be certain.

MTS FlexTest® Models 40/60/100/200 Controller Hardware

Service Information for Controllers Using Series 793 Software:

- Hardware Descriptions
- Specifications
- Installation
- Cabling

100-187-204 F

Copyright information

Trademark information

Publication information

MANUAL PART NUMBER	PUBLICATION DATE
100-187-204 A	**November 2007**
100-187-204 B	**May 2008**
100-187-204 C	**September 2008**
100-187-204 D	**August 2009**
100-187-204 E	**September 2010**
100-187-204 F	**July 2011**

Contents

Technical Support

How to Get Technical Support

Start with your manuals

The manuals supplied by MTS provide most of the information you need to use and maintain your equipment. If your equipment includes software, look for online help and README files that contain additional product information.

If you cannot find answers to your technical questions from these sources, you can use the internet, e-mail, telephone, or fax to contact MTS for assistance.

Technical support methods

MTS provides a full range of support services after your system is installed. If you have any questions about a system or product, contact Technical Support in one of the following ways.

www.mts.com

The web site provides access to our technical support staff by means of an online form:

> www.mts.com > Contact MTS > Service & Technical Support button

E-mail

tech.support@mts.com

Telephone

MTS Call Center 800-328-2255
Weekdays 7:00 A.M. to 5:00 P.M., Central Time

Fax

952-937-4515
Please include “Technical Support” in the subject line.

Outside the U.S.

For technical support outside the United States, contact your local sales and service office. For a list of worldwide sales and service locations and contact information, use the Global MTS link at the MTS web site:

> www.mts.com > Global MTS > (choose your region in the right-hand column) > (choose the location closest to you)

Before You Contact MTS

MTS can help you more efficiently if you have the following information available when you contact us for support.

Know your site number and system number

The site number contains your company number and identifies your equipment type (such as material testing or simulation). The number is typically written on a label on your equipment before the system leaves MTS. If you do not know your MTS site number, contact your sales engineer.

Example site number: 571167

When you have more than one MTS system, the system job number identifies your system. You can find your job number in your order paperwork.

Example system number: US1.42460

Know information from prior technical assistance

If you have contacted MTS about this problem before, we can recall your file based on the:

- MTS notification number
- Name of the person who helped you

Identify the problem

Describe the problem and know the answers to the following questions:

- How long and how often has the problem occurred?
- Can you reproduce the problem?
- Were any hardware or software changes made to the system before the problem started?
- What are the equipment model numbers?
- What is the controller model (if applicable)?
- What is the system configuration?

Know relevant computer information

For a computer problem, have the following information available:

- Manufacturer's name and model number
- Operating software type and service patch information
- Amount of system memory
- Amount of free space on the hard drive where the application resides
- Current status of hard-drive fragmentation
- Connection status to a corporate network

Know relevant software information

For software application problems, have the following information available:

- The software application's name, version number, build number, and (if available) software patch number. This information can typically be found in the **About** selection in the **Help** menu.
- The names of other applications on your computer, such as:
  - Anti-virus software
  - Screen savers
  - Keyboard enhancers
  - Print spoolers
  - Messaging applications

If You Contact MTS by Phone

A Call Center agent registers your call before connecting you with a technical support specialist. The agent asks you for your:

- Site number
- Name
- Company name
- Company address
- Phone number where you can be reached

If your issue has a notification number, please provide that number. A new issue will be assigned a unique notification number.

Identify system type

To enable the Call Center agent to connect you with the most qualified technical support specialist available, identify your system as one of the following types:

- Electromechanical material test system
- Hydromechanical material test system
- Vehicle test system
- Vehicle component test system
- Aero test system

Be prepared to troubleshoot

Prepare to perform troubleshooting while on the phone:

- Call from a telephone close to the system so that you can implement suggestions made over the phone.
- Have the original operating and application software media available.
- If you are not familiar with all aspects of the equipment operation, have an experienced user nearby to assist you.

Write down relevant information

In case Technical Support must call you:

- Verify the notification number.
- Record the name of the person who helped you.
- Write down any specific instructions.

After you call

MTS logs and tracks all calls to ensure that you receive assistance for your problem or request. If you have questions about the status of your problem or have additional information to report, please contact Technical Support again and provide your original notification number.

Problem Submittal Form in MTS Manuals

Use the Problem Submittal Form to communicate problems with your software, hardware, manuals, or service that are not resolved to your satisfaction through the technical support process. The form includes check boxes that allow you to indicate the urgency of your problem and your expectation of an acceptable response time. We guarantee a timely response—your feedback is important to us.

Access the Problem Submittal Form:

- In the back of many MTS manuals (postage paid form to be mailed to MTS)
- www.mts.com > Contact Us > Problem Submittal Form button (electronic form to be e-mailed to MTS)

Preface

Before You Begin

Safety first!

Before you use your MTS product or system, read and understand the *Safety* manual and any other safety information provided with your system. Improper installation, operation, or maintenance can result in hazardous conditions that can cause severe personal injury or death, or damage to your equipment and specimen. Again, read and understand the safety information provided with your system before you continue. It is very important that you remain aware of hazards that apply to your system.

Other MTS manuals

In addition to this manual, you may receive additional manuals in paper or electronic form.

You may also receive an MTS System Documentation CD. It contains an electronic copy of the manuals that pertain to your test system, such as:

- Hydraulic and mechanical component manuals
- Assembly drawings
- Parts lists
- Operation manual
- Preventive maintenance manual

Controller and application software manuals are typically included on the software CD distribution disc(s).

Conventions

Documentation Conventions

The following paragraphs describe some of the conventions that are used in your MTS manuals.

Hazard conventions

Hazard notices may be embedded in this manual. These notices contain safety information that is specific to the activity to be performed. Hazard notices immediately precede the step or procedure that may lead to an associated hazard. Read all hazard notices carefully and follow all directions and recommendations. Three different levels of hazard notices may appear in your manuals. Following are examples of all three levels.

Note *For general safety information, see the safety information provided with your system.*

DANGER

Danger notices indicate the presence of a hazard with a high level of risk which, if ignored, *will* result in death, severe personal injury, or substantial property damage.

WARNING

Warning notices indicate the presence of a hazard with a medium level of risk which, if ignored, *can* result in death, severe personal injury, or substantial property damage.

CAUTION

Caution notices indicate the presence of a hazard with a low level of risk which, if ignored, *could* cause moderate or minor personal injury or equipment damage, or could endanger test integrity.

Notes

Notes provide additional information about operating your system or highlight easily overlooked items. For example:

Note *Resources that are put back on the hardware lists show up at the end of the list.*

Special terms

The first occurrence of special terms is shown in *italics*.

Illustrations

Illustrations appear in this manual to clarify text. They are examples only and do not necessarily represent your actual system configuration, test application, or software.

Electronic manual conventions

This manual is available as an electronic document in the Portable Document File (PDF) format. It can be viewed on any computer that has Adobe Acrobat Reader installed.

Hypertext links

The electronic document has many hypertext links displayed in a blue font. All blue words in the body text, along with all contents entries and index page numbers, are hypertext links. When you click a hypertext link, the application jumps to the corresponding topic.

Chapter 1
Safety Information

Contents

Intended Use of MTS Series 494 Controllers

MTS Series 494 Controllers vary from single-channel, single-station systems to multichannel, multistation systems. This increased flexibility of Series 494 Controllers permits their use in several industrial testing applications.

MTS Series 494 Controllers are typically used in the following testing markets:

- Materials
- Automobile
- Tire and Wheel
- Aircraft

Before you attempt to use your MTS product, read and understand the manuals that accompany this product. Improper installation or operation of this product can result in hazardous conditions that can cause severe personal injury or death, and damage to your equipment and test specimen.

EC Declaration of Conformity for MTS Models 494.04 (FlexTest 40), 494.06 (FlexTest 60), 494.10 (FlexTest 100) and 494.20 (FlexTest 200)

Description of Models

The MTS Series 494 Electronics Control Chassis' are VMEbus chassis' that can house up to twenty VMEbus modules in the front of the chassis and up to twenty MTS Systems Corporation transition modules in the rear panel of the chassis. The chassis can be configured with a variety of MTS VMEbus plug-in modules and related transition modules.

Manufacturer

MTS Systems Corporation
14000 Technology Drive
Eden Prairie, MN, USA 55344-2290
Phone: 952-937-4000

Directives

Low Voltage directive 2006/95/EEC and the EMC directive 2004/108/EC.

Standards

EN 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use, Part 1: General requirements

EN 61000-6-2: Electromagnetic Compatibility, Generic Standards - Immunity for Industrial Environments.

EN 61000-6-4: Electromagnetic Compatibility, Generic Standards - Emission standard for Industrial Environments.

Description	Basic Standard	Test Specification
Limits for harmonic current emissions	EN 61000-3-2	Class A
Limits for voltage fluctuations and flicker	EN 61000-3-3	Class A
Electrostatic discharge	EN 61000-4-2	+/- 4 kV contact discharge +/- 8 kV air discharge Performance Criteria B
Radio frequency electromagnetic field, amplitude modulated	EN 61000-4-3	10 V/m Performance Criteria A
Electrical fast transient	EN 61000-4-4	2 kV mains 2 kV control and signal Performance Criteria B

DESCRIPTION	BASIC STANDARD	TEST SPECIFICATION
Electrical surge immunity test	EN 61000-4-5	2 kV mains line to earth 1 kV mains line to line .5 / 1 kV cables >30 meters line to earth Performance Criteria B
Radio frequency common mode, amplitude modulated	EN 61000-4-6	10 V (rms) Performance Criteria A
Power frequency magnetic field	EN 61000-4-8	30 A (rms)/m 50 and 60 Hz Performance Criteria B
Voltage dips, short interruptions, and voltage variations	EN 61000-4-11	1 cycle and 0% amplitude of cycle Performance Criteria B 10 cycle and 40% amplitude of cycle 25 cycle and 70% amplitude of cycle 250 cycle and 0% amplitude of cycle Performance Criteria C
Radiated emissions	EN 55011	Class A
Conducted emissions	EN 55011	Class A

Name: Rich Baker

Title: Vice President of Engineering

Date: 01 November 2007

Waste Electrical and Electronic Equipment (WEEE) Considerations

The Waste Electrical and Electronic Equipment (WEEE) symbol ([redacted]) indicates that the controller and its electronic parts must not be disposed of as unsorted municipal waste. Proper disposal is required by approved electronic waste collection agencies. Customers in the EC region who desire to return an end-of-life controller and its electronic parts are encouraged to contact your local MTS Systems Sales/Service Offices for instructions.

Safety Circuits

Series 494 hardware includes a number of safety circuits that monitor and respond to potentially unsafe conditions.

Shock Hazards

To avoid shock hazards, users should not attempt to service any parts located inside any Series 494 Controller chassis.

WARNING

Controllers contain components that operate at hazardous voltage levels.

Hazardous voltage levels inside the controller pose a danger. Contact with high-voltage electricity can result in injury or death.

Do not remove any panel, cover, or door on any Series 494 Controller chassis. Do not attempt to service any Series 494 Controller chassis. There are no user-serviceable parts or fuses in any Series 494 Controller chassis.

Input/Output Verification

There are a number of ways that you can verify the integrity of controller input and output circuits.

WARNING

Improper use of controller outputs can result in damage to the controller and unexpected actuator movement.

Unexpected actuator movement can result in injury to personnel or damage to the equipment.

Outputs should be used to monitor controller functions within the specifications included in the *MTS Series 494 Controller Hardware Manual*.

Relay outputs

If necessary, you can use an external device to monitor both NO and NC contacts to detect state changes and verify relay integrity. You can also provide a redundant set of contacts to an external device.

Digital inputs

If necessary, you can set up the controller to monitor redundant digital input signals and use the controller software to verify input circuit integrity and take action if a problem is identified.

Digital outputs

If necessary, you can provide redundant output signals to external systems.

E-Stop Circuits

Emergency stop (E-stop) circuits include an electro-mechanical switch that when pressed, removes power from the HPU E-stop relay and forces a global interlock.

Most Series 494 Controllers include E-Stop outputs that are intended to be monitored by external devices. If necessary, an external device can monitor multiple E-stop output contacts to detect state changes and verify relay integrity.

E-Stop Circuit Testing

The E-Stop circuit should be tested periodically to help ensure that the system shuts down safely when the **E-Stop** button(s) is pressed.

Note *MTS recommends testing the E-Stop circuit at least once per month.*

1. Remove any specimens from each station.
2. Apply power to the controller.
3. Start the HPU and each HSM associated with your test station(s).
4. Press the **E-Stop** button and ensure that the following global-interlock actions occur:
    - Power is removed from each HPU.
    - Power is removed from each HSM.
    - If valve clamping is enabled, the actuator should move to the predetermined position defined in software.
    - Any external I/O device that is monitoring the E-Stop circuit should acknowledge the E-Stop state and take appropriate action.
5. Twist the switch clockwise to release it.
6. Repeat this procedure for each **E-Stop** button used with your controller.

Hardware Interlocks

A Series 494 controller running Series 793 Control Software can have up to eight separate hardware interlock chains. Each test station configuration that you open must be assigned to a unique hardware interlock chain. This allows one controller to run up to eight test stations, each with its own hardware interlock chain.

Note *Some test configurations may only use one station that is assigned to a single hardware interlock chain.*

The controller can generate two type of hardware interlocks, global interlocks, and station interlocks:

Global interlocks

Global interlocks detect controller chassis conditions (such as watchdog timers and undervoltage conditions) that can affect any station running on the controller. A global interlock forces all eight hardware interlock chains to an active state.

Station interlocks

Station interlocks are associated with a specific test station and will force the hardware interlock chain assigned to that station to an active interlock state.

Series 494 controllers include interlock output contacts (NO/NC) that are intended to provide hardware interlock status to external systems.

Note *If necessary for critical applications, you can use an external I/O monitoring device to monitor both NC and NO contacts to detect state changes and verify relay integrity.*

E-Stop and Hardware Interlocks

The following table shows E-stop/interlock operation for a typical system that uses Series 793 Control Software. Interlock and E-stop operation on some test systems may vary.

E-stop and Hardware Interlock Events/Actions (Series 793 Control Software)

E-Stop	Global (Controller) Interlock	Station Interlock
An E-stop occurs when the operator presses an electro-mechanical **E-stop** switch.	Any of the following events results in a global interlock: • Undervoltage conditions on auxiliary power outputs. • Controller conditions such as watchdog timers and backplane monitoring. • E-stop button pressed.	Any of the following events results in a station interlock: • Software events (such as limits). • External interlock input active. • Station Stop button pressed.
An active E-stop causes the following actions: • Physically removes power from the HPU CRM E-stop relay. **Note** *The CRM E-stop relay is located in the HPU.* • Forces a global interlock.	A global interlock applies the following actions to each of the hardware interlock chains: • Sets the controller HPU commands to off. • Sets each controller HSM command to off. • Sets the controller function generator/program (for all stations) to off. • If enabled, the valve driver current is clamped to a predefined value/polarity.	A station interlock applies the following actions to the single hardware interlock chain where that station is assigned: • Sets the station HSM command to off. • Sets the controller function generator/program (for that station only) to off. • If enabled, the valve driver current is clamped to a predefined value/polarity.
E-Stop outputs are intended to be monitored by external devices.	Interlock outputs are intended to be monitored by external devices.	Interlock outputs are intended to be monitored by external devices.
Note *If necessary, an external I/O monitoring device can monitor multiple E-stop/Interlock output contacts to detect state changes and verify relay integrity.*		

Chapter 2

FlexTest Controller Configurations

This chapter describes the various components, specifications, and installation requirements for MTS FlexTest Controller hardware.

Contents

UPS System Requirements 42

FlexTest Controller Overview

About MTS FlexTest Models 40/60/100/200 Controllers

MTS FlexTest Models 40/60/100/200 Controllers are generally used in servohydraulic test systems. They provide real-time closed-loop control, with transducer conditioning and function generation to drive various types of servo-actuators.

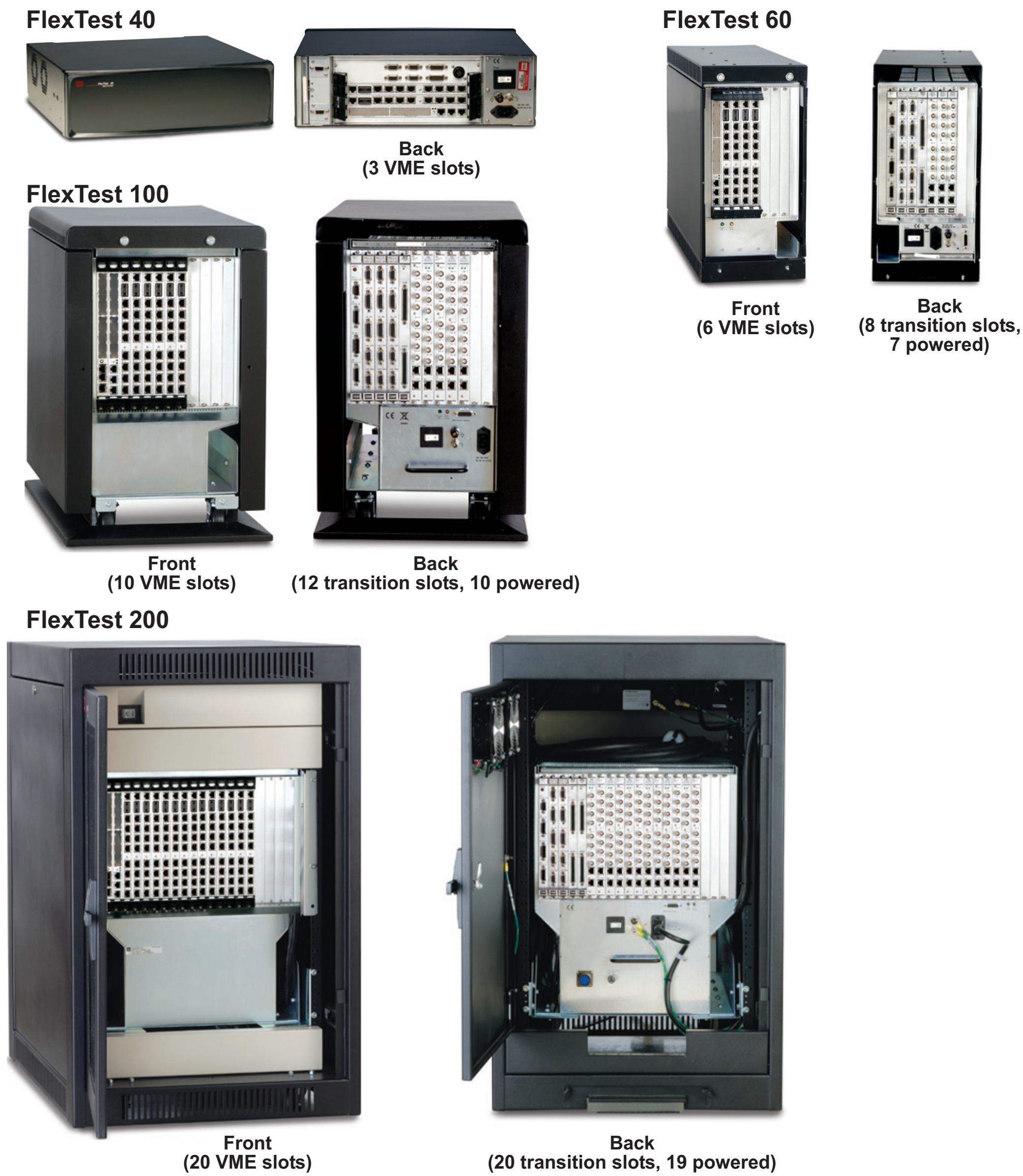
A FlexTest Controller consists of:

- One or more Series 494 Hardware chassis that contain controller hardware.
- A computer workstation that runs MTS controller applications.

Controller capabilities

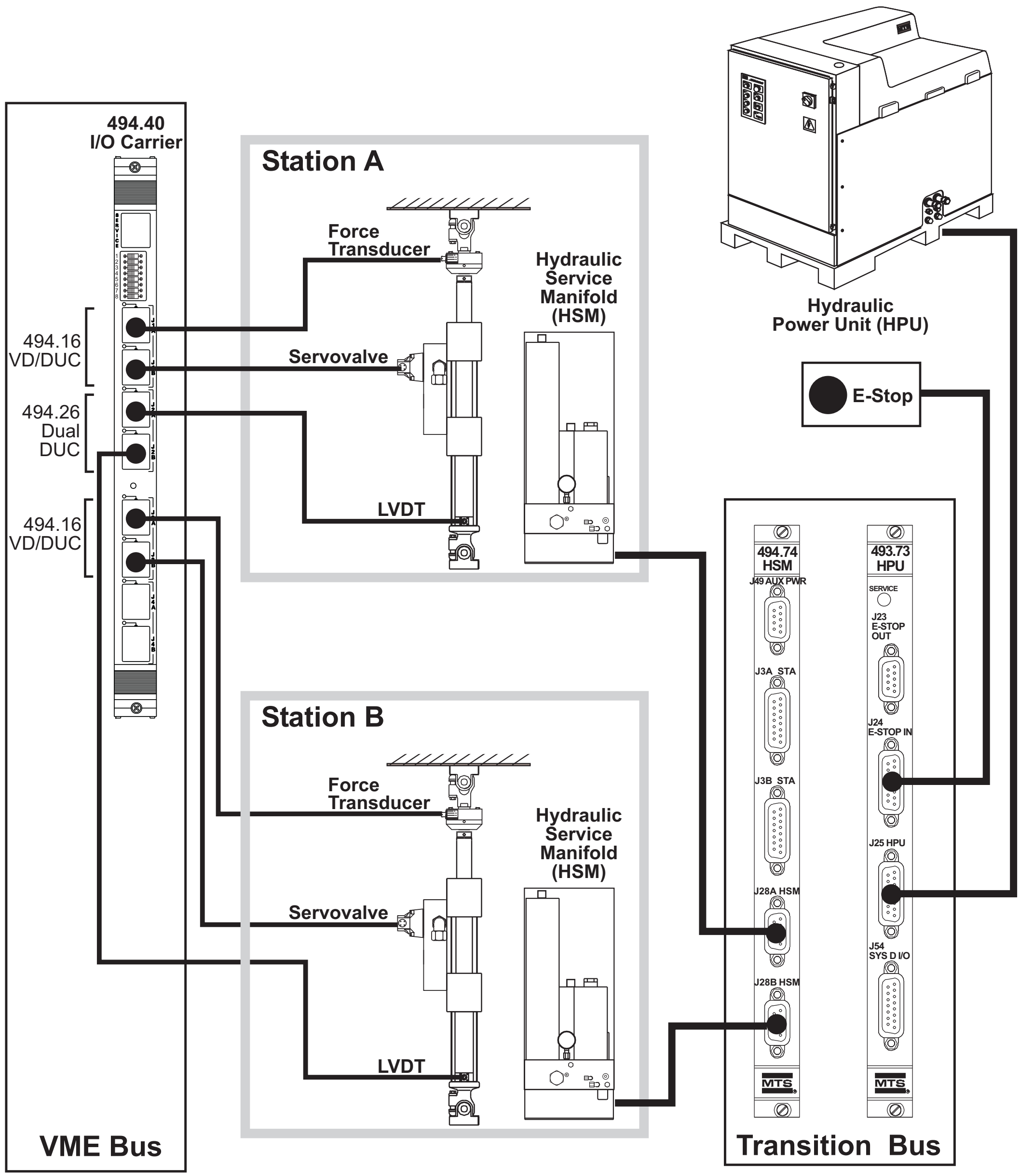
PARAMETER	FLEXTEST 40	FLEXTEST 60	FLEXTEST 100	FLEXTEST 200
Test Stations	2	Up to 6*	Up to 8	Up to 8
Control Channels	Up to 4	Up to 8	Up to 16	Up to 40
Conditioned Transducer Inputs	Up to 12	Up to 24	Up to 40	Up to 80
Auxiliary Data Inputs	Up to 16	Up to 32	Up to 64	Up to 96

*With On/Off Hydraulic Service Manifolds only



FlexTest Models 40/60/100/200 Controllers

Typical Series 494 Chassis Connections (FT60, FT100, FT200)



Installation

This section includes a number of installation requirements for Series 494 Controller Hardware.

Controller Installation Procedure

The following procedure provides a basic outline for the installation of FlexTest controllers.

1. Unpack the controller.
2. Inspect the controller for any damage.

Note *Report any damage to the controller to the shipping agent and MTS.*

CAUTION

Controller electronic components can be damaged during shipping.

Using a controller with damaged components can result in injury to personnel or equipment damage.

Do not attempt to use equipment that was damaged during shipping. Report any damaged components to the shipping agent and MTS.

3. Move the controller chassis to the desired location.

CAUTION

The Model 494.10 and 494.20 Chassis weighs approximately 45 kg (100 lb) and 60 kg (132 lb) respectively.

Improper lifting techniques can cause strained muscles and back injuries.

When lifting this chassis, take the appropriate precautions to prevent injuries to yourself.

CAUTION

The Model 494.06 Chassis has a removable front cover that could loosen when attempting to lift the chassis.

Lifting the Model 494.06 Chassis without first removing the front cover can result in injury to personnel or equipment damage.

Remove the front cover on the Model 494.06 Chassis before attempting to lift the Model 494.06 Chassis.

4. Connect power and cables as required.

WARNING

If you attempt to change a cable connection while the system is in operation, an open control loop condition can result.

An open control loop condition can cause a rapid, unexpected system response which can result in severe personal injury, death, or damage to equipment.

Do not change any cable connections when electrical power or hydraulic pressure is applied. Ensure that all cables are connected after you make any changes in the system configuration. Also, ensure that all cables have appropriate strain relief devices installed at the cable and near the connector plug.

WARNING

Unprotected cables can be damaged by hydraulic fluid, excessive temperature, excessive strain, and contact with sharp, abrasive, or heavy objects.

A damaged cable can cause a rapid, unexpected system response which can result in severe personal injury, death, or damage to equipment.

Protect all system cables as described below:

- Protect electrical cables from spilled hydraulic fluid and from excessive temperatures that can cause the cables to harden and eventually fail.
- Ensure that all cables have strain-relief devices installed at the cable and near the connector plug. Do not use the connector plug as a strain relief.
- Protect all system cables from sharp or abrasive objects that can cause the cable to fail.
- Use a cable cover or cable tray where cables are in traffic locations. Never walk on cables or move heavy objects over them.
- Route cables away from areas that expose them to possible damage.

Installation Requirements–Series 494 Hardware

Software settings

Software is used to define the location (address) of each board used in the system. Controller software uses this information to locate and communicate with each board. In addition, there are other software settings that define hardware parameters.

Blank chassis panels

To help ensure proper ventilation, each blank slot in a Series 494 Chassis must have a blank chassis panel.

Chassis grounding

The controller will not function correctly if the chassis is not grounded properly.

I/O carrier settings

The Model 494.40 I/O Carrier board has a number of hardware settings that must be set before you install the board. These settings include:

- Address switch settings (required)
- The installation of bridge-completion resistors (optional)
- The installation of shunt-calibration resistors (optional)

Interlock jumper plugs

Each system includes a system jumper plug kit. If interlock/E-Stop inputs are not used, you must install a jumper plug to maintain the integrity of those interlocks.

For more information

For detailed descriptions of software settings, see the controller software manuals delivered with your system.

For detailed descriptions of I/O Carrier board settings, see “How to Set Up a Model 494.40 I/O Carrier Board” on page 121.

Environmental Requirements—Series 494 Hardware

All Series 494 hardware components are intended for indoor use only. This indoor environment must conform to the following environmental specifications.

Note *All Series 494 Controller must only be operated under the installation and ambient conditions (such as, temperature, moisture, and EMC) specified.*

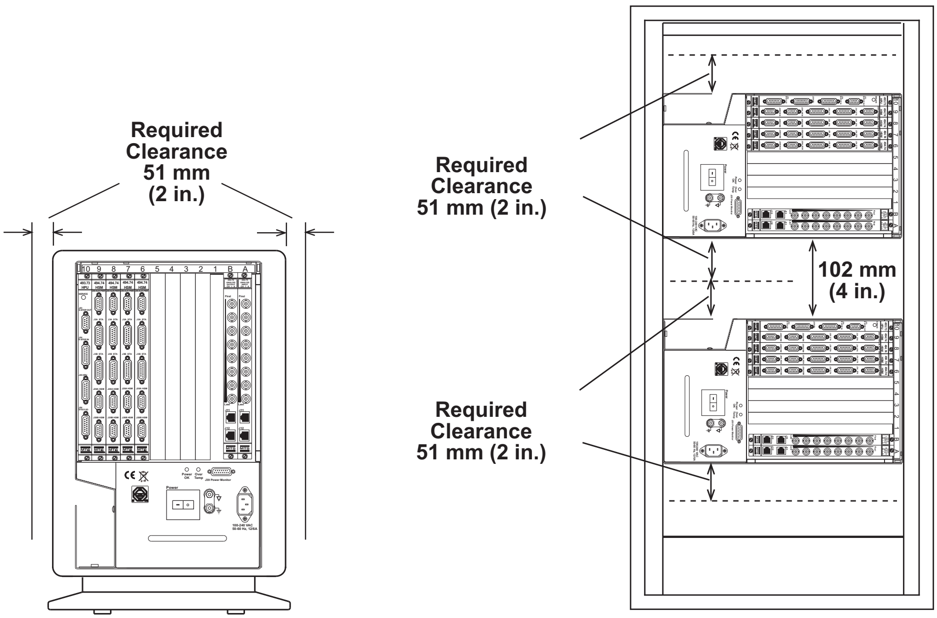
PARAMETER	SPECIFICATION
Temperature	5ºC–40ºC (41ºF–104ºF)
Humidity	5–85%, non-condensing
Altitude	3048 m (10,000 ft) maximum
Space Requirements	For proper ventilation, allow 51 mm (2 in) clearance on all sides of the chassis. The rear of the chassis requires a minimum clearance of 15.24 cm (6 in) for cable connections.

Note *To maintain EMC compliance, the controller must be installed in a location that does not exceed the EN 61000-6-4 emission standard for industrial environments.*

Ventilation Requirements–Series 494 Chassis

For proper ventilation for rack-mounted chassis, you must provide 51 mm (2 in) clearance on all sides of a Series 494 Chassis.

Note *The rear of the chassis requires a minimum clearance of 15.24 cm (6 in) for cable connections.*



CAUTION

The chassis Over Temp indicator (located on the front of the Model 494.06 chassis and on the back of the Models 494.10 and 494.20 chassis) turns on when the chassis temperature is too hot–over 50ºC (122ºF).

Failure to take immediate action to correct the overtemperature condition can result in irreparable damage to components.

Do not operate the system when the chassis Over Temp indicator is on. Shut down the system and check the airflow through the chassis. Check for blocked filters and damaged fans in the chassis. If the chassis is installed in a console, check for blocked filters and damaged fans in the console. Also, make sure that the ambient air temperature is less than 40ºC (104ºF) and that there is at least 51 mm (2 in) clearance on all sides of the chassis.

Rack-Mounting Requirements–Series 494 Chassis

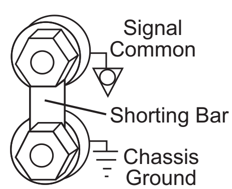
To install a Series 494 Chassis in most 19-inch consoles you will need a console mounting kit.

MOUNTING KIT	PART NUMBER
494.04 Chassis Console Mounting Kit	100-152-784
494.06 Chassis Console Mounting Kit	100-174-282
494.10 Chassis Console Mounting Kit	100-183-825
494.20 Chassis Console Mounting Kit (Vertical Console)	56-819-501
494.20 Chassis Console Mounting Kit (Half-Height Console)	56-781-303

Grounding Requirements–Series 494 Chassis

The controller will not function correctly if the chassis is not grounded as shown. Make sure that your power source is also properly grounded.

The chassis includes two grounds: a chassis ground and a signal common. During manufacturing, the two grounding lugs are connected together with an external shorting bar.



WARNING

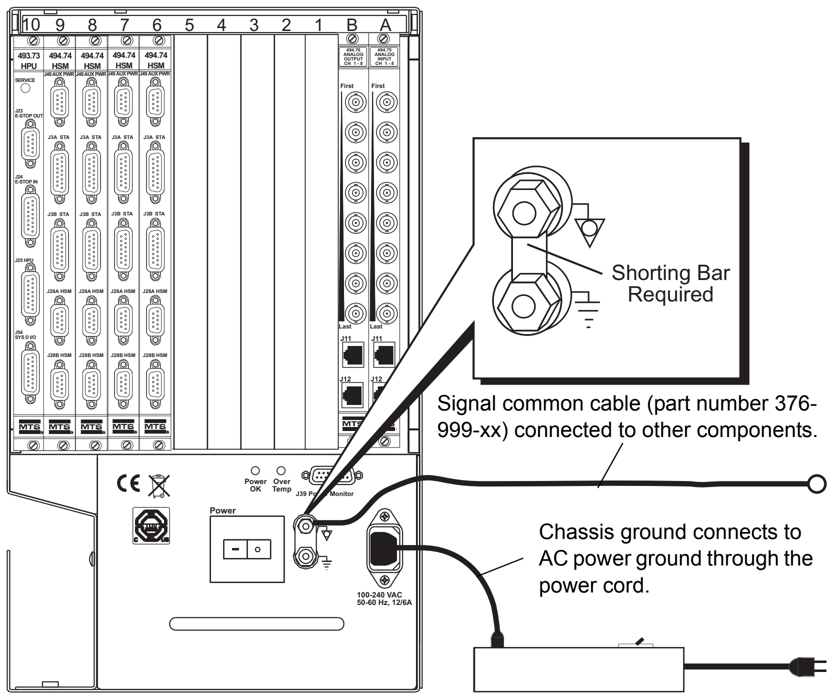
Improper grounding can result in unexpected actuator movement and failure to meet EMC emission and susceptibility requirements.

Unexpected actuator movement can result in injury or death and/or damage to the equipment.

Ensure that each controller chassis is properly grounded.

Stand-alone ground connections

For stand-alone mounting, connect the shorting bar to both ground lugs. Tighten the two nuts that secure the shorting bar to the ground lugs.

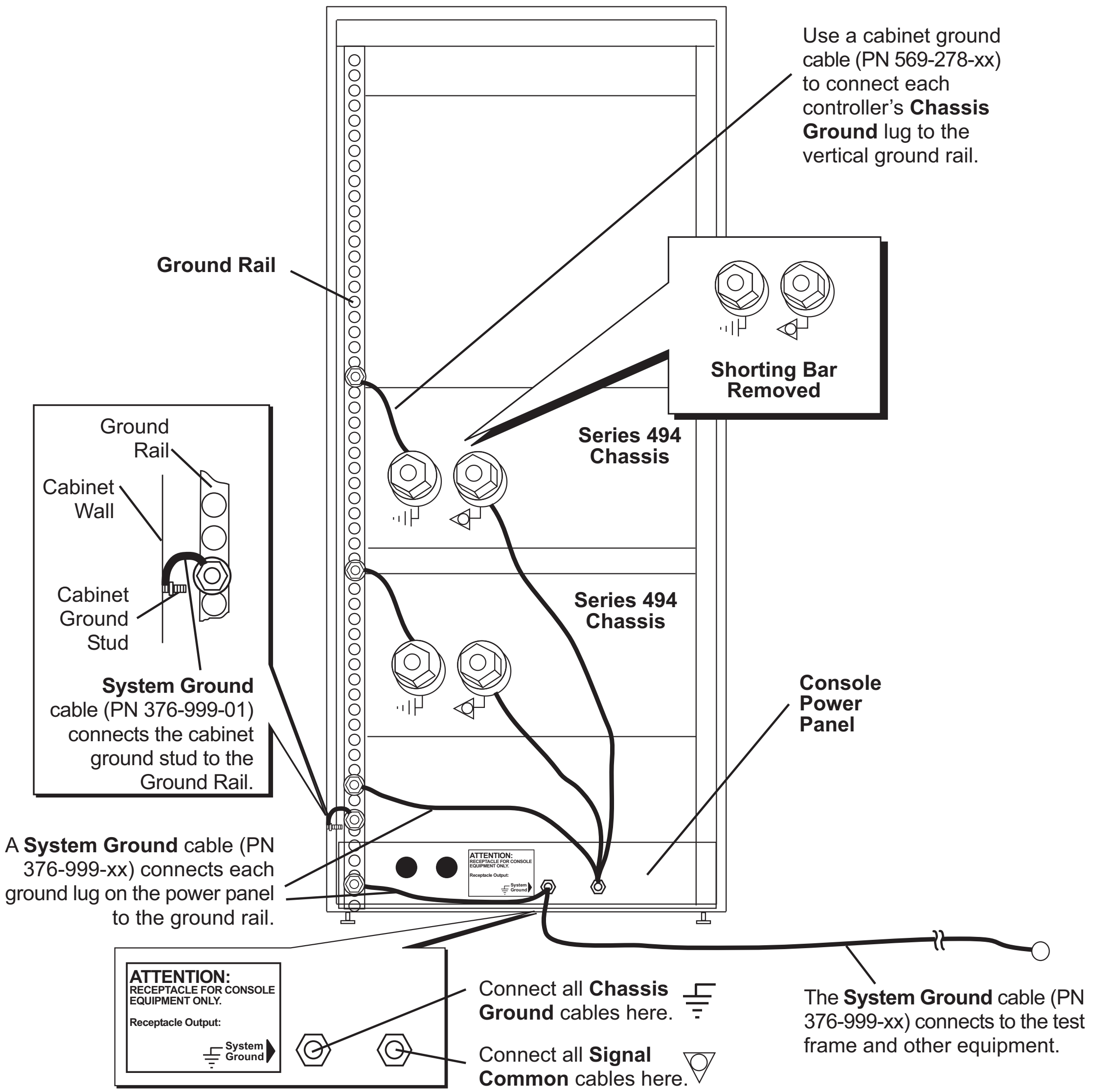


Series 494 Chassis (Rear)

Console ground connections

If you mount a Series 494 Chassis in a console, remove the shorting bar from the chassis ground lugs and connect the chassis ground to the console rail as shown.

The chassis ground connects to the AC power ground through the power cord. The power cord must be plugged into both the chassis and the power source for proper grounding.



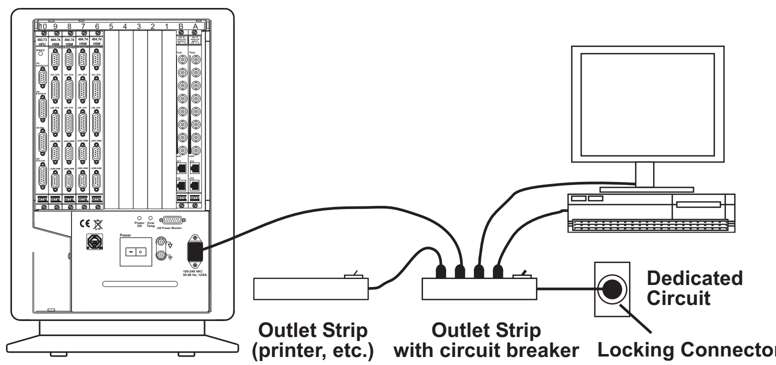
Use a cabinet ground cable (PN 569-278-xx) to connect each controller's **Chassis Ground** lug to the vertical ground rail.
Ground Rail
Shorting Bar Removed
Series 494 Chassis
Series 494 Chassis
Ground Rail
Cabinet Wall
Cabinet Ground Stud
System Ground cable (PN 376-999-01) connects the cabinet ground stud to the Ground Rail.
Console Power Panel
A **System Ground** cable (PN 376-999-xx) connects each ground lug on the power panel to the ground rail.
ATTENTION:
RECEPTACLE FOR CONSOLE EQUIPMENT ONLY.
Receptacle Output:
System Ground
Connect all **Chassis Ground** cables here.
Connect all **Signal Common** cables here.
The **System Ground** cable (PN 376-999-xx) connects to the test frame and other equipment.

AC Power Disconnect Requirements–Series 494 Chassis

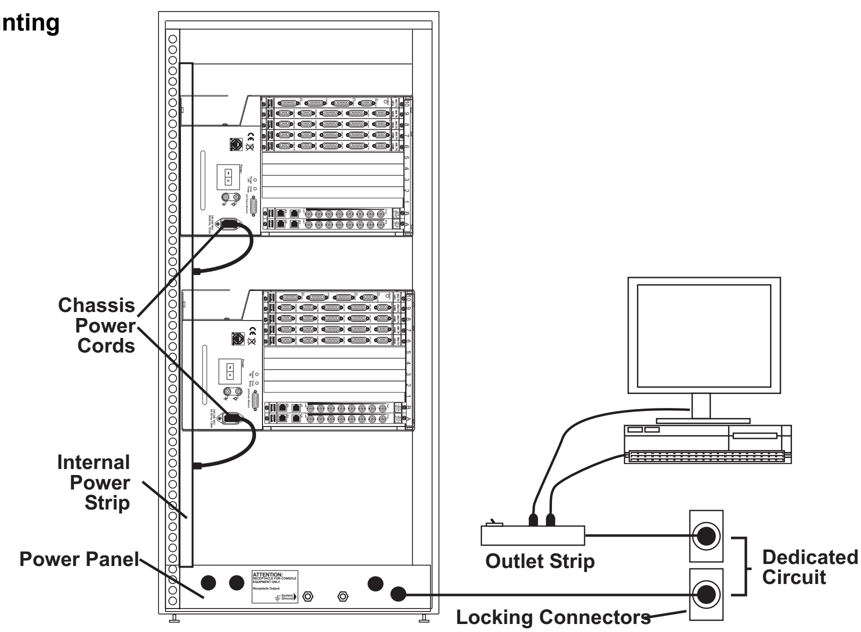
The Series 494 Chassis and the computer workstation should both be powered from the same electrical circuit.

Note *Be sure to locate the chassis so that you have adequate access to disconnect the power cord from the chassis.*

Self-Standing Enclosure



Console Mounting



Cable Requirements–Series 494 Hardware

To maintain EMC compliance and help ensure optimal performance, MTS recommends ordering all system cables from MTS. Cables should be installed so that they are protected from conditions that could damage the cable.

WARNING

Unprotected cables can be damaged by hydraulic fluid, excessive temperature, excessive strain, and contact with sharp, abrasive, or heavy objects.

A damaged cable can cause a rapid, unexpected system response which can result in severe personal injury, death, or damage to equipment.

Protect all system cables as described below:

- Protect electrical cables from spilled hydraulic fluid and from excessive temperatures that can cause the cables to harden and eventually fail.
- Ensure that all cables have strain-relief devices installed at the cable and near the connector plug. Do not use the connector plug as a strain relief.
- Protect all system cables from sharp or abrasive objects that can cause the cable to fail.
- Use a cable cover or cable tray where cables are in traffic locations. Never walk on cables or move heavy objects over them.
- Route cables away from areas that expose them to possible damage.

WARNING

If you attempt to change a cable connection while the system is in operation, an open control loop condition can result.

An open control loop condition can cause a rapid, unexpected system response which can result in severe personal injury, death, or damage to equipment.

Do not change any cable connections when electrical power or hydraulic pressure is applied. Also, ensure that all cables are connected after you make any changes in the system configuration.

UPS System Requirements

UPS Systems for FlexTest 60, 100, 200, and GT Controllers

To provide an increased level of safety, such as needed to address current European Machinery Directive, any system using an FT60, FT100, FT200, or FTGT servo controller must have an acceptable Uninterruptable Power Supply (UPS) properly integrated into the system.

It is important to note that the UPS will not prevent any unexpected motion if the controller, or any other electrical subsystem required for control of the system has an internal failure, including a HPU or a Motor Drive.

UPS requirements

- The UPS must be wired to provide power to the controller and any peripheral equipment that is instrumental in safe system operation and shutdown. In some cases it may be feasible and appropriate to provide UPS power to the Hydraulic Power Unit (HPU).
- The UPS must be sized to provide adequate electrical power for a period of three minutes after loss of input power.
- The controller must be configured to take appropriate actions for safe shutdown of hydraulic equipment being controlled. (Appropriate actions depend on the particular system.)
- Both UPS input power and UPS output power connections must include strain relief and a twist-lock plug or equivalent.
- UPS systems used in the European Union must be CE marked.
- The UPS must have input power-loss (AC Fail) alarm relay contact out and a low battery alarm relay contact out, both of which must be wired to the controller's UPS monitoring interface.

Battery power considerations

A UPS with an AC Fail relay contact wired to the controller provides a mechanism for the controller to identify that the UPS has switched over to battery power due to a detected AC power failure condition from the facility's power grid. This fault signal from the UPS can be used by the controller to start a safe shutdown sequence, ramp command(s) to a safe state(s), and then shut off the power source.

The addition of a low battery warning relay contact out from the UPS will provide additional system safety protection by letting the controller know that the UPS battery is low.

UPS Systems for FlexTest 40 and FlexTest SE Servocontrollers

To provide an increased level of safety and to address current European Machinery Directive, any system using an FT40, or FTSE servo controller must have an acceptable Uninterruptible Power Supply (UPS) properly integrated into the system.

It is important to note that the UPS will not prevent any unexpected motion if the controller, or any other electrical subsystem required for control of the system has an internal failure, including a HPU or a motor drive.

UPS requirements

- The UPS must be wired to provide power to the servocontroller and any peripheral equipment that is instrumental in safe system operation and shut-down. In some cases it may be feasible and appropriate to provide UPS power to the hydraulic power unit (HPU).
- The UPS must be sized to provide adequate electrical power for a period of three minutes after loss of input power.
- The controller must be configured to take appropriate actions for safe shut-down of hydraulic equipment being controlled. (Appropriate actions depend on the particular system.)
- Both UPS input power and UPS output power connections must include strain relief and a twist-lock plug or equivalent.
- UPS systems used in the European Union must be CE marked.
- FT40 (with Model 494.41 System board) and FTSE controllers do not have dedicated UPS monitoring inputs.The UPS must have input power-loss (AC Fail) alarm relay contact out and a low battery alarm relay contact out, both of which must be wired to two of the digital inputs that are part of general-use DI/O in the FT40 or FTSE controllers.

Note *FT40 controllers that include a Model 494.44 or a Model 494.42 system board have dedicated UPS inputs.*

- The controller’s “Event Action” feature must be configured to take appropriate actions for safe shut-down of hydraulic equipment being controlled. (Appropriate actions depend on the particular system.)

Battery power considerations

A UPS with an AC Fail relay contact wired to the controller provides a mechanism for the controller to identify that the UPS has switched over to battery power due to a detected AC power failure condition from the facility's power grid. This fault signal from the UPS can be used by the controller to start a safe shutdown sequence, ramp command(s) to a safe state(s), and then shut off the power source.

The addition of a low battery warning relay contact out from the UPS will provide additional system safety protection by letting the controller know that the UPS battery is low.

Specifications–UPS Systems Used with MTS Controllers

Any UPS used with an MTS system must comply with these specifications.

UPS Specifications

Item	Requirement
Operating temperature	5–40 deg C
Operating humidity	5–85% non-condensing
Supported UPS output voltage range	100–240 V AC nominal, single phase, sine-wave output
Input/output frequency range	50–60 Hz
Output load regulation	-/+5% nominal operating voltage (both in battery and normal operation modes)
Switch-over time to battery on power loss	0 s (recommended), < 6 ms (required)

UPS power requirements

The following UPS power requirements include power for the PC, MTS Controller (one chassis), and 25% capability for other subsystems.

UPS Power Requirements

Controller Type	Controller Chassis	UPS Power Required
FlexTest SE	493.02	1200 watt
FlexTest GT	493.10	2500 watt
Aero ST	493.20	3500 watt
Flextest 40	494.04	1200 watt
FlexTest 60	494.06	1800 watt
FlexTest 100	494.10	2500 watt
FlexTest 200	494.20	3500 watt

Controller P0 Interlock Check Utility

793-based systems include a utility that uses Telnet commands to set and clear interlocks on various boards to identify boards that cannot set or clear interlocks. This is often the result of a bent P0 pin on the board connector.

During normal startup, sysload will run this utility. If a problem is identified,

1. Sysload will not complete.
2. A results window lists the problem boards and the location of the log file that contains the results.

You can also run this utility using the **P0interlockcheck** command line, **before** sysload runs.

FlexTest 40 Controller Configuration

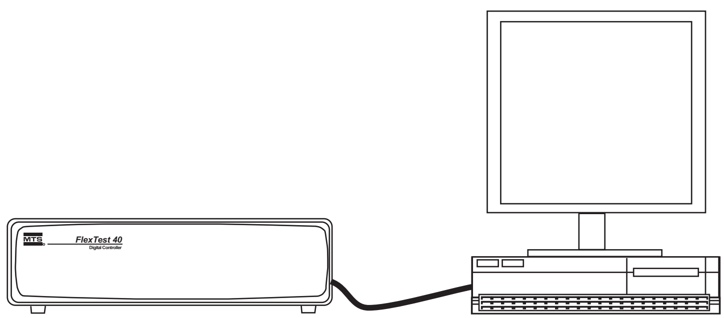
About the FlexTest 40 Controller

The FlexTest 40 Controller is a fully digital proportional, integral, derivative, feed forward (PIDF) servocontroller that provides complete control of one station in a test system.

A FlexTest 40 Controller consists of:

- One Model 494.04 Chassis that contains controller hardware.
- A computer workstation that runs MTS controller software applications.

For a detailed listing of configuration options, see the *FlexTest 40 Configuration* engineering drawing (Part number 700-003-810).



Controller capabilities

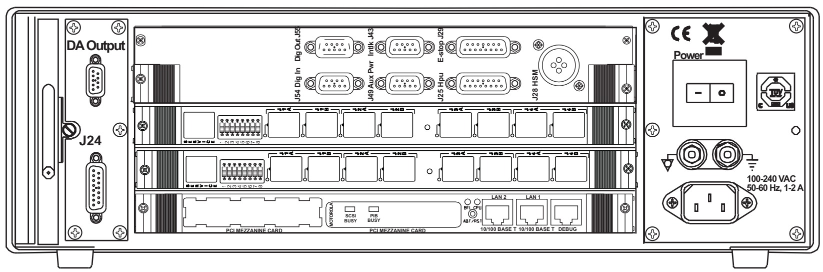
PARAMETER	FLEXTEST 40
Test Stations	1
Control Channels	Up to 4
Conditioned Transducer Inputs	Up to 12
Auxiliary Data Inputs	Up to 16

About the Model 494.04 Chassis

The Model 494.04 Chassis is a four-slot VME chassis that you can rack mount or place on a desktop. All cabling is accessed through the rear panel.

Mezzanine cards

Two slots are reserved for Model 494.40 I/O Carrier boards. Each I/O carrier board can contain up to four mezzanine cards. You can use mezzanine cards to condition transducers, drive servovalves, provide A-to-D inputs, and interface to various digital transducers (such as encoders and Temposonics transducers).



Model 494.04 Chassis (rear view)

Hydraulic control

The system board provides control of the test system hydraulics, including hydraulic power unit (HPU) and hydraulic service manifold (HSM) control.

Interlocks

The system board provides interlock inputs and outputs.

- You can use interlock-output contacts to control external devices.
- You can use interlock inputs from external devices to initiate station and program interlocks.

System board

The system board provides three optically isolated digital inputs and three relay-contact digital outputs.

- You can use digital-input signals to trigger test events in your controller software.
- You can use digital-output signals to control external devices.

Specifications–Model 494.04 Chassis

All equipment related to the controller should be connected to the same fused power circuit.

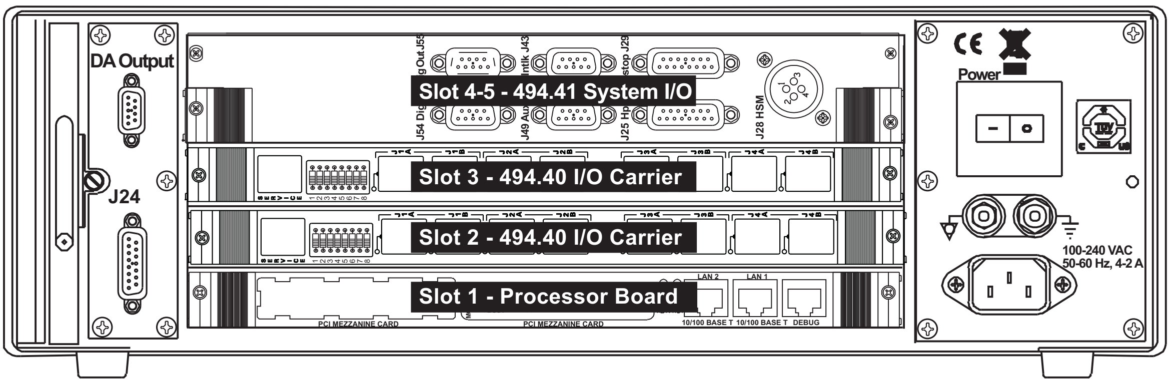
Note *Electrical connections must be made by qualified personnel and conform to local codes and regulations. Local electrical codes supersede any information found here.*

Model 494.04 Chassis Specifications

Parameter	Specification
Input Voltage	100–240 V AC (single phase) power factor corrected universal input
Input Frequency	50–60 Hz
Input Current	5 A at 100 V AC 3 A at 240 V AC
Facility Power Requirements	Provide a dedicated circuit for the chassis, computer, and monitor.
Input Surge	<40 A
Insulation Over Voltage	Category I
Pollution Degree	2
Weight	Approximately 8.6 kg (19 lb)
Dimensions	Width: 43 cm (17 in) Height: 14 cm (5.5 in) Depth: 44.5 cm (17.5 in)

Model 494.04 Chassis Boards

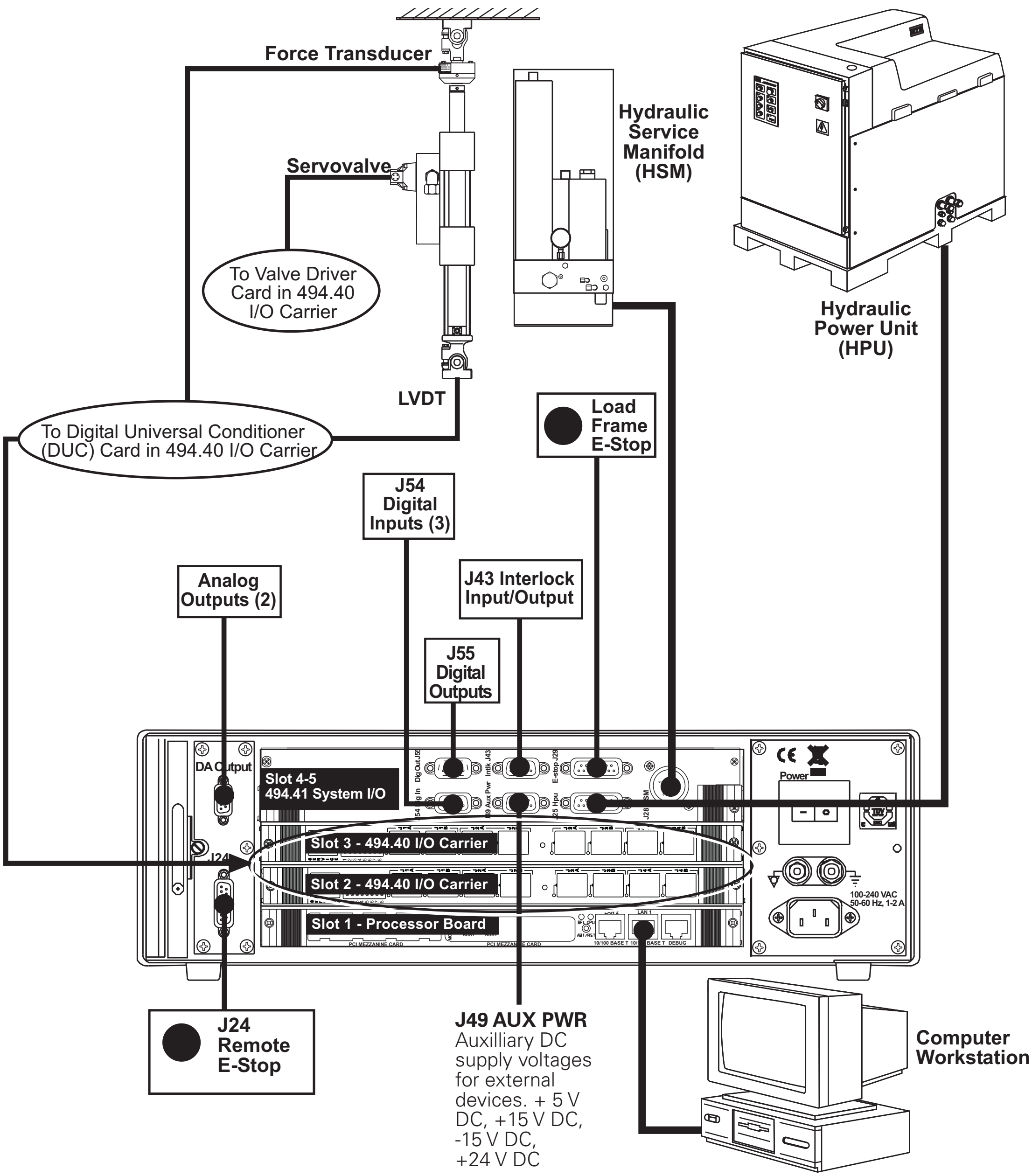
The Model 494.04 Chassis includes three VME bus slots that contain the boards listed in the following table.



Rear View of the Model 494.04 Chassis

Slot	Board Name	Function
Slot 1	**Processor Board**	Provides PIDF processing and an interface between the controller and the computer workstation.
Slots 2, 3	**Model 494. 40 I/O Carrier**	Supports up to four mezzanine cards that can condition transducers, drive servovalves, provide A-to-D inputs, and interface to various digital transducers (such as encoders and Temposonics transducers).
Slots 4, 5	**System Board**	Provides digital I/O, E-Stop, and HSM/HPU control. Compatible system boards include: the Model 494.41 Single-Station System Board, the Model 494.42 Single-Station System Board, and the Model 494.44 Two-Station System Board.

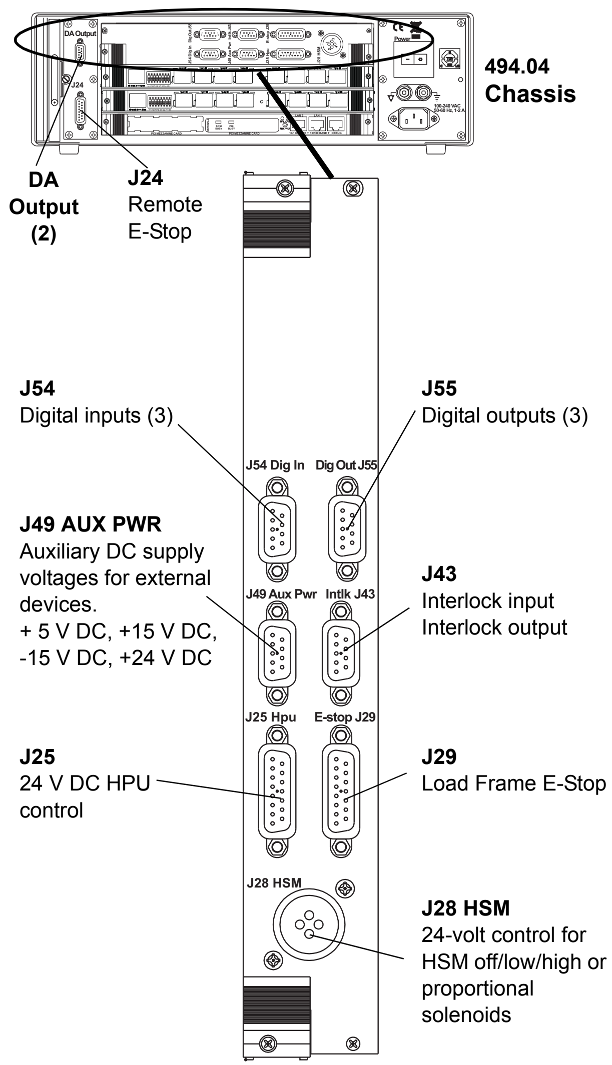
Typical Model 494.04 Chassis Connections



Model 494.41 Single-Station System Board

About the Model 494.41 Single-Station System Board

The Model 494.41 System board is a two-slot board that is only used in the Model 494.04 Chassis. This board provides analog and digital I/O, E-Stop, HSM, and HPU control for one station.



Board features

External Interfaces

- Three digital inputs (J54)
- Three digital outputs (J55)
- Auxiliary power outputs for external devices (J49)
- Two analog outputs (DA Output connector located on the 494.04 chassis)

Hydraulic Control

- 24-volt HPU control (J25)
- 24-volt HSM control (Off/Low/High or proportional) (J28)
- E-Stop/Interlock Control
- Load-frame E-Stop control (J29)
- Optional E-Stop control (J24-located on the 494.04 chassis)
- One interlock input and one interlock output (J43)

Model 494.41 System Board Specifications

Model 494.41 Specifications (part 1 of 3)

PARAMETER	SPECIFICATION
HSM Control*	**Connector J28 (CPC-4S)**
Off/Low/High Control	
Low Output	+24 V DC, 1.0 A maximum
High Output	+24 V DC, 1.0 A maximum
Proportional Control	
Signal Output	0–0.78 A
Solenoid Impedance	20–25 Ω
Ramp Time (0 to full scale)	2.1 s or 4.2 s (software selectable) * The type of HSM control (off/low/high or proportional) is software configurable.
Interlock Output Relay	**Connector J43 (D9S)**
Voltage	30 V DC/AC maximum
Current	1 A maximum
	Normally Open Relay Contacts: Open = Interlock
	Normally Closed Relay Contacts: Closed = Interlock
Interlock Input	**Connector J43 (D9S)**
Interlock Trip Voltage	0.8 V minimum, 3 V maximum
Maximum Input Voltage	+26 V DC
Input Resistance	2700 Ω
Interlock Power Output	+24 V DC (current limited by a 6.6-KΩ resistor)

Model 494.41 Specifications (part 2 of 3)

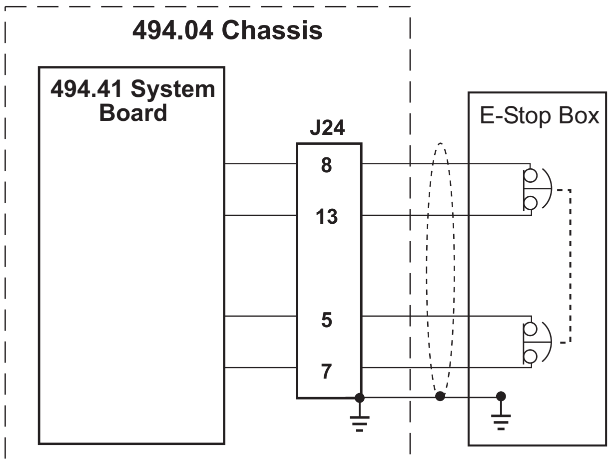
PARAMETER	SPECIFICATION
Program Interlock Input	**Connector J29 (D15S)**
Input Logic	Switch Contact Closed = no program interlock Switch Contact Open = program interlock
HPU Outputs (Start/Low/High)	**Connector J25 (D15P)**
HPU Output	Output Voltage: 24 V DC at 10 mA
HPU ON Input	Trip Voltage: 0.9–5.5 V DC Maximum Input Voltage: +26 V DC
HPU Interlock Inputs (Low Level and Overtemp)	**Connector J25 (D15P)**
Trip-point Voltage	18–23 V DC Maximum Input Voltage: +26 V DC
Auxiliary Power Outputs	**Connector J49 (D9S)**
+5 V DC	0.75 A at 40ºC (104ºF)
+15 V DC	0.75 A at 40ºC (104ºF)
-15 V DC	0.75 A at 40ºC (104ºF)
+24 V DC	0.75 A at 40ºC (104ºF)

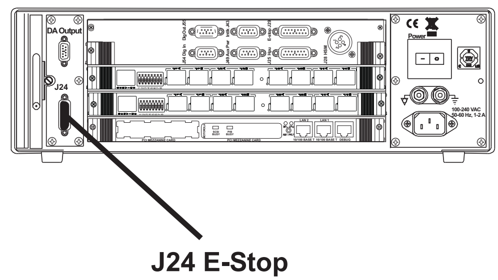
Model 494.41 Specifications (part 3 of 3)

PARAMETER	SPECIFICATION
Digital Output Relays	**Connector J55 (D9S)**
Voltage	30 V AC/DC maximum
Current	1 A maximum
Output logic	Output 1: One normally open (NO) contact Open = Output is OFF Output 2: One normally open (NO) contact and one normally closed (NC) contact NO Contact: Open = Output is OFF NC Contact: Closed = Output is OFF Output 3: One normally open (NO) contact Open = Output is OFF
Aux. Voltage	24 V DC, 0.75 A at 40°C
Digital Inputs	**Connector J54 (D9P)**
Input ON/OFF Trip Voltage	0.8–3 V DC
Maximum Input Voltage	+ 26 V DC
Input Resistance	2.7 KΩ
Digital Input Power Output	+ 24 V DC (current limited by 6.6-KΩ resistor)
D/A Outputs	**Connector "D/A Output" (D9P)**
Resolution	16 bit
Output Type	Single ended
Output Voltage	+/- 10 V full scale
Output Current	5.0 mA maximum
	Note *This connector is located on the rear panel of the 494.04 chassis.*

J24 Emergency Stop Connections for the Model 494.41 System Board

The Model 494.41 System board provides two E-Stop inputs that are available on the **J24 E Stop** connector (located on the rear panel of the Model 494.04 Chassis).





Cable specification

To maintain EMC compliance, the **J24 E-Stop** cable must comply with the following specifications:

Connector type–15-pin, type D, male EMI connector.

Backshell–EMI metallized plastic or metal.

Cable–24 AWG, four-conductor with braided shield, with the braid connected to a metallized plastic backshell at the chassis and to ground at the emergency stop (E-Stop) box.

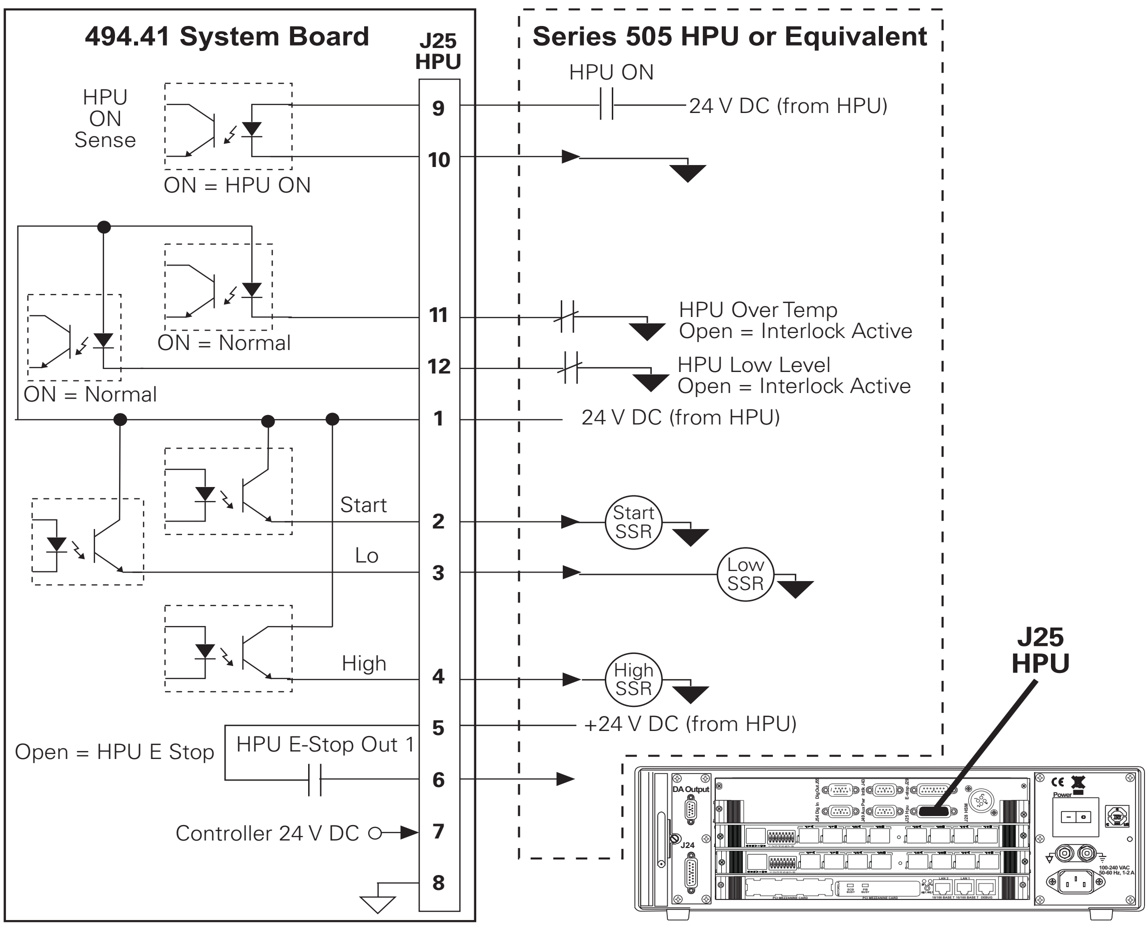
Jumper plug required

If connector **J24** is not used, you must install a jumper plug to maintain the integrity of the interlocks. Use jumper plug part number 039-713-201 or jumper pins 5-7 and 8-13.

J25 Hydraulic Power Unit Connections for the Model 494.41 System Board

Connector **J25 HPU** provides 24-volt logic signals that control the hydraulic power unit (HPU). The connector can be connected directly to MTS Series 505 HPUs and similar HPUs with low-current, 24-volt input controls.

Note *Other MTS HPUs require the Model 493.07 HPU Converter Box to convert the low-current HPU output signal to a signal that can drive the HPU relay.*



CAUTION

Control voltages for hydraulic power units vary between models. The interface between the Model 494.41 System board and an HPU consists of 24-volt logic signals.

Connecting J25 to a non-compliant HPU can damage the board.

Do not connect 24 V DC relay circuitry or 115 V AC circuitry to connector J25 on the Model 494.41 System board.

Cable specification

To maintain EMC compliance, **J25 HPU** cables must comply with the following specifications:

Connector—15-contact, type-D, female EMI connector.

Backshell–EMI metallized plastic or metal.

Cable—22 AWG, 10-conductor with braided shield with the shield connected to metallized plastic or metal backshell to the chassis.

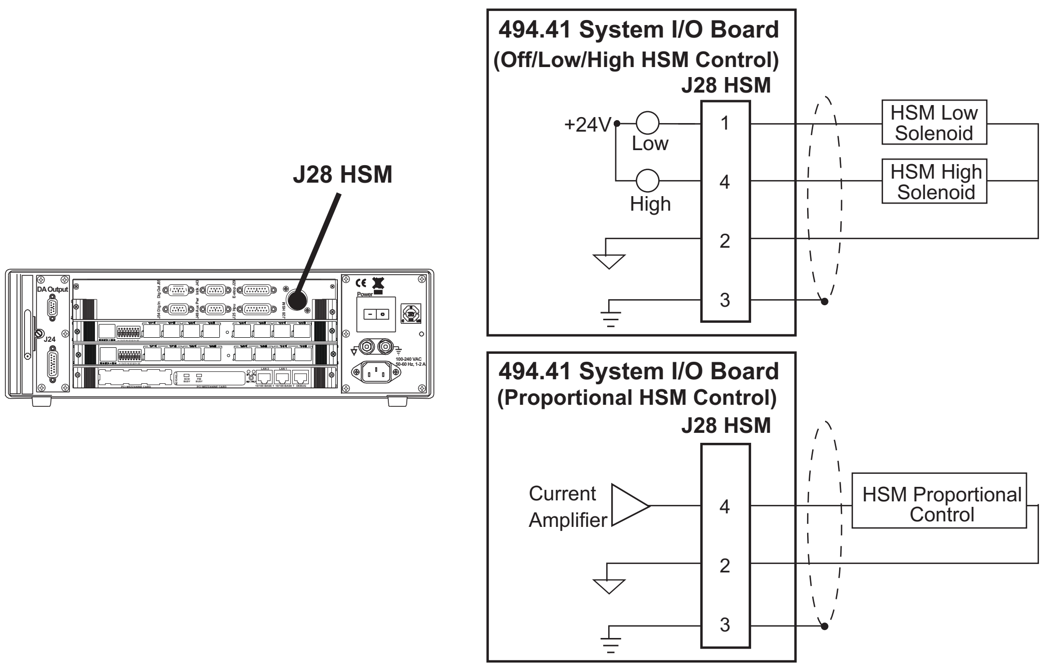
Jumper plug required

If connector **J25 HPU** is not used, you must install a jumper plug to maintain the integrity of the interlocks. Use jumper plug part number 039-713-301 or jumper pins 1–7, 2–3–5, 6–9, 8–10–11–12.

J28 HSM Connections for the Model 494.41 System Board

HSM control (off/low/high or proportional) is software configurable. The Model 494.41 Board provides separate 24-volt, low-pressure and high-pressure outputs that drive the HSM low- and high-pressure solenoids. Proportional control provides a current output from 0 to 0.78 A.

Note *The Model 494.41 Board cannot be used with 115 V AC HSMs. Applications that use 115 V AC HSMs require an external converter box (such as a Model 413.08), which is used with this board.*



Cable specification

To maintain EMC compliance, J25 HPU cables must comply with the following specifications:

J28 HSM

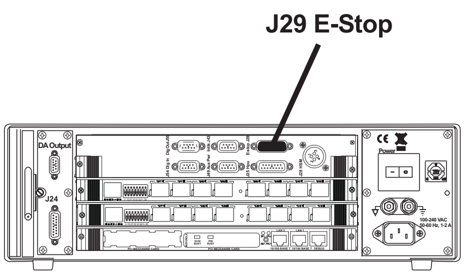
Connector—4-contact, CPC-4P, male EMI connector.

Proportional Control Cable—18 AWG, 2-conductor with foil shield with the drain wire connected to pin 3 of the CPC connector.

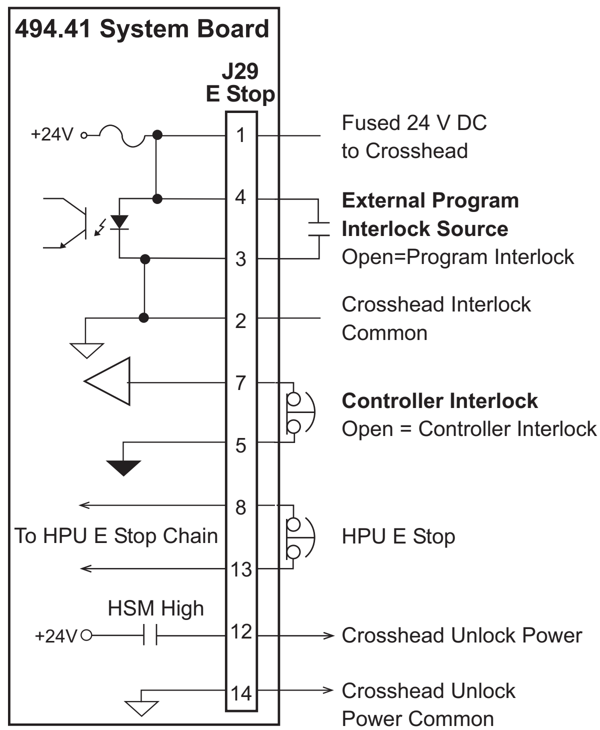
Off/low/high Control Cable—18 AWG, 3-conductor with foil shield with the drain wire connected to pin 3 of the CPC connector.

J29 Emergency Stop Connections for the Model 494.41 System Board

Connector **J29 E-STOP** provides an output to external devices when an emergency stop signal is generated. You can also connect an external E-Stop to the J29 connector.



* MTS Model 505 Pumps and older do not use the HPU E-Stop 2 signal.



Cable specification

To maintain EMC compliance, the **J29 E-STOP** cable must comply with the following specifications:

Connector type–15-pin, type D, male EMI connector.

Backshell–EMI metallized plastic or metal.

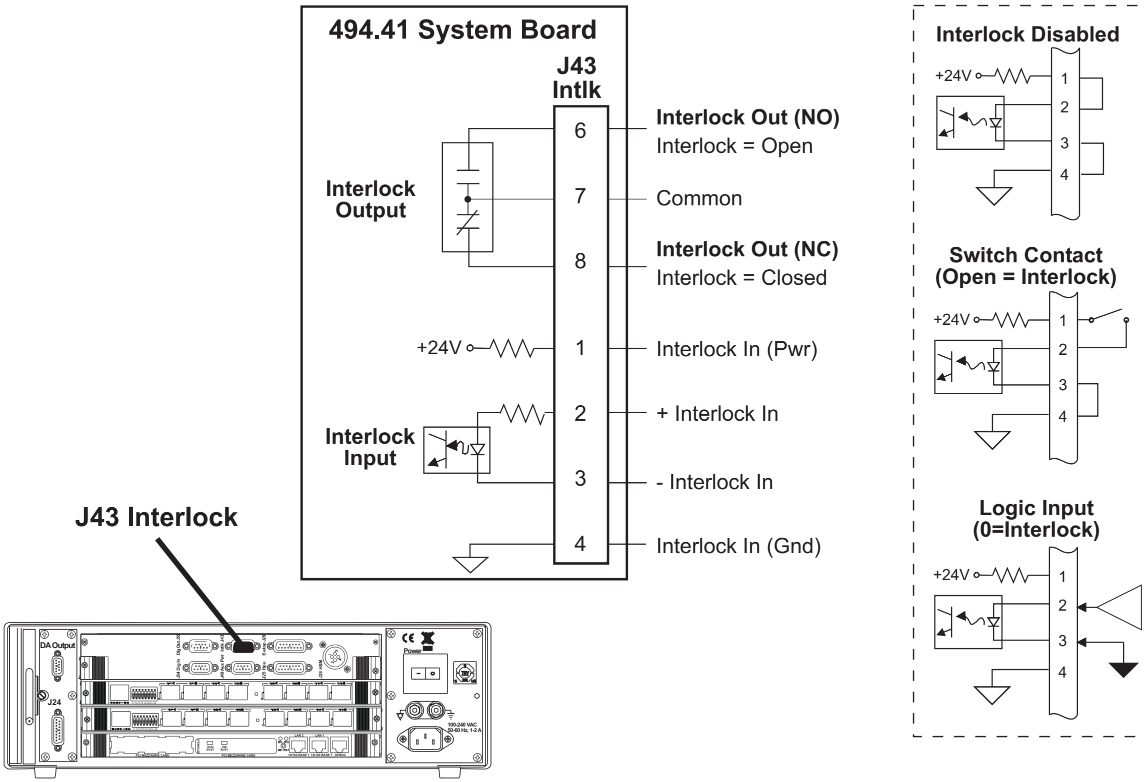
Cable–18 AWG, 8-conductor with foil shield, with the drain wire connected to a metallized plastic backshell at the chassis.

Jumper plug required

If connector **J29** is not used, you must install a jumper plug to maintain the integrity of the interlocks. Use jumper plug part number 100-007-947 or jumper pins 3-4, 5-7, 8-13, and 11-15.

J43 Interlock Connections for the Model 494.41 System Board

Connector **J43 Interlock** provides one optically isolated interlock input and a relay-contact interlock output.



Cable specification

To maintain EMC compliance, the **J43 Interlock** cable must comply with the following specifications:

Connector type–9-pin, type D, male EMI connector.

Backshell–EMI metallized plastic or metal.

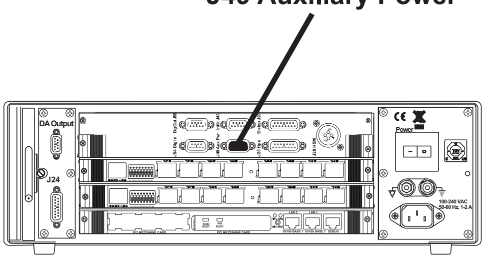
Cable–shielded twisted pairs (24 AWG minimum), braided shield with the shield connected to the metallized backshell at the chassis.

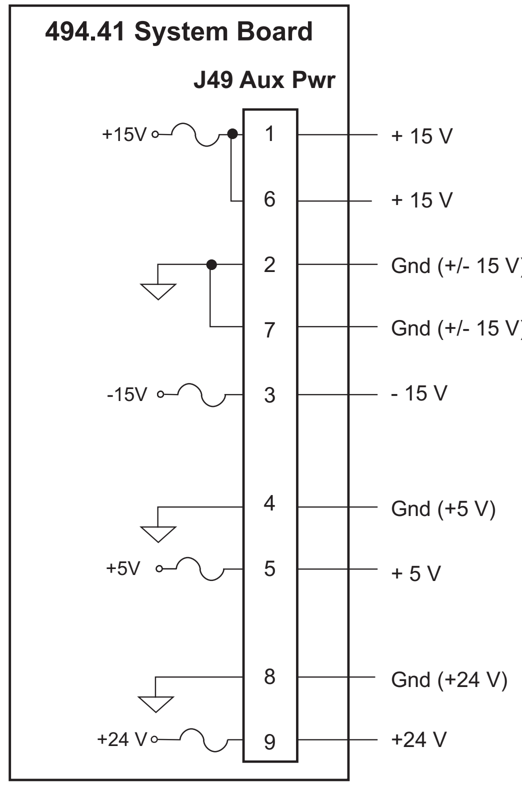
Jumper plug required

If connector **J43** is not used, you must install a jumper plug to maintain the integrity of the interlocks. Use jumper plug part number 100-057-245, or jumper pins 1-2, 3-4, and 5-9.

J49 Auxiliary Power Connections for the Model 494.41 System Board

The **J49 Aux Pwr** connector provides fused (self resetting) auxiliary power outputs for: +5 V DC, +15 V DC, -15 V DC, and +24 V DC.





Cable specification

To maintain EMC compliance, the **J49 Auxiliary Power** cable must comply with the following specifications:

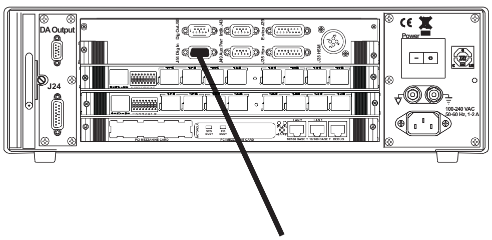
Connector type–9-pin, type D, male EMI connector.

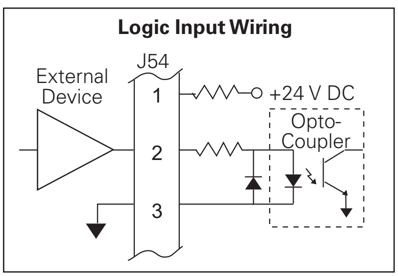
Backshell–EMI metallized plastic or metal.

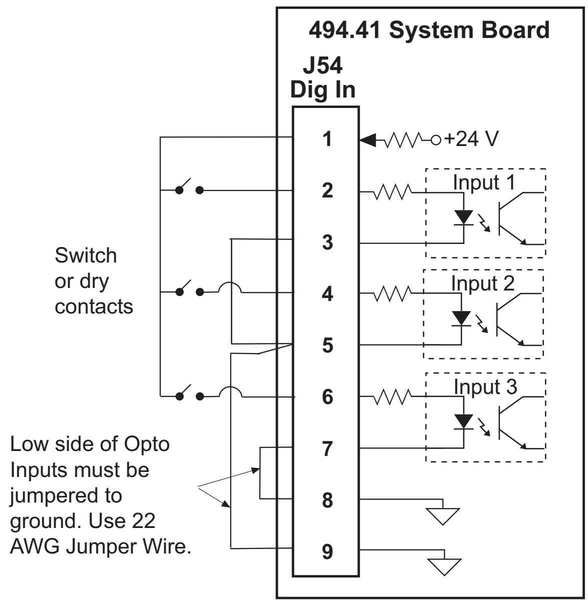
Cable–AWG and number of conductors as required. Braided shield with the shield connected to the metallized backshell at the chassis.

J54 Digital Input Connections for the Model 494.41 System Board

Connector **J54 Dig In** accepts up to three optically isolated digital-input signals from external devices. You can use these digital input signals to trigger test events in controller applications.







Cable specification

To maintain EMC compliance, the **J54 Digital Input** cable must comply with the following specifications:

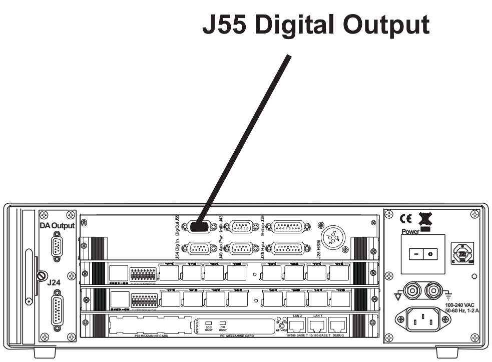
Connector type–9-pin, type D, male EMI connector.

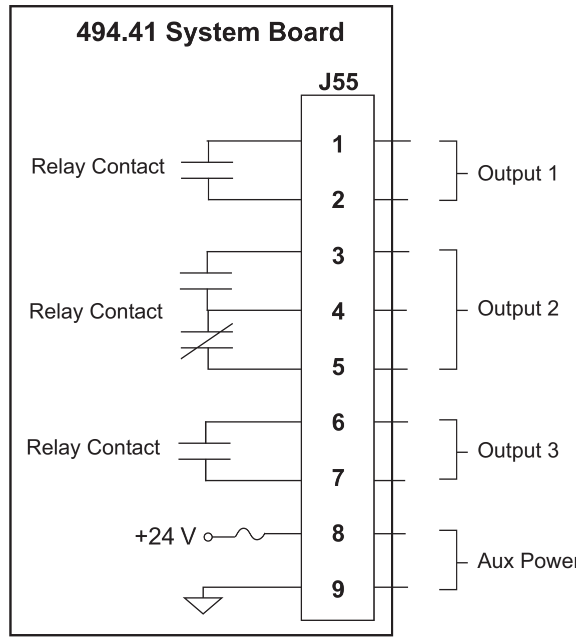
Back shell–EMI metallized plastic or metal.

Cable–AWG and number of conductors as required. Braided shield with the shield connected to the metallized backshell at the chassis.

J55 Digital Output Connections for the Model 494.41 System Board

Connector **J55 Dig Out** provides three general-purpose digital outputs that can send digital-logic signals to external switches or logic devices.





Cable specification

To maintain EMC compliance, the **J55 Digital Output** cable must comply with the following specifications:

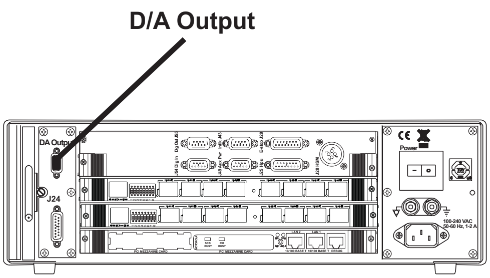
Connector–9-pin, type D, male EMI connector.

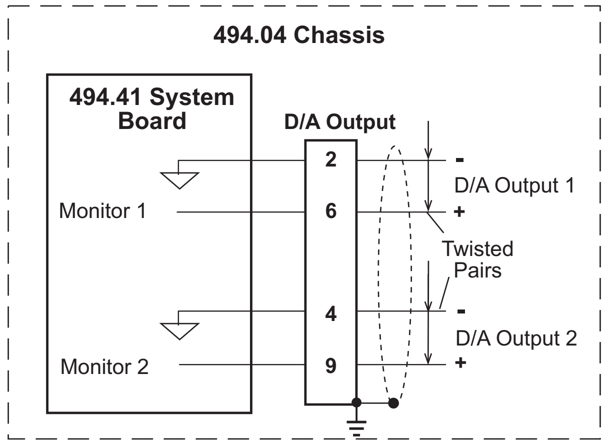
Back shell–EMI metallized plastic.

Cable–AWG and number of conductors as required. Braided shield with the shield connected to the metallized backshell at the chassis.

Analog Output Connections for the Model 494.41 System Board

The Model 494.41 System board provides two analog output signals that are available on the **D/A Output** connector (located on the rear panel of the Model 494.04 Chassis). Each D/A output is software defined.





Cable specification

To maintain EMC compliance, the **D/A Output** cable must comply with the following specifications:

Connector type–9-pin, type D, male EMI connector.

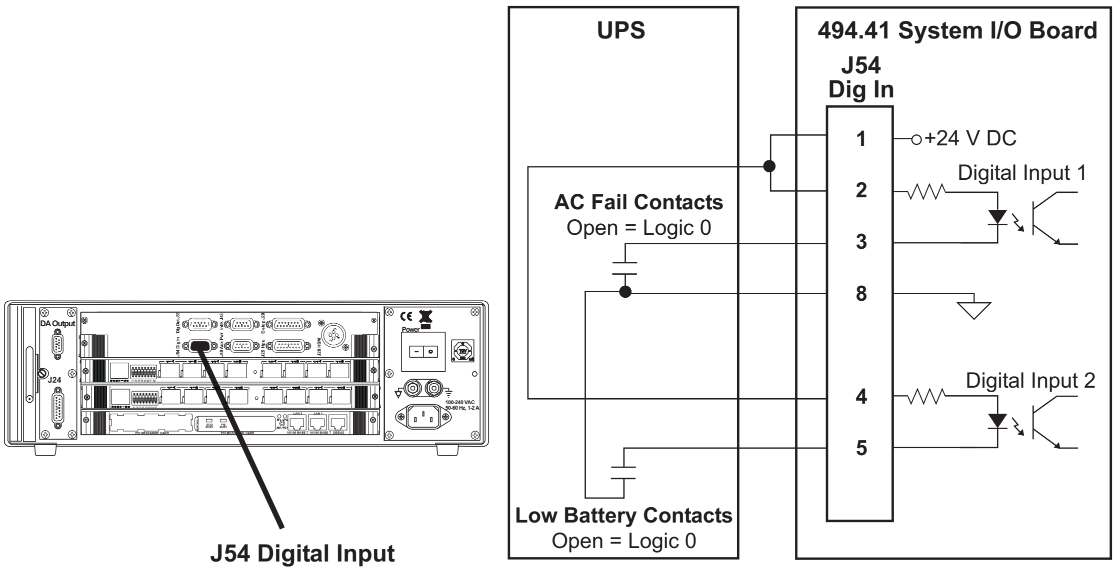
Backshell–EMI metallized plastic or metal.

Cable–shielded twisted pairs (24 AWG minimum), braided shield with the shield connected to the metallized backshell at the chassis.

UPS Connections for the Model 494.41 System Board (FT40)

The following drawing shows UPS connections for the Model 494.41 System board. Once connected, use your controller software to add the digital input resources and configure the digital inputs to perform various actions in response to the UPS signals.

Note *See your controller software user guide for information on how digital inputs are assigned and used.*



Cable specification

To maintain EMC compliance, the **J54 Digital Input** cable must comply with the following specifications:

Connector type–9-pin contact, type D, male EMI connector.

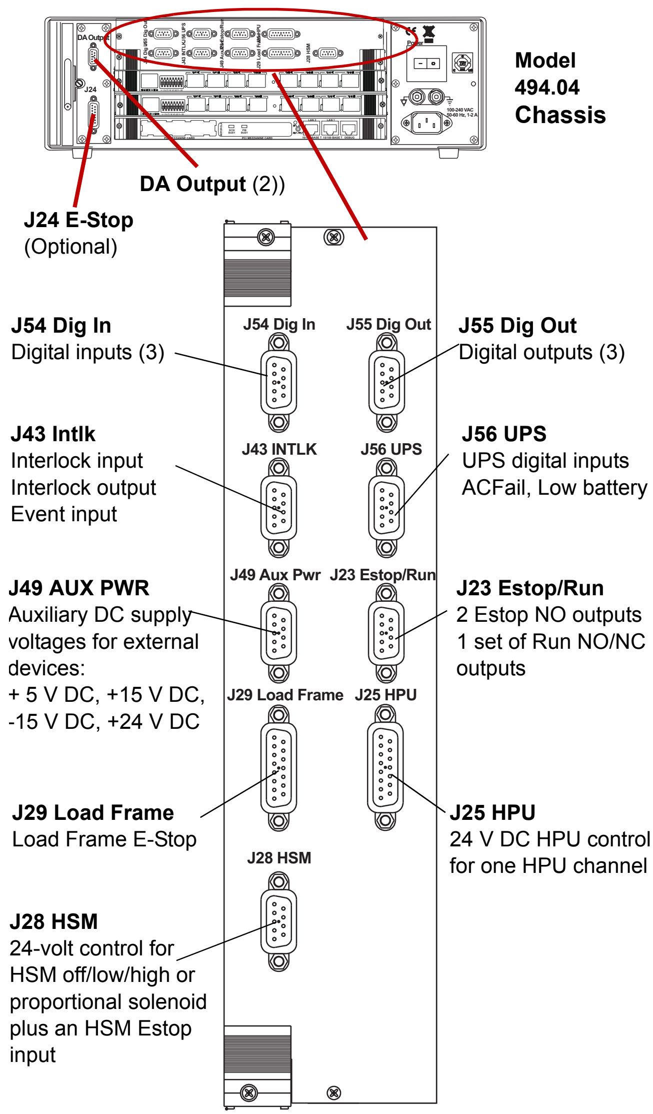
Back shell–EMI metallized plastic or metal.

Cable—26 to 22 AWG, 4-conductor with an overall braided shield that is connected to the backshell at the chassis.

Model 494.42 Single-Station System Board

About the Model 494.42 Single-Station System Board

The Model 494.42 System Board is a two-slot board that is only used in the Model 494.04 Chassis. This board provides analog and digital I/O, E-Stop, HSM, UPS, and HPU control for one station.



Board features

External Interfaces

- Three digital inputs (J54)
- Three digital outputs (J55)
- Auxiliary power outputs for external devices (J49)
- UPS inputs (J56) ACFail and low battery inputs (switch contacts)
- Two analog outputs (DA Output connector on the 494.04 chassis)

Hydraulic Control

- 24-volt HPU control (J25)
- 24-volt HSM control (Off/Low/High or proportional) for one HSM (J28)

E-Stop/Interlock Control

- Load-frame E-Stop and crosshead control for one load frame (J29)
- Optional E-Stop inputs (J24-located on the 494.04 chassis)
- Interlock (J43) provides one interlock input, one interlock output, and a software-defined event input
- E-Stop/Run outputs (J23)

Model 494.42 System Board Specifications

Model 494.42 Specifications (part 1 of 4)

Parameter	Specification
E-Stop/Run Output Relay Contacts	**Connector J23 (D9S)**
Voltage	30 V DC/AC maximum
Current	1 A maximum
	Two (2) Normally Open Estop Relay Contacts: HPU E-Stop = Open
	Set of NO/NC Prog. Run Relay Contacts: Normally Open Contacts: Prog. Run = Closed Normally Closed Contacts: Prog. Run = Open
HPU Outputs (Start/Low/High)	**Connector J25 (D15P)**
HPU Outputs (start, low, high)	Output Voltage: 24 V DC at 250 mA
HPU ON Input	Trip Voltage: 0.8–10.0 V DC Maximum Input Voltage: +26 V DC
HPU Interlock Inputs (Low Level and Overtemp)	**Connector J25 (D15P)**
Trip-point Voltage	0.8–10.0 V DC Maximum Input Voltage: +26 V DC

Model 494.42 Specifications (part 2 of 4)

PARAMETER	SPECIFICATION
HSM Control*	**Connector J28 (D-9S)**
Off/Low/High Control	
Low Output	+24 V DC, 1.0 A maximum
High Output	+24 V DC, 1.0 A maximum
Proportional Control	
Signal Output	0–0.78 A
Solenoid Impedance	20–25 Ω
Ramp Time (0 to full scale)	2.1 s or 4.2 s (software selectable) * The type of HSM control (off/low/high or proportional) is software configurable.
Load Frame E-Stop	**Connector J29 (D15S)**
Crosshead Unlock Output	24 V DC at 1 A
Program Interlock Input	Switch Contact Closed = no program interlock Switch Contact Open = program interlock
Interlock Output Relay	**Connector J43 (D9S)**
Voltage	30 V DC/AC maximum
Current	1 A maximum
	Normally Open Relay Contacts: Open = Interlock
	Normally Closed Relay Contacts: Closed = Interlock

Model 494.42 Specifications (part 3 of 4)

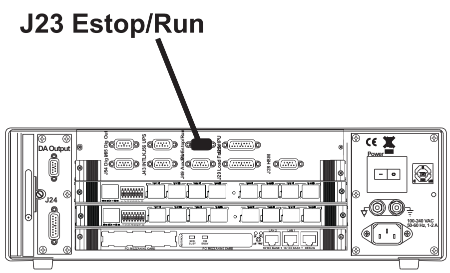
PARAMETER	SPECIFICATION
Interlock Input	**Connector J43 (D9S)**
Interlock Trip Voltage	0.8 V minimum, 3 V maximum
Maximum Input Voltage	+26 V DC
Input Resistance	2700 Ω
Interlock Power Output	+24 V DC (current limited by a 15-KΩ resistor)
Event Switch-Contact Input	**Connector J43 (D9S)**
	Event contacts open= Active event
	Event contacts closed= Inactive event
Auxiliary Power Outputs	**Connector J49 (D9S)**
+5 V DC	0.75 A maximum
+15 V DC	0.75 A maximum
-15 V DC	0.75 A maximum
+24 V DC	0.75 A maximum
Digital Inputs	**Connector J54 (D9P)**
Input ON/OFF Trip Voltage	0.8–3 V DC
Maximum Input Voltage	+ 26 V DC
Input Resistance	2.7 KΩ
Digital Input Power Output	+ 24 V DC (current limited by 2.7-KΩ resistor)

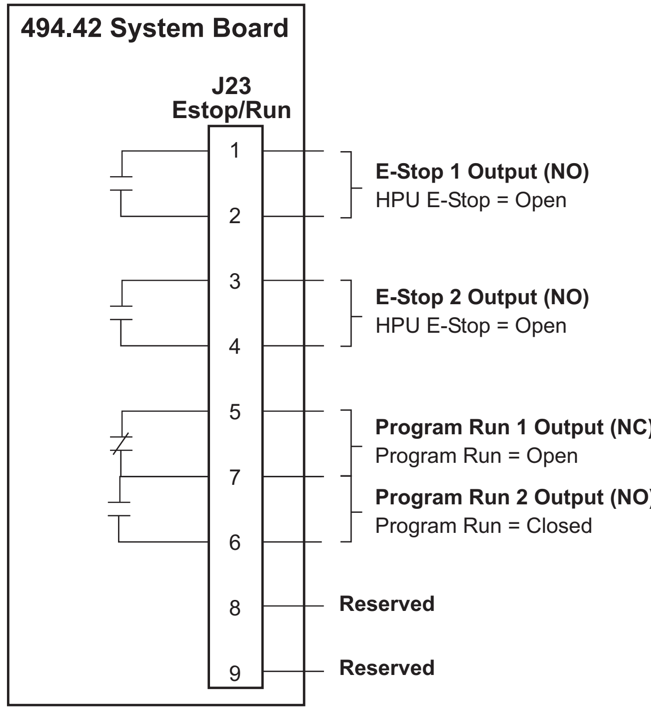
Model 494.42 Specifications (part 4 of 4)

PARAMETER	SPECIFICATION
Digital Output Relays	**Connector J55 (D9S)**
Voltage	30 V AC/DC maximum
Current	1 A maximum
Output logic	**Output 1:** One normally open (NO) contact Open = Output is OFF **Output 2:** One normally open (NO) contact and one normally closed (NC) contact NO Contact: Open = Output is OFF NC Contact: Closed = Output is OFF **Output 3:** One normally open (NO) contact Open = Output is OFF
Aux. Voltage	24 V DC, 0.75 A
UPS Alarm Inputs	**Connector J56 (D9S)** **UPS ACFAIL Alarm Input (switch contact):** Open=UPS ACFAIL active (logic 1) Closed= UPS ACFAIL not active (logic 0) **UPS Low Battery Alarm Input (switch contact):** Open=UPS Low Battery active (logic 1) Closed= UPS Low Battery not active (logic 0)
D/A Outputs	**Connector "D/A Output" (D9P)**
Resolution	16 bit
Output Type	Single ended
Output Voltage	+/- 10 V full scale
Output Current	5.0 mA maximum ***Note*** *This connector is located on the rear panel of the Model 494.04 Chassis.*

J23 E-Stop/Run Output Connections for the Model 494.42 System Board

The Model 494.42 System Board provides E-Stop/Program Run outputs that are available on the **J23 E-Stop/Run** connector.





Cable specification

To maintain EMC compliance, the **J23 E-Stop/Run** cable must comply with the following specifications:

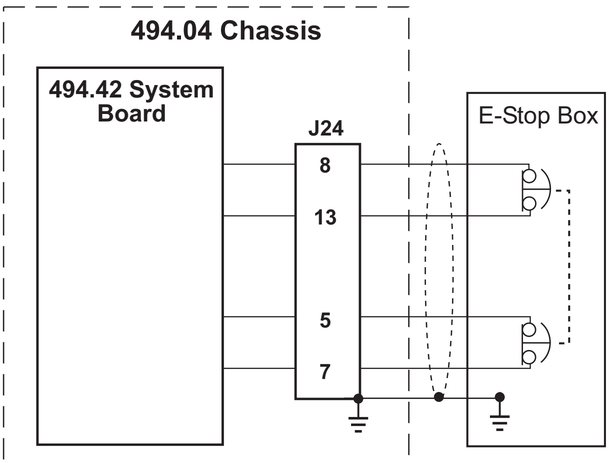
Connector type–9-pin, type D, male EMI connector.

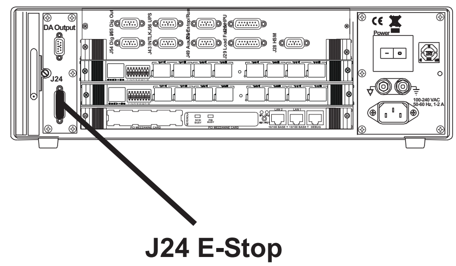
Backshell–EMI metallized plastic or metal.

Cable–4-conductor with braided shield, with the braid connected to a metallized plastic backshell at the chassis.

J24 Emergency Stop Connections for the Model 494.42 System Board

The Model 494.42 System Board provides two optional E-Stop inputs that are available on the **J24 E Stop** connector (located on the rear panel of the Model 494.04 Chassis).





Cable specification

To maintain EMC compliance, the **J24 E-Stop** cable must comply with the following specifications:

Connector type–15-pin, type D, male EMI connector.

Backshell–EMI metallized plastic or metal.

Cable–24 AWG 4-conductor with braided shield, with the braid connected to a metallized plastic backshell at the chassis and to ground at the emergency stop (E-Stop) box.

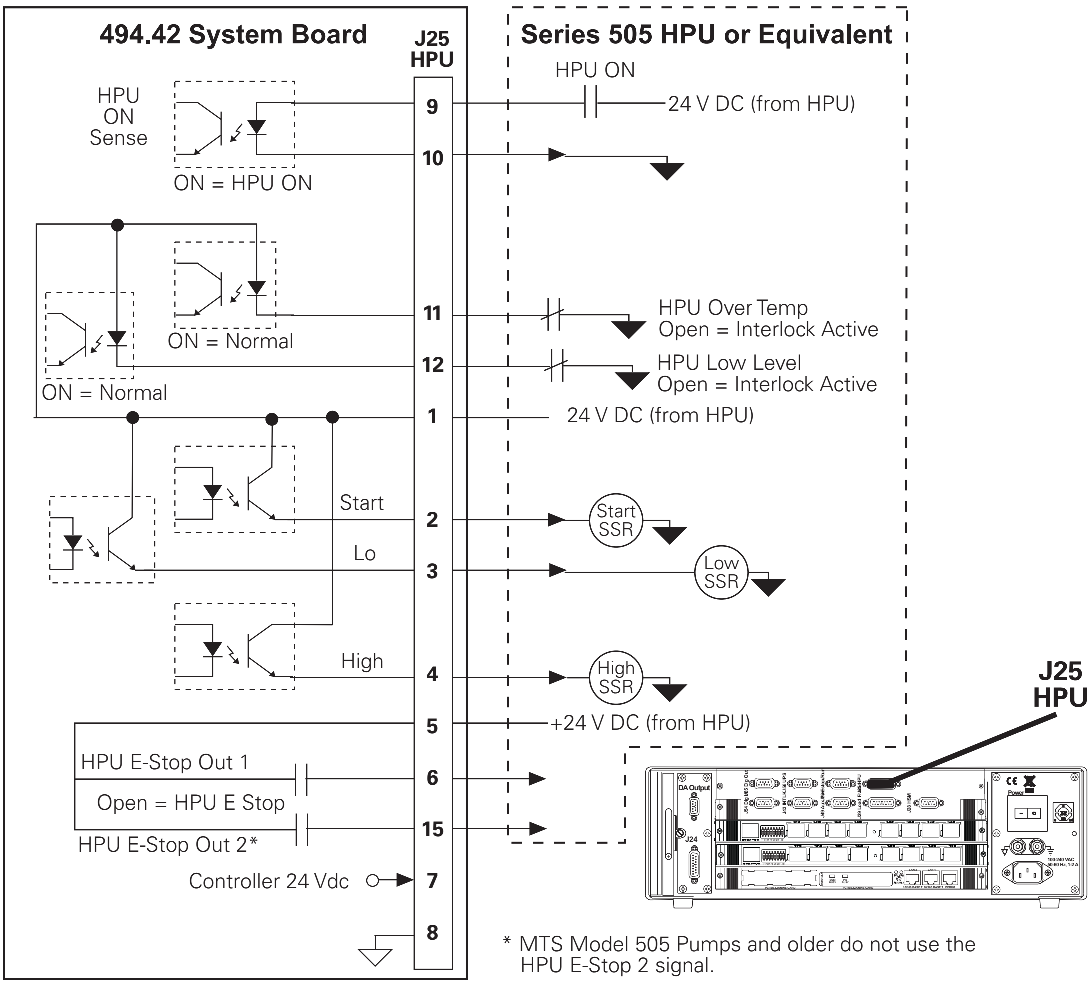
Jumper plug required

If connector **J24** is not used, you must install a jumper plug to maintain the integrity of the interlocks. Use jumper plug part number 039-713-201 or jumper pins 5-7 and 8-13.

J25 Hydraulic Power Unit Connections for the Model 494.42 System I/O Board

Connector **J25 HPU** provides 24-volt logic signals that control the hydraulic power unit (HPU). The connector may be connected directly to MTS Series 505 HPUs and similar HPUs that use low-current, 24-volt input controls.

Note *Other MTS HPUs require the Model 493.07 HPU Converter Box to convert the low-current HPU output signal to a signal that can drive the HPU relay.*



* MTS Model 505 Pumps and older do not use the HPU E-Stop 2 signal.

CAUTION

Control voltages for hydraulic power units vary between models

The HPU interface between the Model 494.42 System I/O board and an HPU is 24-volt logic signals. Connecting J25 to a non-compliant HPU can damage the board.

Do not connect 24 V DC relay circuitry or 115 V AC circuitry to connector J25 on the Model 494.42 System I/O board.

Cable specification

To maintain EMC compliance, **J25 HPU** cables must comply with the following specifications:

Connector—15-contact, type-D, female EMI connector.

Backshell–EMI metallized plastic or metal.

Cable—22 AWG, 10-conductor with braided shield with the shield connected to metallized plastic or metal backshell to the chassis.

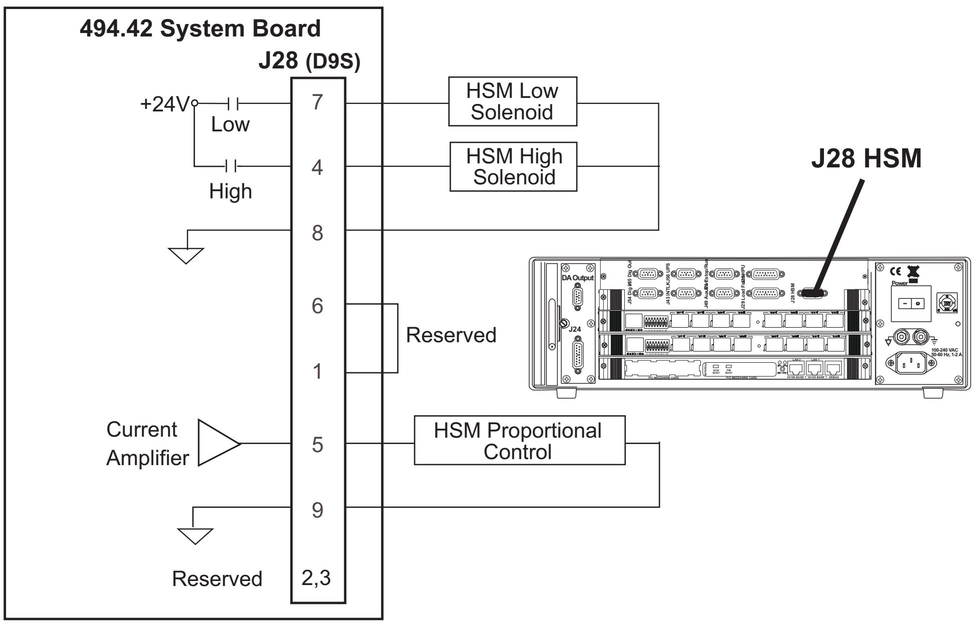
Jumper plug required

If connector **J25 HPU** is not used, you must install a jumper plug to maintain the integrity of the interlocks. Use jumper plug PN 039-713-301 or jumper pins 1–7, 2–3–5, 6–9, 8–10–11–12.

J28 HSM Connections for the Model 494.42 System Board

HSM control (off/low/high or proportional) is software configurable. The Model 494.42 board provides separate 24-volt, low-pressure and high-pressure outputs that drive the HSM low- and high-pressure solenoids. Proportional solenoid control provides a current output from 0 to 0.78 A.

Note *The Model 494.42 board can not be used with 115 V AC HSMs. Applications that use 115 V AC HSMs require an external converter box (such as a Model 413.08), which is used with this board.*



Cable specification

To maintain EMC compliance, **J28 HSM** cables must comply with the following specifications:

Connector—9-pin type D male EMI connector.

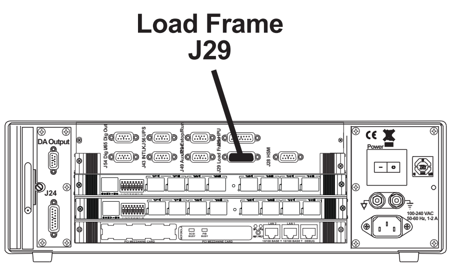
Backshell—EMI metallized plastic or metal.

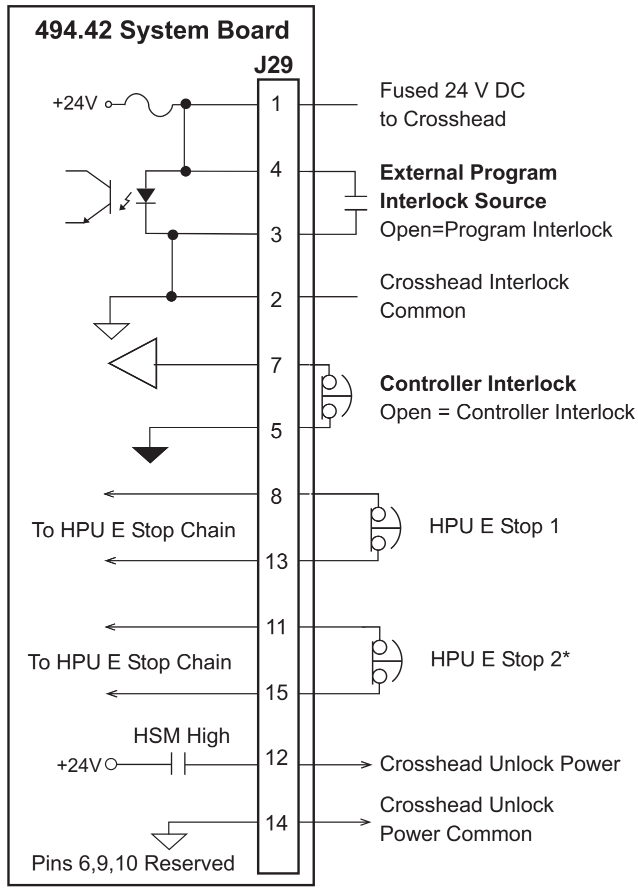
Proportional Control Cable—18 AWG, 2-conductor with foil shield drain wire connected to conductive backshell.

Off/low/high Control Cable—18 AWG, 3-conductor with foil shield drain wire connected to conductive backshell.

J29 Load Frame Connections for the Model 494.42 System Board

Connector **J29 Load Frame** provides an interface to connect one load frame.





* MTS Model 505 Pumps and older do not use the HPU E-Stop 2 signal.

Cable specification

To maintain EMC compliance, the **J29 Load Frame** cable must comply with the following specifications:

Connector type–15-pin, type D, male EMI connector.

Backshell–EMI metallized plastic or metal.

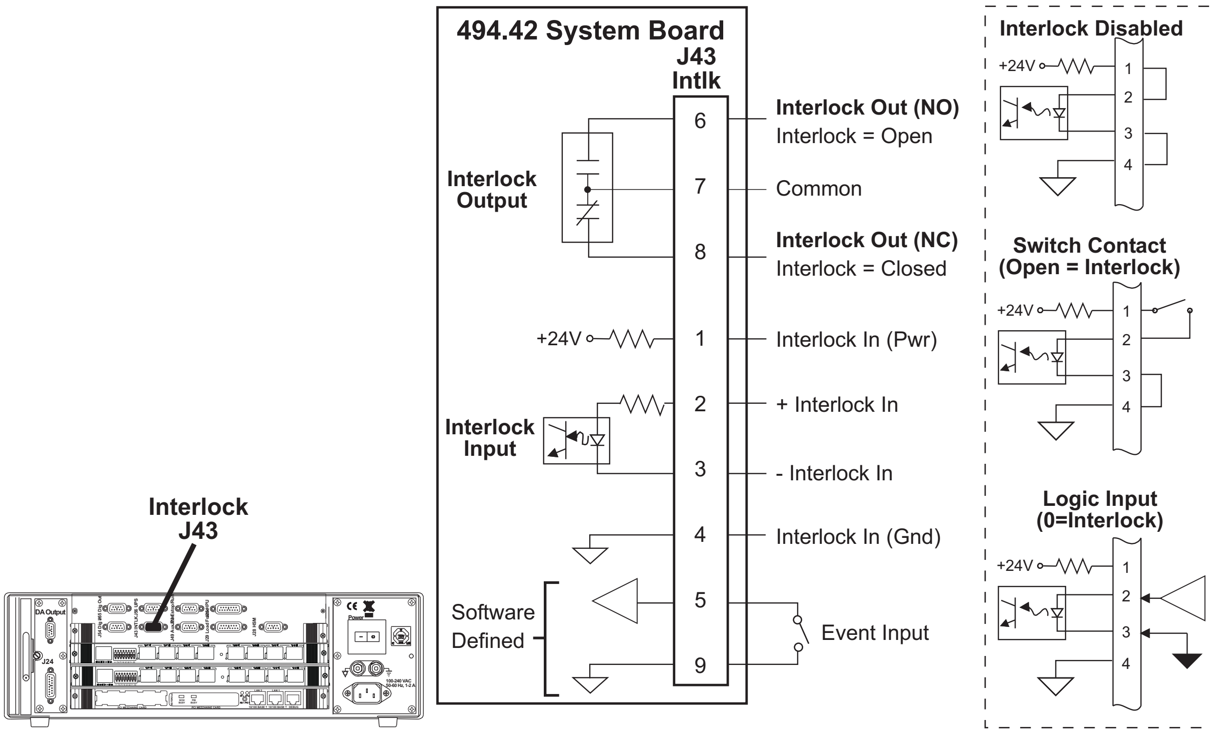
Cable–18 AWG 8-conductor with foil shield, with the drain wire connected to a metallized plastic backshell at the chassis.

Jumper plug required

If connector **J29** is not used, you must install a jumper plug to maintain the integrity of the interlocks. Use jumper plug part number 100-007-947 or jumper pins: 3-4, 5-7, 8-13, and 11-15.

J43 Interlock Connections for the Model 494.42 System Board

Connector **J43 Intlk** provides one optically isolated interlock input and a relay-contact interlock output per connector.



Cable specification

To maintain EMC compliance, the **J43 Intlk** cable must comply with the following specifications:

Connector type–9-pin, type D, male EMI connector.

Backshell–EMI metallized plastic or metal.

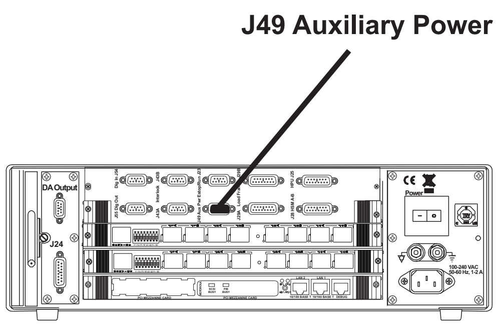
Cable–shielded twisted pairs (24 AWG minimum), braided shield with shield connected to the metallized backshell at the chassis.

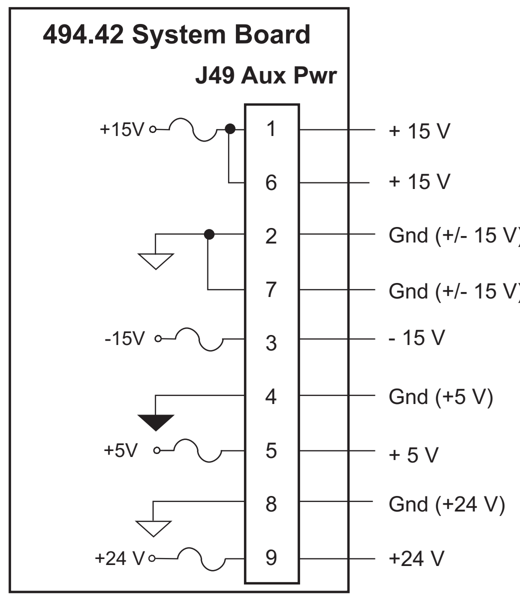
Jumper plug required

If connector **J43** is not used, you must install a jumper plug to maintain the integrity of the interlocks. Use jumper plug part number 100-057-245, or jumper pins: 1-2, 3-4, and 5-9.

J49 Auxiliary Power Connections for the Model 494.42 System Board

The **J49 Aux Pwr** connector provides fused (self resetting) auxiliary power outputs for: +5 V DC, +15 V DC, -15 V DC, and +24 V DC.





Cable specification

To maintain EMC compliance, the **J49 Auxiliary Power** cable must comply with the following specifications:

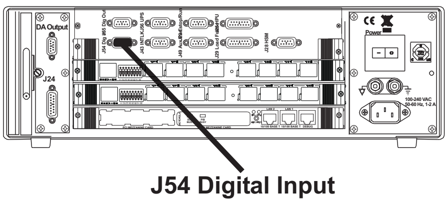
Connector type–9-pin, type D, male EMI connector.

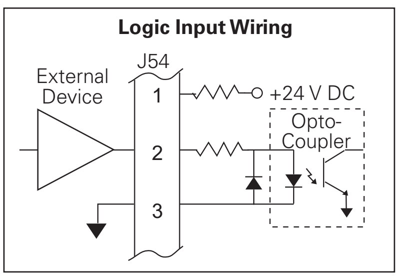
Backshell–EMI metallized plastic or metal.

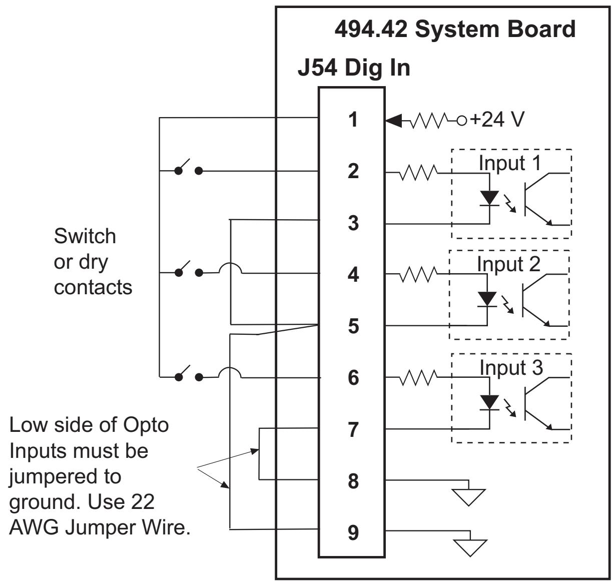
Cable–AWG and number of conductors as required. Braided shield with shield connected to the metallized backshell at the chassis.

J54 Digital Input Connections for the Model 494.42 System Board

Connector **J54 Dig In** accepts up to three optically isolated digital-input signals from external devices. You can use these digital input signals to trigger test events in controller applications.







Cable specification

To maintain EMC compliance, the **J54 Digital Input** cable must comply with the following specifications:

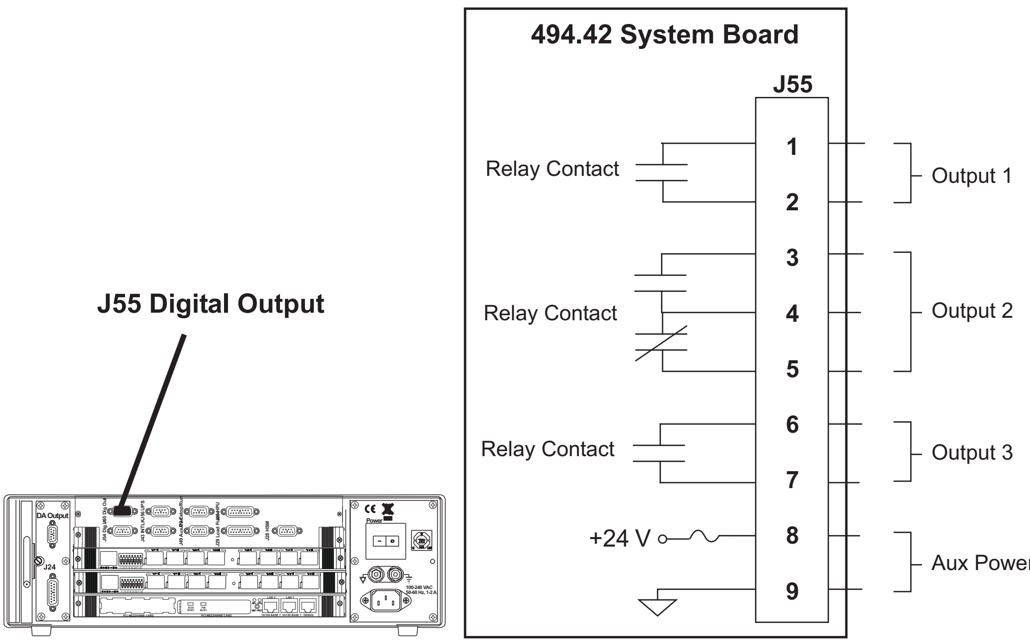
Connector type–9-pin, type D, male EMI connector.

Back shell–EMI metallized plastic or metal.

Cable–AWG and number of conductors as required. Braided shield with the shield connected to the metallized backshell at the chassis.

J55 Digital Output Connections for the Model 494.42 System Board

Connector **J55 Dig Out** provides three general-purpose digital outputs that can send digital-logic signals to external switches or logic devices.



Cable specification

To maintain EMC compliance, the **J55 Digital Output** cable must comply with the following specifications:

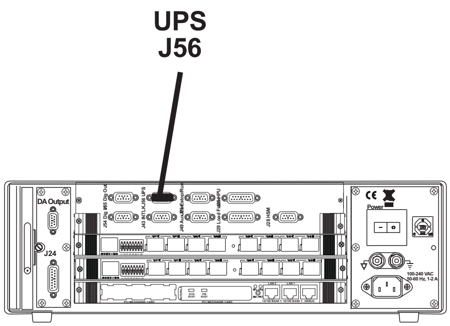
Connector–9-pin, type D, male EMI connector.

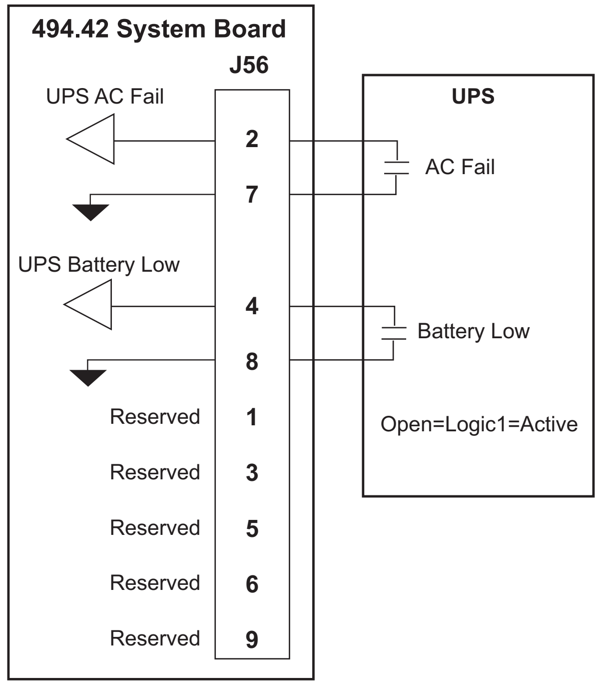
Back shell–EMI metallized plastic.

Cable–AWG and number of conductors as required. Braided shield with the shield connected to the metallized backshell at the chassis.

J56 UPS Input Connections for the Model 494.42 System Board

Connector **J56 UPS** provides dedicated inputs for an uninterruptible power supply (UPS).





Cable specification

To maintain EMC compliance, the **J56 UPS** cable must comply with the following specifications:

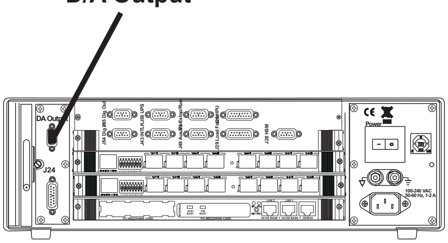
Connector–9-pin contact type D male EMI connector

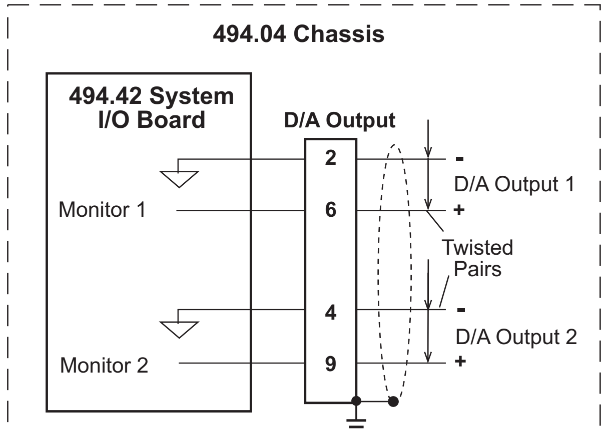
Back shell–EMI metallized plastic

Cable–AWG and number of conductors as required. Braided shield with shield connected to the metallized backshell at the chassis.

Analog Output Connections for the Model 494.42 System Board

The Model 494.42 System Board provides two analog output signals that are available on the **D/A Output** connector (located on the rear panel of the 494.04 chassis). Each D/A output is software defined.





Cable specification

To maintain EMC compliance, the **D/A Output** cable must comply with the following specifications:

Connector type–9-pin, type D, male EMI connector.

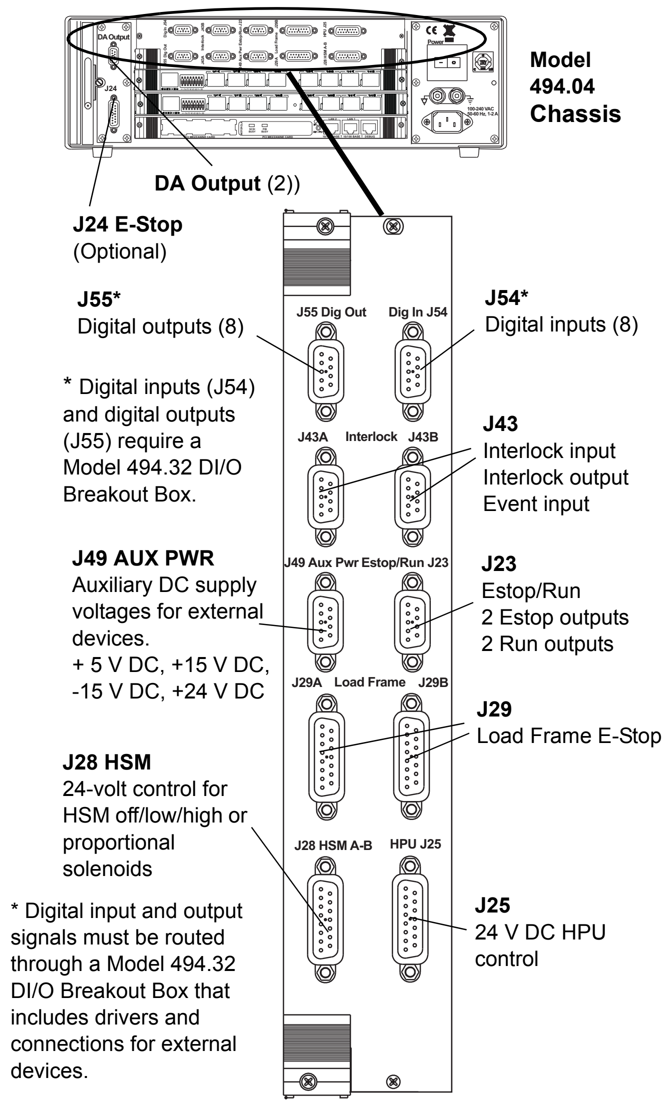
Backshell–EMI metallized plastic or metal.

Cable–shielded twisted pairs (24 AWG minimum), braided shield with the shield connected to the metallized backshell at the chassis.

Model 494.44 Two-Station System Board

About the Model 494.44 Two-Station System Board

The Model 494.44 System Board is a two-slot board that is only used in the Model 494.04 Chassis. This board provides analog and digital I/O, E-Stop, HSM, and HPU control for two stations.



Board features

External Interfaces

- Eight digital inputs (J54*)
- Eight digital outputs (J55*)
- Auxiliary power outputs for external devices (J49)
- Two analog outputs (DA Output connector on the 494.04 chassis)

Hydraulic Control

- 24-volt HPU control (J25)
- 24-volt HSM control (Off/Low/High or proportional) for two HSMs (J28)

E-Stop/Interlock Control

- Load-frame E-Stop and crosshead control for two load frames (J29A and J29B)
- Optional E-Stop inputs (J24-located on the 494.04 chassis)
- Two connectors (J43 A and J43B) each provides one interlock input, one interlock output, and a software-defined event input
- E-Stop/Run outputs (J23)

Model 494.44 System Board Specifications

Model 494.44 Specifications (part 1 of 3)

PARAMETER	SPECIFICATION
HSM Control*	**Connector J28A and 28B (D-15S)**
Off/Low/High Control	
Low Output	+24 V DC, 1.0 A maximum
High Output	+24 V DC, 1.0 A maximum
Proportional Control	
Signal Output	0–0.78 A
Solenoid Impedance	20–25 Ω
Ramp Time (0 to full scale)	2.1 s or 4.2 s (software selectable) * The type of HSM control (off/low/high or proportional) is software configurable.
E-Stop/Run Output Relay	**Connector J23 (D9S)**
Voltage	30 V DC/AC maximum
Current	1 A maximum
	Two (2) Normally Open Relay Contacts: HPU E-Stop = Open
	Normally Open Relay Contacts: Prog. Run = Closed
Interlock Output Relay	**Connector J43 A/B(D9S) (one per J43 connector)**
Voltage	30 V DC/AC maximum
Current	1 A maximum
	Normally Open Relay Contacts: Open = Interlock
	Normally Closed Relay Contacts: Closed = Interlock

Model 494.44 Specifications (part 2 of 3)

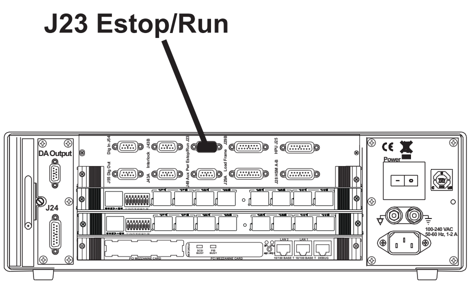
PARAMETER	SPECIFICATION
Interlock Input	**Connector J43 A/B (D9S) (one per J43 connector)**
Interlock Trip Voltage	0.8 V minimum, 3 V maximum
Maximum Input Voltage	+26 V DC
Input Resistance	2700 Ω
Interlock Power Output	+24 V DC (current limited by a 15-KΩ resistor)
Load Frame E-Stop	**Connector J29A and J29B (D15S)**
Crosshead Unlock Output	24 V DC at 1 A
Program Interlock Input	Switch Contact Closed = no program interlock Switch Contact Open = program interlock
HPU Outputs (Start/Low/High)	**Connector J25 (D15P)**
HPU Outputs (start, low, high)	Output Voltage: 24 V DC at 250 mA
HPU ON Input	Trip Voltage: 0.8–10.0 V DC Maximum Input Voltage: +26 V DC
HPU Interlock Inputs (Low Level and Overtemp)	**Connector J25 (D15P)**
Trip-point Voltage	0.8–10.0 V DC Maximum Input Voltage: +26 V DC

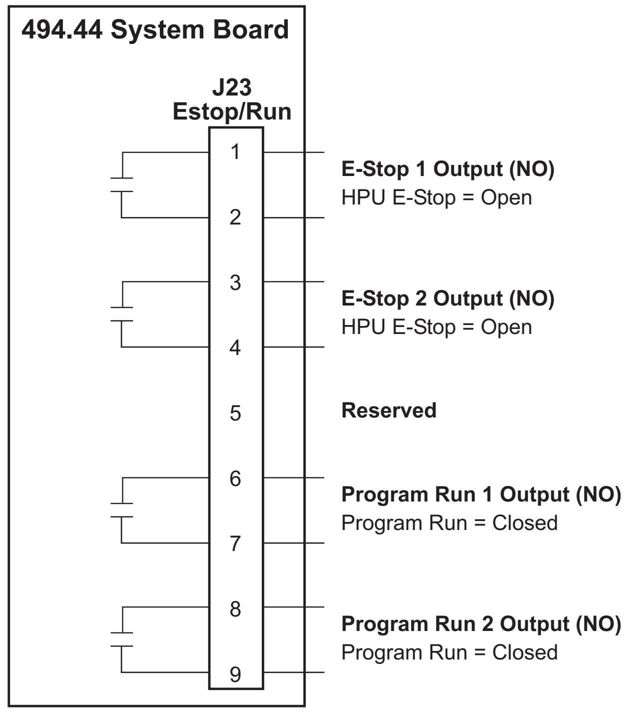
Model 494.44 Specifications (part 3 of 3)

PARAMETER	SPECIFICATION
Auxiliary Power Outputs	**Connector J49 (D9S)**
+5 V DC	0.75 A maximum
+15 V DC	0.75 A maximum
-15 V DC	0.75 A maximum
+24 V DC	0.75 A maximum
Digital Outputs	**Connector J55 (D9S)**
	Note *Digital output signals must be routed through a Model 494.32 DI/O Breakout Box that includes drivers and connections for external devices.*
Digital Inputs	**Connector J54 (D9P)**
	Note *Digital input signals must be routed through a Model 494.32 DI/O Breakout Box that includes opto-isolators and connections for external devices.*
D/A Outputs	**Connector "D/A Output" (D9P)**
Resolution	16 bit
Output Type	Single ended
Output Voltage	+/- 10 V full scale
Output Current	5.0 mA maximum
	Note *This connector is located on the rear panel of the Model 494.04 Chassis.*

J23 E-Stop/Run Output Connections for the Model 494.44 System Board

The Model 494.44 System Board provides E-Stop/Program Run outputs that are available on the **J23 E-Stop/Run** connector.





Cable specification

To maintain EMC compliance, the **J23 E-Stop/Run** cable must comply with the following specifications:

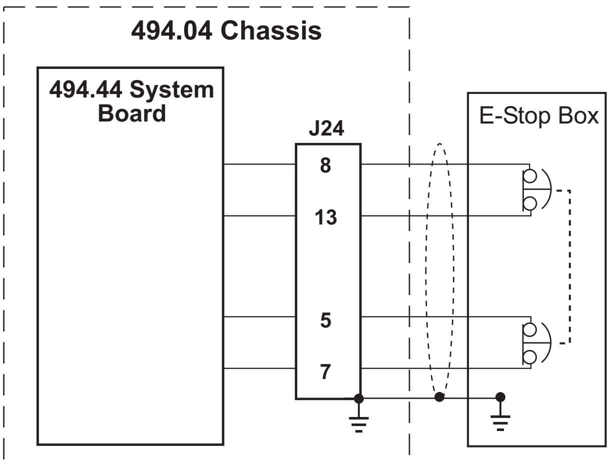
Connector type–9-pin, type D, male EMI connector.

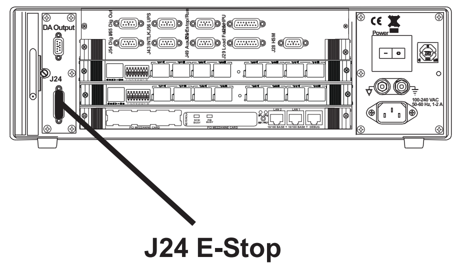
Backshell–EMI metallized plastic or metal.

Cable–4-conductor with braided shield, with the braid connected to a metallized plastic backshell at the chassis.

J24 Emergency Stop Connections for the Model 494.44 System Board

The Model 494.44 System Board provides two optional E-Stop inputs that are available on the **J24 E Stop** connector (located on the rear panel of the Model 494.04 Chassis).





Cable specification

To maintain EMC compliance, the **J24 E-Stop** cable must comply with the following specifications:

Connector type–15-pin, type D, male EMI connector.

Backshell–EMI metallized plastic or metal.

Cable–24 AWG 4-conductor with braided shield, with the braid connected to a metallized plastic backshell at the chassis and to ground at the emergency stop (E-Stop) box.

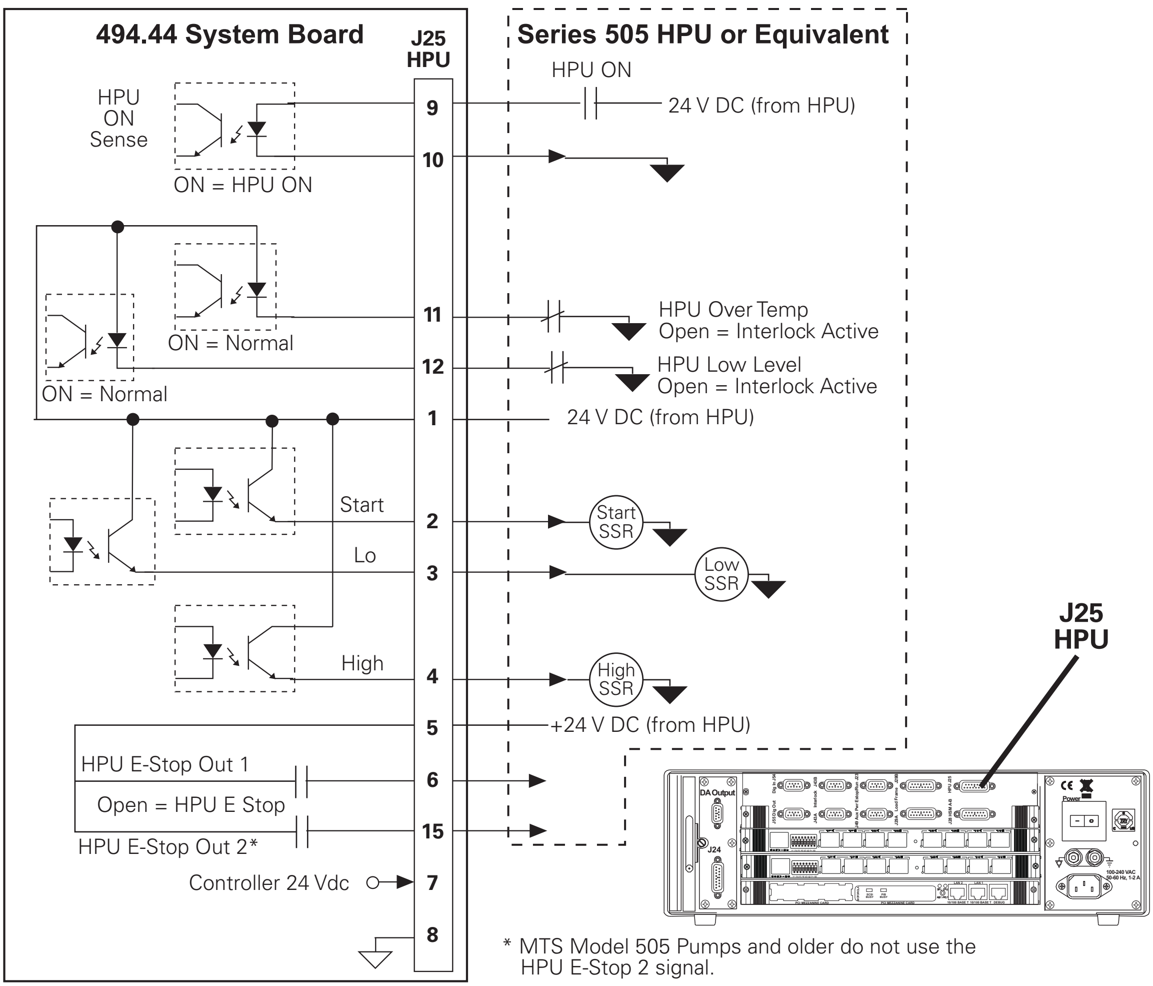
Jumper plug required

If connector **J24** is not used, you must install a jumper plug to maintain the integrity of the interlocks. Use jumper plug part number 039-713-201 or jumper pins 5-7 and 8-13.

J25 Hydraulic Power Unit Connections for the Model 494.44 System I/O Board

Connector **J25 HPU** provides 24-volt logic signals that control the hydraulic power unit (HPU). The connector may be connected directly to MTS Series 505 HPUs and similar HPUs that use low-current, 24-volt input controls.

Note *Other MTS HPUs require the Model 493.07 HPU Converter Box to convert the low-current HPU output signal to a signal that can drive the HPU relay.*



* MTS Model 505 Pumps and older do not use the HPU E-Stop 2 signal.

CAUTION

Control voltages for hydraulic power units vary between models

The HPU interface between the Model 494.44 System I/O board and an HPU is 24-volt logic signals. Connecting J25 to a non-compliant HPU can damage the board.

Do not connect 24 V DC relay circuitry or 115 V AC circuitry to connector J25 on the Model 494.44 System I/O board.

Cable specification

To maintain EMC compliance, **J25 HPU** cables must comply with the following specifications:

Connector—15-contact, type-D, female EMI connector.

Backshell–EMI metallized plastic or metal.

Cable—22 AWG, 10-conductor with braided shield with the shield connected to metallized plastic or metal backshell to the chassis.

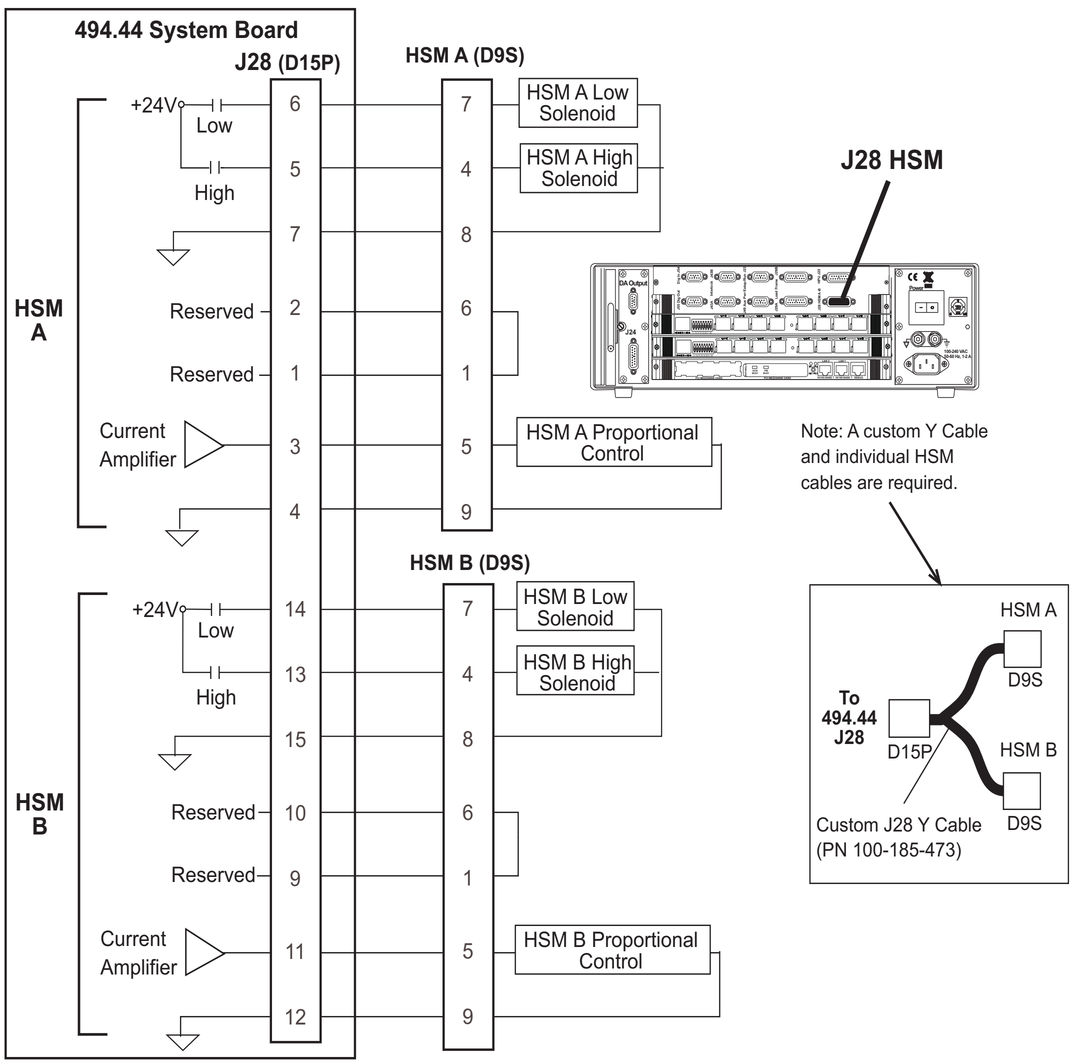
Jumper plug required

If connector **J25 HPU** is not used, you must install a jumper plug to maintain the integrity of the interlocks. Use jumper plug PN 039-713-301 or jumper pins 1–7, 2–3–5, 6–9, 8–10–11–12.

J28 HSM Connections for the Model 494.44 System Board

HSM control (off/low/high or proportional) for both HSMs is software configurable. The Model 494.44 board provides separate 24-volt, low-pressure and high-pressure outputs that drive the HSM low- and high-pressure solenoids. Proportional solenoid control provides a current output from 0 to 0.78 A.

Note *The Model 494.44 board can not be used with 115 V AC HSMs. Applications that use 115 V AC HSMs require an external converter box (such as a Model 413.08), which is used with this board.*



Cable specification

To maintain EMC compliance, **J28 A/B HSM** cables must comply with the following specifications:

Connector—9-pin type D male EMI connector.

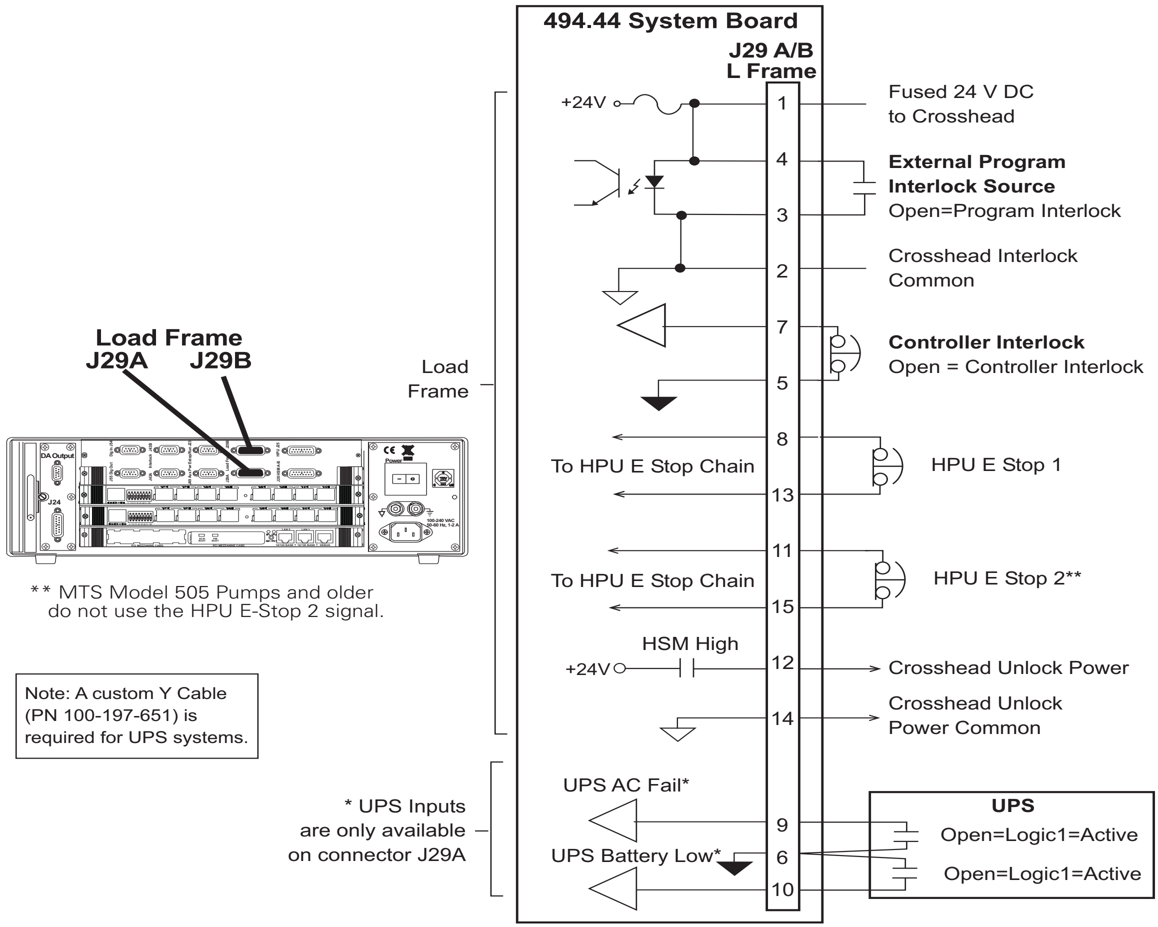
Backshell—EMI metallized plastic or metal.

Proportional Control Cable—18 AWG, 2-conductor with foil shield drain wire connected to conductive backshell.

Off/low/high Control Cable—18 AWG, 3-conductor with foil shield drain wire connected to conductive backshell.

J29 A/B Load Frame Connections for the Model 494.44 System Board

Connector **J29 A/B Load Frame** provides interfaces to connect up to two load frames and optional UPS (J29A only).



Cable specification

To maintain EMC compliance, the **J29 A/B Load Frame** cable must comply with the following specifications:

Connector type–15-pin, type D, male EMI connector.

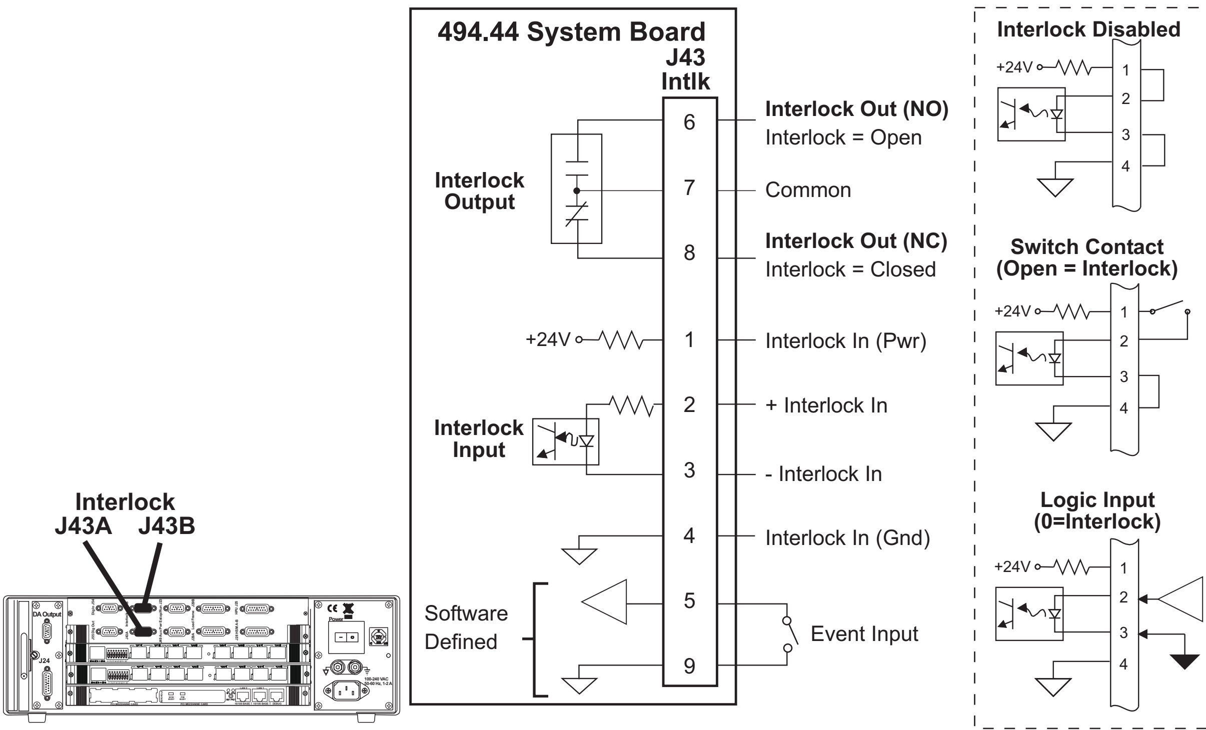
Backshell–EMI metallized plastic or metal.

Cable–18 AWG 8-conductor with foil shield, with the drain wire connected to a metallized plastic backshell at the chassis.

Jumper plug required If connector **J29** is not used, you must install a jumper plug to maintain the integrity of the interlocks. Use jumper plug part number 100-007-947 or jumper pins: 3-4, 5-7, 8-13, and 11-15.

J43 A/B Interlock Connections for the Model 494.44 System Board

Connector **J43 A/B Interlock** provides one optically isolated interlock input and a relay-contact interlock output per connector.



Cable specification To maintain EMC compliance, the **J43 Interlock** cable must comply with the following specifications:

Connector type–9-pin, type D, male EMI connector.

Backshell–EMI metallized plastic or metal.

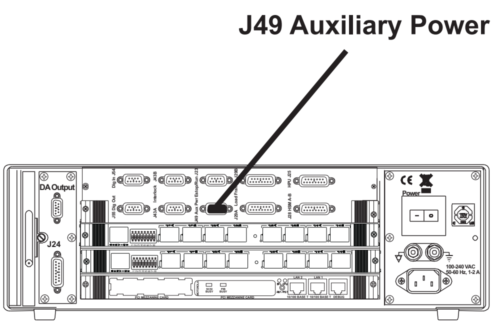
Cable–shielded twisted pairs (24 AWG minimum), braided shield with shield connected to the metallized backshell at the chassis.

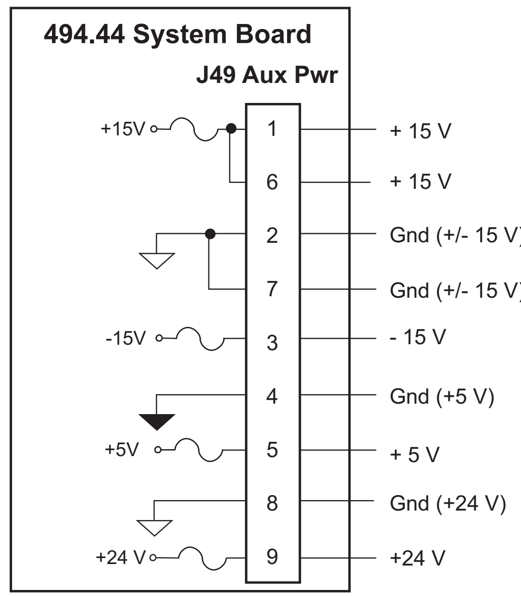
Jumper plug required

If connector **J43** is not used, you must install a jumper plug to maintain the integrity of the interlocks. Use jumper plug part number 100-057-245, or jumper pins: 1-2, 3-4, and 5-9.

J49 Auxiliary Power Connections for the Model 494.44 System Board

The **J49 Aux Pwr** connector provides fused (self resetting) auxiliary power outputs for: +5 V DC, +15 V DC, -15 V DC, and +24 V DC.





Cable specification

To maintain EMC compliance, the **J49 Auxiliary Power** cable must comply with the following specifications:

Connector type–9-pin, type D, male EMI connector.

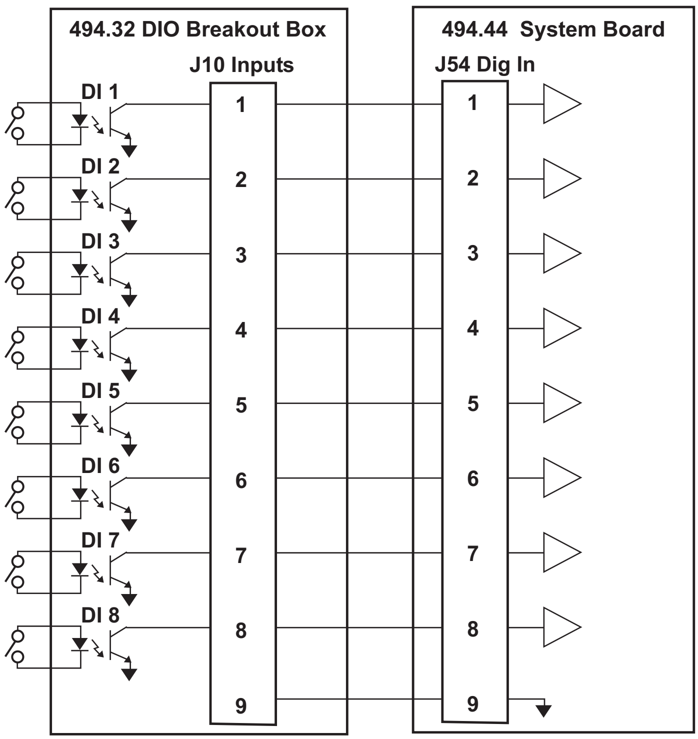
Backshell–EMI metallized plastic or metal.

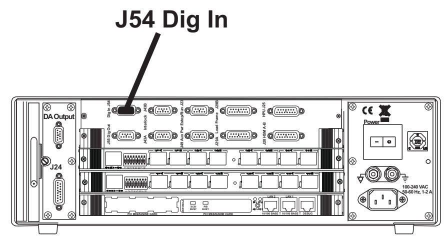
Cable–AWG and number of conductors as required. Braided shield with shield connected to the metallized backshell at the chassis.

J54 Digital Input Connections for the Model 494.44 System Board

Connector **J54 Dig In** accepts up to eight optically isolated digital-input signals from the Model 494.32 8-Channel DI/O Breakout Box. You can use these digital input signals to trigger test events in controller applications.

Note *Digital input power for the breakout box is brought in through breakout-box connector J19.*





Cable specification

To maintain EMC compliance, the **J54 Digital Input** cable must comply with the following specifications:

Connector type–9-pin, D type, female EMI connector.

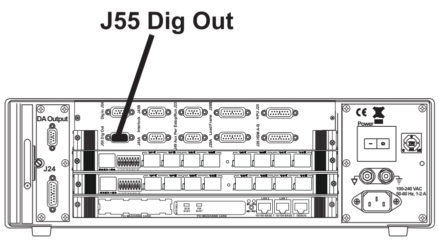
Back shell–EMI metallized plastic or metal.

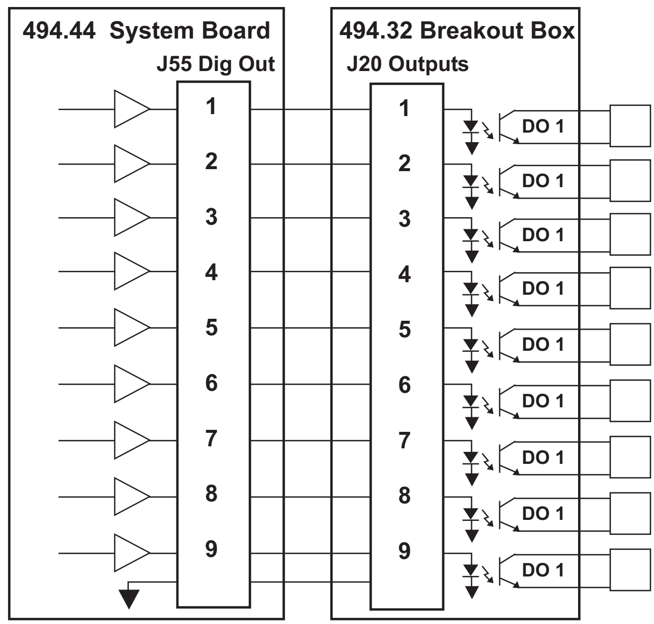
Cable–AWG and number of conductors as required. Braided shield with shield connected to the metallized backshell at the chassis and at the DI/O Breakout box.

J55 Digital Output Connections for the Model 494.44 System Board

Connector **J55 Dig Out** provides eight digital outputs that must be used with the Model 494.32 8-Channel High-Current DI/O Breakout Box. The breakout box provides high-current switching/isolation and device connections for each of the eight J55 outputs.

Note *External power for the output devices is brought into the breakout box through breakout-box connector J29.*





Cable specification

To maintain EMC compliance, the **J55 Digital Output** cable must comply with the following specifications:

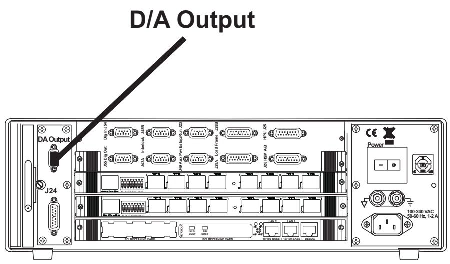
Connector–9-pin contact type D male EMI connector

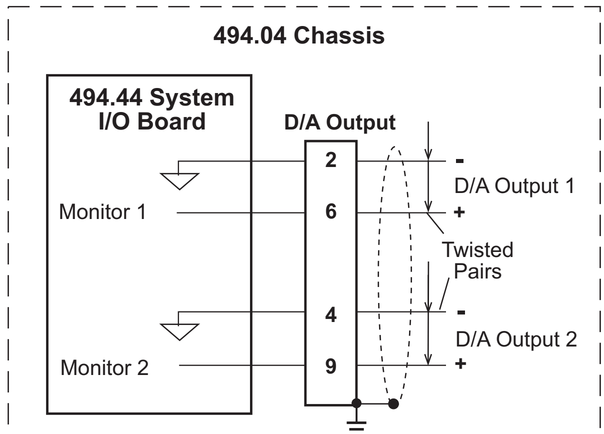
Back shell–EMI metallized plastic

Cable–AWG and number of conductors as required. Braided shield with shield connected to the metallized backshell at the chassis.

Analog Output Connections for the Model 494.44 System Board

The Model 494.44 System Board provides two analog output signals that are available on the **D/A Output** connector (located on the rear panel of the 494.04 chassis). Each D/A output is software defined.





Cable specification

To maintain EMC compliance, the **D/A Output** cable must comply with the following specifications:

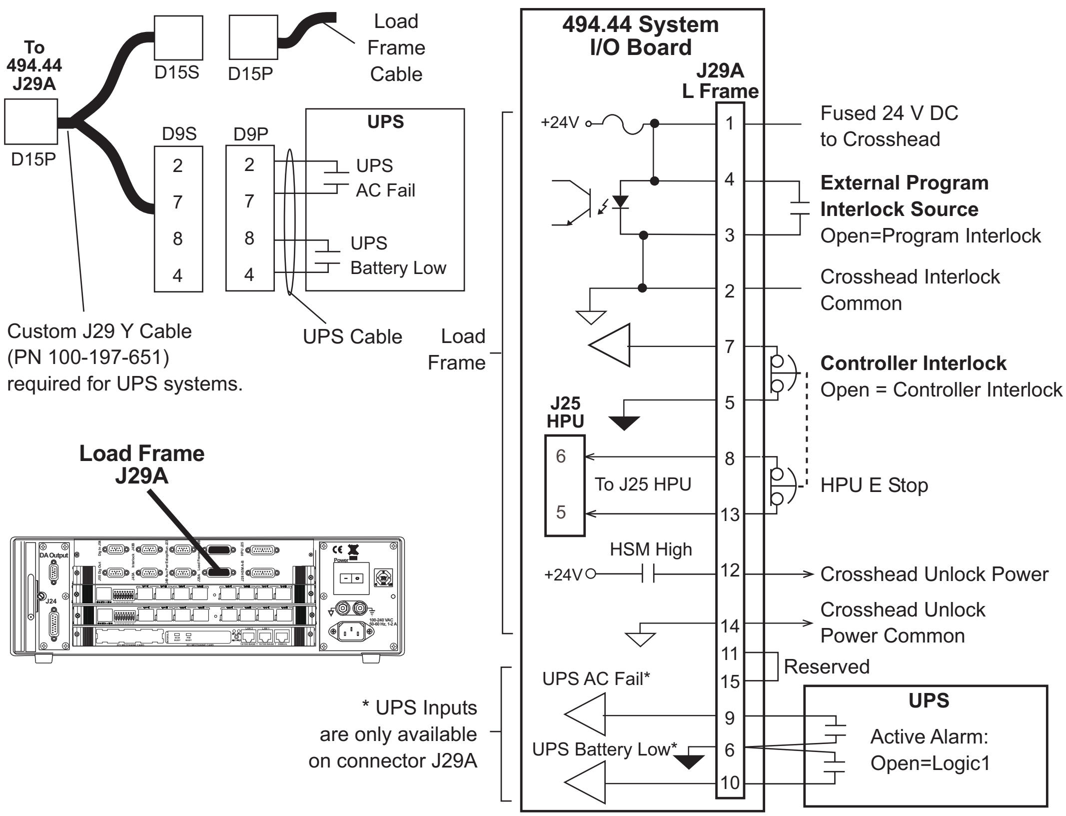
Connector type–9-pin, type D, male EMI connector.

Backshell–EMI metallized plastic or metal.

Cable–shielded twisted pairs (24 AWG minimum), braided shield with the shield connected to the metallized backshell at the chassis.

UPS Connections for the Model 494.44 System Board (FT40)

The following drawing shows UPS connections for the Model 494.44 System Board. Once connected, you must use your controller software to configure the various UPS options.



Cable specification

To maintain EMC compliance, the UPS cable that connects to the load frame Y cable must comply with the following specifications:

Connector type–9-pin, type D, male EMI connector.

Backshell–EMI metallized plastic or metal.

Cable–26–22 AWG, four-conductor with overall braided shield, with the braided shield connected to the metallized backshell at the chassis.

FlexTest 60 Controller Configuration

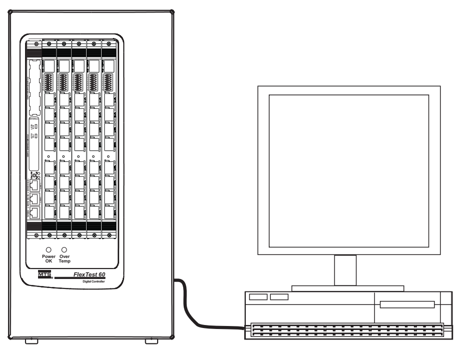
About the FlexTest 60 Controller

The MTS FlexTest 60 Digital Controller is a fully digital proportional, integral, derivative, feed forward (PIDF) servocontroller that provides complete control of up to six stations in a test system.

A FlexTest 60 Controller consists of:

- One Model 494.06 Chassis that contains controller hardware.
- A computer workstation that runs MTS controller applications.

For a detailed listing of configuration options, see the *FlexTest 60 Configuration* engineering drawing (Part number 700-003-811).



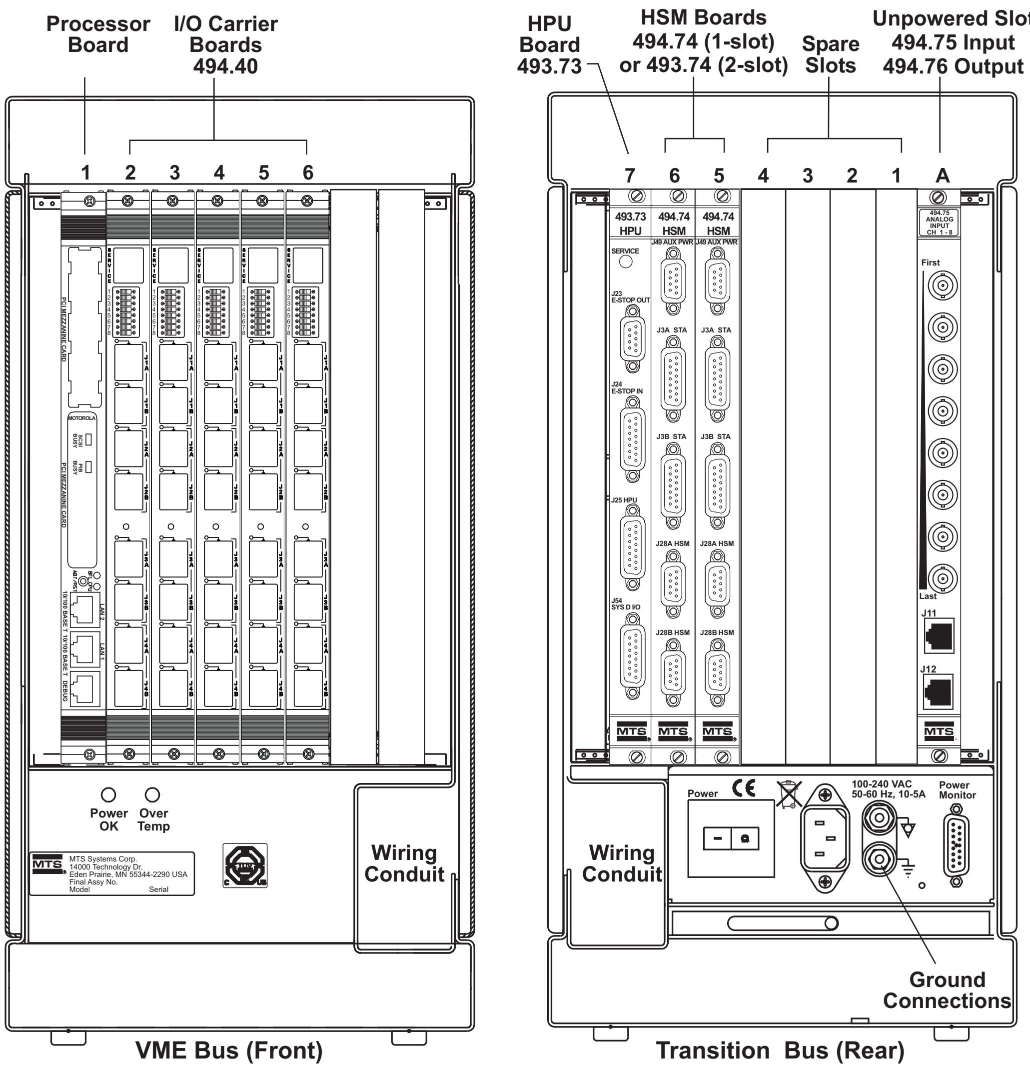
Controller capabilities

PARAMETER	FLEXTEST 60
Test Stations	Up to 6*
Control Channels	Up to 8
Conditioned Transducer Inputs	Up to 24
Auxiliary Data Inputs	Up to 32
VME Bus Slots	6
Transition Bus Slots	7 (powered), 1 (unpowered)

* Six-station configurations only support On/Off HSMs.

About the Model 494.06 Chassis

The Model 494.06 Chassis houses up to six MTS VME bus boards in its front panel and up to eight transition boards in its rear panel. The Model 494.06 Chassis can be rack mounted or mounted in a standalone enclosure. The physical board locations must match the board locations defined in your hardware-mapping software.



Specifications–Model 494.06 Chassis

All equipment related to the controller should be connected to the same fused power circuit.

Note *Electrical connections must be made by qualified personnel and conform to local codes and regulations. Local electrical codes supersede any information found here.*

Model 494.06 Chassis Specifications

Parameter	Specification
Input Voltage	100–240 V AC (single phase) power factor corrected universal input
Input Frequency	50–60 Hz
Input Current	10 A at 100 V AC 5 A at 240 V AC
Facility Power Requirements	Provide a dedicated circuit for the chassis, computer, and monitor.
Input Surge	<40 A
Insulation Over Voltage	Category I
Pollution Degree	2
Weight	Approximately 14 kg (31 lb)
Dimensions	Width: 21.6 cm (8.5 in) Height: 44.2 cm (17.4 in) Depth: 64.8 cm (25.5 in)

FlexTest 100 Controller Configuration

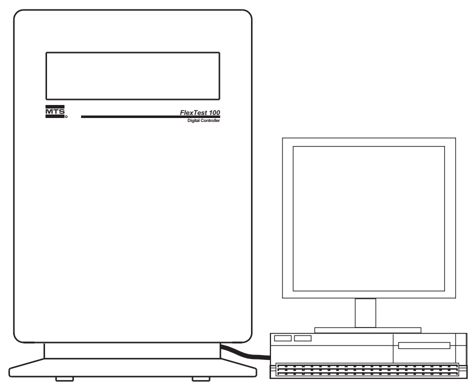
About the FlexTest 100 Controller

The MTS FlexTest 100 Digital Controller is a fully digital proportional, integral, derivative, feed forward (PIDF) servocontroller that provides complete control of up to eight stations in a test system.

A FlexTest 100 Controller consists of:

- One Model 494.10 Chassis that contains controller hardware.
- A computer workstation that runs MTS controller applications.

For a detailed listing of configuration options, see the *FlexTest 100 Configuration* engineering drawing (Part number 700-003-812).

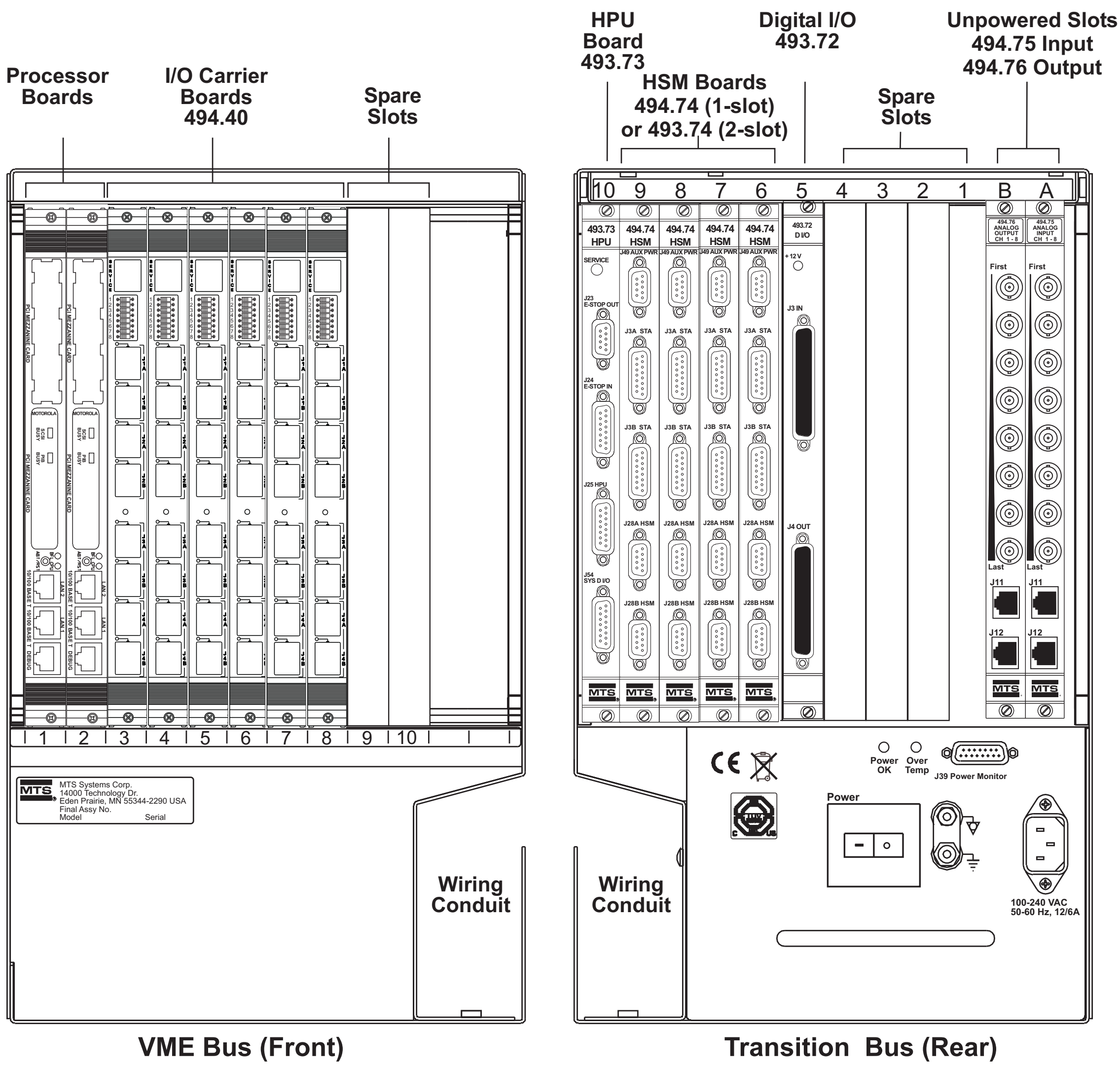


Controller capabilities

PARAMETER	FLEXTEST 100
Test Stations	Up to 8
Control Channels	Up to 16
Conditioned Transducer Inputs	Up to 40
Auxiliary Data Inputs	Up to 64
VME Bus Slots	10
Transition Bus Slots	10 (powered), 2 (unpowered)

About the Model 494.10 Chassis

The Model 494.10 Chassis houses up to 10 MTS VME bus boards in its front panel and up to 12 transition boards in its rear panel. The Model 494.10 Chassis can be rack mounted or mounted in a stand-alone enclosure. The physical board locations must match the board locations defined in the hardware-mapping software.



Specifications–Model 494.10 Chassis

All equipment related to the controller should be connected to the same fused power circuit.

Note *Electrical connections must be made by qualified personnel and conform to local codes and regulations. Local electrical codes supersede any information found here.*

Model 494.10 Chassis Specifications

Parameter	Specification
Input Voltage	100–240 V AC (single phase) power factor corrected universal input
Input Frequency	50–60 Hz
Input Current	12 A at 100 V AC 6 A at 240 V AC
Facility Power Requirements	Provide a dedicated circuit for the chassis, computer, and monitor.
Input Surge	<80 A
Insulation Over Voltage	Category I
Pollution Degree	2
Weight	Approximately 45.4 kg (100 lb)
Dimensions	Width: 37 cm (14.5 in) Height: 56 cm (22 in) Depth: 66 cm (26 in)

FlexTest 200 Controller Configuration

About the FlexTest 200 Controller

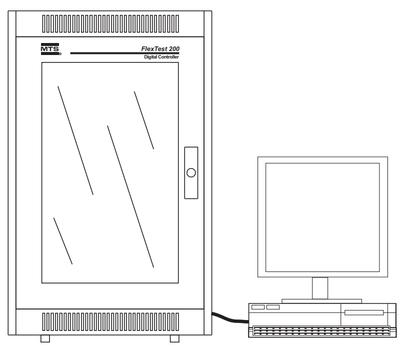
The MTS FlexTest 200 Digital Controller is a fully digital proportional, integral, derivative, feed forward (PIDF) servocontroller that provides complete control of up to eight stations in a test system.

A FlexTest 200 Controller consists of:

- One Model 494.20 Chassis that contains controller hardware.
- A computer workstation that runs MTS controller applications.

For a detailed listing of configuration options, see the *FlexTest 200 Configuration* engineering drawing (Part number 700-003-813).

For a detailed listing of Aero configuration options, see the *FlexTest 200 Aero Configuration* engineering drawing (Part number 700-004-113).



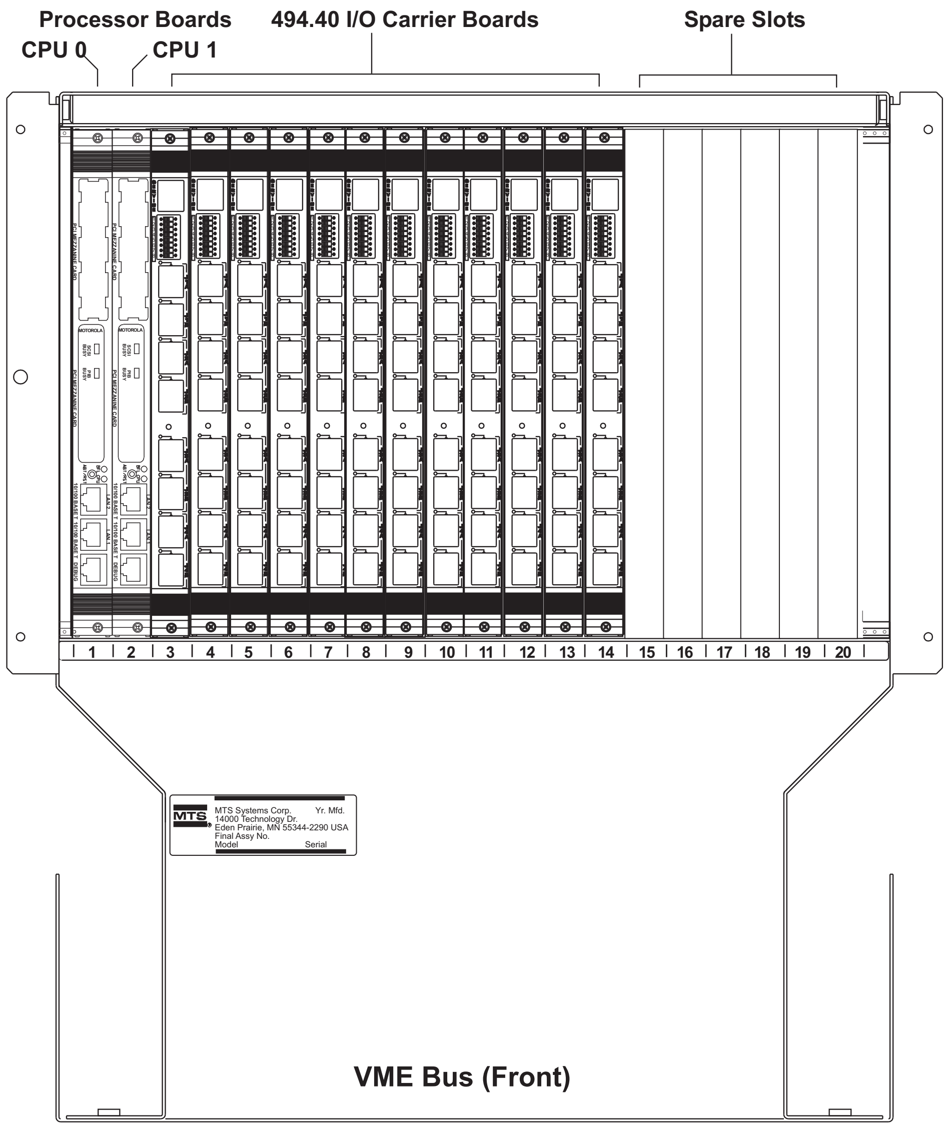
Controller capabilities

PARAMETER	FLEXTEST 200
Test Stations	Up to 8
Control Channels	Up to 40
Conditioned Transducer Inputs	Up to 80
Auxiliary Data Inputs	Up to 96
VME Bus Slots	20
Transition Bus Slots	19 (powered), 1 (unpowered)

About the Model 494.20 Chassis

VME bus boards

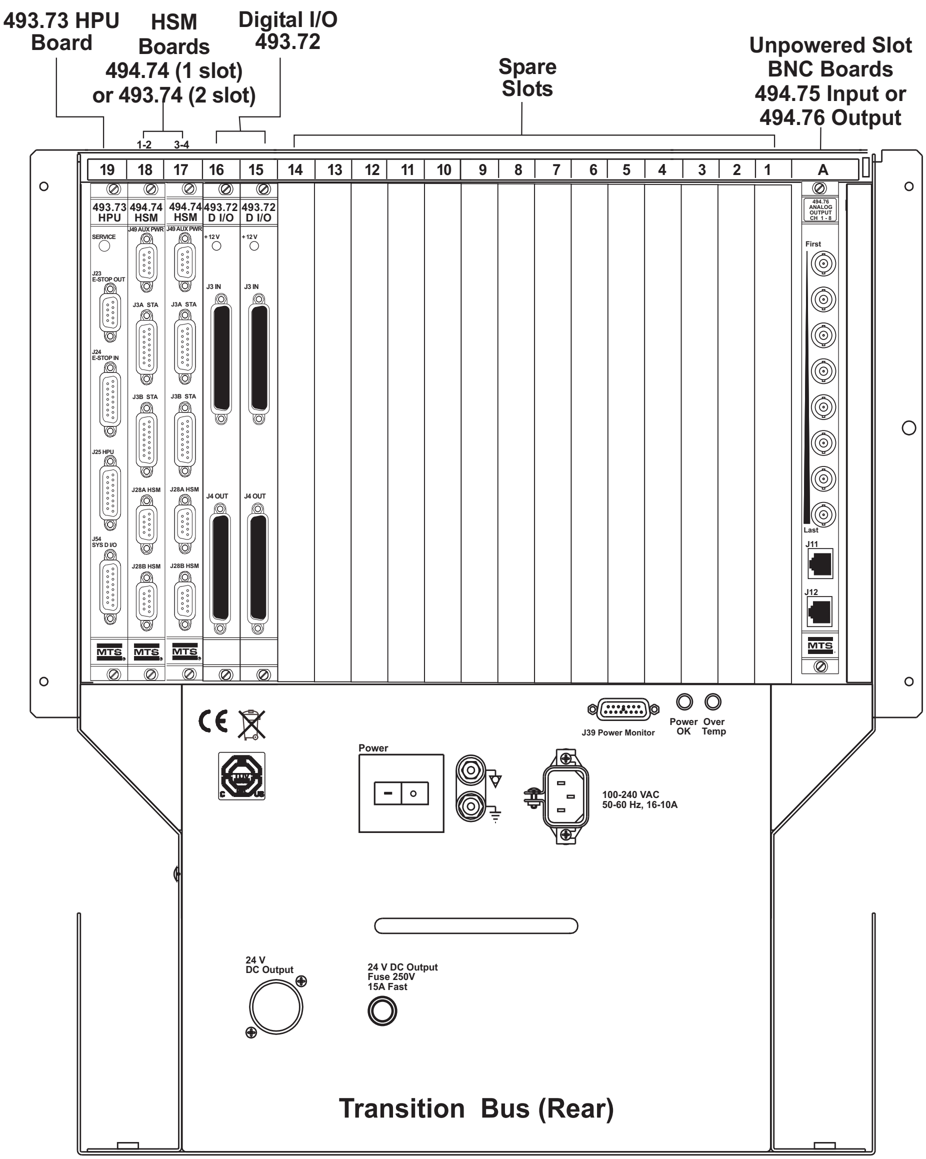
The Model 494.20 Chassis houses up to 20 MTS VME bus boards in its front card cage. The physical board locations must match the board locations defined in your hardware-mapping software.



Transition boards

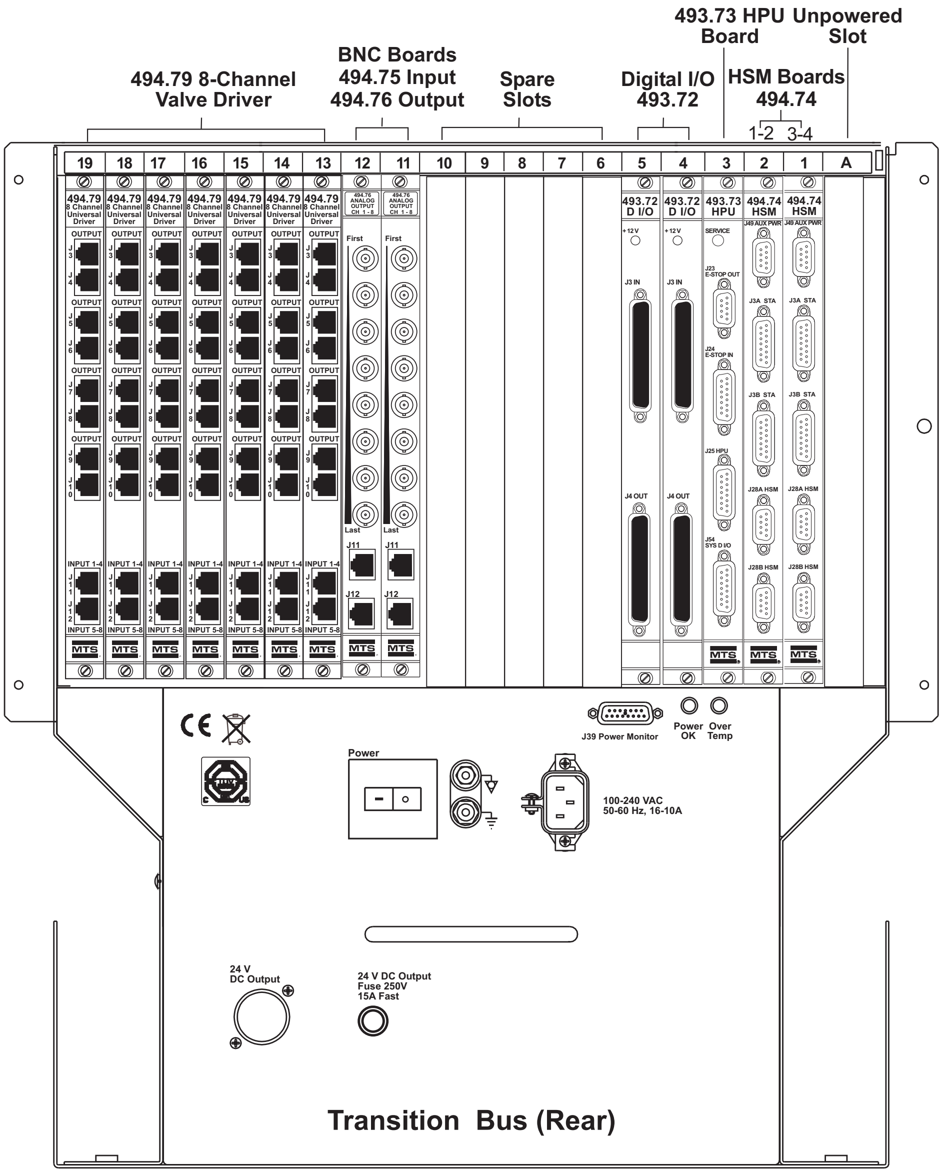
The Model 494.20 Chassis houses up to 20 transition boards in its rear card cage. The physical board locations must match the board locations defined in your hardware-mapping software.

Note *Series 793 Software maps HSM interlock I/O connectors (J3 A/B on 494.74, J43 A/B on 493.74) to stations on a left-to-right basis.*



Transition Boards (Aero Structural Test Systems)

For a detailed listing of Aero configuration options, see the *FlexTest 200 Aero Configuration* engineering drawing (Part number 700-004-113).



Specifications–Model 494.20 Chassis

All equipment related to the controller should be connected to the same fused power circuit.

Note *Electrical connections must be made by qualified personnel and conform to local codes and regulations. Local electrical codes supersede any information found here.*

Model 494.20 Chassis Specifications

PARAMETER	SPECIFICATION
Input Voltage	100–240 V AC (single phase) power factor corrected universal input
Input Frequency	50–60 Hz
Input Current	16 A at 100 V AC 8 A at 240 V AC
Facility Power Requirements	Provide a dedicated circuit for the chassis, computer, and monitor.
Input Surge	<100 A
Insulation Over Voltage	Category I
Pollution Degree	2
Weight	Approximately 60 kg (132 lb)
Dimensions	Width: 60 cm (24 in) Height: 98 cm (38 in) Depth: 90 cm (35 in)

Model 494.20 Chassis 24 V DC Output

The Model 494.20 Chassis includes a **24 V DC Output** that you can use to power external devices. The output is fused with a 15 A, 250 V, fast fuse.

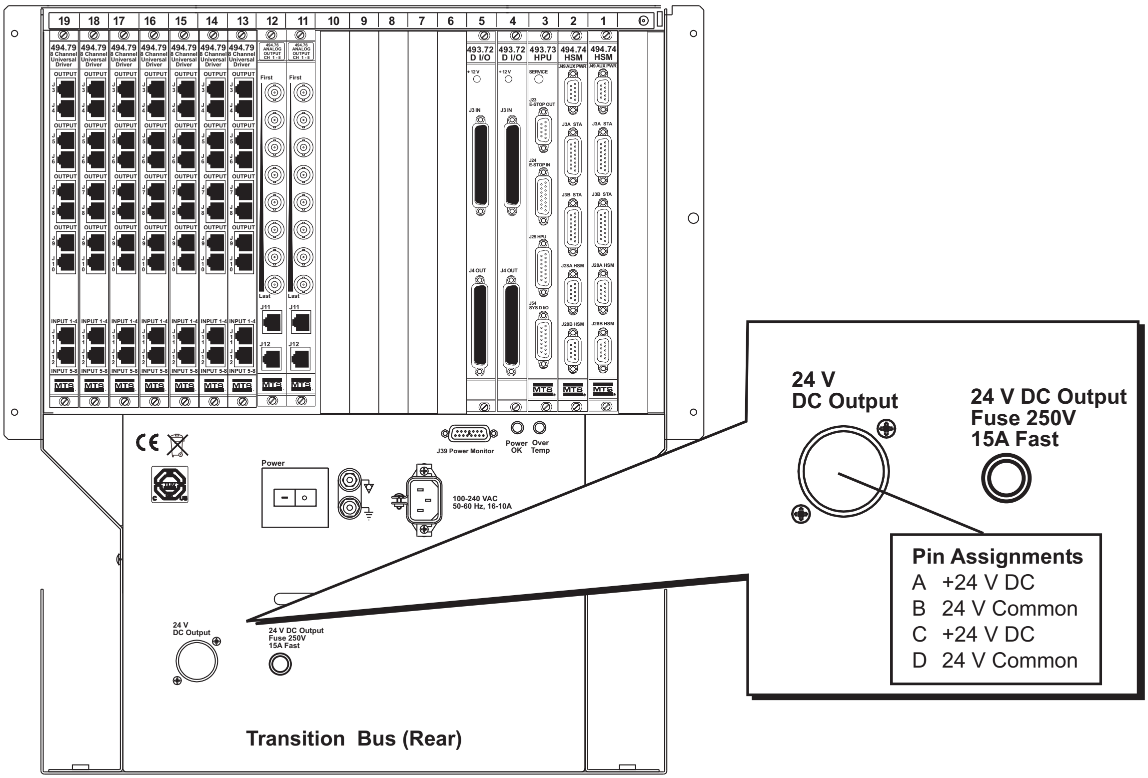
Cable specification

To maintain EMC compliance, **24 V DC Output** cables must comply with the following specifications:

Connector–4-contact, Amphenol Series 97 connector.

Backshell–EMI metal.

Cable–AWG and number of conductors as required. Braided shield with the shield connected to the metallized backshell at the chassis.



Chapter 3

VME Bus Boards

Contents

VME Bus Board Overview

About VME Bus Boards

MTS VME Bus boards plug into the VME card cage located on the front of a Series 494 Chassis. VME Bus boards include processor boards and Model 494.40 I/O carrier boards.

Processor board The chassis requires at least one VME bus processor board. The processor board provides PIDF processing and an interface between the controller and the computer workstation.

I/O carrier board Each I/O carrier board can contain up to four mezzanine cards. You can use mezzanine cards to condition transducers, drive servovalves, and provide A-to-D/D-to-A inputs and outputs.

Multiple chassis If multiple chassis are used, a Model 494.43 Multi Chassis Interface board is required.

System Update Rates

The following table lists the maximum system update rates for various controllers and channel counts.

Number of Channels	FlexTest 40	FlexTest 60	FlexTest 100	FlexTest 200
Type of Processor	2500	2500	5500	7100
1–2 Control Channels	6144 Hz	6144 Hz	6144 Hz	NA
3–4 Control Channels	4096 Hz	4096 Hz	4096 Hz	NA
5–8 Control Channels	NA	2048 Hz	2048 Hz	6144 Hz
9–16 Control Channels	NA	NA	2048 Hz	4096 Hz
17–24 Control Channels	NA	NA	NA	2048 Hz
>24 Control Channels	NA	NA	NA	1024 Hz

How to Install and Remove a VME Bus Board

VME bus boards are inserted into a backplane connector and secured to the chassis with IEEE locking levers at the top and bottom of the faceplate.

CAUTION

The plug-in boards and cards contain static-sensitive components.

Improper handling of boards and cards can cause component damage.

Follow these precautions when handling boards and cards:

- Turn off electrical power before installing or removing a board.
- Use a static ground strap to ground yourself to the chassis ground before touching the chassis or a board.
- Keep unused boards and cards in conductive bags. Also, be sure you are grounded when removing a board or card from a conductive bag.
- Handle boards with their front panel or circuit card edges. Do not touch any circuit card components, pins, or circuit connection points.

CAUTION

Each Series 494 Controller can only use VME Bus boards that are designed by and purchased from MTS.

The use of VME Bus boards from other manufacturers can result in damage to the equipment.

Do not use VME Bus boards from other manufacturers in any MTS controller chassis.

Board installation procedure

1. Make sure that your controller software is configured to recognize each board.
2. Turn off the AC power switch on the back of the chassis before installing or removing boards.
3. Use a static ground strap (MTS part number 100-183-454) to ground yourself to chassis ground before touching the chassis or a board.
4. Make sure that the Model 494.40 I/O Carrier board address switch settings match those in your software.

5. Insert each VME bus board:

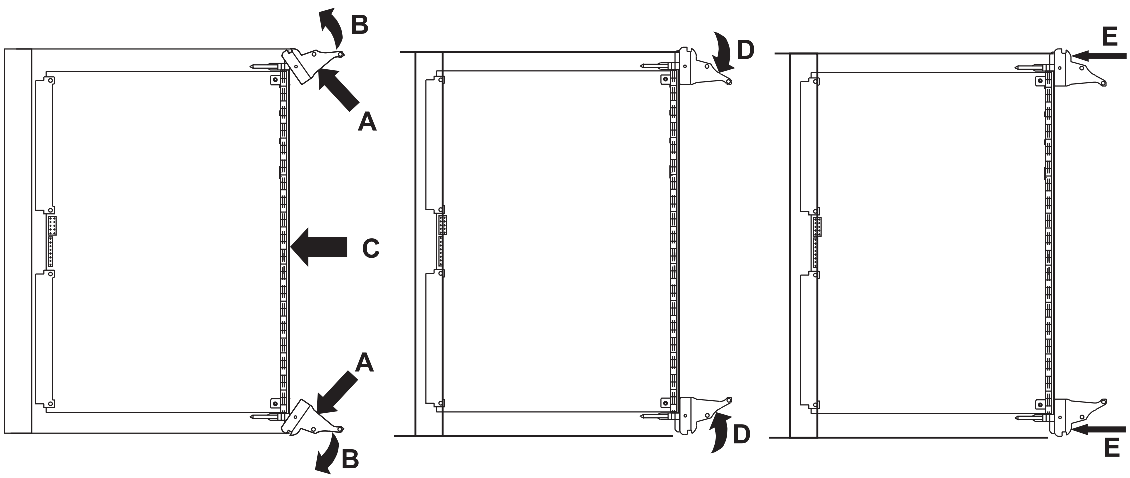
    A. Press and hold the buttons on each of the plastic levers (A).

    B. Rotate the levers (B) out (away from the board).

    C. Carefully insert the board (C) in the VME bus slot until it stops.

    D. Rotate the levers in (toward the board) (D) until the board is firmly seated in the backplane connector.

    E. Tighten the two screws (located in the levers) (E) to secure the board to the chassis.



Board removal procedure

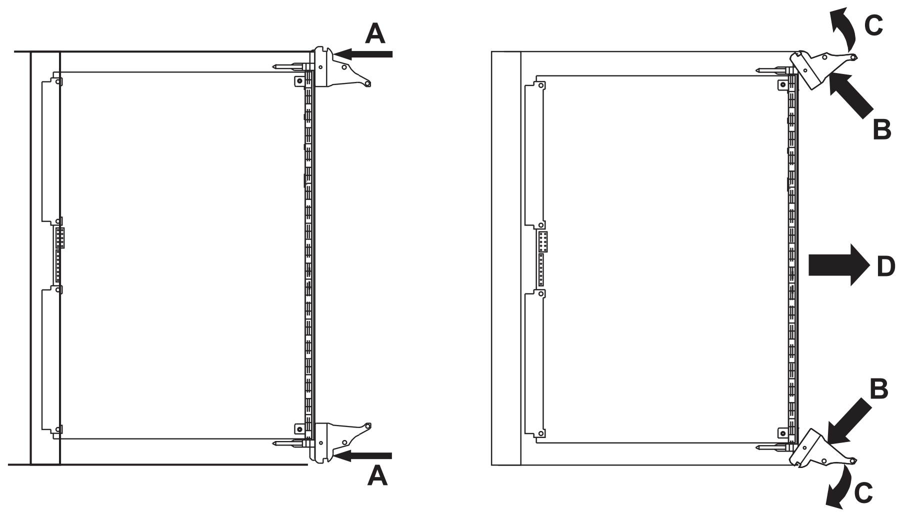
1. Turn off the AC power switch on the back of the chassis before installing or removing boards.
2. Use a static ground strap (MTS part number 100-183-454) to ground yourself to chassis ground before touching the chassis or a board.
3. Remove the VME bus board:

    A. Loosen the two screws (located in the levers) (A) that secure the board to the chassis.

    B. Press and hold the buttons on each of the plastic levers (B).

    C. Rotate the levers (C) out (away from the board).

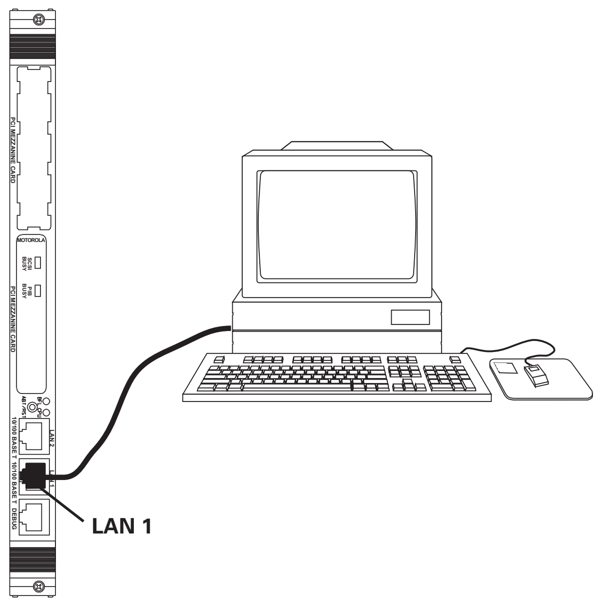
D. Carefully remove the board (D) from the VME bus slot.



Processor Connections

Computer Workstation Connections

The computer workstation is connected to the Model 494.96 Processor board installed in the VME bus of the chassis through an Ethernet 10/100 Base-T connection. The computer workstation must have a dedicated Ethernet-compatible connector.



CAUTION

Several boards have connectors that look similar to a phone connector.

Connecting telecommunications equipment cables to boards in the controller chassis can damage the electrical components of the chassis or your telecommunications system.

Limit the possibility of damaging boards by only using the connector types recommended by MTS.

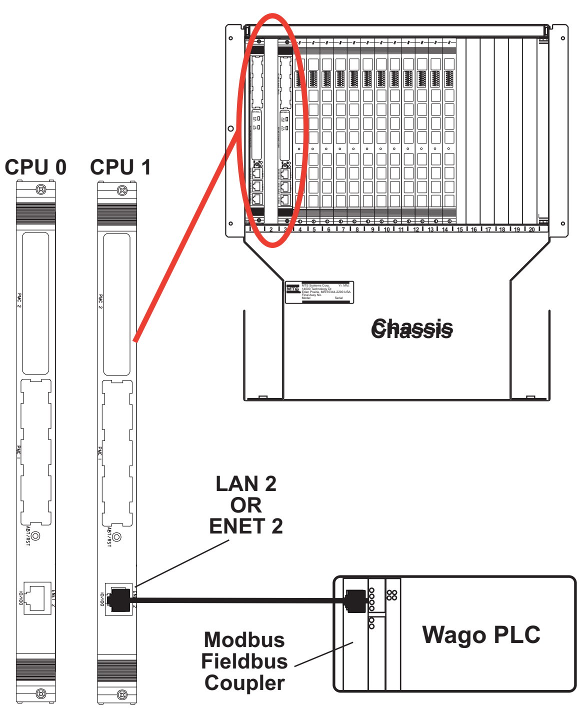
Wago Ethernet TCP/IP FieldBus Coupler Connections

The following drawing shows the controller processor connections for a Wago PLC (programmable logic controller).

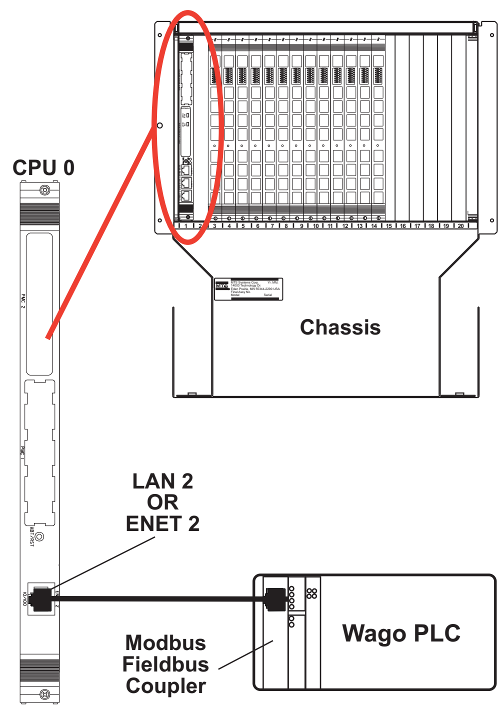
- The processor connection (LAN 2 or ENET 2) depends on the number of processors and the type of processor(s) used in your controller.
- The Wago PLC connection is typically made to a Modbus FieldBus Coupler module intalled in a Wago PLC chassis.

Note *Only use interconnect cables supplied by MTS.*

Dual Processor Wago Ethernet Connection



Single Processor Wago Ethernet Connection



Model 494.40 I/O Carrier Board

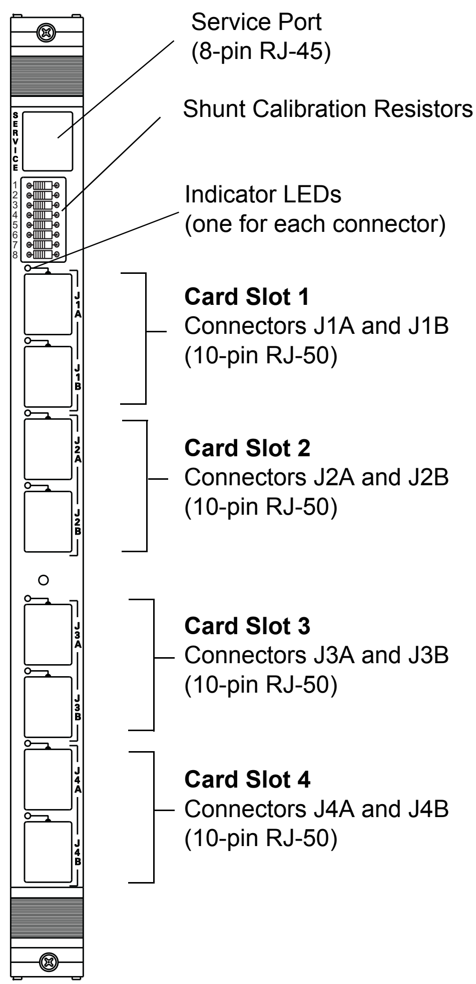
About the Model 494.40 I/O Carrier Board

The Model 494.40 I/O Carrier board is a VME board where you can install up to four mezzanine cards. These cards perform a variety of functions, such as transducer conditioning, valve driving, and other I/O functions.

Note *The Model 494.40B board is a new generation release of the 494.40 board that is compatible with the old boards.*

Your system hardware-mapping software provides the controller software with the I/O carrier board and individual card addresses.

The I/O carrier board includes two RJ-50 front-panel connectors for each mezzanine card. These connectors route signals to and from the card.



Board features

- The I/O carrier board has a front-panel shunt-calibration-resistor socket for use by conditioner cards.
- Each card connector has a software-controlled LED indicator. The LED function is defined by the controller software.
- The I/O carrier board has internal sockets for bridge-completion resistors.
- The I/O carrier board has an RJ-45 connector for service connection to cards.

How to Set Up a Model 494.40 I/O Carrier Board

1. Turn off electrical power to the chassis before installing or removing boards and cards.

CAUTION

The plug-in boards and cards contain static-sensitive components.

Improper handling of boards and cards can cause component damage.

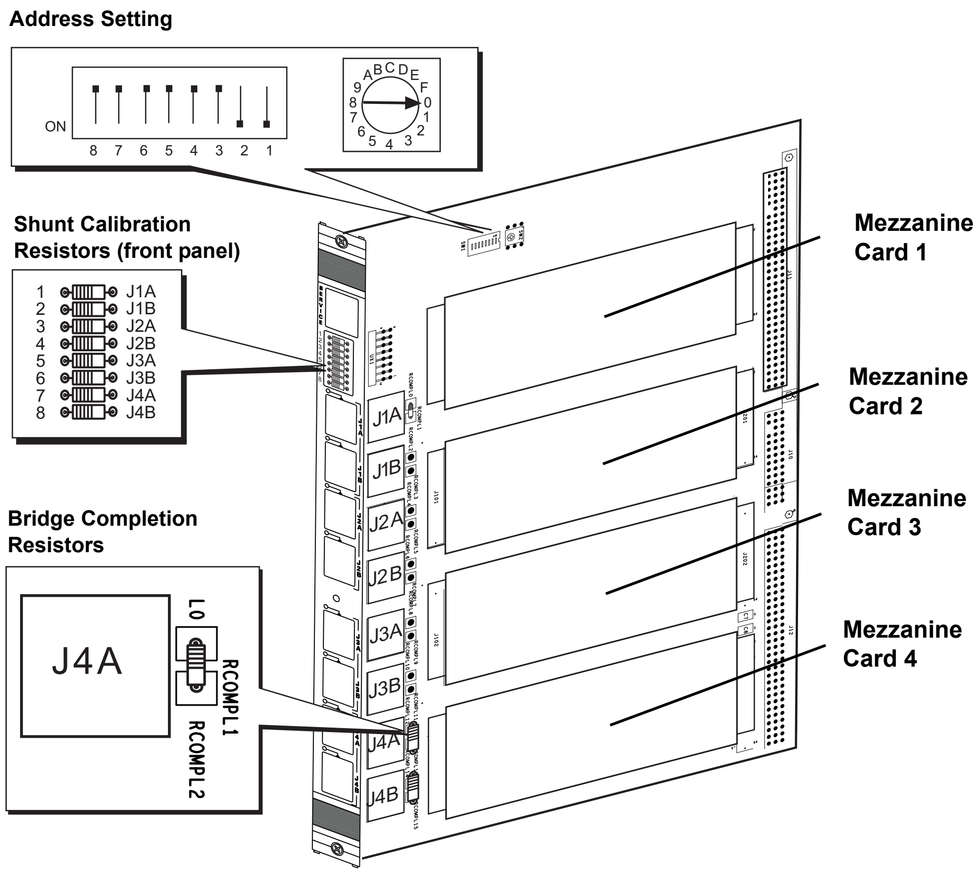
Follow these precautions when handling boards and cards:

- Turn off electrical power before installing or removing a board.
- Use a static ground strap to ground yourself to the chassis ground before touching the chassis or a board.
- Keep unused boards and cards in conductive bags. Also, be sure you are grounded when removing a board or card from a conductive bag.
- Handle boards with their front panel or circuit card edges. Do not touch any circuit card components, pins, or circuit connection points.

2. Use a static ground strap to ground yourself to chassis ground before touching the chassis or a board.
3. Set up the new board.
   A. Set the board address switch settings.
   B. Install the required cards.
   C. (Optional) Install bridge completion resistors on the I/O carrier board.
   D. (Optional) Install shunt calibration resistors on the front panel of the I/O carrier board.
4. Install the I/O carrier board.
   A. Plug the board into the chassis.
   B. Connect the system cables to the board.
5. After you have installed all boards, apply power to the system and use the hardware-mapping and control software to configure the address setting and various card settings of the I/O carrier board.
6. Allow the system to warm up for a minimum of one hour.
7. Perform calibration and tuning procedures.

Model 494.40 I/O Carrier Board Settings

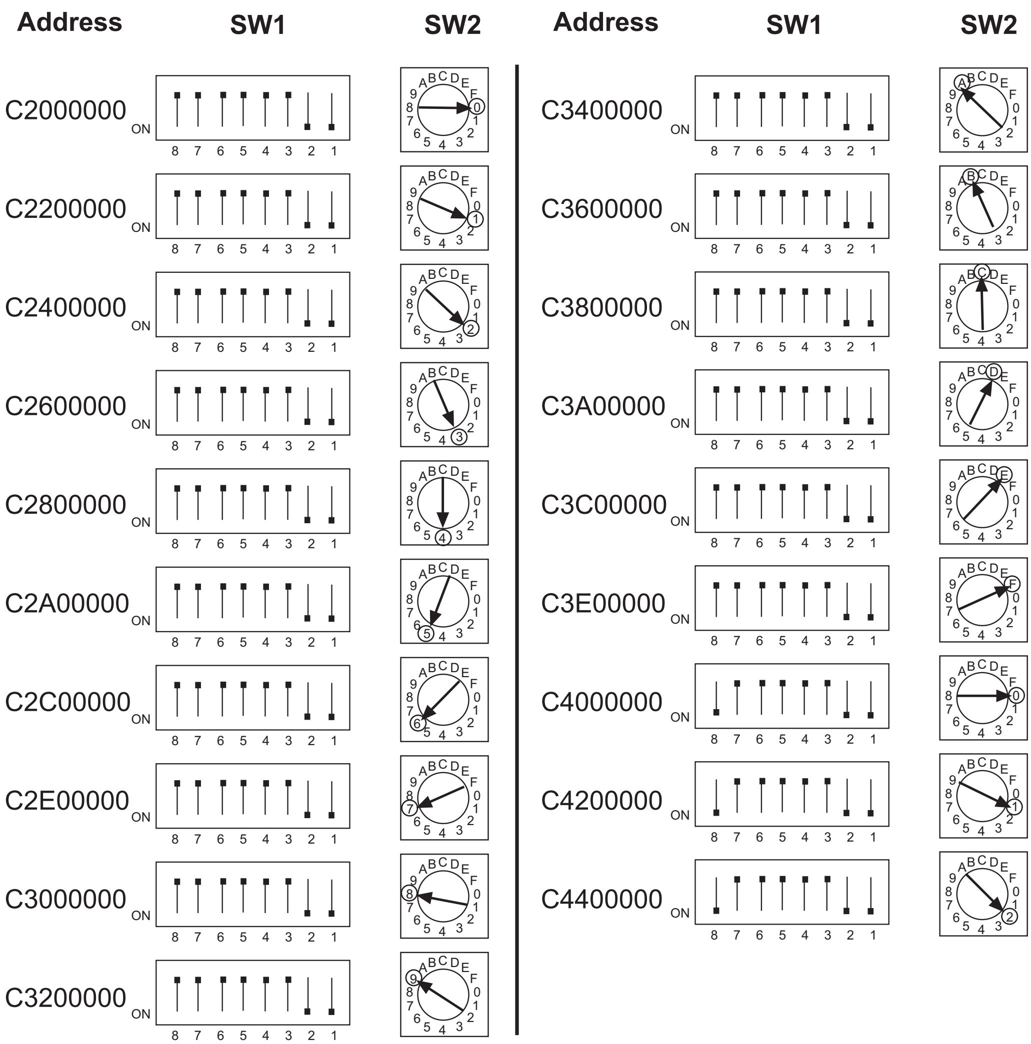
When you add or replace an I/O carrier board, you must set the board address. If DUC cards are used, you can add optional shunt calibration and bridge-completion resistors to the I/O carrier board. The locations for these settings are shown below.



How to Set the Model 494.40 I/O Carrier Board Address

The address setting for the I/O carrier board must match the settings used by the system control software.

1. Determine the I/O carrier address.
2. Locate address switches SW1 and SW2 on the I/O carrier circuit board and set the board address using the settings shown below.



How to Install a Shunt-Calibration Resistor on an I/O Carrier Board

The Model 494.40 I/O Carrier board has a front-panel socket where you can insert shunt-calibration plug assembly for use with DUC cards. Each socket is associated with one of the eight RJ-50 connectors on the front panel.

1. Determine the RJ-50 connector(s) used by the transducer(s).

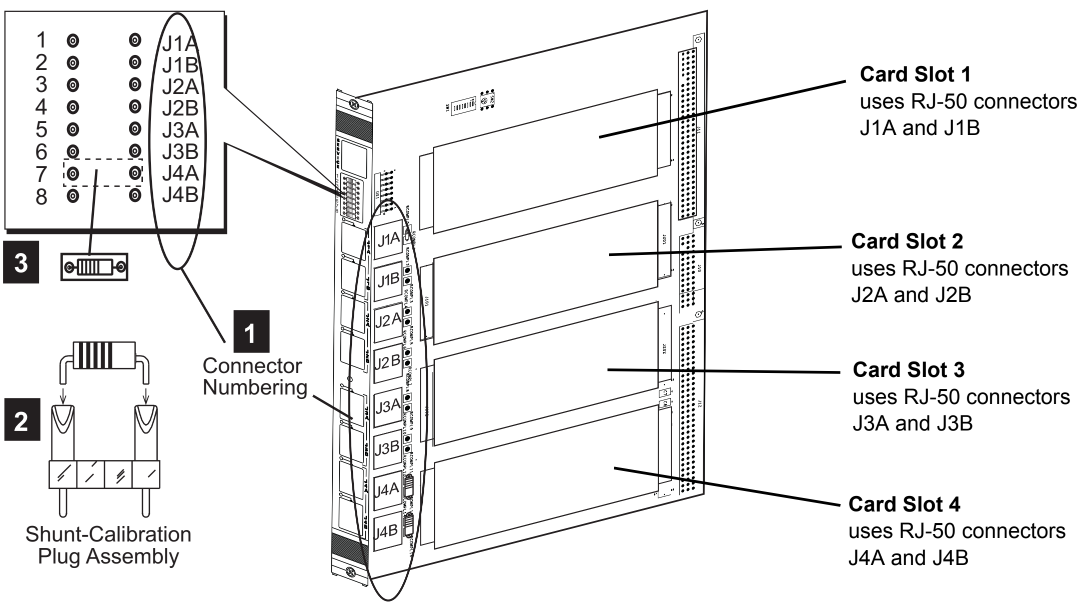
Note *Each mezzanine-card slot on the I/O carrier board connects to two RJ-50 connectors on the front of the I/O carrier board.*

2. Solder the shunt-calibration resistors to an MTS shunt-calibration plug assembly (MTS 11-433-826).

Note *The shunt-calibration plug assembly includes plug assemblies for eight shunt resistors. Each resistor should be labeled with its resistance value and transducer serial number.*

3. Insert the shunt-calibration plug assemblies into the front-panel sockets.

Note *If you use MTS TEDS modules or MTS transducers with integrated shunt-calibration resistors, you must insert a jumper plug (MTS 100-188-097) into the socket for each transducer input where you will use the integrated shunt-calibration resistor.*

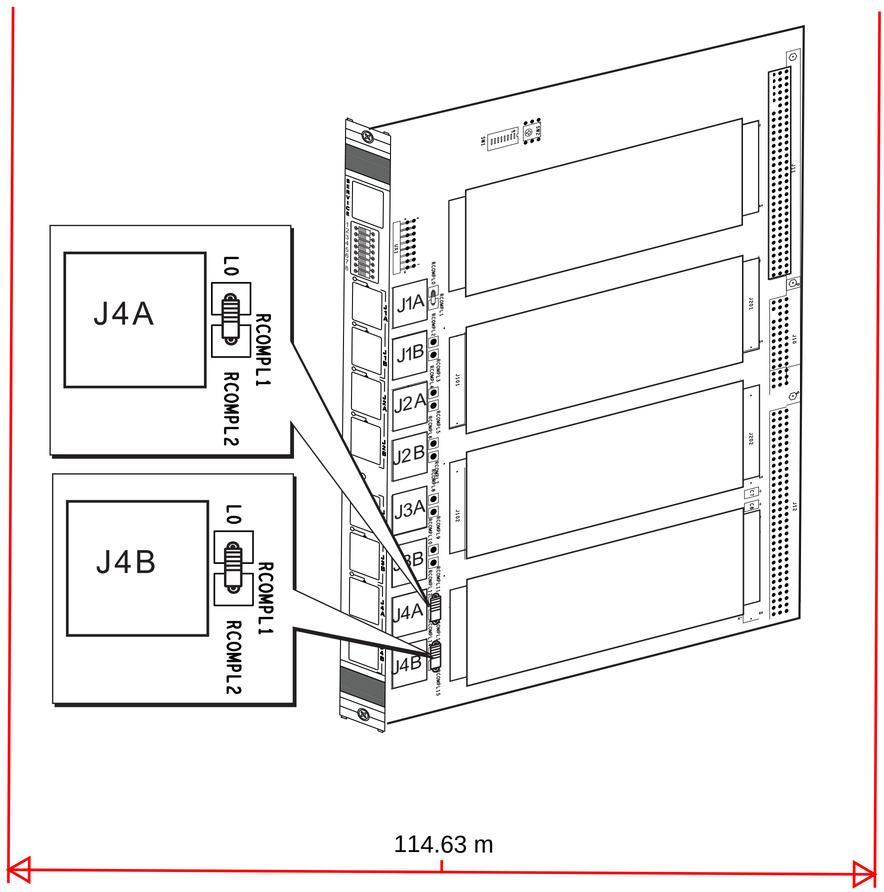


How to Install a Bridge-Completion Resistor on an I/O Carrier Board

You can install bridge-completion resistors on the I/O Carrier board for use with DUC cards that condition 1/4-bridge transducers such as strain gages.

The I/O Carrier circuit board has eight sockets for bridge completion resistors. Each resistor socket is associated with one of the eight RJ-50 connectors on the front panel.

1. Determine the RJ-50 connector used by the DC conditioner.
2. On the I/O Carrier circuit board, install the bridge completion resistor in the socket associated with that connector.
3. On the DUC card, set the bridge-completion switch to the quarter-bridge position.

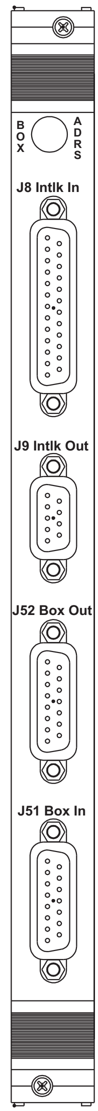


Model 494.43 Multibox Board

About the Model 494.43 Multibox Board

The Model 493.43 Multibox board allows multiple controllers to share a master hardware synchronization clock and pass station interlock state information between each other.

In addition, this front panel module also provides user station interlock inputs and outputs.



Board features

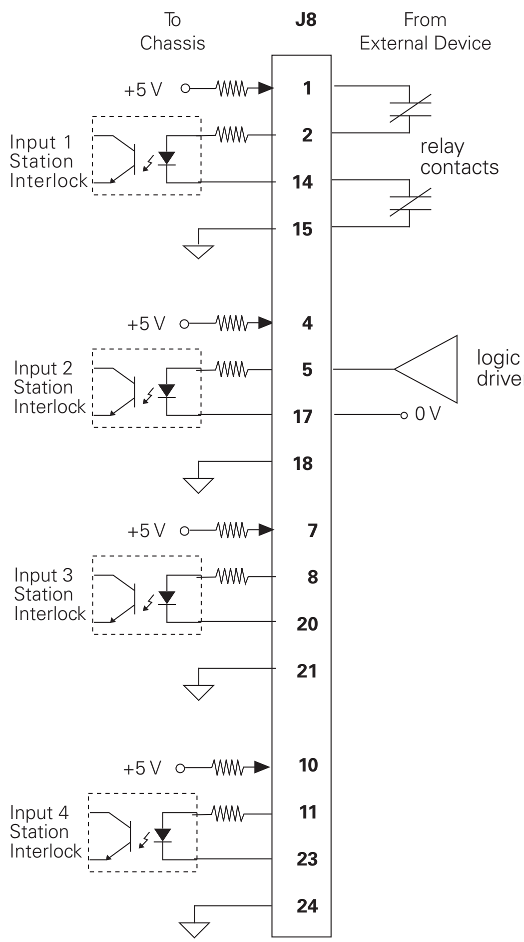
- Four optically isolated station-interlock inputs (J8)
- Four station-interlock outputs with relay contacts (J9)
- Box In (J51) and Box Out (J52) to connect multiple MTS controller chassis to share station interlock status and the master synchronization clock
- 32 MB flash disk on board (older versions only)
- Box address switch (software readable) allows you to set a unique address for each controller in a multi-box chain

Specifications–Model 494.43 Multibox Board

PARAMETER	SPECIFICATION
J9 Intlk Out	Contact (Open = Interlock) Logic (0 = Interlock) Output Current: 1 A maximum at 30 V DC/AC.
J8 Intlk In	
Input Debounce Time	12–16 ms
Input Resistance	2.7 kΩ
Minimum Input Off Voltage	0.8 V (Interlock)
Maximum Input Voltage	26 V
Minimum Input On Voltage	3 V at 1 mA (No Interlock)

J8 Interlock In Connections for the Model 494.43 Multibox Board

Connector **J8 Interlock IN** provides four optically isolated station interlock inputs that can be connected to external interlock chains.



Cable specifications

Connector–25-contact, type D, male, EMI

Backshell–EMI, metallized plastic

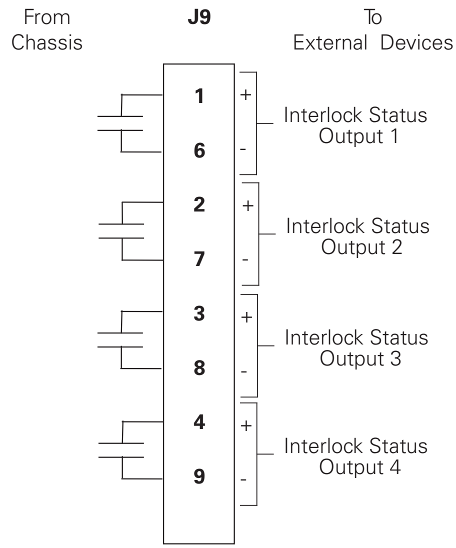
Cable–Twisted pairs with overall braided shield. The braided shield is terminated to conductive backshell at the chassis.

Jumper plug required

Use MTS jumper plug part number 100-079-233.

J9 Interlock Out Connections for the Model 494.43 Multibox Board

Connector **J9 Interlock OUT** provides four station interlock outputs that can be connected to a multiple MTS controller box interlock chain



Cable specifications

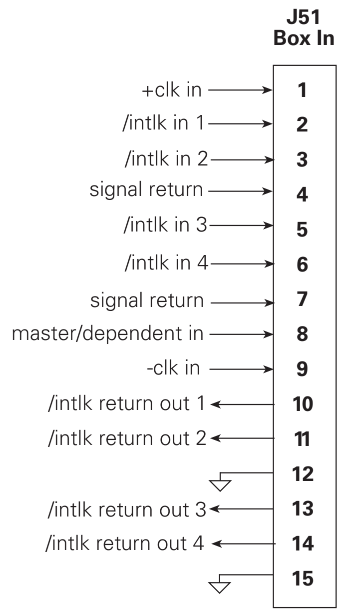
Connector–9-contact, type D, male, EMI

Backshell–EMI, metallized plastic

Cable–Twisted pairs with overall braided shield. The braided shield is terminated to conductive backshell at the chassis.

J51 Box In Connections for the Model 494.43 Multibox Board

The **J51 Box In** connector provides an interface for connecting multiple MTS controller boxes together to allow sharing of station interlock status and a master synchronization clock.



Master/dependent input

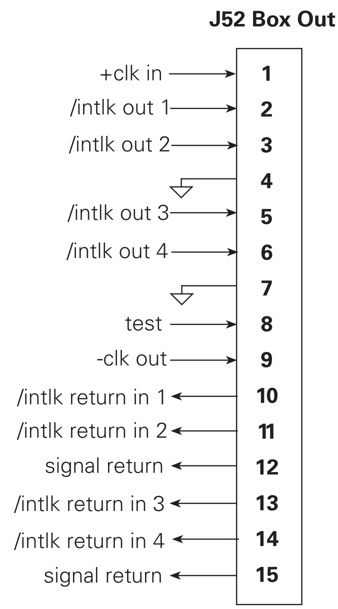
The master/dependent input setting (connector pin 8) determines whether a controller box is master or dependent in the multi-box chain. If this pin is jumpered to ground, the controller is dependent; if not jumpered to ground, it is the master. Upon a CPU or interlock reset, software checks the state of this pin and configures the controller box accordingly.

Cable specification

Use MTS cable part number 056-534-1xx.

J52 Box Out Connections for the Model 494.43 Multibox Board

The **J52 Box Out** connector provides an interface for connecting multiple MTS controller chassis together to allow sharing of station interlock status and a master synchronization clock.



Last controller jumper

The last controller box in a chain must have a jumper plug (MTS part number 100-079-126) on its **J52 Box Out** connector. This jumper allows the return of the composite station interlock signal for all controllers in the chain to monitor.

Note *If there is only one controller, a jumper is still required on its* ***Box Out*** *connector.*

Cable specification

Use MTS cable part number 056-534-1xx.

Chapter 4

Mezzanine Cards

Contents

About Mezzanine Cards

You can install any of the mezzanine cards listed in the following table in one of the four card slots on the Model 494.40 I/O Carrier board.

CAUTION

Damage can occur if you connect a high-level signal to a mezzanine card when the chassis power is off.

Improper operation can damage mezzanine cards.

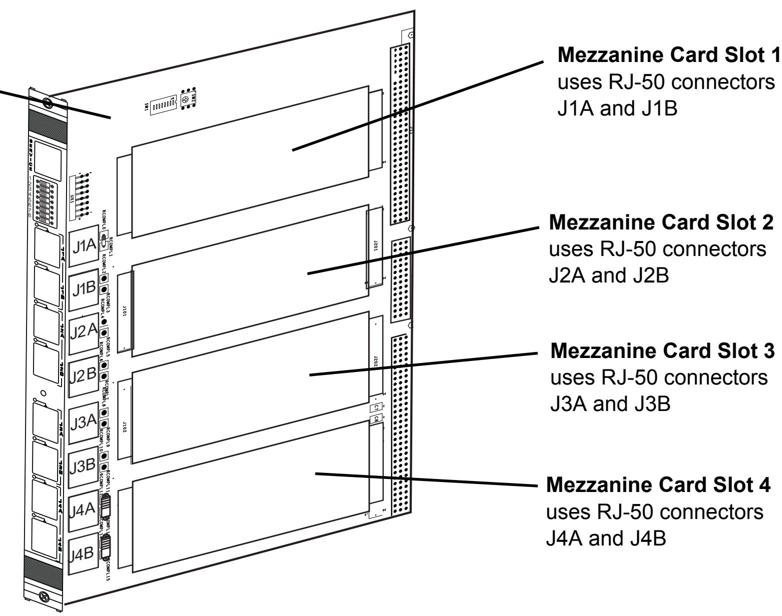
Do not apply a high-level signal to a mezzanine card when the chassis power is off. Disconnect power from any externally powered devices **before** you switch the chassis power off.

Connections

Each card slot has two front-panel RJ-50 connector on the I/O carrier board where you can connect external devices or transition boards.

Setup

You can configure mezzanine cards using hardware switches on the card, hardware-mapping software, and control software. Shunt-calibration and bridge-completion resistors for DC conditioners are installed on the Model 494.40 I/O Carrier board.



Note *Typically, conditioner cards are installed in slots 1 and 2, speciality cards (such as D to A or transducer conditioners) are installed in slot 3, and valve drivers are installed in slot 4.*

Mezzanine Cards (part 1 of 3)

Model	Mezzanine Card Type	Function	Compatible Transition Boards
494.16	**VD/DUC**	This card includes a digital universal conditioner (DUC) (upper RJ-50 connector–JXA) and a valve driver (lower RJ-50 connector–JXB). The conditioner portion of this card is identical to the conditioners in the Model 494.26 Card. With a 2-stage servovalve, you can configure this card to provide a DUC for “active mode” feedback (or an auxiliary input) while the valve driver provides the drive signal for a Series 252 Servovalve. With a 3-stage servovalve, the DUC is reserved for the valve LVDT feedback while the valve driver provides the drive signal for a Series 256 or 257 Servovalve.	Not required
494.21	**DUC/ Accelerometer**	This card combines a multi-range digital universal conditioner (DUC) input and an accelerometer compensation input on a single card. The summing of the two signals is performed on the card based on software settings. ***Note*** *You can also use this card as a stand-alone multi-range DUC without an accelerometer input.*	Not required
494.25	**Single DUC**	This card has one digital universal conditioner (DUC) that you can configure as either an AC conditioner or a DC conditioner. The conditioner uses a single, front-panel RJ-50 connector (JXA) on the I/O carrier board. The lower connector (JXB) is inactive. The AC configuration is typically used to condition an LVDT. The DC configuration contains circuitry that supports 1/4-, 1/2-, and full-bridge transducers. The configuration and setup of this card is identical to the Model 494.26 Dual DUC card.	Not required

Mezzanine Cards (part 2 of 3)

Model	Mezzanine Card Type	Function	Compatible Transition Boards
494.26	**Dual DUC**	This card has two digital universal conditioners (DUCs) that you can independently configure (with software) as either an AC conditioner or a DC conditioner. Each conditioner on the DUC card connects to a front-panel RJ-50 connector on the I/O carrier board. The AC configuration is typically used to condition an LVDT. The DC configuration contains circuitry that supports 1/4-, 1/2-, and full-bridge transducers.	Not required
494.45	**8-Input A/D Card**	This card converts up to eight +/- 10 volt analog signals from external devices to digital signals for use by the controller. You can connect the signals directly to the front-panel RJ-50 connectors or route them through a Model 494.75 8-Input BNC transition board. Input Signals 1-4 use the top RJ-50 connector (JXA). Input Signals 5-8 use the bottom RJ-50 connector (JXB).	494.75 8-Input BNC transition board
494.46	**8-Output D/A Card**	This card converts up to eight digital signals to +/- 10 volt analog signals for use by external devices. The analog output signals are available from the front-panel RJ-50 connectors or you can route them through a Model 494.76 8-Output BNC transition board. You can also configure your system to route analog output signals to the Model 494.79 8-Channel Valve Driver transition board. This board provides drive signals for up to eight Series 252 Servovalves. Output Signals 1-4 use the top RJ-50 connector (JXA). Output Signals 5-8 use the bottom RJ-50 connector (JXB).	494.76 8-Output BNC transition board 494.79 8-Channel Valve Driver transition board

Mezzanine Cards (part 3 of 3)

Model	Mezzanine Card Type	Function	Compatible Transition Boards
494.47	**Dual UART/ Encoder Interface**	This card provides two channels that allow the control software to communicate with and provide conditioning for two external devices. Each channel connects to the external device through an RJ-50 connector on the I/O carrier board. You can configure this card to provide two channels that communicate in UART mode or two channels that communicate in digital transducer mode. **UART mode**–provides two channels that can be software configured to support RS-485 serial (2-wire or 4-wire) communications for a Model 494.05 Handset, a Model 409 Temperature Controller, or a combination of both. **Digital transducer mode**–provides two channels that support a number of digital transducer protocols including: incremental encoders, Temposonics G transducers with pulse-width modulated output, standard SSI (synchronous serial interface) devices (most absolute encoders and Temposonics R), and selected variants of SSI (such as Teledyne Gurly). ***Note*** *When in digital transducer mode, both channels must run the same transducer protocol.*	Not required

How to Install a Mezzanine Card

Each Model 494.40 I/O Carrier board has four slots where you can install mezzanine cards.

CAUTION

The plug-in boards and cards contain static-sensitive components.

Improper handling of boards and cards can cause component damage.

Follow these precautions when handling boards and cards:

- Turn off electrical power before installing or removing a board.
- Use a static ground strap to ground yourself to the chassis ground before touching the chassis or a board.
- Keep unused boards and cards in conductive bags. Also, be sure you are grounded when removing a board or card from a conductive bag.
- Handle boards with their front panel or circuit card edges. Do not touch any circuit card components, pins, or circuit connection points.

CAUTION

Mezzanine cards can be installed incorrectly.

An incorrectly installed mezzanine card can cause the controller to operate in an unspecified manner or damage electronic components.

Ensure that mezzanine cards are properly aligned and seated on the I/O carrier connectors.

1. Turn off the AC power switch on the back of the chassis before installing or removing boards.
2. Use a static ground strap (MTS part number 100-183-454) to ground your body to chassis ground before touching the chassis or a board.

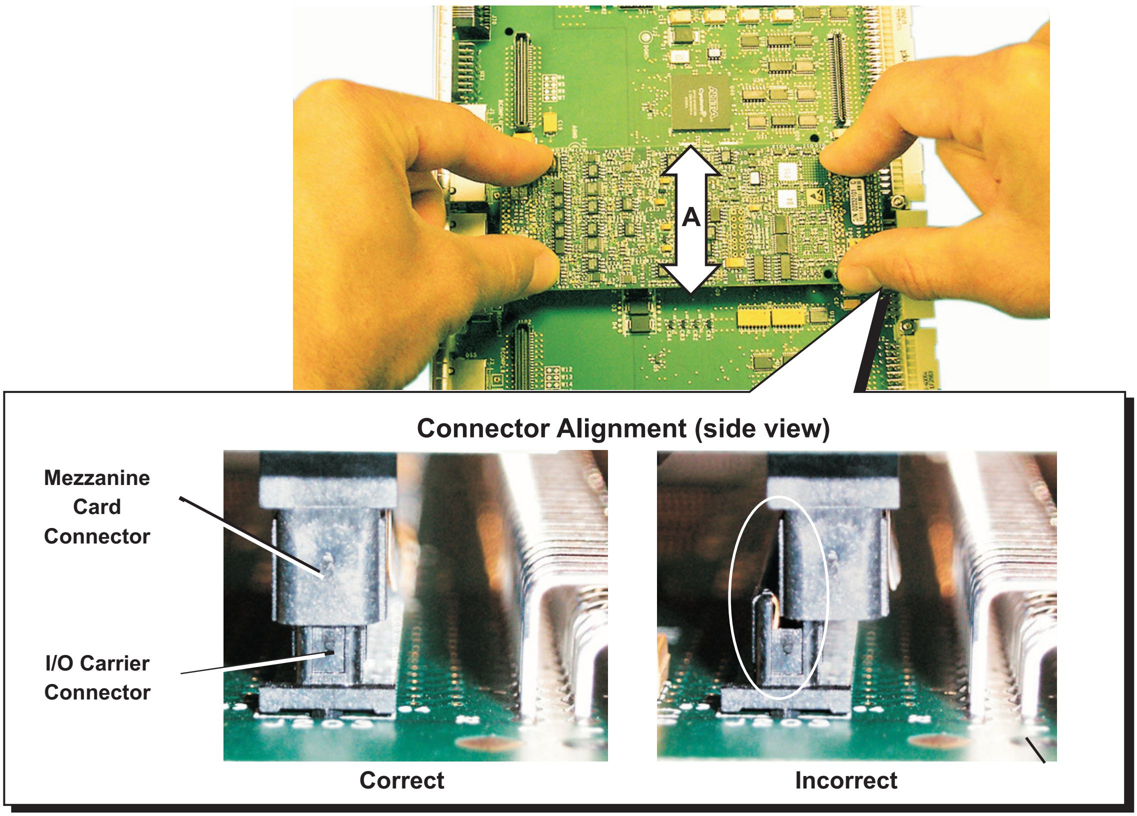
3. Align the mezzanine card.

   A. Place the I/O carrier board flat on an antistatic surface.

      If the I/O carrier board is not flat, you will not be able to properly install the mezzanine cards.

   B. Align the mezzanine card connectors with the mating connectors on the I/O carrier board.

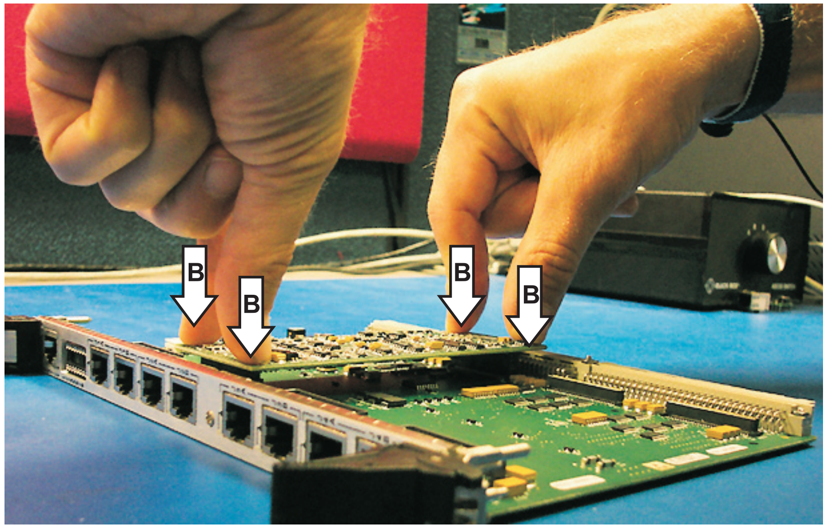
      When properly aligned, you should be able to slightly move the mezzanine card back and forth (A) within the connector.



4. Insert the mezzanine card.

   A. Apply equal downward force (B) to all four corners of the mezzanine card so that both connectors seat at the same time.

   B. Make sure that both connectors are fully seated.



How to Remove a Mezzanine Card

CAUTION

The plug-in boards and cards contain static-sensitive components.

Improper handling of boards and cards can cause component damage.

Follow these precautions when handling boards and cards:

- Turn off electrical power before installing or removing a board.
- Use a static ground strap to ground yourself to the chassis ground before touching the chassis or a board.
- Keep unused boards and cards in conductive bags. Also, be sure you are grounded when removing a board or card from a conductive bag.
- Handle boards with their front panel or circuit card edges. Do not touch any circuit card components, pins, or circuit connection points.

CAUTION

Mezzanine cards can be removed incorrectly.

Using a screwdriver or other instrument to remove the mezzanine card can damage electronic components.

Use the proper technique (described in this document) to remove mezzanine cards.

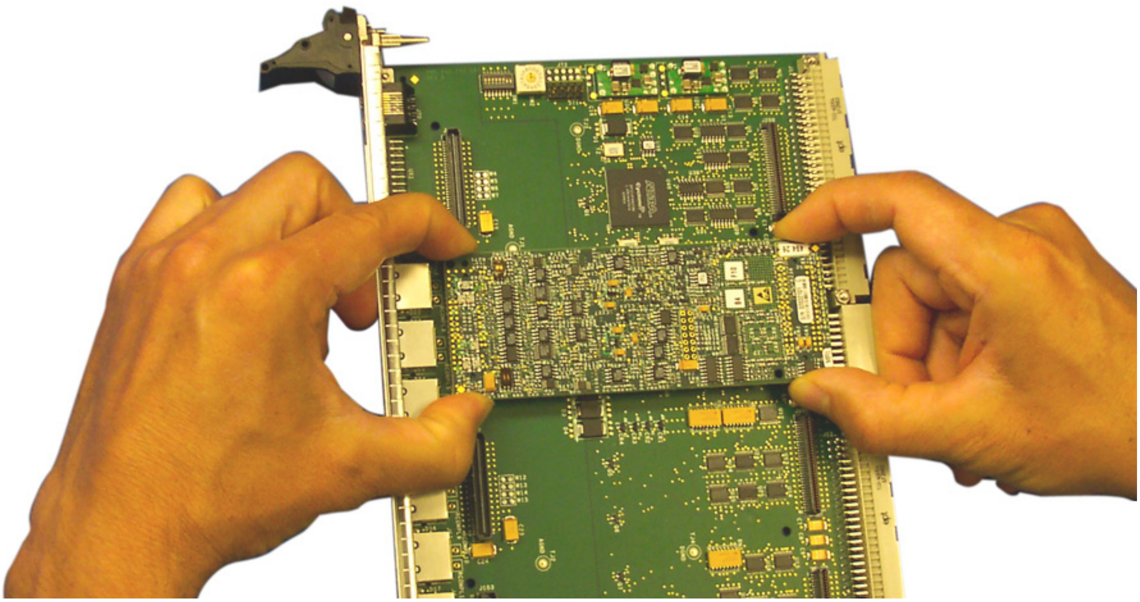
1. Turn off the AC power switch on the back of the chassis before installing or removing boards.
2. Use a static ground strap (MTS part number 100-183-454) to ground your body to chassis ground before touching the chassis or a board.
3. Remove the mezzanine card.

   A. Place the I/O carrier board flat on an antistatic surface.

      If the I/O carrier board is not flat, you will not be able to properly remove the mezzanine cards.

B. Grasp the mezzanine card in all four corners and gently rock the mezzanine card while lifting it.

Do not pry the edges of the card.



Digital Universal Conditioner Mezzanine Cards

About Digital Universal Conditioners

Some Series 494 mezzanine cards include digital universal conditioner (DUC) circuits that provide signal conditioning for AC and DC transducers. Each DUC circuit has the same features and specifications and is software configurable as an AC or DC conditioner.

The following mezzanine cards include DUCs:

- Model 494.26 Dual DUC mezzanine card
- Model 494.25 Single DUC mezzanine card
- Model 494.16 Valve Driver/DUC mezzanine card
- Model 494.21 Multi-Range DUC with Acceleration Compensation mezzanine card

CAUTION

DUC cards include components that can be damaged through improper operation.

Connecting a high-level signal to a DUC when the chassis power is off can damage the DUC.

Never apply a high-level signal to a DUC when the chassis power is off. Always remove power from any externally powered devices **before** you turn the chassis power off.

Digital Universal Conditioner (DUC) Features

You can configure a DUC as either an AC conditioner or a DC conditioner.

General

- Software-configurable conditioner gains allows the use of a wide range of transducers.
- Each DUC channel has its own indicator LED (located on the I/O carrier board).
- The conditioner includes a IEEE 1451.4, Class 2 smart transducer interface.
- A high-frequency input filter helps protect against ESD and EMI interference.
- An analog anti-aliasing filter is provided before the A-to-D converter.
- The conditioner includes programmable digital filters.

Excitation

- In DC mode, an excitation-sense circuit helps compensate for IR line losses by boosting the DC excitation voltage when necessary.
- Excitation under- and over-current detection is available for all configurations. A system interlock is generated if an excitation fault is detected.
- The AC conditioner supports multiple, software-configurable excitation frequencies.

DC configuration

- The DC conditioner supports quarter-, half-, and full-bridge transducers.
- The quarter-bridge DC conditioner supports the use of a customer-supplied bridge-completion resistor that you install on the I/O carrier board and bridge-completion circuitry on the DUC.
- The half-bridge DC conditioner uses a bridge-completion circuit located on the conditioner.
- Software configuration allows you to apply a shunt resistor (installed on the I/O carrier board) to the selected leg of the bridge.

Specifications–Digital Universal Conditioner (DUC)

Note *The specifications for the DUC circuit in the Model 494.21 card are different than the specifications for the other Series 494 DUC cards.*

DUC Specifications (part 1 of 2)

PARAMETER	SPECIFICATION
Input Types	AC or DC (software configurable)
Conditioner Analog Gain	Analog gains: x.91, x1.75, x3.25, x6.28, x11.36, x21.92, x40.69, x78.60, x150.59, x290.64, x539.11, x1042.08, x1815.24, x3503.41, x6498.55, x12379.91 The analog gain settings are software configurable.
Gain Stability	DC Gain stability: 30 ppm/ °C typical AC Gain stability: 55 ppm/ °C typical
Common Mode Rejection (at gain of 120)	+/- 11 V 100 dB DC at 120 Hz; 60 dB at 1KHz
Input Impedance	AC: 1 MΩ typical DC: 100 MΩ
DC Excitation	1–20 V DC (software configurable). ***Important*** *If you use a 4-wire cable for a DUC that is configured for an 8-wire device, the excitation voltage will not be correct.*
A/D Resolution	16 bit
Excitation Stability	AC: 30 ppm/ °C typical DC: 25 ppm/ °C typical
AC Excitation	Excitation voltage: 0.5 Vpeak to 10 Vpeak (software configurable) Excitation frequencies: 10 KHz, 5 KHz, 2.5 KHz, 2 KHz, 1 KHz (software configurable) Distortion (THD): ≤1% typical

DUC Specifications (part 2 of 2)

Parameter	Specification
Excitation Drive Current	100 mA maximum (AC/DC)
Excitation Failure Interlocks	An over- or under-current condition generates a system interlock. AC/DC over current: 105 mA typical AC/DC under current: 1–2 mA typical ***Note*** *Undercurrent detection may not work properly for AC transducers with a DC resistance greater than 180 ohms. In this instance, the detection circuit may constantly report an undercurrent condition. You may need to configure your controller software to disable the Excitation Failure interlock for that input.* Excitation Failure interlocks are available for quarter-, half-, and full-bridge DC configurations and for AC configurations.
Smart Transducer Interface	IEEE 1451.4 Class 2

Digital Universal Conditioner (DUC) Bridge Connections

The following figures show the full-, half-, and quarter-bridge configurations for a DUC that is configured as a DC conditioner.

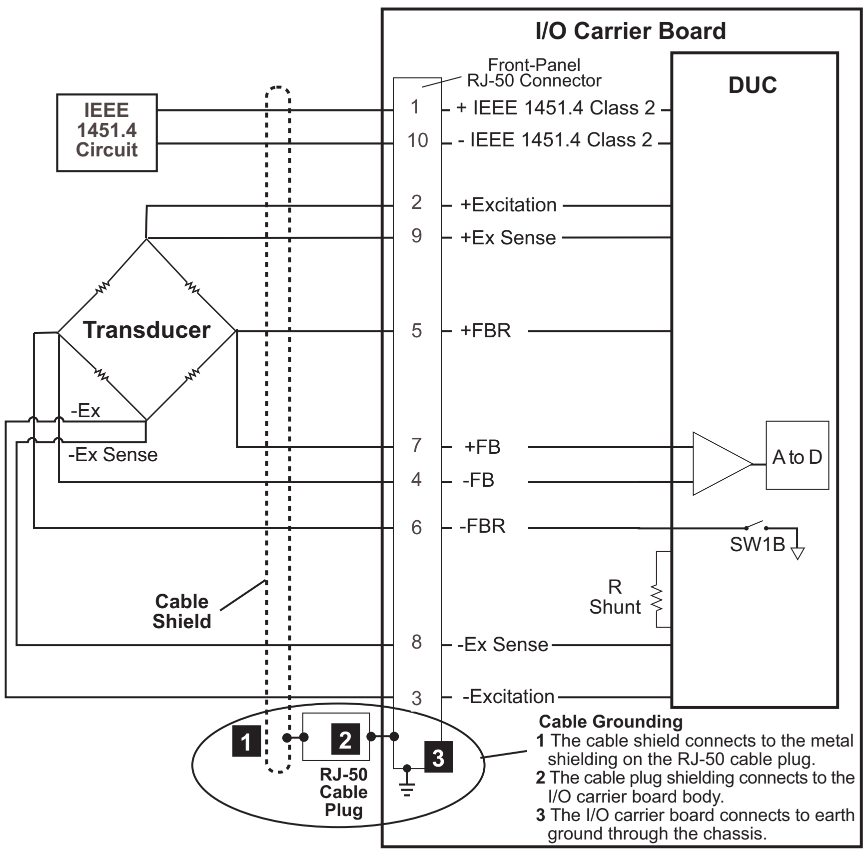
Shunt calibration

The shunt-calibration resistor (R Shunt) sockets are located on the front of the I/O carrier board. Use system hardware-mapping software to specify which leg of the bridge is shunted during calibration.

Note *If you use MTS TEDS modules or MTS transducers with integrated shunt-calibration resistors, you must insert a jumper plug (MTS part number 100-188-097) into the socket for each transducer input where you will use the integrated shunt-calibration resistor.*

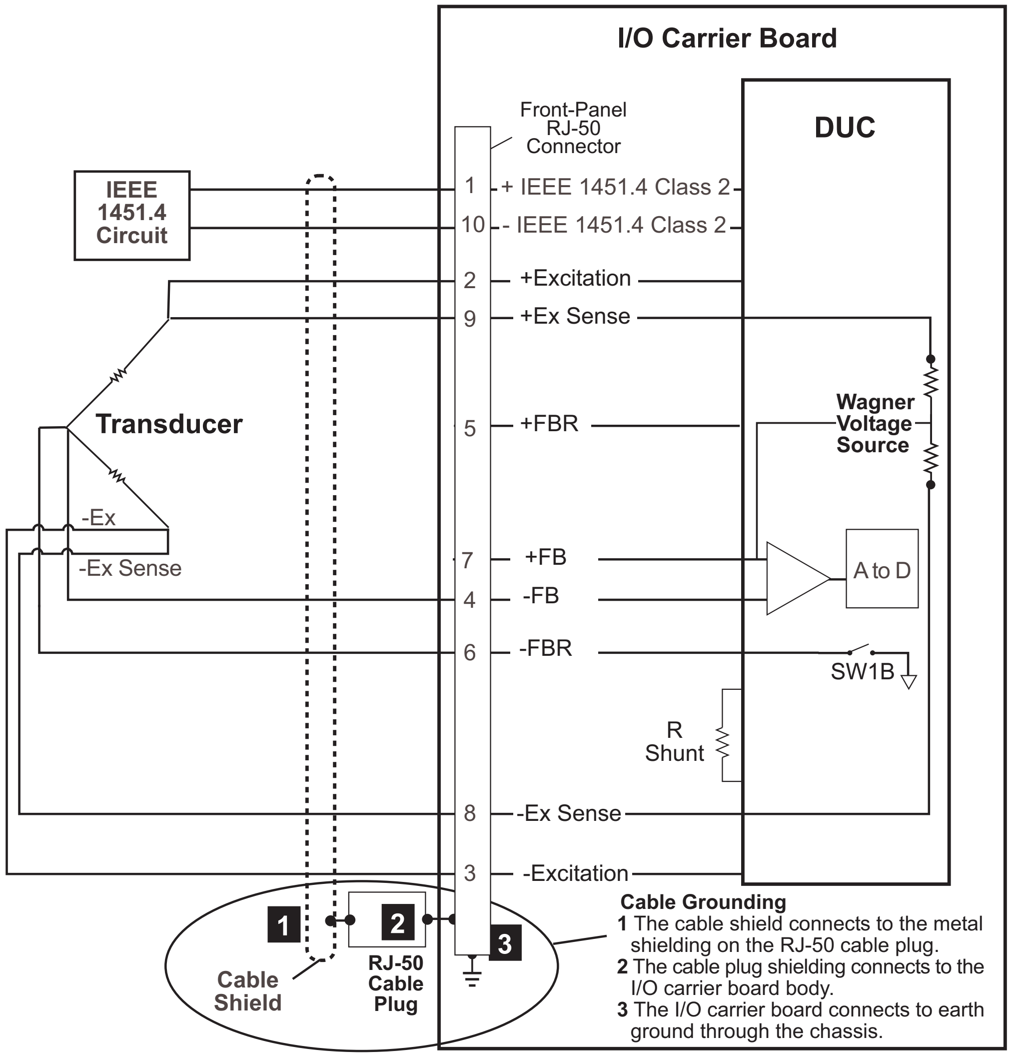
Full-bridge configuration

The following figure shows a full-bridge configuration.



Half-bridge configuration

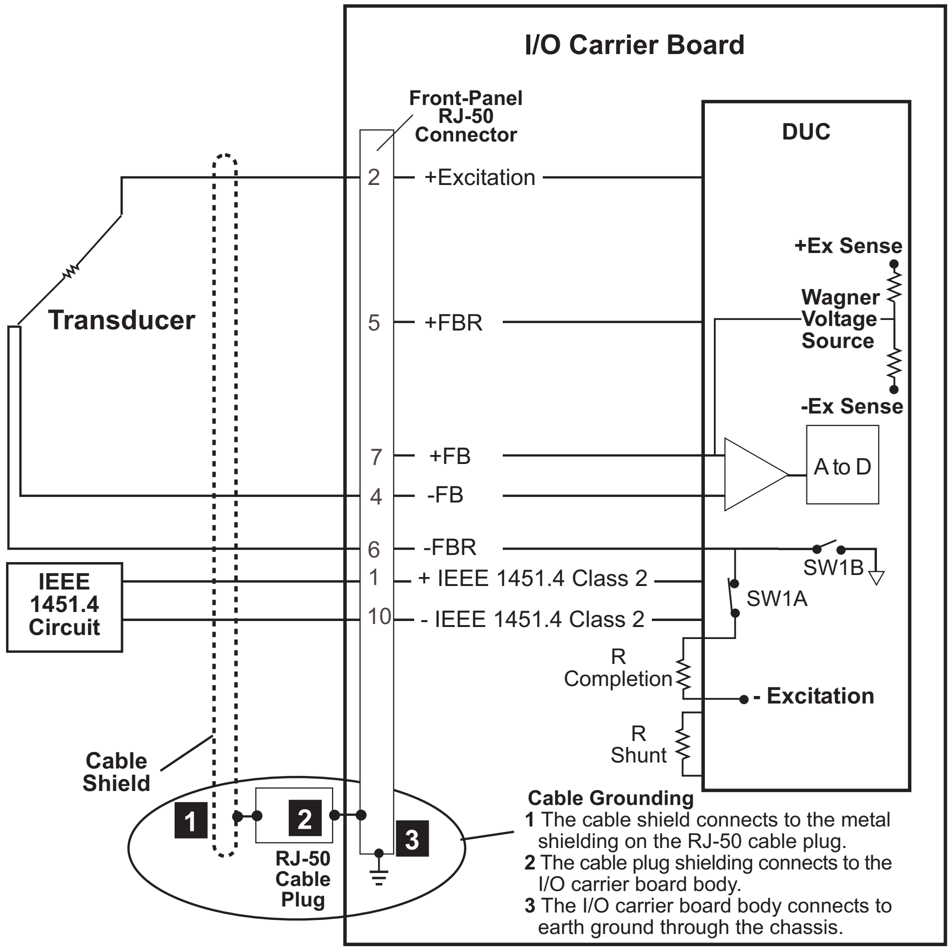
The following figure shows a half-bridge configuration. In this configuration, the transducer makes up half of the bridge circuit while the other half of the bridge is located on the DUC card.



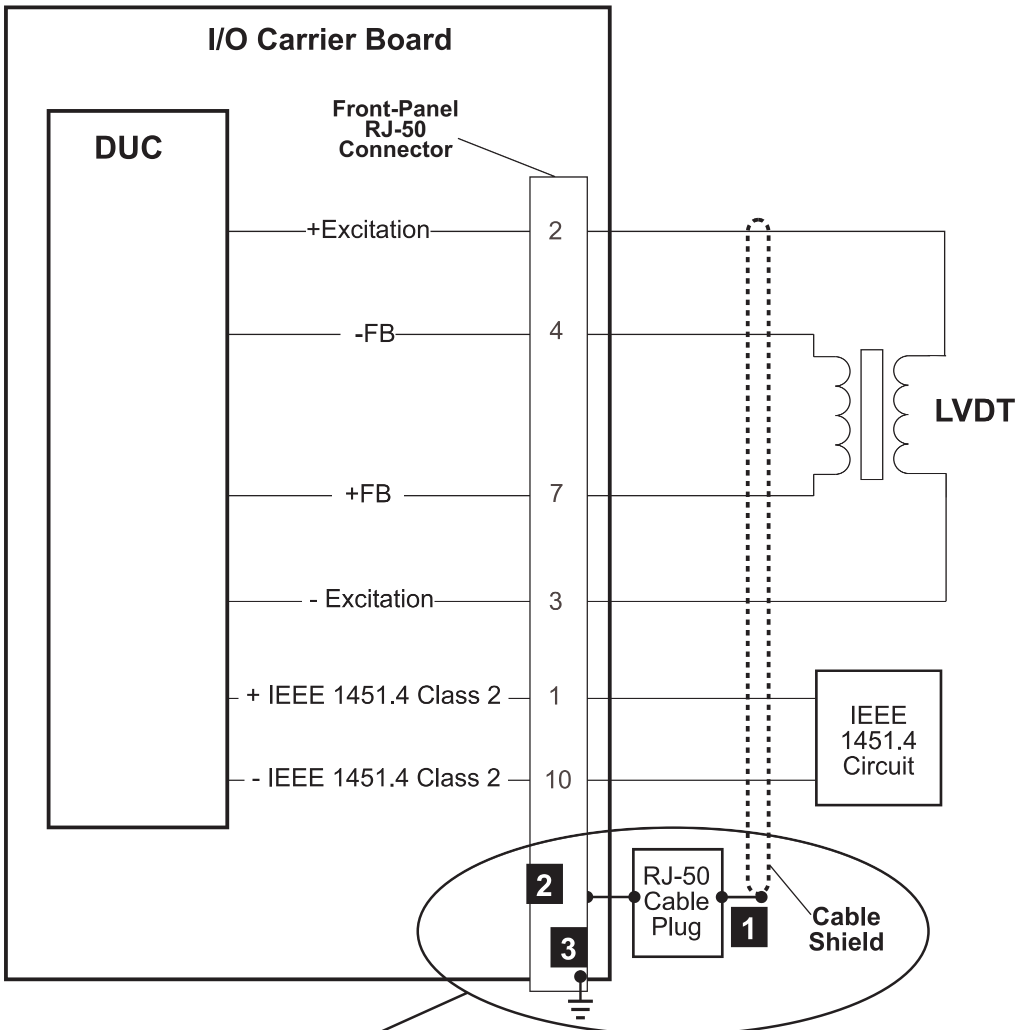
Quarter-bridge configuration

The following figure shows a quarter-bridge configuration. In this configuration, one half of the bridge resides on the DUC card.

When a quarter-bridge transducer is used, a bridge-completion resistor (R Completion) is required. The bridge-completion resistor is installed on the I/O carrier board. Once installed, you must physically set switch SW1A on the card to connect one end of R Completion to -FBR.



Digital Universal Conditioner (DUC) LVDT Connections



Cable Grounding
1 The cable shield connects to the metal shielding on the RJ-50 cable plug.
2 The cable plug shielding connects to the I/O carrier board body.
3 The I/O carrier board connects to earth ground through the chassis.

How to Set Up a Digital Universal Conditioner (DUC)

1. Turn off electrical power to the chassis before installing or removing boards and cards.

CAUTION

The plug-in boards and cards contain static-sensitive components.

Improper handling of boards and cards can cause component damage.

Follow these precautions when handling boards and cards:

- Turn off electrical power before installing or removing a board.
- Use a static ground strap to ground yourself to the chassis ground before touching the chassis or a board.
- Keep unused boards and cards in conductive bags. Also be sure you are grounded when removing a board or card from a conductive bag.
- Handle boards with their front panel or circuit card edges. Do not touch any circuit card components, pins, or circuit connection points.

CAUTION

DUC cards include components that can be damaged through improper operation.

Connecting a high-level signal to a DUC when the chassis power is off can damage the DUC.

Never apply a high-level signal to a DUC when the chassis power is off. Always remove power from any externally powered devices **before** you turn the chassis power off.

2. Use a static ground strap to ground yourself to chassis ground before touching the chassis or a board.

3. Set up the mezzanine card(s).

   A. (Optional) For transducers that require a ground reference, set the card grounding DIP switch to the **ON** position.

   B. (Optional) For quarter-bridge transducers, set the bridge-completion DIP switch on the card to the **ON** position and install a bridge completion resistor on the I/O carrier board.

   C. (Optional) Install shunt calibration resistor plug assemblies on the front panel of the I/O carrier board.

Note *If you use MTS TEDS modules or MTS transducers with integrated shunt-calibration resistors, you must insert a jumper plug (MTS part number 100-188-097) into the socket for each transducer input where you will use the integrated shunt-calibration resistor.*

4. Install the mezzanine cards on the I/O carrier board.

5. Repeat the preceding steps to set up and install any other cards.

6. Install the I/O carrier board(s).

   A. Plug the board into the VME card cage.

   B. Connect the transducer cables to the I/O carrier board.

7. Apply power to the system and use hardware-mapping and control software to configure each conditioner.

Important *If you use a 4-wire cable for a DUC that is configured for an 8-wire device, the excitation voltage will not be correct.*

8. Allow the hardware to warm up for an hour, and then perform calibration and tuning procedures.

Model 494.25 Single DUC Card

About the Model 494.25 Single DUC Card

The Model 494.25 Single DUC is a mezzanine card that you can plug into one of the slots on the Model 494.40 I/O Carrier board.

This card includes one digital universal conditioner (DUC) that you can configure as either an AC conditioner or a DC conditioner. Transducers connect to each conditioner through a front panel RJ-50 connector on the I/O carrier board.

Model 494.25 Single DUC Card Settings

Hardware configuration

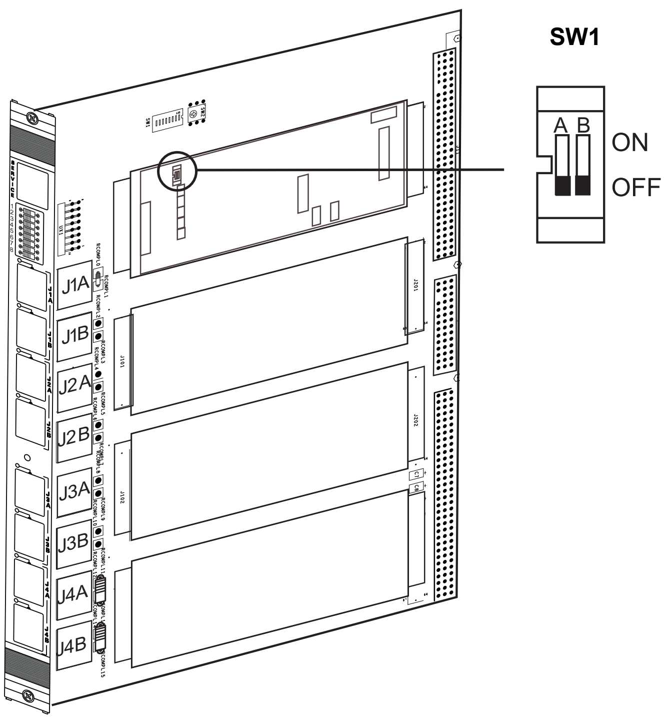
The conditioner on this card has a two-position switch that is used to set up the following DC conditioner functions:

- Switch A connects a bridge completion resistor to -FBR to complete a quarter-bridge circuit.
- Switch B provides a ground reference for an external transducer by connecting -FBR to ground.

Software configuration

After you set up and install the hardware, you must configure your control software settings for the conditioner.

Note *For detailed information on software configuration, calibration, and tuning, see the control software and tuning/calibration documentation.*



Switch Settings

A = Bridge Completion Switch
The **ON** position connects a user-installed bridge completion resistor to complete a quarter-bridge circuit.

B = Grounding Switch
The **ON** position connects -FBR line to ground. (See the bridge completion drawings for details.)

Model 494.25 Single DUC Card Pin Assignments

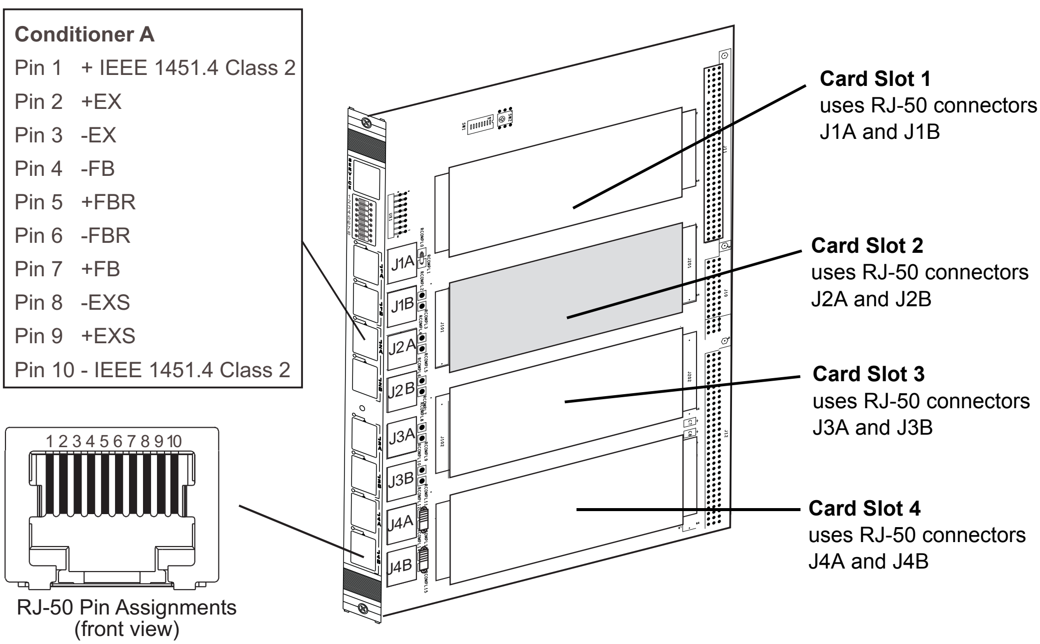
Signals are routed to and from each conditioner through an RJ-50 connector located on the front of the I/O carrier board.

CAUTION

The front-panel sockets on the I/O carrier board only accept cabling with 10-pin, shielded, RJ-50 connectors with a gray boot.

The use of other RJ connector types (less than 10 pins or unshielded with a black boot) with the I/O carrier board can cause component damage.

Only use transducer cables equipped with 10-pin, braided shield, RJ-50 connectors (with a gray boot) with the I/O carrier board.



Cable Grounding

1 The cable shield connects to the metal shielding on the RJ-50 cable plug.

2 The cable plug shielding connects to the I/O Carrier Board body.

3 The I/O Carrier Board body connects to earth ground through the chassis.

Model 494.26 Dual DUC Card

About the Model 494.26 Dual DUC Card

The Model 494.26 Dual DUC is a mezzanine card that you can plug into one of the slots on the Model 494.40 I/O Carrier board.

This card includes two digital universal conditioners (DUCs) that you can independently configure as either an AC conditioner or a DC conditioner. Transducers connect to each conditioner through a front panel RJ-50 connector on the I/O Carrier board.

Model 494.26 Dual DUC Card Settings

Hardware configuration

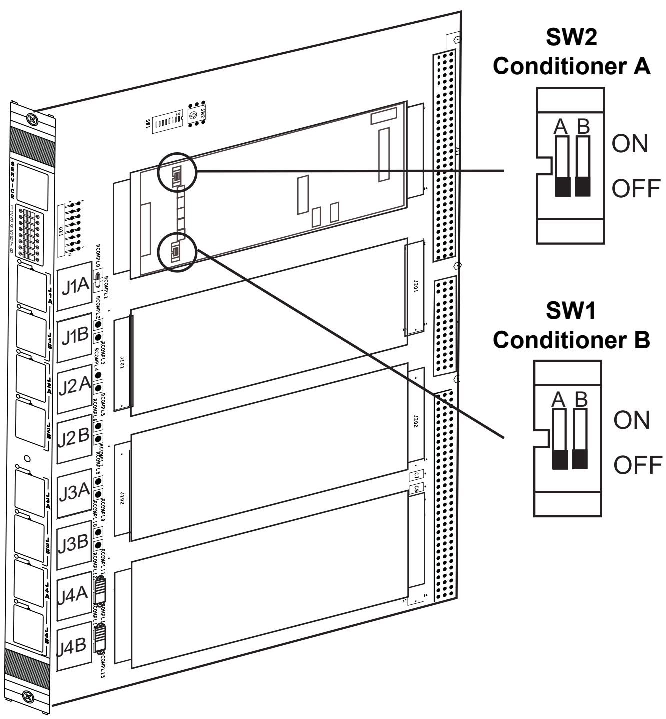
Each of the two conditioners on this card has a two-position switch that is used to set up the following DC conditioner functions:

- Switch A connects a bridge completion resistor to -FBR to complete a quarter-bridge circuit.
- Switch B provides a ground reference for an external transducer by connecting -FBR to ground.

Software configuration

After you set up and install the hardware, you must configure your control software settings for the conditioner.

Note *For detailed information on software configuration, calibration, and tuning, see the control software and tuning/calibration documentation.*



Switch Settings

A = Bridge Completion Switch
The **ON** position connects a user-installed bridge completion resistor to complete a quarter-bridge circuit.

B = Grounding Switch
The **ON** position connects -FBR line to ground (see the bridge completion drawings for details).

Model 494.26 Dual DUC Card Pin Assignments

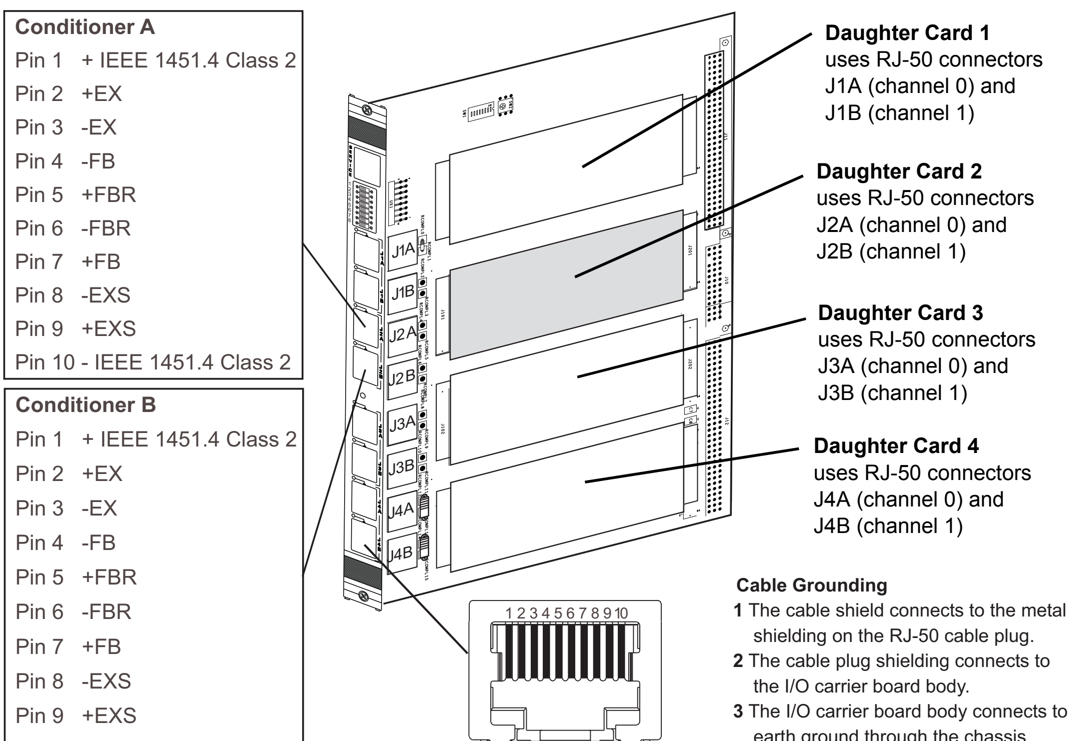
Signals are routed to and from each conditioner through an RJ-50 connector located on the front of the I/O carrier board.

CAUTION

The front-panel sockets on the I/O carrier board only accept cabling with 10-pin, shielded, RJ-50 connectors with a gray boot.

The use of other RJ connector types (less than 10 pins or unshielded with a black boot) with the I/O carrier board can cause component damage.

Only use transducer cables equipped with 10-pin, braided shield, RJ-50 connectors (with a gray boot) with the I/O carrier board.



RJ-50 Pin Assignments (front view)

Model 494.16 VD/DUC Mezzanine Card

About the Model 494.16 VD/DUC Card

The Model 494.16 VD/DUC card combines a valve driver (VD) and a digital universal conditioner (DUC) on a single mezzanine card. You can install this card in one of the four slots in the Model 494.40 I/O Carrier board.

2-stage valve applications

The valve driver can drive single or dual 2-stage servovalves. With the 2-stage configuration, you can use the DUC portion of this card for the "active mode" feedback signal or for an auxiliary input signal.

3-stage valve applications

The valve driver can drive one 3-stage servovalve. With the 3-stage configuration, the DUC portion of this card is reserved for the inner-loop feedback signal from the valve-spool LVDT.

Model 494.16 Valve Driver Features

Valve outputs

The valve driver on the Model 494.16 Card includes two valve outputs that provide identical drive signals. With two outputs, each valve coil on a single servovalve can be driven with a separate current source. You can also use the two outputs to drive dual two-stage servovalves.

Valve-driver features

- Each valve-driver output has programmable full-scale current.
- Each valve-driver output includes a programmable dither signal to help prevent servovalve silting and to overcome static friction.
- Each valve-driver output includes a valve balance control. This signal is a DC offset added to the servovalve command to compensate for any mechanical unbalance in the servovalve.

Safety features

The valve-driver circuit includes features that help prevent valve movement during startup or loss of power.

- When you initially apply power, a software switch connects the valve outputs to ground until control is established.
- During interlock conditions (such as loss of DC chassis power) a software switch shorts the valve outputs to help keep the valve from moving.
- A set of diodes on the output helps protect the control circuit from voltage spikes generated by the valve coil.

Specifications–Model 494.16 Valve Driver Card

PARAMETER	SPECIFICATION
Output Current	100 mA maximum per output (software configurable)
Valve Outputs per Card	2
Dither	
Frequency	1 Hz–4915.2 Hz (software adjustable)
Amplitude	0–5 V DC (software adjustable)
Valve Clamping	Software configurable valve clamping setting performs the following actions when a hydraulic interlock occurs. • **Disabled**—Valve does not clamp. This is the default action if the clamp entry is omitted. • **Zero**—Clamps the servovalve to zero. If valve balance is used, it will clamp to this value. • **Positive**—Clamps the servovalve to positive 50% spool opening on a 2-stage valve driver, 50% outer-loop command on the 3-stage valve driver. • **Negative**—Clamps the servovalve to negative 50% spool opening on a 2-stage valve driver, 50% outer-loop command on a 3-stage valve driver.
Valve Balance Offset	+/- 10 V DC (software adjustable)

How to Set Up a Model 494.16 VD/DUC Card

1. Turn off electrical power to the chassis before installing or removing boards and cards.

CAUTION

The plug-in boards and cards contain static-sensitive components.

Improper handling of boards and cards can cause component damage.

Follow these precautions when handling boards and cards:

- Turn off electrical power before installing or removing a board.
- Use a static ground strap to ground yourself to the chassis ground before touching the chassis or a board.
- Keep unused boards and cards in conductive bags. Also be sure you are grounded when removing a board or card from a conductive bag.
- Handle boards with their front panel or circuit card edges. Do not touch any circuit card components, pins, or circuit connection points.

CAUTION

DUC cards include components that can be damaged through improper operation.

Connecting a high-level signal to a DUC when the chassis power is off can damage the DUC.

Never apply a high-level signal to a DUC when the chassis power is off. Always remove power from any externally powered devices **before** you turn the chassis power off.

2. Use a static ground strap to ground yourself to chassis ground before touching the chassis or a board.

3. Set up the VD/DUC card(s).

   A. (Optional) For transducers that require a ground reference, set the card grounding DIP switch to the **ON** position.

   B. (Optional) For quarter-bridge transducers, set the bridge-completion DIP switch on the card to the **ON** position and install a bridge completion resistor on the I/O carrier board.

4. Install the VD/DUC card(s) on the I/O carrier board.
5. (Optional) Install shunt-calibration-resistor plug assemblies on the front panel of the I/O carrier board(s).

Note *If you use MTS TEDS modules or MTS transducers with integrated shunt-calibration resistors, you must insert a jumper plug (MTS part number 100-188-097) into the socket for each transducer input where you will use the integrated shunt-calibration resistor.*

6. Install the I/O carrier board(s).
   A. Plug the board into the VME card cage.
   B. Connect the transducer cables to the I/O carrier board.
   C. Connect the valve cable to the I/O carrier board.
7. After you have installed all boards, apply power to the system and use the hardware-mapping and control software to configure the conditioner and the valve driver.
8. Allow the system to warm up for an hour and then perform valve-balance, calibration, and tuning procedures.

Model 494.16 VD/DUC Card Settings

Software configuration

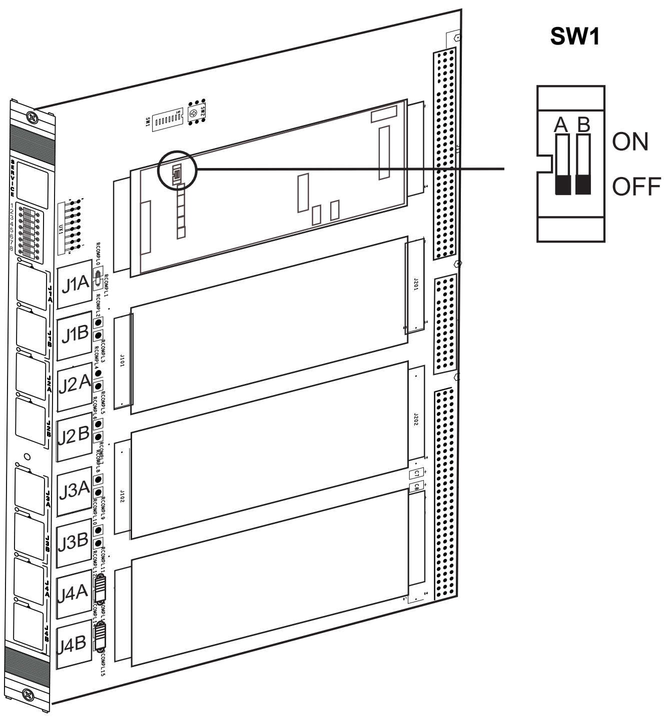
Most configuration and setup of the valve driver (VD) and digital universal conditioner (DUC) is done through software.

Note *For detailed information on software configuration, calibration, and tuning, see the control software and tuning/calibration manuals.*

Hardware settings

The conditioner portion of this card has a two-position switch (SW1) that is used to set up the following DC conditioner functions:

- Switch 1A connects a bridge-completion resistor to -FBR to complete a quarter-bridge circuit.
- Switch 1B provides a ground reference for an external transducer by connecting -FBR to ground.



Switch Settings

A = Bridge Completion Switch
The **ON** position connects a user-installed bridge completion resistor to complete a quarter-bridge circuit.

B = Grounding Switch
The **ON** position connects -FBR line to ground. (See the bridge completion drawings for details.)

Model 494.16 VD/DUC Card Pin Assignments

Signals are routed to and from the DUC and valve driver through two RJ-50 connectors located on the front of the I/O carrier board.

CAUTION

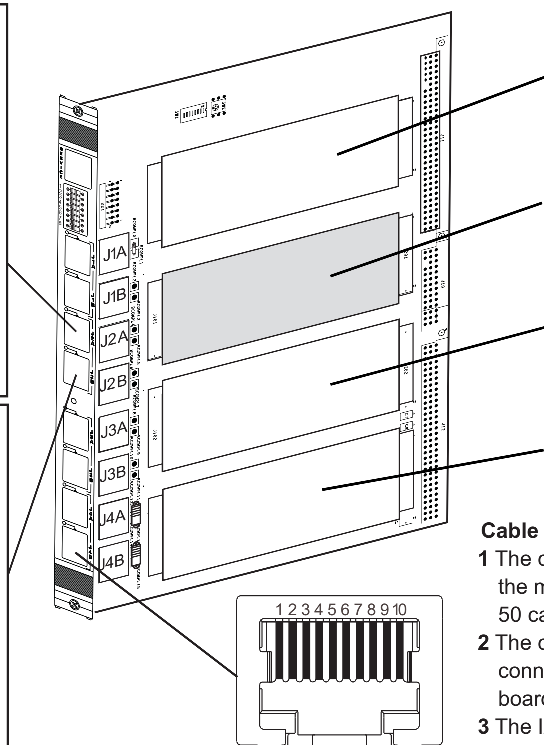
The front-panel sockets on the I/O carrier board only accept cabling with 10-pin, shielded, RJ-50 connectors with a gray boot.

The use of other RJ connector types (less than 10 pins or unshielded with a black boot) with the I/O carrier board can cause component damage.

Only use transducer cables equipped with 10-pin, braided shield, RJ-50 connectors (with a gray boot) with the I/O carrier board.

DUC	
Pin 1	+ IEEE 1451.4 Class 2
Pin 2	+EX
Pin 3	-EX
Pin 4	-FB
Pin 5	+FBR
Pin 6	-FBR
Pin 7	+FB
Pin 8	-EXS
Pin 9	+EXS
Pin 10 - IEEE 1451.4 Class 2	

Valve Driver	
Pin 1	+ IEEE 1451.4 Class 2
Pin 2	+VD CH1
Pin 3	-VD CH1
Pin 4	Spare
Pin 5	Analog Gnd.
Pin 6	Analog Gnd.
Pin 7	Spare
Pin 8	+VD CH2
Pin 9	-VD CH2
Pin 10 - IEEE 1451.4 Class 2	



RJ-50 Pin Assignments
(front view)

Card Slot 1
uses RJ-50 connectors J1A and J1B

Card Slot 2
uses RJ-50 connectors J2A and J2B

Card Slot 3
uses RJ-50 connectors J3A and J3B

Card Slot 4
uses RJ-50 connectors J4A and J4B

Cable Grounding

1 The cable shield connects to the metal shielding on the RJ-50 cable plug.

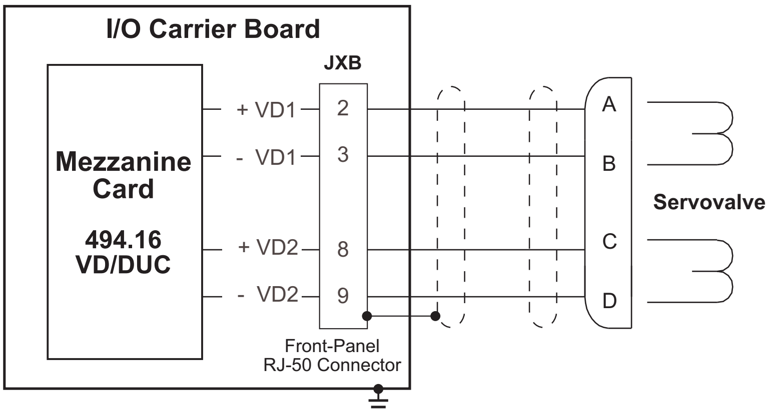
2 The cable plug shielding connects to the I/O carrier board body.

3 The I/O carrier board body connects to earth ground through the chassis.

Two-Stage Servovalve Connections for the Model 494.16 VD/DUC Card

With a two-stage servovalve, you can use the DUC portion of the card to provide control feedback for a channel while the valve driver provides the drive signal for the servovalve.

Single two-stage valve



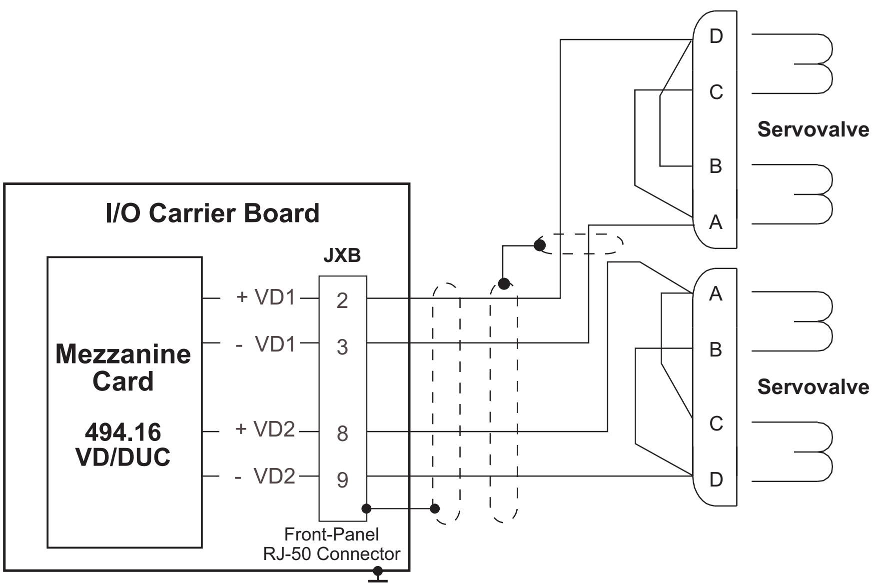
Cable Grounding

1 The cable shield connects to the metal shielding on the RJ-50 cable plug.

2 The cable plug shielding connects to the I/O carrier board body.

3 The I/O carrier board connects to earth ground through the chassis.

Dual two-stage valve



Cable Grounding

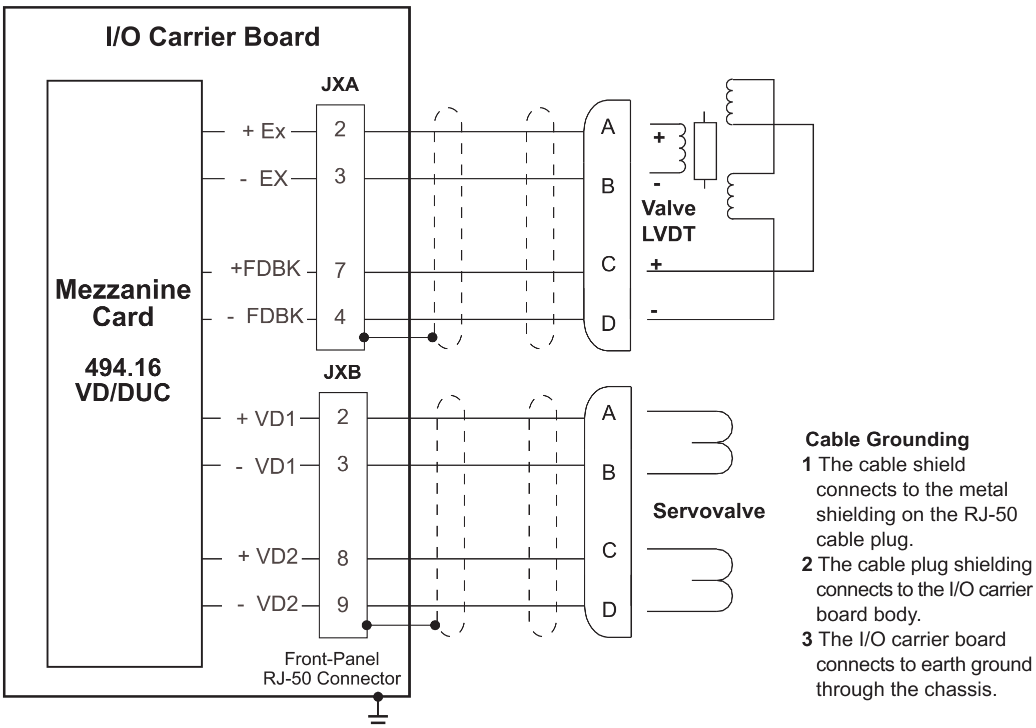
1 The cable shield connects to the metal shielding on the RJ-50 cable plug.

2 The cable plug shielding connects to the I/O carrier board body.

3 The I/O carrier board connects to earth ground through the chassis.

Three-Stage Servovalve Connections for the Model 494.16 VD/DUC Card

With a three-stage servovalve, the inner-loop LVDT uses the DUC portion of the card while the valve driver portion provides the drive signal for a Series 252 Servovalve which controls a Series 256 or 257 Servovalve.



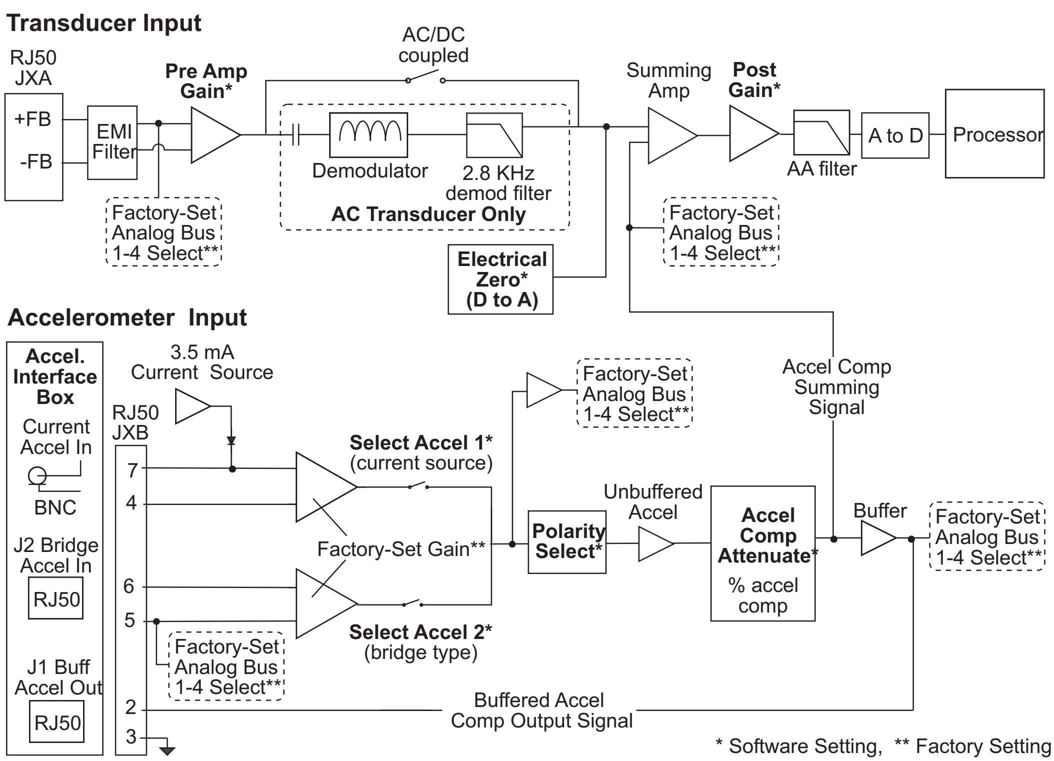
Model 494.21 Multi-Range DUC with Acceleration Compensation Card

About the Model 494.21 Multi-Range DUC /Acceleration Compensation Card

The Model 494.21 Mezzanine Card plugs into one of the slots on the Model 494.40 I/O Carrier. This card combines a multi-range digital universal conditioner (DUC) input and an accelerometer compensation input on a single card.

The acceleration compensation signal is summed with the DUC input signal to minimize unwanted feedback from motion caused by a mass attached to the transducer. The summing of the two signals is performed on the card based on software settings.

Note *You can also use this card as a stand-alone multi-range DUC without an accelerometer input.*



Transducer input

This card includes a multi-range digital universal conditioner (DUC) that you can configure as either an AC conditioner or a DC conditioner. Transducers connect to the card through a front-panel RJ-50 connector on the I/O carrier board.

The DUC circuit is similar to other Series 494 DUCs with the addition of an AC transducer demodulator (located before the summing amp). The demodulator allows you to apply an electrical zero offset to AC transducer signals.

Accelerometer input signals

Software settings specify the type of accelerometer connected to the card.

Bridge Device–provides an input for a bridge-type accelerometer.

Current Source–provides 3.5 mA current-source excitation and a differential amplifier for direct accelerometer connections.

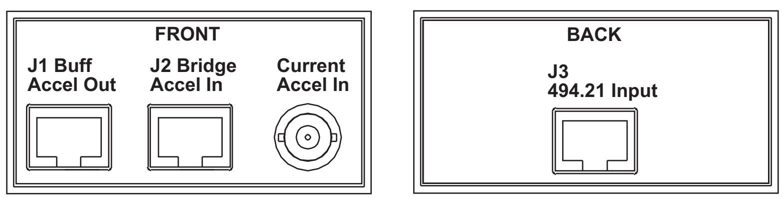
Buffered Accel Output–accepts the buffered output from an external device such as a charge amplifier.

Accelerometer gain settings

The gain for the bridge and current source accelerometer inputs are factory set to match a specific accelerometer.

Accelerometer adapter box

The adapter module provides an interface between various accelerometer types and the Model 494.21 Card.



Analog-bus signal routing

Factory-installed board modifications provide signal routing to one of four analog busses. This allows physical signal routing to various points on the Model 494.21 Card or on other cards that are installed on the same I/O carrier board.

Electrical zero

The DUC circuit allows you to apply a software-controlled electrical offset to the transducer signal before it enters the summing amp. This allows you to compensate for large offsets to help prevent signal saturation.

Note *The Model 494.21 Card can be configured for a number of custom applications. For custom applications, refer to the system configuration drawings for analog bus routing, interconnects, cable part numbers, and other information.*

Specifications–Model 494.21 Multi-Range DUC/Acceleration Compensation Card

Model 494.21 Specifications (part 1 of 2)

PARAMETER	SPECIFICATION
Input Types	AC or DC (software configurable)
Conditioner Analog Gain	Analog gains: x.91, x1.75, x3.25, x6.28, x11.36, x21.92, x40.69, x78.60, x150.59, x290.64, x539.11, x1042.08, x1815.24, x3503.41, x6498.55, x12379.91 The analog gain settings are software configurable.
Gain Stability	DC Gain stability: 30 ppm/ °C typical AC Gain stability: 55 ppm/ °C typical
Common Mode Rejection (at gain of 150)	+/- 11 V 100 dB DC at 120 Hz; 60 dB at 1 KHz
Input Impedance	AC: 1 MΩ typical DC: 2 MΩ
DC Excitation	1–20 V DC (software configurable)
A/D Resolution	16 bit
Excitation Stability	AC: 30 ppm/ °C typical DC: 25 ppm/ °C typical
AC Excitation	Excitation voltage: 0.5 V peak to 10 V peak (software configurable) Excitation frequencies: 10 KHz, 5 KHz, 2.5 KHz, 2 KHz, 1 KHz (software configurable) Distortion (THD): ≤1% typical
Excitation Drive Current	100 mA maximum (AC/DC)

Model 494.21 Specifications (part 2 of 2)

PARAMETER	SPECIFICATION
Excitation Failure Interlocks	An over- or under-current condition generates a system interlock. AC/DC overcurrent: 105 mA typical AC/DC undercurrent: 1–2 mA typical ***Note*** *Undercurrent detection may not work properly for AC transducers with a DC resistance greater than 180 ohms. In this instance, the detection circuit may constantly report an undercurrent condition. You may need to configure your controller software to disable the Excitation Failure interlock for that input.* Excitation Failure interlocks are available for quarter-, half-, and full-bridge DC configurations and for AC configurations.
Smart Transducer Interface	IEEE 1451.4 Class 2

Model 494.21 Multi-Range DUC/Acceleration Compensation Card Settings

Software configuration

Most configuration and setup of this card is done through software.

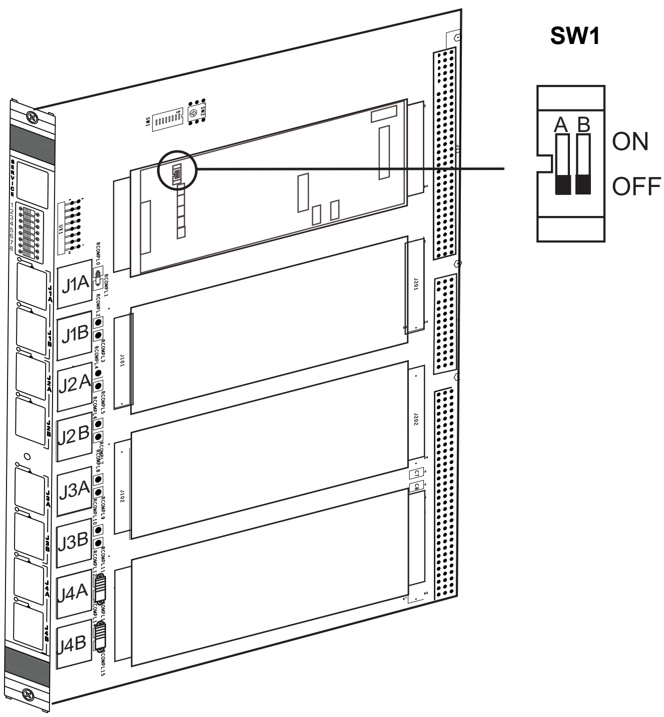
Note *For detailed information on software configuration, calibration, and tuning, see the control software and tuning/calibration manuals.*

Hardware settings

The conditioner portion of this card has a two-position switch (SW1) that is used to set up the following DC conditioner functions:

- Switch 1A connects a bridge-completion resistor to -FBR to complete a quarter-bridge circuit.
- Switch 1B provides a ground reference for an external transducer by connecting -FBR to ground.

Note *Most hardware settings are factory installed. For custom applications, refer to the system configuration drawings for analog bus routing, interconnects, cable part numbers, and other information.*



Switch Settings

A = Bridge Completion Switch
The **ON** position connects a user-installed bridge completion resistor to complete a quarter-bridge circuit.

B = Grounding Switch
The **ON** position connects -FBR line to ground.

Model 494.21 Multi-Range DUC/Acceleration Compensation Card Pin Assignments

Signals are routed to and from each input through an RJ-50 connector located on the front of the I/O carrier board.

CAUTION

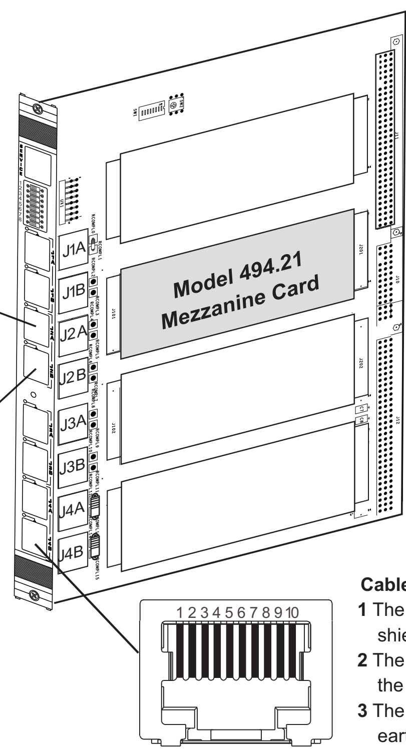
The front-panel sockets on the I/O carrier board only accept cabling with 10-pin, shielded, RJ-50 connectors with a gray boot.

The use of other RJ connector types (less than 10 pins or unshielded with a black boot) with the I/O carrier board can cause component damage.

Only use transducer cables equipped with 10-pin, braided shield, RJ-50 connectors (with a gray boot) with the I/O carrier board.

DUC Input	
Pin 1	+ IEEE 1451.4 Class 2
Pin 2	+EX
Pin 3	-EX
Pin 4	-FB
Pin 5	+FBR
Pin 6	-FBR
Pin 7	+FB
Pin 8	-EXS
Pin 9	+EXS
Pin 10 -	IEEE 1451.4 Class 2

Accel Input	
Pin 1	Reserved
Pin 2	Buff Accel
Pin 3	Signal GND (Buff Accel)
Pin 4	- Accel 1 (current source)
Pin 5	+ Accel 2 (bridge)
Pin 6	- Accel 2 (bridge)
Pin 7	+ Accel 1 (current source)
Pin 8	Reserved
Pin 9	Reserved
Pin 10	Reserved



RJ-50 Pin Assignments (front view)

Cable Grounding

1 The cable shield connects to the metal shielding on the RJ-50 cable plug.

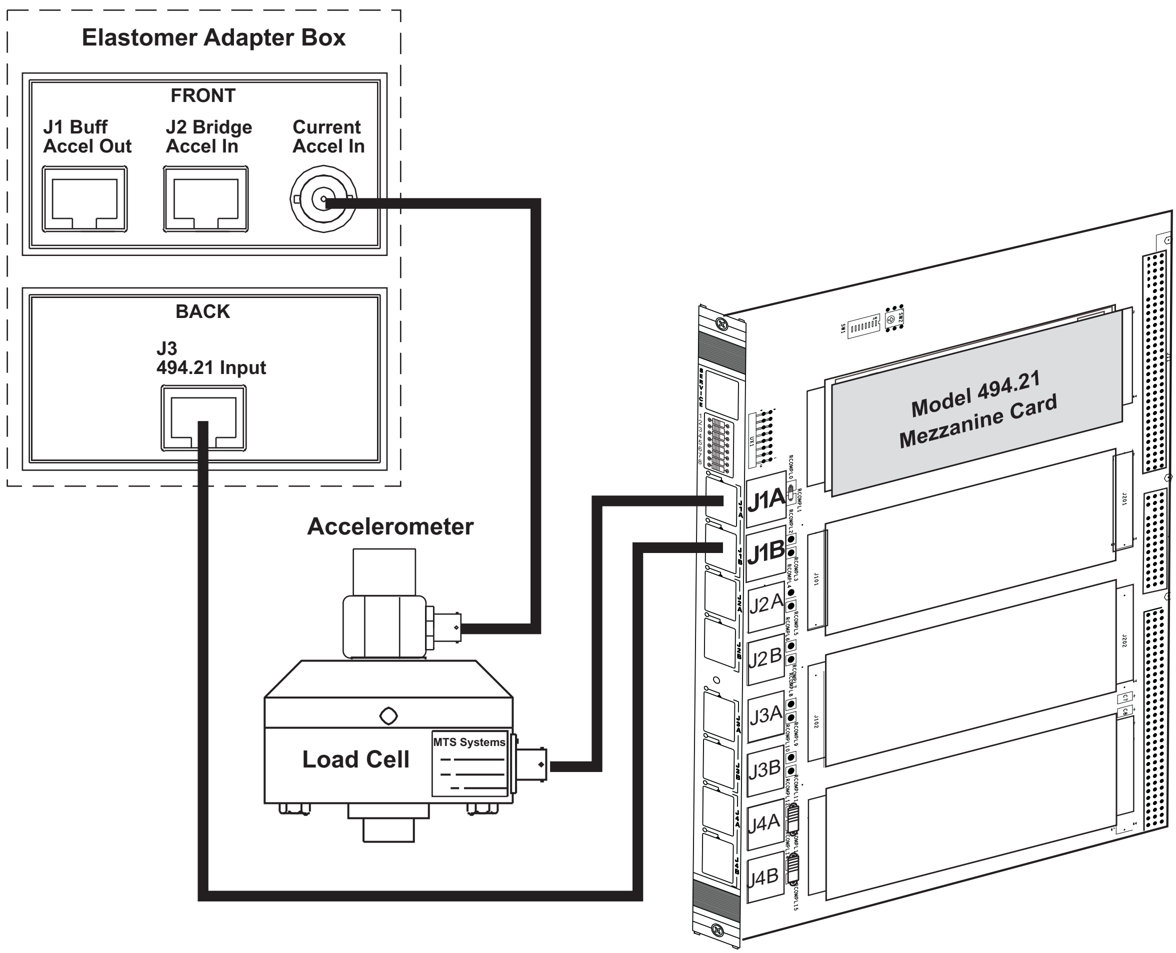
2 The cable plug shielding connects to the I/O carrier board body.

3 The I/O carrier board body connects to earth ground through the chassis.

Model 494.21 Multi-Range DUC/Acceleration Compensation Card Configuration

The following drawing shows a basic configuration for acceleration compensation using the Model 494.21 Card.

Note *The Model 494.21 Card can be configured for a number of custom applications. For custom applications, refer to the system configuration drawings for analog bus routing, interconnects, cable part numbers, and other information.*



Model 494.45 8-Input A/D Converter Card

About the Model 494.45 8-Input A/D Card

The Model 494.45 8-Input A/D Card is a mezzanine card that you can plug into one of the slots on the Model 494.40 I/O Carrier board. Each A/D card accepts up to eight analog input signals that must be within ± 12.5 V DC. The A/D card also includes a software-configurable digital filter for each input.

External analog signals include stand-alone function generators, external controller outputs, or a computer-controlled analog output. Analog input signals are typically routed to the A/D card through a Model 494.75 8-Input BNC Transition Board. The transition board connects to the front-panel connectors on the I/O carrier board that contains the A/D card.

Specifications–Model 494.45 8-Input A/D Card

PARAMETER	SPECIFICATION
Inputs	Eight (8) high-level, differential analog inputs, ± 12.5 V DC.
Input Impedance	50 KΩ
A/D Resolution	16 bits

Model 494.45 8-Input A/D Card Pin Assignments

Analog input signals are typically routed to the A/D card through a Model 494.75 8-Input BNC transition board. Signals are routed to the A/D card through RJ-50 connectors located on the front of the I/O carrier board that contains the A/D card.

⚠ CAUTION

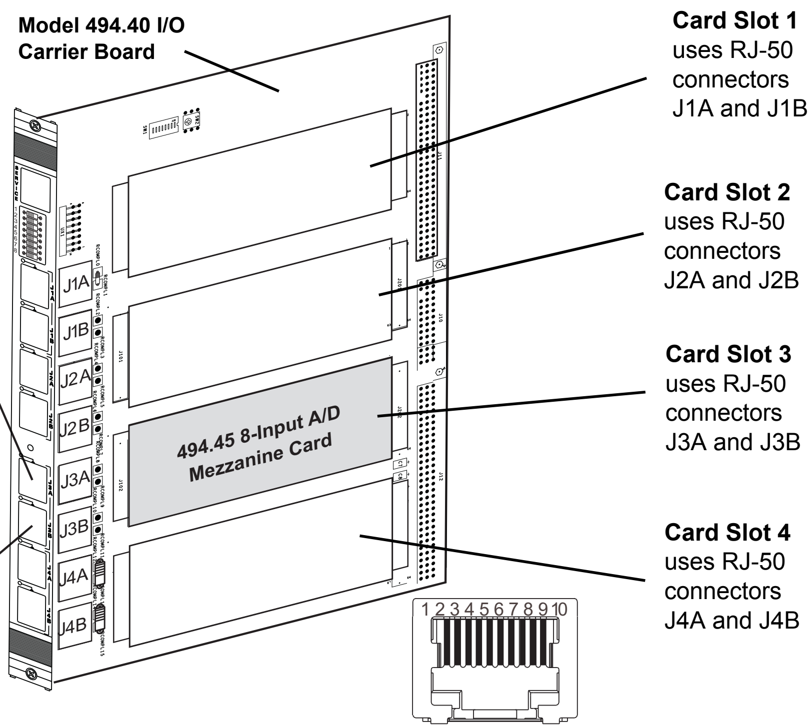
The front-panel sockets on the I/O carrier board only accept cabling with 10-pin, shielded, RJ-50 connectors.

The use of other RJ connector types (less than 10 pins or unshielded with a black boot) with the I/O carrier board can cause component damage.

Only use cables equipped with 10-pin, braided shielded, RJ-50 connectors (with gray boot) with the I/O carrier board.

Analog Inputs 1-4	
Pin 1	Not used
Pin 2	A/D IN[1]+
Pin 3	A/D IN[1] -
Pin 4	A/D IN[2]+
Pin 5	A/D IN[2] -
Pin 6	A/D IN[3]+
Pin 7	A/D IN[3] -
Pin 8	A/D IN[4]+
Pin 9	A/D IN[4] -
Pin 10	Not used

Analog Inputs 5-8	
Pin 1	Not used
Pin 2	A/D IN[5]+
Pin 3	A/D IN[5] -
Pin 4	A/D IN[6]+
Pin 5	A/D IN[6] -
Pin 6	A/D IN[7]+
Pin 7	A/D IN[7] -
Pin 8	A/D IN[8]+
Pin 9	A/D IN[8] -
Pin 10	Not used



RJ-50 Pin Assignments (front view)

Model 494.45 8-Input A/D Card Connections

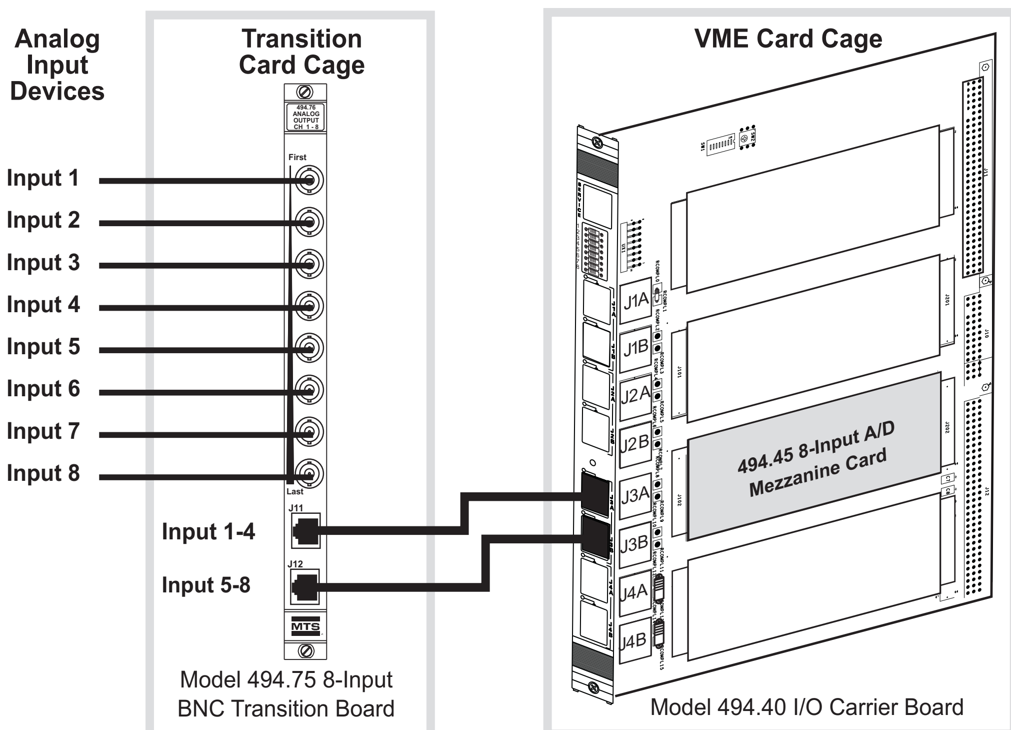
Analog input signals are typically routed to the A/D converter card through a Model 494.75 8-Input BNC Transition Board. The two transition board outputs (J11, J12) connect to the I/O carrier board RJ-50 connectors used with the A/D Converter card slot (J3A and J3B).

CAUTION

The front-panel sockets on the I/O carrier board only accept cabling with 10-pin, shielded, RJ-50 connectors.

The use of other RJ connector types (less than 10 pins or unshielded) with the I/O carrier board can cause component damage.

Only use cables equipped with 10-pin, braided shielded, RJ-50 connectors (with gray boot) with the I/O carrier board.



Model 494.46 8-Output D/A Card

About the Model 494.46 8-Output D/A Card

The Model 494.46 8-Output D/A Card is a mezzanine card that you can plug into one of the slots on the Model 494.40 I/O Carrier board. Each D/A converter card provides up to eight analog output signals.

Analog output signals are typically routed from the D/A card to a Model 494.76 8-Output BNC transition board. The transition board connects to the front-panel connectors on the I/O carrier board that contains the D/A card. The BNC board includes a BNC connector for each D/A output.

You can also use the Model 494.46 card to drive a Model 494.79 8-Channel Valve Driver transition board. In this application, cables route the D/A output signals from the I/O carrier board to the valve driver transition board.

Specifications–Model 494.46 8-Output D/A Card

Parameter	Specification
Outputs	Each Model 494.46 D/A card provides eight (8) single-ended, analog-output signals.
Resolution	16 bits
Output Drive	± 10 V DC minimum at 5 mA

Model 494.46 8-Output D/A Card Pin Assignments

Analog output signals are typically routed from the D/A card through a Model 494.76 8-Output BNC transition board. Signals are routed from the D/A card through RJ-50 connectors located on the front of the I/O carrier board.

CAUTION

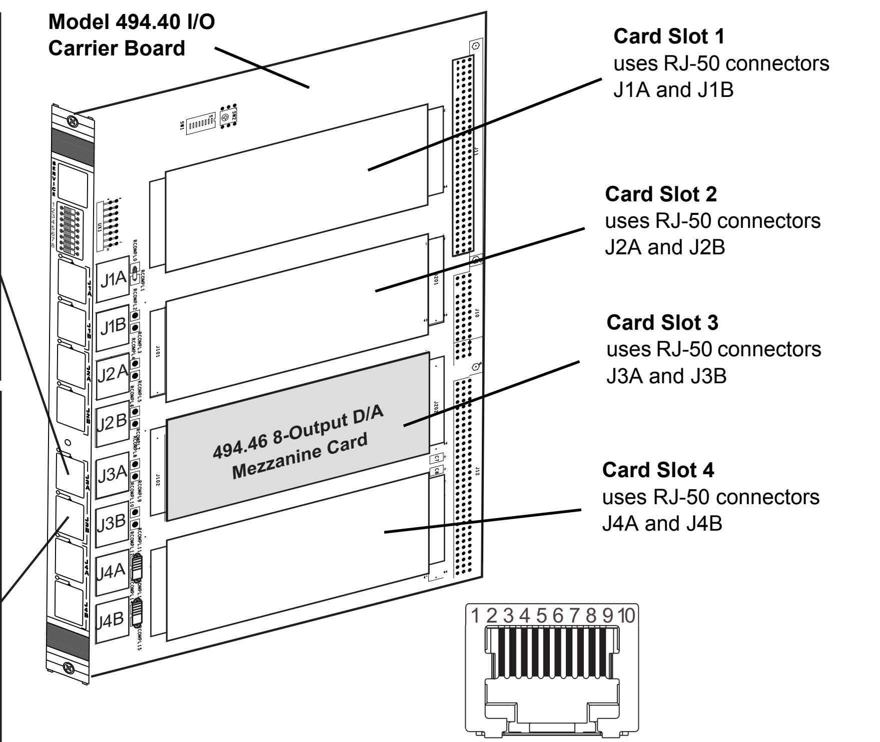
The front-panel sockets on the I/O carrier board only accept cabling with 10-pin, shielded, RJ-50 connectors.

The use of other RJ connector types (less than 10 pins or unshielded) with the I/O carrier board can cause component damage.

Only use cables equipped with 10-pin, braided shielded, RJ-50 connectors (with gray boot) with the I/O carrier board.

First	
Pin 1	Not used
Pin 2	D/A Out [1]+
Pin 3	D/A Out [1] -
Pin 4	D/A Out [2]+
Pin 5	D/A Out [2] -
Pin 6	D/A Out [3]+
Pin 7	D/A Out [3] -
Pin 8	D/A Out [4]+
Pin 9	D/A Out [4] -
Pin 10	Reserved

Last	
Pin 1	Not used
Pin 2	D/A Out [5]+
Pin 3	D/A Out [5] -
Pin 4	D/A Out [6]+
Pin 5	D/A Out [6] -
Pin 6	D/A Out [7]+
Pin 7	D/A Out [7] -
Pin 8	D/A Out [8]+
Pin 9	D/A Out [8] -
Pin 10	Reserved

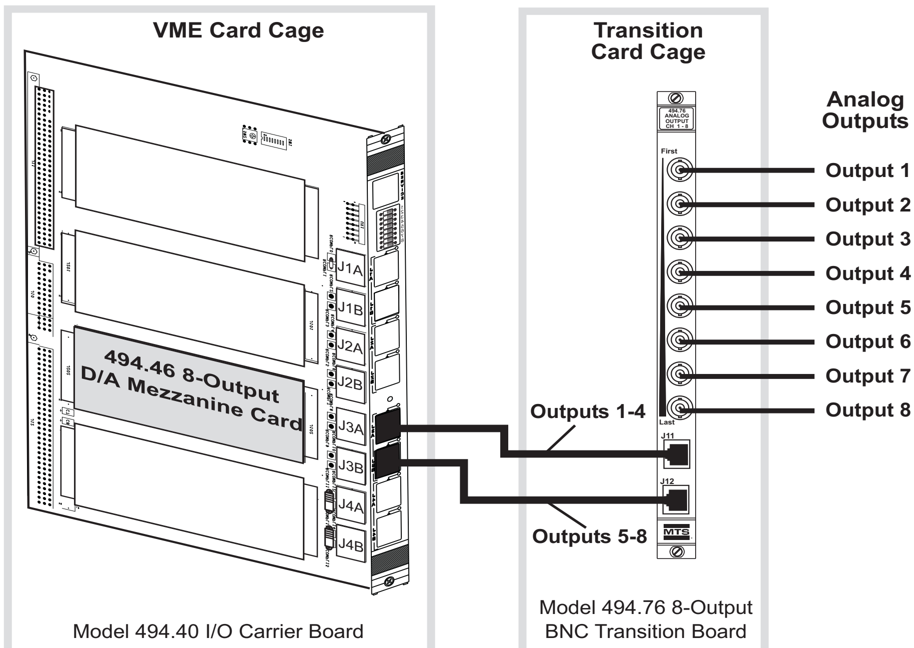


RJ-50 Pin Assignments (front view)

Model 494.46 8-Output D/A Connections

Analog output signals are typically routed to external devices through a Model 494.76 8-Output BNC transition board.

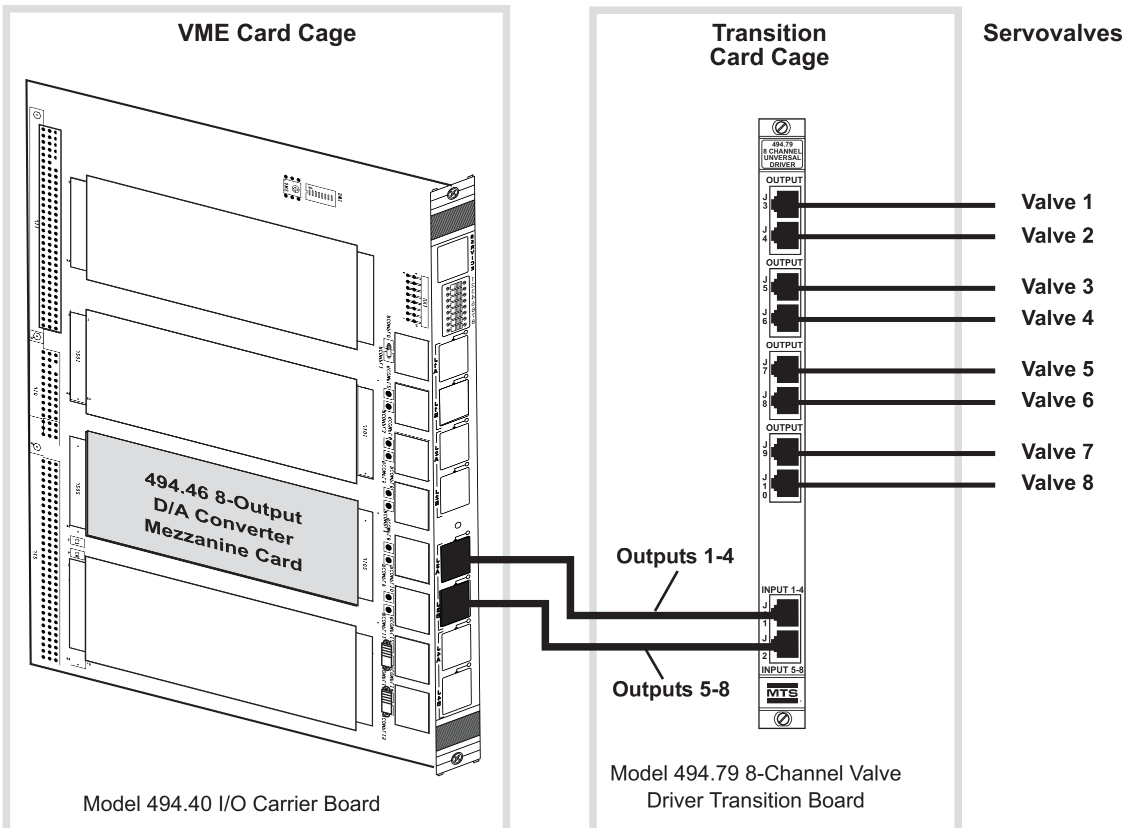
The transition board (J11, J12) connects to the front-panel I/O carrier board connectors associated with the D/A mezzanine card slot (J2A and J2B in the following figure).



Servo valve driver

You can use the analog output signals from the Model 494.46 D/A card to drive a Model 494.79 8-Channel Valve Driver transition board.

The transition board (J11, J12) connects to the front-panel I/O carrier board connectors associated with the D/A converter mezzanine card slot (J2A and J2B in the following figure).



Model 494.47 Dual UART/Encoder Interface Card

About the Model 494.47 Dual UART/Encoder Card

The Model 494.47 UART/Encoder is a mezzanine card that you can plug into one of the slots on the Model 494.40 I/O Carrier board. The UART/ Encoder card includes two interfaces that you can configure for two UART devices or two digital transducers. The device mode and other parameters are software configurable.

Software setup for the card includes selecting the device type (UART or digital transducer). If you select digital transducer as the device type, you must also select a mode. These settings determine the operation and pin assignments for the card.

UART configuration

When configured for UART devices, each channel can support a different device. The UART configuration supports devices such as the Model 494.05 Handset and the Model 409 Temperature Controller.

Digital transducer configuration

When configured for digital transducers, both transducers must be the same type. Supported digital transducer types include:

- Incremental encoders with quadrature outputs
- SSI devices such as Temposonics R transducers
- Gurley absolute encoders
- Temposonics G transducers
- Counters

External clock output

The Model 494.47 card can also be configured to provide differential RS-485 external-clock and external-trigger outputs to synchronize external systems (such as data acquisition systems) to the controller clocks.

Specifications–Model 494.47 Dual UART/Encoder Card

PARAMETER	SPECIFICATION
Encoder Interface	RS-485
UART Electrical Interface	RS-485 (2 or 4 wire)
UART Baud Rate	300 to 57600 Baud (software configurable)
Power Out (to device)	15 V DC, Poly fused at 200 mA (continuous current) and 400 mA (trip current)
Supported Encoder/Digital Transducer Interfaces	You can use system hardware-mapping software to select the type of interface: SSI (Temposonics R) Gurley (Teledyne) Incremental/Velocity (includes counter selection) PWM (Temposonics G)

SSI duty-cycle settings

Older versions of the Model 494.47 and Model 494.49 cards used a fixed 25% low/75% high duty cycle for the SSI clock. To support other types of SSI encoders, newer versions of these cards will set the duty cycle based on the SSI baud rate setting. With the new design:

- SSI baud rates less than or equal to 115.74 kHz = 50/50 duty cycle.
- SSI baud rates greater than 115.74 kHz = 25/75 duty cycle.

The revisions listed in the following table include the SSI duty-cycle changes described above. Cards that have the programmable-logic-device revision listed in the table will support the 50/50 duty cycle.

ENCODER CARD	PROGRAMMABLE LOGIC DEVICE REVISION
Model 494.47	H or higher
Model 494.49	C or higher

UART Pin Assignments for the Model 494.47 Dual UART/Encoder Card

Signals are routed to and from the Model 494.47 card through two RJ-50 connectors located on the front of the I/O carrier board. The device type that you set for the card determines the pin assignments. The following figure shows the pin assignments for RS-485/UART devices (such as the Model 494.05 Handset, selected Model 409 Temperature Controllers, and Eurotherm Series 2200/Series 2400 Temperature Controllers).

CAUTION

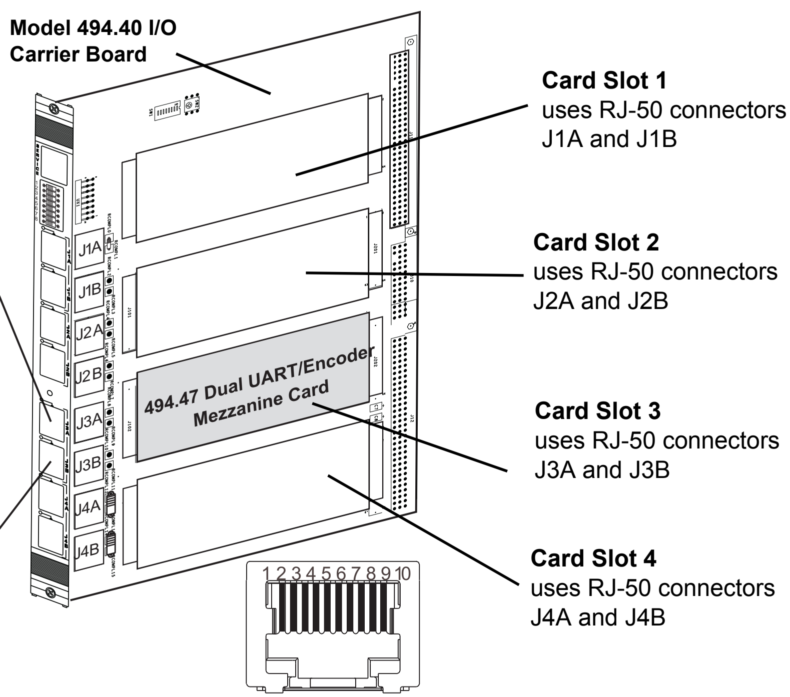
The front-panel sockets on the I/O carrier board only accept cabling with 10-pin, shielded, RJ-50 connectors.

The use of other RJ connector types (less than 10 pins or unshielded) with the I/O carrier board can cause component damage.

Only use cables equipped with 10-pin, braided shielded, RJ-50 connectors (with gray boot) with the I/O carrier board.

Device 1	
Pin 1	+ IEEE 1451.4 Class 2
Pin 2	+ Tx [1]
Pin 3	- Tx [1]
Pin 4	+ Power
Pin 5	+ Intlk [1]
Pin 6	- Intlk [1]
Pin 7	- Power
Pin 8	+ Rx [1]
Pin 9	- Rx [1]
Pin 10	- IEEE 1451.4 Class 2

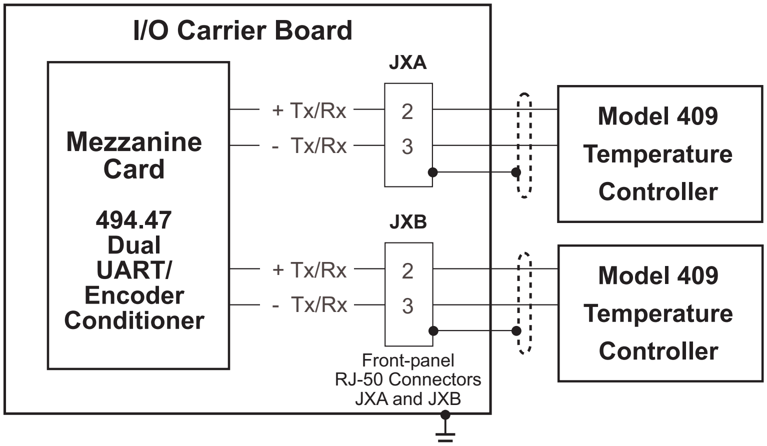
Device 2	
Pin 1	+ IEEE 1451.4 Class 2
Pin 2	+ Tx [2]
Pin 3	- Tx [2]
Pin 4	+ Power
Pin 5	+ Intlk [2]
Pin 6	- Intlk [2]
Pin 7	- Power
Pin 8	+ Rx [2]
Pin 9	- Rx [2]
Pin 10	- IEEE 1451.4 Class 2



RJ-50 Pin Assignments (front view)

UART Connections for the Model 494.47 Dual UART/Encoder Card

Model 409 Temperature Controller Connections



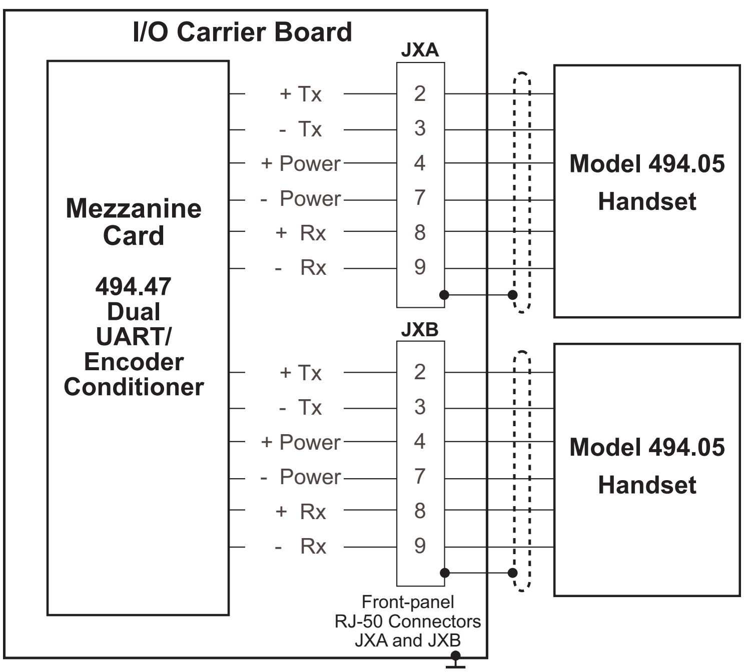
Cable Grounding

1 The cable shield connects to the metal shielding on the RJ-50 cable plug.

2 The cable plug shielding connects to the I/O carrier board body.

3 The I/O carrier board connects to earth ground through the chassis.

Model 494.05 Handset Connections



Cable Grounding

1 The cable shield connects to the metal shielding on the RJ-50 cable plug.

2 The cable plug shielding connects to the I/O carrier board body.

3 The I/O carrier board connects to earth ground through the chassis.

Incremental Encoder/Counter Pin Assignments for the Model 494.47 Card

Signals are routed to and from the Model 494.47 card through two RJ-50 connectors located on the front of the I/O carrier board. The device type that you set for the card determines the pin assignments. The following figure shows the pin assignments for incremental encoders with quadrature outputs.

CAUTION

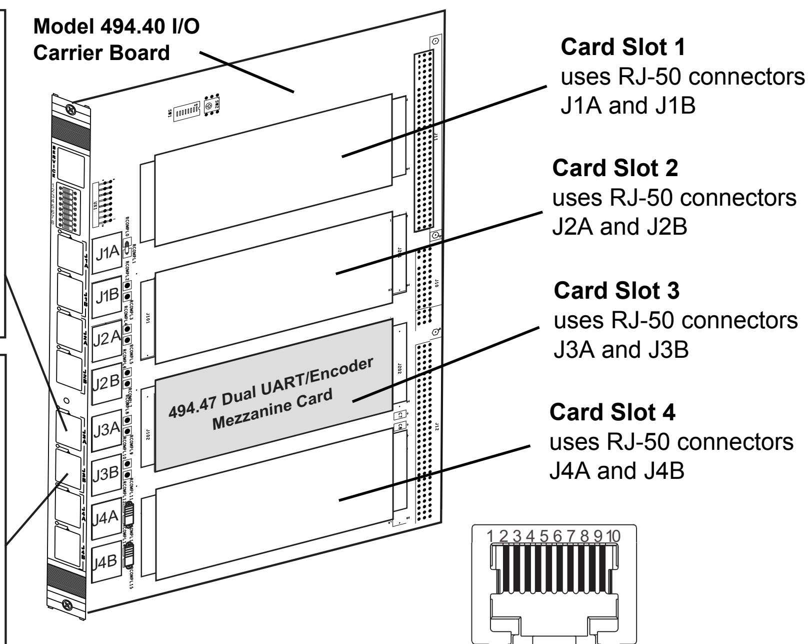
The front-panel sockets on the I/O carrier board only accept cabling with 10-pin, shielded, RJ-50 connectors.

The use of other RJ connector types (less than 10 pins or unshielded) with the I/O carrier board can cause component damage.

Only use cables equipped with 10-pin, braided shielded, RJ-50 connectors (with gray boot) with the I/O carrier board.

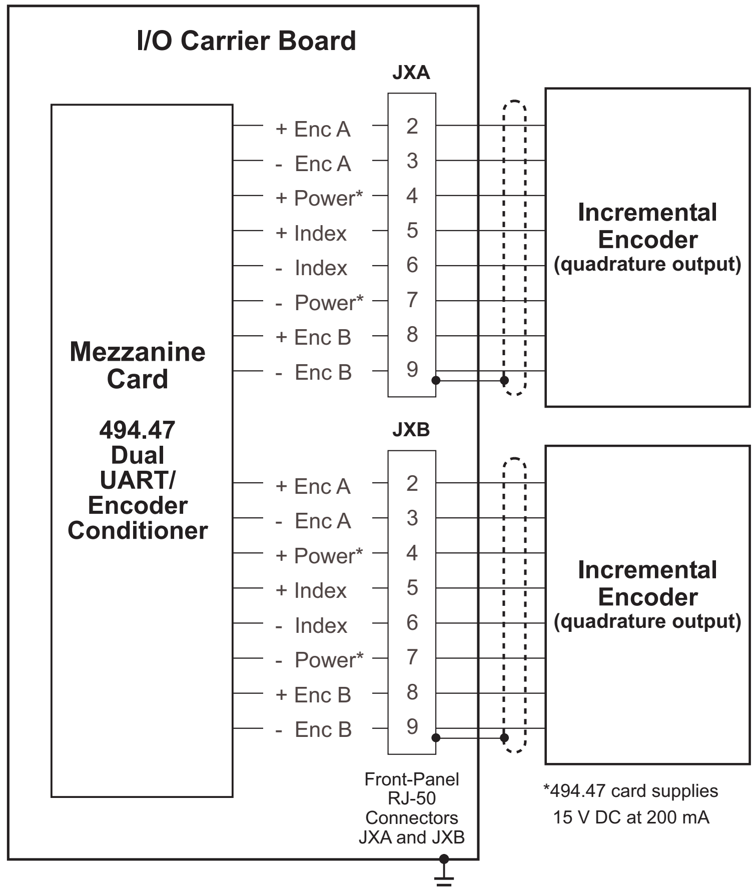
Device 1	
Pin 1	+ IEEE 1451.4 Class 2
Pin 2	+ Enc A [1]
Pin 3	- Enc A [1]
Pin 4	+ Power
Pin 5	+ Index [1]
Pin 6	- Index [1]
Pin 7	- Power
Pin 8	+ Enc B [1]
Pin 9	- Enc B [1]
Pin 10	- IEEE 1451.4 Class 2

Device 2	
Pin 1	+ IEEE 1451.4 Class 2
Pin 2	+ Enc A [2]
Pin 3	- Enc A [2]
Pin 4	+ Power
Pin 5	+ Index [2]
Pin 6	- Index [2]
Pin 7	- Power
Pin 8	+ Enc B [2]
Pin 9	- Enc B [2]
Pin 10	- IEEE 1451.4 Class 2



RJ-50 Pin Assignments (front view)

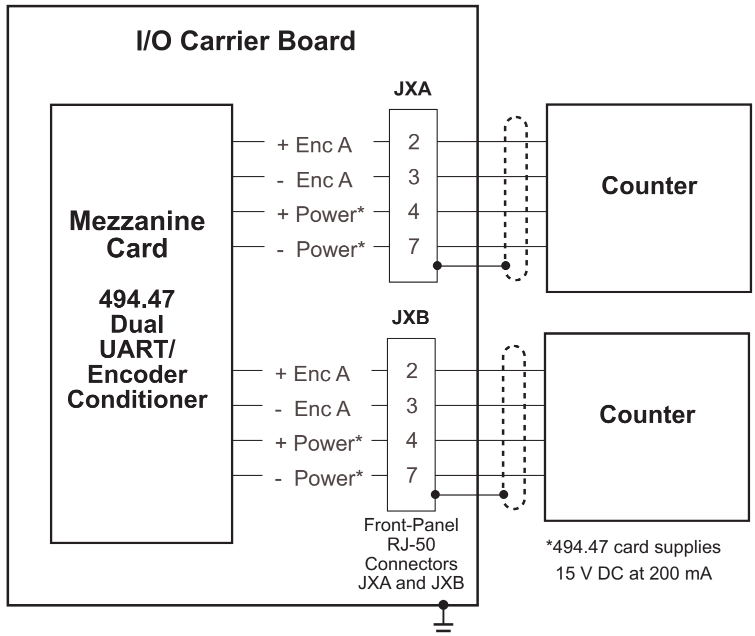
Incremental Encoder Connections for the Model 494.47 Card



Cable Grounding

1 The cable shield connects to the metal shielding on the RJ-50 cable plug.
2 The cable plug shielding connects to the I/O carrier board body.
3 The I/O carrier board connects to earth ground through the chassis.

Counter Connections for the Model 494.47 Card



Cable Grounding

1 The cable shield connects to the metal shielding on the RJ-50 cable plug.
2 The cable plug shielding connects to the I/O carrier board body.
3 The I/O carrier board connects to earth ground through the chassis.

SSI Encoder Pin Assignments for the Model 494.47 Card

The device type that you set for the UART/digital transducer card determines the pin assignments. The following figure shows the pin assignments for SSI devices (such as Temposonics R transducers).

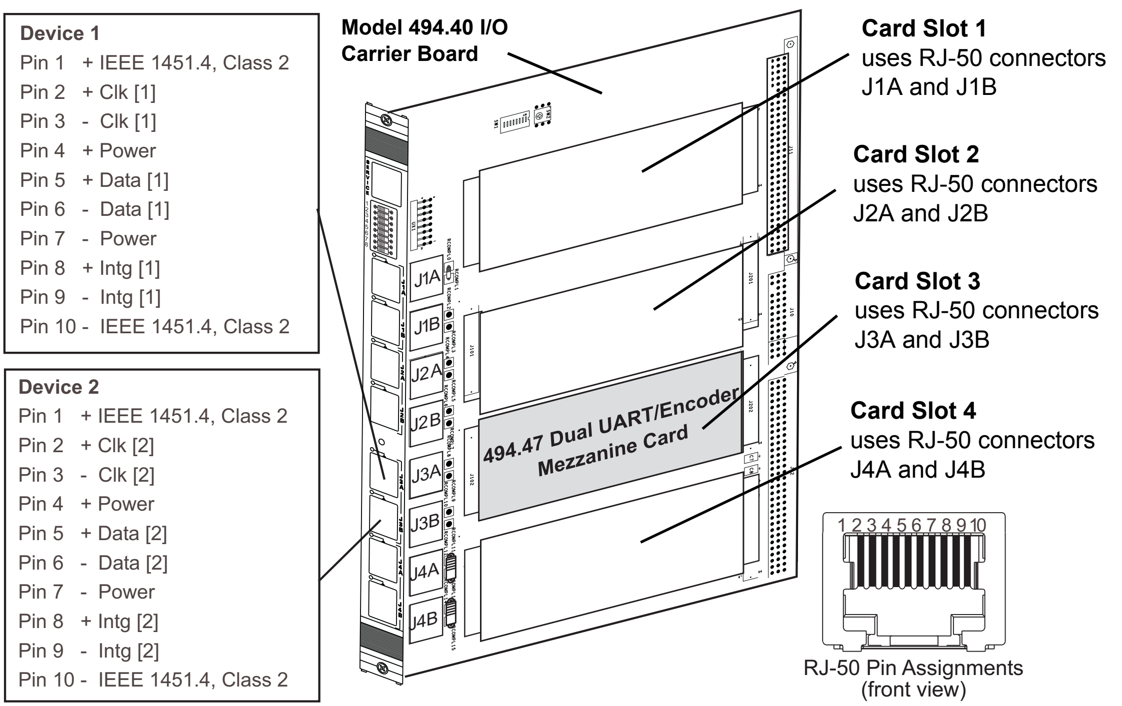
Signals are routed to and from the UART/digital transducer card through two RJ-50 connectors located on the front of the I/O carrier board.

CAUTION

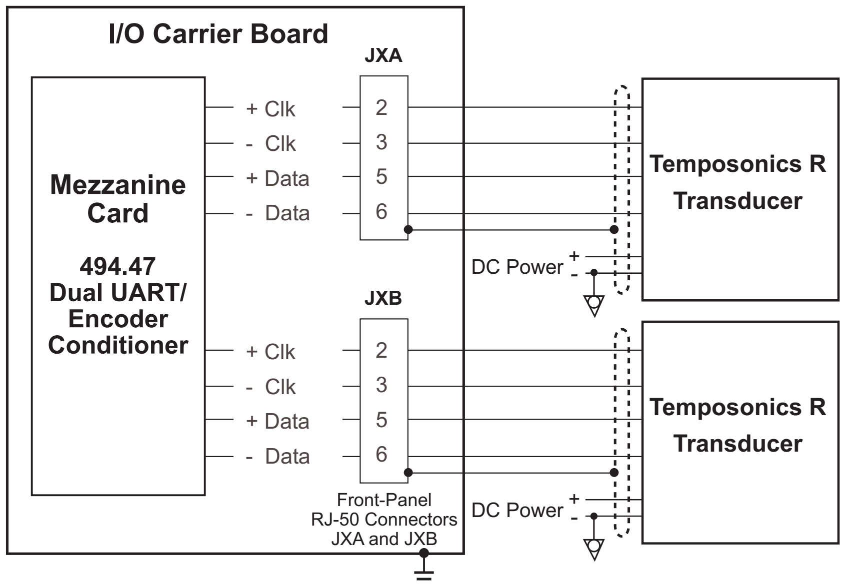
The front-panel sockets on the I/O carrier board only accept cabling with 10-pin, shielded, RJ-50 connectors.

The use of other RJ connector types (less than 10 pins or unshielded) with the I/O carrier board can cause component damage.

Only use cables equipped with 10-pin, braided shielded, RJ-50 connectors (with gray boot) with the I/O carrier board.



SSI Encoder (Temposonics R) Connections for the Model 494.47 Card



Cable Grounding

1 The cable shield connects to the metal shielding on the RJ-50 cable plug.

2 The cable plug shielding connects to the I/O carrier board body.

3 The I/O carrier board connects to earth ground through the chassis.

4 The negative (-) side of the DC Power must be connected to signal ground on the controller chassis.

Pulse-Width-Modulated Output Pin Assignments for the Model 494.47 Card

The device type that you set for the UART/digital transducer card determines the pin assignments. The following figure shows the pin assignments for devices with a pulse-width-modulated output (such as Temposonics G transducers).

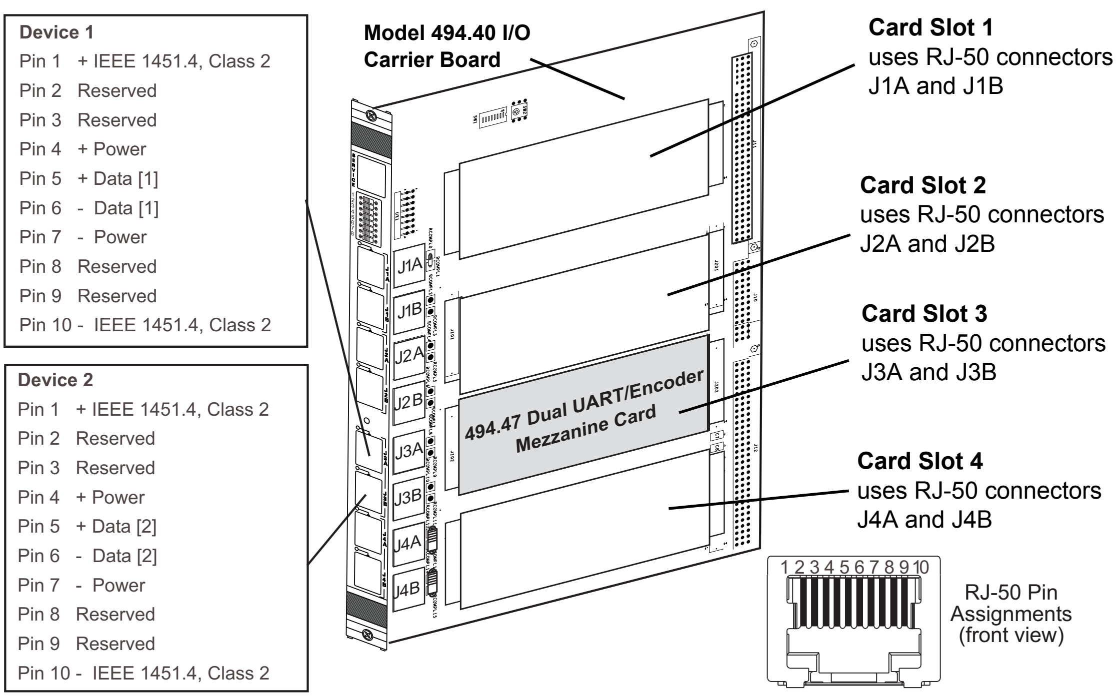
Signals are routed to and from the UART/digital transducer card through two RJ-50 connectors on the front of the I/O carrier board.

CAUTION

The front-panel sockets on the I/O carrier board only accept cabling with 10-pin, shielded, RJ-50 connectors.

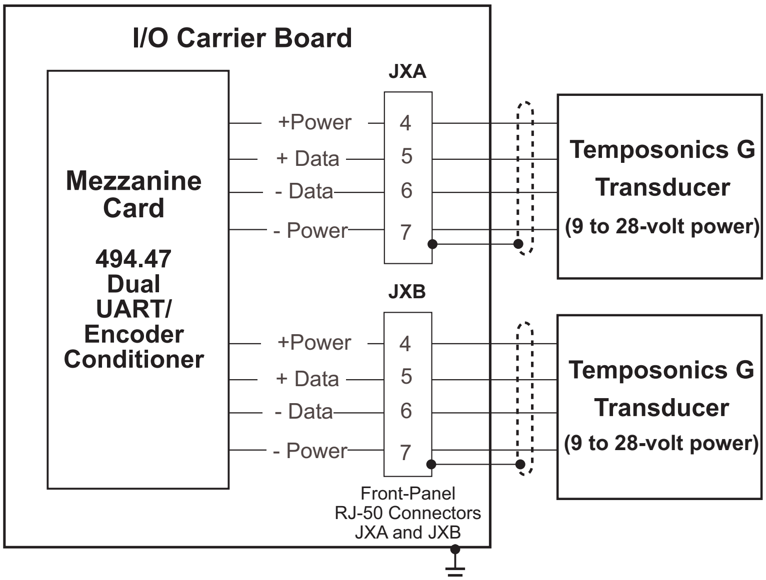
The use of other RJ connector types (less than 10 pins or unshielded) with the I/O carrier board can cause component damage.

Only use cables equipped with 10-pin, braided shielded, RJ-50 connectors (with gray boot) with the I/O carrier board.



Pulse-Width-Modulated (PWM) Connections for the Model 494.47 Card

Temposonics G (PWM) Connections (9- to 28-volt power option)



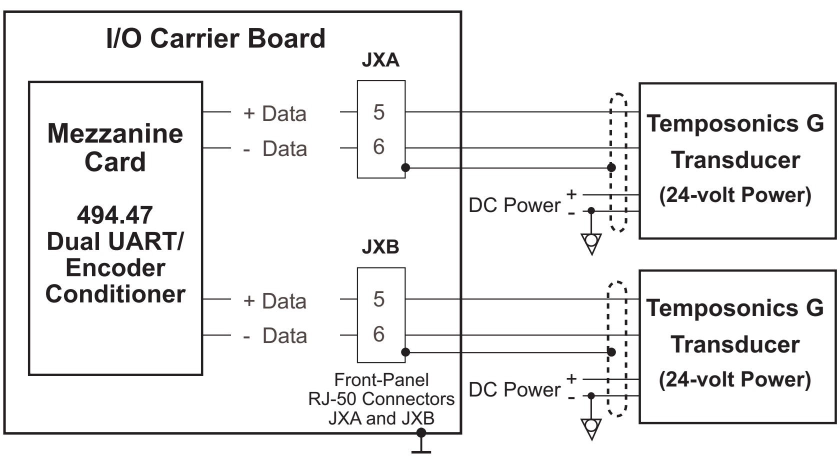
Cable Grounding

1 The cable shield connects to the metal shielding on the RJ-50 cable plug.

2 The cable plug shielding connects to the I/O carrier board body.

3 The I/O carrier board connects to earth ground through the chassis.

Temposonics G (PWM) Connections (standard 24-volt power option)



Cable Grounding

1 The cable shield connects to the metal shielding on the RJ-50 cable plug.

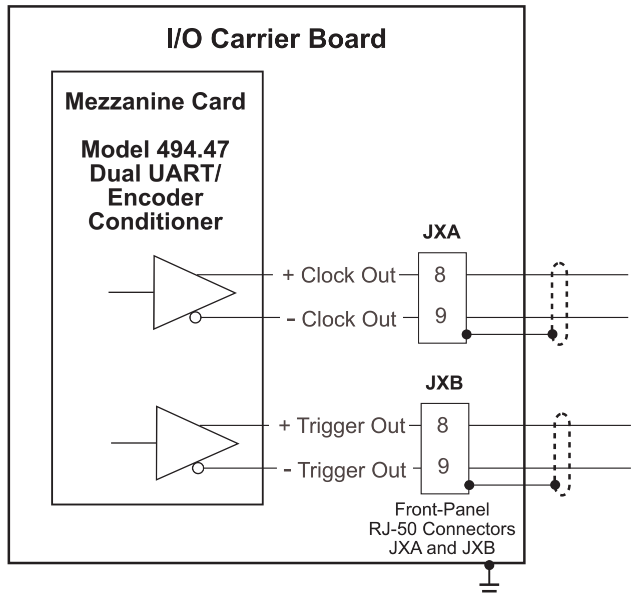
2 The cable plug shielding connects to the I/O carrier board body.

3 The I/O carrier board connects to earth ground through the chassis.

4 The negative (-) side of the DC Power must be connected to signal ground on the controller chassis.

External Clock Connections for the Model 494.47 Card

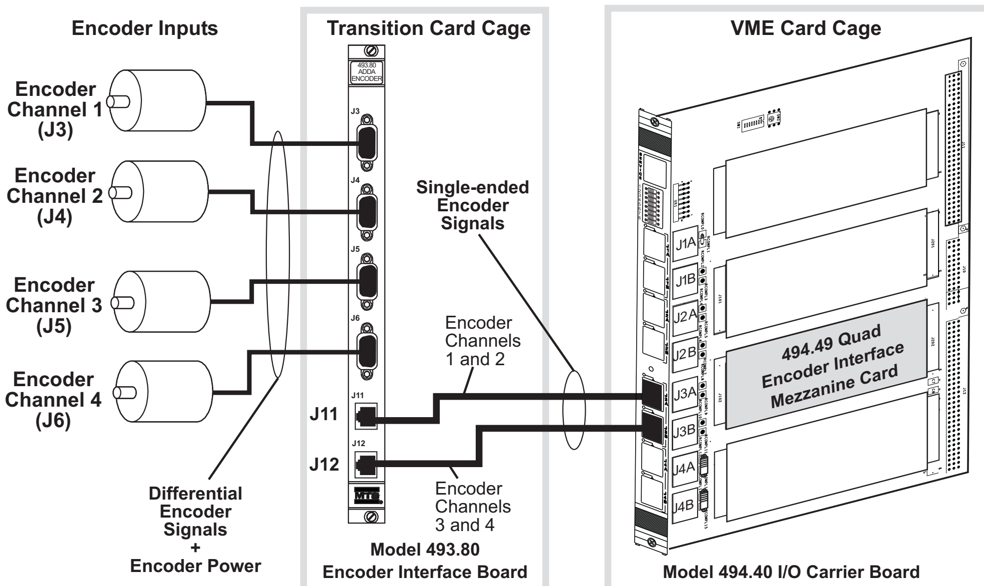
The Model 494.47 card can be configured to provide differential RS-485 external clock and external-trigger outputs to synchronize external systems (such as data acquisition systems) to the controller clocks.



Model 494.49 Quad Encoder Interface Card

About the Model 494.49 Quad Encoder Interface Card

The Model 494.49 Quad Encoder Interface is a mezzanine card that resides in one of the slots on the Model 494.40 I/O Carrier board. The Model 494.49 card can accept up to four digital transducer (encoder) signals from a Model 493.80 Quad Encoder transition board.



Supported transducers

The Quad Encoder Interface card supports the following transducer types:

- SSI (Temposonics R)
- Gurley (Teledyne)
- Incremental/Velocity (includes counter selection)
- Pulse-width-modulated (PWM) (Temposonics G)

Note *The digital transducer interface type that you select applies to each of the four channels on the Model 494.49 card.*

External clock output

The Model 494.49 board can also be configured to provide TTL external-clock and external-trigger outputs to synchronize external systems (such as data acquisition systems) to the controller clocks.

Specifications–Model 494.49 Quad Encoder Interface Card

PARAMETER	SPECIFICATION
Digital Transducer/ Encoder Electrical Interface	TTL transceivers. The Model 493.80 Quad Encoder transition board converts four channels of differential RS-422 encoder signals (J3-J8) into TTL encoder signals (J11, J12) that are compatible with the Model 494.49 Quad Encoder Interface card.
Supported Digital Transducer/ Encoder Interfaces	Use hardware-mapping software to select the type of interface: SSI (Temposonics R) Gurley (Teledyne) Incremental/Velocity (includes counter selection) PWM (Temposonics G) ***Note*** *The interface type that you select applies to each of the four channels on the Model 494.49 card.*
Device Power	The Model 494.49 card does not supply power to external devices. Device power is supplied by the Model 493.80 Quad Encoder transition board or by an external power supply.

SSI duty-cycle settings

Older versions of the Model 494.47 and Model 494.49 cards used a fixed 25% low/75% high duty cycle for the SSI clock. To support other types of SSI encoders, newer versions of these cards will set the duty cycle based on the SSI baud rate setting. With the new design:

- SSI baud rates less than or equal to 115.74 kHz = 50/50 duty cycle.
- SSI baud rates greater than 115.74 kHz = 25/75 duty cycle.

Model 494.49 cards that have the programmable-logic-device revision listed below will support the 50/50 duty cycle.

ENCODER CARD	PROGRAMMABLE LOGIC DEVICE REVISION
Model 494.49	C or higher

Model 494.49 Quad Encoder Interface Card Connections

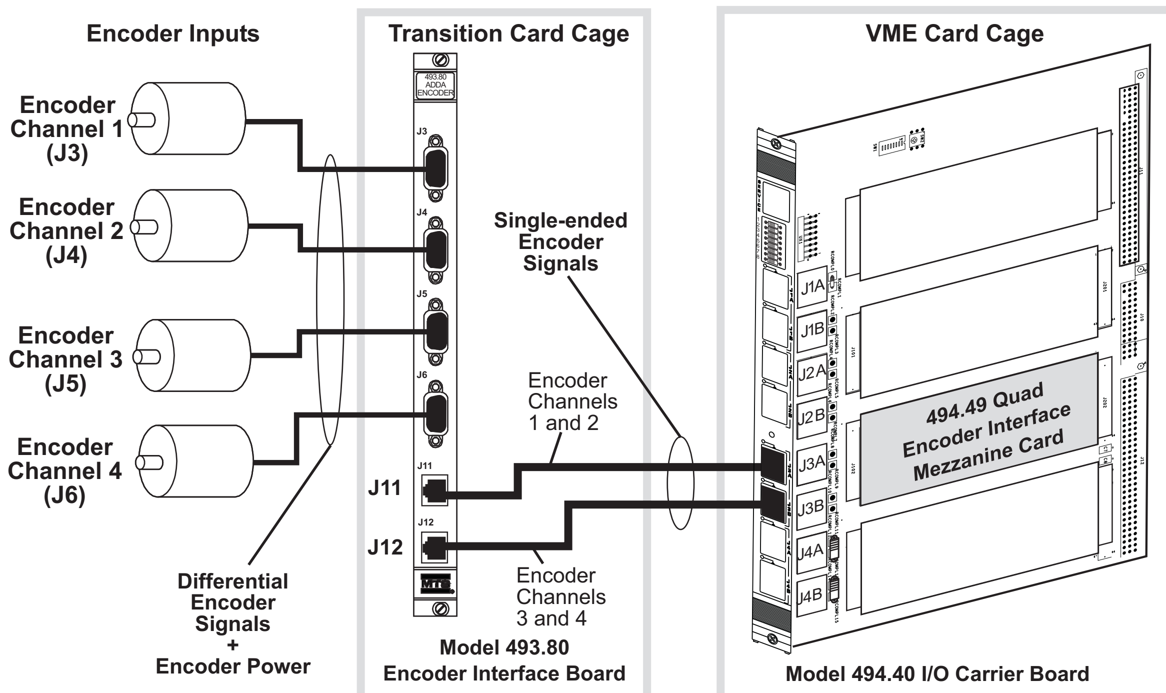
Encoder signals are routed to the Model 494.49 card through a Model 493.80 Quad Encoder Transition Board. Transition board connectors J11 and J12 connect to the I/O carrier board RJ-50 connectors.

CAUTION

The front-panel sockets on the I/O carrier board only accept cabling with 10-pin, shielded, RJ-50 connectors.

The use of other RJ connector types (less than 10 pins or unshielded) with the I/O carrier board can cause component damage.

Only use cables equipped with 10-pin, braided shielded, RJ-50 connectors (with gray boot) with the I/O carrier board.



Incremental Encoder/Counter Pin Assignments for the Model 494.49 Card

The device type that you set in your hardware-mapping software determines the pin assignments. The following figure shows the pin assignments for incremental encoders with quadrature outputs.

Note *Signals are routed to and from the Quad Encoder card through two RJ-50 connectors located on the front of the I/O carrier board.*

CAUTION

The front-panel sockets on the I/O carrier board only accept cabling with 10-pin, shielded, RJ-50 connectors.

The use of other RJ connector types (less than 10 pins or unshielded) with the I/O carrier board can cause component damage.

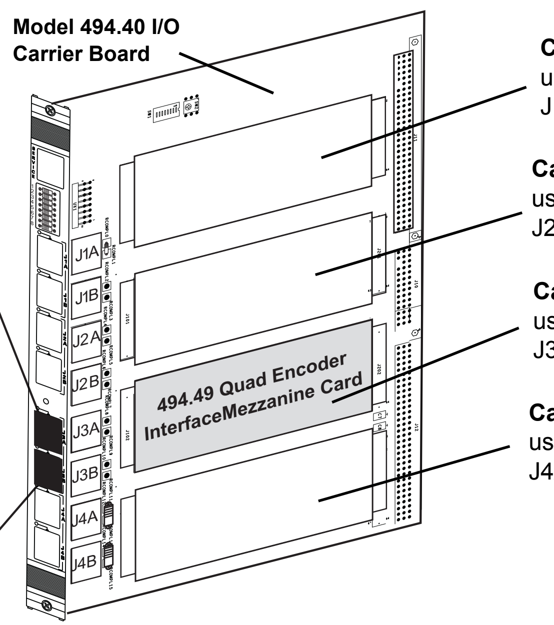
Only use cables equipped with 10-pin, braided shielded, RJ-50 connectors (with gray boot) with the I/O carrier board.

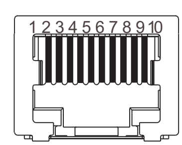
Encoder 1 and 2

Pin 1 + IEEE 1451.4 Class 2
Pin 2 A (Channel 1)
Pin 3 B (Channel 1)
Pin 4 Index (Channel 1)
Pin 5 Digital Ground
Pin 6 A (Channel 2)
Pin 7 B (Channel 2)
Pin 8 Index (Channel 2)
Pin 9 Digital Ground]
Pin 10 - IEEE 1451.4 Class 2

Encoder 3 and 4

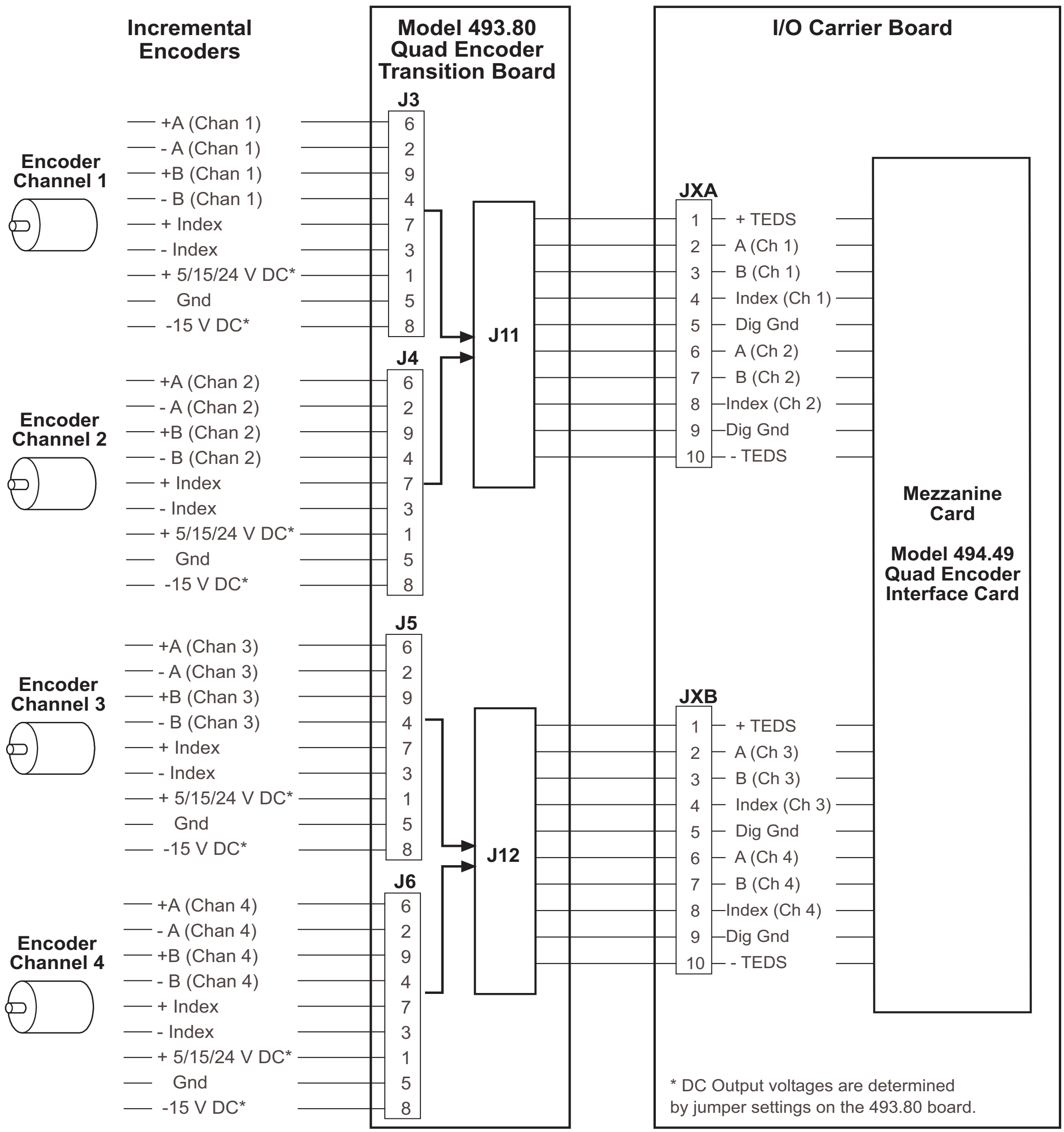
Pin 1 + IEEE 1451.4 Class 2
Pin 2 A (Channel 3)
Pin 3 B (Channel 3)
Pin 4 Index (Channel 3)
Pin 5 Digital Ground
Pin 6 A (Channel 4)
Pin 7 B (Channel 4)
Pin 8 Index (Channel 4)
Pin 9 Digital Ground]
Pin 10 - IEEE 1451.4 Class 2



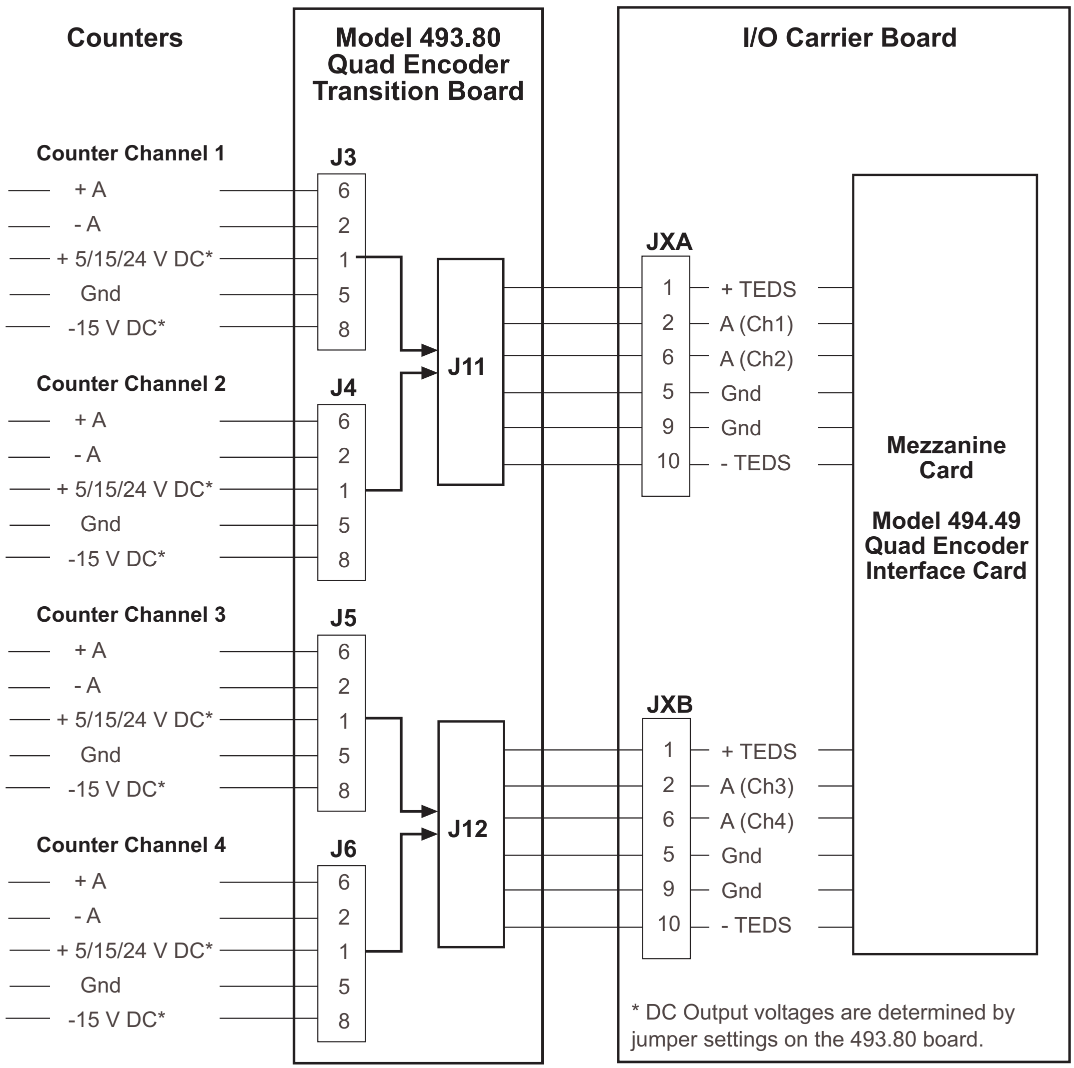


RJ-50 Pin Assignments (front view)

Incremental Encoder Connections for the Model 494.49 Card



Counter Connections for the Model 494.49 Card



SSI/Gurley Encoder Pin Assignments for the Model 494.49 Card

The device type that you set in your hardware-mapping software determines the pin assignments. The following figure shows the pin assignments for SSI devices (such as Temposonics R transducers).

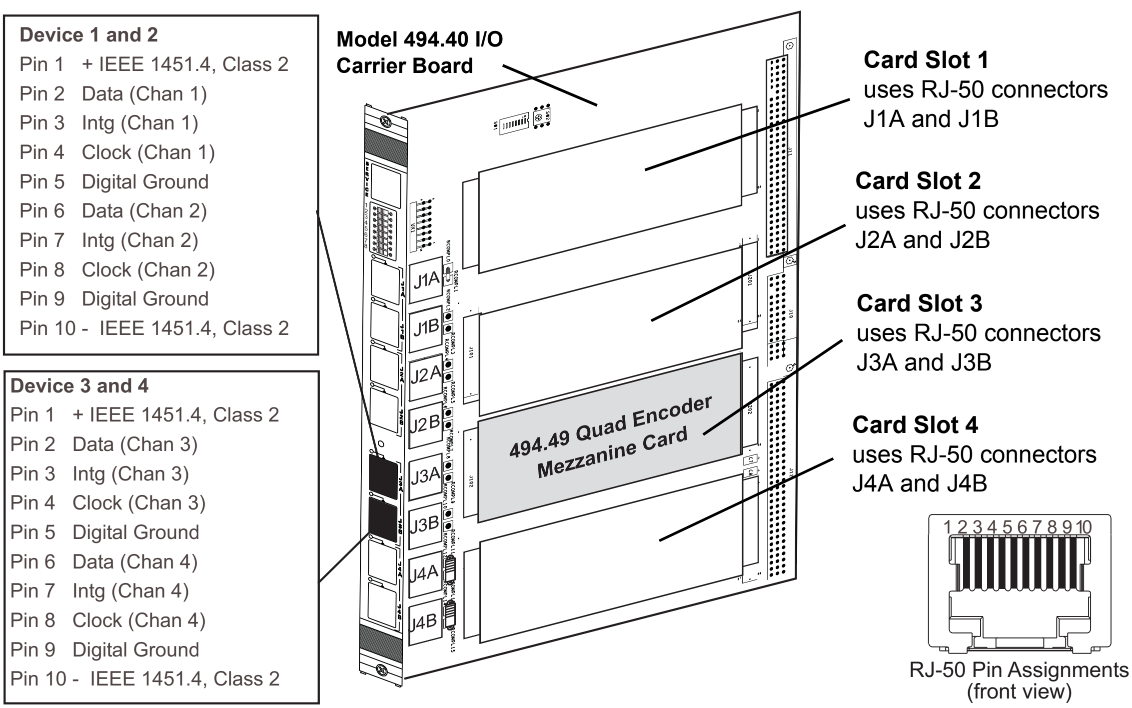
Note *Signals are routed to and from the Quad Encoder card through two RJ-50 connectors located on the front of the I/O carrier board.*

CAUTION

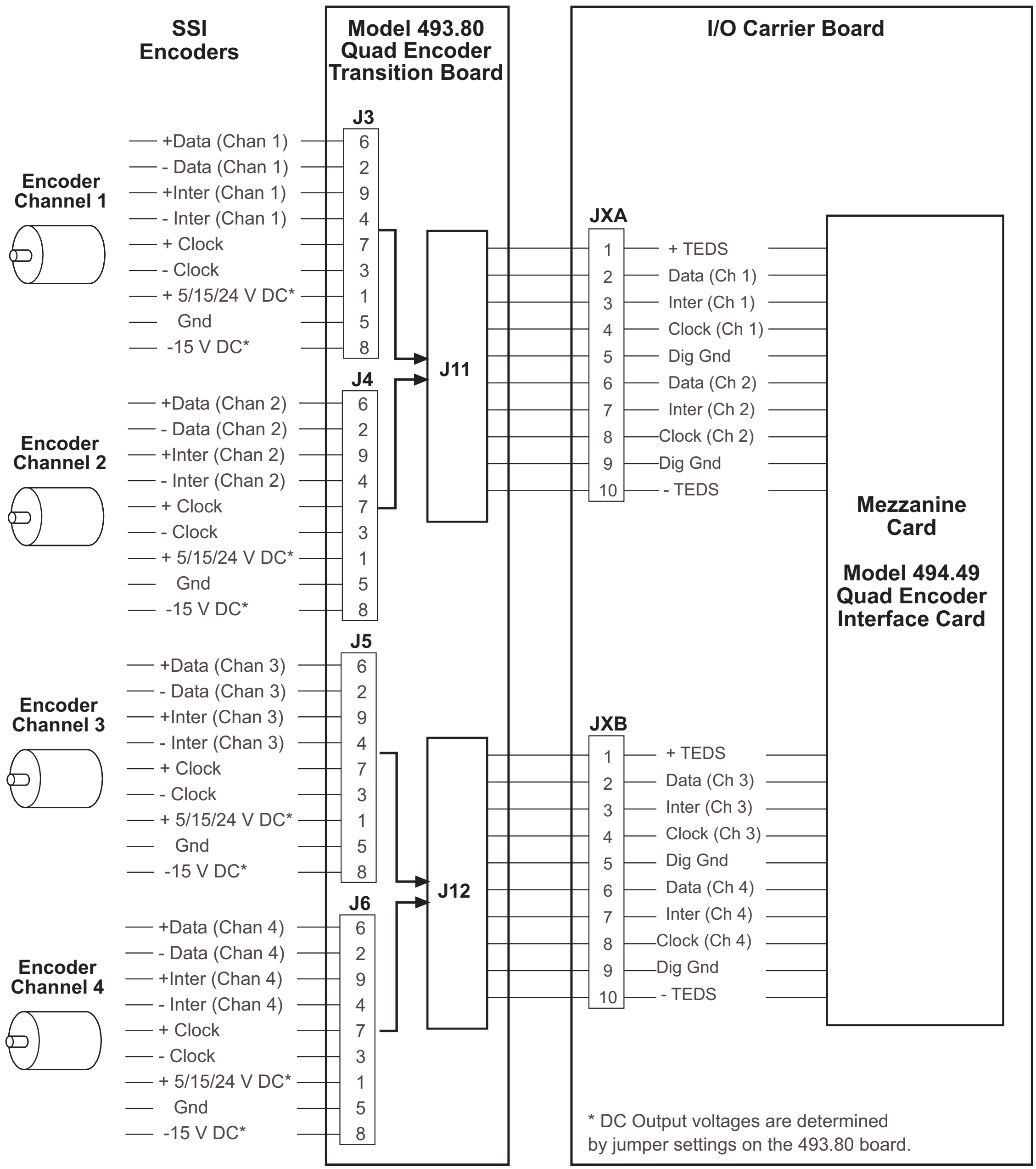
The front-panel sockets on the I/O carrier board only accept cabling with 10-pin, shielded, RJ-50 connectors.

The use of other RJ connector types (less than 10 pins or unshielded) with the I/O carrier board can cause component damage.

Only use cables equipped with 10-pin, braided shielded, RJ-50 connectors (with gray boot) with the I/O carrier board.



SSI/Gurley Encoder (Temposonics R) Connections for the Model 494.49 Card



PWM Input Pin Assignments for the Model 494.49 Quad Encoder Card

The device type that you set in your hardware-mapping software determines the pin assignments. The following figure shows the pin assignments for devices that provide a pulse-width-modulated output (such as Temposonics G transducers).

Note *Signals are routed to and from the Quad Encoder card through two RJ-50 connectors located on the front of the I/O carrier board.*

CAUTION

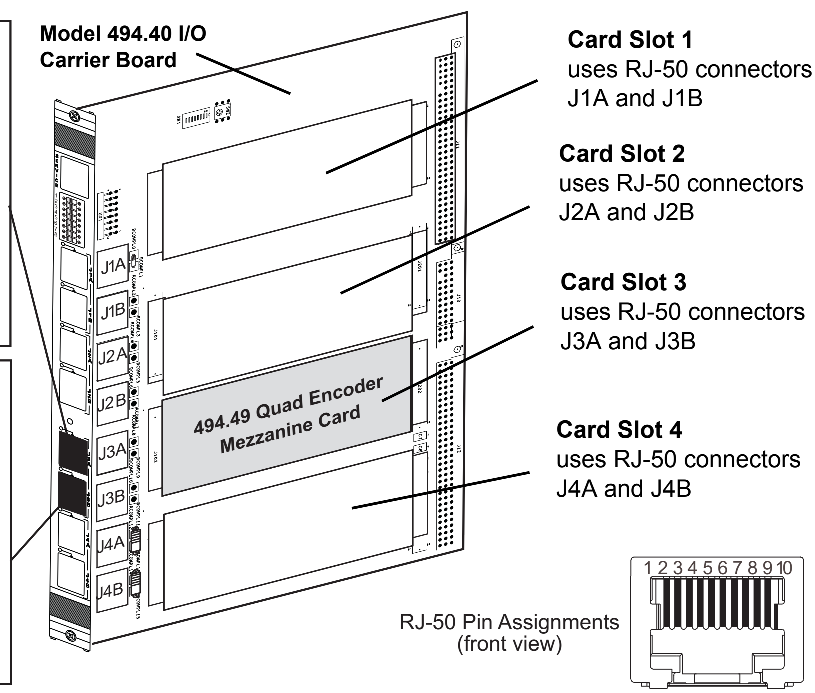
The front-panel sockets on the I/O carrier board only accept cabling with 10-pin, shielded, RJ-50 connectors.

The use of other RJ connector types (less than 10 pins or unshielded) with the I/O carrier board can cause component damage.

Only use cables equipped with 10-pin, braided shielded, RJ-50 connectors (with gray boot) with the I/O carrier board.

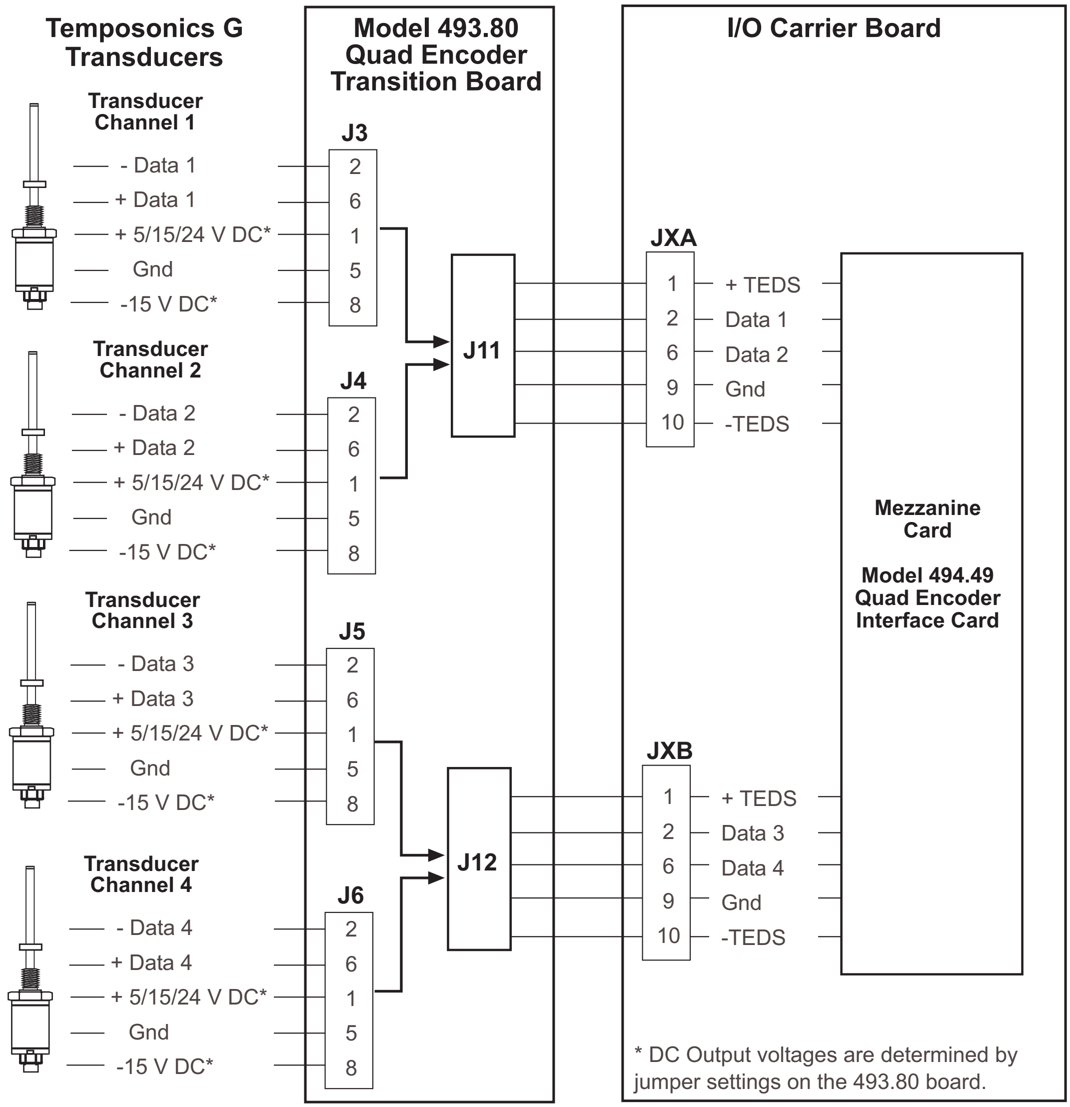
Device 1 and 2	
Pin 1	+ IEEE 1451.4, Class 2
Pin 2	Data 1
Pin 3	Reserved
Pin 4	Reserved
Pin 5	Reserved
Pin 6	Data 2
Pin 7	Reserved
Pin 8	Reserved
Pin 9	Digital Ground
Pin 10 -	IEEE 1451.4, Class 2

Device 3 and 4	
Pin 1	+ IEEE 1451.4, Class 2
Pin 2	Data 3
Pin 3	Reserved
Pin 4	Reserved
Pin 5	Reserved
Pin 6	Data 4
Pin 7	Reserved
Pin 8	Reserved
Pin 9	Digital Ground
Pin 10 -	IEEE 1451.4, Class 2



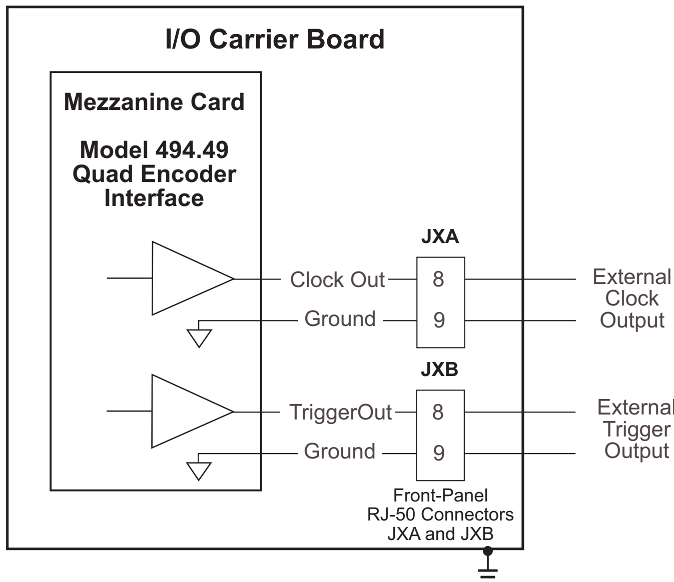
Temposonics G Connections for the Model 494.49 Quad Encoder Card

The Model 493.80 transition board converts the differential signals from the Temposonics G transducers into single-ended signals that are compatible with the Model 494.49 Quad Encoder Interface card. The transition board also supplies DC power to each transducer.



External Clock Connections for the Model 494.49 Quad Encoder Card

The device type that you set in your hardware-mapping software determines the pin assignments. The following figure shows the pin assignments for single-ended TTL external clock and external-trigger outputs used to synchronize external systems (such as data acquisition systems) to the controller clocks



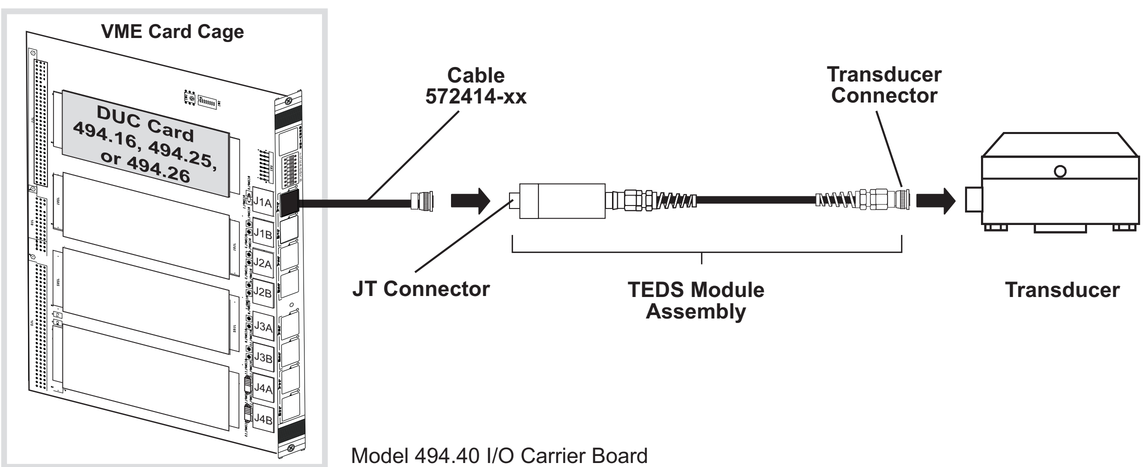
TEDS Transducer ID Module

About the TEDS Transducer ID Module

The TEDS Transducer ID module (TEDS module) includes a chip that can store TEDs IDs used to identify the transducer, and optional shunt-calibration resistors. The controller communicates with the TEDS module through a IEEE 1451.4, Class 2 smart transducer interface.

Transducer connections

TEDS Module options include different connectors that allow the TEDS module to connect directly to the transducer. The TEDS Transducer ID module connects to a DUC mezzanine card through a 572414-xx cable. This cable has an RJ-50 connector that connects to the Model 494.40 I/O Carrier card and a JT connector that connects to the TEDS module.



Model 494.40 I/O Carrier Board

Integrated shunt-calibration resistors

You can order the TEDS module with integrated shunt-calibration resistors. To use a TEDS module with integrated shunt-calibration resistors, you must insert a jumper plug (MTS part number 100-188-097) into that transducer's shunt calibration socket (located on the front of the I/O carrier board).

External shunt-calibration resistors

To use an external shunt-calibration resistor with a transducer, you can order a TEDS module with internal shorting jumpers. You must mount the external shunt-calibration resistor on a plug assembly (MTS part number 114-338-26) and plug that assembly into that transducer's shunt calibration socket (located on the front of the I/O carrier board).

Chapter 5

Digital I/O and Transition Boards

Digital I/O Hardware

Transition Boards

Digital I/O Hardware Devices

About Digital I/O Hardware

Digital I/O hardware allows the controller to drive output devices and monitor input devices. The following digital I/O hardware is compatible with MTS FlexTest 40/60/100/200 Controllers.

Digital I/O Hardware

Transition Board	Function
Model 493.72 Digital I/O Board	The Model 493.72 Digital I/O board is a transition board that provides 16 digital inputs and 16 digital outputs. The Model 493.72 board is typically used with the Model 494.31 16-Channel High-Current DI/O Breakout Box or the Model 493.31 16-Channel Low-Current Breakout Box.
Model 493.31 16-Channel Low-Current DI/O Breakout Box	Provides terminal plug connections for external input and output devices that connect to the Model 493.72 Digital I/O board.
Model 494.31 16-Channel High-Current DI/O Breakout Box	Provides terminal plug connections for external devices, connections for external input/output power supplies, and high-current switching circuits for digital outputs. The Model 494.31 16-Channel High-Current Breakout Box is typically used with the Model 493.72 Digital I/O board.
Model 494.32 8-Channel Digital I/O Breakout Box	Provides eight input and output opto-isolators with connectors that are used to connect high-current devices to the Model 494.44 System Board. ***Note*** *The Model 494.32 DI/O Breakout Box can only be used with the Model 494.44 System Board.*
Model 494.33 DI/O Power Supply	Supplies 24 V DC power to the following DI/O breakout boxes: • Model 494.31 16-Channel High-Current Breakout Box • Model 494.32 8-Channel High-Current Breakout Box

Model 493.72 Digital I/O Board

About the Model 493.72 Digital I/O Board

The Model 493.72 Digital I/O board is a transition board that provides 16 digital inputs and 16 digital outputs.

The Model 493.72 board is typically used with the Model 494.31 (high current) or the Model 493.31 (low current) breakout boxes.

Digital I/O Transition Board

Cables connected to J3 and J4 connect digital input and output circuits on the Model 493.72 board to the DI/O breakout box.

Digital Inputs (J3)–can be used to trigger test events within controller applications. Digital input signals are monitored by controller software. The Model 493.72 board includes configurable debounce circuits for digital inputs.

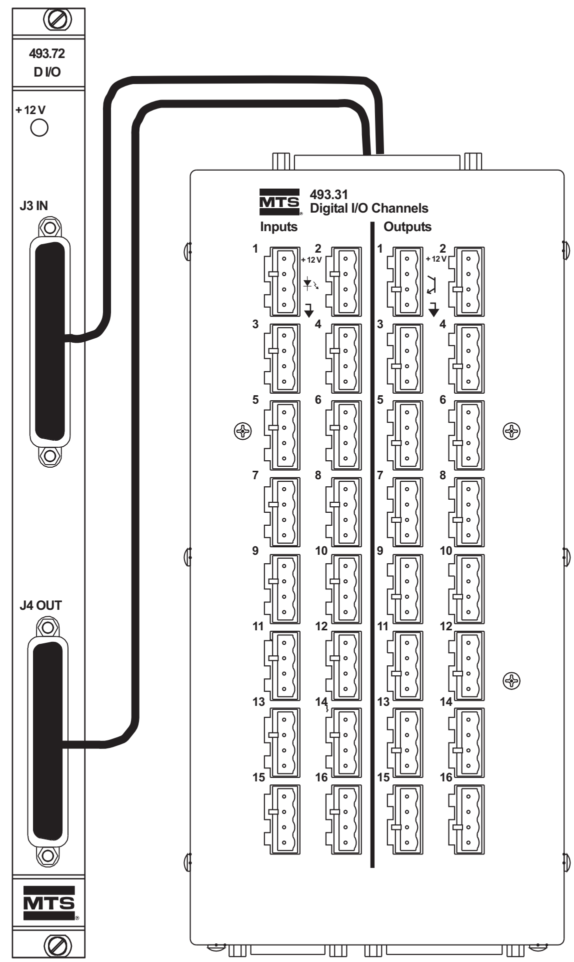
Digital Outputs (J4)–can be used to control external devices. Digital output signals are generated by controller software. These low-current output signals drive output devices that are connected to a DI/O breakout box.

Model 494.31 16-Channel High-Current DI/O Breakout Box

Provides terminal plug connections for external devices, connections for external input/output power supplies, and high-current switching circuits for digital outputs.

Model 493.31 16-Channel Low-Current DI/O Breakout Box

Provides terminal plug connections for external devices.



Model 494.72 Digital I/O Board

Model 494.31 or Model 493.31 DI/O Breakout Box

Specifications–Model 493.72 Digital I/O Board

Model 493.72 Digital I/O Board Specifications

PARAMETER	SPECIFICATION
Digital Inputs	**Connector J3 (D-37S)** Provides 16 optically isolated digital inputs: Input ON Voltage = 2.7–26 V DC (at 0.5 mA minimum) Input OFF Voltage = <0.8 V DC Input Resistance = 2 Kohm Jumper Selectable Debounce Times: 20 ms, 10 ms, 1 ms, 0.1 ms
Digital Outputs	**Connector J4 (D-37S)** Provides 16 optically isolated digital outputs: Output Voltage = 5–30 V DC Output Current = 20 mA maximum at 12 V DC

Low current Low-current applications that use the Model 493.31 DI/O Breakout Box typically use the 12 VDC power from the Model 493.72 board.

High current High-current applications that use the Model 494.31 DI/O Breakout Box typically use the output circuits from the Model 493.72 board to drive the high-current switching circuits on the breakout box.

For more information For device wiring diagrams see:
“Model 493.31 16-Channel Low-Current DI/O Breakout Box” on page 210
“Model 494.31 16-Channel High-Current DI/O Breakout Box” on page 214.

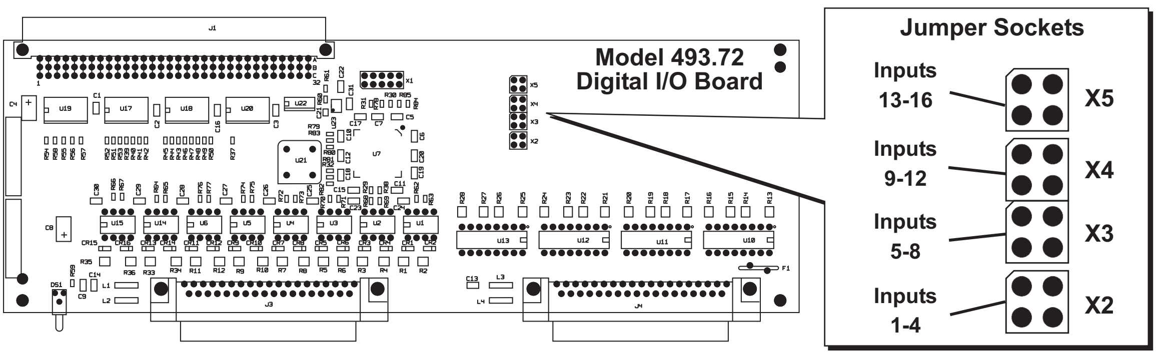
How to Change the Debounce Settings on the Model 493.72 Digital I/O Board

If necessary, install jumpers on the Model 493.72 Digital I/O board to change the debounce time for each group of four digital inputs.

Note *The board ships with no jumpers installed, which provides a default debounce time of 20 ms for each input.*

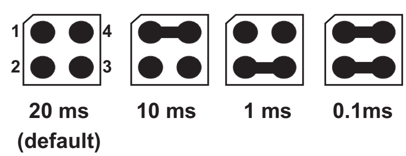
1. Locate the four jumper sockets (X2-X5) on the Model 493.72 Digital I/O board.

   Each jumper socket sets the debounce time for a group of four inputs.



2. Install jumpers to change the debounce time.

Debounce Jumper Settings



Model 493.31 16-Channel Low-Current DI/O Breakout Box

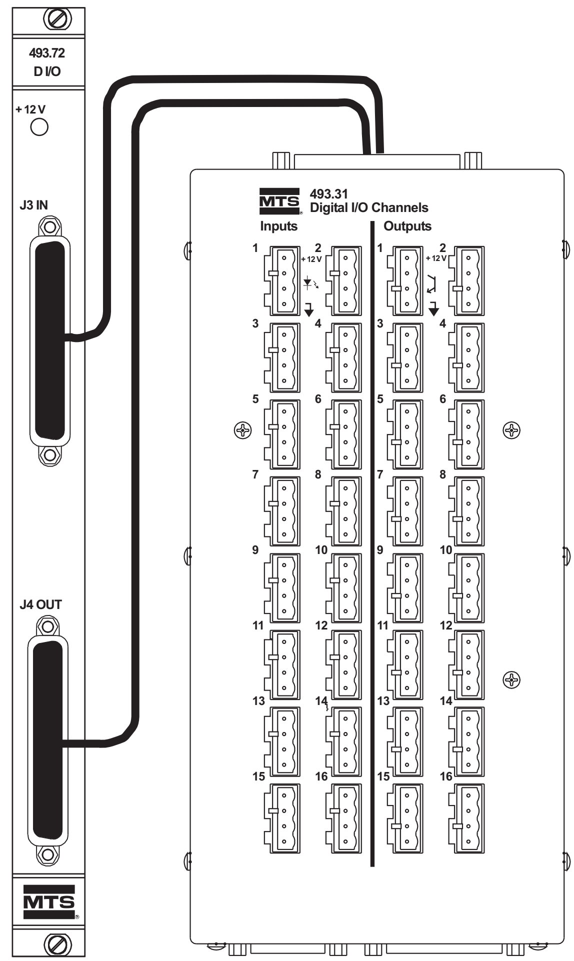
About the Model 493.31 DI/O Breakout Box

The Model 493.31 16-Channel Low-Current DI/O Breakout Box provides a terminal plug interface to external devices that are monitored and controlled directly by the Model 493.72 Digital I/O board.

The breakout box connects to the digital I/O board through two cables, one for the digital inputs and one for the digital outputs.

Current Capabilities

Because the Model 493.31 Breakout Box only includes terminal plug connections, input and output devices are monitored and driven by circuits on the Model 493.72 Digital I/O Board.



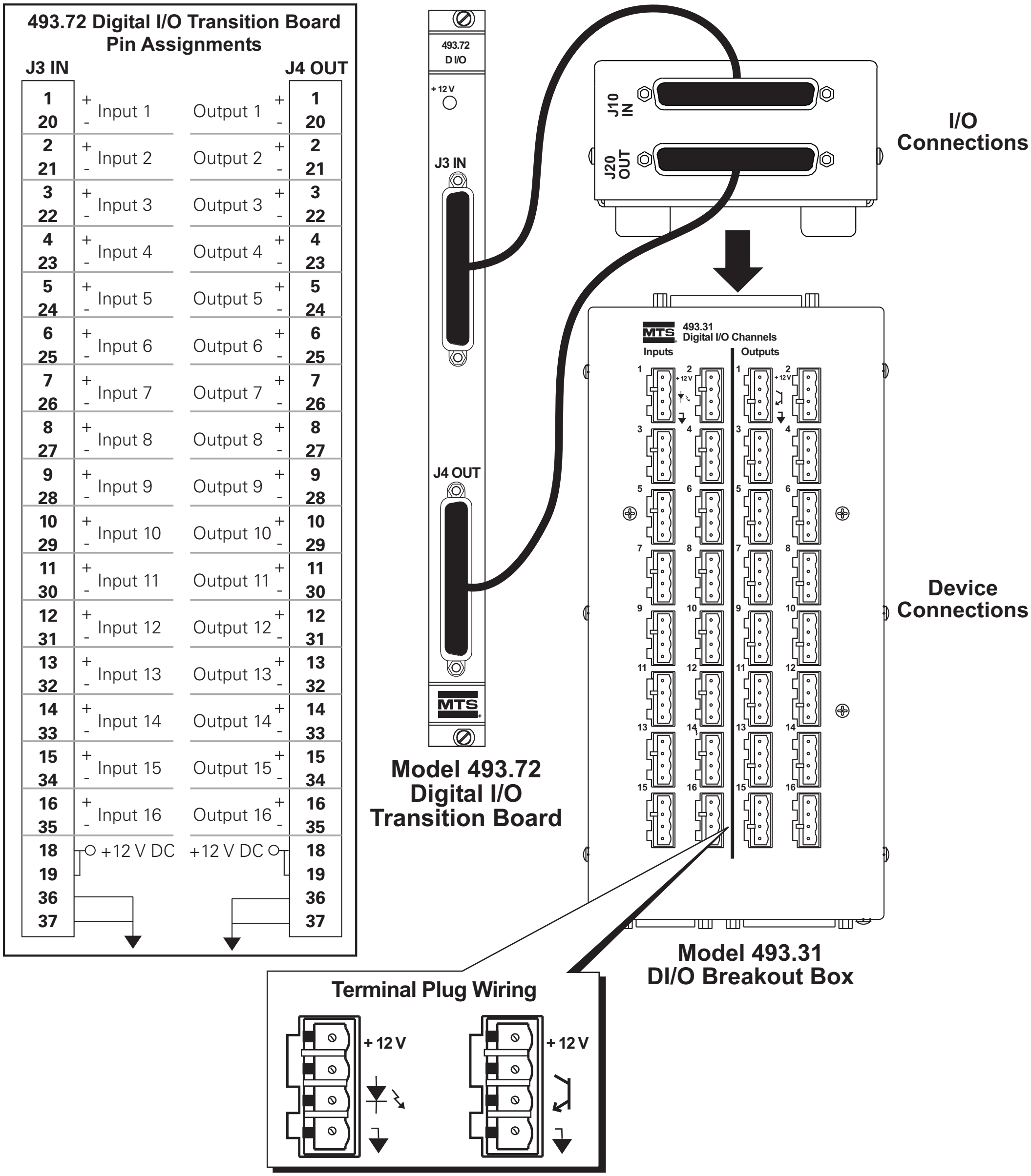
Model 494.72 Digital I/O Board

Model 493.31 16-Channel Low-Current DI/O Breakout Box

For more information

For more information on the current capabilities of the Model 493.72 board, see “Specifications–Model 493.72 Digital I/O Board” on page 208.

Digital I/O Connections for the Model 493.31 DI/O Breakout Box



493.72 Digital I/O Transition Board Pin Assignments

J3 IN			J4 OUT
1 (+), 20 (-)	Input 1	Output 1	1 (+), 20 (-)
2 (+), 21 (-)	Input 2	Output 2	2 (+), 21 (-)
3 (+), 22 (-)	Input 3	Output 3	3 (+), 22 (-)
4 (+), 23 (-)	Input 4	Output 4	4 (+), 23 (-)
5 (+), 24 (-)	Input 5	Output 5	5 (+), 24 (-)
6 (+), 25 (-)	Input 6	Output 6	6 (+), 25 (-)
7 (+), 26 (-)	Input 7	Output 7	7 (+), 26 (-)
8 (+), 27 (-)	Input 8	Output 8	8 (+), 27 (-)
9 (+), 28 (-)	Input 9	Output 9	9 (+), 28 (-)
10 (+), 29 (-)	Input 10	Output 10	10 (+), 29 (-)
11 (+), 30 (-)	Input 11	Output 11	11 (+), 30 (-)
12 (+), 31 (-)	Input 12	Output 12	12 (+), 31 (-)
13 (+), 32 (-)	Input 13	Output 13	13 (+), 32 (-)
14 (+), 33 (-)	Input 14	Output 14	14 (+), 33 (-)
15 (+), 34 (-)	Input 15	Output 15	15 (+), 34 (-)
16 (+), 35 (-)	Input 16	Output 16	16 (+), 35 (-)
18, 19	+12 V DC	+12 V DC	18, 19
36, 37			36, 37

Digital Input Connections for the Model 493.31 DI/O Breakout Box

The **J3 In** connector on the Model 493.72 board accepts up to sixteen digital-input signals from external devices that are connected to the Model 493.31 DI/O Breakout Box. These signals are monitored by controller software.

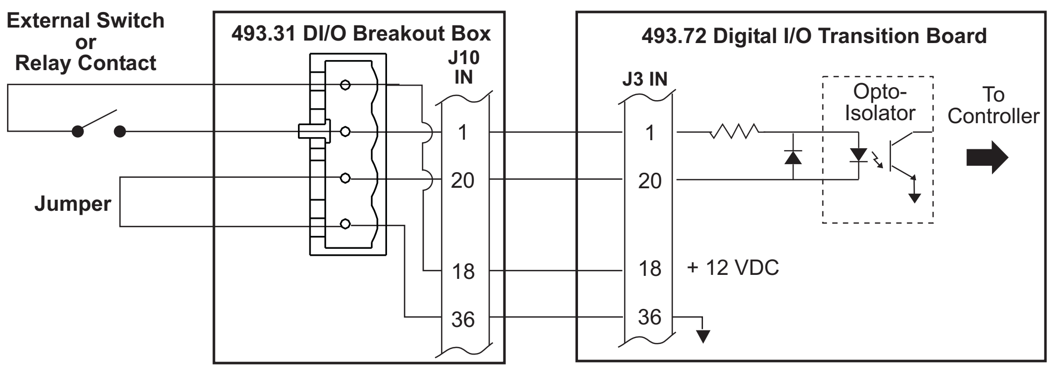
Breakout box connections

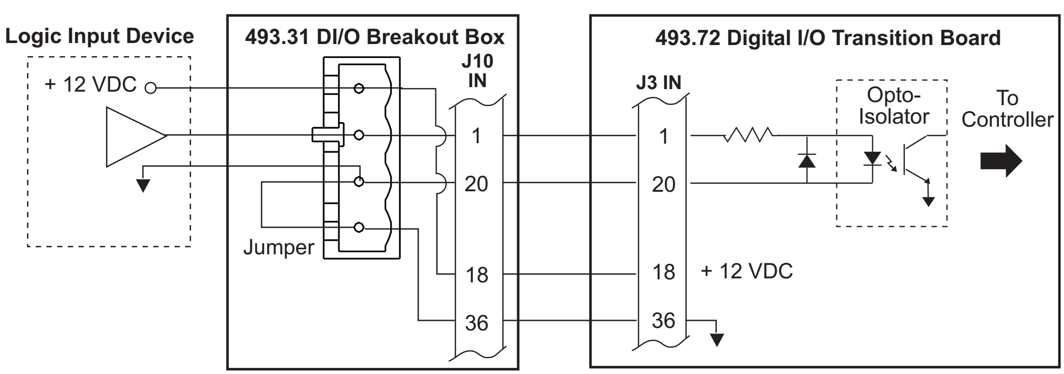
Each input device connects to a terminal plug that is inserted into one of the 16 input sockets on the D I/O breakout box.

Model 493.72 board connections

A cable from **J10** on the DI/O breakout box connects all 16 input-device signals to **J3** on the Model 493.72 board. Each digital input on the Model 493.72 board has an opto isolator that is controlled by the input device.

Note *Digital inputs have 20-ms debounce circuits. If required, install jumpers on the Model 493.72 board to shorten the debounce times.*





For more information

The connection drawings show pin assignments for input 1. For a complete list of pin assignments, see "Digital I/O Connections for the Model 493.31 DI/O Breakout Box" on page 211.

Digital Output Connections for the Model 493.31 Breakout Box

The **J4 Out** connector provides up to sixteen digital output signals that can control external devices. These digital-output signals are controlled by controller software.

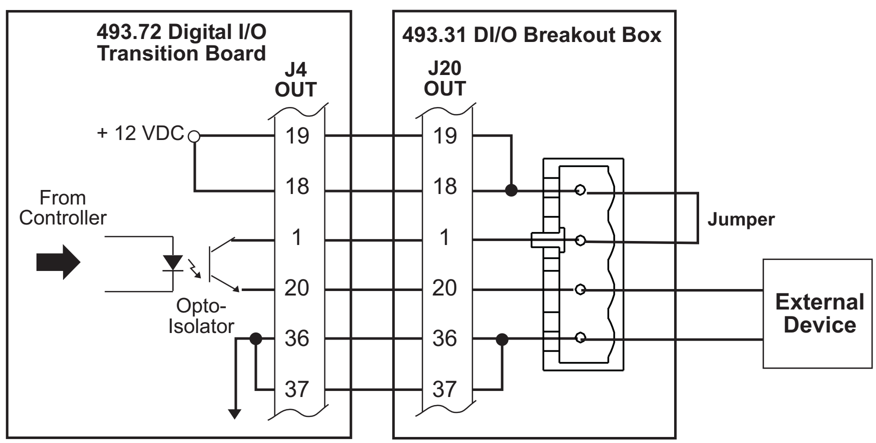
Breakout box connections

Device connections–each output device connects to a terminal plug that is inserted into one of the 16 output sockets on the digital I/O breakout box.

Power connections–you can connect an external power supply to connector **J21**. This supply voltage is distributed to each of the 16 output sockets on the digital I/O breakout box.

DI/O board connections

A cable from **J4** on the Model 493.72 Digital I/O board connects all 16 digital-output signals to connector **J20** on the Digital I/O Breakout box. Each digital output on the Model 493.72 board has an opto-isolator that controls the power to a device connected to the digital I/O breakout box.



For more information

The connection drawings show pin assignments for output 1. For a complete list of pin assignments, see “Digital I/O Connections for the Model 493.31 DI/O Breakout Box” on page 211.

Model 494.31 16-Channel High-Current DI/O Breakout Box

About the Model 494.31 DI/O Breakout Box

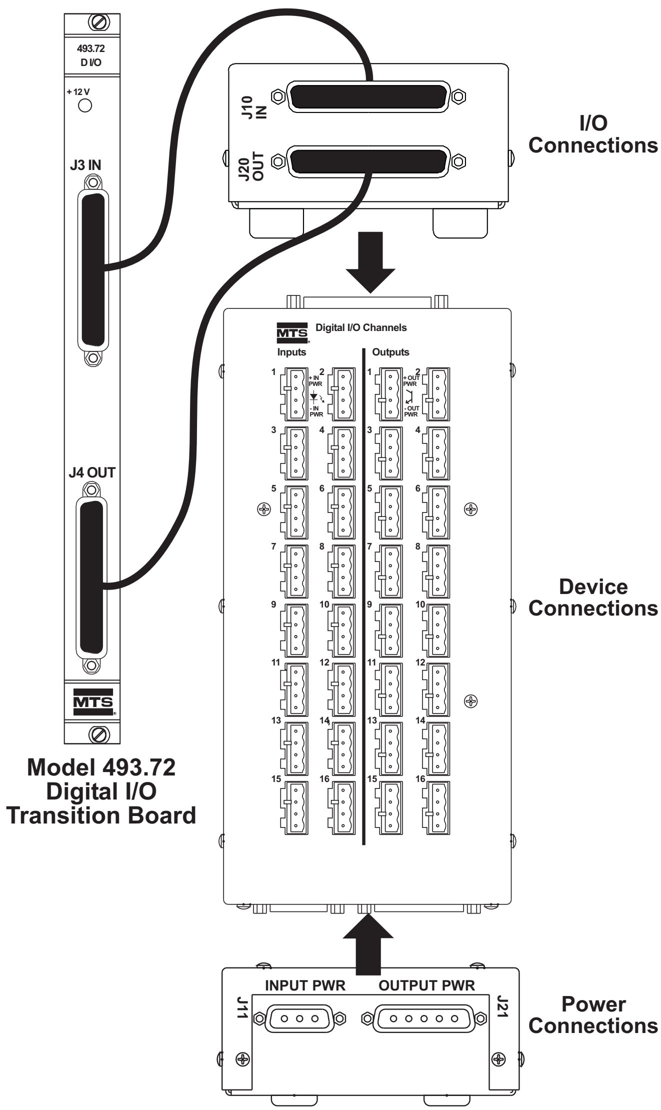
The Model 494.31 16-Channel High-Current DI/O Breakout Box provides a terminal-plug interface and output-device drivers that are monitored and controlled by the Model 493.72 Digital I/O board.

The breakout box connects to the Model 493.72 Digital I/O board through two cables, one for the digital inputs and one for the digital outputs.

Device connections–each input/output device connects to a terminal plug that is inserted into one of the 16 input/output sockets on the DI/O breakout box.

Power connections–you can connect an external input and output power supply to the Model 494.31 DI/O Breakout Box. Input/output supply voltages are distributed to the respective input/output sockets on the digital I/O breakout box.

High-current, power-switching circuits–each digital output includes a power MOSFET that is controlled by the corresponding opto isolator on the Model 493.72 Digital I/O board.



Model 493.72 Digital I/O Transition Board

Specifications–Model 494.31 DI/O Breakout Box

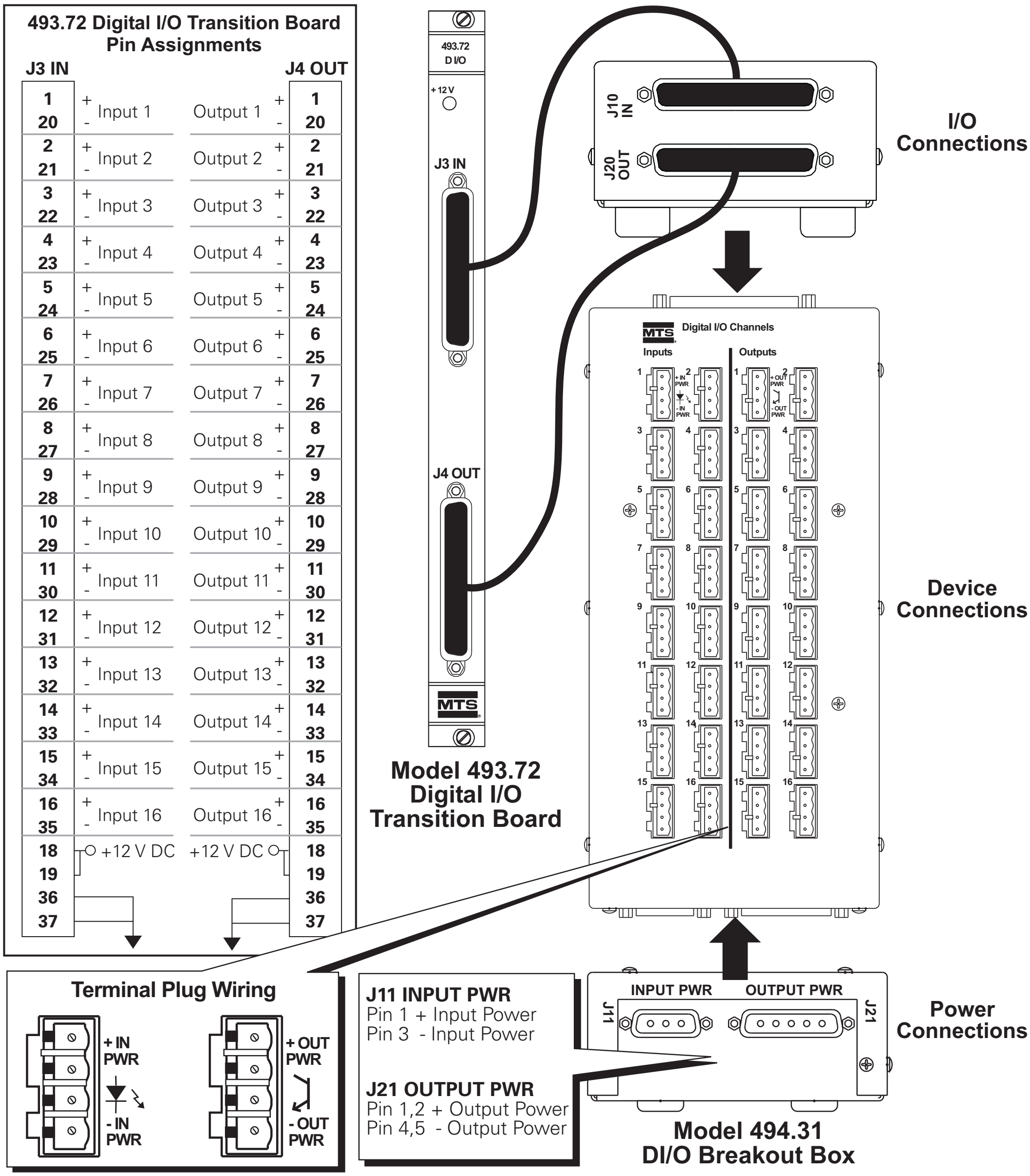
Model 494.31 DI/O Breakout Box Specifications

PARAMETER	SPECIFICATION
Model 494.31 Breakout Box Output Circuits	The high-current digital I/O breakout box includes 16 power MOSFETS (one for each output) that provide the high-current output for output devices. The low-current opto isolators on the Model 493.72 board drive high-current MOSFETS on the digital I/O breakout box. Maximum Output Voltage = 30 V DC Maximum Output Current = 2 A

For more information

For more information on the Model 493.72 Digital I/O Board, see "Model 493.72 Digital I/O Board" on page 207

Digital I/O Connections for the Model 494.31 DI/O Breakout Box



Digital Input Connections for the Model 494.31 DI/O Breakout Box

The **J3 In** connector accepts up to sixteen digital-input signals from external devices. These signals are monitored by controller software.

Breakout box connections

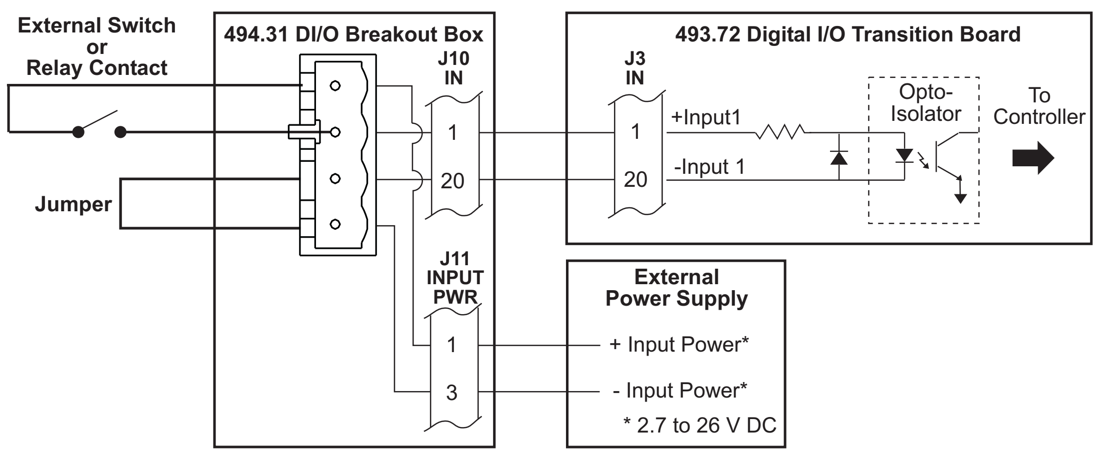
Device connections–each input device connects to a terminal plug that is inserted into one of the 16 input sockets on the D I/O breakout box.

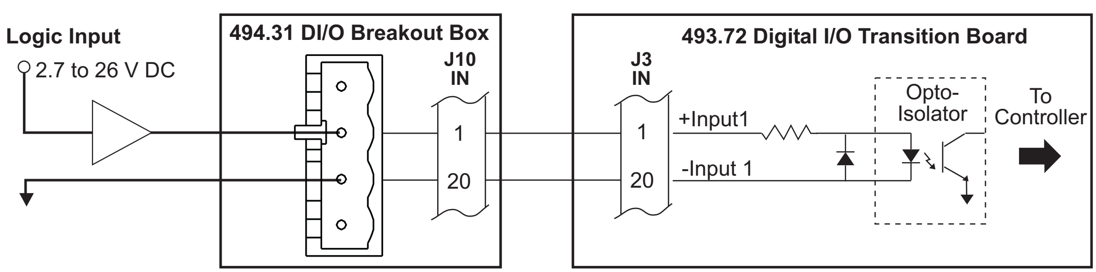
Power connections–if required, you can connect an external power supply to connector **J11**. This supply voltage is distributed to each of the 16 input sockets on the Model 494.31 DI/O Breakout Box.

Model 493.72 Digital I/O board connections

A cable from **J10** on the DI/O breakout box connects all 16 input-device signals to **J3** on the Model 493.72 board. Each digital input on the Model 493.72 board has an opto isolator that is controlled by the input device.

Note *Digital inputs have 20-ms debounce circuits. If required, you install jumpers on the Model 493.72 Digital I/O board to shorten the debounce times.*





Digital Output Connections for the Model 494.31 Breakout Box

The **J4 Out** connector provides up to sixteen digital output signals that can control external devices. These digital-output signals are controlled by controller software.

Breakout box connections

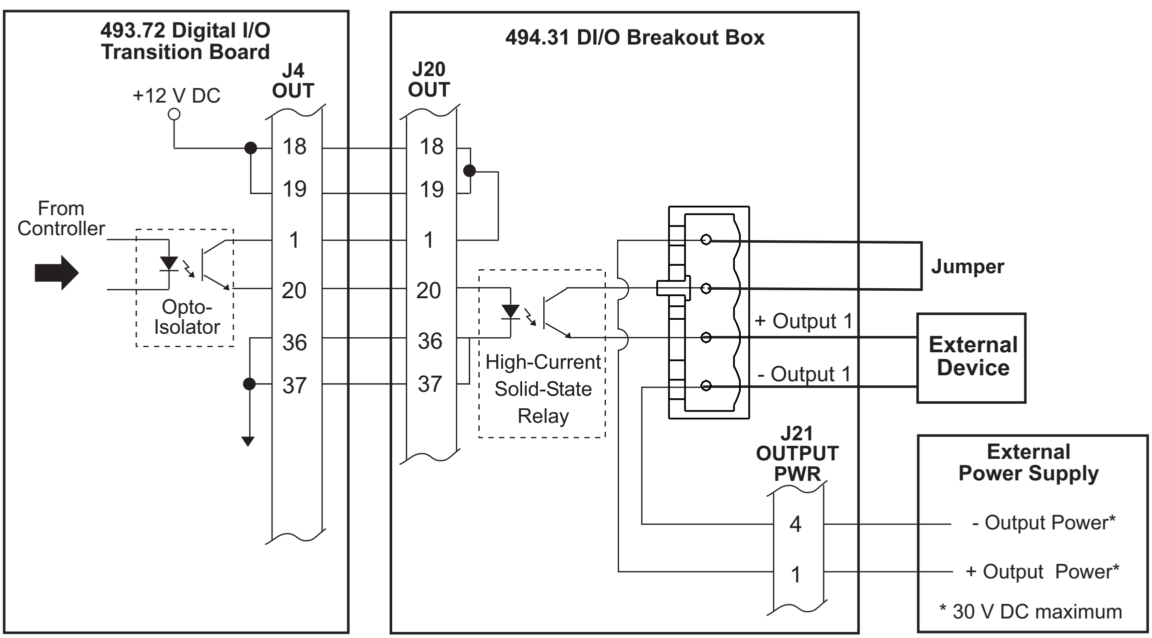
Device connections–each output device connects to a terminal plug that is inserted into one of the 16 output sockets on the digital I/O breakout box.

Power connections–you can connect an external power supply to connector **J21**. This supply voltage is distributed to each of the 16 output sockets on the digital I/O breakout box.

High-current, power-switching circuits–each digital output includes a power MOSFET that is controlled by the corresponding opto isolator on the Model 493.72 Digital I/O board. Each output MOSFET is rated for a maximum of 30 V DC and 2 A.

DI/O board connections

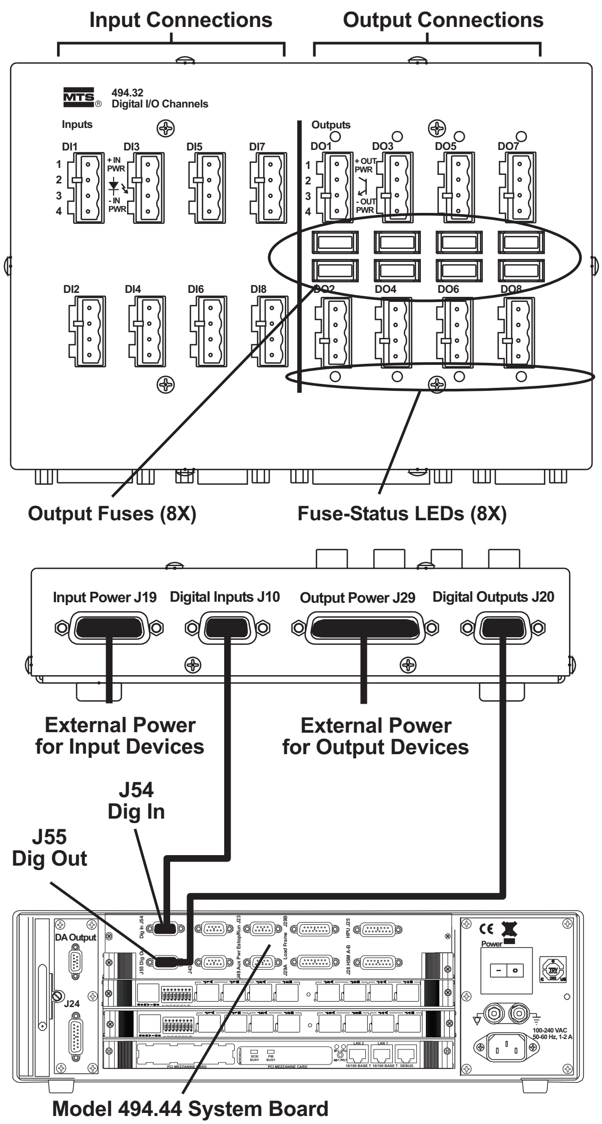
A cable from **J4** on the Model 493.72 Digital I/O board connects all 16 digital-output signals to connector **J20** on the Digital I/O Breakout box. Each digital output on the Model 493.72 board has an opto isolator that controls the corresponding power MOSFET on the digital I/O breakout box.



Model 494.32 8-Channel DI/O Breakout Box

About the Model 494.32 DI/O Breakout Box

The Model 494.32 DI/O Breakout Box is used to connect input and output devices to the Model 494.44 System Board.



Note *The Model 494.32 DI/O Breakout Box can only be used with the Model 494.44 System Board.*

Inputs

Includes opto-isolator circuits, terminal plug connections, and external power connections for eight input devices.

- Connections for one or two external input supply voltages (J19).
- Self-resetting fuses for each plug's power and ground connections.

Outputs

Includes high-current opto-isolator circuits, terminal plug connections, and external power connections for eight output devices.

- Replaceable fuses for each output.
- Fuse-status LEDs for each output.
- Connections for one or two external output supply voltages (J29).

Mounting options

Includes four rubber feet for mounting on a flat surface. An optional DIN rail mounting kit is also available.

Specifications–Model 494.32 DI/O Breakout Box

Device connections

Individual input and output connections require a four-position terminal plug (included with the breakout box). Input and output terminal plugs have different keying.

Output circuits

PARAMETER	SPECIFICATION
Maximum Output Voltage	30 V DC
Maximum Output Current	2 A (per channel)
Output Fuse	3 A, fast-blow fuse (one per channel)
Output Fuse Voltage Drop	0.15 V typical
Output-On Resistance	0.03 ohm maximum

Input circuits

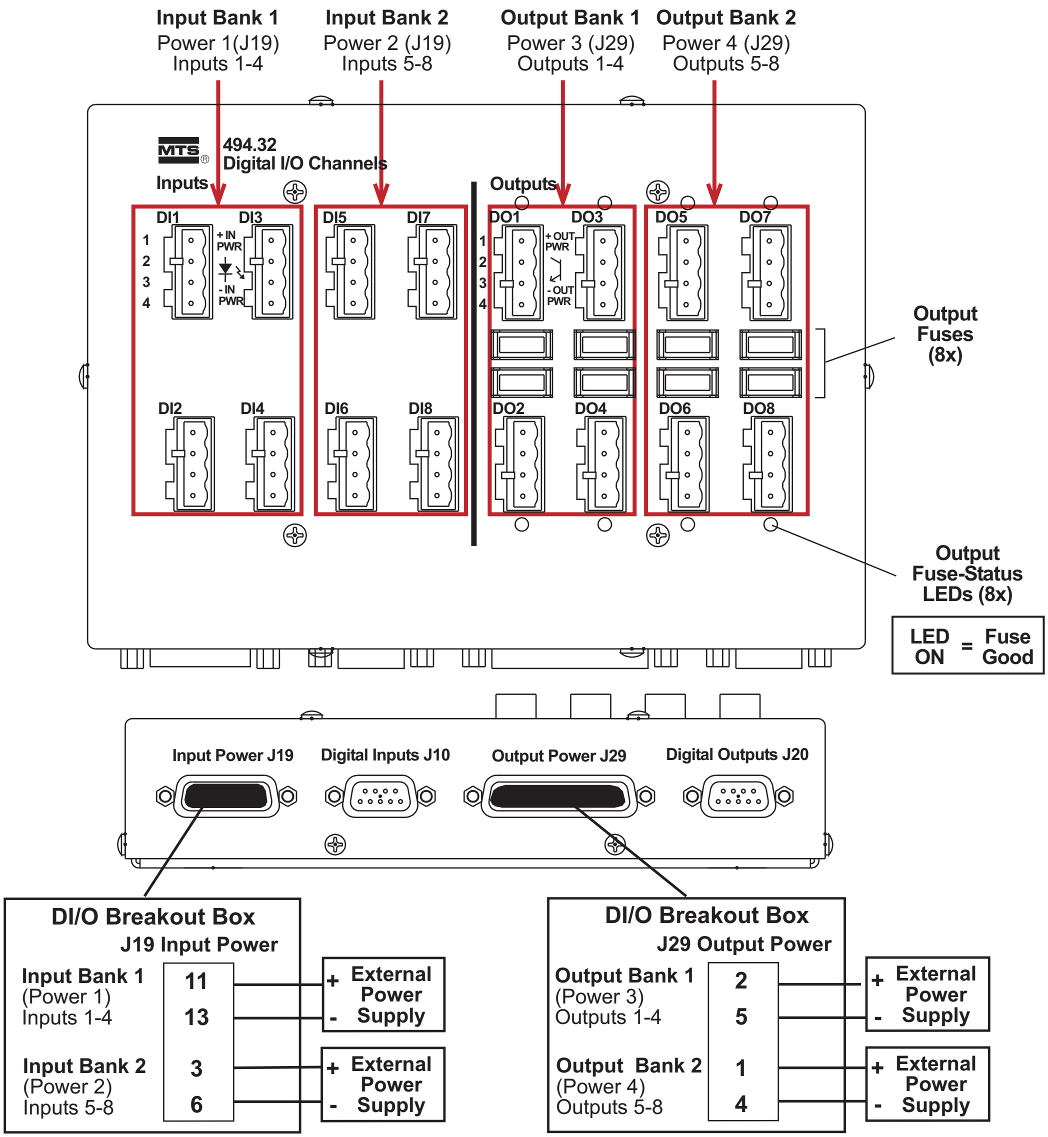
PARAMETER	SPECIFICATION
Input Voltage	3.3 to 24 V DC
Input Current	3.35 mA maximum (Vin = 5 V DC) 18 mA maximum (Vin = 24 V DC)
Input Power Fuses	200 mA, self-resetting (two per channel)
Logic Input Differential Voltage	3.3 V DC minimum

For more information

For more information on DI/O power supplies, see “Model 494.33 Digital I/O Power Supply” on page 225.

Power Connections for the Model 494.32 DI/O Breakout Box

Input and output channels are grouped into banks that can be independently powered.



Digital Input Connections for the Model 494.32 DI/O Breakout Box

The Model 494.32 DI/O Breakout Box includes eight opto-isolators that accept signals from input devices (switch contacts, logic inputs). The opto-isolators convert the input signals to signals that are compatible with the input circuits (J54) on the Model 494.44 System Board.

Device connections

Each input device connects to a terminal plug that is inserted into one of the eight input sockets on the breakout box.

Power connections

You can connect up to two input power sources to connector **J19 Input Power**. When two power sources are used, inputs 1–4 are powered by one source and inputs 5–8 are powered by the other source. These supply voltages are internally wired to pins 1 and 4 of each input socket.

Note *Input devices can also receive power from power sources that are not connected to the breakout box.*

Input power fuses

The internal power and ground connections for each socket include a self-resetting fuse.

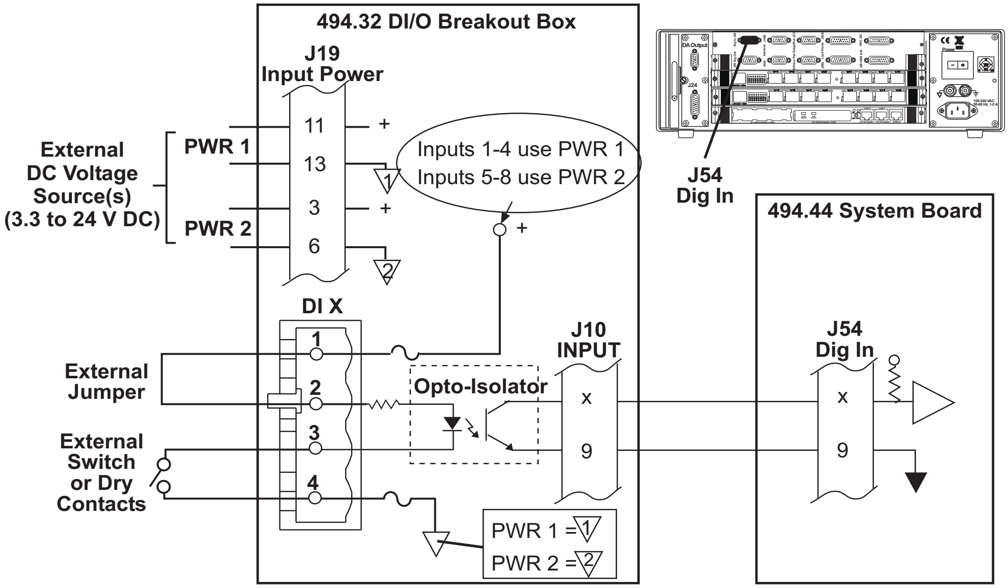
Debounce circuits

The breakout box does not include debounce circuitry. Each digital input has a 20-ms debounce circuit located on the Model 494.44 System Board.

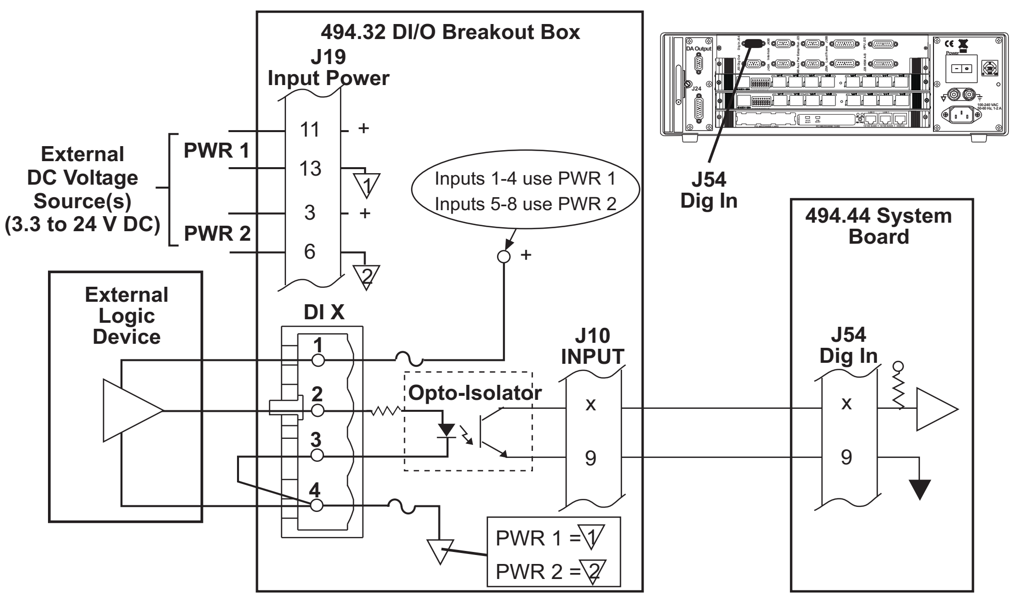
System board connections

A cable from **J10 Digital Inputs** on the DI/O Breakout Box connects all eight input-device signals to **J54 Dig In** on the Model 494.44 System Board.

Digital Input Connections for Switches or Dry Contacts



Digital Input Connections for Logic Devices



Digital Output Connections for the Model 494.32 DI/O Breakout Box

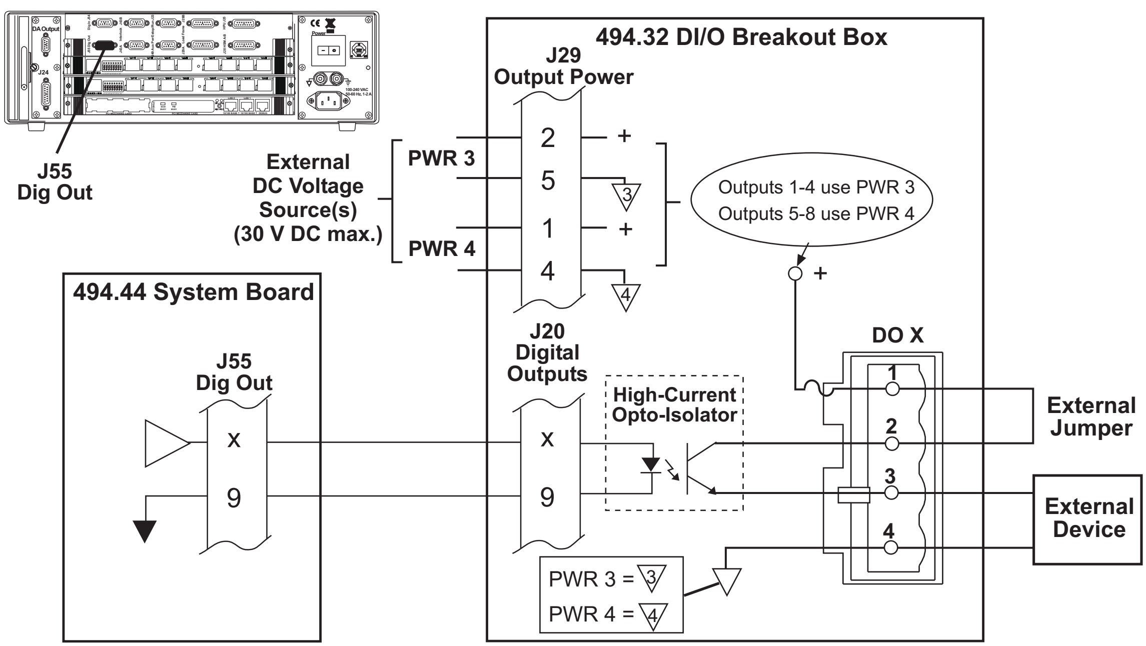
Output signals from the Model 494.44 System Board drive high-current opto-isolators on the DI/O breakout box. These high-current opto-isolators supply the higher voltage and current required by output devices.

Device connections Each output device connects to a terminal plug that is inserted into one of the eight output sockets on the DI/O breakout box.

Power connections You can connect up to two output power sources to connector **J29 Output Power**. When two power sources are used, outputs 1-4 are powered by one source and outputs 5-8 are powered by the other source. These supply voltages are internally wired to pins 1 and 4 of each of the eight input sockets.

Output fuses Each output connection includes a replaceable 3-amp fuse.

Model 494.44 System Board connections A cable from the **J55 Dig Out** connector on the Model 494.44 System Board connects all eight digital-output signals to connector **J20 Digital Outputs** on the DI/O breakout box.



Model 494.33 Digital I/O Power Supply

About the Model 494.33 Digital I/O Power Supply

The Model 494.33 DI/O Power Supply can provide 24 V DC power to the following DI/O breakout boxes:

- Model 494.31 16-Channel Low-Current DI/O Breakout Box
- Model 494.32 8-Channel DI/O Breakout Box

Power Output Connections

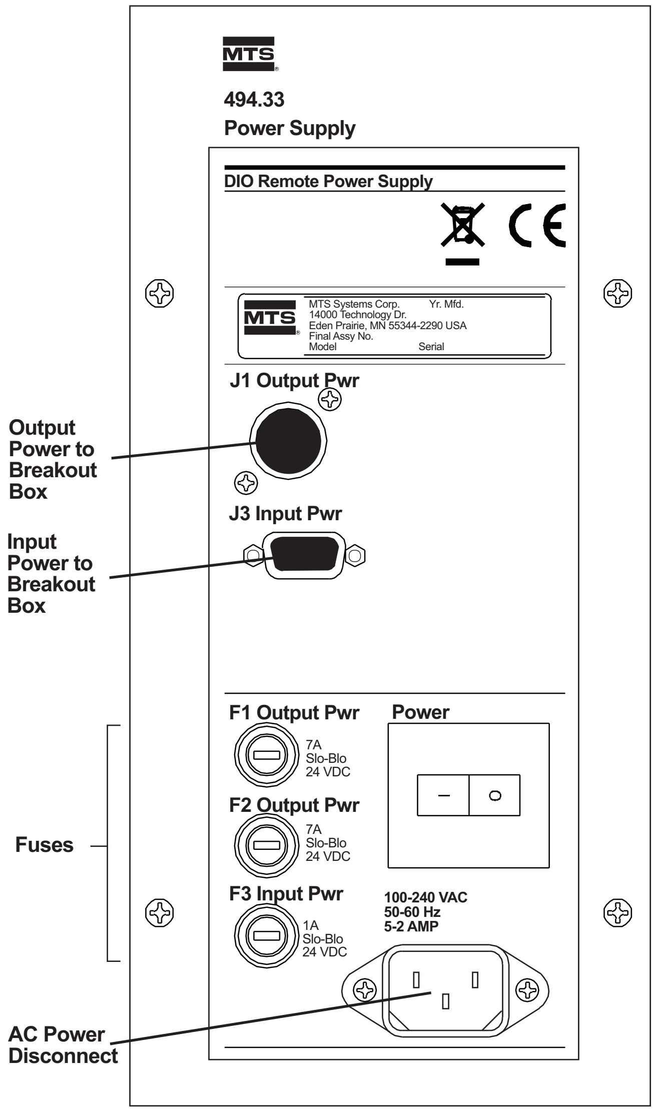
J1 Output Pwr—supplies two separate 24 V DC, 7-amp power feeds for breakout-box output devices.

J3 Input Pwr—supplies 24 V DC, 1-amp power for breakout-box inputs such as switches and external logic devices.

Note *All power outputs are fused.*

Mounting Options

The power supply includes four rubber feet for mounting on a flat surface. The rubber feet are removable to allow DIN rail mounting.



Specifications–Model 494.33 DI/O Power Supply

Electrical

PARAMETER	SPECIFICATION
Input Voltage	100–240 V AC, 5–2 A, single phase
“J1 Output Pwr” Output	24 V DC, 14 A maximum (7 A per output)* Fuse: 7 A, 250 V, Slo-Blo
“J3 Input Pwr” Output	24 V DC, 1 A maximum* Fuse:1 A, 250 V, Slo-Blo

* The maximum cable length for all power cables is 6 m (20 ft).

WARNING

When used in an electrical circuit, the voltage and current (amperage) ratings of a fuse are selected to limit the capacity of the circuit and to provide protection of the devices (equipment) in the circuit.

Using fuses with ratings that are different from the ones specified can result in fire or electrical damage to the equipment. Fire can also result in injury or death to personnel.

Before replacing a fuse, troubleshoot and correct the cause. Look for damaged conductors (for example, wires, switches, relays, terminals, and so on) and faulty equipment. Replace a fuse only with one that has the same ratings.

AC power disconnect

To disconnect AC power from the power supply, unplug the AC power cable from the front of the power supply.

Environmental requirements

Parameter	Specification
Temperature	5°C–40°C (41°F–104°F)
Humidity	5–85%, non-condensing
Ventilation	For proper ventilation, allow 51 mm (2 in) clearance on each end (fan intake and exhaust) of the power supply. The top side of the power supply (where the cables connect) requires a minimum clearance of 15.24 cm (6 in).

Dimensions

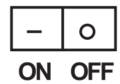
Parameter	Specification
Length	29.2 cm (11.5 in)
Width	13.3 cm (5.25 in)
Height	14.0 cm (5.5 in)
Weight	3.2 kg (7 lb)

Fuse Replacement—Model 494.33 DI/O Power Supply

The Model 494.33 DI/O Power Supply includes output fuses and a resettable circuit breaker that is built into the power switch.

Fuse replacement

1. If required, shut down system hydraulics.
2. Switch the **Power** switch on the front of the power supply to the off position.



3. Check the fuses.

   Replace any blown fuses with the exact replacement value listed below:

   Fuse FI and F2 (Output Pwr)—7 A, 250 V, Slo-Blo

   Fuse F3 (Input Pwr)—7 A, 250 V, Slo-Blo

WARNING

When used in an electrical circuit, the voltage and current (amperage) ratings of a fuse are selected to limit the capacity of the circuit and to provide protection of the devices (equipment) in the circuit.

Using fuses with ratings that are different from the ones specified can result in fire or electrical damage to the equipment. Fire can also result in injury or death to personnel.

Before replacing a fuse, troubleshoot and correct the cause. Look for damaged conductors (for example, wires, switches, relays, terminals, and so on) and faulty equipment. Replace a fuse only with one that has the same ratings.

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4. Determine the cause of the blown fuse and fix the problem.
5. If required, check the controller input/output status to make sure that they are set to a safe state.
6. Switch the **Power** switch on the front of the power supply to the on position.

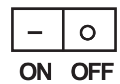
Circuit Breaker Reset—Model 494.33 DI/O Power Supply

The Model 494.33 DI/O Power Supply includes a circuit breaker that is built into the power switch.

Important *You should develop a circuit breaker reset procedure based on a risk assessment for your system.*

Reset procedure

1. If required, shut down system hydraulics.
2. Switch the **Power** switch on the front of the power supply to the off position.



3. If required, check the controller input/output status to make sure that they are set to a safe state.
4. Switch the **Power** switch on the front of the power supply to the on position.

   Switching the power switch off and then on resets the circuit breaker. If the overcurrent condition still exists, the circuit breaker continues to trip (remove power) each time it is reset.

WARNING

Resetting the circuit breaker restores power to digital input and output (DI/O) devices. Resetting the circuit breaker can result in unexpected actuator movement and unexpected operation of DI/O devices.

Unexpected actuator movement and operation of DI/O devices can result in injury to personnel or damage to the equipment.

Follow a circuit breaker reset procedure that is based on a risk assessment that you performed for your site.

Overtemperature Reset—Model 494.33 DI/O Power Supply

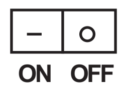
The Model 494.33 DI/O Power Supply includes an overtemperature circuit. This circuit removes all power outputs if the internal temperature is too high.

Important *You should develop an overtemperature reset procedure based on a risk assessment for your system.*

Reset procedure

Perform the following procedure to reset the overtemperature circuit and restore DC power output:

1. If required, shut down system hydraulics.
2. Switch the **Power** switch on the front of the power supply to the off position.



3. Determine the cause of the overtemperature condition (blocked filter, damaged fans, inadequate ventilation clearance) and fix the problem.
4. If required, check the controller input/output status to make sure that they are set to a safe state.
5. Switch the **Power** switch on the front of the power supply to the on position.

   Switching the power switch off and then on resets the overtemperature circuit.

WARNING

Resetting the overtemperature circuit restores power to digital input and output (DI/O) devices. Resetting the overtemperature circuit can result in unexpected actuator movement and unexpected operation of DI/O devices.

Unexpected actuator movement and operation of DI/O devices can result in injury to personnel or damage to the equipment.

Determine the cause of the overtemperature condition and fix the problem. Follow an overtemperature reset procedure that is based on a risk assessment that you performed for your site.

Power Connections for the Model 494.31 DI/O Breakout Box

To maintain EMC compliance, power cables must comply with the following specifications.

Note *The maximum cable length for all power cables is 6 m (20 ft).*

For cable pin assignments, see "Power Connections Model 494.31 DI/O Breakout Box" on page 232.

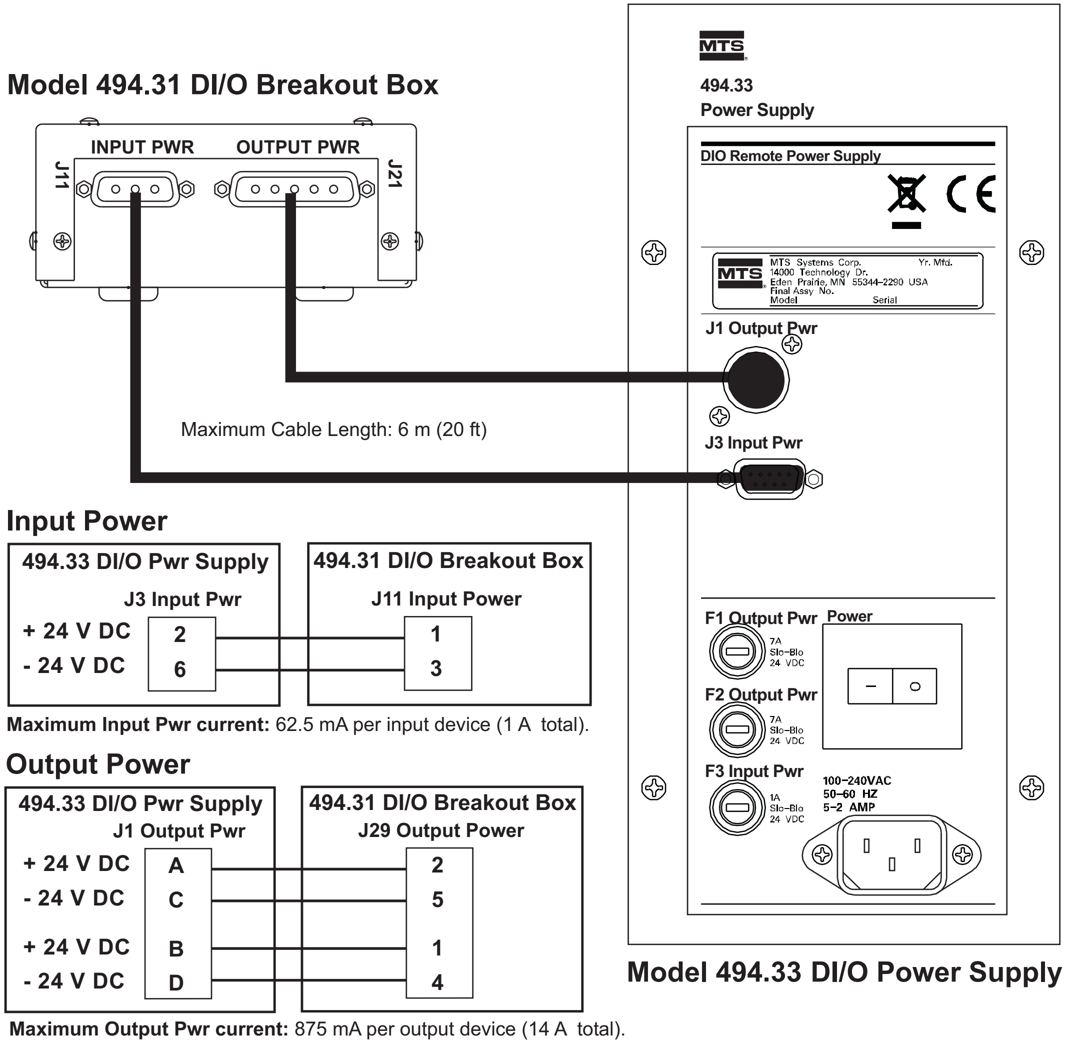
Output Pwr cable

Parameter	To J1, 494.33 Power Supply	To P21, 494.31 Breakout Box
Connector	4-contact, PT male connector	5-power contact, type D, female EMI connector
Backshell	Non-conductive with strain relief	EMI metallized plastic or metal
Cable	16 AWG, 4-conductor with braided shield connected to the backshell at the DI/O breakout box only.	

Input Pwr cable Model 494.31 DI/O Breakout Box

Parameter	To J1, 494.33 Power Supply	To P11, 494.31 Breakout Box
Connector	9-contact, type D, male EMI connector	3-power contact, type D, female EMI connector
Backshell	EMI metallized plastic or metal	
Cable	18 AWG, 4-conductor with braided shield connected to the backshell at the DI/O breakout box only.	

Power Connections Model 494.31 DI/O Breakout Box



For more information

For more information on the Model 494.31 DI/O Breakout Box, see “Model 494.31 16-Channel High-Current DI/O Breakout Box” on page 214.

Power Connections for the Model 494.32 DI/O Breakout Box

To maintain EMC compliance, power cables must comply with the following specifications.

Note *The maximum cable length for all power cables is 6 m (20 ft).*

For cable pin assignments, see "Power Connections Model 494.32 DI/O Breakout Box" on page 234.

Output Pwr cable

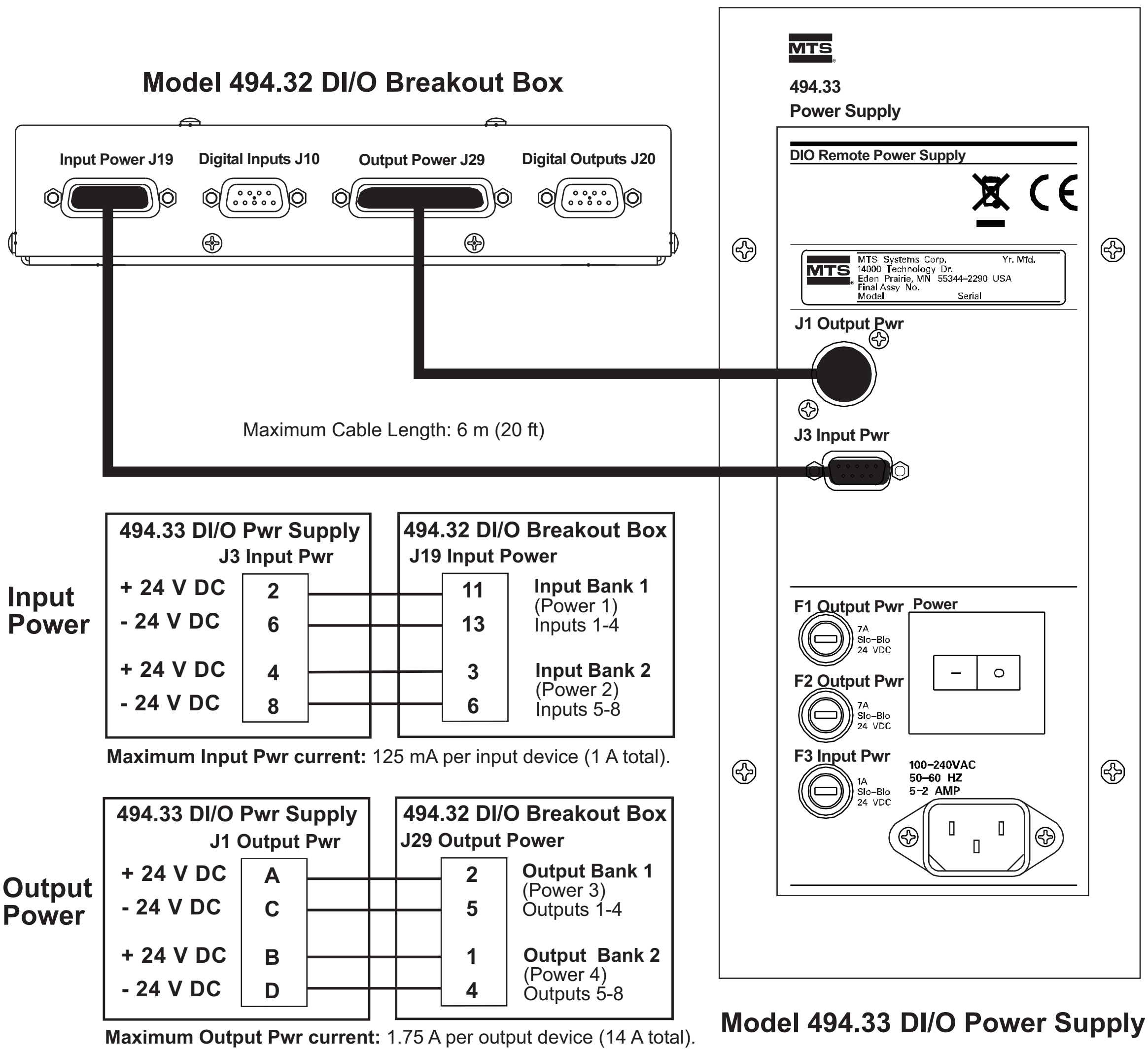
Parameter	To J1, 494.33 Power Supply	To P29, 494.32 Breakout Box
Connector	4-contact, PT male connector	5-power contact, type D, female EMI connector
Backshell	Non-conductive with strain relief	EMI metallized plastic or metal
Cable	16 AWG, 4-conductor with braided shield connected to the backshell at the DI/O breakout box only.	

Input Pwr cable Model 494.32 DI/O Breakout Box

Parameter	To J1, 494.33 Power Supply	To J3, 494.32 Breakout Box
Connector	9-contact, type D, male EMI connector	15-contact, type D, female EMI connector
Backshell	EMI metallized plastic or metal	
Cable	18 AWG, 4-conductor with braided shield connected to the backshell at the DI/O breakout box only.	

Power Connections Model 494.32 DI/O Breakout Box

Input and output channels are grouped into banks that are independently powered.



For more information

For more information on the Model 494.32 DI/O Breakout Box, see "Model 494.32 8-Channel DI/O Breakout Box" on page 219.

Transition Boards

About Transition Boards

Transition boards plug into the transition card cage located in the rear of the chassis. Each transition board allows external devices to interface with the controller.

Note *The Model 494.04 Chassis does not use transition boards.*

Series 494 Transition Boards

Transition Board	Function
Model 493.72 Digital I/O	Contains sixteen general purpose digital input channels and sixteen general purpose digital output channels.
Model 493.73 HPU Interface	Provides an interface between the controller and a hydraulic power unit (HPU) and other devices.
Model 494.74 Two-Station HSM Interface	Provides an interface between the controller and a hydraulic service manifold and other devices. This is a one-slot board that provides off/low/high HSM control for up to two stations.
Model 493.74 Two-Station HSM Interface	Interfaces the controller with a hydraulic service manifold and other devices. This is a two-slot board that provides off/low/high and proportional HSM control for up to two stations.
Model 494.75 8-Input BNC	Provides eight BNC connections for analog input signals and RJ-50 connectors that route these signals to the Model 494.45 A/D Converter mezzanine card.
Model 494.76 8-Output BNC	Provides eight BNC connections for analog output signals. RJ-50 connectors route these signals from the Model 494.46 D/A Converter mezzanine card to the BNC board.
Model 494.79 8-Channel Valve Driver	Contains eight separate valve drivers. Each valve driver requires an external valve-drive signal, provided by a Model 494.46 8-Output D/A mezzanine card.

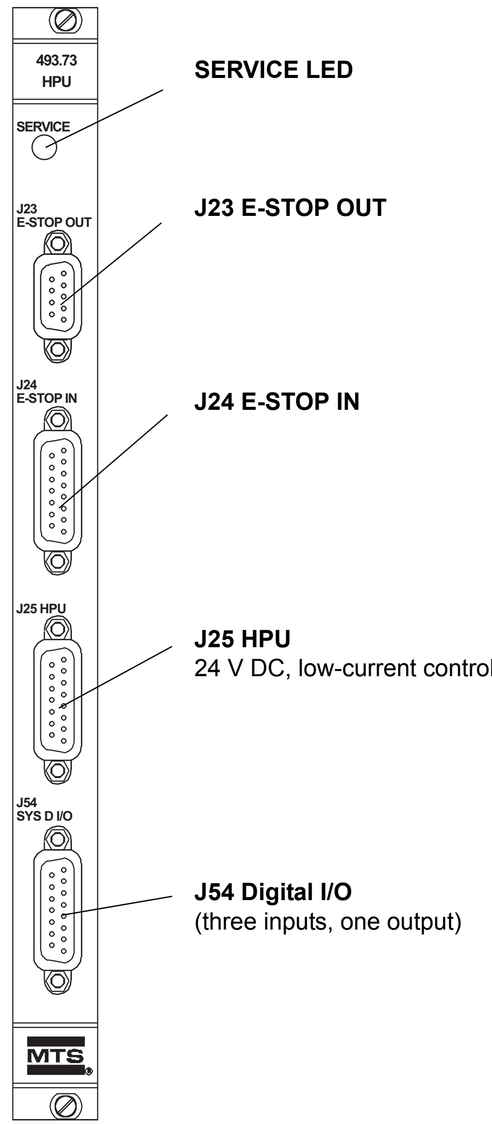
Model 493.73 HPU Interface Board

About the Model 493.73 HPU Interface Board

The Model 494.73 HPU Interface board is a single-width transition board that plugs into the transition card cage on a Series 494 Chassis.

This board provides 24-volt logic signals that control the hydraulic power unit (HPU).

Note *The emergency stop (E-Stop) inputs and outputs are part of a controller-wide E-Stop system.*



Board features

Service LED–The Service LED turns ON during system startup and turns OFF when the processor has successfully booted and is communicating with the HPU interface board.

E-Stop Out (J23)–provides a set of E-Stop relay contacts that can be used with external devices.

E-Stop In (J24)–accepts an external emergency stop switch.

HPU (J25–provides 24-volt logic signals that control the hydraulic power unit (HPU).

Digital I/O (J54)–provides three digital inputs and one digital output.

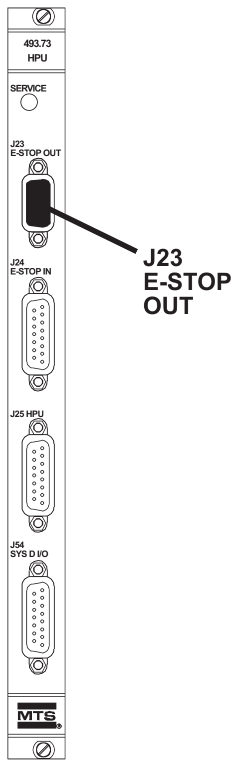
Specifications–Model 493.73 HPU Interface Board

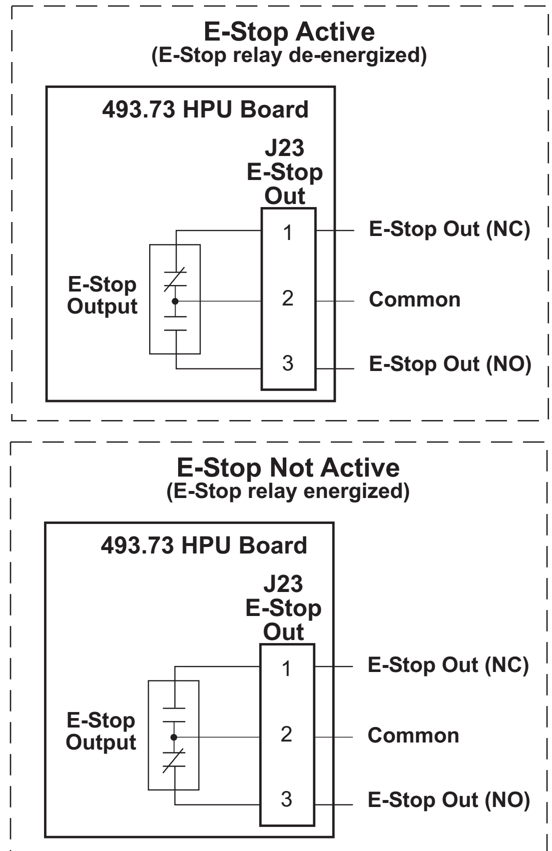
Model 493.73 Specifications

PARAMETER	SPECIFICATION
E-Stop Output*	**Connector J23 (D9S)**
Voltage	24 V DC/AC maximum
Current	1 A maximum
	Normally Open Contacts: Open = E-Stop Active
	Normally Closed Contacts: Closed = E-Stop Active
	* The E-Stop relay is de-energized when an E-Stop is active.
E-Stop Input	**Connector J24 (D15S)**
Voltage	24 V DC maximum
Current	25 mA maximum
Digital Inputs	**Connector J54, (D15S)**
Input OFF Trip Voltage	≤ 0.8 V DC
Input ON Trip Voltage	>3.0 V DC at 0.3 mA to 26 V DC at 3.8 mA
Maximum Voltage	+ 26 V DC
Input Resistance	2.7 KΩ
Digital Input Power Output	+ 24 V DC (current limited by 6.6 KΩ resistor)
Digital Output	**Connector J54, (D15S)**
Maximum Voltage	26 V DC
Typical Output Current	30 mA at 1 V

J23 E-Stop Output Connections for the Model 493.73 HPU Interface Board

Connector **J23 E-STOP Out** provides a set of E-Stop relay contacts that can be used with external devices. An E-Stop on any of the E-Stop buttons connected to the chassis will de-energize the E-Stop relay.





Cable specifications

To maintain EMC compliance, **23 E-STOP Out** cables must comply with the following specifications:

Connector —9-contact, type D, female EMI connector.

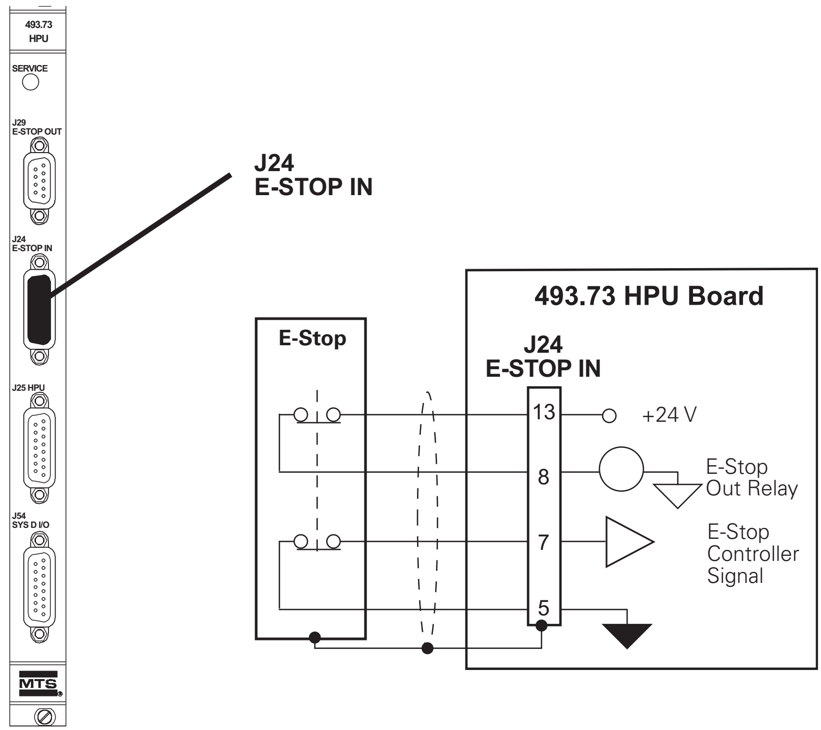
Backshell–EMI metallized plastic or metal.

Cable—AWG and number of conductors as required. Braided shield with shield connected to the metallized backshell at the chassis.

J24 E-Stop Input Connections for the Model 493.73 HPU Interface Board

Connector **J24 E-STOP In** provides an input for an external emergency stop switch.

Note *Emergency stop inputs are part of a controller-wide E-Stop system.*



Cable specifications

To maintain EMC compliance, **24 E-STOP In** cables must comply with the following specifications:

Connector —15-contact, type D, male EMI connector.

Backshell–EMI metallized plastic or metal.

Cable–24 AWG 4-connector with overall braided shield connected to metallized plastic backshell at the chassis and to ground at the emergency stop station.

Jumper plug required

If connector **J24** is not used, you must install a jumper plug to maintain the integrity of the interlocks. Use jumper plug part number 039-713-201 or jumper pins: 5 and 7; 8 and 13.

J25 HPU Connections for the Model 493.73 HPU Interface Board

Connector **J25 HPU** provides 24-volt logic signals that control the hydraulic power unit (HPU). The connector can be connected directly to MTS Series 505 HPUs and similar HPUs with low-current (8 mA or less), 24-volt controls.

Note *Other MTS HPUs require the Model 493.07 HPU Converter Box to convert the low-current HPU output signal to a high-current signal that can drive the HPU relay.*

CAUTION

Control voltages for hydraulic power units vary between models.

The HPU interface between the Model 493.73 HPU transition board and an HPU is 24 volt logic signals. Connecting J25 to a non-compliant HPU can damage the module.

Do not connect 24 V DC relay circuitry or 115 V AC circuitry to the HPU connector J25.

Cable specification

To maintain EMC compliance, **J25 HPU** cables must comply with the following specifications:

Connector–15-contact, type D, female EMI connector.

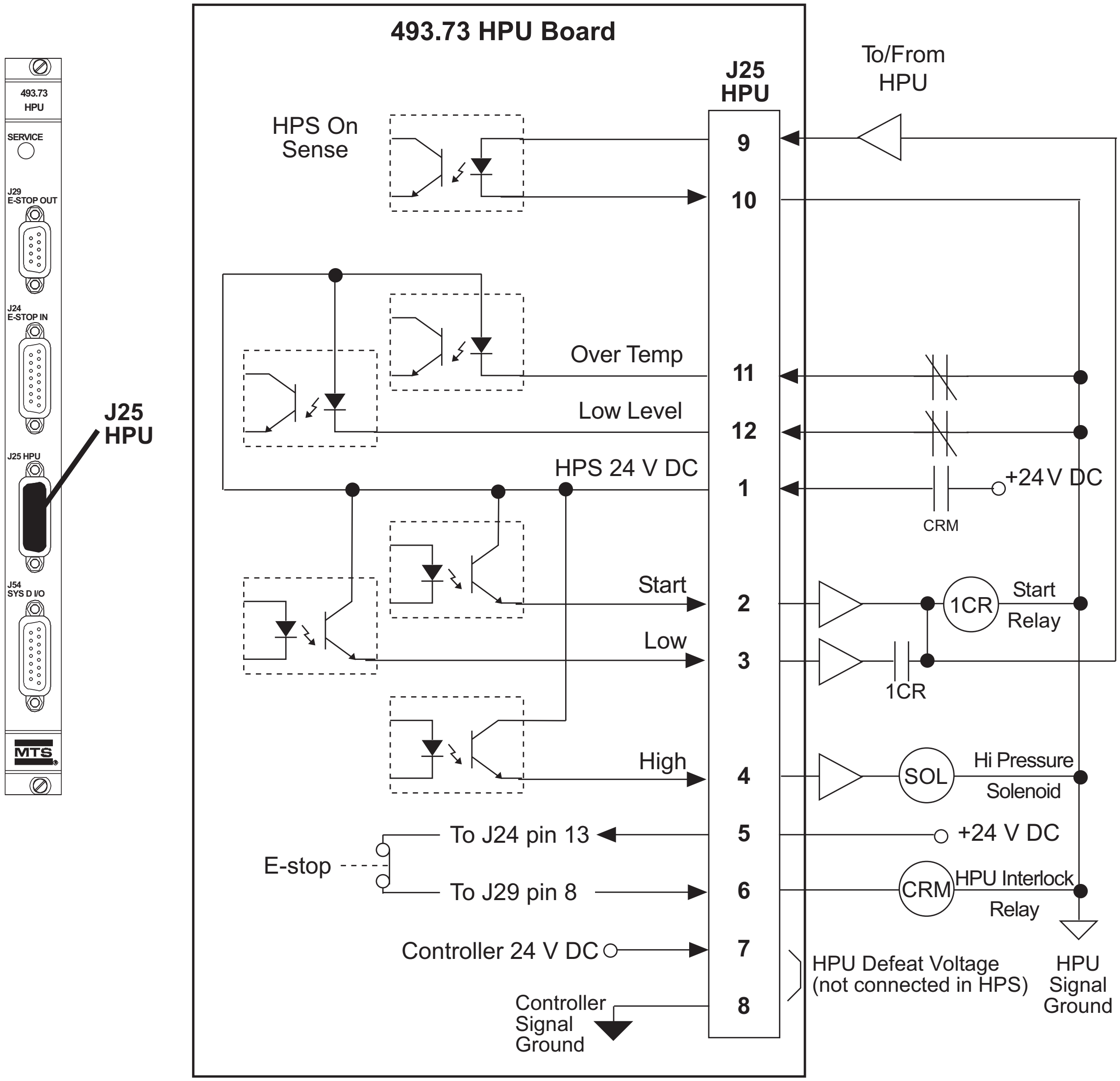
Backshell–metal.

Cable—32 AWG, 9 conductor with overall braided shield, with the braided shield connected to the backshell at the chassis.

Jumper plug required

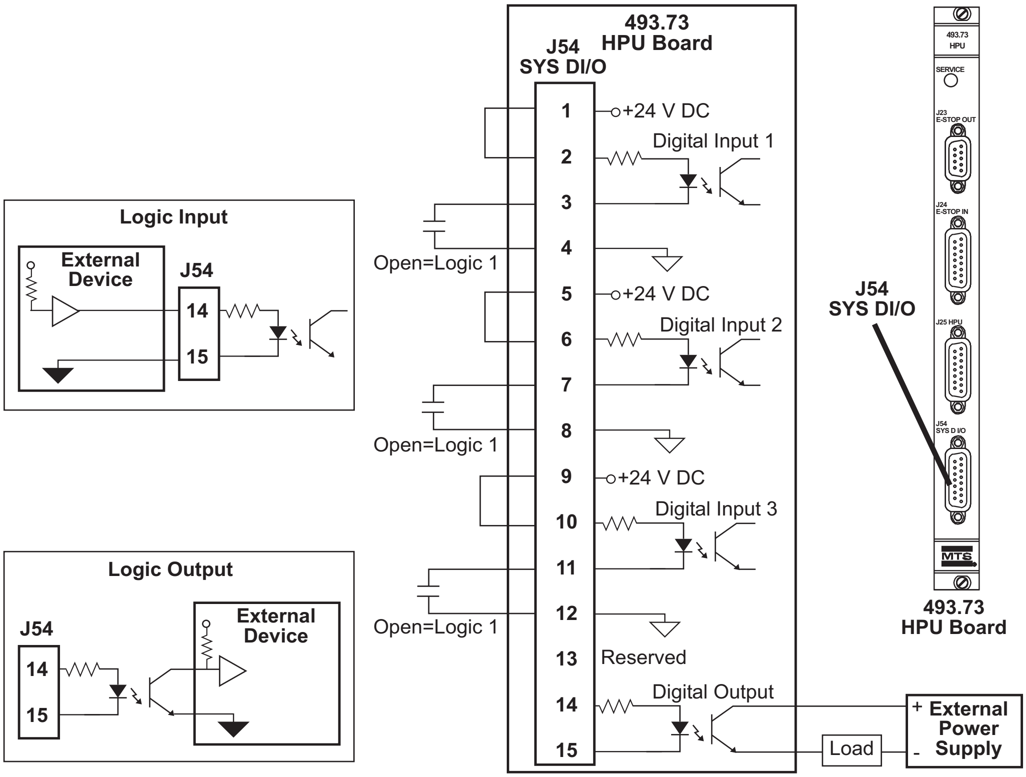
If connector **J25 HPU** is not used, you must install a jumper plug to maintain the integrity of the interlocks. Use jumper plug part number 039-713-301 or jumper pins 1–7, 2–3–5, 6–9, 8–10–11–12.

J25 HPU Connections



J54 DI/O Connections for the Model 493.73 HPU Interface Board

Connector **J54 SYS DI/O** provides three digital inputs and one digital output. Inputs can be external switches or logic inputs. The inputs are connected to the high and low inputs of an opto-isolator that includes a debounce circuit for use with mechanical switch contacts.



Cable specifications

To maintain EMC compliance, **J54 System I/O** cables must comply with the following specifications:

Connector–15-contact, type D, male EMI connector.

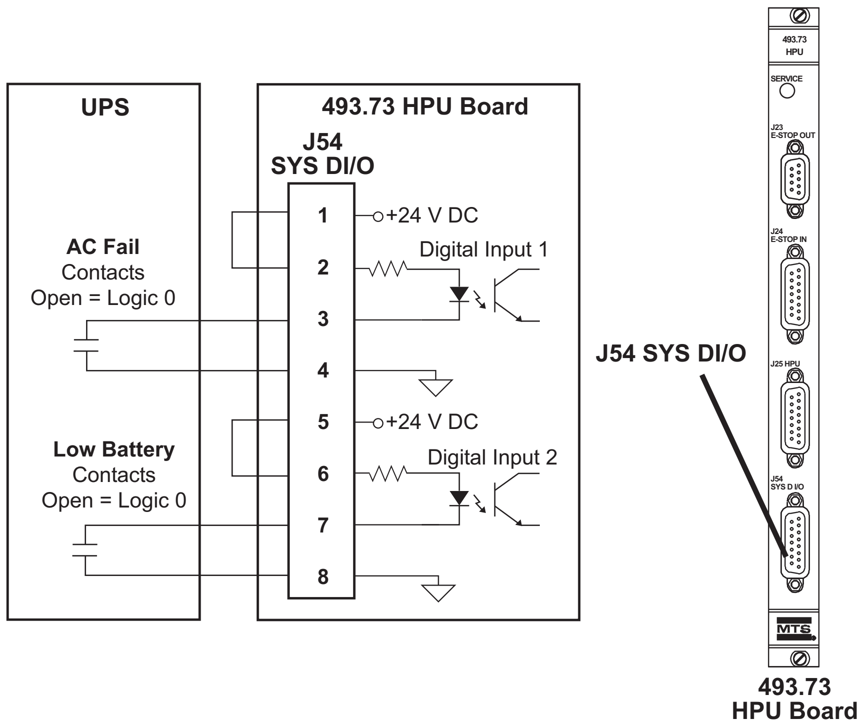
Backshell–EMI metallized plastic or metal.

Cable–AWG and number of conductors as required. Braided shield with shield connected to the metallized backshell at the chassis.

UPS Connections for the Model 493.73 HPU Board (FT60, FT100, FT200, FTGT)

The following drawing shows UPS connections for the Model 493.73 HPU board. Once connected, use your controller software to add UPS hardware resources and configure the various UPS options.

Note *Systems that use Series 793 Control Software have Hwi Editor and station setup settings for UPS systems.*



Cable specification

To maintain EMC compliance, **J54 SYS DI/O** cables must comply with the following specifications:

Connector–15-contact, type D male EMI connector.

Backshell–metallized plastic or metal.

Cable—26 to 22 AWG, 4-conductor with overall braided shield, with the braided shield connected to the backshell at the chassis.

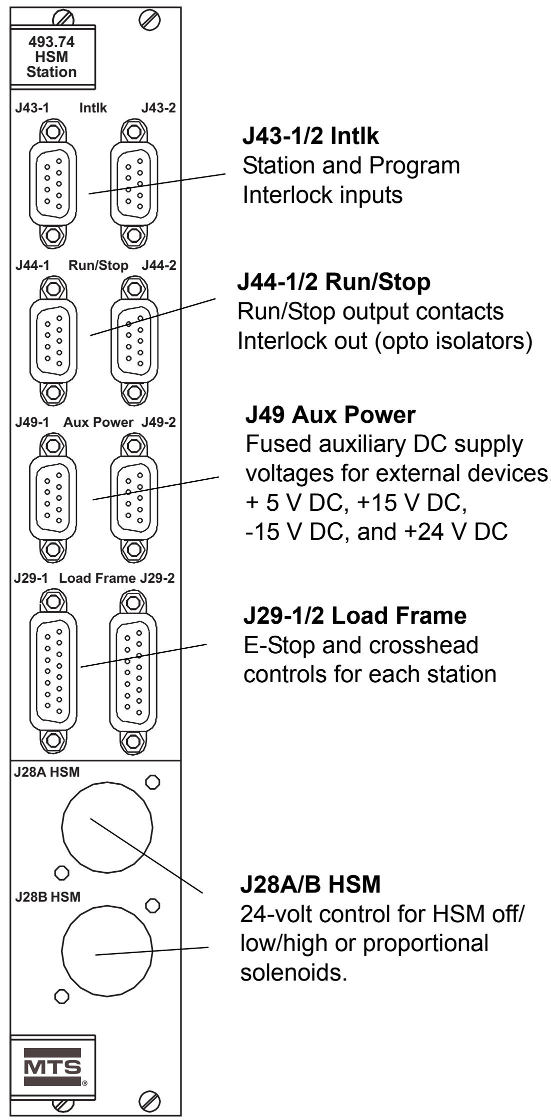
Model 493.74 Two-Station HSM Interface Board

About the Model 493.74 Two-Station HSM Interface Board

The Model 493.74 Two-Station HSM Interface board is a double-width board that plugs into the transition card cage on a Series 494 Chassis. Each Model 493.74 HSM transition board controls up to two stations.

Each station has the following connections:

- 24-volt hydraulic service manifold (HSM) control (off/low/high or proportional) (J28 HSM)
- E-Stop and crosshead controls for a load unit control module (J29 Load Frame)
- Inputs that can initiate station and program interlocks (J43 Interlock)
- Remote run/stop outputs for external devices (J44 Run/Stop)
- Auxiliary power outputs for external devices (J49 Aux Power)



Specifications–Model 493.74 Two-Station HSM Board

Model 493.74 Specifications (part 1 of 2)

PARAMETER	SPECIFICATION
HSM Control*	**Connector J28 (CPC-4S)**
Off/Low/High Control	
Low Output	+24 V DC, 1.0 A maximum
High Output	+24 V DC, 1.0 A maximum
Proportional Control	
Signal Output	0–0.78 A
Solenoid Impedance	20–25 Ω
Ramp Time (0 to full scale)	2.1 s or 4.2 s (software selectable) * The type of HSM control (off/low/high or proportional) is software configurable.
Load Frame	**Connectors J29-1 and J29-2 (D15S)**
Crosshead Unlock Output	1.0 A at 24 V DC
Crosshead Unlock Input	Normally Closed Relay Contacts: Open = Interlock
Interlock Inputs	**Connectors J43-1 and J43-2 (D15S)**
Interlock Off Trip Voltage	≤ 0.8 V DC
Interlock On Trip Voltage	>3.0 V DC at 0.3 mA to 26 V dc at 3.8 mA
Maximum Input Voltage	+26 V DC
Input Resistance	6.6 KΩ
Interlock Power Output	+24 V DC, current limited by a 15-KΩ resistor.

Model 493.74 Specifications (part 2 of 2)

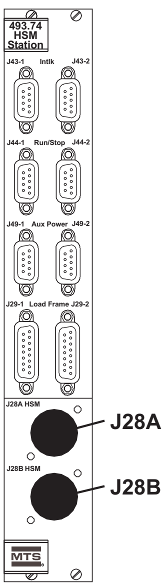
PARAMETER	SPECIFICATION
Run/Stop Output Relays	**Connectors J44-1 and J44-2 (D15S)**
Relay Voltage Rating	30 V DC/AC maximum
Relay Current Rating	1 A maximum **Normally Open Relay Contacts:** Open = Program is stopped **Normally Closed Relay Contacts:** Closed = Program is stopped
Interlock Output	**Opto-Isolator Output:** (Open-collector, open-emitter) Maximum Voltage: 26 V DC Typical Output Current: 30 mA at 1 V DC Transistor OFF = Interlock
Auxiliary Power Outputs	**Connector J49, (D9S)**
+5 V DC	0.75 A maximum
+15 V DC	0.75 A maximum
-15 V DC	0.75 A maximum
+24 V DC	0.75 A maximum

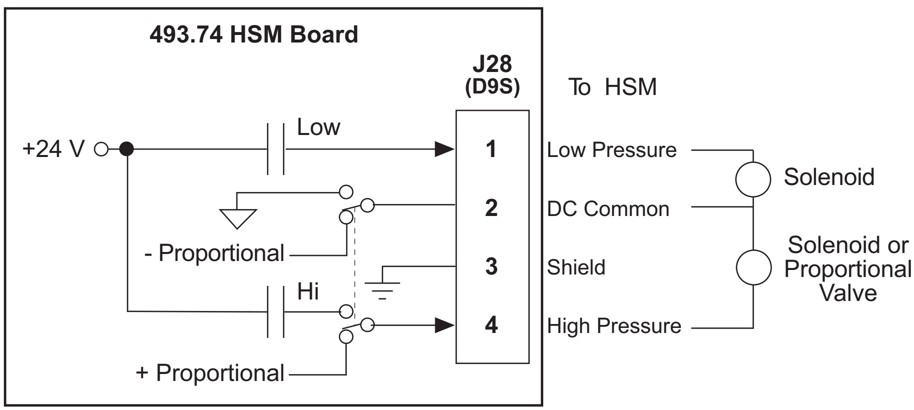
J28 HSM Connection for the Model 493.74 HSM Board

Connector **J28 HSM** controls a hydraulic service manifold (HSM). HSM control (off/low/high or proportional) is software configurable.

Off/low/high control provides separate 24-volt, low-pressure and high-pressure outputs that drive the HSM low- and high-pressure solenoids. Proportional control provides a current output from 0 to 0.78 A.

Note *The Model 493.74 HSM board cannot be used directly with 115 V AC HSMs. Applications that use 115 V AC HSMs require an external converter box (such as a Model 413.08), which is used with this board.*





Cable specification

To maintain EMC compliance, **J28 HSM** cables must comply with the following specifications:

Connector–4-contact, CPC male connector (AMP Incorporated).

Cable for on/off HSMs–18 AWG, 2-conductor with foil shield with drain wire connected to pin 3 at the chassis.

Cable for high/low HSMs–18 AWG/4 conductor with overall foil shield with drain wire connected to pin 3 at the chassis.

J28 Proportional HSM Output Configuration

The proportional HSM output option provides a current source that drives a proportional solenoid on the HSM. The proportional output is configured with the controller software.

Pressure settings

This board supports software-selectable HSM **High** and **Low** pressure settings.

HSM rate settings

This board supports the following software-selectable HSM rate settings: **Fast** (2 seconds) or **Slow** (4 seconds).

To calculate ramp rates

$$\text{Fast Rate (psi/s)} = \frac{\text{Maximum HSM Pressure (psi)}}{\text{2 s (Fast)}}$$

$$\text{Slow Rate (psi/s)} = \frac{\text{Maximum HSM Pressure (psi)}}{\text{4 s (Slow)}}$$

To calculate ramp times

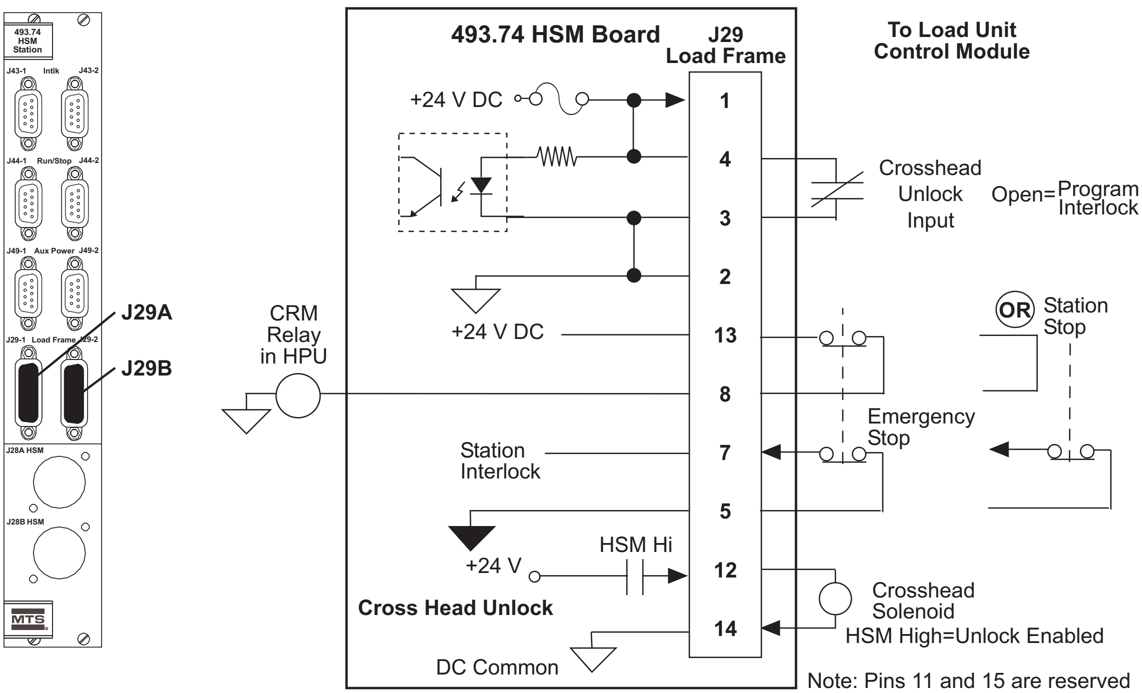
The amount of time to reach low and high pressure depends on the **Low** and **High** pressure settings and the **HSM Rate** setting.

$$\text{Ramp time to low psi (s)} = \frac{\text{Low setting (psi)}}{\text{Rate (psi/s)}}$$

$$\text{Ramp time to high psi (s)} = \frac{\text{High setting (psi)-Low setting (psi)}}{\text{Rate (psi/s)}}$$

J29 Load Frame Connections for the Model 493.74 HSM Board

Connector **J29 Load Frame** connects to the load unit control module. Load frame signals include E-Stop and crosshead controls for each station.



Cable specification

To maintain EMC compliance, **J29 Load Frame** cables must comply with the following specifications:

Connector–15-contact, type D, male EMI connector with conductive backshell.

Cable for load frames with crosshead locks built after 1985–18 AWG, 8 conductor with overall foil shield with drain wire connected to the conductive backshell.

Cable for all load frames without crosshead locks–22 AWG, 6 conductor with overall foil shield with drain wire connected to the conductive backshell.

Jumper plug

If connector **J29** is not used, you must install a jumper plug to maintain the integrity of the interlocks. Use jumper plug part number 100-007-947 or jumper pins: 3 and 4; 5 and 7; 11 and 15; 8 and 13.

Station stop

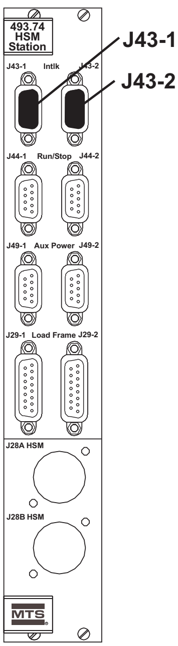
The Emergency Stop connection can also be configured as a station stop. When this is done, be sure that you have other Emergency Stop boxes near by. Pressing **Station Stop** will shut down the hydraulics to an individual station without shutting down power to the hydraulic power unit.

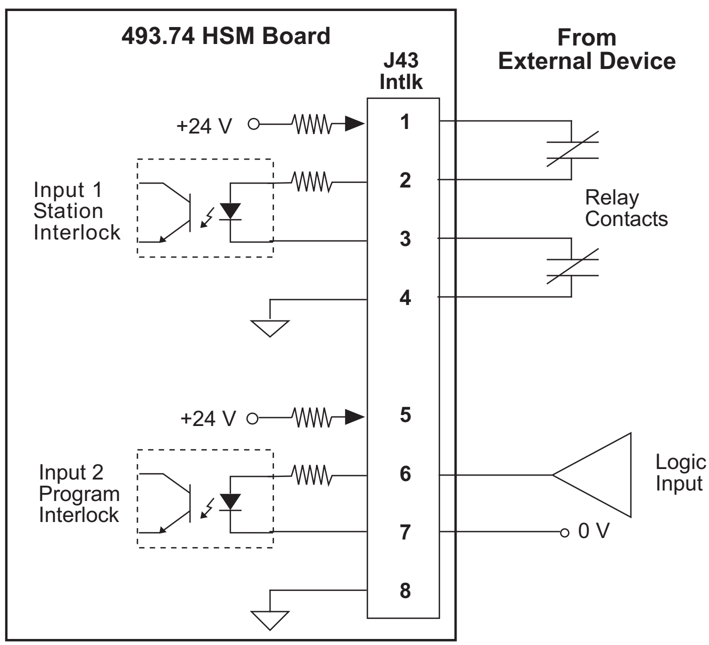
Note *A Model 493.73 HPU Transition Board must be installed for the Emergency Stop connection to be enabled.*

J43 Interlock Connections for the Model 493.74 HSM Board

Connector **J43 Interlock** provides two optically isolated inputs that can initiate interlocks. Input 1 initiates a station interlock. Input 2 initiates a program interlock. Both inputs can accept relay-contact or logic-signal inputs.

Note *If only one contact is used, the other contact must be jumpered.*





Cable specification

To maintain EMC compliance, **J43 Interlock** cables must comply with the following specifications:

Connector–9-contact, type D, male EMI connector.

Backshell–EMI metallized plastic or metal.

Cable–AWG and number of conductors as required. Braided shield with shield connected to the metallized backshell at the chassis.

Jumper plug

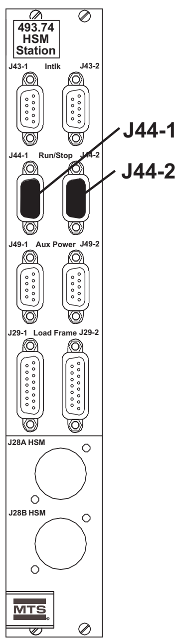
If connector **J43** is not used, you must install a jumper plug to maintain the integrity of the interlocks. Use jumper plug part number 100-007-948 or jumper pins 1 and 2; 3 and 4; 5 and 6; 7 and 8.

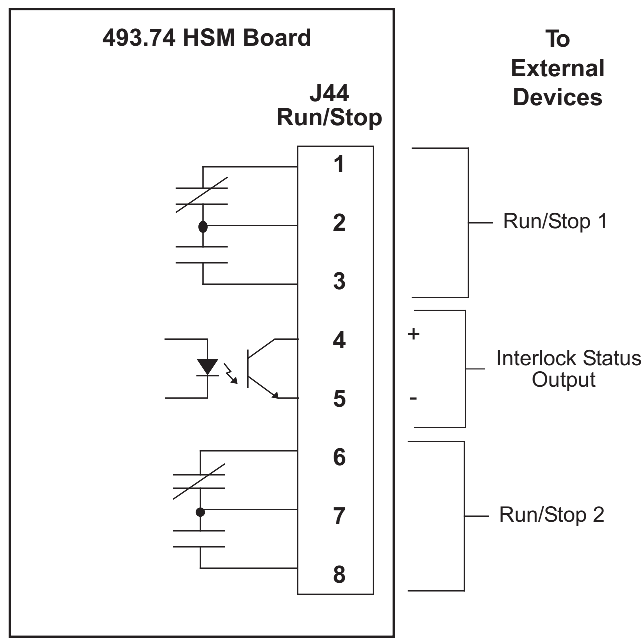
J44 Run/Stop Connections for the Model 493.74 HSM Board

Run/Stop status output

Connector **J44 Run/Stop** provides the run/stop status of the controller to external devices.

- Two form C contacts provide the run/stop status.
- The contacts are rated 1.0 A at 30 V (AC or DC).





Interlock status output

Connector **J44 Run/Stop** also provides opto-isolator outputs that indicate the interlock status of each station to an external device. These interlock status outputs are normally on and will turn off when an interlock occurs.

Cable specification

To maintain EMC compliance, **J44 Run/Stop** cables must comply with the following specifications:

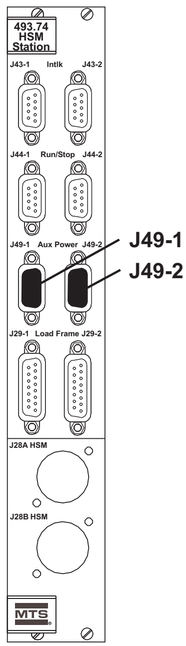
Connector–9-contact, type D, female EMI connector.

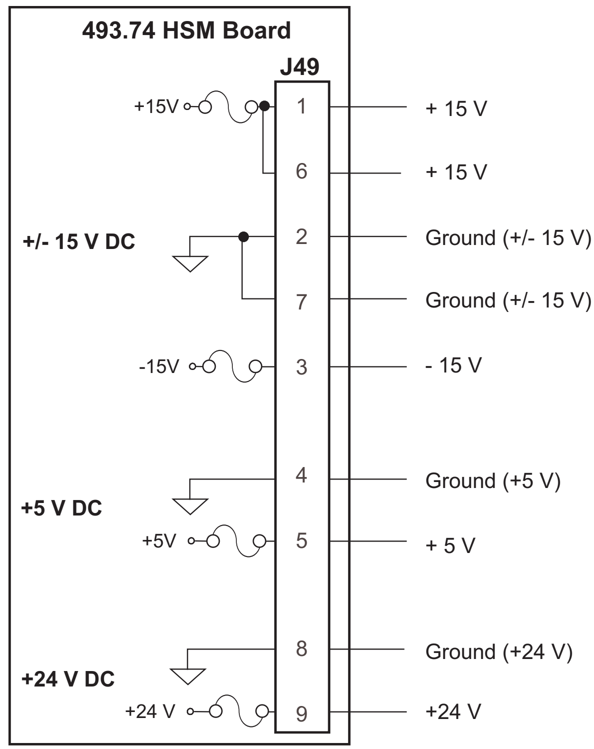
Backshell–EMI metallized plastic or metal.

Cable–AWG and number of conductors as required. Braided shield with shield connected to the metallized backshell at the chassis.

J49 Auxiliary Power Connections for the 493.74 HSM Board

Connector **J49 Aux Pwr** provides auxiliary power outputs for: +5 V DC, +15 V DC, -15 V DC, and +24 V DC.





Cable specification

To maintain EMC compliance, **J49 Aux Power** cables must comply with the following specifications:

Connector–9-contact, type D, male EMI connector.

Backshell–EMI metallized plastic or metal.

Cable–AWG and number of conductors as required. Braided shield with shield connected to the metallized backshell at the chassis.

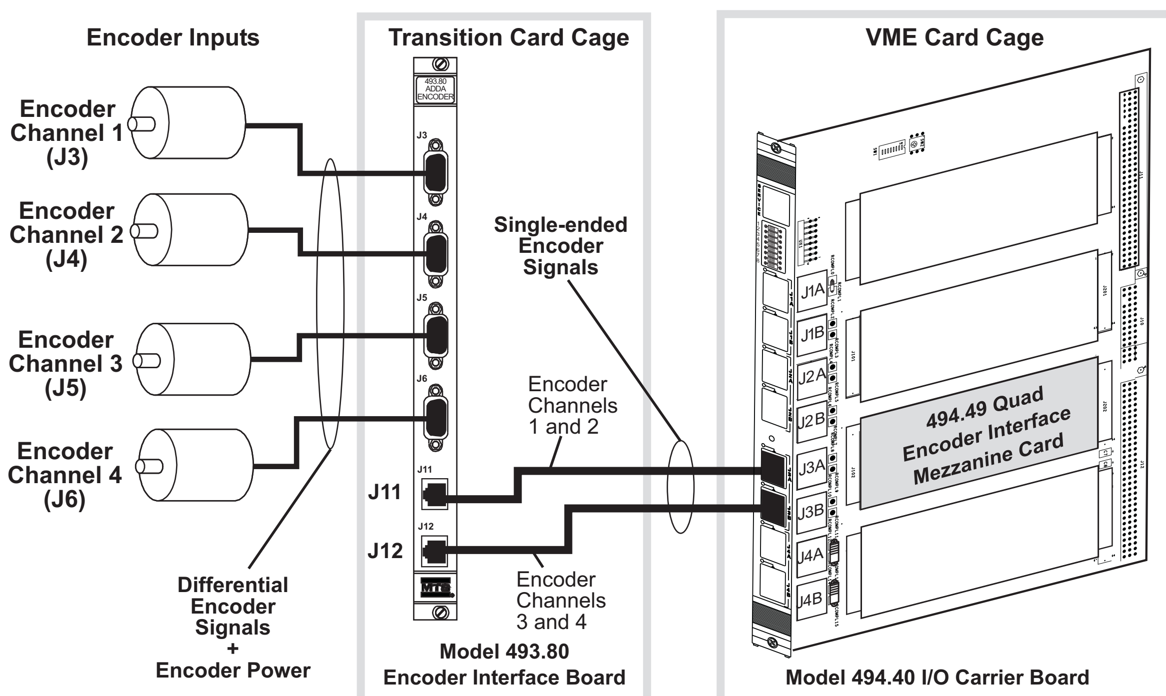
Model 493.80 Encoder Interface Board

About the Model 493.80 Encoder Interface Board

The Model 493.80 Encoder Interface board converts four channels of differential RS-422 encoder signals into TTL encoder signals that are compatible with the Model 494.49 Quad Encoder Interface card. In addition, the Model 493.80 board can supply DC power to each of the four encoders.

The Model 493.80 board includes jumpers that configure the board for the following digital transducer types:

- **SSI devices**–such as Temposonics R transducers, Gurley and other absolute encoders
- **Non-SSI devices**–such as incremental encoders, and PWM devices such as Temposonics G transducers.



Specifications–Model 493.80 Encoder Interface Board

PARAMETER	SPECIFICATION
Digital Transducer/ Encoder Electrical Interface	The Model 493.80 Encoder Interface board converts four channels of differential RS-422 encoder signals (J3-J8) into TTL encoder signals (J11, J12) that are compatible with the Model 494.49 Quad Encoder Interface card.
Supported Digital Transducer/ Encoder Interfaces	The Model 493.80 board includes jumpers that configure the board for the following digital transducer types: **SSI devices–**such as Temposonics R transducers, Gurley and other absolute encoders **Non-SSI devices–**such as incremental encoders, and PWM devices such as Temposonics G transducers.
Device Power	Fused power is available on the following pins on each of the four D-9S connectors(J3–J6). Three voltage levels (+5 V DC, +/- 15 V DC, and +24 V DC at 1 Amp) are available and can be selected by jumper settings on the 493.80 board. Power is available on the following pins on connectors J3–J8: Pin 5–Ground Pin 1–DC Power Pin 8– -15 V DC

Power Settings for the Model 493.80 Encoder Interface Board

Power for the encoders can be supplied from the Model 493.80 board. Three voltage levels (+5 V DC, +/- 15 V DC, and +24 V DC) are available and can be selected by the jumper settings in the following table.

Power Settings for the Model 493.80 Encoder Interface Board

CHANNEL	+5 V DC	+/- 15 V DC	+ 24 V DC
1	**X3** (No jumper) **X4** (1-2) **X5** (1-2) **X6** (No jumper)	**X3** (1-2) **X4** (1-2) **X5** (2-3) **X6** (1-2)	**X3** (No jumper) **X4** (2-3) **X5** (2-3) **X6** (2-3)
2	**X7** (No jumper) **X8** (1-2) **X9** (1-2) **X10** (No jumper)	**X7** (1-2) **X8** (1-2) **X9** (2-3) **X10** (1-2)	**X7** (No jumper) **X8** (2-3) **X9** (2-3) **X10** (2-3)
3	**X11** (No jumper) **X12** (1-2) **X13** (1-2) **X14** (No jumper)	**X11** (1-2) **X12** (1-2) **X13** (2-3) **X14** (1-2)	**X11** (No jumper) **X12** (2-3) **X13** (2-3) **X14** (2-3)
4	**X15** (No jumper) **X16** (1-2) **X17** (1-2) **X18** (No jumper)	**X15** (1-2) **X16** (1-2) **X17** (2-3) **X18** (1-2)	**X15** (No jumper) **X16** (2-3) **X17** (2-3) **X18** (2-3)

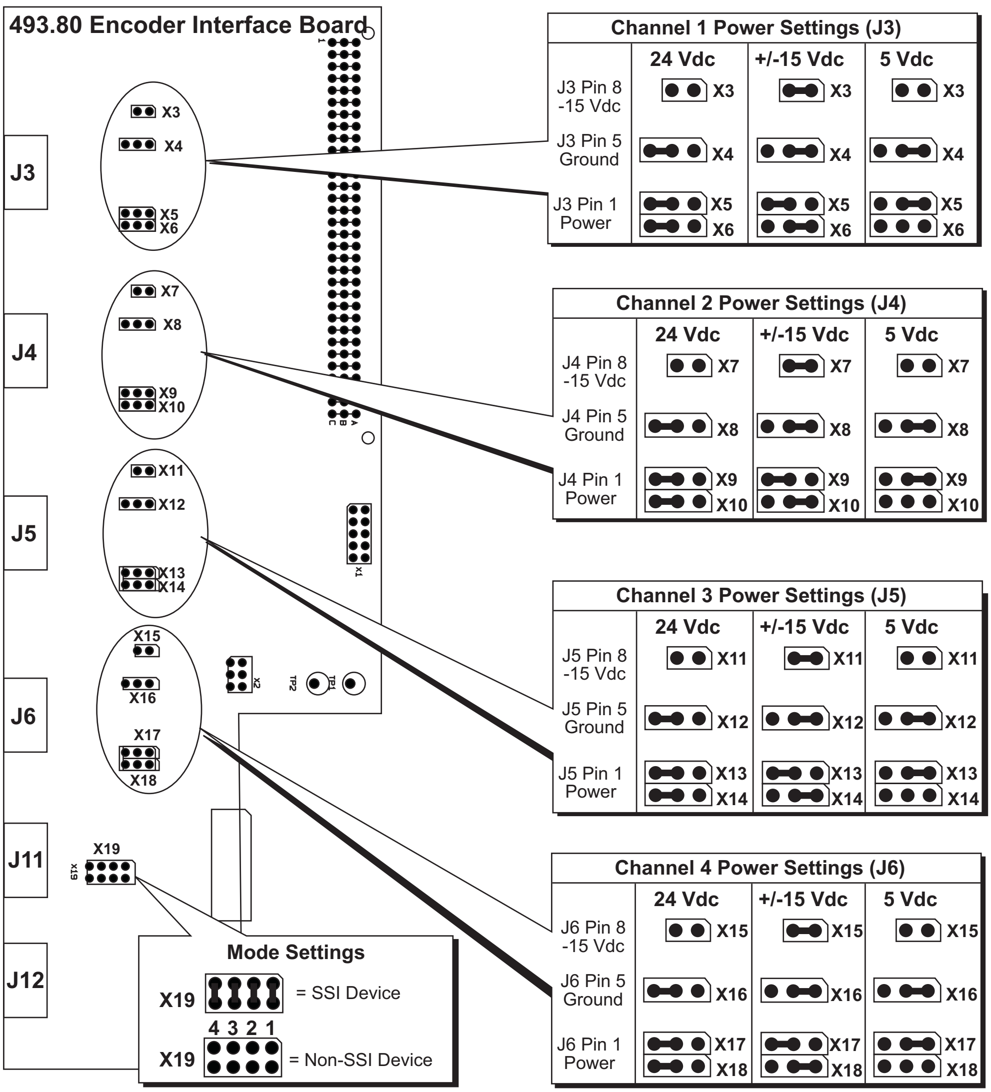
Note *It is the system integrator's responsibility to determine the suitability (cable line loss, current requirements) of the internal power configuration.*

For more information

For jumper locations, see "Jumper Settings and Locations for the Model 493.80 Encoder Interface Board" on page 257.

Jumper Settings and Locations for the Model 493.80 Encoder Interface Board

Each channel on the Model 493.80 board includes jumpers that you can configure for various voltages. When used with the Model 494.49 Quad Encoder board, the jumper setting for each channel's mode must be the same (all SSI or all non-SSI).



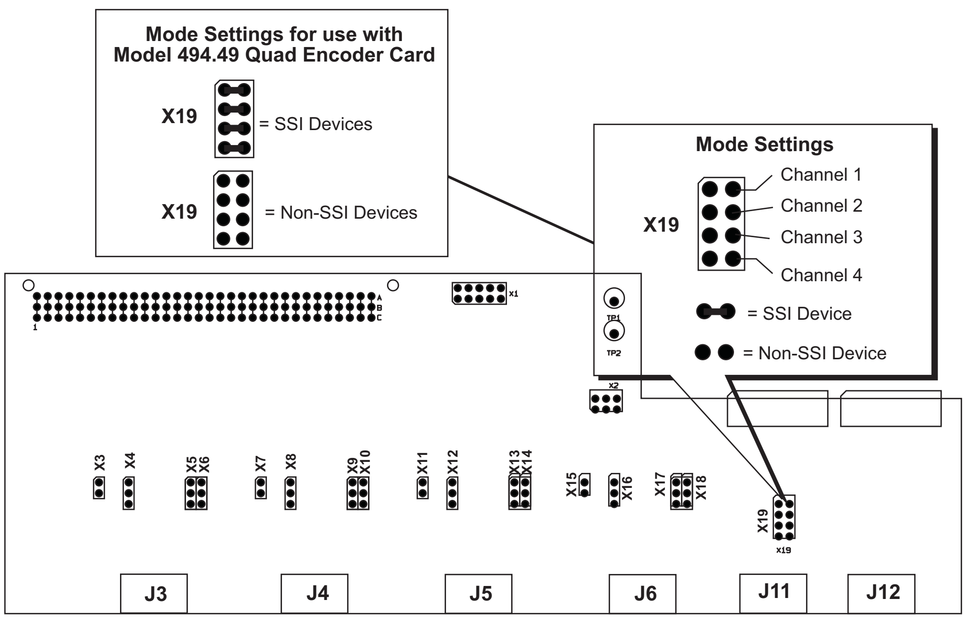
Mode Settings for the Model 493.80 Encoder Interface Board

Each channel on the Model 493.80 board includes jumpers that you can configure for various modes.

Note *When used with the Model 494.49 Quad Encoder board, the jumper setting for each channel's mode must be the same (all SSI or all non-SSI).*

Mode settings include:

- **SSI devices**–such as Temposonics R transducers, Gurley and other absolute encoders
- **Non-SSI devices**–such as incremental encoders, and PWM devices such as Temposonics G transducers.



493.80 Encoder Interface Board

Model 494.74 Two-Station HSM Interface Board

About the Model 494.74 Two-Station HSM Interface Board

The Model 494.74 Two-Station HSM transition board is a single-width board that plugs into the transition card cage on a Series 494 Chassis.

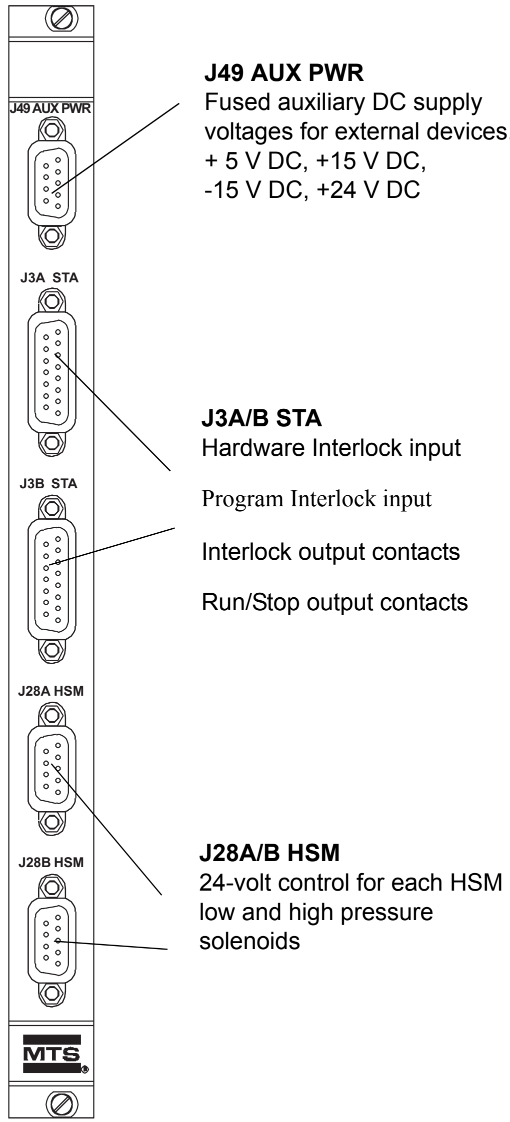
AUX Power (J49)–the J49 connector provides fused (self resetting) auxiliary power outputs for: +5 V DC, +15 V DC, -15 V DC, and +24 V DC.

HSM Interlocks (J3)–each station has a J3 connector that includes the following interfaces to external equipment:

- External hardware interlock inputs
- Program (function generator) interlock inputs
- Run/Stop Output contacts
- Interlock Output contacts

HSM Control (J28)–this connector provides two 24-volt HSM control (Off/Low/High) circuits. Each station has a J28 connector for the HSM control cable.

Note *The Model 494.74 Two-Station HSM board cannot be used directly with 115 V AC HSMs. Applications that use 115 V AC HSMs require an external converter box (such as a Model 413.08), which is used with this board.*



Specifications–Model 494.74 Two-Station HSM Interface Board

Model 494.74 Specifications (part 1 of 2)

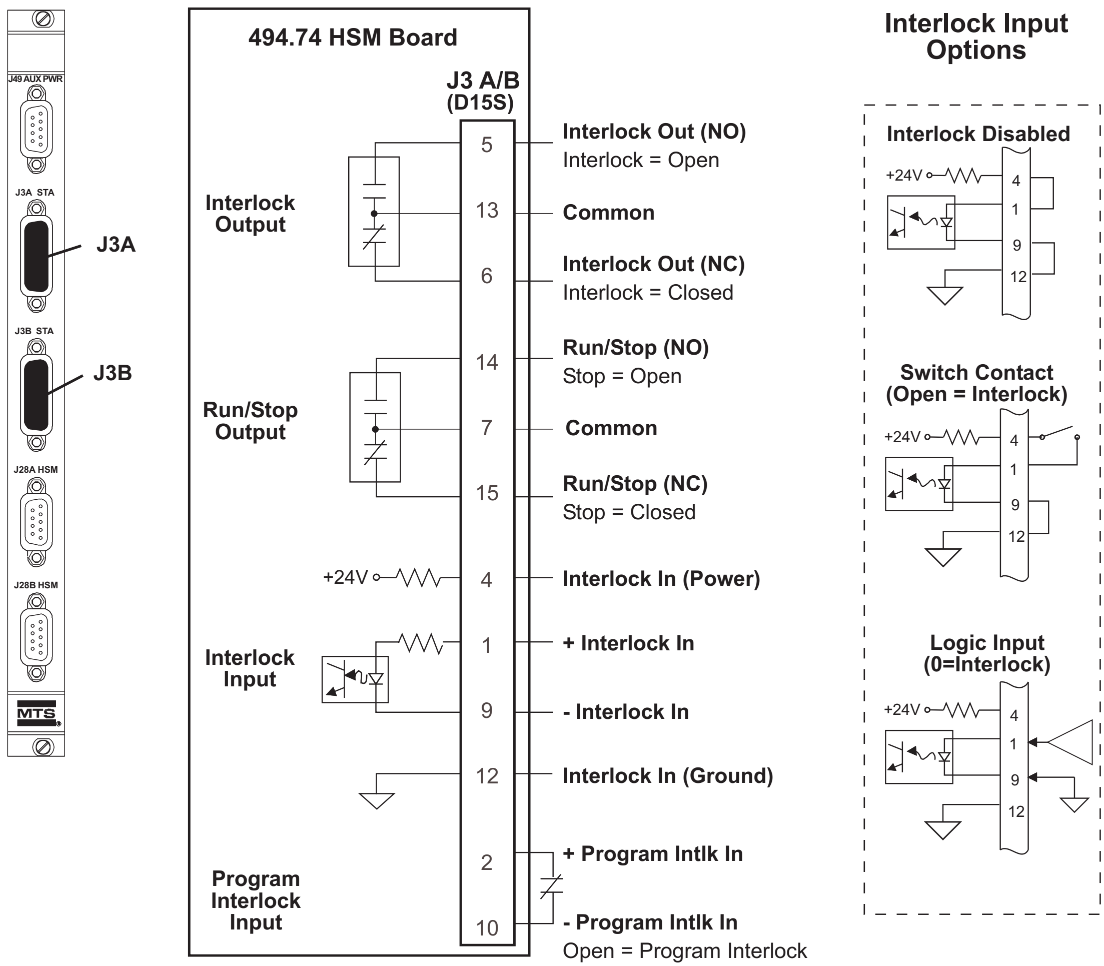
PARAMETER	SPECIFICATION
HSM Outputs	**Connectors 28A and 28B (D9S))**
Low Output	1.0 A maximum
High Output	1.0 A maximum
	HSM Command State Monitoring:
	Each HSM channel monitors and compares the HSM command state against the actual HSM Low and High output states to help sense failed HSM relay contacts.
	If a discrepancy is encountered, +24 V power is removed from the HSM High and Low relay contacts for that HSM channel. In addition, the HSM controls for that HSM channel are forced to the Off state.
Interlock Output Relays	**Connectors J3A and J3B (D15S)**
Voltage	30 V DC/AC maximum
Current	1 A maximum
	Normally Open Relay Contacts: Open = Interlock
	Normally Closed Relay Contacts: Closed = Interlock
Interlock Inputs	**Connectors J3A and J3B (D15S)**
Interlock Trip Voltage	2 V minimum, 3 V maximum (at ~ 0.5 mA)
Maximum Input Voltage	+26 V DC
Input Resistance	3000 Ω
Interlock Power Output	+24 V DC, current limited by a 3000-Ω resistor

Model 494.74 Specifications (part 2 of 2)

PARAMETER	SPECIFICATION
Run/Stop Output Relays	**Connectors J3A and J3B (D15S)**
Voltage Rating	30 V DC/AC maximum
Current Rating	1 A maximum
	Normally Open Relay Contacts: Open = Program is stopped
	Normally Closed Relay Contacts: Closed = Program is stopped
Auxiliary Power Outputs	**Connector J49, (D9S)**
+5 V DC	0.75 A maximum
+15 V DC	0.75 A maximum
-15 V DC	0.75 A maximum
+24 V DC	0.75 A maximum

J3 Interlock Connections for the Model 494.74 HSM Board

Each HSM channel has interlock inputs and outputs that are available through connector J3A or J3B (one channel per connector). Interlock output contacts can control external devices. Interlock inputs from external devices can initiate station and program interlocks.



Interlock output J3

Each HSM channel has a set of interlock output contacts that are available through connector J3A and J3B (one channel per connector). These interlock contacts change state when an interlock line goes active and can be used to control external devices.

Contacts	Interlock	No Interlock
Normally Open	Open	Closed
Normally Closed	Closed	Open

Run/Stop output J3

Each HSM channel has a set of Run/Stop Output contacts that are available through connectors J3A and J3B (one channel per connector). You can use these contacts to control external devices.

The run/stop contacts respond to the function generator run/stop states for the test station where the HSM is assigned.

Contacts	Test Station Stop	Test Station Run
Normally Open	Open	Closed
Normally Closed	Closed	Open

Interlock input J3

Each HSM channel has a set of interlock inputs that are available through connector J3A and J3B (one channel per connector). External switch contacts or logic signals connected to the interlock input can initiate a station interlock.

Program interlock J3

Each HSM channel includes a program interlock input from an external mechanical switch that is available through connector J3A and J3B (one channel per connector). External switch contacts connected to the Program interlock input can initiate a program interlock.

A program interlock occurs when the external switch contacts are open.

Note *For Series 793 Controller applications, a program interlock stops the function generator for the station where the J3 Interlock connector is assigned. The J3 Interlock connector is assigned to a station based on the HSM module chassis-slot position.*

Cable specification

To maintain EMC compliance, **J3 Interlock** cables must comply with the following specifications:

Connector–15-contact, type D, male EMI connector.

Backshell–EMI metallized plastic or metal.

Cable–AWG and number of conductors as required. Braided shield with shield connected to the metallized backshell at the chassis.

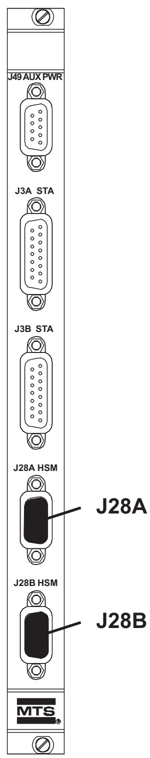
Jumper plug required

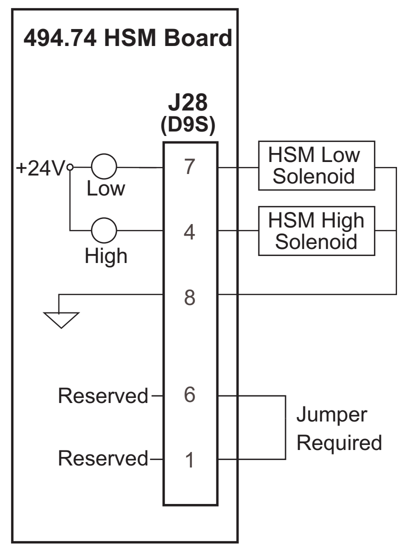
If connector **J3** is not used, you must install a jumper plug to maintain the integrity of the interlocks. Use jumper plug part number 100-180-351 or jumper pins: 1 and 4; 2 and 10; 9 and 12.

J28 HSM Connections for the Model 494.74 HSM Board

The control cable for each HSM plugs into a separate J28 connector on the 494.74 HSM board. Each HSM channel has separate 24-volt, low-pressure and high-pressure outputs that drive the HSM low- and high-pressure solenoids.

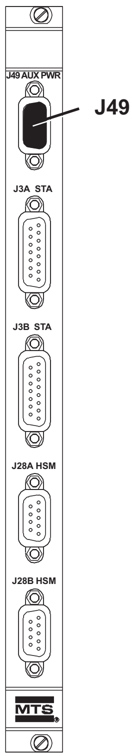
Note *The Model 494.74 HSM board cannot be used directly with 115 V AC HSMs. Applications that use 115 V AC HSMs require an external converter box (such as a Model 413.08), which is used in conjunction with this board.*

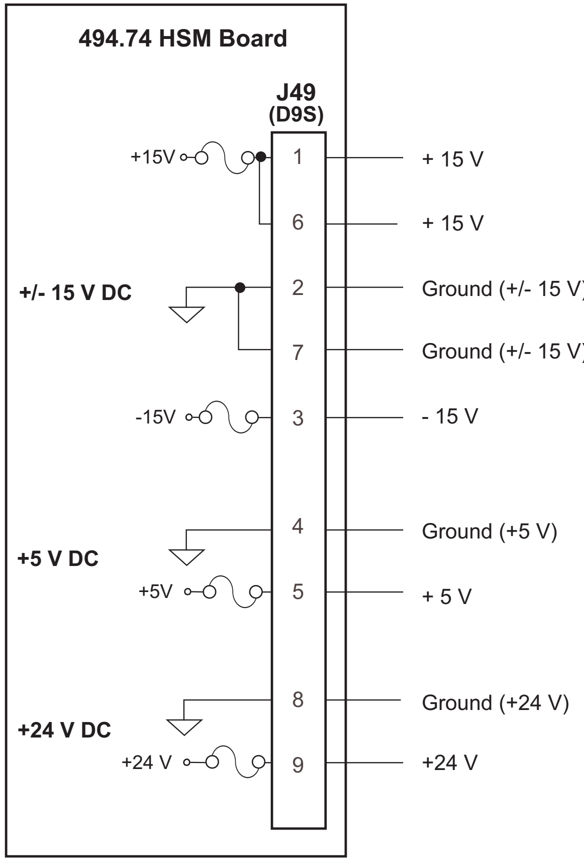




J49 Auxiliary Power Connections for the Model 494.74 HSM Board

The J49 connector provides auxiliary power outputs for: +5 V DC, +15 V DC, -15 V DC, and +24 V DC.





Cable specification

To maintain EMC compliance, **J49 Aux Power** cables must comply with the following specifications:

Connector–9-contact, type D, male EMI connector.

Backshell–EMI metallized plastic or metal.

Cable–AWG and number of conductors as required. Braided shield with shield connected to the metallized backshell at the chassis.

Model 494.75 8-Input BNC Transition Board

About the Model 494.75 8-Input BNC Transition Board

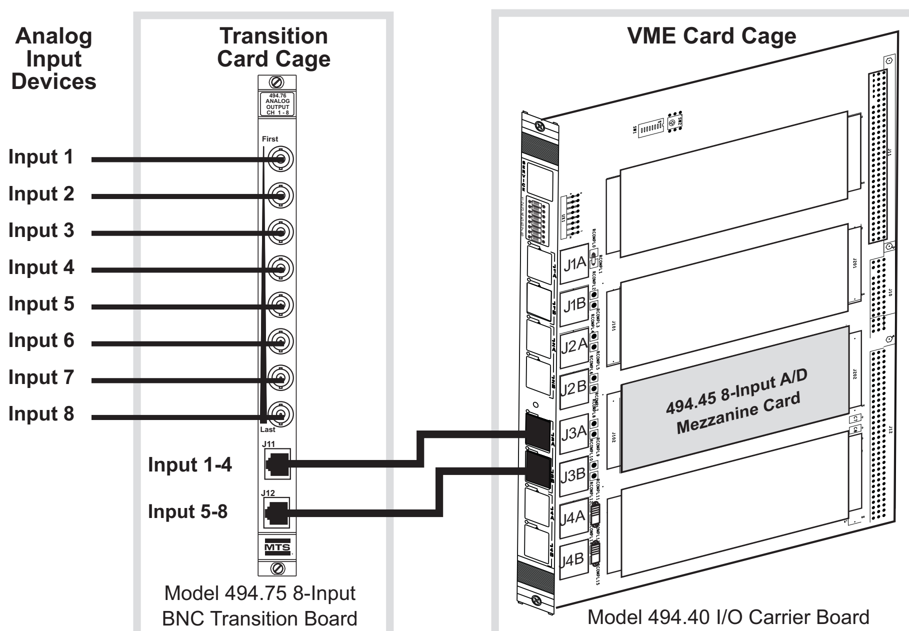
Analog input signals are typically routed to the Model 494.45 A/D Converter mezzanine card through a Model 494.75 8-Input BNC Transition Board. The two outputs of this transition board connect to the front-panel RJ-50 connectors on the I/O carrier board associated with the A/D converter mezzanine card (J3A and J3B).

CAUTION

The front-panel sockets on the I/O carrier board only accept cabling with 10-pin, shielded, RJ-50 connectors with a gray boot.

The use of other RJ connectors (less than 10 pins or unshielded with a black boot) with the I/O carrier board can cause component damage.

Only use transducer cables equipped with 10-pin, braided shield, RJ-50 connectors (with a gray boot) with the I/O carrier board.



Model 494.76 8-Output BNC Transition Board

About the Model 494.76 8-Output BNC Transition Board

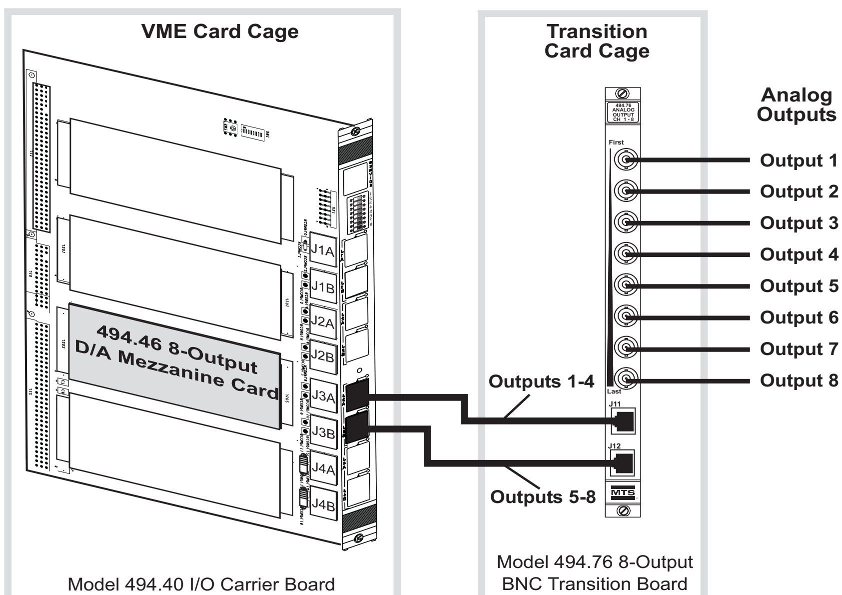
Analog output signals are typically routed to external devices through a Model 494.76 8-Output BNC transition board. The transition board connects to the front-panel I/O carrier board connectors associated with the D/A converter mezzanine card slot (J3A and J3B).

CAUTION

The front-panel sockets on the I/O carrier board only accept cabling with 10-pin, shielded, RJ-50 connectors with a gray boot.

The use of other RJ connector types (less than 10 pins or unshielded with a black boot) with the I/O carrier board can cause component damage.

Only use transducer cables equipped with 10-pin, braided shield, RJ-50 connectors (with a gray boot) with the I/O carrier board.



Model 494.79 8-Channel Valve Driver Board

About the Model 494.79 8-Channel Valve Driver Board

The Model 494.79 8-Channel Valve Driver is a transition board that contains eight separate valve drivers. Each valve driver requires an external valve-drive signal. Valve drive signals are typically provided by a Model 494.46 8-Output D/A mezzanine card.

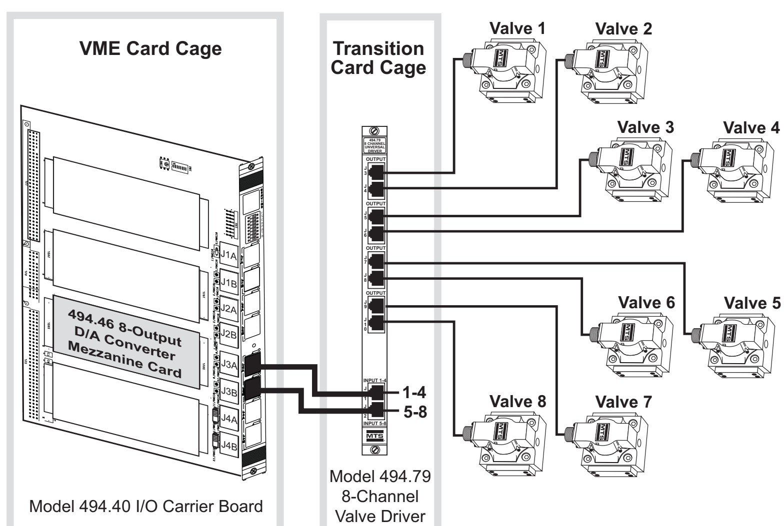
The valve-drive signals from the D/A card are routed to the valve driver board through two cables that run from the I/O carrier board to the valve driver board.

CAUTION

Improper operation can damage valve driver cards.

Damage can occur if you connect a high-level signal to a valve driver card when the chassis power is off.

Do not apply a high-level signal to a valve driver card when the chassis power is off. Disconnect power from any externally powered devices **before** you switch the chassis power off.



Specifications–Model 494.79 8-Channel Valve Driver Board

The Model 494.79 8-Channel Valve Drive board only supports two-stage valves.

PARAMETER	SPECIFICATION
Output Current	Software-configurable output current settings: 25 mA, 50 mA, or 75 mA. ***Note*** *If other output currents are required, call MTS about board modifications.*
Valve Outputs per Channel	1
Dither Frequency Amplitude	 1–4915.2 Hz (software adjustable) 0–5 V DC (software adjustable)
Valve Clamping	A software-configurable valve clamping circuit performs the following actions when an interlock or E-Stop occurs: **Disabled**—Valve does not clamp. This is the default action if the clamp entry is omitted. **Zero**—Clamps the servovalve to zero—if valve balance is used, it will clamp to this value. **Positive**—Clamps the servovalve to positive 50% spool opening on a 2-stage valve driver. **Negative**—Clamps the servovalve to negative 50% spool opening on a 2-stage valve driver.
Cable Loss Detection Circuits	An interlock occurs when a cable loss is detected. **Valve Driver Cable–**Each valve driver has a cable-loss detection circuit that consists of an extra wire that loops out to the valve and back to the Model 494.79 Valve Driver. This circuit detects if the valve cable is unplugged from the controller or if the cable has been cut. This circuit **will not** detect when the cable is unplugged at the valve. **Transition Cable–**The Model 494.79 board also has a cable-loss detection circuit that senses a disconnect or break in the cable that runs from the Model 494.46 D/A Converter to the Model 494.79 transition board.
Valve Balance Offset	+/- 10 V DC (software adjustable)

Model 494.79 8-Channel Valve Driver Board Pin Assignments

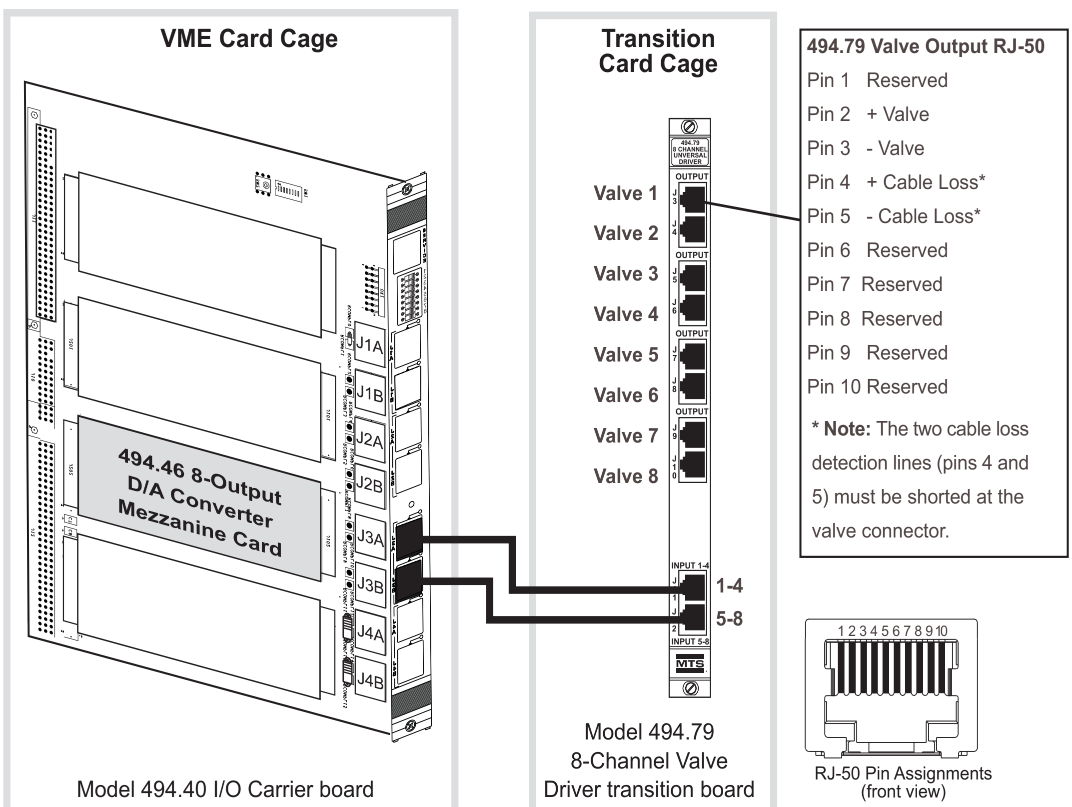
The following figure shows the pin assignments for each of the eight valve driver outputs.

CAUTION

The front-panel sockets on the Model 494.79 board only accept cabling with 10-pin, shielded, RJ-50 connectors with a gray boot.

The use of other RJ connector types (less than 10 pins or unshielded with a black boot) with the Model 494.79 board can cause component damage.

Only use transducer cables equipped with 10-pin, braided shield, RJ-50 connectors (with a gray boot) with the Model 494.79 board.

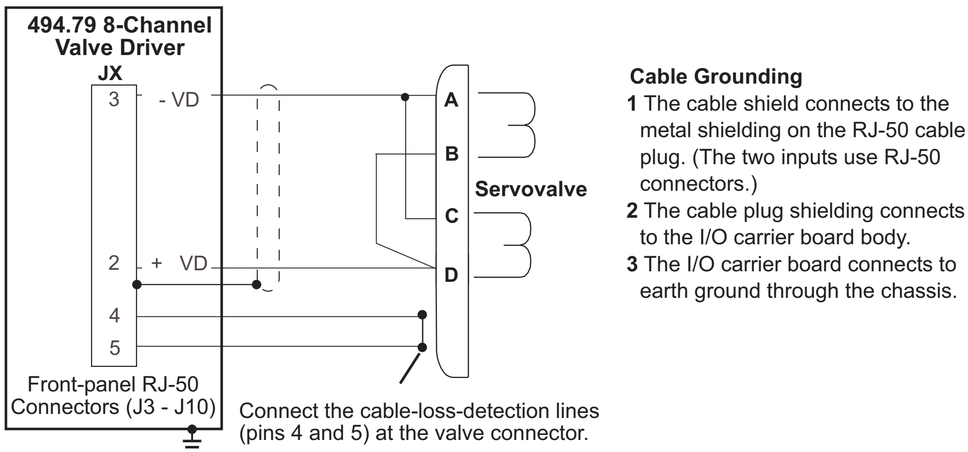


Two-Stage Servovalve Connections for the Model 494.79 Valve Driver

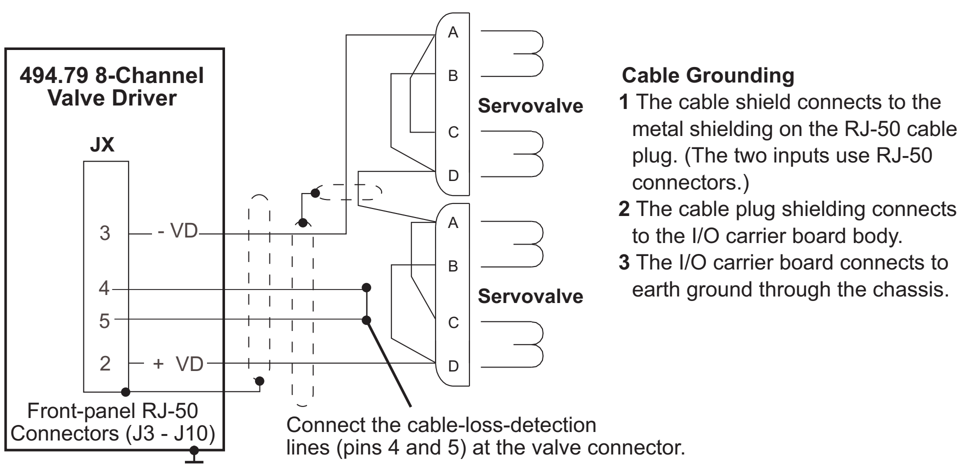
You can use the analog output signals from the D/A converter card to drive a Model 494.79 8-Channel Valve Driver board. The transition board connects to the D/A converter card through front-panel I/O carrier board connectors.

Note *The following diagrams show wiring for systems where compression is positive.*

Single two-stage valve



Dual two-stage valves



Model 493.07 HPU Converter Box

About the Model 493.07 Converter Box

This section describes how to jumper the Model 493.07 Converter Box to connect a Series 494 Chassis and other controller types to a hydraulic power unit (HPU). The converter box converts logic-level signals to and from the Series 494 Chassis to relay signals used by the HPU pump.

For pumps that are 24 V PLC compliant, the converter box is not needed. This includes all Series 505 HPUs and 506.52–.92 HPUs.

Part numbers

The Model 493.07 Converter Box is available in 24 V DC and 115 V AC versions for specific controllers.

CAUTION

HPUs that require control voltages that are not compatible with the controller HPU Interface board require a Model 493.07 Converter Box designed for the correct voltage.

Connecting a 24 V Converter Box to a 115 V AC HPU can cause damage and improper operation.

Make sure that the voltage marked on the cover of the converter box matches the required voltage for the HPU.

Model 493.07 Converter Box Part Numbers

Controller Hardware	HPU Voltage	Part Number
Series 493 and 494	24 V DC	49-969-401
Series 493 and 494	115 V AC	49-969-403
Model 407 Controller	24 V DC	49-969-402
Model 407 Controller	115 V AC	49-969-404
Pre-1986 Controllers*	24 V DC	49-969-405
Pre-1986 Controllers*	115 V AC	49-969-406

* Converter box interfaces to controllers manufactured before 1986 require custom cables.

⚠ WARNING

When connected to a 120-volt HPU, the Model 493.07 Converter Box contains dangerous voltages.

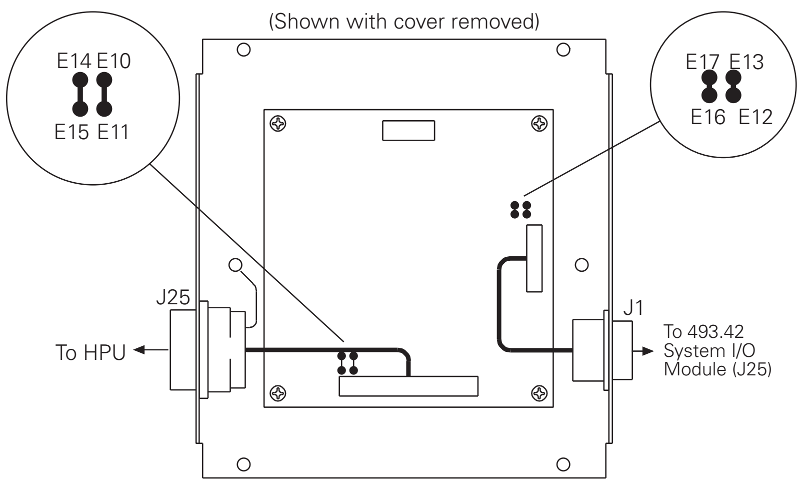
Removing the cover from the Model 493.07 Converter Box without first disconnecting all cables can expose you to a dangerous electrical shock hazard that can cause series personal injury or death.

Disconnect all cables from the Model 493.07 Converter Box before removing the cover.

Jumper settings

As shipped, the HPU interface on the Model 493.07 Converter Box is compatible with Model 458.10/.20, 490.01, 493.xx, 494.xx, and 497.05 components.

The following figure shows the main components of the Model 493.07 Converter Box, including connectors and jumpers.



The Model 493.07 Converter Box can be connected to other controllers (as shown in the following table) using a "Y" cable.

Note *If the Series 494 Chassis is the only device connected to the HPU, the jumper settings are not necessary.*

Compatible with	Jumpers
Model 458.05/.10/.20/.40 **Model 490.01** **Model 497.05**	**Standard jumper setting:** **E10–E11 install** **E12–E13 install** **E14–E15 install** **E16–E17 install** **E10–E13 remove** **E14–E17 remove**
Model 413.05 **Model 436.11** **Model 407.05**	**Jumper change required:** **E10–E11 remove** **E12–E13 remove** **E14–E15 remove** **E16–E17 remove** **E10–E13 install** **E14–E17 install**

Note *The Model 493.07 Converter Box cannot be used with both groups of controllers at the same time. If this functionality is required, use an HPU isolation box.*

Connections for the Model 493.07 Converter Box

This section describes how to connect a Series 494 Chassis to a variety of MTS hydraulic configurations.

Cable specifications

Use the following connectors and cables to connect the Series 494 Chassis to your HPU with a Model 493.07 Converter Box:

Series 494 Chassis to Model 493.07 Converter Box

J25 Connector–15-contact, type D, female EMI connector at J25 of the Model 493.73 HPU Transition board in the rear panel of the Series 494 Chassis, or J25 on the Model 494.41 System board in the Model 494.04 chassis.

Backshell–EMI metal.

J1 Connector–14-contact, type CPC, male connector at J1 of the Model 493.07 Converter Box chassis.

Cable–24 AWG, 10-conductor with overall foil shield, (Carol C0745 or equivalent) with drain wire connected to metallized plastic backshell at the 493.10 chassis, and pin 14 at the Model 493.07 Controller Box chassis.

Model 493.07 Converter Box to HPU

J25 Connector–24-contact, type CPC, female connector at J25 of the Model 493.07 Converter Box chassis.

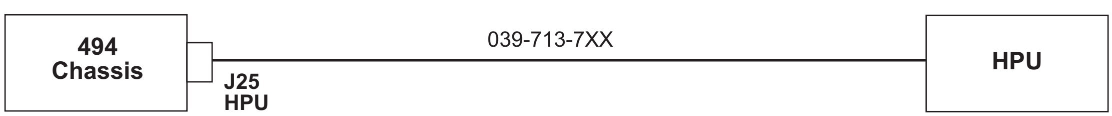
J1 Connector–14-contact, type MS connector at J1 of the HPU.

Cable–18 AWG, 14-conductor with overall foil shield, with drain wire connected to pin 4 of connector J25 and pin A of the pump connector.

Direct HPU connections

The following diagrams show how to connect the chassis to a hydraulic power unit.

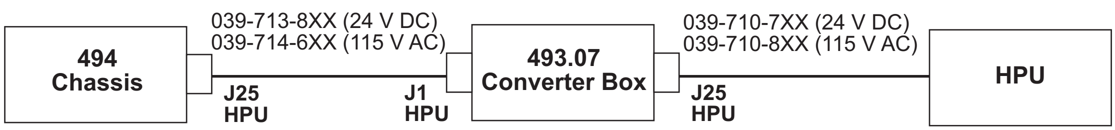
Single Series 494 Chassis with a Model 505 Pump or 24 V PLC pump (Model 506.52-.92)



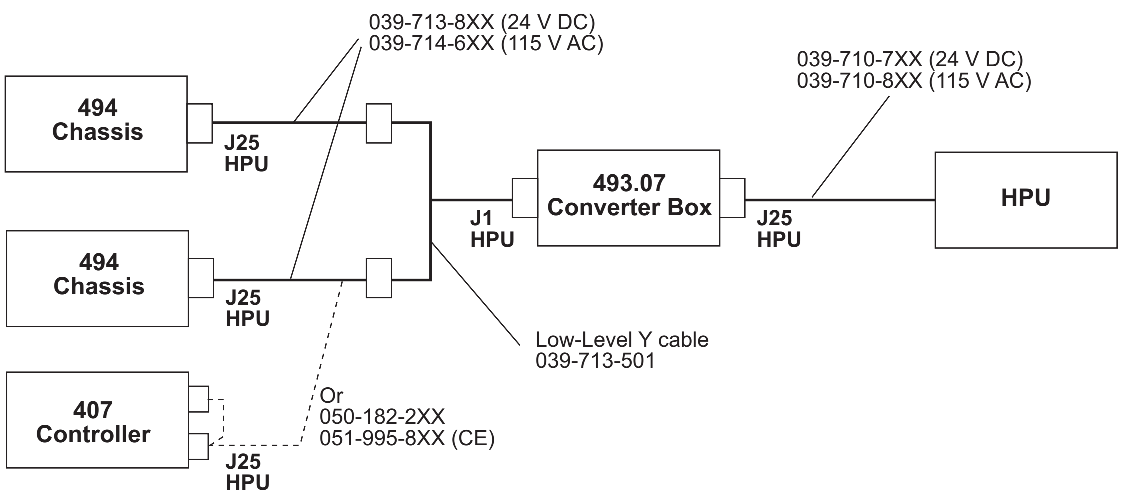
Converter box connections

The following three configurations have cables to support both 24 V DC and 115 V AC control voltages. A Model 493.07 Converter Box is available for each voltage (not both). Be sure the cables and converter box are rated for the same voltage.

Single Series 494 Chassis with a non-PLC pump



Multiple Series 494 Chassis and 407 Controllers

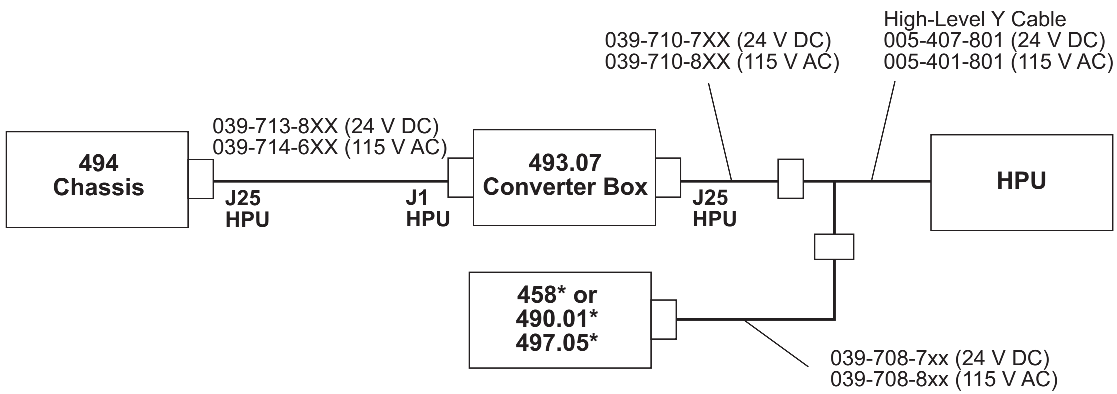


Controller compatibility

You can mix Model 493.07, 458, 490, and 497.05 Controllers directly on the same HPU (without the use of an HPU isolation box).

You cannot mix Model 493.07, 458, 490, and/or 497.05 Controllers with 436, 413.05, or 413.8x Controllers unless you use an isolation box.

You can jumper the Model 493.07 Converter box so you can use it directly with 436 and 413.05 Controllers. You must use an isolation box if you attempt to use the converter box with Model 458, 490, and 497.05 Controllers.



* For standard Model 493.07 Converter Box jumper setting only. Alternate settings are required for Model 436.11 and 413.05 Controllers.

Chapter 6

Cables

Series 494 Cable Part Numbers

For a complete listing of Series 494 cable part numbers, see the *System Cable/Jumper Plug Guide* engineering drawing (part number 700-003-814).

How to Identify Series 494 RJ-50 Connectors

All Series 494 cables equipped with 10-pin RJ-50 connectors have a gray boot. Do not use cables with black connector boots with Series 494 hardware. Older cables with black boots may use other types of connectors that can damage the RJ-50 sockets on Series 494 I/O Carrier boards.

CAUTION

The front-panel sockets on the I/O carrier board only accept cabling with 10-pin, shielded, RJ-50 connectors with a gray boot.

The use of other RJ connector types (less than 10 pins or unshielded with a black boot) with the I/O carrier board can cause component damage.

Only use transducer cables equipped with 10-pin, braided shield, RJ-50 connectors (with a gray boot) with the I/O carrier board.

Series 494 Cable Connections

Follow these precautions when connecting cables to a controller.

WARNING

Unprotected cables can be damaged by hydraulic fluid, excessive temperature, excessive strain, and contact with sharp, abrasive, or heavy objects.

A damaged cable can cause a rapid, unexpected system response which can result in severe personal injury, death, or damage to equipment.

Protect all system cables as described below:

- Protect electrical cables from spilled hydraulic fluid and from excessive temperatures that can cause the cables to harden and eventually fail.
- Ensure that all cables have strain-relief devices installed at the cable and near the connector plug. Do not use the connector plug as a strain relief.
- Protect all system cables from sharp or abrasive objects that can cause the cable to fail.
- Use a cable cover or cable tray where cables are in traffic locations. Never walk on cables or move heavy objects over them.
- Route cables away from areas that expose them to possible damage.

WARNING

If you attempt to change a cable connection while the system is in operation, an open control loop condition can result.

An open control loop condition can cause a rapid, unexpected system response which can result in severe personal injury, death, or damage to equipment.

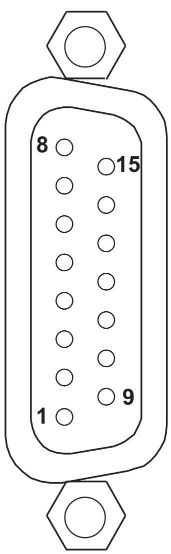
Do not change any cable connections when electrical power or hydraulic pressure is applied. Also, ensure that all cables are connected after you make any changes in the system configuration.

Appendix A
Troubleshooting and Maintenance

Chassis Troubleshooting

J39 Service Test Points

The **J39 Power Monitor** connector (located on the rear panel of the Model 494.06, 494.10, and 494.20 Chassis) provides service test points. Test points include all of the power supply voltages and the status of the overtemperature sensor and the power-fail circuit.



494.xx Chassis

J39 Power Monitor

2	+ 5 V DC
3	+ 12 V DC
4	- 12 V DC
5	+ 15 V DC
6	- 15 V DC
7	+ 24 V DC
8	AGND
9	2.5 V Ref
10	+ 5 V AC Fail
11	AGND
12	+ 24 V AC Fail
13	Over Temp (TTL “0” = Overtemp condition)
14	Internal Chassis Temperature*
15	Power Fail (TTL “0” = Power failure)

$$\text{* Temperature (degrees C)} = \left[\frac{\text{Vout (pin 14)}}{0.005}\right] - 273.15$$

Note *Each output signal on the J39 connector includes a 2 K-ohm current-limiting resistor. These outputs cannot provide enough current to drive external devices.* Do not connect external devices (other than high-impedance test equipment) to the J39 connector.

Overcurrent Protection for Series 494 Hardware

Series 494 hardware includes the following overcurrent protection:

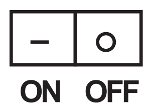
- Self-resetting fuses for each auxiliary power output.
- AC circuit breaker built into the chassis power switch.

Note *There are no user-replaceable fuses in any Series 494 Controller.*

How to Reset the Chassis Circuit Breaker

Each Series 494 Hardware chassis has a circuit breaker built into the power switch. If an overcurrent condition occurs, the circuit breaker removes power from the chassis power supply.

1. Determine and correct the cause of the overcurrent condition.
2. On the back of the chassis, switch the **Power** switch to the **OFF** position.



3. Switch the **Power** switch to the **ON** position to reset the circuit breaker.

   If the overcurrent condition still exists, the circuit breaker will continue to trip (remove power) each time it is reset.

How to Correct Over Temp Conditions

The Model 494.06, 494.10, and 494.20 chassis include an **Over Temp** indicator that turns on when the internal chassis temperature is too hot.

Note *The **Over Temp** indicator is located on the front of the 494.06 chassis and on the back of the 494.10 and 494.20 chassis.*

1. Shut down the system and check the airflow through the chassis.

   Check for blocked filters and damaged fans in the chassis and the rest of the control console.

2. Make sure that the ambient air temperature is less than 40ºC (104ºF).

3. For proper ventilation, make sure that there is 51 mm (2 in) clearance on all sides of the chassis.

4. Let the chassis cool down and restart the system.

   If the **Over Temp** indicator is on, shut down the system.

CAUTION

The chassis Over Temp indicator (located on the front of the Model 494.06 chassis and on the back of the Models 494.10 and 494.20 chassis) turns on when the chassis temperature is too hot–over 50ºC (122ºF).

Failure to take immediate action to correct the overtemperature condition can result in irreparable damage to components.

Do not operate the system when the chassis **Over Temp** indicator is on. Shut down the system and check the airflow through the chassis. Check for blocked filters and damaged fans in the chassis. If the chassis is installed in a console, check for blocked filters and damaged fans in the console. Also, make sure that the ambient air temperature is less than 40ºC (104ºF) and that there is at least 51 mm (2 in) clearance on all sides of the chassis.

WARNING

Operating the system when the Over Temp indicator is on can result in unexpected actuator movement.

A moving actuator can injure anyone in its path.

Do not operate the system when the chassis **Over Temp** indicator is on. Shut down the system and check the airflow through the chassis. Check for blocked filters and damaged fans in the chassis. If the chassis is installed in a console, check for blocked filters and damaged fans in the console. Also, make sure that the ambient air temperature is less than 40ºC (104ºF) and that there is at least 51 mm (2 in) clearance on all sides of the chassis.

Service Connections

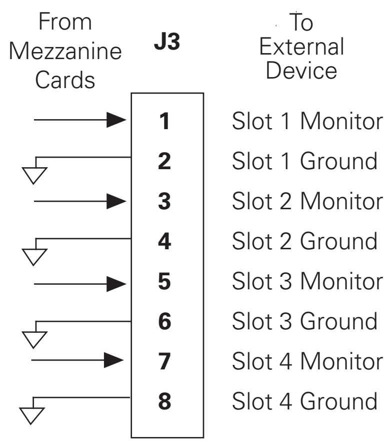
About Service Connections

A Series 494 Chassis can have several service connectors. There are two types of connectors:

- The chassis connection monitors the power supply.
- The connection on the I/O carrier board monitors the output of each card.

J3 I/O carrier service connection

The **J3 Service** connector on the Model 494.40 I/O Carrier board provides the monitor output from each of the four I/O option cards installed. It is an 8-pin RJ-45 connector.



Important *The signals at the J3 Service connector are provided for service and troubleshooting only. These signals are defined by the I/O option cards that are installed on a respective Model 494.40 I/O Carrier board. Some of these signals may be uncalibrated. Before use, take appropriate steps to determine the characteristics of these signals.*

Chassis Maintenance

This section describes how to maintain your MTS controller chassis.

How to Clean the Chassis

Remove dust from the chassis with appropriate electronics cleaner.

How to Clean the Air Filter

Be sure the cooling fan is operational and not clogged. Clean or replace the filter as required.

The filter is typically located in the top of the chassis, and can be accessed from the rear.

To clean the air filter:

1. Remove the filter from the chassis.
2. Immerse the filter in a large pan filled with warm water and a mild detergent, and allow it to soak a few minutes.
3. Gently agitate the filter to loosen debris.
4. Rinse the filter thoroughly with clean water.

CAUTION

Chassis filter elements can be damaged when improperly cleaned.

Compressed air can damage a chassis filter element.

Do not use compressed air to clean the chassis filter.

5. Allow the filter to drip until completely dry.
6. Replace the filter in the chassis.

CAUTION

An improperly installed chassis filter will not filter the air properly. This can result in excessive amounts of dust and debris on the inside of the controller.

Excessive amounts of dust and debris on the inside of the controller can result in an over-temp condition.

Install the filter so that the arrow on the side of the filter points in the direction of air flow through the chassis.

Appendix B
Optional Station Configurations

About Optional Station Configurations

You can configure the Series 494 Chassis to support an optional six or eight stations. When configuring your system for a six or eight stations, consider the following:

- Ensure that the .hwi file is correctly set for the desired multistation configuration, especially the interlock and HSM board settings.
- Power to each HSM is limited.
- Cross-head interlocks with solenoid power are not supported.
- AC input power must be at least 115 V AC.
- Auxiliary power out of J49 on the Model 493.74 HSM Transition board is not supported.

Six-Station Configurations

The six-station configuration can provide either six or eight channels of control.

- A typical 6-channel/6-station configuration requires 12 Digital Universal Conditioners and 6 two-stage valve drivers.
- A typical 8-channel/6-station configuration requires 16 Digital Universal Conditioners and 8 two-stage valve drivers.

HSM power limits

HSM power current is limited to 1.6 A per HSM.

Interlocks

For 6-station configurations, the .hwi file must contain the line **INTERLOCKS=6**. This line must be a discrete entry, not part of any other hwi section.

Cross-head interlocks with solenoid power are not supported for 6-station configurations.

Eight-Station Configurations

The eight-station configuration can provide eight channels of control.

A typical 8-Channel/8-Station configuration requires 16 Digital Universal Conditioners and 8 two-stage valve drivers.

HSM power limits

HSM power current is limited to 1.6 A per HSM.

Interlocks

For 8-station configurations, the .hwi file must contain the line **INTERLOCKS=8**. This line must be a discrete entry, not part of any other hwi section.

Cross-head interlocks with solenoid power are not supported for 8-station configurations.

Appendix C
Aero Multibox Systems

This section describes the basic tasks required to set up Aero Multibox systems.

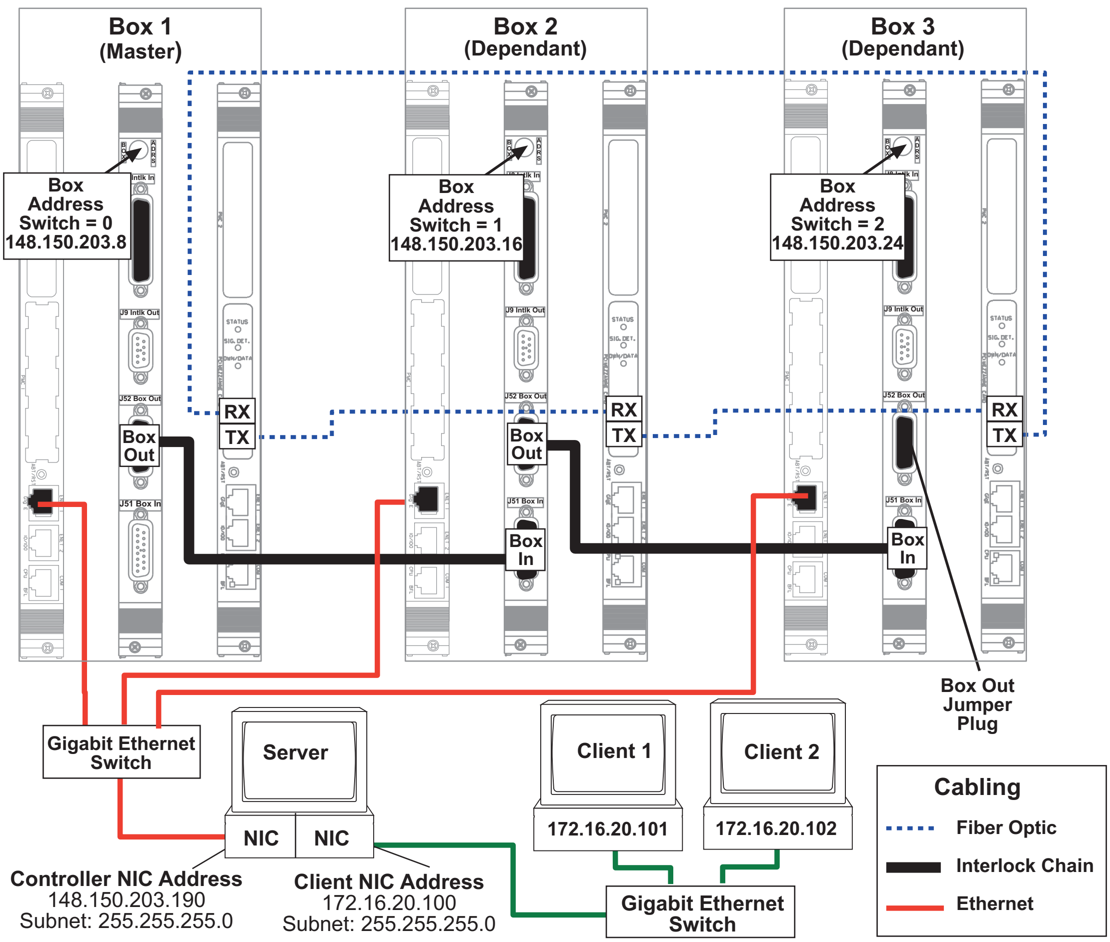
Important *The procedures in this section should only be performed by MTS-trained personnel.*

Aero Multibox Overview

About Multibox Systems

A multibox system consists of up to 12 networkable 20-slot controller chassis (boxes) that can be combined to create various test systems.

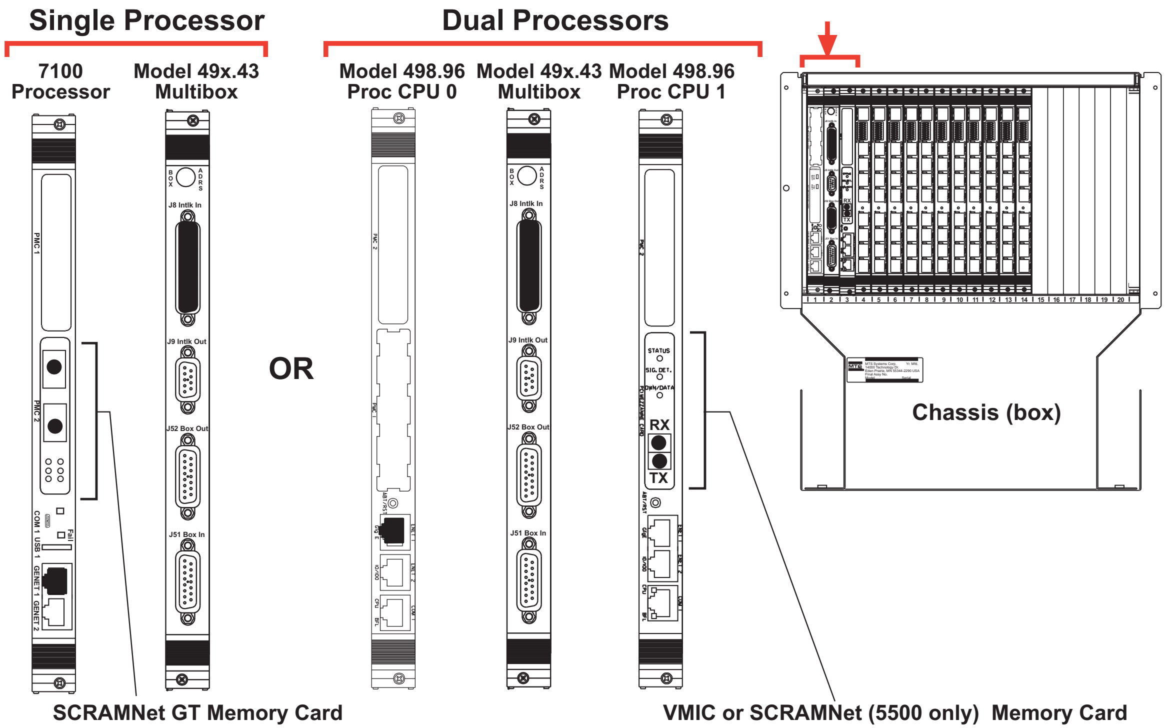
- Series 493 Hardware can provide up to 30 control channels per box for a maximum of 360 control channels for a 12-box system.
- Series 494 Hardware can provide up to 40 control channels per box for a maximum of 480 control channels for a 12-box system.



Multibox Hardware

Multibox Hardware

ITEM	DESCRIPTION
Dual Processor Systems	**CPU 0 SUP processor board–**this processor board includes a Gigabit Ethernet connnection for the controller network. **CPU 1 DSP processor board–**this processor board includes a VMIC reflective memory mezzanine card.
Single Processor Systems	Newer systems use a single dual-core 7100 processor board equipped with a SCRAMNet GT reflective memory module.
Model 49x.43 Multibox Board	Each box in a multibox system includes a Model 49x.43 Multibox board. • An address switch on this board sets the TCP/IP address for the box. • Box In/Box Out connections provide box-to-box clock and interlock synchronization for multiple boxes.
HPU/HSM Boards	Each system requires an HPU and HSM board that must be installed in the master box. • Model 493.73 HPU board with E-Stop input • Model 493.74 or 494.74 HSM board with Station-Stop input ***Important*** *HPU and HSM boards can only be installed in the first box in the chain (master box).*



Processor Memory Module Compatibility

Some applications, such as multibox systems, require the installation of a memory module on a processor board. The following table lists the types of memory modules that can be used with various processors.

Important *When a multibox system uses both 5500 processors and 7100 processors, all processors must use ScramNet GT memory modules.*

Memory Module Compatibility

Processor Type	VMIC Memory Card Compatible?	SCRAMNet GT Memory Card Compatible?
5100	Yes	No
5500	Yes	Yes
7100	No	Yes
Multibox system with 5500 and 7100	No	Yes

Task 1 Set Up Multibox Hardware

The following procedure outlines the basic steps required to set up the hardware used in a multibox system.

1. "AeroPro Workstation Requirements" on page 294.
2. "Add HPU and HSM Boards to the Master Controller Box" on page 295.
3. "Reflective Memory Module Node Address Jumper Settings" on page 296.
4. "Multibox Processor Settings" on page 297.
5. "Multibox Chassis Address Settings" on page 298.
6. "Verify the I/O Carrier Address Settings" on page 299.

AeroPro Workstation Requirements

Hardware requirements

WORKSTATION	RECOMMENDED REQUIREMENTS*
AeroPro Server	Intel Quad Core Xeon, 2.34 GHz processor, or faster 4 GB RAM 256 MB video card, PCIe Two PCI network cards (Gigabit). Depending on controller hardware, additional network cards may be required. DVD+R/+RW drive 250 GB Hard drive, RAID 1
AeroPro Client	Intel Dual Core, 2.46 GHz processor 2 GB RAM 256 MB video memory One network card, Gigabit, PCIe DVD RW drive 160 GB hard drive, RAID 1

* Workstation requirements and specifications are subject to change without notice. Please verify the current requirements and specifications with MTS before you install any MTS software products and network workstations with any MTS equipment.

Software requirements

Operating System:

- Microsoft Windows XP, Service Pack 2 (service pack 3 for AeroPro 6.20 and above), OR
- Windows Vista Business, Service Pack 1

Note *AeroPro systems that include VXI 1629 or 1529 hardware are incompatible with Windows Vista.*

- Microsoft Internet Explorer 6.0
- Microsoft Excel 2007

Note *Do not install other office applications on the system.*

Add HPU and HSM Boards to the Master Controller Box

Each multibox system requires an HPU board and a HSM board. These boards must only be installed in the first box in the chain (Master box).

- Model 493.73 HPU board with E-Stop input
- Model 493.74 (or 494.74) HSM board with Station-Stop input

Important *If reconfiguring a system, you must remove any HPU and HSM boards from the dependent boxes.*

Board locations

The HPU/HSM board locations depend on the type of HSM board used. Use the following table to determine the correct board locations.

HPU/HSM Board Locations

Board Type	Model 494.74 Single-Width HSM Board	Model 493.74 Double-Width HSM Board
Model 493.73 HPU Board	Transition Slot 3	Transition Slot 4
HSM Board	HSM 1-2: Transition Slot 2	HSM 1-2: Transition Slot 3
	HSM 3-4: Transition Slot 1	HSM 3-4: Transition Slot 1

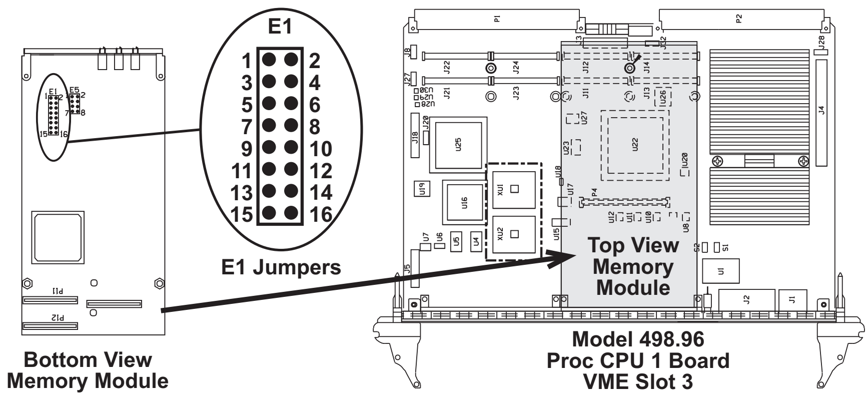
Reflective Memory Module Node Address Jumper Settings

Each box in a dual-processor multibox system must have a reflective memory module (VMIC) installed on the DSP processor board located in VME slot 3. Each VMIC module must have a discrete Node ID number. The Node ID number is set on the VMIC module using the E1 jumpers (see table below).

Note *7100 processors do not use the VMIC card. SCRAMNet GT memory cards do not require any jumper settings.*

Node ID numbering convention:

Box 1 = Node 0,
Box 2 = Node 1,
Box 3 = Node 2...



VMIC Node Address Jumper Settings

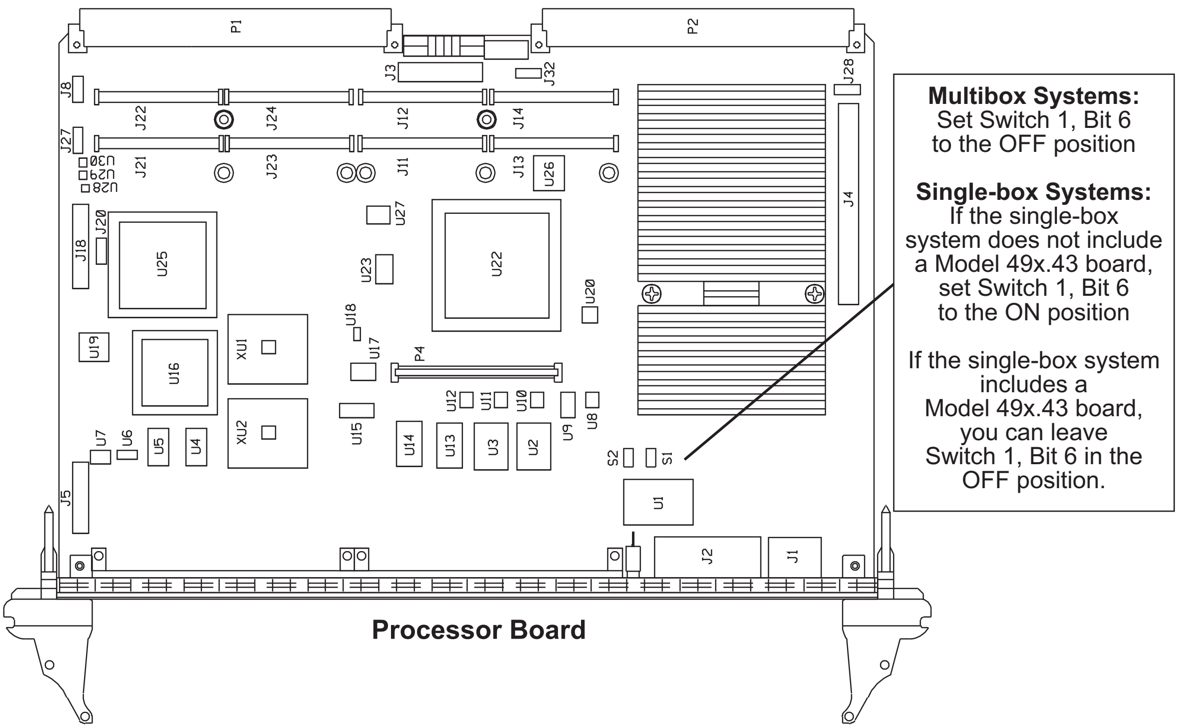
Chassis Node ID Number	Pins 1 to 2	Pins 3 to 4	Pins 5 to 6	Pins 7 to 8	Pins 9 to 10	Pins 11 to 12	Pins 13 to 14	Pins 15 to 16
0 (Box 1)	Install	Install	Install	Install	Install	Install	Install	Install
1 (Box 2)	**Remove**	Install	Install	Install	Install	Install	Install	Install
2 (Box 3)	Install	**Remove**	Install	Install	Install	Install	Install	Install
3 (Box 4)	**Remove**	**Remove**	Install	Install	Install	Install	Install	Install
4 (Box 5)	Install	Install	**Remove**	Install	Install	Install	Install	Install
5 (Box 6)	**Remove**	Install	**Remove**	Install	Install	Install	Install	Install
6 (Box 7)	Install	**Remove**	**Remove**	Install	Install	Install	Install	Install
7 (Box 8)	**Remove**	**Remove**	**Remove**	Install	Install	Install	Install	Install
8 (Box 9)	Install	Install	Install	**Remove**	Install	Install	Install	Install
9 (Box 10)	**Remove**	Install	Install	**Remove**	Install	Install	Install	Install
10 (Box 11)	Install	**Remove**	Install	**Remove**	Install	Install	Install	Install
11 (Box 12)	**Remove**	**Remove**	Install	**Remove**	Install	Install	Install	Install

Multibox Processor Settings

When used in a multibox system, both processors in each box must have Switch 1 Bit 6 set to the off position.

Note *If you remove a box from a multibox system and use it as a standalone controller (without a Model 49x.43 Multibox board), you must set Switch 1 Bit 6 on both processor boards to the* ***on*** *position.*

Typically, when a box is removed from a multibox system, the Model 49x.43 Multibox board remains in the box and Switch 1 Bit 6 on both processor boards are left in the ***off*** *position.*



Processor Board

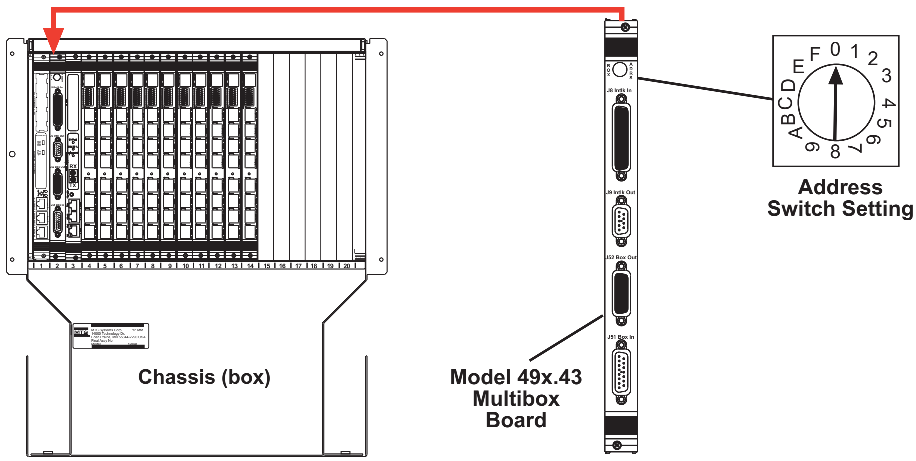
7100 Processors

7100 processors do not have multibox switch settings.

- When used in a multibox system, the processor IP address is determined by the chassis address setting on the Model 49x.43 Multibox board.
- When used in a single-box configuration, the processor IP address defaults to 148.150.203.191.

Multibox Chassis Address Settings

Each chassis (box) in a multibox system requires a Model 49x.43 Multibox board with a front-panel address switch that sets the TCP/IP address setting for the box.



Model 49x.43 Multibox Board Address Settings

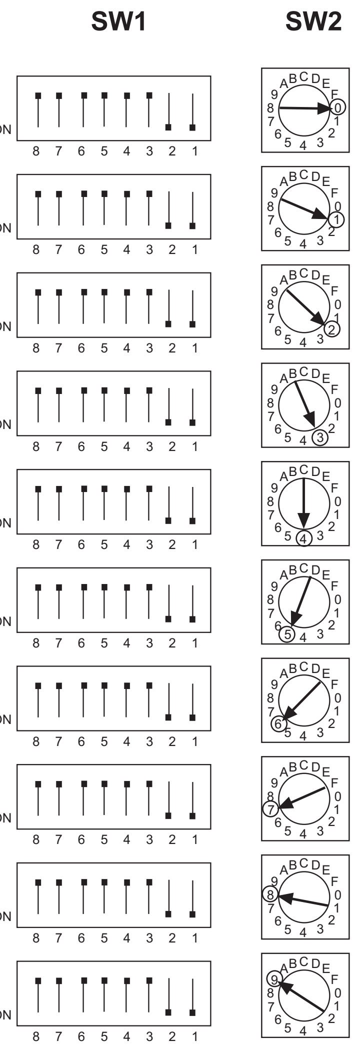
Box	Address Switch Setting	TCP/IP Address
First Box (Master)	0	148.150.203.8
Box 2 (Dependent)	1	148.150.203.16
Box 3 (Dependent)	2	148.150.203.24
Box 4 (Dependent)	3	148.150.203.32
Box 5 (Dependent)	4	148.150.203.40
Box 6 (Dependent)	5	148.150.203.48
Box 7 (Dependent)	6	148.150.203.56
Box 8 (Dependent)	7	148.150.203.64
Box 9 (Dependent)	8	148.150.203.72
Box 10 (Dependent)	9	148.150.203.80
Box 11 (Dependent)	A (10)	148.150.203.88
Box 12 (Dependent)	B (11)	148.150.203.96

Verify the I/O Carrier Address Settings

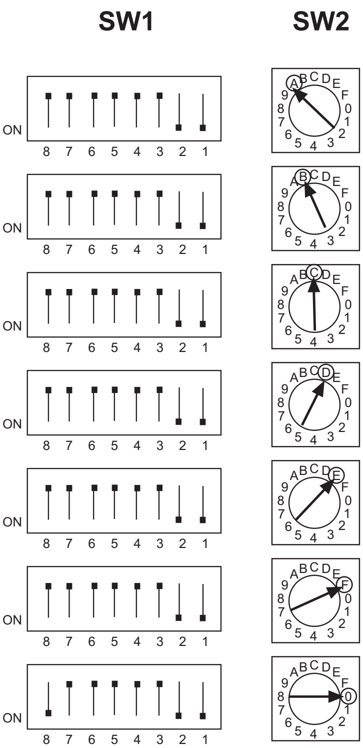
Each I/O Carrier board installed in the VME bus must have a unique address. This address is set using switches SW1 and SW2 on the I/O Carrier board.

I/O Carrier boards should be installed from left-to-right starting with the lowest address. Any blank slots in the VME bus should have addresses reserved as part of this low-to-high addressing sequence.

VME Slot	Address
4	C2000000
5	C2200000
6	C2400000
7	C2600000
8	C2800000
9	C2A00000
10	C2C00000
11	C2E00000
12	C3000000
13	C3200000



VME Slot	Address
14	C3400000
15	C3600000
16	C3800000
17	C3A00000
18	C3C00000
19	C3E00000
20	C4000000



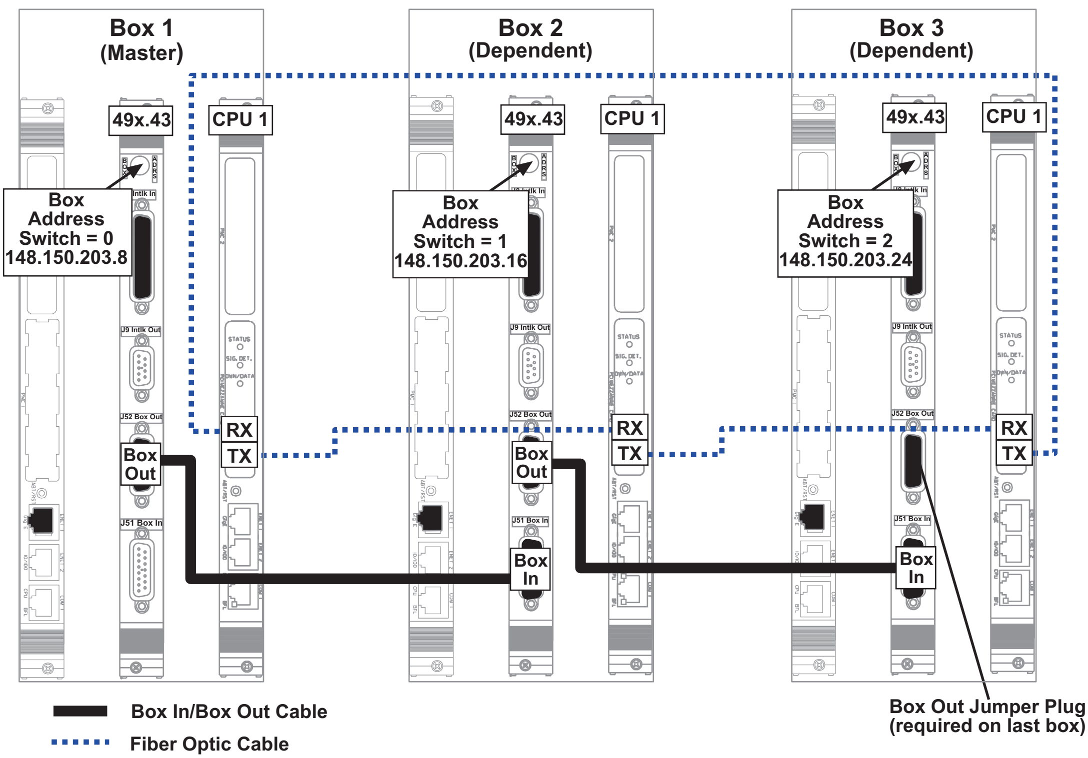
Task 2 Make Multibox Connections

Once the hardware is installed and configured, you can make the box-to-box connections and set up the various networks used in the multibox system.

Connect Multibox Hardware (dual processors)

1. Connect the **Fiber-Optic** cables as show below.
2. Connect the **Box In/Box Out** cables as shown below.
3. Install a **Box Out** jumper plug on the last box.

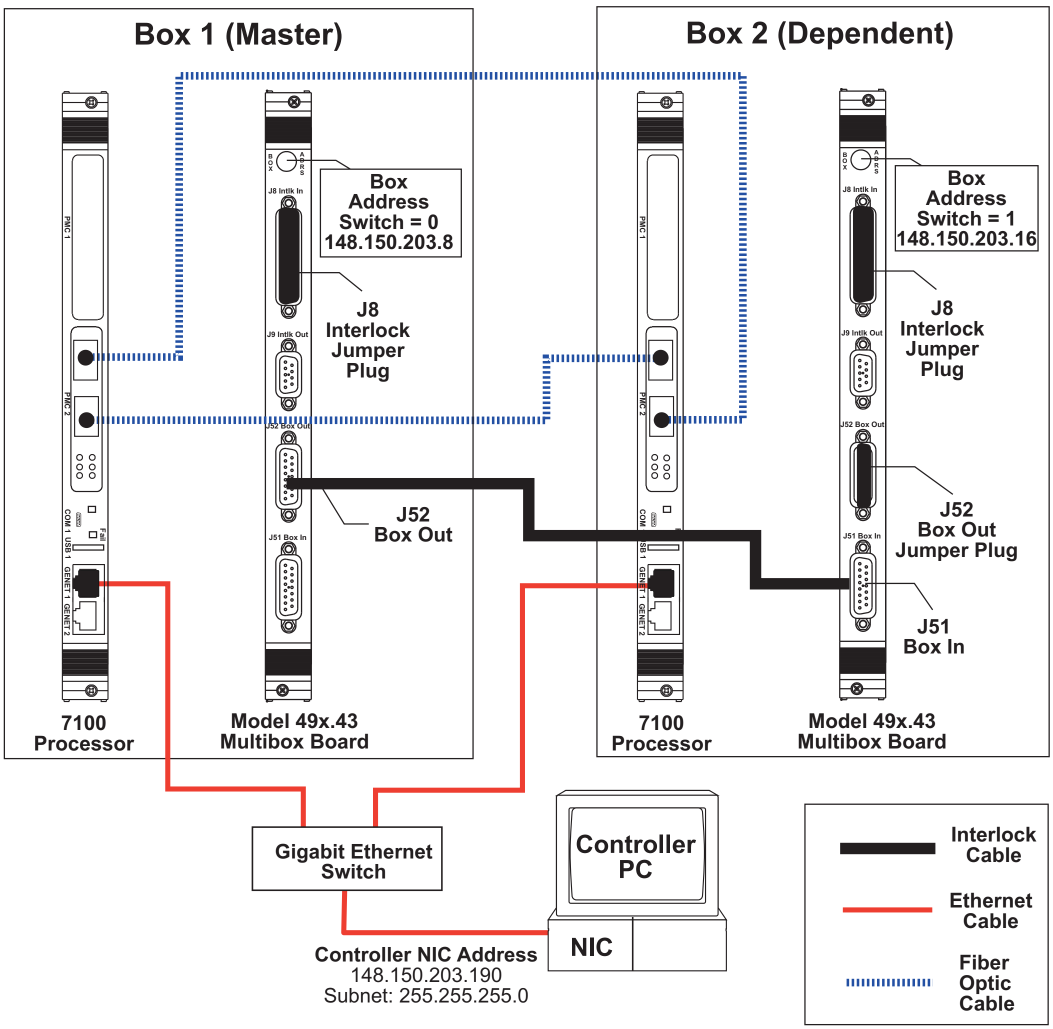
Note *Dual processor configurations require the installation of VMIC memory modules on each processor board.*



Connect Multibox Hardware (single 7100 processor)

1. Connect the **Fiber-Optic** cables as show below.
2. Connect the **Box In/Box Out** cables as shown below.
3. Install a **Box Out** jumper plug on the last box.

Note *Single 7100 processor configurations require the installation of SCRAMNet GT memory modules on each processor board.*

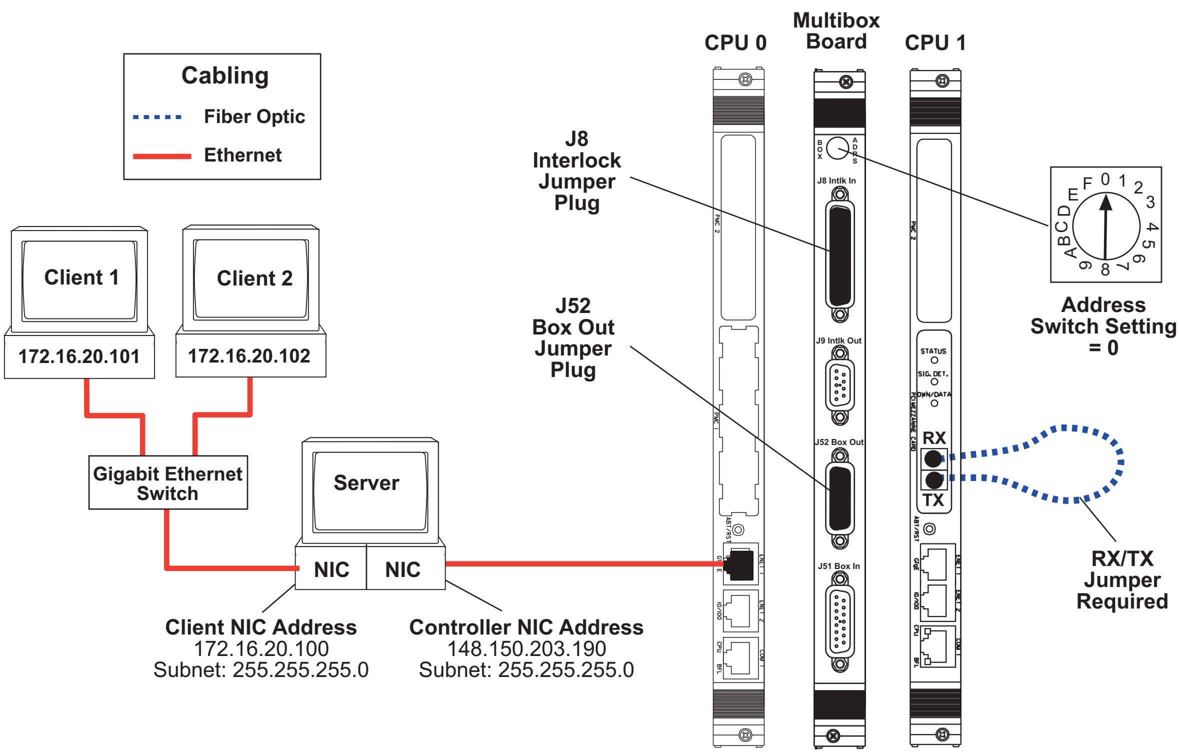


Single-Box Multibox Chassis Connections

Typically, when a box is removed from a multibox system, the Model 49x.43 Multibox board remains in the box and Switch 1 Bit 6 on both processor boards are left in the off position.

Dual-processor systems

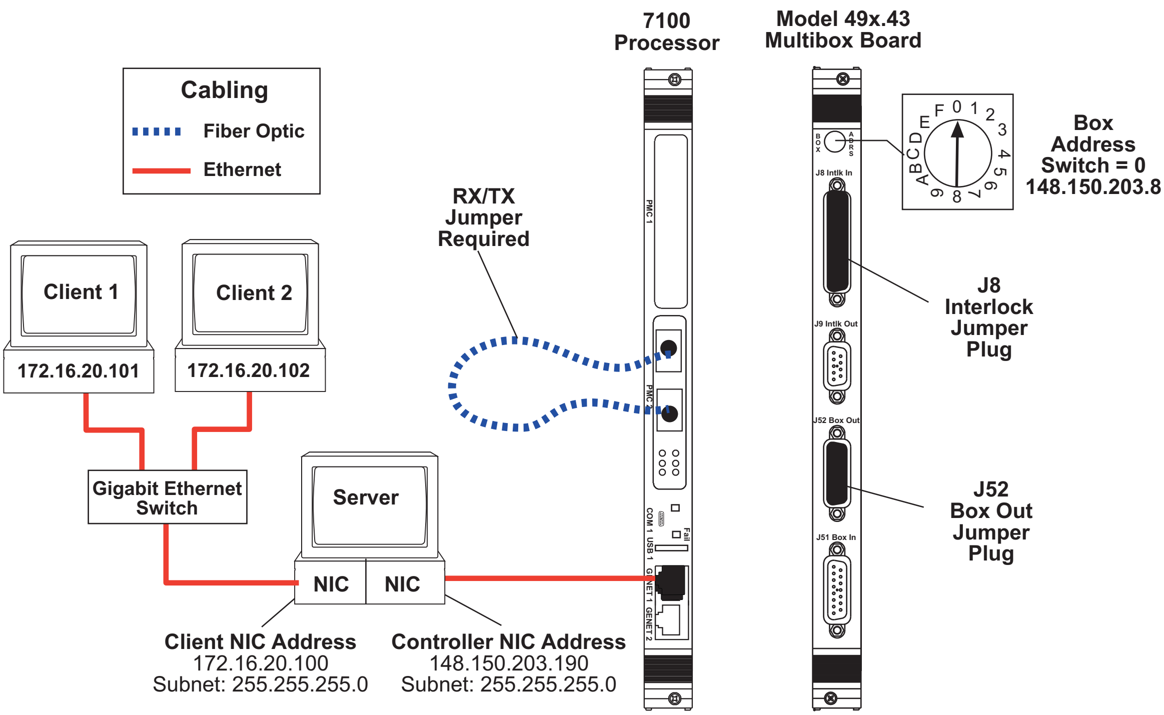
If you use a single multibox chassis to run a test, you must connect it as shown in the following drawing.



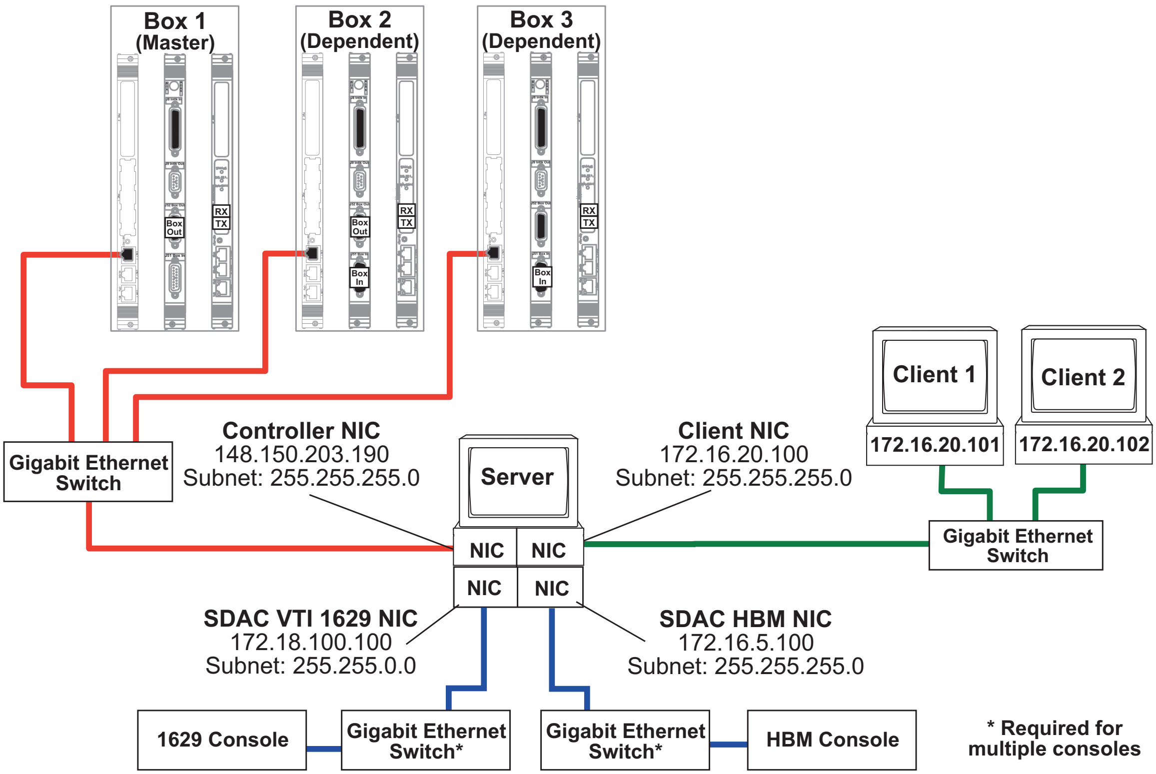
7100 Processors

7100 processors do not have processor switch settings.

- If used in a single-box configuration that includes a Multibox board, the processor IP address is determined by the front-panel address switch setting on the Multibox board. When this switch is set to 0, the IP address is 148.150.203.8.
- If used in a single-box configuration without a Multibox board, the processor IP address defaults to 148.150.203.191.



Multibox Network Address Settings



Server PC

The Server PC requires a network interface card (NIC) and a Gigabit Ethernet switch for each network.

Server Network Interface Card Settings

Network Interface Card	TCP/IP Address	Subnet
Controller Network (494/AeroST)	148.150.203.190	255.255.255.0
Controller Network (Aero90)	172.16.100.100	255.255.255.0
Client Network	172.16.20.100	255.255.255.0
SDAC (HBM)	172.16.5.100	255.255.255.0
SDAC (1629 or 1529)	172.18.100.100	255.255.0.0

Client PC

Each Client PC requires a network interface card (NIC) that connects to a Gigabit Ethernet switch.

Client Multibox Network Interface Card Settings

NETWORK INTERFACE CARD	TCP/IP ADDRESS	SUBNET
Client 1	172.16.20.101	255.255.255.0
Client 2	172.16.20.102	255.255.255.0
Client 3	172.16.20.103	255.255.255.0
Client n	172.16.20.10n	255.255.255.0

Task 3 Use the CMT to Configure the Multibox System

The Controller Management Tool (CMT) procedures are performed when you are combining two or more controller chassis (boxes) into a multibox system. These procedures must be performed in the following order:

1. "Delete the Old Single-Box Controller Folder" on page 307.
2. "Install System Controller Files" on page 308.
3. "Use the CMT to Configure the Controller" on page 309.
4. "Reboot the Controllers" on page 311.
5. "Use the CMT to Register Multiple Controllers" on page 312.

Once you have performed these procedures, you must create an Hwi file for each controller (box).

Delete the Old Single-Box Controller Folder

When switching from a single controller to a multibox controller or if you are configuring a new system as a multibox, you must first remove the existing single-box controller folder.

This folder (“793 for Aero” for an AeroST controller or “MTS Flex Test 200” for the Flex Test controller) is created when the 793 software is installed and must be removed for a multibox configuration.

Important *Back up the existing controller folder if you will use it to run future single-box tests.*

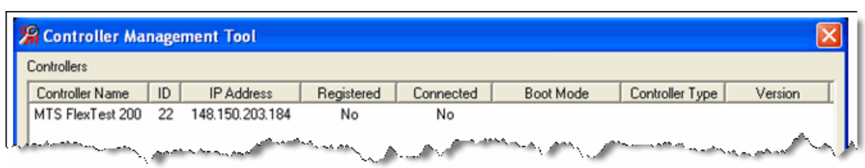
1. Use the CMT Tool to check for old single-box controller folders.

   A. Make sure the AeroPro Server PC is on and you are logged into the AeroPro user account.

   B. Start the Controller Management Tool (CMT) application from the server PC.

   Start > All Programs > MTS 793 Software > Tools > Controller Management Tool

   If the default controller exists, it will appear in the CMT window without any controllers connected (as shown below).



   C. Close the CMT and answer “No” to saving the log file.

2. **Important**–back up the existing controller folder if you will use it to run future single-box tests.

3. Delete the existing single-box controller folder.

   A. Open Windows Explorer and navigate to one of the following locations depending on the controller type.

   “C:\MTS 793\Controllers” for FlexTest controllers

   “C:\ 793Aero\Controllers” for AeroST controllers

B. Highlight the old single-box controller folder and click **Delete**.

The default names for the controller folders are “793 for Aero” for an AeroST controller or “MTS Flex Test 200” for the Flex Test controller.

Install System Controller Files

Note *This step is not required when using the Controller Management Tool (CMT) with 793 software version 5.20 and later.*

1. Turn ON the power to all the controllers (boxes) in the multibox configuration.
2. If necessary, on the Server PC, launch the Controller Management Tool (CMT) application.

   Start > All Programs > MTS 793 Software > Tools > Controller Management Tool

   As the controllers boot up, they will appear in the CMT window.
3. Highlight the first Controller and click **Install**.

   When the system files are successfully installed, the red **Install System Files** indicator changes to a green **Ready** indicator.
4. Repeat for all other controllers.

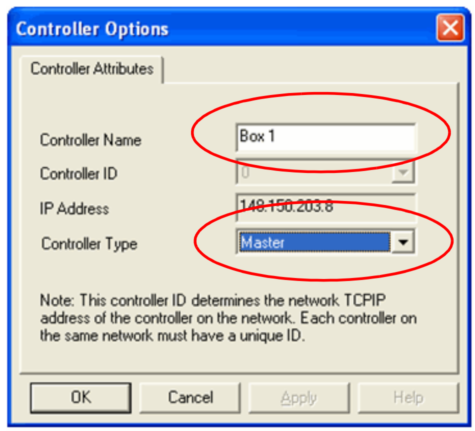
Use the CMT to Configure the Controller

Use the Controller Management Tool (CMT) application to rename each box and set the Controller Type to define the Master and Dependent controllers. As you rename each controller, the various folders in the **Controllers** directory will also be renamed with the new controller name (Box 1, Box 2, ...).

1. If necessary, start the Controller Management Tool application.
2. Configure the Master controller.

   The Master controller is the first box in the multibox configuration and includes the HPU and HSM boards.

   A. In the CMT window, select the first controller and click **Options**.

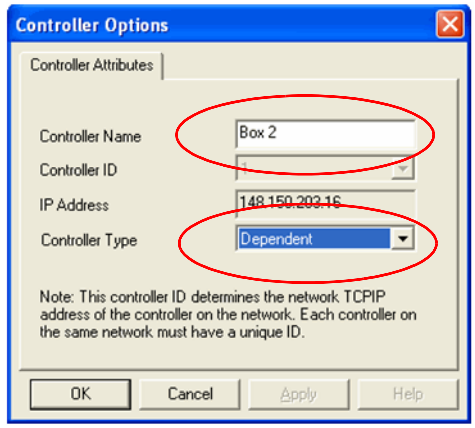


   B. In the **Controller Name** text box, type **Box 1**.

   C. In the **Controller Type** list, click **Master**.

3. Configure the Dependent controllers.

   A. Select the next controller and click **Options**.



   B. In the Controller Options window:

   In the **Controller Name** text box, type **Box 2**.

   In the **Controller Type list,** click **Dependent**.

   C. Click **OK**.

4. Repeat Step 3 for all other Dependent controllers in the multibox configuration incrementing the “Box x” number each time and setting the Controller Type for each box to **Dependent**.

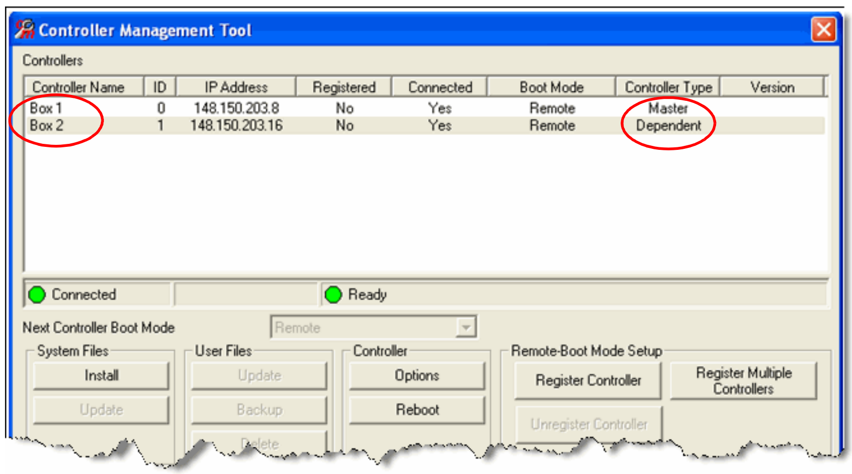
Reboot the Controllers

Once you have used the Controller Management Tool (CMT) to name all the controllers and define their Controller Type (master or dependent) you must use the CMT to reboot all the controllers.

1. In the CMT window, select each controller one at a time and click **Reboot**.

   The CMT window will go blank until the controllers have completed their reboots and come on line again.

2. Check the CMT window to make sure that all the controllers have rebooted successfully with the correct controller name and type.



Use the CMT to Register Multiple Controllers

1. Make sure that all controllers are connected properly (including all network connections).
2. Apply power to each controller.
3. Allow the CMT to detect each controller.

   Each controller that is detected appears in the CMT window. The **Controller Name** typically appears as Unregistered_0 and Unregistered_1.
4. In the Controller Management Tool (CMT) window, click **Register Multiple Controllers**.
5. Make sure that the **Registered** column for each box indicates **Yes**.

Task 4 Create an Hwi File for Each Box

Each controller (box) in a multibox configuration requires an Hwi file that maps all the hardware in that box to specific locations in the chassis.

You must perform the following procedures for each box in a multibox system.

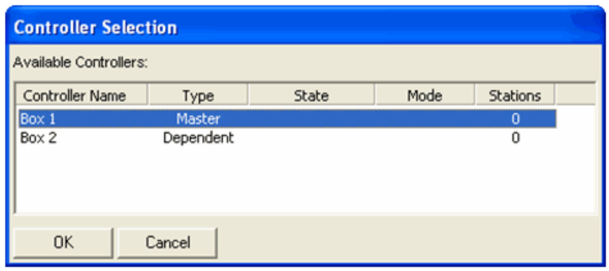
1. "Select a Controller and run the Detect Hardware Feature to Help Build an Hwi file" on page 314.
2. "Define the VME Slot Locations" on page 316.
3. "Configure Servo Valve Outputs" on page 320.
4. "Configure the Model 494.79 Multiple Universal Driver (MUD) Board" on page 322.
5. "Configure Each Model 493.25 / 494.26 DUC" on page 323.
6. "Configure the Model 493.73 HPU Options" on page 324.
7. "Save the Hwi File in the Correct Folder" on page 325.

Select a Controller and run the Detect Hardware Feature to Help Build an Hwi file

1. Start the Hwi Editor application.

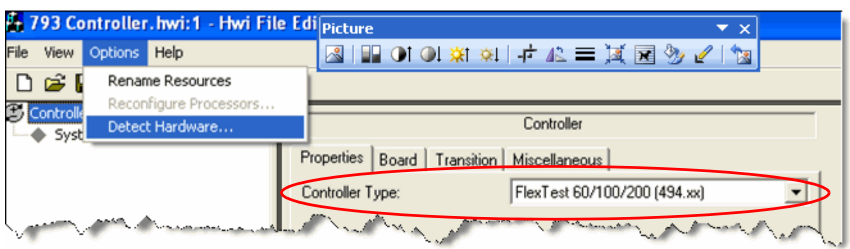
   All Programs > MTS 793 Software > Service Tools > Hwi Editor

   The following window will open showing all the controllers that are available on the controller network (only two in this example).

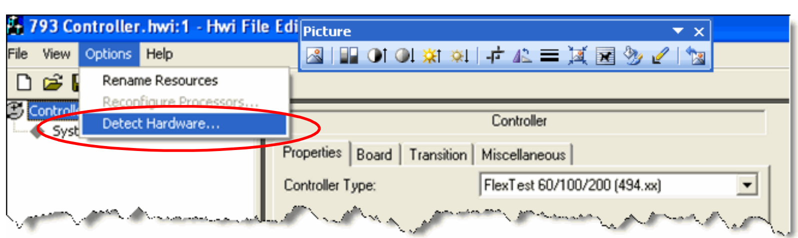


2. Select the Controller that you want to create an Hwi file for and click **OK**.

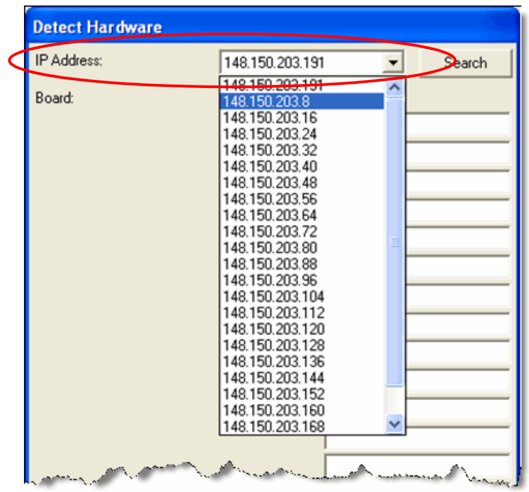
3. In the Hwi File Editor window, set the **Controller Type**.



4. On the **Options** menu, click **Detect Hardware**.



5. Select the TCP/IP address for the box that you want to create an Hwi file. Each box in a multibox system has a unique TCP/IP address. See the table below.



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Controller TCP/IP Addresses

Boxes 1-6	Boxes 7-12
Box 1: 148.150.203.8	**Box 7: 148.150.203.56**
Box 2:148.150.203.16	**Box 8: 148.150.203.64**
Box 3: 148.150.203.24	**Box 9 : 148.150.203.72**
Box 4: 148.150.203.32	**Box 10 : 148.150.203.80**
Box 5: 148.150.203.40	**Box 11: 148.150.203.88**
Box 6: 148.150.203.48	**Box 12: 148.150.203.96**

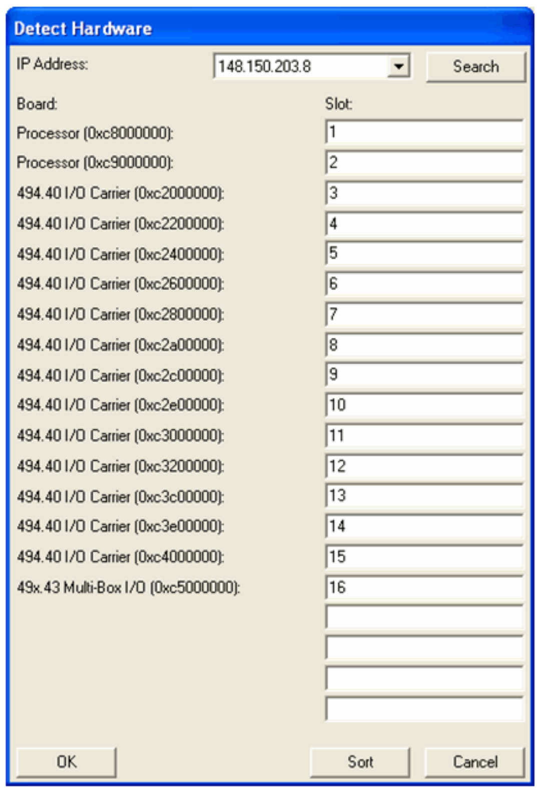
Define the VME Slot Locations

The Hwi Editor application can detect the hardware in the controller but cannot detect the exact VME slot where the various VME boards are installed. You must verify the slot number where each VME board is installed and make changes as necessary.

Important *I/O carriers should be physically installed (left-to-right) based on their address settings starting with the lowest address setting.*

1. Click **Search** to detect the hardware installed in the box.

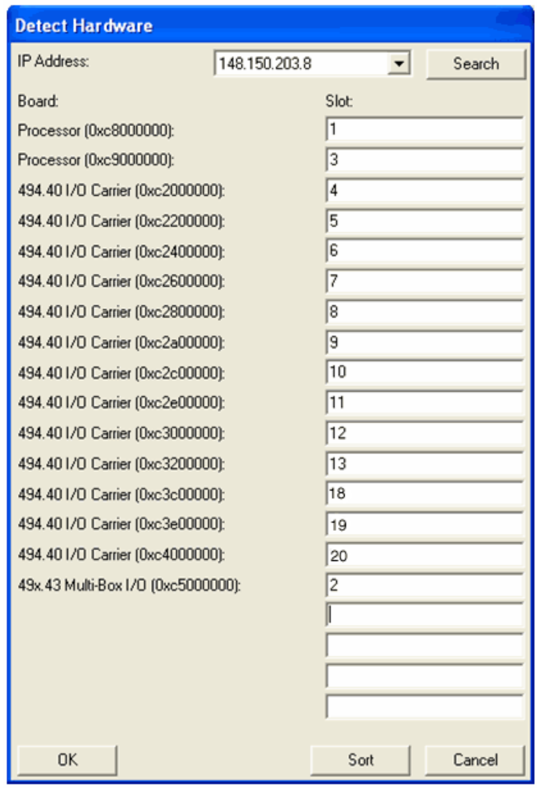
   When the Hwi Editor detects the hardware, it shows the processors and then numbers the rest of the VME boards based on their address settings. Any gaps in the VME chassis (slots with no hardware installed) are not shown.



2. Where necessary, change the numbers in the **Slot** column to match the physical location of the hardware.

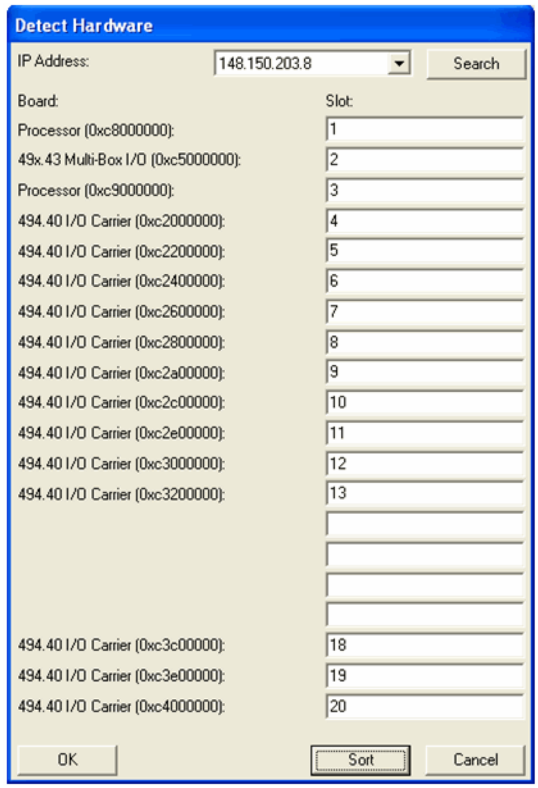
Note *If the I/O carriers were physically installed (left-to-right) starting with the lowest address setting, most of their slot numbers should be correct.*

In this example, the 49x.43 Multi-Box I/O is located in VME Slot 2 and the last three 494.40 I/O Carriers are located in VME Slots 18, 19 and 20. VME slots 14, 15, 16, and 17 were left empty.



3. Click **Sort**.

   The hardware will be reordered to match the physical locations set in the previous step. See the example below.



4. Verify that the slot locations shown match the physical location of the hardware and click **OK**.

About Servovalve Drive Outputs for Aero Applications

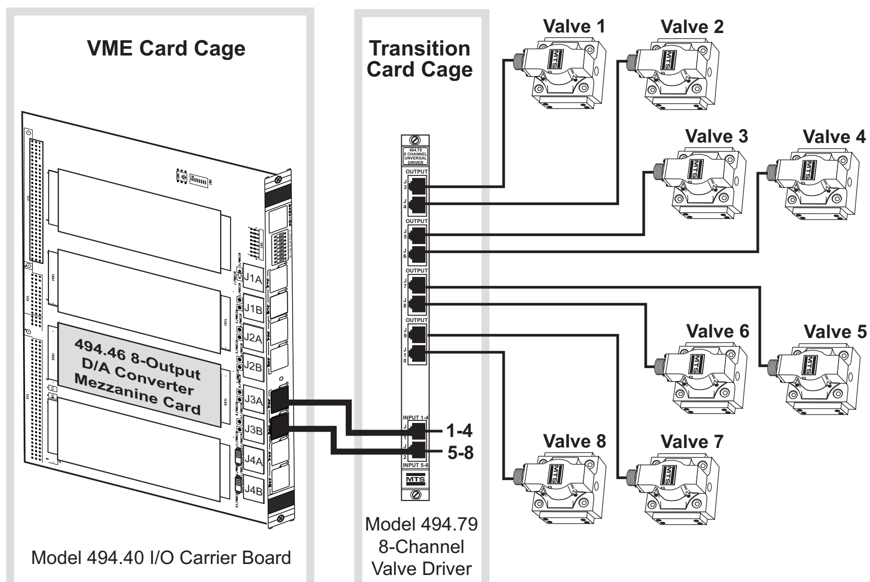
Aero applications use a combination of a Model 49x.46 D/A cards and Model 49x.79 MUD boards to provide the servo valve drive outputs. Four D/A cards provide 32 outputs (eight outputs per card) for a Flex Test 200 controller and 24 outputs (six outputs per card) in an AeroST controller.

D/A card locations

For Aero applications, the D/A cards that are used to drive the MUD boards are located on the I/O carrier located in VME Slot 20. If additional outputs are required, the next D/A card is installed in the I/O carrier located in VME Slot 19.

MUD board locations

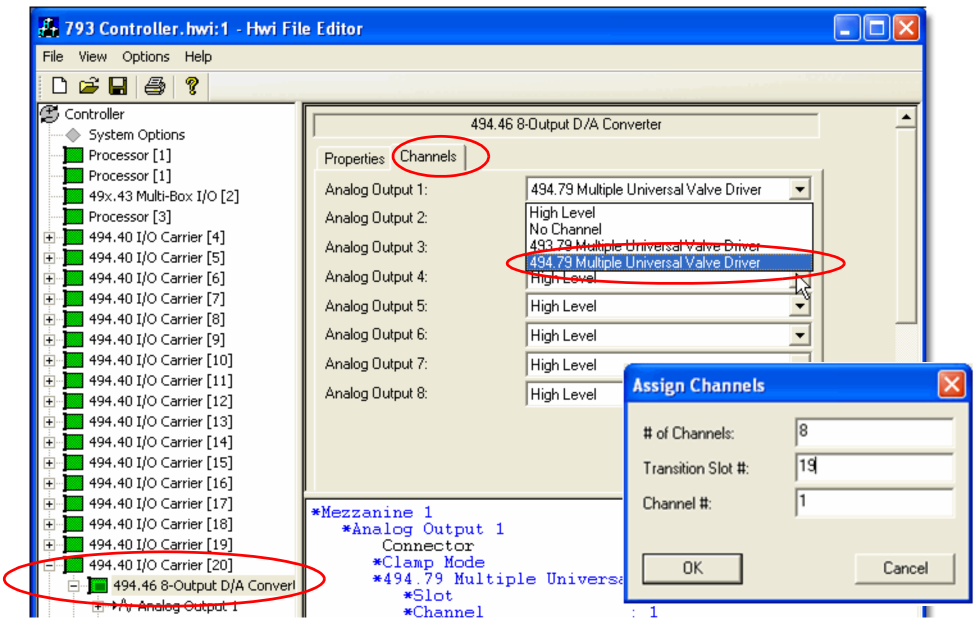
MUD boards are assigned to the D/A cards in descending order starting with transition slot 19. For example, the four D/A cards located in VME slot 20 will drive the MUD boards located in transition slots 19, 18, 17, and 16.



Configure Servo Valve Outputs

Perform this procedure to define which D/A card is connected to which MUD board.

1. Navigate to **494.40 IO carrier [20]** and click + to expand the tree.
2. Click + for the first Model 494.46 8-Output D/A Converter to expand the tree to show the eight analog outputs as shown below.



3. Assign the D/A outputs to a Model 494.79 MUD board.

   A. In the right-hand side of the window, click the **Channels** tab.

   B. From the **Analog Output** 1 list, click **494.79 Multiple Universal Valve Driver**.

   C. In the Assign Channels window:

   - Set the **# of Channels** to 8 (6 for the 493.79 in the AeroST).
   - Set the **Transition Slot #** of the MUD card to 19.

     Assign MUD boards in descending order starting in Transition Slot 19.
   - Set the **Channel #** to 1

D. Click **OK**.

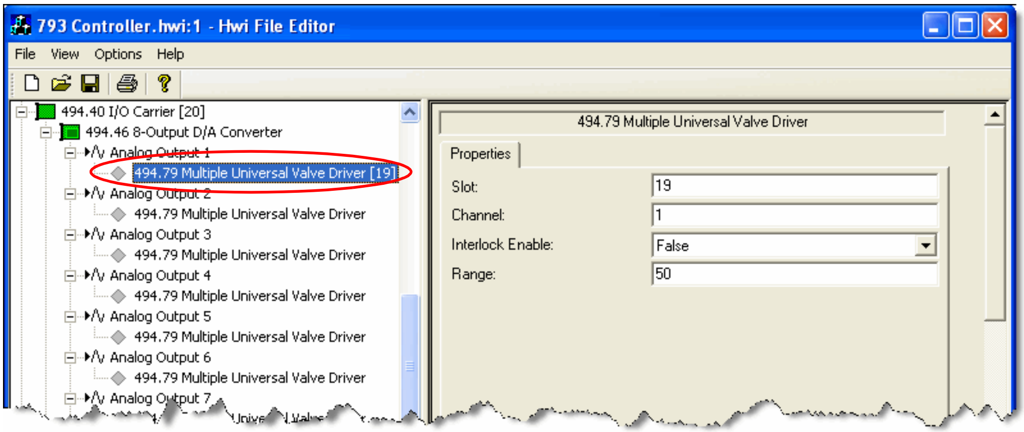
The Hwi Editor will assign all 8 outputs (6 for the Model 493.79) to the MUD board located in Transition Slot 19.

4. Repeat this procedure for each D/A and MUD board combination.

The next MUD board in the sequence is located in Transition Slot 18.

Configure the Model 494.79 Multiple Universal Driver (MUD) Board

1. In the Hwi File Editor window, expand the hardware tree to display the **494.79 Multiple Universal Valve Driver [19]** settings.



2. In the **Interlock Enable** list, click **False**.

Note *Standard MTS servo valve cables do not support the cable-loss interlock detection circuit so the **Interlock Enable** setting must be set to **False**.*

3. In the **Range** box, enter the servovalve drive current value that matches the coil rating of the servo valve. Selections include: 25 mA, 50 mA, and 75 mA.

   MTS servo valves have a coil rating of 50 mA.

Note *Some custom systems require a user-defined drive current value. For these systems, the range setting is set to zero and a resistor is installed on the MUD board.*

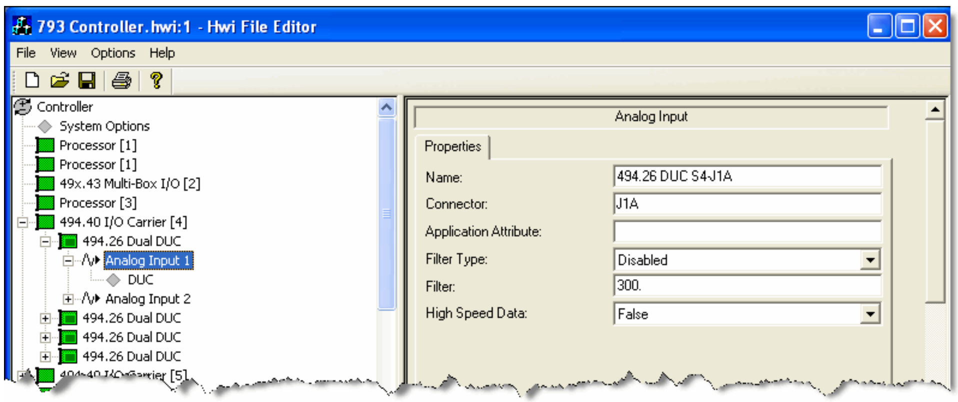
4. Repeat this procedure for each of the “494.79 Multiple Universal Valve Driver” outputs in the controller.

Configure Each Model 493.25 / 494.26 DUC

For Hwi Editor versions 5.20 and above, use the **Show Hwi Defaults** feature to make universal changes to the DUC default settings that you can apply to all the DUCs in the controller.

1. Disable the analog input filter.

   A. Starting at the 494.40 IO Carrier in VME Slot 4 expand the hardware tree down to the level of "Analog Input x".



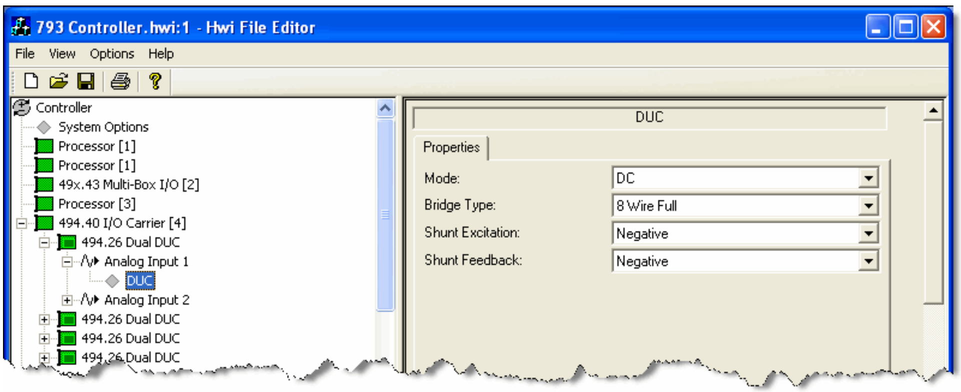
   B. In the **Filter Type** list, click **Disabled**.

Note *MTS recommends that for Aero test applications, all filters on the conditioner inputs of the Model 494.25 /494.26 DUCs are initially set to "Disabled."*

2. Configure the DUC.

   A. Expand the hardware tree down and select the **DUC** icon.

   The default values for the type of cable connected (4 or 8 wires) and the polarity of the applied shunt are shown below.



   B. If necessary, make changes to match the bridge type, shunt excitation and shunt polarity.

3. Repeat this procedure for each DUC in the controller chassis.

For more information

For more information on configuring DUCs, see “Digital Universal Conditioner Mezzanine Cards” on page 143 and the *MTS Series 793 Utility Software* manual.

Configure the Model 493.73 HPU Options

This is only required on the Master Controller (Box 1) at the 148.150.203.8 TCP/IP address. All other controllers in the multibox system do not have hydraulic control hardware.

1. Expand the 493.73 HPU hardware tree to the “Hydraulic Interface” level.
2. Set **First On** to **True**.
3. Set **Last Off** to **True**.

Save the Hwi File in the Correct Folder

The Hwi file must be saved in the folder that the CMT application created for the controller box. These folders (named “Box 1”, “Box 2” ... “Box ‘n’”) are located in the **C:\MTS 793\Controllers** directory.

1. Make sure the Hwi file is named: “793 Controller.hwi”.
2. Save the Hwi file in the folder with the controller’s name.

   For example: C:\MTS 793\Controllers\Box 1.

Appendix D

Model 793 Multibox Systems

This section provides a general overview on how to set up Model 793 Multibox Systems.

Perform the following procedures in the order shown:

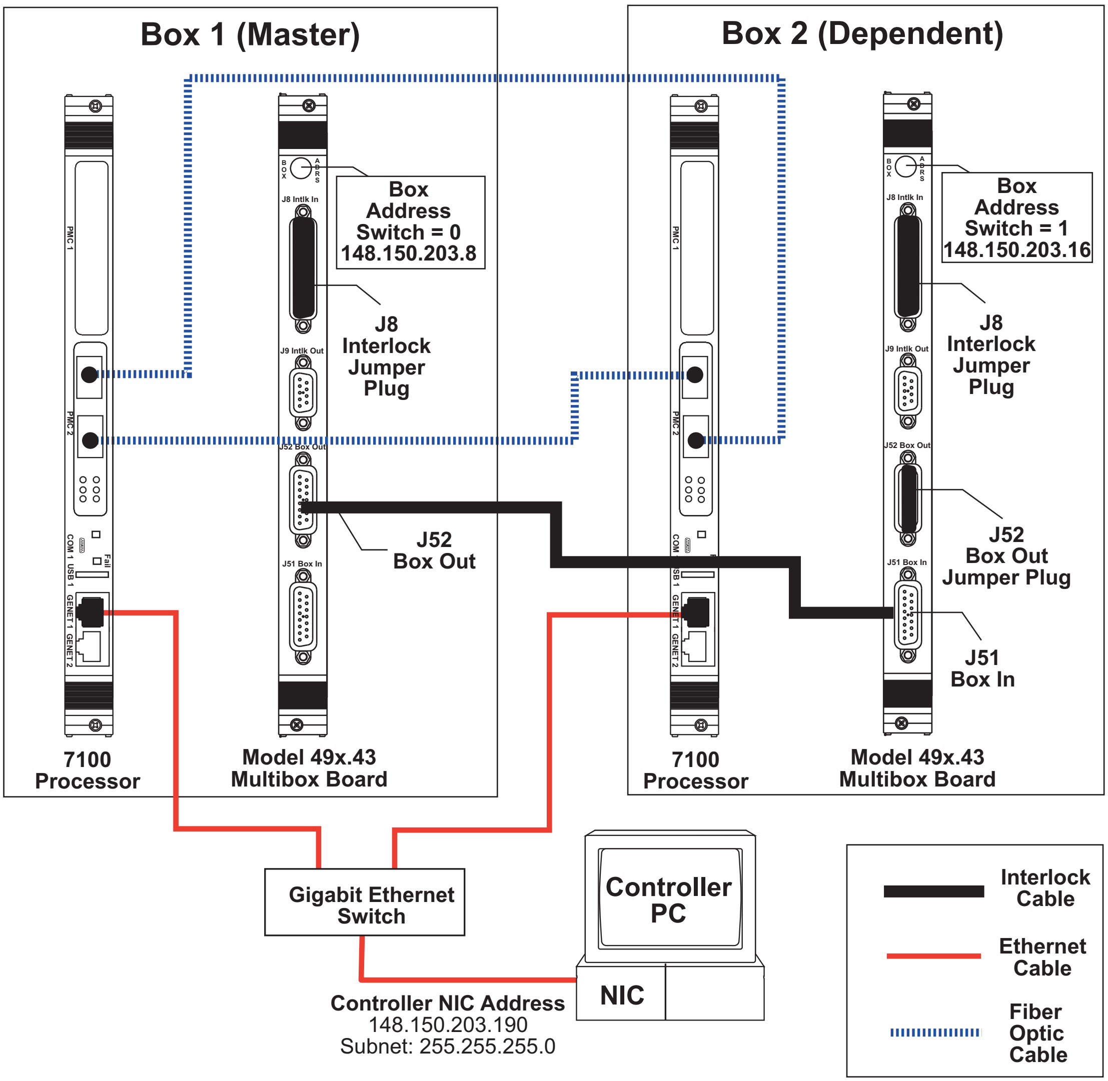
1. "Connect the Multibox System" on page 328.
2. "Use the CMT to Register Multiple Controllers" on page 329.
3. "Use the CMT to Configure the Controller" on page 331.
4. "Create an .hwi File for Each Box" on page 333.
5. "Use the Station Builder Application to Create a Multibox Configuration" on page 334.

Important *The procedures in this section should only be performed by MTS personnel.*

Task 1 Connect the Multibox System

Model 793 Multibox System Connections

Each multibox system requires an HPU board and a HSM board. These boards must only be installed in the first box in the chain (Master box).



Task 2 Register the Controllers

Use the CMT to Register Multiple Controllers

1. Make sure that all controllers are connected properly (including all network connections).

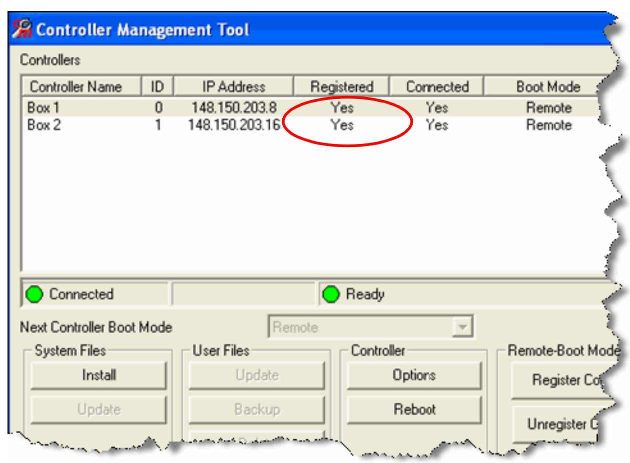
2. Apply power to each controller.

3. Allow the CMT to detect each controller.

   Each controller that is detected appears in the CMT window. The **Controller Name** typically appears as Unregistered_0 and Unregistered_1.

Note *Depending on the controller product type that you installed, you may see an additional controller (for example, MTS FlexTest 200). If you want to remove this controller, see* *"Optional–Delete the default single-box controller folder" on page 330.*

4. In the Controller Management Tool (CMT) window, click **Register Multiple Controllers**.



5. Make sure that the **Registered** column for each box indicates **Yes**.

Optional–Delete the default single-box controller folder

When you register multibox controllers, the CMT will also display the default single-box controller that was installed in the initial installation. (The controller type depends on the controller product that was installed. For example, MTS FlexTest 200).

- This default controller is not required for multibox systems but is required if you want to run in demo mode.
- If you leave the default controller installed, you may be prompted to select a controller during system load and in certain applications. If this seems confusing, use the following procedure to remove the default controller

To remove the default single-box controller:

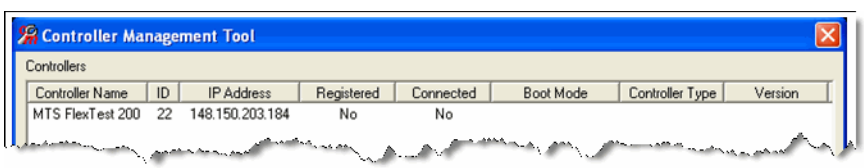
1. Use the CMT Tool to check for old single-box controller folders.

   A. Make sure the controller PC is on.

   B. Start the Controller Management Tool (CMT) application from the server PC.

   Start > All Programs > MTS 793 Software > Tools > Controller Management Tool

   If the default controller exists, it will appear in the CMT window without any controllers connected (as shown below).



   C. Close the CMT and answer “No” to saving the log file.

2. **Important**–back up the existing controller folder if you will use it to run future demo mode tests.

3. Delete the existing single-box controller folder.

   A. Open Windows Explorer and navigate to the following default location.

   “C:\MTS 793\Controllers”

   B. Highlight the old single-box controller folder and click **Delete**.

Task 3 Configure the Controllers

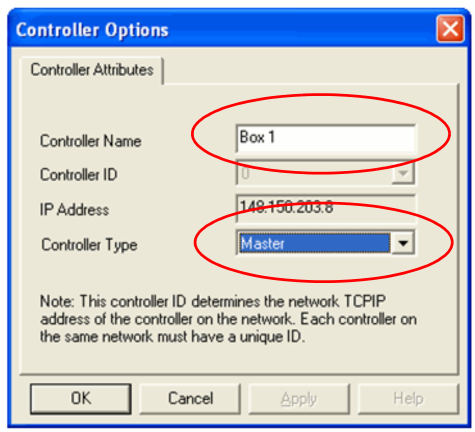
Use the CMT to Configure the Controller

Use the Controller Management Tool (CMT) application to rename each box and set the Controller Type to define the Master and Dependent controllers. As you rename each controller, the various folders in the **Controllers** directory will also be renamed with the new controller name (Box 1, Box 2, ...).

1. If necessary, start the Controller Management Tool application.
2. Configure the Master controller.

   The Master controller is the first box in the multibox configuration and includes the HPU and HSM boards.

   A. In the CMT window, select the first controller and click **Options**.

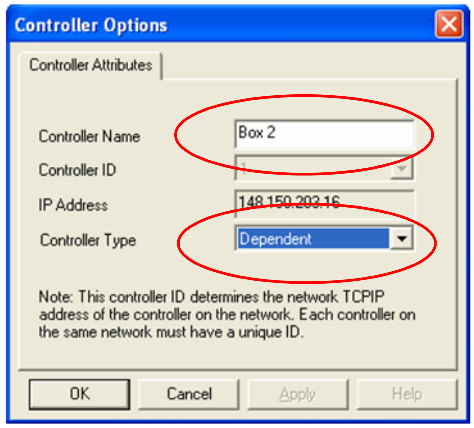


   B. In the **Controller Name** text box, type **Box 1**.

   C. In the **Controller Type** list, click **Master**.

3. Configure the Dependent controllers.

   A. Select the next controller and click **Options**.



   B. In the Controller Options window:

   In the **Controller Name** text box, type **Box 2**.

   In the **Controller Type list,** click **Dependent**.

   C. Click **OK**.

4. Repeat Step 3 for all other Dependent controllers in the multibox configuration incrementing the “Box x” number each time and setting the Controller Type for each box to **Dependent**.

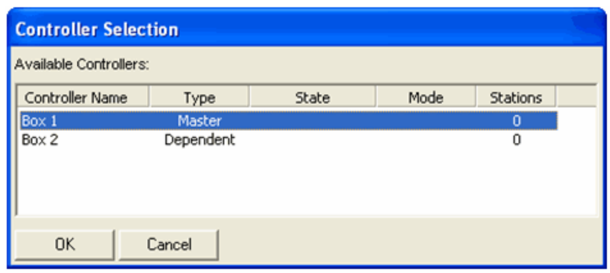
Task 4 Create an .hwi File for Each Box

Each controller (box) in a multibox configuration requires an .hwi file that maps all the hardware in that box to specific locations in the chassis.

1. Start the Hwi Editor application.

   All Programs > MTS 793 Software > Service Tools > Hwi Editor

   The following window will open showing all the controllers that are available on the controller network (only two in this example).



2. Select the Controller that you want to create an .hwi file for and click **OK**.

3. Create an Hwi file for each box.

For more information

For more information on how to create .hwi files, see the MTS Series 793 Utility Software manual (PN 100-147-132).

- A pdf version of this manual is available through the **Start > MTS 793 Software > Electronic Documentation** menu.

Task 5 Use the Station Builder Application to Create a Multibox Configuration

Once you have use the Controller Management Tool (CMT) application to register and configure the multibox system and created Hwi files for each box, you can use the Station Builder application to create the configurations required for your test.

Multibox configurations are created in the same manner as single-box systems with the following exceptions:

- The resources shown in the Station Builder application are grouped by the box where they are installed.
- All the hardware resources used in a control channel must reside in the same box.

Important *Control channels that use hardware resources from one box cannot include hardware resources from another box.*

For more information

For more information on how to create stations, see the MTS Series 793 Control Software manual (PN 100-147-130).

- A pdf version of this manual is available through the **Start > MTS 793 Software > Electronic Documentation** menu.
- You can also select **793 Control Software** from the Station Builder **Help** menu to view an on-line help window.

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