit Partner and then restart Partner for the changes to take effect.

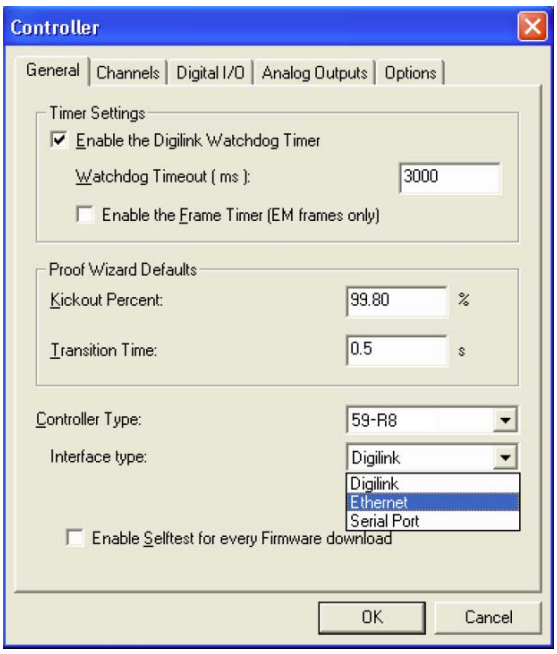


Figure 8. Partner interface type selection.

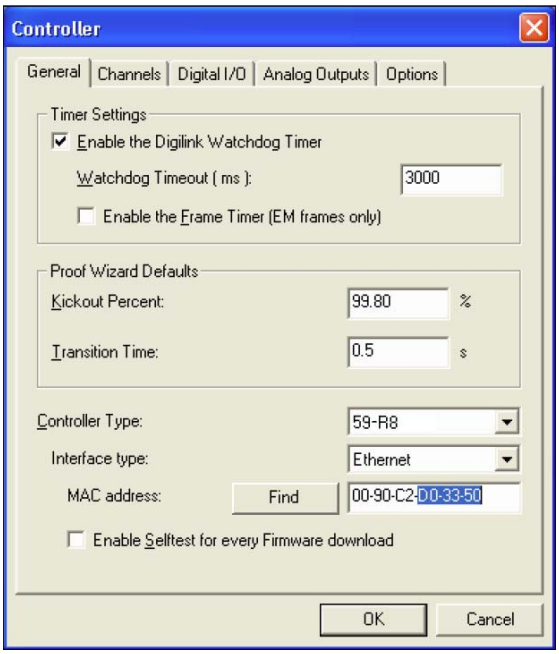


Figure 9. Partner MAC address entry.

b. For systems with **Bluehill** software, perform the following:

   i. Start Bluehill.

   ii. Select the **Admin** button. (Ensure no methods are open.)

   iii. On the Admin page, select **Configuration**.

iv. Select **Frame** in the navigation bar (see Figure 10).

v. Select the Controller type according to the **Controller Type** that is indicated on the front of the Bluehill CD case.

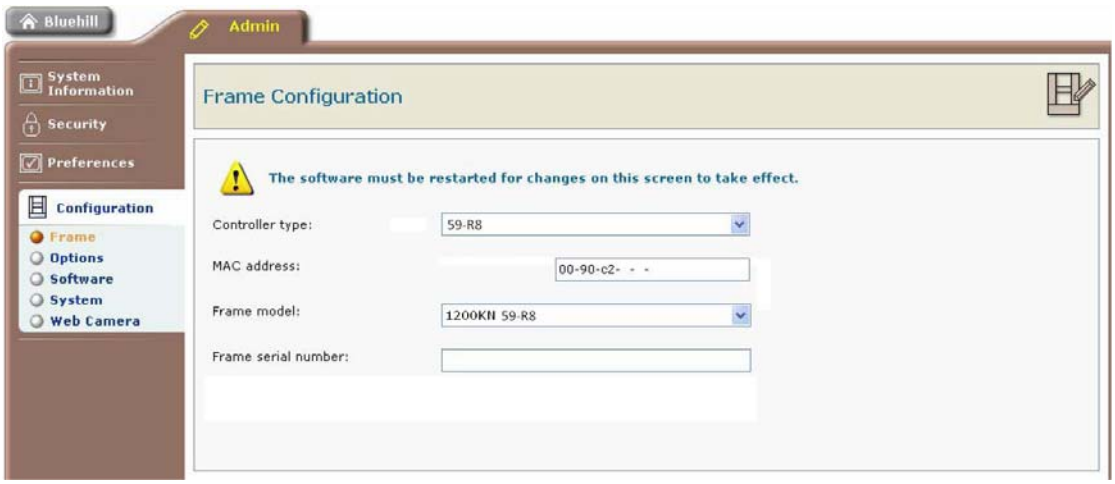


Figure 10. Bluehill frame configuration.

vi. Enter the MAC address; the MAC address is case sensitive. In addition to an IP address the EFI uses a unique MAC address, which can be found on the label affixed to the front of the 59-Series control unit (usually below the ethernet connection). The first six digits (00-90-C2) indicate that the EFI is an Instron device. The last six digits are unique to that EFI to ensure that Bluehill only communicates with that specific EFI.

vii. Select the Frame model according to the **Frame Selection** that is indicated on the front of the Bluehill CD case.

viii. Enter the Frame serial number.

ix. Close the Admin window.

x. Exit Bluehill and then restart Bluehill for the changes to take effect.

Initial startup

Equipment required

- A torque wrench (supplied)
- A ratchet wrench (supplied)
- A 6 mm hex key (supplied)
- All tools **for your frame model** that are listed in Table 3

Table 3. Tools required per frame model.

Frame Model	Instron Supplied Tools	Customer Supplied Tools
600KPX-J3	• 5/16 in hex-bit socket • 27 mm hex-bit socket	3/4 in square-drive wrench[1]
1000KPX-J3	• 5/16 in hex-bit socket • 36 mm socket • Piece of 36 mm hex stock	1 in square-drive wrench[1]
1500KPX-J3	• 3/8 in hex-bit socket • 36 mm socket • Piece of 36 mm hex stock	1 in square-drive wrench[1]
2000KPX-J3	• 3/8 in hex-bit socket • Spanner wrench • 36 mm socket • Piece of 36 mm hex stock • 6 mm hex key	1 in square-drive wrench[1]

1. The wrench must have a handle length (or extension) that provides enough leverage to loosen a bolt that has been tightened up to 810 N-m (600 lbf-ft) - a handle length (or extension) of 1 m (40 in) or longer is recommended.

Recommended procedure

1. Verify that the following have been completed:
   - The frame is secured to the foundation (if required)
   - The HPS reservoir is filled with the appropriate amount and type of oil
   - The air breather assembly is installed on the fill hole of the HPS reservoir
   - All system interconnect cables are installed and have secure connections
   - All Operating Instructions and accompanying documentation for the system have been read and understood by the operator
   - Any shipping hardware (typically painted red) has been removed from the frame
   - For systems that have optional high-capacity external grips mounted in the test space, verify that the grip brackets have been removed from between the upper and lower grips
2. Locate the Operating Instructions that were supplied with the system. You will be required to refer to procedures and information that are provided in the Operating Instructions as you perform the initial startup.

3. Ensure that the test space is clear - there should be no fixtures installed in the test space. This would **exclude** any fixtures that were installed at the factory and remained in the test space for shipment. These fixtures can remain in the test space. Also ensure that there is no shipping hardware on the frame.
4. Ensure that the HPS is turned off.
5. For frames with a J3-style crosshead (crosshead lift and lock cylinders), perform the following. Otherwise go to step 6.
   a. Ensure that the crosshead support collars are positioned as shown in Figure 11. These collars will support the crosshead during this portion of the procedure and it is imperative that they are located as shown and are tightened to the required torque (see Table 4).

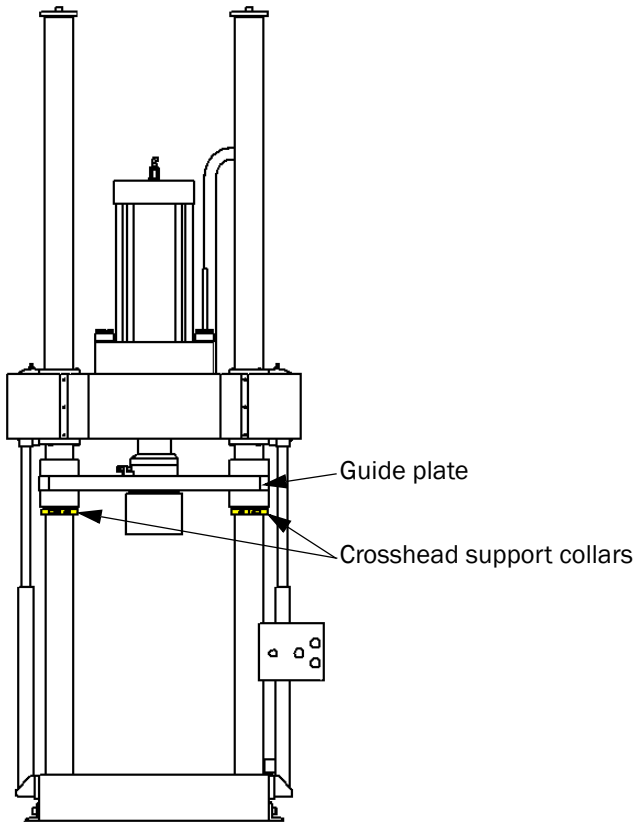


Figure 11. Location of crosshead support collars.

   b. **For 2000KPX frames:** Remove the covers from the lock cylinders, see Figure 12. Each cover is held in place by five M8 socket head cap screws. Loosen and remove the cap screws (use 6 mm hex key).
   c. Unclamp the crosshead lock cylinders using the controls on the lifts and locks control unit.
   d. Loosen each clamp bolt (see Figure 12) (use the tool(s) listed in Table 3 for your frame model) until the following occurs:
      - **For all frames except 2000KPX frames:** There is a gap between the bolt head and piston.
      - **For 2000KPX frames:** There is a gap between the clamp nut and piston.

e. Tighten each clamp bolt (or nut for 2000KPX frames) until it makes complete contact with the piston.

f. **For 2000KPX frames:** Tighten the setscrew of each clamp nut (use 6 mm hex key) (see Figure 12).

g. Clamp the crosshead lock cylinders.

h. Install the provided covers over the lock cylinders, refer to "Install covers for crosshead lock cylinders - J3-style crosshead" on page 31.

6. Perform the "System Startup" procedure provided in Chapter 3 of the Operating Instructions that were supplied with the system.

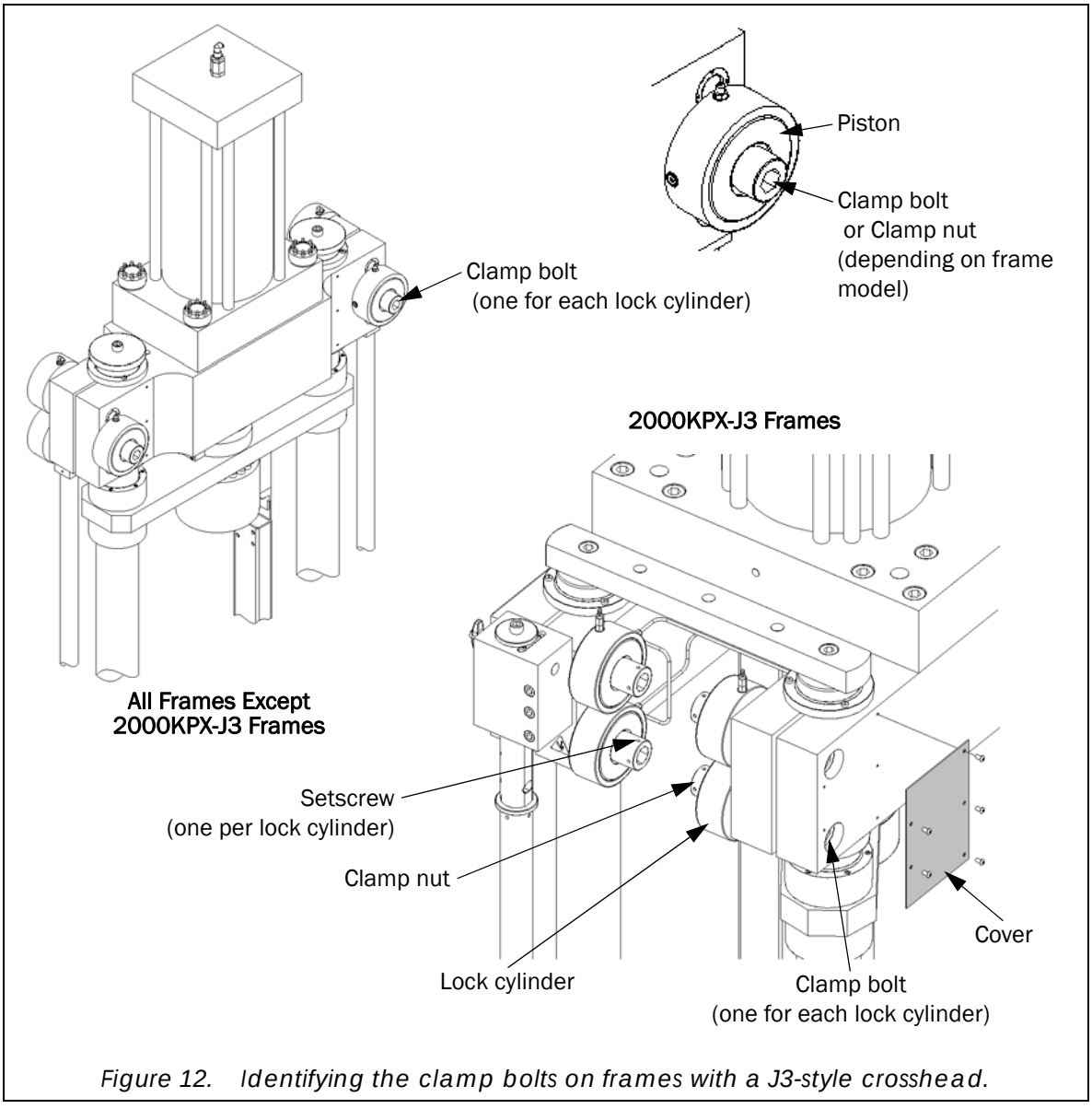


Figure 12. Identifying the clamp bolts on frames with a J3-style crosshead.

7. Check that the frame is enabled. If the frame will not enable, see "Troubleshooting" on page 47, specifically Problem No. **2** of the table. Once any problems are corrected, enable the frame.

8. Start the HPS by pressing the **Pump Start** button on the HPS controls; the **FRAME READY** indicator will illuminate. Immediately check the position of the piston within the hydraulic cylinder, the piston should be positioned so that it is neither fully retracted nor fully extended. Use the jog controls to move the piston if necessary - typically a separation of 6 mm (0.25 in) is sufficient. If the piston is in either of these conditions, the servo loop control could build up enough error to shutdown the HPS (the controlling software will display a "Position loop error").
9. **For frames with a J3-style crosshead**, perform the following:
    a. Clamp and unclamp the crosshead lock cylinders several times using the controls on the lifts and locks control unit.

When the crosshead is unclamped, it may move up slightly. This is normal operation and is not a cause for concern.

    b. Unclamp the crosshead lock cylinders.
    c. Cycle the crosshead lift cylinders up and down several times using the controls on the lifts and locks control unit - be sure to **RAISE** the crosshead first.
    d. Position the crosshead so that full stroke of the hydraulic cylinder can be achieved.
    e. Clamp the crosshead lock cylinders. The crosshead lock cylinders are now securing the crosshead to the columns. Do not unclamp the cylinders unless crosshead adjustment is necessary.
    f. Adjust the crosshead support collars on the columns so that they are in contact with the bottom of the crosshead (use hex-bit socket and ratchet wrench). Secure the crosshead support collars to the columns. Tighten the cap screws to the torque specified in Table 4 (use hex-bit socket specified in Table 4 and torque wrench).

Table 4. Crosshead support collar torque requirements.

Frame Model	Size of Hex-Bit Socket Needed	Required Torque
600KPX, 1000KPX	5/16 in	68 N-m (50 ft-lbs)
1500KPX, 2000KPX	3/8 in	156 N-m (115 ft-lbs)

10. **For frames with a J1-style crosshead**, raise the crosshead so that full stroke of the hydraulic cylinder can be achieved. Follow the procedure for manual crosshead adjustment in Chapter 3 of the Operating Instructions that were supplied with the system.
11. Using the **JOG** controls on the user control panel, stroke the hydraulic cylinder one full cycle to help bleed air out of the system and introduce hydraulic fluid into the system.
12. Place the **Tension/Compression** switch to **Tension** and use the **JOG** controls on the user control panel to fully retract the hydraulic cylinder. Once the hydraulic cylinder is fully retracted, place the **Tension/Compression** switch to **Compression** and use the **JOG** controls to fully extend the hydraulic cylinder. Repeat this tension-compression cycle 10 times.
13. The system is now ready for normal operation. Before the system is operated any further, be sure to read and understand the material provided in the System Operating Instructions (supplied separately).
14. If the system will not be operated at this time, perform the "System Shutdown" procedure provided in the System Operating Instructions (supplied separately).

Install covers for crosshead lock cylinders - J3-style crosshead

Warning

When the frame is equipped with crosshead lock cylinders (J3-style crosshead), the supplied covers MUST be installed over the cylinders. The bolts used in the lock cylinders will become projectiles if any should break. Severe personal injury could result if the covers are not in place!

For frames that are equipped with hydraulic lock cylinders (J3-style crosshead), covers are provided that mount to the ends of the crosshead and cover the lock cylinders. These covers are either removed for shipment or during installation and must be installed on the frame once the frame is in place and ready for operation. Mounting hardware is supplied. Slide the covers down over the ends of the crosshead from the top. Secure in place with cap screws, refer to Figure 13.

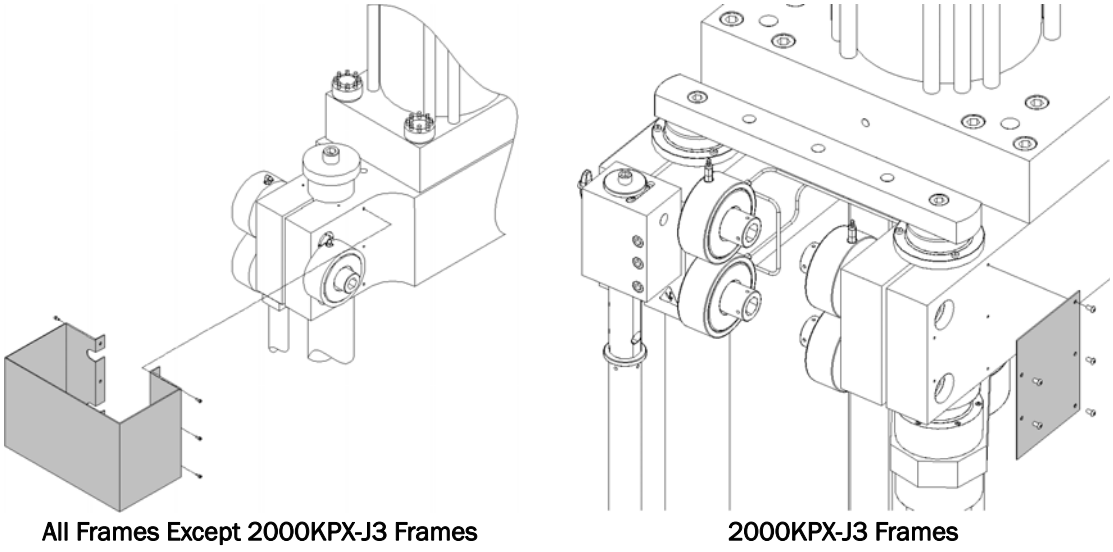


Figure 13. Installing lock cylinder covers on frames with a J3-style crosshead.

Optional accessories

Installation of accessories such as compression plates, tension rods, external grips, etc. that were purchased with your testing system are covered under separate instructions that are included with each accessory.

Some accessories are designed to be mounted temporarily in the frame, while others are designed to be mounted semi-permanently to the frame. Semi-permanent mounting means that the accessory is designed to remain mounted to, or near, the frame for most testing, regardless of whether or not the accessory is being used for a given test. The semi-permanent mounting is typically done for accessories that are large enough to make continuous installation and removal difficult and cumbersome. Accessories that are considered semi-permanently mounted would be:

- Test space enclosures
- Furnace systems
- Automatic extensometers
- High-capacity external grips

Semi-permanently mounted accessories are typically not installed until the system is fully operational. Typically the Instron service engineer will assist with this during installation of the system. For more detailed information on these accessories, refer to the individual instructions that are included with each accessory.

Chapter 3
Additional System Details

Frame

Test space

The KPX frame is a single test space frame capable of static tension and compression testing. All tests are performed between the hydraulic cylinder (2, Figure 14) and base (7). The hydraulic cylinder is mounted to the top of the crosshead. The hydraulic cylinder applies the test load to the specimen while the crosshead, columns and base make the rigid frame.

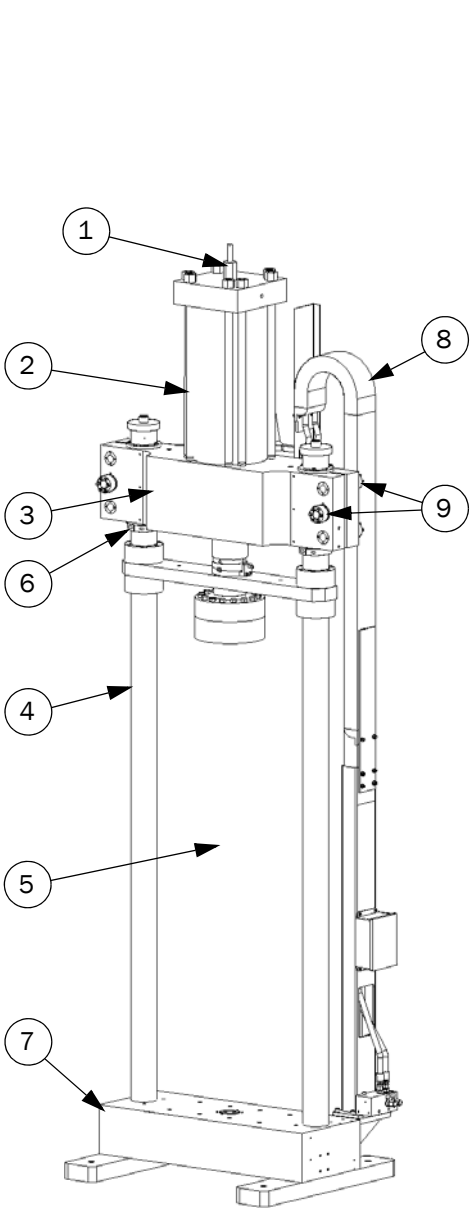
Applying a load to the specimen is accomplished as follows. The HPS supplies hydraulic fluid, under pressure, to the double acting hydraulic cylinder. This pressure either extends or retracts the rod (10) of the hydraulic cylinder. The direction that the rod travels is defined by the operator through the electronic controls and controlling software. A compressive load is placed on the specimen when the rod is extended, and a tensile load is placed on the specimen when the rod is retracted.

For frames with a J1-style or J3-style crosshead, the height of the test opening can be adjusted between tests to accommodate different load train heights and specimen lengths. This is accomplished by adjusting the position of the crosshead on the columns. The crosshead can be positioned anywhere along the columns that is within the normal test space opening. For further description of crosshead styles, see "Crosshead" on page 33. For procedures on crosshead adjustment, refer to information provided in the System Operating Instructions (supplied separately).

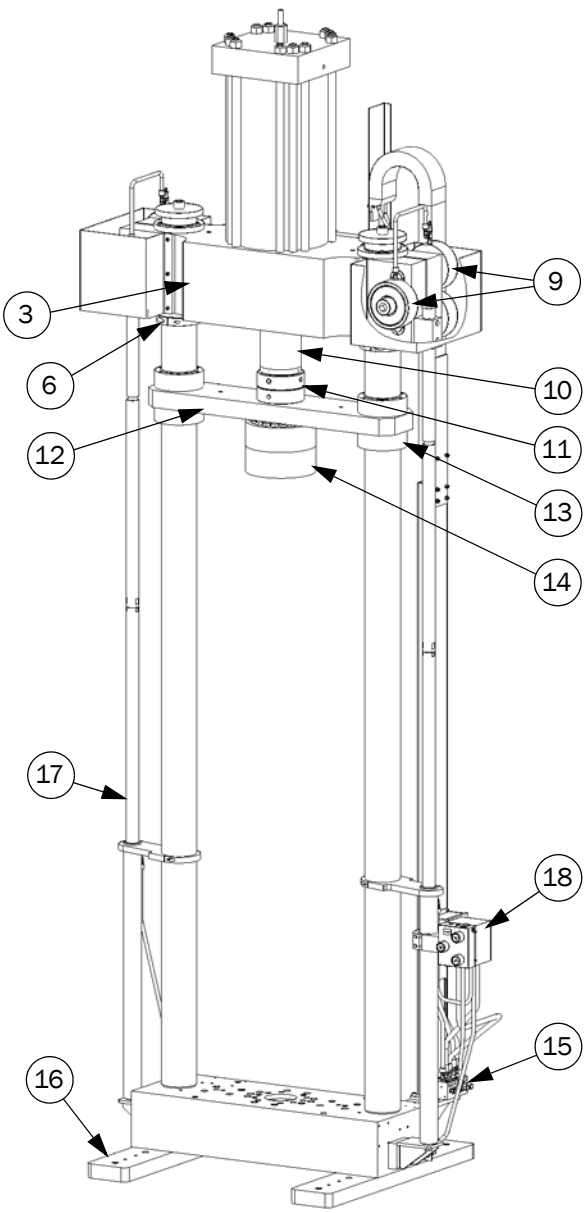
Crosshead

The crosshead (3, Figure 14) is mounted to the columns (4) that extend from the frame base. There are several crosshead styles available:

- **J1-style crosshead** - The crosshead is manually adjustable to any position along the length of the columns. Adjusting the position of the crosshead changes the size of the frame's test opening. This provides greater flexibility in the size of specimen that can be tested. Adjustment is done by manually blocking and lifting the crosshead to the desired position. The hydraulic cylinder can be used to provide the lifting force for the crosshead, or, if desired, a crane or fork truck can be used. Adjustment can only be done between tests, never during a test. During a test, the crosshead is secured to the columns by multiple Superbolt™ tensioners. This provides a rigid frame for testing. The number of tensioners used is dependent on the frame model (refer to information provided in the System Operating Instructions (supplied separately)).
- **J3-style crosshead** - The crosshead is hydraulically adjustable to any position along the length of the columns. Adjusting the position of the crosshead changes the size of the frame's test opening. This provides greater flexibility in the size of specimen that can be tested. Adjustment is done using hydraulic crosshead lift cylinders. Adjustment can only be done between tests, never during a test.



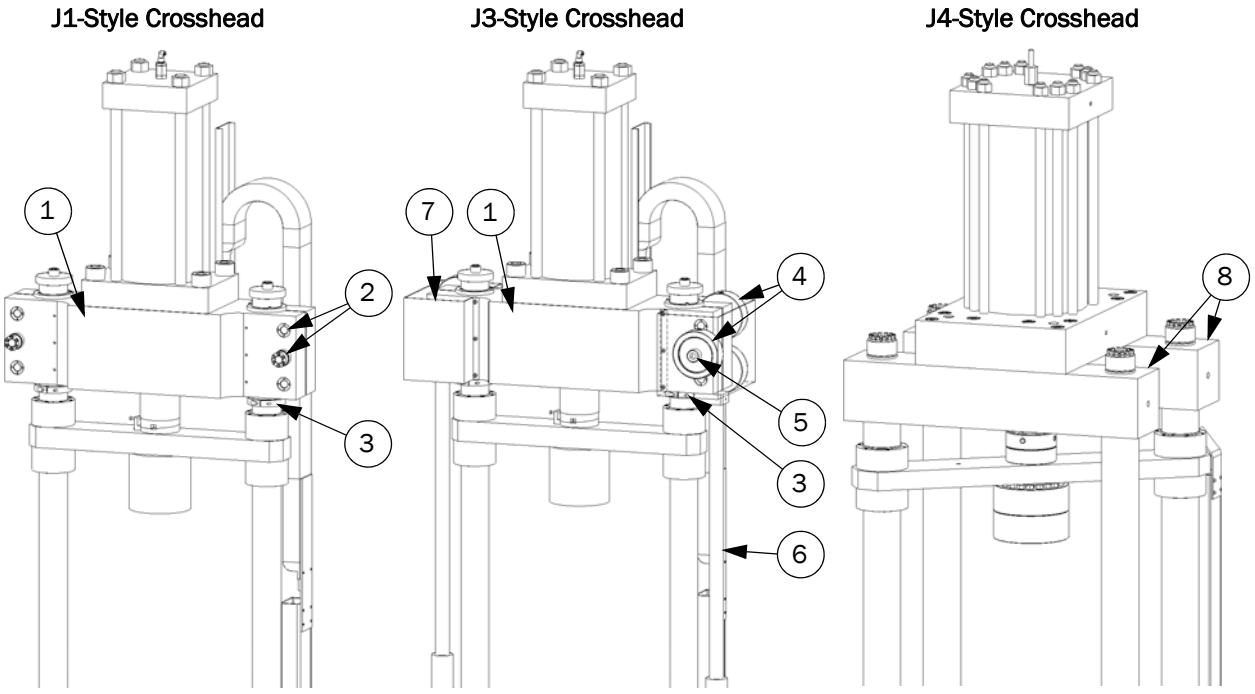
Frame with a J1-style crosshead



Frame with a J3-style crosshead

1. Position encoder
2. Hydraulic cylinder
3. Crosshead
4. Column
5. Test space
6. Crosshead support collar
7. Base
8. Flexible track
9. Crosshead clamping mechanism (see Figure 15 for specific styles)
10. Rod
11. Pre-load device
12. Guide plate
13. Bearing and wiper assembly
14. Load cell
15. Frame manifold
16. Mounting feet
17. Crosshead lift cylinder
18. Lift and lock control unit

Figure 14. KPX frame components - 2 column frame shown.



1. Crosshead - adjustable (J1-style or J3-style crosshead)
2. Manual crosshead clamp
3. Crosshead support collar
4. Hydraulic crosshead lock cylinder
5. Clamp bolt
6. Hydraulic crosshead lift cylinder
7. Lock cylinder covers
8. Crosshead - fixed (J4-style crosshead)

Figure 15. Crosshead styles and components.

During a test, the crosshead is secured to the columns by multiple hydraulic crosshead lock cylinders. The number of lock cylinders is dependent on the frame model (refer to Table 5). The lock cylinders provide enough clamping force so that the crosshead can maintain its position on the columns during testing; even testing at full frame capacity - this provides a rigid frame for testing. In addition, the lock cylinders have an electrical interlock that prevents starting a test or adjusting the hydraulic cylinder if the crosshead is unclamped.

The hydraulic lift and lock cylinders are operated by controls on a lifts and locks control unit that is mounted to the frame. The hydraulic lift and lock cylinders receive hydraulic pressure from the HPS. A separate manifold directs the flow of oil to the cylinders from the HPS. For more information on the manifold, refer to "Lifts and locks manifold assembly" on page 46.

- **J4-style crosshead** - The crosshead is fixed; no adjustment is possible.

Table 5. Number of lock cylinders used for frames with a J3-style crosshead.

Frame Model	Number of Lock Cylinders
600KPX-J3, 1500KPX-J3	6
1000KPX-J3	4
2000KPX-J3	8

Crosshead support collars

All KPX frames with either a J1-style or J3-style crosshead have crosshead support collars that mount to each column, as shown in Figure 15 on page 35. The crosshead support collars have several purposes:

- During normal operation, the crosshead support collars are to be positioned so that they are in contact with the bottom of the crosshead and the cap screws of the crosshead support collars are to be tightened to the torque specified in the System Operating Instructions (supplied separately). When properly placed and torqued, the crosshead support collars will support the weight of the crosshead, guide plate and accessories, if a mechanical or hydraulic failure should occur.
- For frames with a J1-style crosshead, the crosshead support collars are used during adjustment of the crosshead.
- For frames with a J3-style crosshead, the crosshead support collars are used during adjustment of the crosshead travel range.

Load measurement

A strain gauged load cell is used to measure the force applied to the test specimen. The load cell (14, Figure 14 on page 34) is mounted to the end of the hydraulic cylinder rod (10). This mounting arrangement provides a load measuring system that is independent of the hydraulic system. This means that the force measured by the load cell is free of interference due to piston friction and hysteresis; it is a direct force measurement.

Caution

The controlling software is equipped with overload protection for the load transducer. The overload protection should prevent damage to the load transducer during a test by shutting off the HPS when an overload condition occurs.

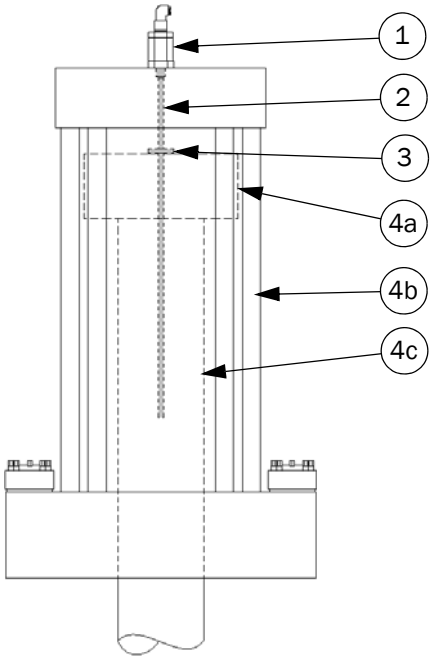
Position measurement

A position encoder is used to determine the position of the piston inside the hydraulic cylinder. Two position encoder resolution options are available. For specifications, refer to information provided in the System Operating Instructions (supplied separately). All encoders are digital quadrature style encoders.

KPX frames with the C3 position option use a magnetostrictive-type encoder (see Figure 16). The encoder is mounted to the stationary end of the hydraulic cylinder (4). The encoder rod (2) extends through the cylinder body (4b) and into the piston (4a). The encoder magnet (3) is attached to the end of the piston so that the encoder rod extends through the magnet. As the piston moves up and down, the encoder magnet moves along the encoder rod. The position of the encoder magnet on the encoder rod produces an electrical signal that is proportional to its position. As the position of the encoder magnet on the encoder rod changes, the electrical signal changes. The electrical signal is transmitted to the 59 Series control unit.

KPX frames with the C4 position option use a linear position encoder that is mounted external to the actuator rod.

For either type of encoder, the 59 Series control unit converts the signal into the relative position of the hydraulic cylinder rod in relation to a stationary frame member.



1. Position encoder
2. Encoder rod
3. Encoder magnet
4. Hydraulic cylinder
   a. Piston
   b. Cylinder body
   c. Rod

Figure 16. Magnetostrictive-type position encoder mounted in hydraulic cylinder.

Hydraulic cylinder and anti-rotation

The rod is formed from high strength, chrome plated steel for maximum service life. Specifications provided in the System Operating Instructions (supplied separately) list the amount of hydraulic cylinder stroke. The rod extends through the crosshead and is attached to a guide plate.

The hydraulic cylinder is fitted with an anti-rotation/linear guidance device to maintain load train alignment and to reduce the effects of torsion and bending on the specimen. The anti-rotation device consists of a guide plate (12, Figure 14 on page 34) that is mounted to the end of the hydraulic cylinder rod and to two columns. The guide plate is equipped with bearing and wiper assemblies to assure smooth operation as it moves up and down on the columns.

Optional accessories

Instron offers a wide variety of testing accessories that can be used with the KPX frame. Some are designed to be mounted temporarily in the frame, while others are designed to be mounted semi-permanently to the frame. Semi-permanent mounting means that the accessory is designed to remain mounted to, or near, the frame for most testing, regardless of whether or not the accessory is being used for a given test. The semi-permanent mounting is typically done for accessories that are large enough to make continuous installation and removal difficult and cumbersome. This section will **briefly** discuss these semi-permanently mounted accessories. For more detailed information on these accessories, refer to the individual instructions that accompany each accessory.

For information on the wide variety of testing accessories that are offered by Instron, contact your local Instron Sales Representative as directed on page 14. Your Sales Representative can help you select accessories that best fit your testing needs.

- **Test space enclosure:** Test space enclosures surround the frame to retain specimen debris and prevent disturbance of the test in progress. Enclosures are typically floor mounted.
- **Furnace system:** A furnace system provides high temperature testing capability. The furnace system includes a mounting bracket for mounting to the frame; typically on the base. The mounting bracket permits rotation of the furnace so that it can be removed from the test space when not in use.
- **Automatic extensometers:** These extensometers provide automatic strain measurement of the specimen being tested. These extensometers are provided with a mounting bracket for mounting to the frame; typically on the base. When necessary, the mounting bracket permits rotation of the extensometer so that it can be removed from the test space when not in use.
- **High-capacity external grips:** These grips include hydraulic wedge grips, pneumatic wedge grips, single side acting grips, and dual side acting grips. These grips mount directly to the load cell and base. Before shipment from the factory, they are mounted to the frame and typically remain installed for shipment (except for 2000KN frames). When it is necessary to perform compression testing (or tension testing with different fixtures) on a frame with these grips installed, optional secondary load string adapters can be purchased so that compression (or tension) accessories can be mounted directly to the high-capacity grips.
- **Tee-slot table:** Tee-slot tables provide additional methods for mounting accessories to the frame base. The tee-slot table mounts directly to the frame base. Before shipment from the factory, it is mounted to the frame and typically remains installed for shipment.

Controls and electronics

Tension/compression control switch

This switch (Figure 17) allows the operator to place hydraulic demand at the appropriate side of the hydraulic cylinder for testing in the direction required (tension or compression). The switch controls a solenoid valve that directs the return of pilot pressure from the hydraulic cylinder to the HPS. When the switch is set to **Tension**, the HPS will receive pilot pressure from the tension side of the hydraulic cylinder. Likewise for the **Compression** setting. This allows the hydraulic cylinder to build pressure in the proper direction and load the specimen.

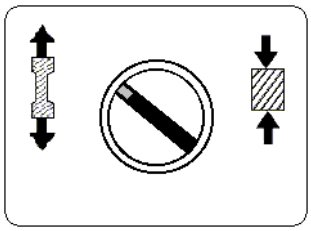


Figure 17. Tension/compression control switch.

59 Series control unit

The 59 Series control unit (Figure 18) is an enclosure that typically sits on the console. The unit houses control components that: receive and process data from the various system transducers; communicates with the system's controlling software; and provides feedback to the system's servo valve to operate the frame as set up in the controlling software. The control components consist of a digital signal processor card, transducer signal conditioning cards, a frame interface board, a 24 VDC power supply for the frame interface board, a fused power entry module, a relay board, and an optional analog outputs card (when purchased).

External connections to the control components are made on the front and rear of the unit. Connection descriptions are outlined in Table 6.

Table 6. 59 Series control unit function descriptions.

LOAD:	A female 25-pin interface that connects the system's load cell to the transducer conditioning card.
STRAIN 1: (optional)	A female 25-pin interface that connects an extensometer to an optional transducer conditioning card.
STRAIN 2: (optional)	A female 25-pin interface that connects an extensometer to an optional transducer conditioning card. (Typically only required for transverse strain or other dual extensometer setups.)
ETHERNET:	A connection for communication with the computer.
I/O: (optional)	Allows connection of analog chart recorders and plotters, etc. Features 4 zero suppressed and scaled 10V outputs via BNC connectors. A 25 pin D connector provides recorder pulse drive, 4 logic line outputs and 4 logic line inputs to trigger internal and external events.
SERVICE:	A connection for optional communications modem for remote diagnostics.

Table 6. 59 Series control unit function descriptions. (Continued)

SERVICE Display:	Provides an indication of self-tests that are performed by the controls during system startup. You should see the following general sequence: the two 7-segment LEDs count up to “21” and then back down, and then the letter “P” will flash alternately with the number “22”. This entire sequence typically takes between one and two minutes to complete. “P” indicates the all self-tests have passed. If the LEDs should flash the letter “F” at any time during the sequence, this indicates that a self-test has failed. If this occurs, you should contact your local Instron Services department as directed on page 14 for assistance in troubleshooting the failure. When conditions are normal, the **T** indicator is green and the **A** indicator is blinking red.
HPS, A:	A female 14-pin interface that connects the HPS to the control unit.
Position, H:	A female 9-pin interface that connects the system’s position encoder to the control unit.
User Control Panel, N:	An interface that connects the user control panel to the control unit.
HPS Controls, M:	A female 15-pin interface that connects the HPS control box to the control unit.
Frame, R:	A female 10-pin interface that connects various frame functions to the control unit.
Ground:	A ground lug that connects the control unit to an earth ground. Typically connects to a ground lug on the frame base.
Power Entry Module:	Provides a male 3-prong connection for incoming power and a power ON/OFF switch.

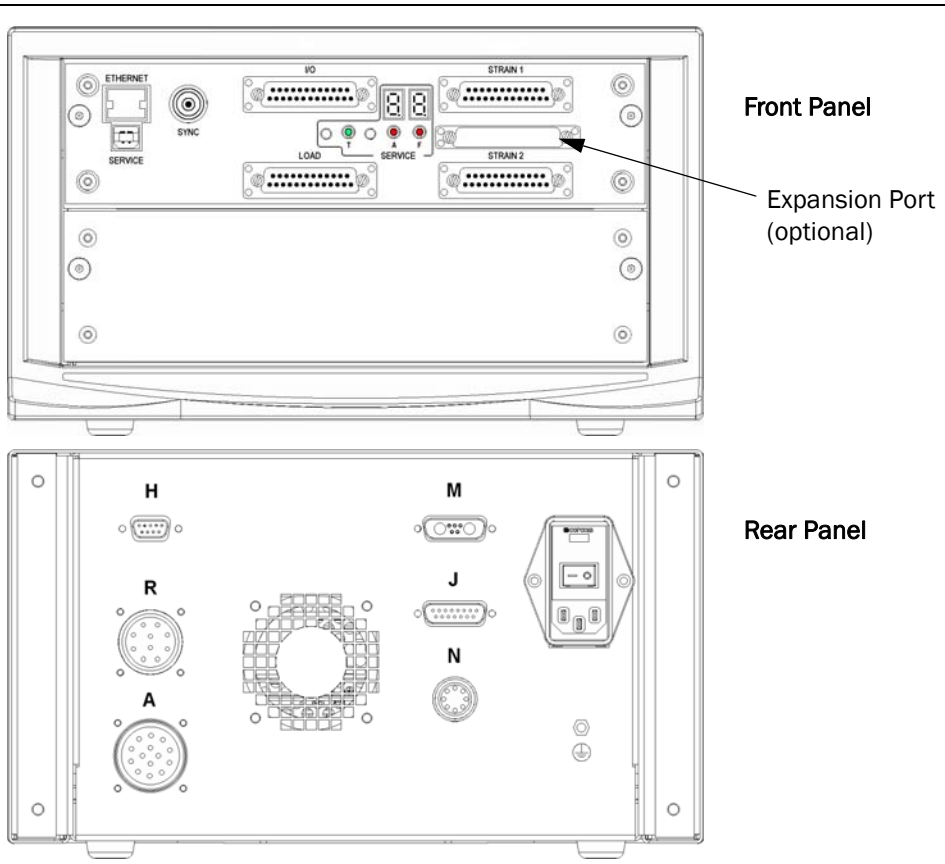


Figure 18. The 59 Series control unit.

Computer system and controlling software

The computer system is the operator communication link with the various system controls and the frame. Operators enter information and control parameters into the computer by way of the controlling software package.

The 59 Series control unit receives messages from the computer and sends the message to the testing system to perform the required operation. While testing, the controller receives data from the load and position transducers on the frame and sends the data to the computer. A frame interface board mounted inside the control unit provides signal interfacing between the controller and the system components.

Communication between the 59 Series control unit and the computer is accomplished through an Ethernet Frame Interface (EFI) that is mounted inside the 59 Series control unit.

For detailed information on the computer system, please refer to the computer manufacturer's literature that was provided with the system. For more information on the controlling software, refer to the software's On-line Help system or to the manual provided.

Computer systems are typically purchased from Instron with the testing system, however they may be customer supplied. If this is the case, refer to any information provided by the computer vendor in regards to its operation, warranty, etc. Instron is not responsible for customer supplied equipment.

Electrical panel

Warning

Disconnect the electrical power supply before removing the covers to electrical equipment.

Disconnect equipment from the electrical power supply before removing any electrical safety covers to replace fuses, inspect or clean the system. Do not reconnect the power source while the covers are removed. Refit covers as soon as possible.

System electronics are mounted on an electrical panel. The panel is mounted inside the electrical box on the side of the console. The electrical panel houses a motor starter for the electric motor in the HPS and an overload relay for the motor.

Hydraulic system

Introduction

Warning

Shut down the HPS and discharge hydraulic pressure before disconnecting any hydraulic fluid coupling.

Do not disconnect any hydraulic coupling without first shutting down the HPS and discharging stored pressure to zero. Tie down or otherwise secure all pressurized hoses to prevent movement during system operation and to prevent the hose from whipping about in the event of a rupture.

The hydraulic system includes any component that controls or routes hydraulic fluid (oil) through the testing system. For specifications of the hydraulic oil, refer to maintenance information provided in the System Operating Instructions (supplied separately).

Hydraulic power supply

The function of the HPS is to act as the power supply for the frame. This includes powering the hydraulic cylinder and hydraulic lift and lock cylinders (for frames with a J3-style crosshead). The HPS is a variable pressure unit; it creates hydraulic pressure as required depending on system demand.

The HPS is enclosed in a console that has a desktop surface for placement of the computer system and 59 Series control unit. The components of the HPS can vary depending on the configuration of the system. In general however, major components of the HPS are: a reservoir; a pump; an electric motor; a heat exchanger; one or more manifold assemblies; and the hydraulic fluid (oil). Figure 19 identifies typical HPS components. An electrical panel mounted inside the console houses the motor starters, with overloads, for the electric motor.

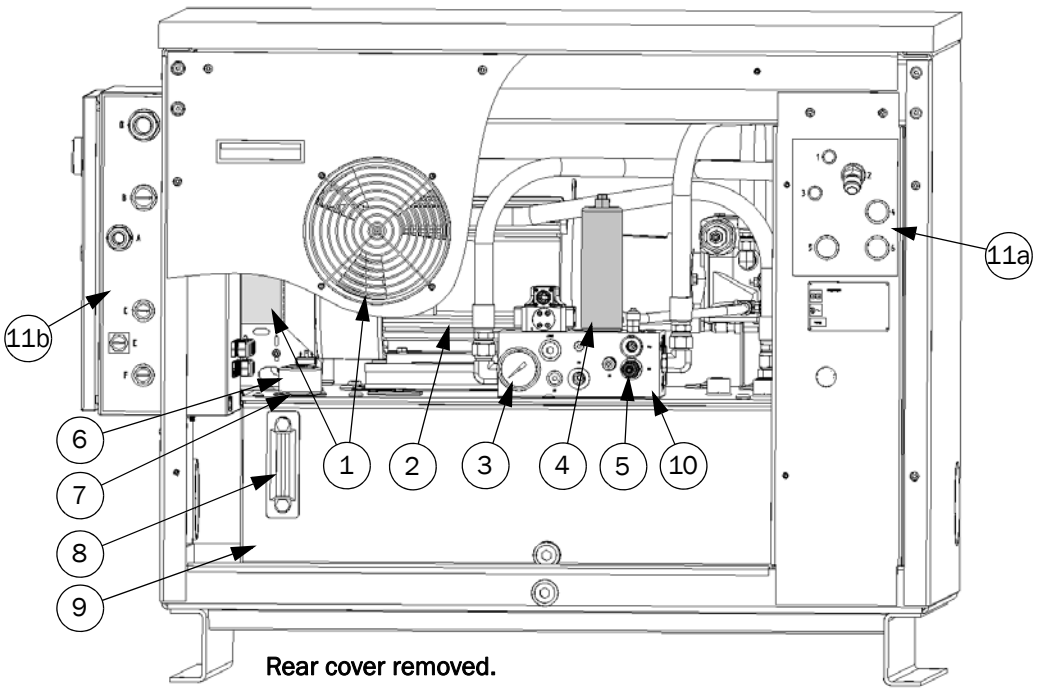
When the HPS is on, the hydraulic cylinder should be positioned so that the piston is neither fully retracted nor fully extended. When the hydraulic cylinder is in either of these conditions, it is difficult for the 59 Series controls to maintain the position and the servo loop control could build up enough error to shut down the HPS.

Reservoir

Caution

DO NOT start the HPS without the screen trapper or air breather assembly installed on the reservoir. Starting the HPS with the solid cap (that is used for shipping) on the reservoir instead of the air breather assembly could cause pump cavitation.

The reservoir holds the oil that is needed to operate the various hydraulic components. For approximate reservoir capacity, and information on adding oil to or changing the oil in the reservoir, refer to maintenance information provided in the System Operating Instructions (supplied separately). The reservoir is equipped with a sight gauge, air breather assembly and screen trapper.



1. Heat exchanger and fan
2. Motor
3. System pressure gauge
4. Oil filter
5. Relief valve RV1
6. Air breather filter
7. Fill hole
8. Sight gauge
9. Reservoir
10. Servo manifold
11. Connection panels
    a. Hydraulic
    b. Electric

Figure 19. Components of the HPS.

Sight gauge

The reservoir is equipped with an oil level and temperature sight gauge. The sight gauge (8, Figure 19) is visible through the rear cover of the console. The reservoir should be filled so that the oil is to the top of the sight gauge when the hydraulic cylinder is completely retracted. Filling the reservoir with the hydraulic cylinder slightly extended will cause overflowing of the reservoir when the hydraulic cylinder is retracted. The level of the oil is monitored by a level switch inside the reservoir, see "Oil temperature/level switch" on page 44. The maximum temperature of the hydraulic oil under normal operating conditions should remain below 60 deg. C (140 deg. F), and should never exceed 80 deg. C (176 deg. F). Consult factory for operating conditions that result in oil temperatures that exceed 80 deg. C (176 deg. F). Oil temperature is monitored by a temperature switch inside the reservoir, see "Oil temperature/level switch" on page 44.

Air breather assembly

An air breather assembly (6, Figure 19) is placed on the reservoir's fill hole to allow the reservoir to breathe while preventing dirt from entering the reservoir. It can be easily removed for access to the reservoir. For maintenance of the air filter, refer to maintenance information provided in the System Operating Instructions (supplied separately).

Screen trapper

A tightly meshed screen trapper is placed in the reservoir's fill hole. This screen prevents larger debris from entering the reservoir when it is filled. Maintenance of the screen trapper should be done anytime oil is added to the reservoir, refer to maintenance information provided in the System Operating Instructions (supplied separately).

Oil temperature/level switch

A temperature/level switch is mounted in the reservoir that monitors the temperature and the level of the oil. The switch will trip at either an oil temperature of 70 +/-6 deg. C (158 +/-10 deg. F) or an oil level lower than 184 mm (7.25 in) from the top of the reservoir. This distance is below the bottom of the sight gauge but above the opening in the suction pipe. If the switch is tripped from either condition, the system controls will shut off the HPS. This prevents the oil temperature from exceeding the recommended maximum temperature and prevents the HPS from operating with a low oil level. The controlling software will indicate a "Motor Temp" error, no matter which condition tripped the switch. Refer to Problem No. 11 of Table 9 on page 47.

Pump and motor

An electric motor is used to operate the pump that forces oil from the reservoir, through the high pressure hydraulic hoses and into the hydraulic cylinder. As the controller directs the frame to place load on a specimen, the HPS builds pressure in the system and the piston is actuated inside the hydraulic cylinder. Some pump and motor information is listed in Table 7.

The pump is equipped with a flow control adjustment that controls the system idle pressure. Idle pressure is the pressure of the HPS when it is operating under no load conditions (i.e. when the frame is not being adjusted or performing a test). This flow control adjustment is set at the factory and should not require further adjustment. Any adjustments should only be made by an Instron service engineer.

For pump and motor maintenance, refer to the separately supplied manufacturer's information.

Table 7. HPS information.

HPS Catalog Number and Model	Required Flow at Maximum Testing Speed	Idle Pressure	System Relief Pressure	Motor Power
600KPX-D17, V22h	Dependent on the frame's load cell option, see below.			
with L1 load cell option	10.30 Lpm (2.72 gpm)	21 bar (300 psi)	110 bar (1600 psi)	10 hp
with L2 load cell option	10.30 Lpm (2.72 gpm)	21 bar (300 psi)	138 bar (2000 psi)	10 hp
with L3 load cell option	10.30 Lpm (2.72 gpm)	21 bar (300 psi)	193 bar (2800 psi)	10 hp
1000KPX-D18, V22e	14.84 Lpm (3.92 gpm)	21 bar (300 psi)	179 bar (2600 psi)	10 hp
1500KPX-D18, V22e	20.18 Lpm (5.33 gpm)	21 bar (300 psi)	207 bar (3000 psi)	10 hp
2000KPX-D19, V22f	26.35 Lpm (6.96 gpm)	21 bar (300 psi)	207 bar (3000 psi)	15 hp

Manifold assemblies

The function of any manifold is to control and route the hydraulic oil as needed to various system components. The following manifold assemblies may be present on this system (dependent on frame configuration):

- Servo manifold assembly
- Lifts and locks manifold assembly
- Accessory relief manifold

Servo manifold assembly

A standard servo manifold (3, Figure 19) includes the following components. Refer to Table 8 for the function of each component.

- A servo valve
- An oil filter
- A system pressure gauge
- A servo blocker valve
- A system relief valve

Table 8. Function of components on servo manifold.

Component	Function
Servo valve:	The servo valve controls the flow of oil to the hydraulic cylinder. The position of the servo valve, which is determined by parameters entered into the controlling software by the operator, defines how the hydraulic cylinder will operate. It will either block the flow of oil to the hydraulic cylinder to hold the piston stationary, or allow oil to enter the hydraulic cylinder through one of its ports to extend or retract the piston (as dictated by the **Tension/ Compression** switch and the settings in the controlling software).
Oil filter:	A high pressure 3-micron oil filter is mounted on the manifold to provide the necessary filtration for the high performance hydraulic components in the system. Oil passes through this filter directly after exiting the pump and before being routed to any other hydraulic component. The filter is equipped with an indicator to show when the filter is dirty and should be serviced. For maintenance of the oil filter, refer to maintenance information provided in the System Operating Instructions (supplied separately).
System pressure gauge:	A pressure gauge is located on the servo manifold so that system pressure can be monitored as needed. This pressure gauge is visible through a cut out in the rear cover of the console. System pressure is set at the factory and should not require further adjustment. Any adjustments should only be made by an Instron service engineer.
System relief valve:	The system relief valve provides pressure relief for the system to prevent damage to system components in the event that the pump builds too much pressure. This valve is set at the factory and should not require further adjustment. Any adjustments should only be made by an Instron service engineer.
Servo blocker valve:	The servo blocker valve is a normally closed valve that opens when system has electrical power. On loss of system power, the valve closes. Its purpose is to prevent hydraulic cylinder drift.

Lifts and locks manifold assembly

When the frame is equipped with a J3-style crosshead, a lifts and locks manifold assembly is provided. The manifold is located in the control unit that is mounted to the frame. It contains needle valves for operator control of the lift and lock cylinders, needle valves for control of lift cylinder speed, and pressure relief valves. Procedures for operation of the needle valve controls is provided in the System Operating Instructions (supplied separately). Oil is routed, at the appropriate pressure, from the HPS, through the frame manifold (located on the frame base) to the lifts and locks manifold.

Lock cylinder pressure switch

When the frame is equipped with a J3-style crosshead, the hydraulic system includes a pressure switch that detects hydraulic pressure at the lock cylinders. This pressure switch is located at the crosshead. If the pressure falls below a set pressure, the switch is tripped which sends a signal to the controller that the crosshead is unclamped. When this is the case, the system controls will not permit operation of the frame to jog the hydraulic cylinder or run a test until the crosshead is locked. The switch also sends a signal to the HPS causing the pump to increase hydraulic pressure so that the lift and lock cylinders can be operated. Once the crosshead is positioned and the locks control valve is closed, the pump will reduce to idle pressure when the switch senses that the appropriate clamp pressure is reached.

Pressure settings

All relief valves, reducing valves, pressure switches, etc. are set at the factory to their proper operating pressure. They should not need further adjustment. If you feel adjustment is necessary, contact your local Instron Services department as directed on page 14. Any adjustments should only be made by an Instron service engineer.

Oil cooling

An air-over-oil heat exchanger and fan (1, Figure 19) are used to cool the oil and exhaust the warm air from the console. The fan is mounted to the rear cover and has a guarded vent hole. Fresh air is drawn into the console through a guarded vent hole on the side of the console. This vent hole is equipped with a filter.

Troubleshooting

In the event that problems arise during operation of the system, refer to Table 9 for help in determining the specific problem and its solution. If the problem cannot be determined through the chart, contact your local Instron Services department as directed on page 14. Another option would be to check the listing of Frequently Asked Questions (FAQs), available on the Instron website (www.instron.com), for a description/solution to your problem.

Table 9. Troubleshooting the KPX system.

<table>
<tr><th>No.</th><th>Possible Indications</th><th>Possible Problem</th><th>Solution</th></tr>
<tr><td rowspan="2">1</td><td rowspan="2">• The indicators on the SERVICE display do not light when the system disconnect switch is turned on
• Frame power is lost for no apparent reason
• Test aborts and HPS shuts down
• Frame will not enable
• An interlock error message appears in the controlling software</td><td>Frame and/or 59 Series control unit are not receiving power</td><td>• Check incoming power supply for both frame and control unit</td></tr>
<tr><td>A fuse could be blown</td><td>• Check all system fuses, refer to “Replacement of fuses” on page 54.</td></tr>
<tr><td rowspan="6">2</td><td rowspan="6">• HPS will not start</td><td colspan="2">Always verify that:
• Computer is on
• 59 Series control unit is on
• Controlling software is running
• Frame is enabled
• A test procedure/method is open
• The load transducer is calibrated</td></tr>
<tr><td>Emergency Stop engaged</td><td>Disengage Emergency Stop button, enable frame and start HPS</td></tr>
<tr><td>System disconnect switch not ON (|)</td><td>Turn the disconnect switch to ON (|).</td></tr>
<tr><td>Overload protect circuit may have tripped</td><td>For assistance, contact your local Instron Services department as directed on page 14</td></tr>
<tr><td colspan="2">If none of the above appear to be the problem:
• For Partner systems, check the Status display for any abnormal conditions or check the On-line Help for other helpful information
• For Bluehill systems, check the Status Log for any abnormal conditions. Click the Load Frame icon; the Status Log appears on the bottom portion of the Load Frame tab.</td></tr>
</table>

Table 9. Troubleshooting the KPX system. (Continued)

No.	Possible Indications	Possible Problem	Solution
3	• System locks up • Test will not start • Test aborts • Software posts an error message stating that communication is lost • Transducers will not calibrate • Flashing single point LED on diagnostic display is not present	Communication between frame and controls is lost.	Reset the system by performing the shutdown and startup procedures that are provided in the System Operating Instructions (supplied separately).
4	• Test will not start • Test aborts • HPS shuts down • Software posts an error message stating “Position Loop Failure”	Position measurement is not working	Check the position encoder cable for damage or loose connection. If problem is not resolved, refer to Problem No. 9
		Hydraulic cylinder is either fully extended or retracted	Enable the frame, start the HPS and adjust the hydraulic cylinder so that it is neither fully extended nor retracted, zero all measurements, and calibrate all transducers
		Tension/Compression switch in wrong position for test	Place the **Tension/Compression** switch in the correct position for the test direction
		For frames equipped with a J3-style crosshead, the lock cylinders are unclamped	Be sure the locks control switch is set to **CLAMP**
5	• Software posts an error message stating “Control Panel Watchdog Timeout”	Communication has been lost with the user control panel	Check the user control panel cable for damage. If damage is found contact your local Instron Services department as directed on page 14.
6	• After opening a procedure the HPS will not start	The frame is not enabled	Enable the frame: • For Partner systems, select ***Machine*** and then ***Enable Frame*** • For Bluehill systems, select the ***Frame*** icon and then ***Enable Frame***
		For systems operating with Partner software, the “Enable Frame Timer” setting may be enabled	Verify the status of the “Enable Frame Timer” check box in Partner: 1. Select **Tools**/**Configure**/**Controllers**; Controller window will open. 2. Select the controller (**59-R8**) and click ***Modify***. 3. Be sure the “Enable Frame Timer” box is NOT checked.
7	• For Partner systems: after starting a procedure, the live data and live graph appear on the computer monitor but the frame is not moving	The software could be in Simulation mode	Verify that the lower right corner of the screen does not have the word “SIM”. If it does, select **Tools**/**Configure**/**Simulation** and uncheck the “Simulate Test” box

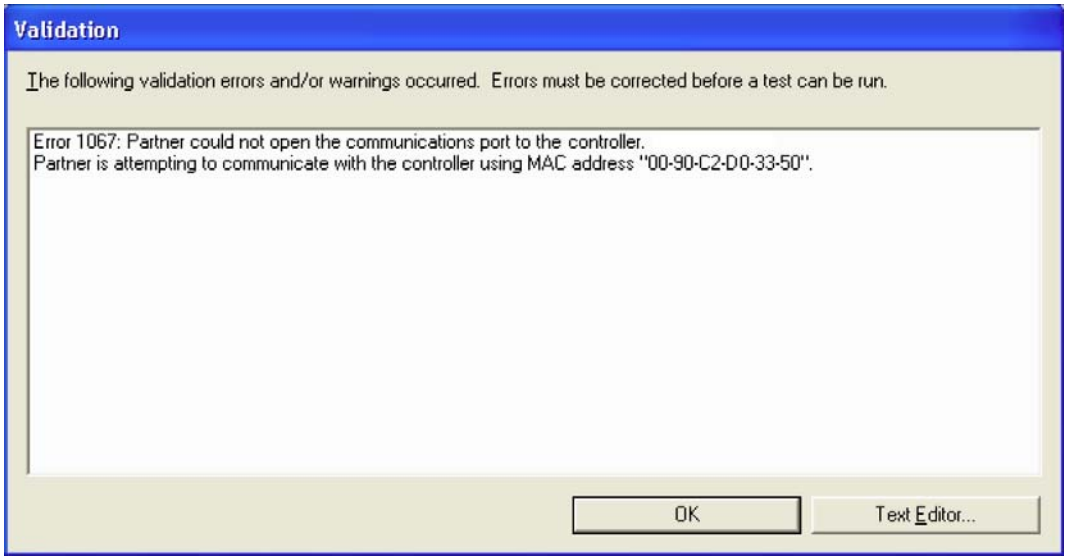
Table 9. Troubleshooting the KPX system. (Continued)

No.	Possible Indications	Possible Problem	Solution
8	• Software posts an error message stating “Sensor Loop Failure”	Control rate for the control mode selected is too fast	The frame should not be operated in load/stress control during the yield portion of a test. Select position or strain control and restart test, or contact your local Instron Services department as directed on page 14.
		Tension/Compression switch in wrong position for test	Place the **Tension/Compression** switch in the correct position for the test direction
		Load cell cable could be damaged or have loose connections	Check load cell cable for damage and check that connections are secure
9	• Position display does not change when the hydraulic cylinder is moving • The hydraulic cylinder stops inadvertently during a test or during manual adjustment • Software indicates a “Hard Stop” or other error for no apparent reason	Disconnect switch not ON (|) or customer’s power supply not ON	• Turn the disconnect switch to ON • Turn the customer’s power supply to ON
		Set speed exceeds the load frame maximum speed	Reduce the set speed and enable frame
		Position encoder not functioning or damaged	Check operation of position encoder: 1. Enable the frame. 2. Start the HPS. 3. Manually jog the hydraulic cylinder, verify that it is moving and watch the position display to see if it reads the change in height. 4. If after 3 seconds the HPS shuts down, then the encoder is not functioning; contact your local Instron Services department as directed on page 14.
10	• Software indicates a “Hard Stop” or other error when running a test under strain control	Strain instrument may not be working properly	• Check the instrument for proper operation • Check that the zero pin was removed from the instrument

Table 9. Troubleshooting the KPX system. (Continued)

No.	Possible Indications	Possible Problem	Solution
11	• The HPS shuts down • Software posts a motor temperature error message	Oil level has dropped below the allowable level	Perform checks and/or corrections for an oil leak and then add oil to the reservoir. Refer to procedures provided in Chapter 4 of the System Operating Instructions (supplied separately).
		Oil temperature exceeds temperature switch setpoint, possibly due to: • Fans not operating properly • Environmental conditions exceed requirements provided in Chapter 2 of the System Operating Instructions (supplied separately)	• Check for and correct fan operation • Correct environmental conditions
		Oil temperature must drop below the maximum temperature stated in "Oil temperature/level switch" on page 44 to reset the switch. Once the switch has reset, the HPS can be started.	
12	• For frames with a J3-style crosshead, the hydraulic cylinder will not jog or a test will not start	The locks control valve is open	Refer to information provided in the System Operating Instructions (supplied separately)
		The HPS was not able to build enough pressure to clamp the crosshead lock cylinders before the **Jog** controls were used	Refer to information provided in the System Operating Instructions (supplied separately)
13	• **Pump Start** button is lit but HPS is not running	The disconnect switch not ON (**|**) or customer's power supply not ON	• Turn the disconnect switch to ON (**|**) • Turn the customer's power supply to ON
14	• The software posts an error message like the one shown in Figure 20	• EFI cable could be damaged or have loose connections • Communication problem between EFI and 59 Series control unit or EFI and software • Incorrect version of controlling software is in use	• Check the cable for damage and check that connections are secure • Check that the correct Ethernet crossover cable is being used • Check IP settings, they should match those shown in Figure 21 • Verify that the software version is 8.2a or above for Partner, or 2.15 or above for Bluehill • If none of the above correct the problem, then contact your local Instron Services department as directed on page 14

Partner Software



Bluehill Software

Figure 20. Controlling software error messages.

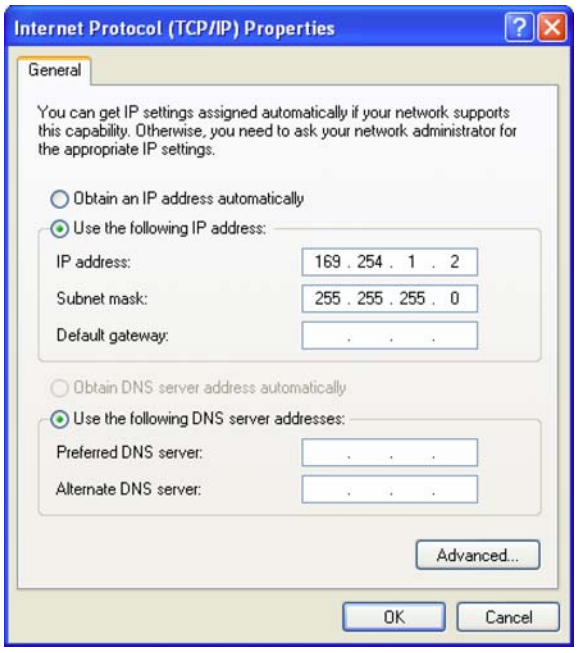


Figure 21. Internet protocol properties.

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Chapter 4
Parts Replacement

Introduction

KPX systems require minimal parts replacement. If a part does require replacement, only the following parts can or should be replaced by the customer:

- Fuses

All other parts replacement should be done by an Instron service engineer. For assistance with replacement of any part, contact your local Instron Services department as directed on page 14.

Replacement of fuses

The system is equipped with fuses as outlined in Table 10.

Table 10. Fuse information.

Fuse Description	Specifications	Instron Part Number	Quantity
Fuses in power entry module of 59 Series control unit	5 amp, 1/4D x 1-1/4LG, 250Vac (equivalent metric size is 6.3D x 32LG)	300-8905-9159	2

These fuses should only need replaced when they are blown. Problems that indicate a blown fuse are described in Table 9 on page 47; refer to Problem No. **1**. If you believe a fuse could be blown, perform the following check to pinpoint which fuse is blown:

1. Start up the system according to the system startup procedure provided in the System Operating Instructions (supplied separately).
2. Check the indicators on the **SERVICE** display of the 59 Series control unit (see page 40), they should be lit. If the indicators are not lit, then the power entry module fuses could be blown. Visually inspect the fuse. Follow the procedure outlined under "Inspect/replace 59 Series power entry module fuses" on page 55 to access and locate the fuse. If the fuse is blown, replace it. Information for the fuse can be found in Table 10.

Inspect/replace 59 Series power entry module fuses

The 59 Series power entry module fuses are located in the power entry module on the rear of the 59 Series control unit. Perform the following procedure to inspect or replace the fuses.

Equipment required

No equipment is required, although it may be helpful to have a flat screwdriver to remove the fuse holder.

Recommended procedure

1. Be sure the system is shut down. **All** power should be off.
2. Depress the tab of the fuse holder (see Figure 22) and remove it from the power entry module.
3. Inspect or change fuses as necessary. Fuse specifications are listed in Table 10.
4. Once work is complete, replace the fuse holder.

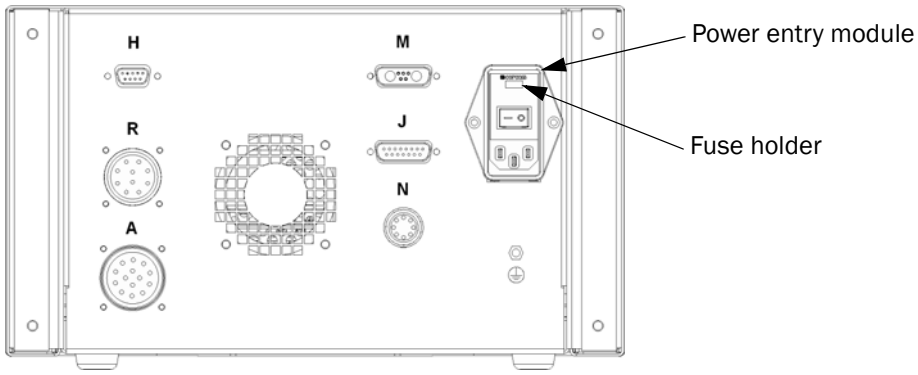

Figure 22. 59 Series power entry module fuses.

Replacement or repair of load cells

Instron load cells, in general, are electrically calibrated, self-identifying and rationalized. Approximate resistances can be provided to allow confirmation of a possible broken gauge, or a faulty connector or cable.

If a strain gauge in a cell has been badly overstressed, but still maintains its electrical continuity, the cell may show a higher than normal amount of creep. If a gauge has become improperly bonded due to degradation in use, the cell may exhibit a combination of general instability in its balance point, together with a large amount of creep. Difficulties of this sort rarely appear as an instability in the calibration of the cell.

If a load cell has been overloaded, the load-sensitive member may be permanently deformed to the extent that the proper dimensional alignments inside the cell are no longer maintained. If you suspect that a cell may be damaged, contact your local Instron Services department as directed on page 14 to arrange returning the load cell for analysis and possible repair.

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