Instruction Manual

ECO422D
SD/HD Changeover Unit
S/N C050000 and above

077-0354-00

077035400

Instruction Manual

Tektronix

ECO422D
SD/HD Changeover Unit
S/N C050000 and above

077-0354-00

Warning
The servicing instructions are for use by qualified personnel only. To avoid personal injury, do not perform any servicing unless you are qualified to do so. Refer to all safety summaries prior to performing service.

www.tektronix.com

Contacting Tektronix

Tektronix, Inc.
14150 SW Karl Braun Drive
P.O. Box 500
Beaverton, OR 97077
USA

For product information, sales, service, and technical support:

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- Worldwide, visit www.tektronix.com to find contacts in your area.

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

To avoid potential hazards, use this product only as specified.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of the system. Read the *General Safety Summary* in other system manuals for warnings and cautions related to operating the system.

To Avoid Fire or Personal Injury

Use Proper Power Cord. Use only the power cord specified for this product and certified for the country of use.

Ground the Product. This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making connections to the input or output terminals of the product, ensure that the product is properly grounded.

Observe All Terminal Ratings. To avoid fire or shock hazard, observe all ratings and markings on the product. Consult the product manual for further ratings information before making connections to the product.

Do not apply a potential to any terminal, including the common terminal, that exceeds the maximum rating of that terminal.

Power Disconnect The power cord disconnects the product from the power source. Do not block the power cord; it must remain accessible to the user at all times.

Do Not Operate Without Covers. Do not operate this product with covers or panels removed.

Avoid Exposed Circuitry. Do not touch exposed connections and components when power is present.

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Do Not Operate in Wet/Damp Conditions.

Do Not Operate in an Explosive Atmosphere.

Keep Product Surfaces Clean and Dry.

Symbols and Terms

Terms in this Manual. These terms may appear in this manual:

WARNING. *Warning statements identify conditions or practices that could result in injury or loss of life.*

CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Terms on the Product. These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product. The following symbols may appear on the product:

CAUTION
Refer to Manual

WARNING
High Voltage

Protective Ground
(Earth) Terminal

Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

Do Not Service Alone. Do not perform internal service or adjustments of this product unless another person capable of rendering first aid and resuscitation is present.

Disconnect Power. To avoid electric shock, switch off the instrument power, then disconnect the power cord from the mains power.

Use Care When Servicing With Power On. Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

Preface

This manual contains operating and servicing information for the ECO422D.

The information included in this manual explains how to operate, verify, and service the system:

- *Operating Basics* explains the controls, indicators, connectors, and how to operate the instrument.
- *Specifications* describes functional characteristics and performance requirements for the ECO422D.
- *Theory of Operation* explains how the ECO422D operates.
- *Performance Verification* describes how to verify the functional performance of the ECO422D.
- *Adjustment Procedures* gives the field adjustment procedures.
- *Maintenance* contains the following information:
  - How to safely handle static sensitive modules and components
  - How to remove and replace replaceable parts
  - Corrective maintenance information
- *Replaceable Electrical Parts* lists all replaceable parts in the ECO422D.
- *Replaceable Mechanical Parts* lists all replaceable parts in the ECO422D to a module level. Parts are identified on an indexed illustration to make them easier to identify.
- *Appendices*
  - *Options* lists the available options for the ECO422D.
- *Index*

Product Documentation

The following table lists the documentation that is available for the product and shows where you can find it: in a printed manual, on the product documentation CD–ROM, or on the Tektronix Web site at www.tektronix.com.

Table i: Product documentation

Item / Tektronix part number	Purpose	Location
ECO422D SD/HD Changeover Unit Installation and Safety Instructions 071-2683-XX	Provides safety and compliance information with hardware installation instructions to present the associated safety warnings.	Printed manual and also available in electronic form on the Product Documentation CD and at www.tektronix.com/manuals
ECO422D SD/HD Changeover Unit Instruction Manual (this manual) 077-0354-XX	Provides operation and application information.	Electronic format on the Product Documentation CD and at www.tektronix.com/manuals
ECO422D SD/HD Changeover Unit Reference Card 061-4234-XX	Provides a summary of factory default and user switch settings.	Printed format and also available in electronic form on the Product Documentation CD and at www.tektronix.com/manuals

Operating Basics

Operating Basics

Controls and Indicators

Figure 1–1 shows the layout of the ECO422D front-panel controls and indicators.

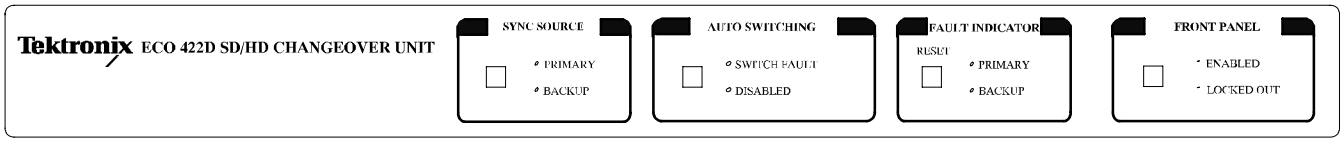


Figure 1-1: Front-panel controls

Sync Source - Primary/Backup. The LED indicates the current Output (whether it is from the Primary or Backup input). It can be manually changed using the Sync Source button. (If the ECO422D is in Normal mode, this is only true when the other input is good or both inputs are bad. Refer to *User Configuration Switch (S14–8)* on page 1–4.) Only one of these LEDs can be on. Primary is the default at power-on.

Auto Switching - Switch on Fault/Disabled. This selects whether the ECO422D will automatically switch to the other input source whenever it detects a fault (Switch on Fault) or not switch (Disabled). Only one of these LEDs can be on after the power-on delay. Switch on Fault is the default setting. During power-on, the DISABLED LED slowly blinks to indicate disabled front panel and error detection during the power–on delay.

Fault Indicator (Reset) - Primary/Backup. Either one or both of these LEDs could be on. They indicate that a fault has occurred on the input. Press the Reset button to clear the fault indicators (turn off the LEDs) after the fault has been corrected. The fault indicator does not automatically reset after an error condition improves. At power-on, the LEDs are reset.

Front Panel - Enabled/Locked Out. This control determines whether or not the operator has access to the other front-panel controls. If it is Enabled, then the user can control the instrument from the front panel. If it is Locked Out, then the user can only toggle back to Enabled and no other front-panel controls are available. The ECO422D will automatically lock out after about 1 minute of inactivity to prevent accidental switching. The front panel is automatically locked out at power-on (during power on, both LEDs are lit).

Internal Controls

Channel Configuration Switch (11 dip switches S1 - S11; see Figure 1-2). These switches select the signal type checked on a channel by setting the amplitude comparison level. Only one switch from each DIP package should be enabled (closed) for each channel, except for attenuation (DIP 8 on switches S7 through S11), which is allowed to be combined with either of the user-defined levels.

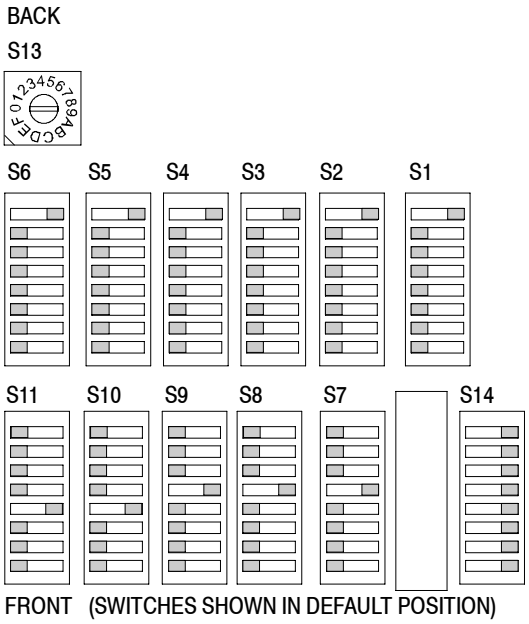


Figure 1-2: Default position of the user configuration and mode switches

The following list shows the functions for each of the switches.

DIP Switch	Input signal
All open	Disabled (signal not checked)
1	NTSC black burst
2	PAL black burst
3	NTSC serial digital video (143 Mb/s)
4	Serial digital video (270 Mb/s) Analog tri-level sync
5	NTSC serial digital audio
6	User defined
7	User defined
8	Serial digital video (1.485 Gb/s) (Channels 1-6) Attenuation (Channels 7-11)

Table 1-1 lists the factory setting of the switches. (NTSC or PAL black burst is determined by the power cord option ordered with the instrument.)

Table 1-1: Factory settings of channel configuration switches (S1 - S11)

Output # / Switch #	Setting (see above)	Attenuation (set with Sx-8) On	Attenuation (set with Sx-8) Off	Type of signal attached
1 / S1	1 or 2	NA	X	Black Burst
2 / S2	1 or 2	NA	X	Black Burst
3 / S3	1 or 2	NA	X	Black Burst
4 / S4	1 or 2	NA	X	Black Burst
5 / S5	1 or 2	NA	X	Black Burst
6 / S6	1 or 2	NA	X	Black Burst
7 / S7	4		√	Serial Digital Video (Component)
8 / S8	4		√	Serial Digital Video (Component)
9 / S9	4		√	Serial Digital Video (Component)
10 / S10	5		√	Serial Digital Audio
11 / S11	5		√	Serial Digital Audio

User Configuration Switch (S14-8) -closed- -Normal-

Attenuation. Attenuation allows larger signals to have their signal level checked. The attenuator adds about 14 dB (x5) attenuation to the signal level being checked. This has no effect on the level of the output signal and only extends the range of the check circuitry. Use this in conjunction with large H sync pulses to increase the accuracy on the level check. Only use this switch in conjunction with the User Defined Levels.

User Configuration Switch (S14 - 8). This switch determines how the ECO422D responds to faulty signals – either Normal or Override.

For Normal operation, the user cannot switch to a bad signal whether the instrument is in manual or auto switch mode. For example, the ECO422D is in manual mode and the Primary signal is bad, while the Backup signal is good. If the user presses the Sync Source button, the output will be the Backup signal. If the user presses the Sync Source button again, the output continues to be the Backup signal. It will not change to Primary until the signal is good and the fault indicator is reset.

In the Override mode, the user can manually switch to a “bad” signal, with Auto mode disabled.

Reference Level Adjustments (R266 and R265). These two adjustments set the reference level for the two user-defined signal options. Select these levels with DIPs 6 (R266) and 7 (R265) of the Channel Configuration switches. These allow the user to set their own signal switching level for special applications. Two examples of signals that may require checking are an active video signal or an H Sync signal.

The procedure used to set these levels is on page 1–10.

Power-on Delay Switch (S13)[1]**.** This hex switch (see Figure 1–2) sets the delay duration between the time power is applied and the time the ECO422D starts error detection. Each position of the switch increments the delay approximately 30 seconds (position 0 = no delay). The factory setting is position 5, which provides a delay of slightly under three minutes.

[1] Serial number B030000 and later.

Connectors

Figure 1–3 shows the layout of the rear panel of the ECO422D.

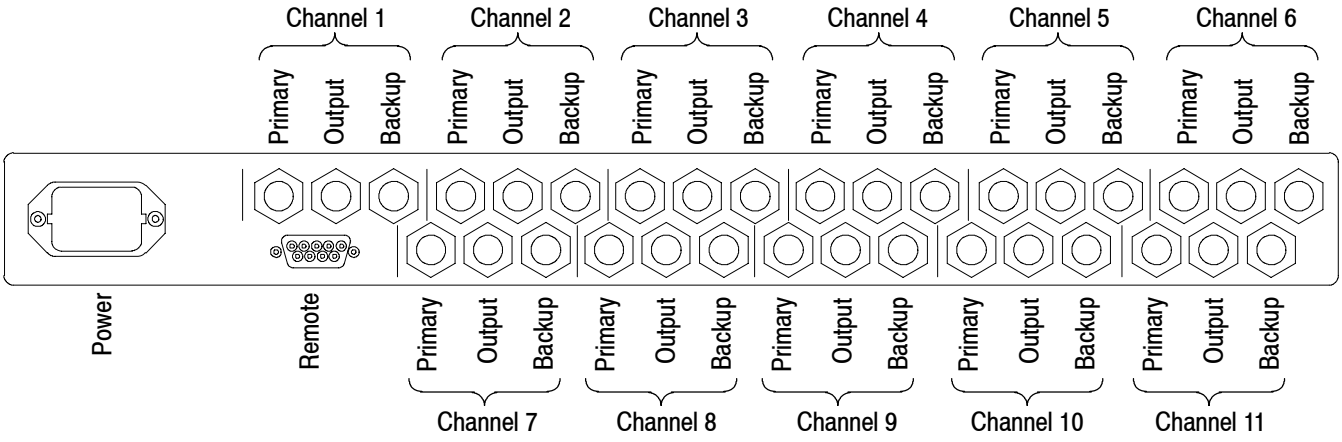


Figure 1-3: Rear panel of the ECO422D

Power

This instrument is designed to operate from a single-phase power source with one current-carrying conductor at or near earth-ground (the neutral conductor). Only the line conductor is fused for over current protection. Mains frequency is 50 or 60 Hz. The operating voltage range is continuous from 100 to 240 VAC.

WARNING. *To prevent personal injury, do not connect power to the ECO422D if the top cover is not installed. Dangerous potentials are present on the Power Supply board.*

Video Signals (11 Channels)

There are 33 video connectors on the rear panel, arranged into a Primary input, a Backup input, and an Output for each of the 11 channels. A general overview of each one is below.

Primary. Input from the primary sync generator. It can be PAL black burst, NTSC black burst, analog tri-level sync, serial digital video, or serial digital audio if signal checking is desired. There are also two user-defined levels available. If no signal checking is required, almost any signal can pass through the unit (within the bandwidth and voltage/current limitations). This should be the same signal type as its Backup signal pair.

Output. Signal output. It is either from the Primary or the Backup source. How the ECO422D is configured determines under what conditions the source changes.

Backup. Input from the backup sync generator. This should be the same signal type as its Primary signal pair.

Opt. ELSW. With Opt. ELSW, channels 4, 5, and 6 are designed for use only with NTSC or PAL black burst, or tri-level sync.

Remote

The rear-panel connector is a 9-pin female D-connector, with one pin tied to ground (see Figure 1-4). The pin-out is shown in Table 1-2.

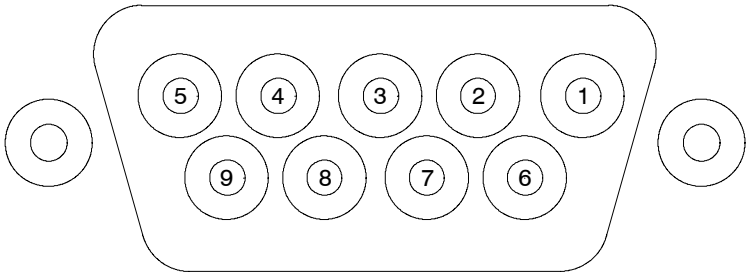


Figure 1-4: Remote connector pins

Table 1-2: Remote connector pin-out

Pin	Signal function
1	Auto switching (input)
2	Toggle sync source (input)
3	Indicate primary sync source active (output)
4	Indicate backup sync source active (output)
5	Fault alarm (output)
6	Fault reset
7	Fault reporting +
8	Fault reporting -
9	Ground

Auto Switching (active low) If low, the automatic switching function from the front panel is disabled. The front panel cannot override this remote command.

Toggle Sync Source (active low) Operates the same as the Sync Source button on the front panel. A low pulse will cause the ECO422D to toggle between Primary and Backup as the output signal.

Indicate Primary Sync Source Active (active high) Indicates that the Primary signals are the sync source.

Indicate Backup Sync Source Active (active high) Indicates that the Backup signals are the sync source.

Fault Alarm (active high) Indicates that at least one of the Primary or Backup input signals is "bad." This alarm signal is latched and will remain high until the error is cleared and the Reset button is pressed.

Fault Reset (active low) This operates like the front-panel Reset button. It clears the fault indicators (turns off the LEDs) after the fault has been corrected.

Fault Reporting – and + It is normally open, indicating that everything is good. It will close in the cases of: loss of power to the ECO422D or one (or more) input signals are bad. The fault is latched and will remain until the fault is cleared. This fault reporting system follows SMPTE 269M guidelines except the interface is 2 pins of the Remote connector (7 & 8) instead of the standard isolated BNC connector and there is no pulsing. When in the open state, the leakage across the closure is less than 100 μA at any voltage from 0 to 5 VDC. The closure is able to withstand 24 VDC in the open state without damage. In the closed state, the maximum voltage drop across the closure should not exceed 2 V at 20 mA. The sensing device should not supply more than 20 mA of current to the reporting device. To provide compliance with the standard, wire a BNC connector adapter as shown in Figure 1–5.

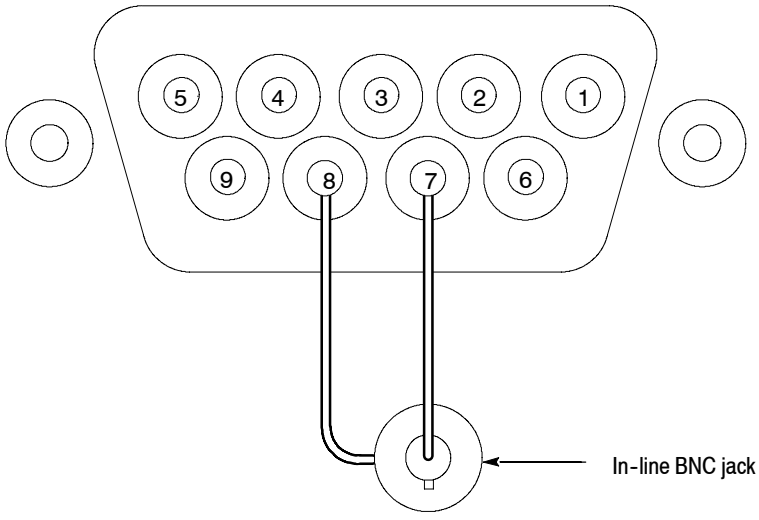


Figure 1-5: Wiring required to conform with SMPTE fault reporting

Operating Basics

In normal operation, the ECO422D is basically a switch that triggers whenever an error occurs in any channel. All 11 Channels switch at the same time.

If any channel is not being used, it is mandatory that its checking function be disabled. Otherwise it will always trigger an error and the ECO422D will not operate properly.

This section covers the state machine discussions (what will happen when some signals go bad) and how to adjust the user-defined inputs.

State Machine Description

Table 1-3 is a truth table that gives the various states the ECO422D outputs based on the state of the inputs. Note that Primary is set to check a given level.

Power – the state of the power supply.

User Config – the state of the user configuration switch. It can either be N (Normal) or O (Override). In Normal mode, the ECO422D will not switch to a "bad signal." In Override operation, the user is allowed to manually switch to a "bad signal."

Switch – Indicates whether or not the Sync Source button on the front panel or the Toggle Sync Source on the remote control has been selected. Note that the front panel and the remote control commands are ANDed together (active low) to produce the switch results.

P – Primary input status – the state of the input detector circuit on a Primary input.

B – Backup input status – the state of the input detector circuit on a Backup input.

O Auto – Resulting output signal with the ECO422D set to "Auto Switching" (switch on error). It can either output Primary or Backup.

O Manual – Resulting output signal with the ECO422D set to "Manual" (no switching on error). It can either output Primary or Backup.

0 – bad signal.

1 – good signal.

↑ – switch (change the current output signal).

↓ – no switch (stay with the current signal).

X – Don't care.

Table 1-3: Truth table for ECO422D switching

Power	User config	Switch	P	B	O auto	O manual
1	N	↓	0	0	↓	↓
1	N	↓	0	1	B	↓
1	N	↓	1	0	P	↓
1	N	↓	1	1	↓	↓
1	N	↑	0	0	↑	↑
1	N	↑	0	1	B	B
1	N	↑	1	0	P	P
1	N	↑	1	1	↑	↑
1	O	↓	0	0	↓	↓
1	O	↓	0	1	B	↓
1	O	↓	1	0	P	↓
1	O	↓	1	1	↓	↓
1	O	↑	0	0	↑	↑
1	O	↑	0	1	B	↑
1	O	↑	1	0	P	↑
1	O	↑	1	1	↑	↑
0	X	X	X	X	P	P

How to Adjust the User-Defined Threshold Levels

The User-defined Threshold Levels are the two levels available from User Configuration switches 6 and 7. They are available so that the user can trigger on signal levels other than the seven predefined levels.

In order to set the Threshold Levels, you need:

- Two good versions of the type of signal you want to check
- A step attenuator (example: 847 Attenuator from KAY Elemetrics)
- A waveform monitor or oscilloscope (optional)
- The ECO422D

The example sets switch 7 for NTSC active video with the threshold set for a 3 dB down color bar. It uses a TSG 130A as the signal source, a 1745A waveform monitor (optional) to view the signal level, and a step attenuator.

1. Connect the equipment as shown in Figure 1–6.

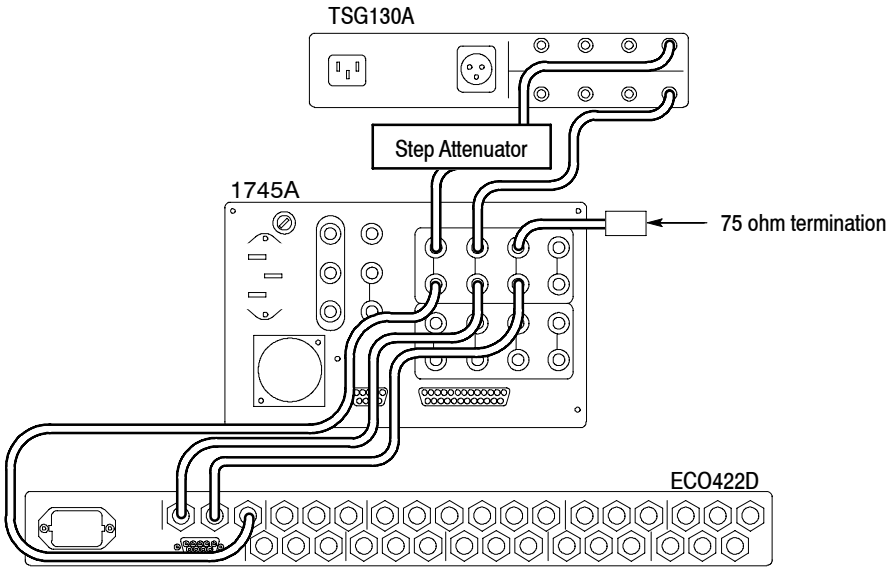


Figure 1-6: Setup for adjusting R265 (the user level for SX-7)

2. Set all of the User Configuration switches to “open” except for S1–7 (for channel 1).

3. Set all S14 switches “closed.”

4. Set the ECO422D to Primary Sync Source.

5. Set the ECO422D Auto Switching to “Switch on Fault.”

6. Set the step attenuator to 0 dB of attenuation.

7. Turn the potentiometer R265 fully. (You are attempting to allow the minimum signal level to pass through before the threshold is reached.)

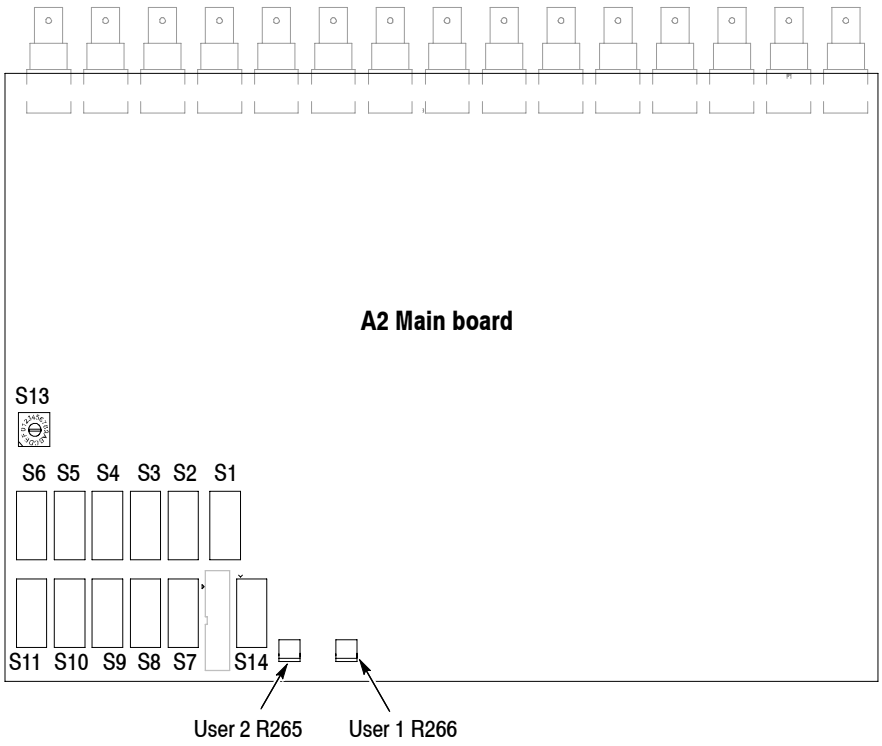


Figure 1- 7: Selection switches and user level control locations

8. Press the fault indicator Reset button. (This clears any errors.)

9. Check the fault indicator for an error indication on either the Primary or Backup channels. If there are no faults, then proceed to the next step. Otherwise, try rotating the potentiometer in the other direction. (You are trying to get the minimum signal level to pass through before reaching the switching threshold.)

10. Set the step attenuator to 3 dB of attenuation (or whatever attenuation is required for your application).

11. Check to see that the sync source has not changed to Backup and no faults are on the Primary channel.

12. Slowly adjust R265 until the ECO422D switches to the Backup sync source and a fault occurs on the Primary channel. Press Reset to verify that the fault is still preset. If the Primary fault indicator LED goes out, continue adjusting the potentiometer. If the LED remains on, S1–7 through S11–7 are set for your user-defined level.

***NOTE**. If you cannot adjust R265 satisfactorily, move the cables from Channel 1 to Channel 7, open S1-7, close S7-7 and activate the Channel 7 attenuator by closing S1-8. Repeat the adjustment steps starting with step 6.*

13. Adjust R266 in the same manner to set a user-defined level for S1–6 through S11–6.

How to Set the Power On Delay

Hex switch S13[2] (see Figure 1–2) sets the delay between the time power is applied and the time the ECO422D starts error detection. Each position of the switch increments the delay approximately 30 seconds, from position 0 (no delay) to position F (over seven minutes). The factory setting is position 5, which provides a delay of slightly under three minutes.

[2] Serial number B030000 and later.

Specifications

Specifications

Introduction

The items listed in the following tables describe the performance of the ECO422D Changeover Unit. Performance Requirements are generally quantitative and can be tested by a Performance Verification procedure contained in the service part of this manual.

Supplemental Information is valuable data pertaining to the operation and output capabilities of this instrument. Only a few items listed in this category may be tested in the Performance Verification procedure.

Performance Conditions – The requirements listed in the electrical specification apply over an ambient temperature range of 0 °C to +40 °C. The rated accuracies are valid when the instrument is calibrated at an ambient temperature range of +20 °C to +30 °C, after a warm-up time of 20 minutes. Test equipment used to verify Performance Requirements must be calibrated and working within the limits specified under the Equipment Required list.

These instruments are intended to operate from an AC power source that will not apply more than 264 V_{RMS} between the supply conductors or either supply conductor and ground. A protective ground connection by way of the grounding conductor is essential for safe operation.

Environmental specifications are listed toward the back of the following tables. In addition a list of appropriate safety and electromagnetic interference (EMI) standards also can be found there.

Table 2-1: General characteristics

Characteristics	Performance requirements	Supplemental information
Return Loss		
(All Inputs and Outputs)		
Channels 1-6		30 dB, 0 to 10 MHz 15 dB, 10 to 750 MHz 10 dB, 750 MHz to 1.5 GHz
Channels 4-6 (Opt. ELSW Only)		30 dB, 0 to 10 MHz (Internally terminated)
Channels 7-11		30 dB, 0 to 10 MHz 15 dB, 10 to 270 MHz 12 dB, 270 to 360 MHz (15 dB typical)
Insertion Loss Channels 1-6		0.2 dB DC to 10 MHz 10 MHz to 1.5 GHz[1]
Channels 4-6 (Opt. ELSW Only)		0.3 dB DC to 10 MHz
Channels 7-11		0.2 dB, DC to 10 MHz 0.5 dB, 10 to 200 MHz 1.0 dB, 200 to 360 MHz
Maximum Switched Voltage		±5 V
Channels 4-6 (Opt. ELSW Only)		±1 V (designed to use NTSC/ PAL Black Burst or TriLevel sync only)
Maximum Switched Current		100 mA
Crosstalk (unselected input to output or channel to channel)		
Channels 1-6		-60 dB to 10 MHz -30 dB to 1.0 GHz -20 dB to 1.5 GHz
Channels 4-6 (Opt. ELSW Only)		-55 dB to 10 MHz -45 dB to 30 MHz
Channels 7-11		-60 dB to 10 MHz -30 dB to 200 MHz -15 dB to 360 MHz

Table 2-1: General characteristics (Cont.)

Characteristics	Performance requirements	Supplemental information
Relay Switch Time		Time that it takes for the relays to switch and settle. Approximately 10 msec.
Channel Switch Time Channels 4-6 (Opt. ELSW Only)		Within 100 ns (*measured with NTSC/PAL Black Burst signal)*
Power-on delay		> 4 minutes, to allow source generator signals to stabilize. With the addition of S13 the delay is adjustable from zero to over seven minutes (see page 1-4).
Insertion Delay Channels 4-6 (Opt. ELSW Only)		Approximately 4 ns (refer to Input signal)

[1] **In the frequency range of 10 MHz to 1.5 GHz, the instrument approximates less than 20 meters of Belden 1694A cable.**

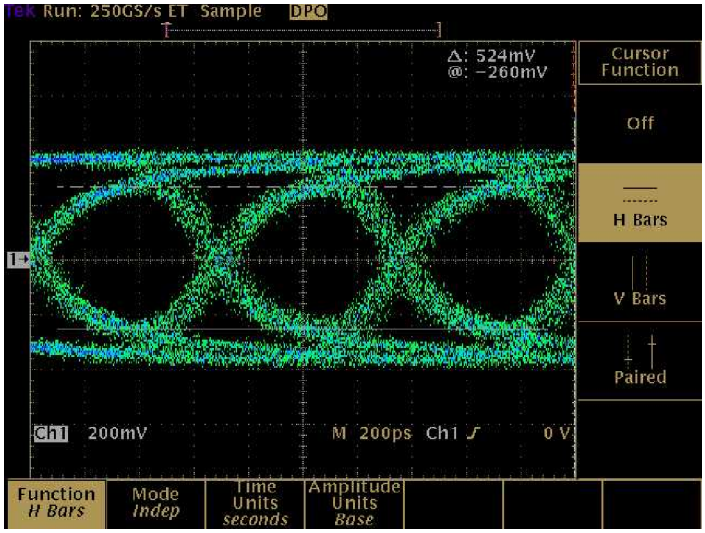


Figure 2-1: Typical eye-pattern of 20 m of Belden 1694A cable

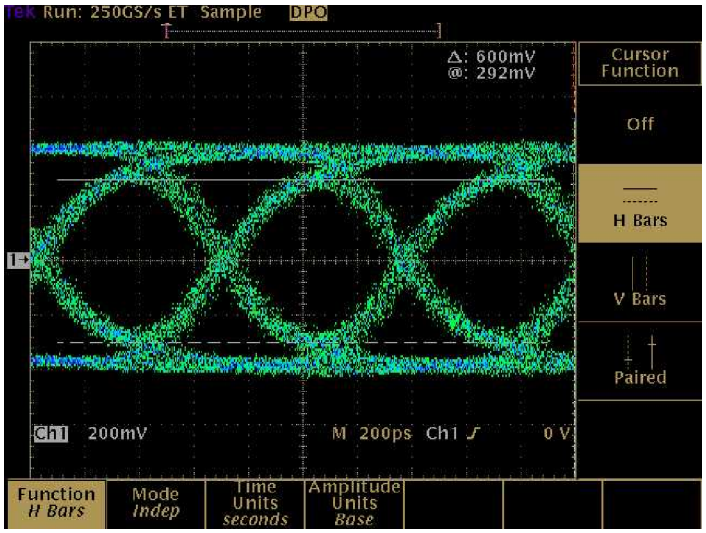


Figure 2-2: Typical eye-pattern of Channels 1-6 HD output (Channels 1-3 with Opt. ELSW)

Table 2-2: Signal loss detection

Characteristics	Performance requirements	Supplemental information	Performance Ver. step
Input Signal	Switching Level within:	These are the defined switching thresholds set with the internal Channel Configuration switch. Between 2 and 4 dB down from nominal.	
NTSC Black Burst (sync level)	-180 to -230 mV	-200 mV	2 & 4
PAL Black Burst (sync level)	-190 to -240 mV	-210 mV	3 & 5
Serial Digital Video (NTSC Composite)	450 to 630 mV	540 mV (between 2 and 5 dB down)	10 & 11
Serial Digital Video (270 Mb/s)	450 to 630 mV	540 mV (between 2 and 5 dB down)	7 & 8
Serial Digital Video (1.485 Gb/s)	450 to 630 mV	540 mV (between 2 and 5 dB down)	16 & 17
Serial Digital Audio	630 to 790 mV	710 mV	13 & 14
User Adjustable	-100 to -700 mV -700 to -3500 mV	Using the two user-defined Channel Configuration switches. Using the user-defined Channel Configuration switch with the attenuator on.	
Attenuation		approximately x5	
Analog tri-level sync	400 to 565 mV	475 mV (between 3 and 6 dB down)	[2]

[2] **Performance is verified indirectly by completing Performance Verification steps 2-5 & 10-11.**

Table 2-3: Power supply

Characteristics	Performance requirements	Supplemental information
External Power Voltage	100 to 240 VAC	Full range, no selector
Input Frequency Range		50/60 Hz
Power Consumption		40 Watts, typical 40 VA, maximum
Supply Accuracy +5 V -5 V		 +5 V ±200 mV -5 V ±200 mV
Hum +5 V -5 V		Typical values: 10 mV 10 mV
Noise +5 V -5 V		(5 MHz measurement bandwidth) ≤ 50 mV ≤ 50 mV
Crest Factor		≥ 1.35

Table 2-4: Mechanical (physical) characteristics

Characteristics	Supplemental information
Rackmount Dimensions Height	 1.734 inches (4.4 cm)
Width	19.0 inches (48.3 cm)
Length	22.1 inches (56.1 cm)
Net Weight	10.8 lbs (4.9 kg)
Shipping Weight	18 lbs, 5 oz (8.3 kg)

Table 2-5: Environmental characteristics

Characteristics	Supplemental information
Temperature	
Nonoperating	-40 °C to +65 °C
Operating	0 °C to +40 °C.
Altitude	
Nonoperating	to 12,192 meters (40,000 feet)
Operating	to 2,000 meters (6,562 feet).
Humidity	5 - 95% humidity, noncondensing
Vibration	
Operating	From 5 to 350 Hz: 0.0002 g^2/Hz Acceleration Power Spectral Density (APSD). From 350 to 500 Hz: -3 dB/Octave Slope. At 500 Hz: 0.00014 g^2/Hz APSD. 0.31 overall GRMS. 10 minutes/axis.
Nonoperating	From 5 to 100 Hz: 0.020 g^2/Hz (APSD). From 100 to 200 Hz: -3 dB/Octave Slope. From 200 to 350 Hz: 0.010 g^2/Hz APSD. From 350 to 500 Hz: -3 dB/Octave Slope. At 500 Hz: 0.007 g^2/Hz APSD. 2.46 overall GRMS. 10 minutes/axis.
Shock (nonoperating)	Half Sine Wave Shock levels: 50 g's (instrument), 11 msec duration, 3 shocks per direction.
Transportation	Qualified under NTSB Test Procedure 1A, Category II (24-inch drop).
Vehicle Vibration (Random Vibration)	Vibrate along all three axes at an overall vibration level of 1.33 GRMS. One hour per axis.
Second Manual Handling (Shock)	Drop on all sides once from a height of 24 inches. Drop on the bottom from a height of 48 inches.

WARNING

The following servicing instructions are for use only by qualified personnel. To avoid injury, do not perform any servicing other than that stated in the operating instructions unless you are qualified to do so. Refer to all safety summaries before performing any service.

Theory of Operation

Theory of Operation

This section provides information on how the ECO422D circuitry works, in order to troubleshoot the instrument.

Logic Conventions

Signal names are all capital letters. For example, SIGNAL.

An active low signal (normally denoted by an overscore) is a signal name enclosed in parentheses. For example, (SIGNAL).

The aside of a signal name is always in square brackets. For example, [SIGNAL].

The aside of an active-low signal is the signal name in parentheses and then enclosed in square brackets. For example, [(SIGNAL)].

ECO422D Block Level Description

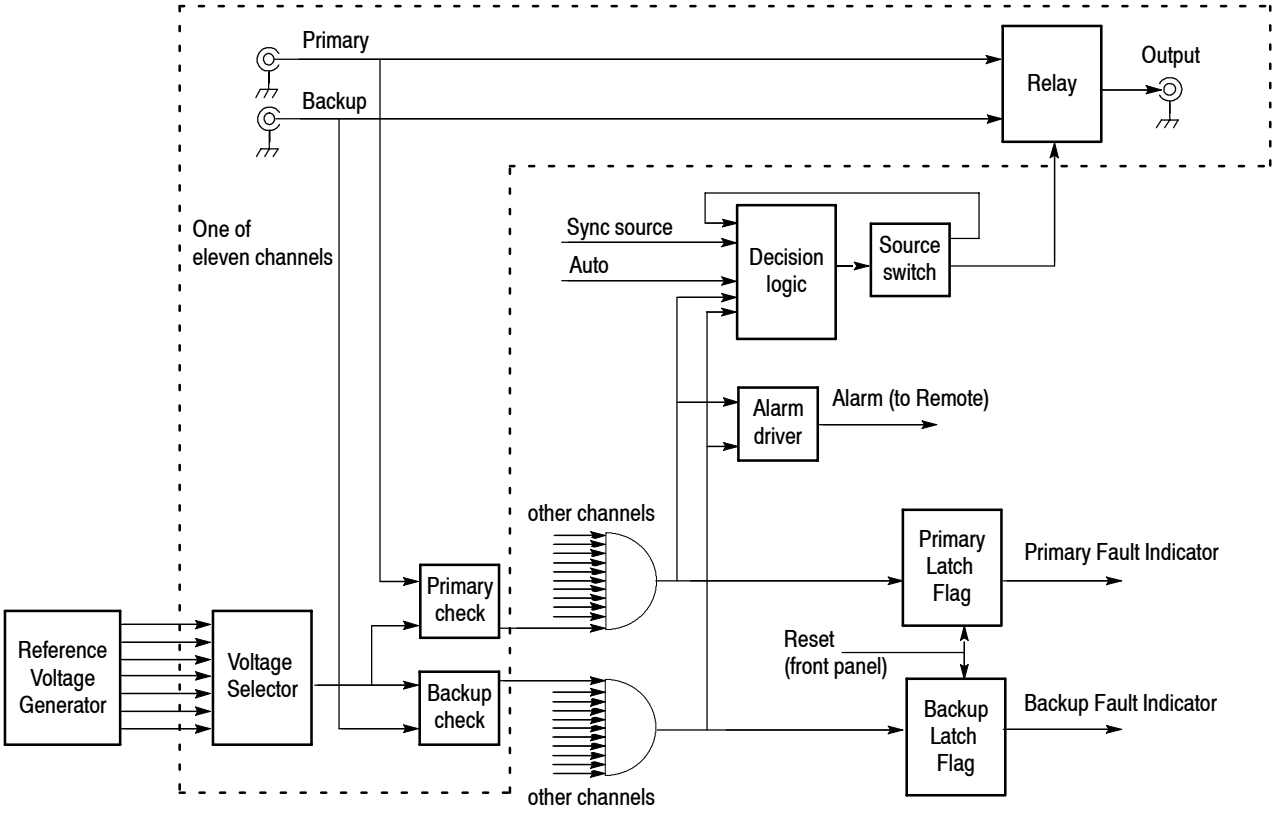


Figure 3- 1: ECO422D Block diagram

The Primary and Backup signals for each channel enter through the BNCs and are applied directly to a Relay, where one signal is switched through to the rear-panel Output and the other terminates in 75 Ω. The rest of the circuitry determines which signal goes to the Output.

The Primary and Backup signals are also applied to the Primary and Backup Check circuitry. This block consists of a peak detector which compares the peak level of the incoming signal with a predefined level from the Reference Voltage Generator, selected by the Voltage Selector. The result of this check is ANDed with the results from the ten other input sets and sent to the Decision Logic circuit that determines the state of the relays. Additional circuitry runs the Alarm Driver for the remote output and the fault indicators on the front panel.

ECO422D Option ELSW Block Level Description

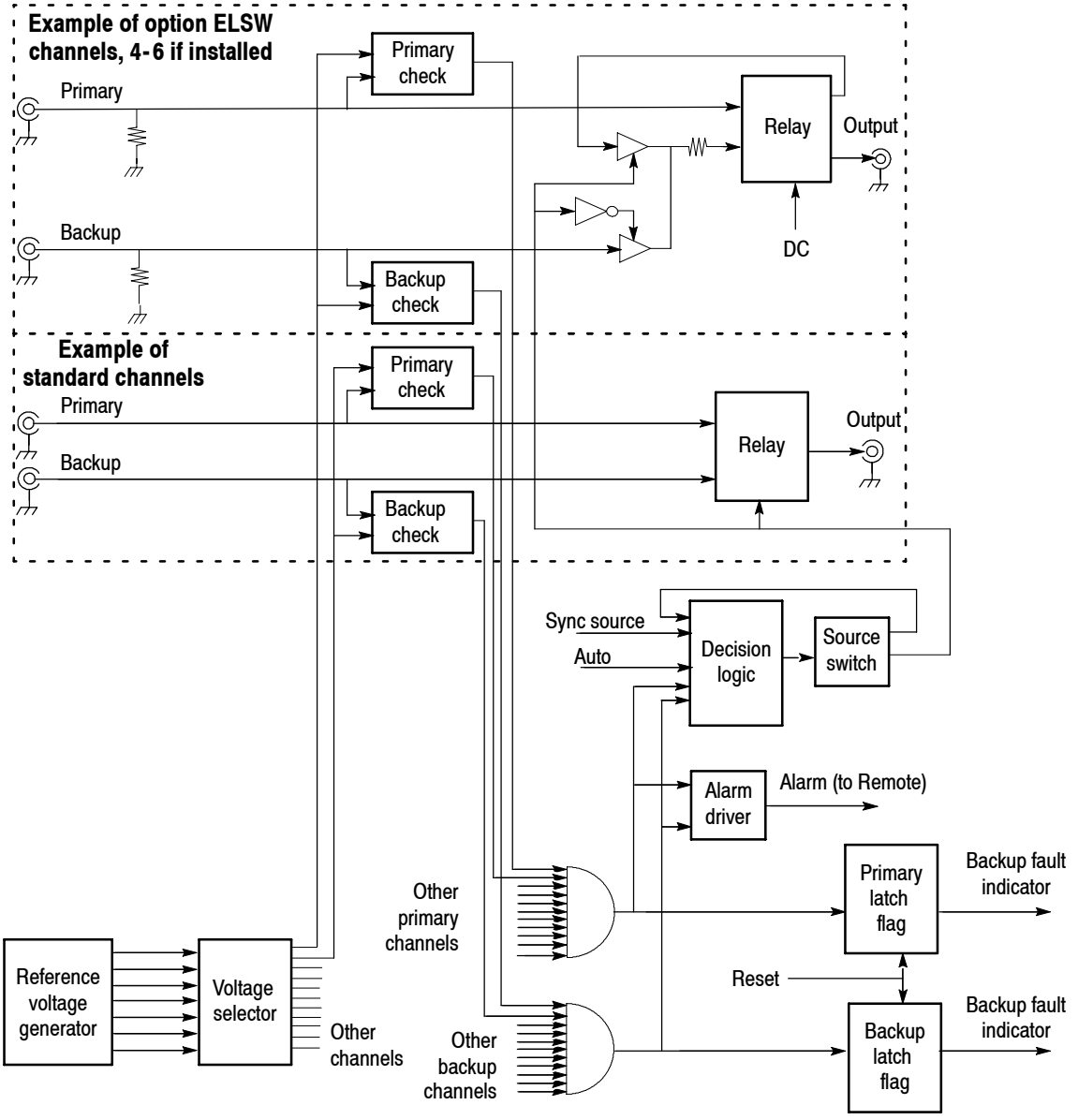


Figure 3-2: ECO422D Option ELSW Block diagram

In the standard instrument, switching between the Primary and Backup signals is accomplished with mechanical relays. With Option ELSW, channels four, five, and six employ electronic switching. This is faster than the mechanical relays and glitch-free, to provide transparent switching of analog sync signals.

This electronic switching design uses two current feedback amplifiers. These two amplifiers are controlled by the same Source Switch signals that control the relays in the other channels. The Source Switch signal is applied directly to the amplifier Output Enable control in the Primary signal path, and is inverted before being applied to the Output Enable control of the amplifier in the Backup signal path. In this way one amplifier or the other is enabled, but not both at the same time.

With Option ELSW the Primary and Backup inputs are terminated in 75 Ω, and the Outputs provide a 75 Ω source for the signal path.

In addition, there is a mechanical relay that switches the Primary signal directly to the Output in the event of power failure. This aligns with the way the standard channels operate, and maintains return loss performance for Option ELSW.

***NOTE**. There are two fuses in the instrument. One is on the Main board, and the other is on the power supply. Make sure to check both internal fuses if the instrument will not power on. The replacement fuse on the power supply should be a 3.15 A, 250 V fuse. The Main board fuse requirement is listed in* Replaceable Mechanical Parts.

Performance Verification

Performance Verification

This section consists of checklists and detailed procedures to use in verifying performance parameters and adjusting it to within tolerances.

The order of these procedures has been chosen to minimize changes in equipment setups. Performance parameters may be checked in any order.

Calibration Data Report

The Calibration Data Report that follows can be used to document instrument performance. In addition, it can be used as a short-form Performance Check for those familiar with the Performance Verification Procedure. Only steps that have numeric Performance Requirements are included in this report form. (Some steps have been omitted.)

Calibration Data Report

Instrument ECO422D **Cal. Date** _____

Serial Number _____

Certificate Number[3] _____ **Technician** _____

Procedure 070-8472-00 **Revision Date** _____

STEP	OPERATION	MINIMUM TOLERANCE	MAXIMUM TOLERANCE	INCOMING	OUTGOING
1	Overall Switching Disabled				
	Channel 1:				
2	NTSC Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
4	NTSC Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
3	PAL Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
5	PAL Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
7	Serial Digital 270 Mb/s Switch - Primary	switch at 2 dB down	switch at 5 dB down		
8	Serial Digital 270 Mb/s Switch - Backup	switch at 2 dB down	switch at 5 dB down		
10	NTSC Serial Digital Composite Switch - Primary	switch at 2 dB down	switch at 5 dB down		
11	NTSC Serial Digital Composite Switch - Backup	switch at 2 dB down	switch at 5 dB down		
13	Serial Digital Audio Switch - Primary	switch at 2 dB down	switch at 4 dB down		
14	Serial Digital Audio Switch - Backup	switch at 2 dB down	switch at 4 dB down		
16	Serial Digital 1.485 Gb/s Switch - Primary	switch at 2 dB down	switch at 5 dB down		
17	Serial Digital 1.485 Gb/s Switch - Backup	switch at 2 dB down	switch at 5 dB down		
	Channel 2: (swap S2 for S1)				
2	NTSC Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
4	NTSC Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
3	PAL Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
5	PAL Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
7	Serial Digital 270 Mb/s Switch - Primary	switch at 2 dB down	switch at 5 dB down		
8	Serial Digital 270 Mb/s Switch - Backup	switch at 2 dB down	switch at 5 dB down		
10	NTSC Serial Digital Composite Switch - Primary	switch at 2 dB down	switch at 5 dB down		

[3]Certificate number is not provided, unless “Certificate of Traceability” is issued.

STEP	OPERATION	MINIMUM TOLERANCE	MAXIMUM TOLERANCE	INCOMING	OUTGOING
11	NTSC Serial Digital Composite Switch - Backup	switch at 2 dB down	switch at 5 dB down		
13	Serial Digital Audio Switch - Primary	switch at 2 dB down	switch at 4 dB down		
14	Serial Digital Audio Switch - Backup	switch at 2 dB down	switch at 4 dB down		
16	Serial Digital 1.485 Gb/s Switch - Primary	switch at 2 dB down	switch at 5 dB down		
17	Serial Digital 1.485 Gb/s Switch - Backup	switch at 2 dB down	switch at 5 dB down		
	Channel 3: (swap S3 for S1)				
2	NTSC Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
4	NTSC Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
3	PAL Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
5	PAL Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
7	Serial Digital 270 Mb/s Switch - Primary	switch at 2 dB down	switch at 5 dB down		
8	Serial Digital 270 Mb/s Switch - Backup	switch at 2 dB down	switch at 5 dB down		
10	NTSC Serial Digital Composite Switch - Primary	switch at 2 dB down	switch at 5 dB down		
11	NTSC Serial Digital Composite Switch - Backup	switch at 2 dB down	switch at 5 dB down		
13	Serial Digital Audio Switch - Primary	switch at 2 dB down	switch at 4 dB down		
14	Serial Digital Audio Switch - Backup	switch at 2 dB down	switch at 4 dB down		
16	Serial Digital 1.485 Gb/s Switch - Primary	switch at 2 dB down	switch at 5 dB down		
17	Serial Digital 1.485 Gb/s Switch - Backup	switch at 2 dB down	switch at 5 dB down		
	Channel 4: (swap S4 for S1)				
2	NTSC Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
4	NTSC Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
3	PAL Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
5	PAL Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
7 [4]	Serial Digital 270 Mb/s Switch - Primary	switch at 2 dB down	switch at 5 dB down		
8 [4]	Serial Digital 270 Mb/s Switch - Backup	switch at 2 dB down	switch at 5 dB down		
10 [4]	NTSC Serial Digital Composite Switch - Primary	switch at 2 dB down	switch at 5 dB down		

STEP	OPERATION	MINIMUM TOLERANCE	MAXIMUM TOLERANCE	INCOMING	OUTGOING
11 [4]	NTSC Serial Digital Composite Switch - Backup	switch at 2 dB down	switch at 5 dB down		
13 [4]	Serial Digital Audio Switch - Primary	switch at 2 dB down	switch at 4 dB down		
14 [4]	Serial Digital Audio Switch - Backup	switch at 2 dB down	switch at 4 dB down		
16 [4]	Serial Digital 1.485 Gb/s Switch - Primary	switch at 2 dB down	switch at 5 dB down		
17 [4]	Serial Digital 1.485 Gb/s Switch - Backup	switch at 2 dB down	switch at 5 dB down		
	Channel 5: (swap S5 for S1)				
2	NTSC Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
4	NTSC Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
3	PAL Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
5	PAL Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
7 [4]	Serial Digital 270 Mb/s Switch - Primary	switch at 2 dB down	switch at 5 dB down		
8 [4]	Serial Digital 270 Mb/s Switch - Backup	switch at 2 dB down	switch at 5 dB down		
10 [4]	NTSC Serial Digital Composite Switch - Primary	switch at 2 dB down	switch at 5 dB down		
11 [4]	NTSC Serial Digital Composite Switch - Backup	switch at 2 dB down	switch at 5 dB down		
13 [4]	Serial Digital Audio Switch - Primary	switch at 2 dB down	switch at 4 dB down		
14 [4]	Serial Digital Audio Switch - Backup	switch at 2 dB down	switch at 4 dB down		
16 [4]	Serial Digital 1.485 Gb/s Switch - Primary	switch at 2 dB down	switch at 5 dB down		
17 [4]	Serial Digital 1.485 Gb/s Switch - Backup	switch at 2 dB down	switch at 5 dB down		
	Channel 6: (swap S6 for S1)				
2	NTSC Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
4	NTSC Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
3	PAL Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
5	PAL Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
7 [4]	Serial Digital 270 Mb/s Switch - Primary	switch at 2 dB down	switch at 5 dB down		
8 [4]	Serial Digital 270 Mb/s Switch - Backup	switch at 2 dB down	switch at 5 dB down		
10 [4]	NTSC Serial Digital Composite Switch - Primary	switch at 2 dB down	switch at 5 dB down		

STEP	OPERATION	MINIMUM TOLERANCE	MAXIMUM TOLERANCE	INCOMING	OUTGOING
11 [4]	NTSC Serial Digital Composite Switch - Backup	switch at 2 dB down	switch at 5 dB down		
13 [4]	Serial Digital Audio Switch - Primary	switch at 2 dB down	switch at 4 dB down		
14 [4]	Serial Digital Audio Switch - Backup	switch at 2 dB down	switch at 4 dB down		
16 [4]	Serial Digital 1.485 Gb/s Switch - Primary	switch at 2 dB down	switch at 5 dB down		
17 [4]	Serial Digital 1.485 Gb/s Switch - Backup	switch at 2 dB down	switch at 5 dB down		
	Channel 7: (swap S7 for S1)				
2	NTSC Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
4	NTSC Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
3	PAL Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
5	PAL Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
7	Serial Digital 270 Mb/s Switch - Primary	switch at 2 dB down	switch at 5 dB down		
8	Serial Digital 270 Mb/s Switch - Backup	switch at 2 dB down	switch at 5 dB down		
10	NTSC Serial Digital Composite Switch - Primary	switch at 2 dB down	switch at 5 dB down		
11	NTSC Serial Digital Composite Switch - Backup	switch at 2 dB down	switch at 5 dB down		
13	Serial Digital Audio Switch - Primary	switch at 2 dB down	switch at 4 dB down		
14	Serial Digital Audio Switch - Backup	switch at 2 dB down	switch at 4 dB down		
	Channel 8: (swap S8 for S1)				
2	NTSC Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
4	NTSC Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
3	PAL Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
5	PAL Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
7	Serial Digital 270 Mb/s Switch - Primary	switch at 2 dB down	switch at 5 dB down		
8	Serial Digital 270 Mb/s Switch - Backup	switch at 2 dB down	switch at 5 dB down		
10	NTSC Serial Digital Composite Switch - Primary	switch at 2 dB down	switch at 5 dB down		
11	NTSC Serial Digital Composite Switch - Backup	switch at 2 dB down	switch at 5 dB down		
13	Serial Digital Audio Switch - Primary	switch at 2 dB down	switch at 4 dB down		
14	Serial Digital Audio Switch - Backup	switch at 2 dB down	switch at 4 dB down		

STEP	OPERATION	MINIMUM TOLERANCE	MAXIMUM TOLERANCE	INCOMING	OUTGOING
	Channel 9: (swap S9 for S1)				
2	NTSC Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
4	NTSC Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
3	PAL Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
5	PAL Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
7	Serial Digital 270 Mb/s Switch - Primary	switch at 2 dB down	switch at 5 dB down		
8	Serial Digital 270 Mb/s Switch - Backup	switch at 2 dB down	switch at 5 dB down		
10	NTSC Serial Digital Composite Switch - Primary	switch at 2 dB down	switch at 5 dB down		
11	NTSC Serial Digital Composite Switch - Backup	switch at 2 dB down	switch at 5 dB down		
13	Serial Digital Audio Switch - Primary	switch at 2 dB down	switch at 4 dB down		
14	Serial Digital Audio Switch - Backup	switch at 2 dB down	switch at 4 dB down		
	Channel 10: (swap S10 for S1)				
2	NTSC Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
4	NTSC Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
3	PAL Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
5	PAL Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
7	Serial Digital 270 Mb/s Switch - Primary	switch at 2 dB down	switch at 5 dB down		
8	Serial Digital 270 Mb/s Switch - Backup	switch at 2 dB down	switch at 5 dB down		
10	NTSC Serial Digital Composite Switch - Primary	switch at 2 dB down	switch at 5 dB down		
11	NTSC Serial Digital Composite Switch - Backup	switch at 2 dB down	switch at 5 dB down		
13	Serial Digital Audio Switch - Primary	switch at 2 dB down	switch at 4 dB down		
14	Serial Digital Audio Switch - Backup	switch at 2 dB down	switch at 4 dB down		
	Channel 11: (swap S11 for S1)				
2	NTSC Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
4	NTSC Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
3	PAL Black Burst Switch - Primary	switch at 2 dB down	switch at 4 dB down		
5	PAL Black Burst Switch - Backup	switch at 2 dB down	switch at 4 dB down		
7	Serial Digital 270 Mb/s Switch - Primary	switch at 2 dB down	switch at 5 dB down		

STEP	OPERATION	MINIMUM TOLERANCE	MAXIMUM TOLERANCE	INCOMING	OUTGOING
8	Serial Digital 270 Mb/s Switch - Backup	switch at 2 dB down	switch at 5 dB down		
10	NTSC Serial Digital Composite Switch - Primary	switch at 2 dB down	switch at 5 dB down		
11	NTSC Serial Digital Composite Switch - Backup	switch at 2 dB down	switch at 5 dB down		
13	Serial Digital Audio Switch - Primary	switch at 2 dB down	switch at 4 dB down		
14	Serial Digital Audio Switch - Backup	switch at 2 dB down	switch at 4 dB down		

[4] **Exclude this step for Opt. ELSW**

Equipment Required

Signal Source – TG700 mainframe with the following modules:

DVG7 Opt. BK: Composite Signal Set. Must be able to output serial digital composite video with optional Black output.

HDVG7 Opt. BK: 1.485 Gb/s Signal Set with optional Black output.

BG7: Analog Black generator with four independently selectable outputs.

AG7: audio signal generator providing eight channels (four AES/EBU pairs) of audio signal generation.

Step Attenuator – The step attenuator must be able to attenuate a signal at least 6 dB and step from 1 to 5 dB in 0.5 dB steps. (Example: 847 Attenuator from KAY Elemetrics Corp.)

Oscilloscope or waveform monitor. Used only to monitor the signals. (Oscilloscope should have a 1 GHz bandwidth, for example, a TDS7000 Series oscilloscope; Example waveform monitor: 1745A Waveform Monitor.)

75 Ω terminations. (Example: Tektronix part number 011-0163-00 for serial digital video or 011-0102-01 for analog and audio)

75 Ω Cables. (Example: Tektronix part number 012-0074-00)

Performance Verification Procedure

Signal Checking Disabled

1. Check Overall Switching Disabled

Disconnect all signals (if any) from the ECO422D and power off the instrument.

Set all switches on S1 through S11 to “open” to disable switches on all channels.

Power the ECO422D on. (No inputs or outputs are required at this point.) Wait for the power-on delay to complete (over 4 minutes).

With the addition of S13[5] the power-on delay is adjustable, from no delay to over seven minutes (see page 1–4).

CHECK – that there are no error shown on the front panel.

Black Burst Checks

2. NTSC Black Burst Check for Channel 1 Primary
Switch between 2 and 4 dB down from nominal

Connect the equipment as shown in Figure 4–1.

Power off all equipment.

Set the Channel Configuration switches to Disabled (signal not checked) for all channels (set all DIP switches on S1 through S11 to “open”).

Set the Channel Configuration switch to NTSC Black Burst for Channel 1 (set S1–1 to “closed” and S1–2 through S1–8 “open”).

Set the step attenuator to 0 dB of attenuation.

Power on all equipment.

Set the TG700 BG7 to output an NTSC black burst signal.

CHECK – that there are no errors shown for either the Primary or Backup ECO422D sync sources.

[5] Serial number B030000 and later.

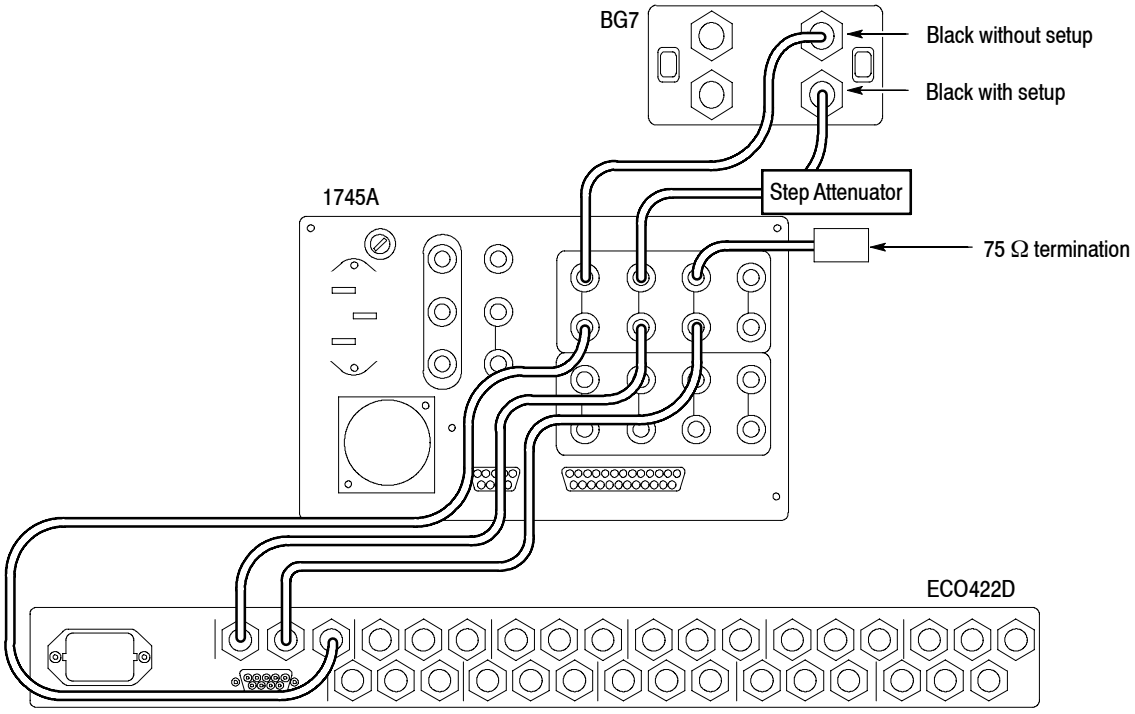


Figure 4- 1: Setup to check Black Burst levels

Set the ECO422D to “Primary” Sync Source and Auto Switch “Switch on Fault.”

Add attenuation, 0.5 dB at a time, to the Primary input signal until the signal source switches to the Backup.

Press the Reset button on the front panel and try to return the signal source to Primary.

CHECK – that the Primary signal still shows an error and automatically switches back to Backup. If the ECO422D doesn’t continue to show the Primary signal in error after the reset, continue adding attenuation until the Primary signal switches to Backup again.

CHECK – that the ECO switches between 2 and 4 dB down.

3. PAL Black Burst Check for Channel 1 Primary Switch between 2 and 4 dB down from nominal

Connect the equipment as shown in Figure 4-1.

Set the Channel Configuration switches to Disabled (signal not checked) for all channels (set all the DIP switches on S2 through S11 to “open”).

Set the Channel Configuration switch to PAL Black Burst for Channel 1 (set S1-1 to “open,” S1-2 “closed,” and S1-3 through S1-8 “open”).

Set the step attenuator to 0 dB of attenuation.

Set the TG700 BG7 to output a PAL black burst signal.

Press Reset.

CHECK - that there are no errors shown for either the Primary or Backup ECO422D sync sources.

Set the ECO422D to “Primary” Sync Source and Auto Switch “Switch on Fault.”

Add attenuation, 0.5 dB at a time, to the Primary input signal until the signal source switches to the Backup.

Press the Reset button on the front panel and try to return the signal source to Primary.

CHECK - that the Primary signal still shows an error and automatically switches back to Backup. If the ECO422D does not continue to show the Primary signal in error after the reset, continue adding attenuation until the Primary signal switches to Backup again.

CHECK - that the ECO switches between 2 and 4 dB down.

4. NTSC Black Burst Check for Channel 1 Backup Switch between 2 and 4 dB down from nominal

Connect the equipment as shown in Figure 4-1, except swap the Primary and Backup input signals at the ECO422D so that the step attenuator is on the Backup channel.

Set the Channel Configuration switches to Disabled (signal not checked) for all channels (set all the DIP switches on S1 through S11 to “open”).

Set the Channel Configuration switch to NTSC Black Burst for Channel 1 (set S1-1 to “closed” and SW1-2 through S1-8 “open”).

Set the step attenuator to 0 dB of attenuation.

Set the TG700 BG7 to output an NTSC black burst signal.

Press Reset.

CHECK – that there are no errors shown for either the Primary or Backup ECO422D sync sources.

Set the ECO422D to “Backup” Sync Source and Auto Switch to “Switch on Fault.”

Add attenuation, 0.5 dB at a time, to the Backup input signal until the signal source switches to the Primary.

Press the Reset button on the front panel and try to return the signal source to Backup.

CHECK – that the Backup signal still shows an error and automatically switches back to Primary. If the ECO422D does not continue to show the Backup signal in error after the reset, continue adding attenuation until the Backup signal switches to Primary again.

CHECK – that the ECO switches between 2 and 4 dB down.

5. PAL Black Burst Check for Channel 1 Backup Switch between 2 and 4 dB down from nominal

Connect the equipment as shown in Figure 4–1, except swap the Backup and Primary input signals at the ECO422D, so that the step attenuator is on the Backup input signal.

Set the Channel Configuration switches to Disabled (signal not checked) for all channels (set all the DIP switches on S2 through S11 to “open”).

Set the Channel Configuration switch to PAL Black Burst for Channel 1 (set S1–1 to “open,” S1–2 “closed,” and S1–30 through S1–8 “open”).

Set the step attenuator to 0 dB of attenuation.

Set the TG700 BG7 to output a PAL black burst signal.

Press Reset.

CHECK – that there are no errors shown for either the Primary or Backup ECO422D sync sources.

Set the ECO422D to “Backup” Sync Source and Auto Switch to “Switch on Fault.”

Add attenuation, 0.5 dB at a time, to the Backup input signal until the signal source switches to the Primary.

Press the Reset button on the front panel and try to return the signal source to Backup.

CHECK – that the Backup signal still shows an error and automatically switches back to Primary. If the ECO422D does not continue to show the Backup signal in error after the reset, continue adding attenuation until the Backup signal switches to Primary again.

CHECK – that the ECO422D switches between 2 and 4 dB down.

6. Check the NTSC & PAL Black Burst for Channels 2 – 11 Switch between 2 and 4 dB down from nominal

Repeat the four previous procedures for Channels 2 – 11 of the ECO422D. Move the cables from Channel 1 to the channel under test. Replace the switch setting for S1 as given in the following Table.

Channel No.	Switch No.
2	S2
3	S3
4	S4
5	S5
6	S6
7	S7
8	S8
9	S9
10	S10
11	S11

Serial Digital Video Checks

7. Serial Digital Component Check for Channel 1 Primary Switch between 2 and 5 dB down from nominal

Connect the equipment as shown in Figure 4–2.

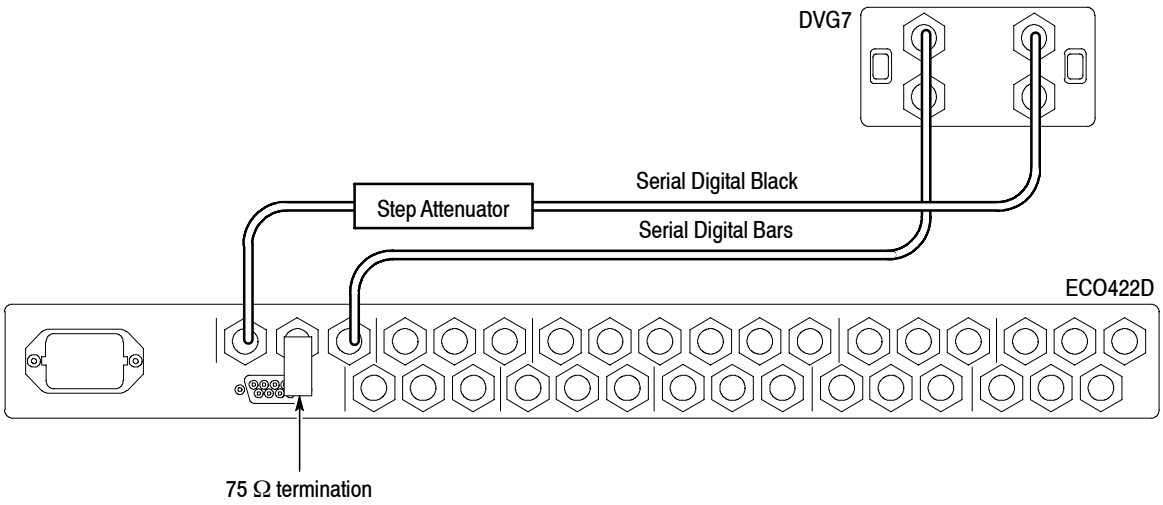


Figure 4-2: Setup to check the component serial digital video levels

Set the Channel Configuration switches to Disabled (signal not checked) for all channels (set all the DIP switches on S1 through S11 to “open”).

Set the Channel Configuration switch to Serial Digital Video Component for Channel 1 (set S1–4 to “closed,” S1–1 through S1–3 “open,” and S1–5 through S1–8 “open”).

Set the step attenuator to 0 dB of attenuation.

Set the TG700 DVG7 to output any serial digital bars signal using the 525/59.94 standard.

Press Reset.

CHECK – that there are no errors shown for either the Primary or Backup ECO422D sync sources.

Set the ECO422D (using the front panel) to “Primary” Sync Source and Auto Switch “Switch on Fault.”

Add attenuation, 0.5 dB at a time, to the Primary input signal until the signal source switches to Backup.

Press the Reset button on the front panel and try to return the signal source to Primary.

CHECK – that the Primary signal still shows an error and automatically switches back to Backup. If the ECO422D does not continue to show the Primary signal in error after the reset, continue adding attenuation until the Primary signal switches to Backup again.

CHECK – that the ECO switches between 2 and 5 dB down.

Repeat using the 625/50 standard bars signal as the input.

8. Serial Digital Component Check for Channel 1 Backup Switch between 2 and 5 dB down from nominal

Connect the equipment as shown in Figure 4–2, except swap the Primary and Backup input signals so that the step attenuator is on the Backup input.

Set the Channel Configuration switches to Disabled (signal not checked) for all channels (set all the DIP switches on S1 through S11 to "open").

Set the Channel Configuration switch to Serial Digital Video Component for Channel 1 (set S1–4 to "closed," S1–1 through S1–3 "open," and S1–5 through S1–8 "open").

Set the TG700 DVG7 to output any serial digital bars signal using the 525/59.94 standard.

Press Reset.

CHECK – that there are no errors shown for either the Primary or Backup ECO422D sync sources.

Set the ECO422D (using the front panel) to "Backup" Sync Source and Auto Switch "Switch on Fault."

Add attenuation, 0.5 dB at a time, to the Backup input signal until the signal source switches to Primary.

Press the Reset button on the front panel and try to return the signal source to Backup.

CHECK – that the Backup signal still shows an error and automatically switches back to Primary. If the ECO422D does not continue to show the Backup signal in error after the reset, continue adding attenuation until the Backup signal switches to Primary again.

CHECK – that the ECO switches between 2 and 5 dB down.

Repeat using a 625/50 bars signal as the input.

9. Check Serial Digital Video (Component) for Channels 2 through 11 Switch between 2 and 5 dB down from nominal

Repeat the previous two procedures for Channels 2 through 11 of the ECO422D, for standard instruments (exclude Channels 4 through 6 if Opt. ELSW is installed). Move the cables from Channel 1 to the channel under test. Replace the switch setting for S1 as given in the following table.

Channel No.	Switch No.
2	S2
3	S3
4	S4
5	S5
6	S6
7	S7
8	S8
9	S9
10	S10
11	S11

10. NTSC Serial Digital Composite Check for Channel 1 Primary Switch between 2 and 5 dB down from nominal

Connect the equipment as shown in Figure 4–3.

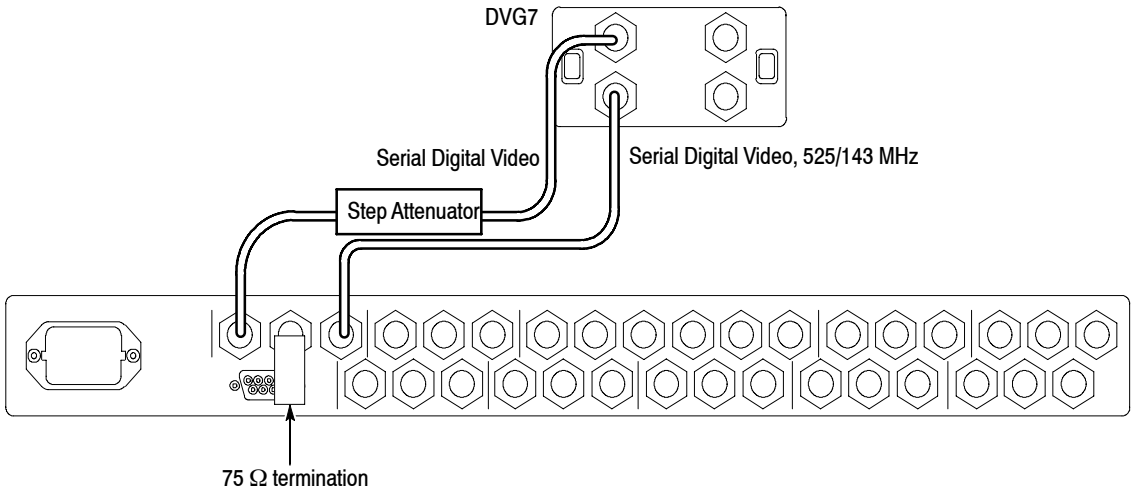


Figure 4–3: Setup to check the serial digital video composite levels

Set the Channel Configuration switches to Disabled (signal not checked) for all channels (set all the DIP switches on S1 through S11 to “closed”).

Set the Channel Configuration switch to NTSC Serial Digital Video Composite for Channel 1 (set S1–3 to “closed,” S1–1 and S1–2 “open,” and S1–4 through S1–8 “open”).

Set the step attenuator to 0 dB of attenuation.

Set the TG700 DVG7 to output any serial digital composite signal of 525/143 MHz format (do not use the SDI Check Field signal).

Press Reset.

CHECK – that there are no errors shown for either the Primary or Backup ECO422D sync sources.

Set the ECO422D to "Primary" Sync Source and Auto Switch to "Switch on Fault."

Add attenuation, 0.5 dB at a time, to the Primary input signal until the signal source switches to Backup.

Press the Reset button on the front panel and try to return the signal source to Primary.

CHECK – that the Primary signal still shows an error and automatically switches back to Backup. If the ECO422D does not continue to show the Primary signal in error after the reset, continue adding attenuation until the Primary signal switches to Backup again.

CHECK – that the ECO switches between 2 and 5 dB down.

11. NTSC Serial Digital Composite Check for Channel 1 Backup Switch between 2 and 5 dB down from nominal

Connect the equipment as shown in Figure 4–3, except swap the Primary and Backup signals, so that the step attenuator is on the Backup input.

Set the Channel Configuration switches to Disabled (signal not checked) for all channels (set all the DIP switches on S1 through S11 to "closed").

Set the Channel Configuration switch to Serial Digital Video Composite for Channel 1 (set S1–3 to "closed," S1–1 and S1–2 "open," and S1–4 through S1–8 "open").

Set the step attenuator to 0 dB of attenuation.

Set the TG700 DVG7 to output any serial digital composite signal. (Do not use the SDI Check Field signal.)

Press Reset.

CHECK – that there are no errors shown for either the Primary or Backup ECO422D sync sources.

Set the ECO422D to "Backup" Sync Source and Auto Switch "Switch on Fault."

Add attenuation, 0.5 dB at a time, to the Backup input signal until the signal source switches to Primary.

Press the Reset button on the front panel and try to return the signal source to Backup.

CHECK – that the Backup signal still shows an error and automatically switches back to Primary. If the ECO422D does not continue to show the Backup signal in error after the reset, continue adding attenuation until the Backup signal switches to Primary again.

CHECK – that the ECO switches between 2 and 5 dB down.

12. Check Serial Digital Video (Composite) for Channels 2 through 11 Switch between 2 and 5 dB down from nominal

Repeat the previous two procedures for Channels 2 through 11 of the ECO422D, for standard instruments (exclude Channels 4 through 6 if Opt. ELSW is installed). Move the cables from Channel 1 to the channel under test. Replace the switch setting for S1 as given in the following table.

Channel No.	Switch No.
2	S2
3	S3
4	S4
5	S5
6	S6
7	S7
8	S8
9	S9
10	S10
11	S11

Serial Digital Audio Checks

13. Serial Digital Audio Check for Channel 1 Primary Switch between 2 and 4 dB down from nominal

Connect the equipment as shown in Figure 4-4.

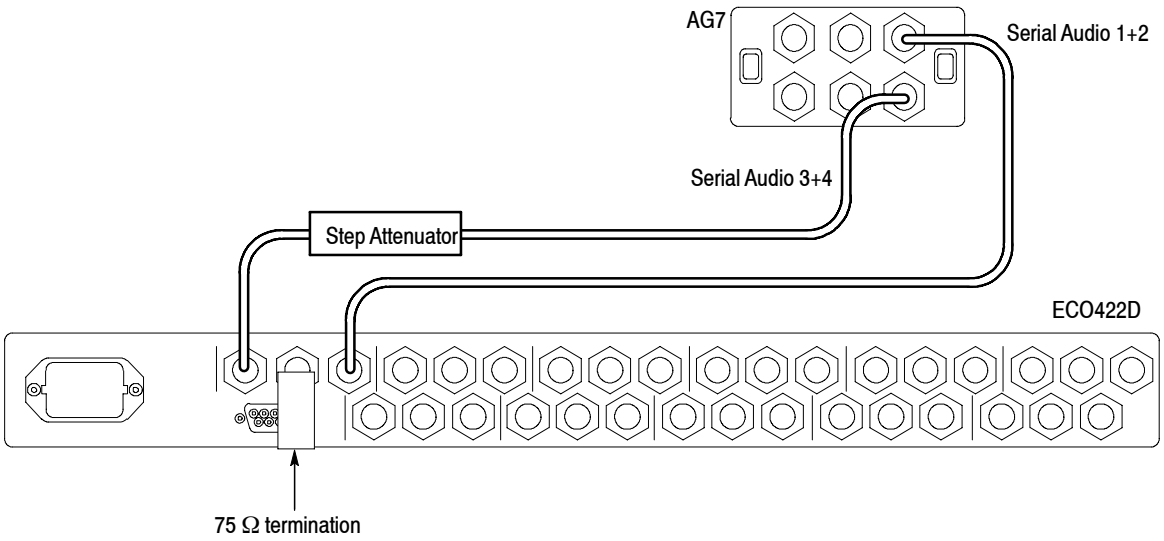


Figure 4-4: Setup to check the serial audio levels

Set the Channel Configuration switches to Disabled (signal not checked) for all channels (set all the DIP switches on S1 through S11 to "open").

Set the Channel Configuration switch to Serial Digital Audio for Channel 1 (set S1-5 to "closed," S1-1 through S1-4 "open," and S1-6 through S1-8 "open").

Set the step attenuator to 0 dB of attenuation.

Set the TG700 AG7 to output either a 1000 or 800 Hz serial digital audio tone on channels 1+2 and 3+4.

Press Reset.

CHECK - that there are no errors shown for either the Primary or Backup ECO422D sync sources.

Set the ECO422D to "Primary" Sync Source and Auto Switch to "Switch on Fault."

Add attenuation, 0.5 dB at a time, to the Primary input signal until the signal source switches to Backup.

Press the Reset button on the front panel and try to return the signal source to Primary.

CHECK – that the Primary signal still shows an error and automatically switches back to Backup. If the ECO422D does not continue to show the Primary signal in error after the reset, continue adding attenuation until the Primary signal switches to Backup again.

CHECK – that the ECO switches between 2 and 4 dB down.

14. Serial Digital Audio Check for Channel 1 Backup
Switch between 2 and 4 dB down from nominal

Connect the equipment as shown in Figure 4–4 except swap the Primary and Backup cables so that the attenuator is on the Backup side.

Set the Channel Configuration switches to Disabled (Signal not checked) for all channels. (set all the DIP switches on S1 through S11 to “open”).

Set the Channel Configuration switch to Serial Digital Audio for Channel 1 (set S1–5 to “closed,” S1–1 through S1–4 “open,” and S1–6 through S1–8 “open”).

Set the step attenuator to 0 dB of attenuation.

Set the TG700 AG7 to output either a 1000 or 800 Hz serial digital audio tone on channels 1+2 and 3+4.

Press Reset.

CHECK – that there are no errors shown for either the Primary or Backup ECO422D sync sources.

Set the ECO422D to “Backup” Sync Source and Auto Switch to “Switch on Fault.”

Add attenuation, 0.5 dB at a time, to the Backup input signal until the signal source switches to Primary.

Press the Reset button on the front panel and try to return the signal source to Backup.

CHECK – that the Backup signal still shows an error and automatically switches back to Primary. If the ECO422D does not continue to show the Backup signal in error after the reset, continue adding attenuation until the Backup signal switches to Primary again.

CHECK – that the ECO switches between 2 and 4 dB down.

15. Check Serial Digital Audio for Channels 2 through 11
Switch between 2 and 4 dB down from nominal

Repeat the previous two procedures for Channels 2 through 11 of the ECO422D, for standard instruments (exclude Channels 4 through 6 if Opt. ELSW is installed). Move the cables from Channel 1 to the channel under test. Replace the switch setting for S1 as given in the following table.

Channel No.	Switch No.
2	S2
3	S3
4	S4
5	S5
6	S6
7	S7
8	S8
9	S9
10	S10
11	S11

16. HD Serial Digital Component Check for Channel 1 Primary
Switch between 2 and 5 dB down from nominal

Connect the equipment as shown in Figure 4–5.

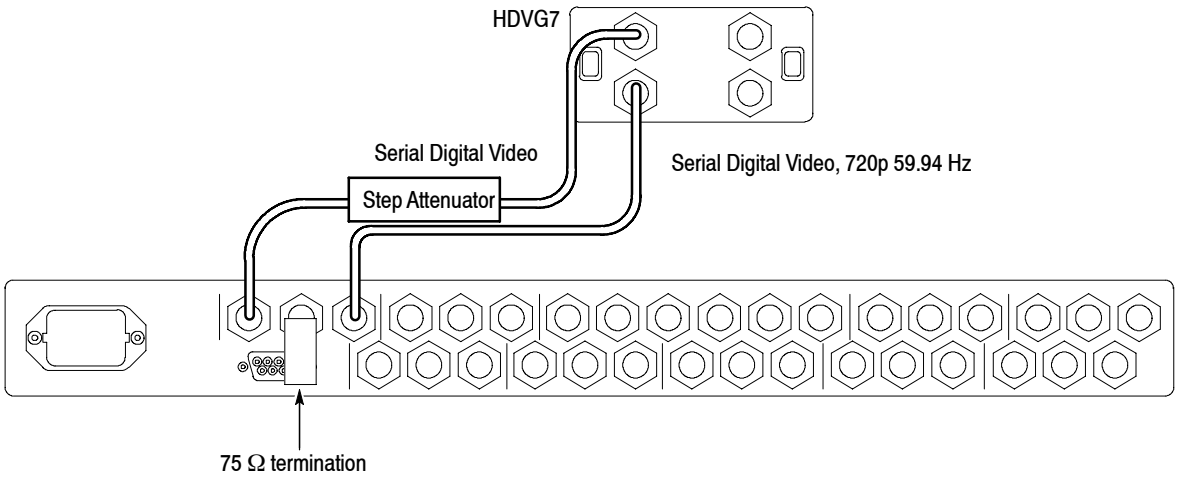


Figure 4-5: Setup to check the component serial digital video levels

Set the Channel Configuration switches to Disabled (signal not checked) for all channels (set all the DIP switches on S1 through S11 to “open”).

Set the Channel Configuration switch to Serial Digital Video 1.485 Gb/s for Channel 1. (Set S1–8 to “closed,” S1–1 through S1–7 to “open.”)

Set the step attenuator to 0 dB of attenuation.

Set the TG700 HDVG7 to output any serial digital bars signal using the 720p/59.94 Hz standard.

Press Reset.

CHECK – that there are no errors shown for either the Primary or Backup ECO422D sync sources.

Set the ECO422D (using the front panel) to "Primary" Sync Source and Auto Switch "Switch on Fault."

Add attenuation, 0.5 dB at a time, to the Primary input signal until the signal source switches to Backup.

Press the Reset button on the front panel and try to return the signal source to Primary.

CHECK – that the Primary signal still shows an error and automatically switches back to Backup. If the ECO422D does not continue to show the Primary signal in error after the reset, continue adding attenuation until the Primary signal switches to Backup again.

CHECK – that the ECO switches between 2 and 5 dB down.

17. HD Serial Digital Component Check for Channel 1 Backup Switch between 2 and 5 dB down from nominal

Connect the equipment as shown in Figure 4–5, except swap the Primary and Backup input signals so that the step attenuator is on the Backup input.

Set the Channel Configuration switches to Disabled (signal not checked) for all channels (set all the DIP switches on S1 through S11 to "open").

Set the Channel Configuration switch to Serial Digital Video Component for Channel 1 (set S1–8 to "closed," and S1–1 through S1–7 to "open."

Set the step attenuator to 0 dB of attenuation.

Press Reset.

CHECK – that there are no errors shown for either the Primary or Backup ECO422D sync sources.

Set the ECO422D (using the front panel) to "Backup" Sync Source and Auto Switch "Switch on Fault."

Add attenuation, 0.5 dB at a time, to the Backup input signal until the signal source switches to Primary.

Press the Reset button on the front panel and try to return the signal source to Backup.

CHECK – that the Backup signal still shows an error and automatically switches back to Primary. If the ECO422D does not continue to show the Backup signal in error after the reset, continue adding attenuation until the Backup signal switches to Primary again.

CHECK – that the ECO switches between 2 and 5 dB down.

18. HD Serial Digital Component Check for Channels 2 through 11 Switch between 2 and 5 dB down from nominal

Repeat the previous two procedures for Channels 2 through 11 of the ECO422D, for standard instruments (exclude Channels 4 through 6 if Opt. ELSW is installed). Move the cables from Channel 1 to the channel under test. Replace the switch setting for S1 as given in the following table.

Channel No.	Switch No.
2	S2
3	S3
4	S4
5	S5
6	S6
7	S7
8	S8
9	S9
10	S10
11	S11

Adjustment Procedure

Adjustment Procedure

The only adjustments required for the ECO422D are the user-defined threshold levels.

Adjusting the User-Defined Threshold Levels

The user-defined threshold levels are the two levels available from User Configuration switches SX-6 (R266) and SX-7 (R265). They are available so that the user can check the levels of signals other than the five predefined levels.

The procedure to adjust these levels is an operator adjustment, not a service adjustment. Therefore it is given in the user portion of this manual; see page 1-10.

Maintenance

Maintenance

This section discusses the various options available for servicing the Tektronix ECO422D. It also contains instructions for preventive maintenance, general troubleshooting, and corrective maintenance. If the instrument does not function properly, troubleshooting and corrective measures should be taken immediately to circumvent additional problems.

Service Options

A number of servicing options are available. They range from returning the instrument to Tektronix for repair and/or recalibration, to a major assembly exchange, to full component level servicing by the customer (at the installation site). Each of these options should be investigated as to which will be the most time efficient and cost effective.

Tektronix Service

Tektronix maintains service centers around the world to provide quick turn-around repair and recalibration services. When this service is used, even during the warranty period, the instrument should be tagged and repackaged according to the instructions at the end of this section.

Service Preparation

- Read the Safety Summary and the Service Strategy sections
- Read the Operating Basics section

Preventive Maintenance

Preventive maintenance consists of cleaning, inspecting, checking performance, activating the switch-over relays, and readjusting the ECO422D on a regular schedule.

The inspection and cleaning schedule should be established based on the amount of use and the surrounding environment of the ECO422D. Under average conditions, a preventive maintenance check should be performed on a one year interval (severe environmental conditions may dictate a shorter time interval).

Cleaning

Clean the instrument often enough to prevent dust or dirt from accumulating. Dust accumulating in the instrument acts as an insulating blanket, preventing proper cooling, and possibly causing overheating and component breakdown. Under high humidity conditions, accumulated dust can also provide an electrical conduction path.

CAUTION. *To avoid damage to the instrument, do not expose it to sprays, liquids, or solvents. Do not use chemical cleaning agents; they can damage the instrument. Avoid chemicals that contain benzene, toluene, xylene, acetone, or similar solvents.*

Clean the exterior surfaces of the instrument with a dry, lint-free cloth or a soft-bristle brush. If dirt remains, use a cloth or swab dampened with a 75% isopropyl alcohol solution. A swab is useful for cleaning in narrow spaces around the controls and connectors. Do not use abrasive compounds on any part of the instrument.

CAUTION. *Avoid getting moisture inside the instrument during exterior cleaning and use only enough solution to dampen the cloth or swab. Use a 75% isopropyl alcohol solution as a cleanser, and rinse with deionized water.*

Visual Inspection

Visually inspect the instrument during the preventive maintenance routine for signs of damage, scorched components, and loose or disconnected pin connectors. If you discover heat damaged parts, try to determine the cause of the overheating before replacing the damaged parts; otherwise, the damage may repeat.

Periodic checks of the transistors and integrated circuits are not recommended. The best measure of performance is the actual operation of the component in the circuit.

Activating the Switch-over Relays

To prevent a build up of corrosion on the switch-over relays, the relays should be activated every 6 months.

Performance Verification and Readjustments

Instrument performance should be checked after each 2000 hours of operation, or every 12 months. This will help to ensure maximum performance and assist in locating defects that may not be apparent during regular operation. The Performance Verification and Adjustment Procedures are included in this manual.

Static-Sensitive Components

CAUTION. *Static discharge can damage or degrade many semiconductor components.*

This instrument contains electrical components that are susceptible to damage or degradation from static discharge. See Table 6–1 for relative susceptibility of various classes of semiconductors. Higher static discharge voltages than the levels listed in Table 6–1 can degrade the performance and reliability of the semiconductor components. Static voltages of 1 kV to 30 kV are common in unprotected environments.

Table 6-1: Static-sensitive components

Semiconductor classes	Relative susceptibility levels
MOS or CMOS microcircuits or discrete or linear microcircuits with MOS inputs (most sensitive)	100 to 500 V
EL, 74F, 74ALS, and 155- P/N parts	200 to 500 V
Schottky Signal Diodes	250 V
Schottky TTL	500 V
High-frequency Bipolar Transistors and ICs	400 to 600 V
JFETs	600 to 800 V
Low-frequency Linear Microcircuits	400 to 1000 V
Low-power Schottky TTL	900 V
TTL (least sensitive)	1200 V

NOTE*. Static discharges of less than 2 kV are seldom felt.*

Observe the following precautions to avoid damage:

1. Minimize handling of static-sensitive components.
2. Transport and store static-sensitive components or assemblies in their original containers or on nonconductive surfaces.
3. Discharge the static voltage from your body by wearing a grounded wrist strap while handling these components. Service static-sensitive components or assemblies only at a static free workstation by qualified personnel. If soldering is involved, use a soldering iron connected to earth ground and special antistatic desoldering tools.
4. Avoid handling components in areas that have a floor or work surface covering capable of generating a static charge. Carpeted floors should be sprayed to reduce static problems. Also nothing capable of generating or holding a static charge should be allowed on the workstation surface.
5. Keep the component leads shorted together whenever possible.
6. Pick up the components by the body, never the leads.
7. Do not slide the components over any surface.
8. Use a soldering iron that is connected to earth ground.
9. Use only special antistatic, suction, or wick-type desoldering tools.

Corrective Maintenance

The following procedure is designed to assist in isolating problems, which in turn expedites repairs and minimizes down time. There are no specific trouble-shooting procedures for this instrument because it is a very simple instrument.

NOTE. *There are three fuses in this instrument. One is accessible through the rear panel, one is on the power supply, and the third is on the Main board. Make sure to check the internal fuse if the instrument will not power on. The replacement fuse on the power supply should be a 3.15 A, 250 V fuse. The Main board and rear panel fuse requirements are listed in* Replaceable Mechanical Parts.

General Troubleshooting Procedures

Ensure that the malfunction is in the instrument. This is done by making sure that the instrument is operating as intended by Tektronix (see Operating Basics), and by checking that a malfunction has not occurred upstream or downstream from the ECO422D.

***NOTE**. A source transition can occur if the channel output amplitude is reduced. This can be caused by over-termination, cable damage, or an accidental short to ground. A channel's selected input and its output are directly connected through an internal relay, therefore the ECO422D detects an output reduction as an input reduction. This does not apply to the three Option ELSW channels, which are buffered.*

To avoid this problem, work on an output only when the ECO422D is not in operation. Disconnect the output cable from the ECO422D before working on the cable, and verify proper termination before reconnecting the cable to the ECO422D.

Determine and evaluate all trouble symptoms. This is accomplished by isolating the problem to a general area, such as an assembly. The block diagram and the Theory of Operation, are valuable aids in signal tracing and circuit isolation.

***CAUTION.** Use extreme care when probing with meter leads or probes. The components are very dense and there is only limited access within the instrument. The inadvertent movement of leads or a probe could cause a short circuit or transient voltages capable of destroying components.*

Determine the nature of the problem. Attempt to make the determination of whether the instrument is out of calibration or if there has been a component failure. Once the type of failure has been determined, proceed on to identify the functional area most likely at fault.

Visually inspect the suspect assembly for obvious defects. Most commonly these will be broken or loose components, improperly seated components, overheated or burned components, chafed insulation, etc. Repair or replace all obvious defects. In the case of overheated components, determine the cause of overheating and correct the cause before reapplying power.

Use successive electrical checks to locate the source of the problem. The primary tool for the problem isolation is the oscilloscope. Use the Performance Verification procedure to determine if a circuit is operating within specifications. At times, it may be necessary to change a calibration adjustment to determine if a circuit is operational, but since this can destroy instrument calibration, care should be exercised. Before changing an adjustment, note its position so that it can be returned to its original setting.

Determine the extent of the repair. If the necessary repair is complex, it may be advisable to contact your local Tektronix field office or representative before continuing. If the repair is minor, such as replacing a component, see the parts list for replacement information. Removal and replacement procedures for the assemblies can be found in this section.

CAUTION. *Always remove the assembly from the instrument prior to attempting to replace a solder-in component. See this section for the correct procedure.*

Tektronix Service Offerings

Tektronix maintains a worldwide service organization that provides a number of services to assist in optimizing your instrument's performance at its specified levels. The services include a range of calibration, repair, upgrade, and installation services that are performed on-site or at a Tektronix service depot. In addition replacement parts are available for self-service customers.

NOTE*. When considering which service offerings best suit the current need, remember that Tektronix provides a limited parts and service warranty for all its products. No customer repairs should be attempted during the warranty period.*

As the original manufacturer, our unique expertise and calibration lab equipment enables us to efficiently return your Tektronix instrument to its factory settings. We make it easy for you to keep instruments operating at peak performance and compliant with regulatory and quality standards, with services and accreditations that include:

- Functional Verification
- Traceable Calibration
- Accredited Calibration

In addition, you have purchased an instrument engineered and manufactured to the highest level of reliability and performance. All customers prefer to protect their investments, so Tektronix has created a range of coverage offerings to keep your instrument performing optimally and reduce downtime to an absolute minimum.

- Coverage purchased with instrument – best value option
- Coverage purchased during the warranty period – high value
- Coverage after the warranty expires – economic value compared to on-demand repair

Service Centers

Tektronix maintains service centers worldwide. These centers provide calibration and repair services for Tektronix instruments. They can be contacted through your Tektronix field office or representative. You can also find service and support information at:

http://www.tektronix.com/serviceandsupport

Not all service centers are equipped to repair or calibrate all instruments; please be prepared to provide the instrument model and serial number when calling for assistance.

Factory Replacement Parts

Replacement parts are available through the local Tektronix field office or representative. However, many common electric parts are available through local sources. Using a local source, where possible, will eliminate shipping delays.

Changes to Tektronix instruments are sometimes made to accommodate improved components, as they become available, and to improve circuit performance. Therefore, it is important to include the following information when ordering parts:

1. Part Number
2. Instrument Type or Number
3. Serial Number
4. Modification or Option Number (if applicable)

Etched Circuit Boards

The instrument consists of etched circuit boards. All of the circuit boards are designed as assemblies. Each assembly has as alphanumeric designation (A1 through A4). These assemblies are listed in the Replaceable Mechanical Parts list of this manual.

***NOTE**. A 2% RMA flux content solder is recommended for making repairs in this instrument. Cleaning of rosin residue is not recommended. Most cleaning solvents tend to reactivate the rosin and spread it under components where it may cause corrosion under humid conditions. The rosin residue, if left alone, does not exhibit these corrosive properties.*

Removal/Replacement Procedures

In general, the boards are held down with Torx screws. Make sure to use a TORX tip to remove or replace the screws. Also, check that you have removed all screws (or nuts on the BNC connector) before trying to remove a board.

The following procedure describes how to replace the instrument chassis. Since most of the instrument components are removed and reinstalled during the procedure, you can use these instructions to remove/replace other components.

Tool and Equipment List

The following table lists the tools and equipment you will need to replace the instrment chassis.

Table 6-2: Chassis replacement tools list

Item	Description
TORX driver handle	With the following tips: T-8, T-10, T-20
Sockets	3/16 in., 5/16 in., and 9/16 in.
1/4 in. nut driver	
1/4 in. open ended wrench	

Removing Components From the Chassis

Perform the following steps to remove parts from an ECO422D chassis that you will use to assemble in a new chassis:

***NOTE**. Keep the parts and mounting hardware together as you disassemble the old chassis. You will reuse these parts when you assemble the new chassis.*

1. Remove the power cord and any signal cables from the instrument.
2. If necessary, remove the instrument from the equipment rack and place on a static-free work surface.
3. Remove the rackmount tracks from each side of the instrument.
4. Remove the top cover from the instrument.
5. Remove the front panel:
   a. Disconnect the front-panel cable from the Main board.
   b. Remove the left and right handles from the front of the instrument.
   c. Remove the front-panel assembly.

6. Remove the Power Supply:

   a. Disconnect the Power Supply cable from the Main board.

   b. Disconnect the cable from the line filter to the Power Supply board.

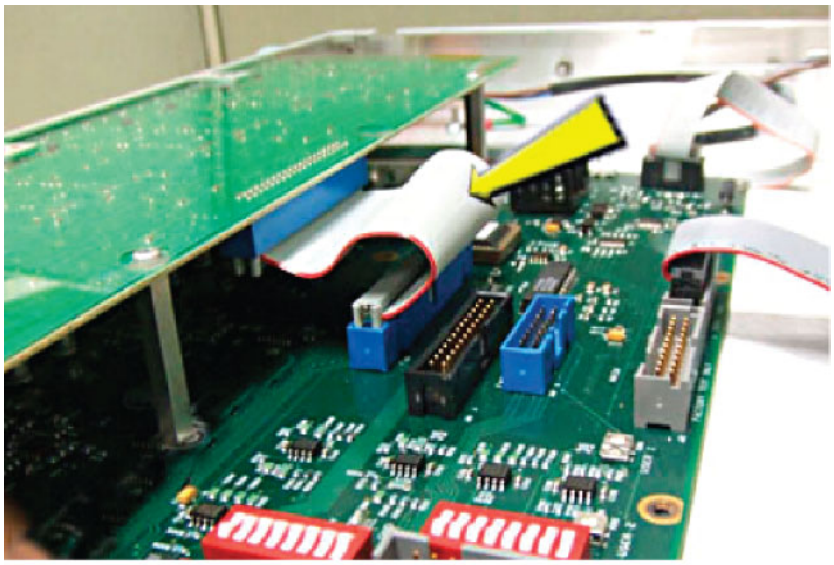
   c. Remove the Power Supply assembly.

   d. Remove the hex nut and screw that were supporting the right-rear of the Power Supply assembly from the chassis.

7. Disconnect the Remote cable from the Main board, and then remove the Remote connector from the rear panel.

8. Remove the Connector board:

   a. Disconnect the cable from the Main board that goes between the Connector board and the Main board as shown in the following figure.

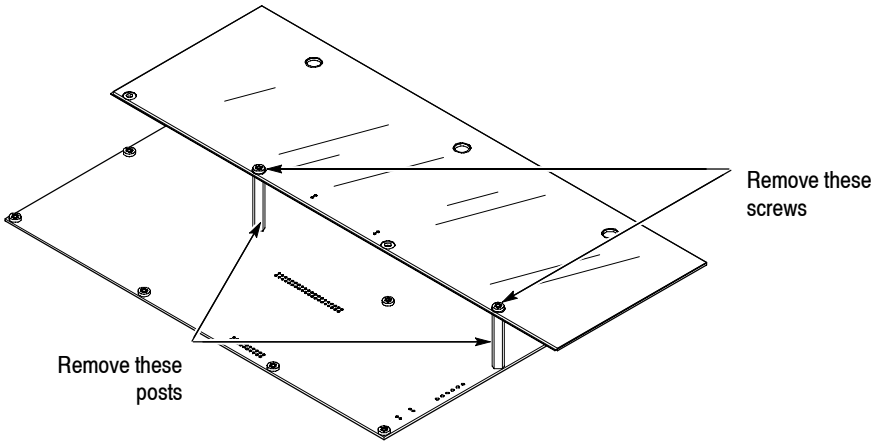


1021-018

   b. Remove all of the nuts from the top row of BNCs on the rear panel.

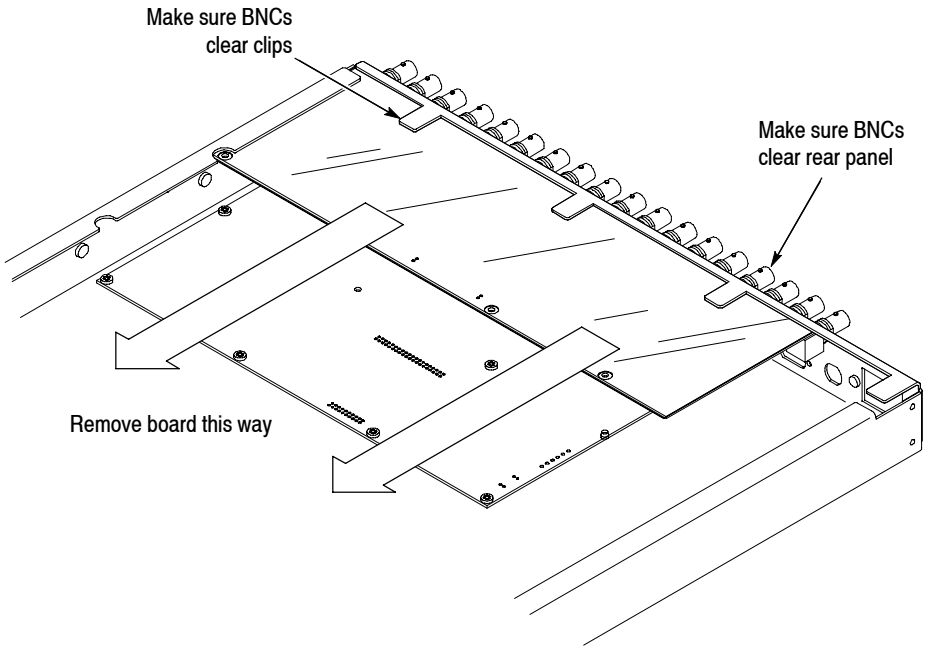
***NOTE**. The top and bottom rows of BNCs use different nuts to attach the connectors to the rear panel. Keep the nuts from the two rows separated to avoid mixing them.*

c. Remove the two screws holding the Connector board to the two posts on the Main board, and then unscrew the posts from the Main board and remove them.



CAUTION. *To prevent circuit board damage, use extreme care when removing the Connector board because there are components on both sides of the board.*

d. Keeping the Connector board level, slide the board toward the front of the instrument until the BNCs clear both the rear panel and the chassis clips.



e. Keep the spacer plate that goes between the BNCs and the rear panel.

9. Remove the Main board:

   a. Remove all of the nuts from the bottom row of BNCs on the rear panel.

***NOTE**. The top and bottom rows of BNCs use different nuts to attach the connectors to the rear panel. Keep the nuts from the two rows separated to avoid mixing them.*

   b. Remove the two screws holding the Main board to the chassis.

***CAUTION.** To prevent circuit board damage, use extreme care when removing the Main board because there are components on both sides of the board.*

   c. Keeping the Main board level, slide the board toward the front of the instrument until the BNCs clear both the rear panel and the chassis clips.

   d. Keep the electrical shield that is under the Main board.

10. Remove the connector plug from the line filter on the rear panel.

Installing Components in the Chassis

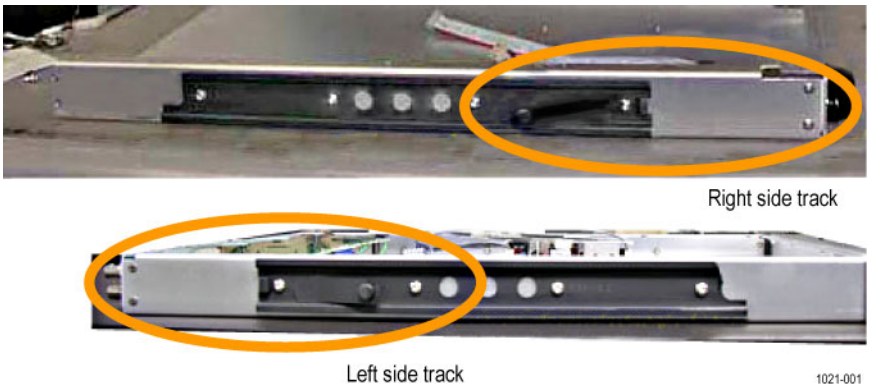
Perform the following steps to install the parts from the old ECO422D chassis into the new chassis.

***CAUTION.** To prevent damage to instrument, refer to the following table for the tightening specifications for each chassis component.*

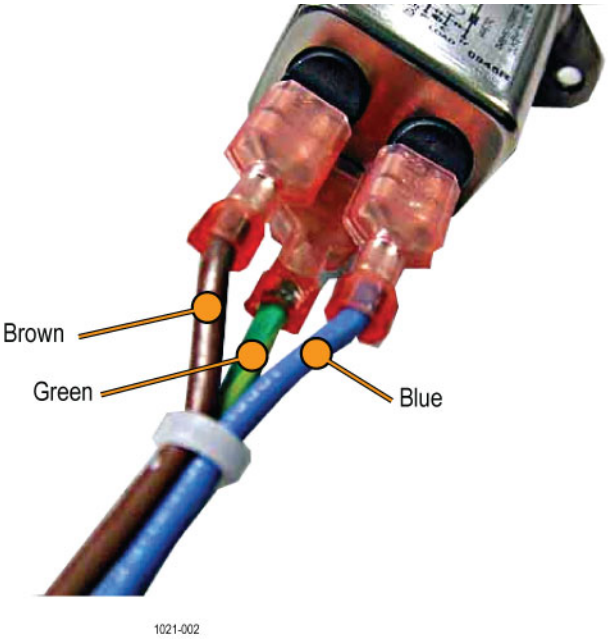
Table 6-3: Tightening specifications for chassis components

Componenet	Specification
Rackmount rails BNC connectors	10 in.-lbs.
Line-filter ground lead	8 in.-lbs.
Power connector plug Remote connector Front-panel assembly and handles Main board Connector board Power Supply assembly Power Supply chassis hex nut	4 in.-lbs.

1. Inspect the new chassis for missing or incorrect studs and pem nuts. Also inspect the chassis for shipping damage and cosmetic defects.
2. Install the rackmount tracks on each side of the chassis as shown in the following figure. The spring on each track should be installed toward the rear of the chassis.

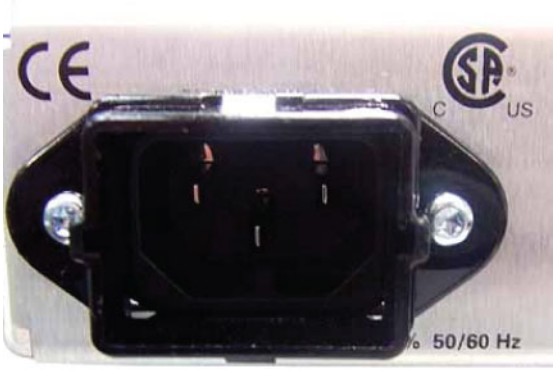


3. Install the line filter:
   a. Connect the line-filter cable to the line filter as shown in the following figure.



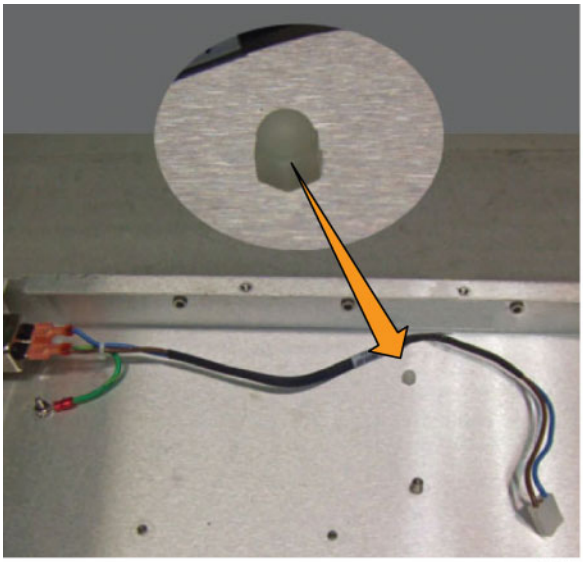
b. With the ground lead (green wire) toward the bottom of the chassis, insert the line filter through the back of the rear panel as shown in the following figure.

c. Place the connector plug you removed from the old chassis on the line filter, and then attach the plug to the chassis as shown in the following figure.



d. Attach the ground lead (green wire) to the chassis stud using the nut you removed while disassembling the chassis.

e. Push the screw through the bottom of the chassis and install the hex nut as shown in the following figure.



1021-005

4. Install the remote connector on the rear panel as shown in the following figure.

1021-006

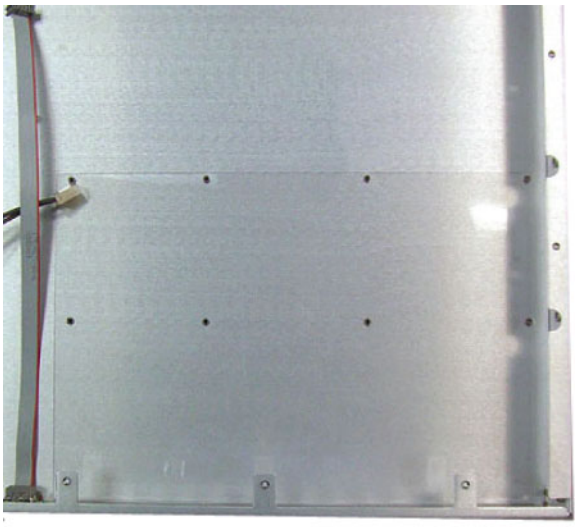
5. Install the front-panel assembly:

   a. Install the front-panel assembly into the front of the chassis.

   b. Install the handles on the sides of the chassis. The right-side handle has a hole at the bottom for securing the instrument in an equipment rack as shown in the following figure.

6. Install the Main board:

   a. Position the electrical shield in the bottom-right corner of the chassis as shown in the following figure.

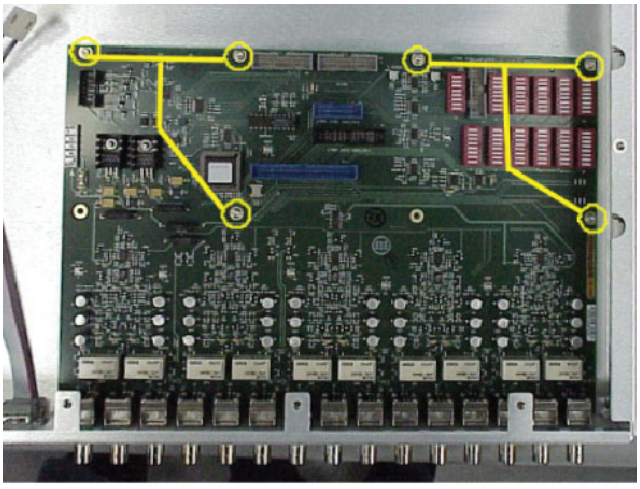


1021-008

CAUTION. *To prevent circuit board damage, use extreme care when installing the Main board because there are components on both sides of the board.*

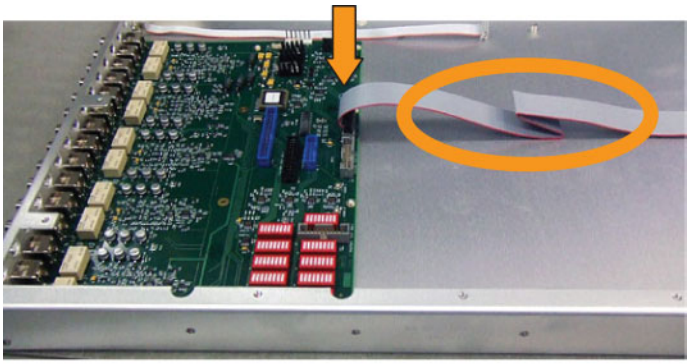
   b. Keeping the Main board level, slide the board toward the rear of the instrument until the BNCs clear both the chassis clips and the rear panel.

   c. Install the six retaining screws in the Main board as shown in the following figure.



1021-009

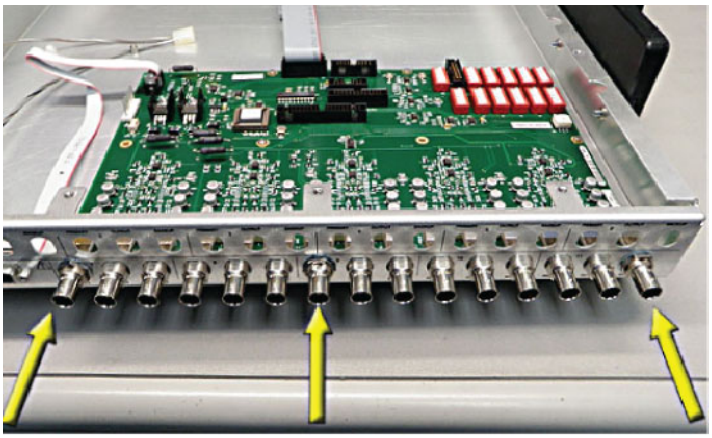
d. Connect the cable from the front panel to J16 on the Main board. Dress the cable as shown in the following figure. The red stripe on the cable faces the dip switches on the Main board.



1021-010

e. Connect the cable from the Remote connector to J17 on the Main board. Dress the cable as shown in the following figure. The red stripe on the cable faces the rear panel.

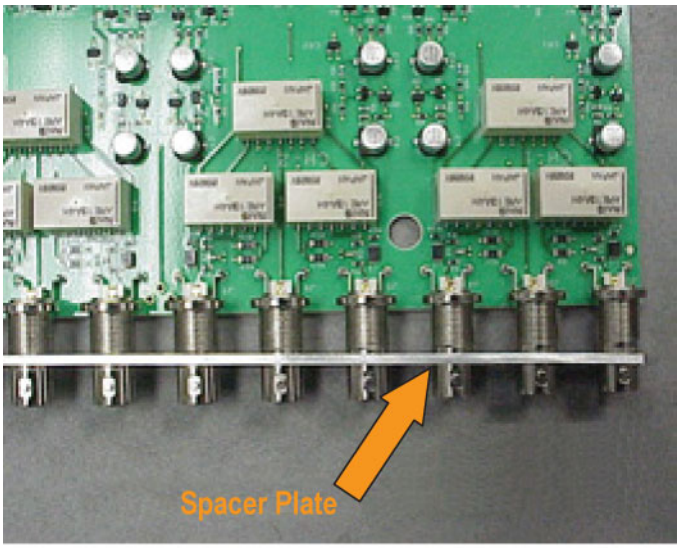
f. Attach the Main board to the rear panel using the lock washers and hex nuts. First install the nuts on the three BNCs shown in the following figure, and then attach the remaining BNCs.



1021-011

7. Install the Connector board:

   a. Install the spacer plate on the BNCs of the Connector board as shown in the following figure.



1021-012

CAUTION. *To prevent circuit board damage, use extreme care when installing the Connector board because there are components on both sides of the board.*

   b. With the Connector board upside down, keep the Connector board level as you slide the board toward the rear of the instrument until the BNCs clear both the chassis clips and the rear panel.

   c. Install the spacer posts into the Main board as shown in the following figure, and then attach the Connector board to the spacer posts.

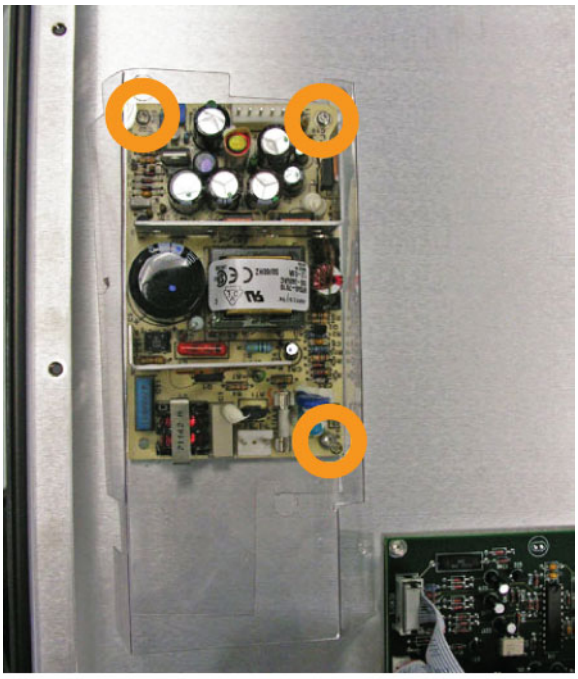
   d. Connect the cable from the Connector board to J18 on the Main board. The red stripe should face the dip switches.

NOTE*. The hex nuts for the Connector board BNCs have keys that allow the nuts to fit over the ears on the BNCs. Also, the nuts are flat on one side an rounded on the other. Install the hex nuts so that the flat side is facing the rear panel of the instrument.*

   e. Attach the Connector board to the rear panel using the lock washers and hex nuts.

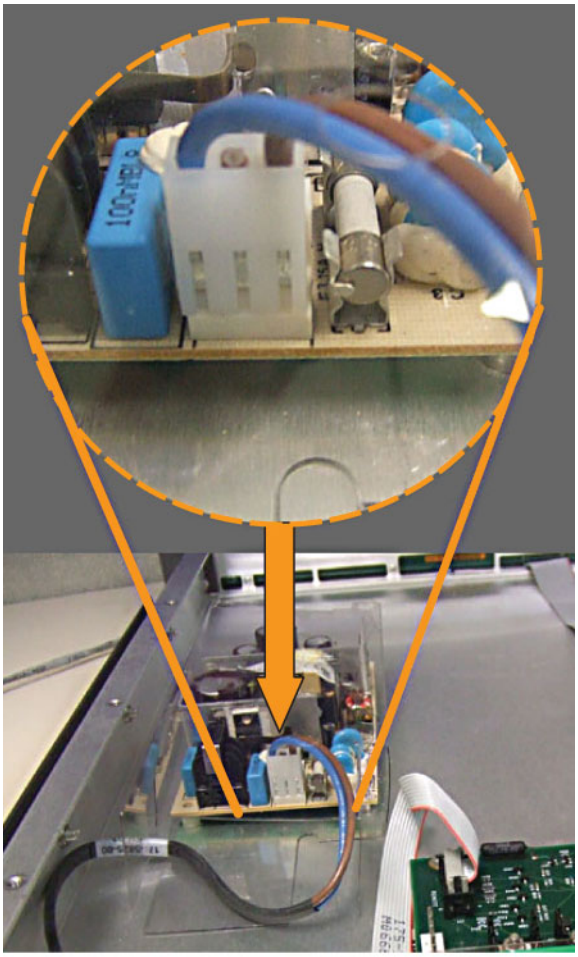
8. Install the Power Supply assembly:

   a. Install the Power Supply assembly, including the plastic electrical shield, into the chassis as shown in the following figure.

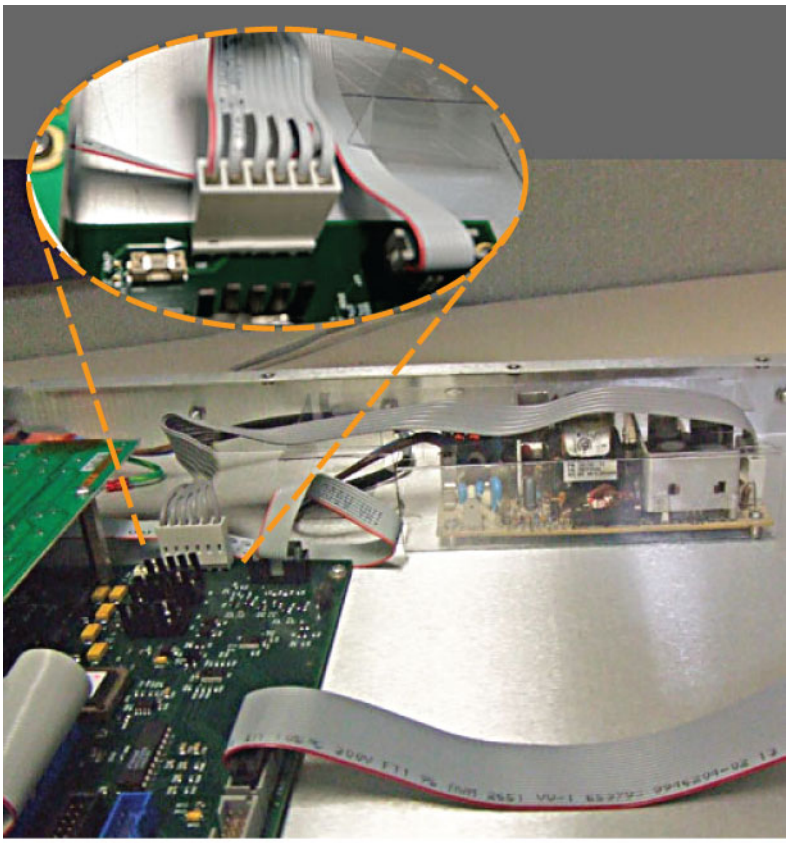


1021-013

b. Connect the cable from the line filter to the Power Supply as shown in the following figure.



c. Connect the cable from the Power Supply to J21 on the Main board. As shown in the following figure, the stripe on the cable faces the rear of the instrument.



1021-015

9. Install the top cover.

Verifying Instrument Operation

After you replace instrument components, verify the operation of the instrument by performing the Performance Verification procedure located in this manual.

Repackaging Instructions

Identification Tag

If the instrument is to be shipped to Tektronix Service Center for service or repair, attach a tag to the instrument showing:

1. Owner (with complete address) and the name of the person at your firm that can be contacted.
2. Instrument serial number and a description of the service required.

Repackaging for Shipment

Repackage the instrument in the original manner to provide adequate protection. If the original packaging is not available or is unfit for use, repackage the instrument as follows:

1. Obtain a corrugated cardboard carton whose inside dimensions are at least six inches greater than the dimensions of the instrument to allow room for cushioning. The shipping carton should have a test strength of at least 275 pounds.
2. Surround the instrument with polyethylene sheeting to protect the finish.
3. Cushion the instrument on all sides by tightly packing dunnage or urethane between the carton and the instrument. Allow three inches on all sides for cushioning.
4. Seal the carton with shipping tape or an industrial stapler.

Replaceable Electrical Parts

Replaceable Electrical Parts

Refer to the Mechanical Parts List chapter for a complete listing and description of replaceable parts for the ECO422D.

Replaceable Mechanical Parts

Replaceable Mechanical Parts

This section contains a list of the components that are replaceable for the ECO422D. Use this list to identify and order replacement parts.

Parts Ordering Information

Replacement parts are available from or through your local Tektronix, Inc., Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest circuit improvements. Therefore, when ordering parts, it is important to include the following information in your order.

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc., Field Office or representative will contact you concerning any change in part number.

Using the Replaceable Mechanical Parts List

The tabular information in the Replaceable Mechanical Parts list is arranged for quick retrieval. Understanding the structure and features of the list will help you find all of the information you need for ordering replaceable parts.

Abbreviations Abbreviations conform to American National Standards Institute (ANSI) standard Y1.1.

Chassis Parts Chassis-mounted parts and cable assemblies are located at the end of the Replaceable Electrical Parts list.

Column Descriptions

Figure & Index No. (Column 1) Items in this section are referenced by figure and index numbers to the illustrations.

Tektronix Part No. (Column 2) Indicates part number to be used when ordering replacement part from Tektronix.

Serial No. (Column 3 and 4) Column three (3) indicates the serial number at which the part was first used. Column four (4) indicates the serial number at which the part was removed. No serial number entered indicates part is good for all serial numbers.

Qty (Column 5) This indicates the quantity of mechanical parts used.

Name and Description (Column 6) An item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. Use the U.S. Federal Catalog handbook H6-1 for further item name identification.

Following is an example of the indentation system used to indicate relationship.

1 2 3 4 5 Name & Description
Assembly and/or Component
Mounting parts for Assembly and/or Component
MOUNTING PARTS/*END MOUNTING PARTS*
Detail Part of Assembly and/or Component
Mounting parts for Detail Part
MOUNTING PARTS/*END MOUNTING PARTS*
Parts of Detail Part
Mounting parts for Parts of Detail Part
MOUNTING PARTS/*END MOUNTING PARTS*

Mounting Parts always appear in the same indentation as the Item it mounts, while the detail parts are indented to the right. Indented items are part of and included with, the next higher indentation. **Mounting parts must be purchased separately, unless otherwise specified.**

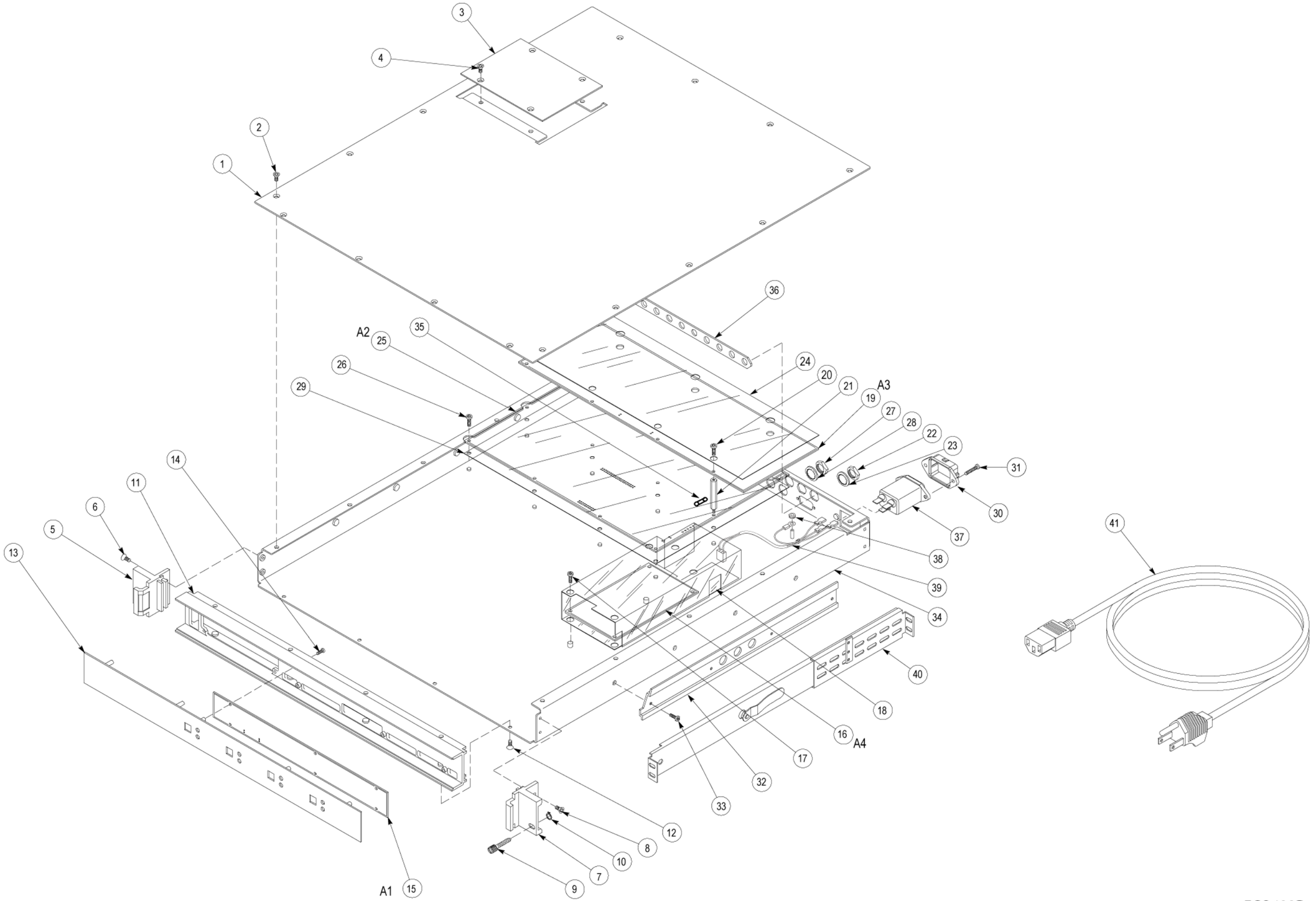
Replaceable Mechanical Parts

Fig. & index no.	Tektronix part no.	Serial number effective	Serial number discontinued	Qty	12345	Name & Description
1-1	200-4678-00			1		COVER,TOP:ALUMINUM,ECO422D
						MOUNTING PARTS
-2	211-0538-00			16		SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,STL
						END MOUNTING PARTS
-3	200-4679-00			1		COVER,TOP:SMALL DOOR;ALUMINUM,
						MOUNTING PARTS
-4	211-1337-00			4		SCREW, MACHINE; 6-32 X 0.312, FLH, 100 DEG, ZINC PLATED STEEL, PHILLIPS
						END MOUNTING PARTS
-5	367-0437-03			1		HANDLE:ALUMINUM
						MOUNTING PARTS
-6	211-0538-00			2		SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,STL
						END MOUNTING PARTS
-7	367-0437-01			1		HANDLE:ALUMINUM
						MOUNTING PARTS
-8	211-0538-00			2		SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,STL
						END MOUNTING PARTS
-9	213-0216-00			1		THUMBSCREW:10-32 X 0.85,0.375 OD HD,SST
-10	354-0025-00			1		RING,RETAINING:EXTERNAL,U/O 0.187 DIA SFT
-11	426-2512-00			1		FRONT FRAME:ALUMINIUM
						MOUNTING PARTS
-12	211-0538-00			4		SCREW,MACHINE:6-32 X 0.312,FLH,100 DEG,STL
						END MOUNTING PARTS
-13	333-4400-00			1		FRONT,PANEL:FRONT PANEL,ECO422D
						MOUNTING PARTS
-14	211-0324-00			10		SCR,ASSEM WSHR:4-40 X 0.188,PNH,SST,PASS,T-9 TORX DR,MACHINE
						END MOUNTING PARTS
-15	671-3241-01			1		A1 - FRONT PANEL CKT BD ASSY
-16	119-4112-00			1		A4 - POWER SUPPLY:SWITCHING,AUTO IN 85-264VAC,
						47-440HZ,OUT 5VDC 5A,+15V2A, -15V 0.5A
						MOUNTING PARTS
-17	211-0408-00			3		SCR, ASSEM WSHR; 4-40 X 0.250, PNH, STL, ZINC, T-10 TORX DR, SEMS
						END MOUNTING PARTS
	220-0187-00			1		NUT, HEX; CAP NUT, 4-40, NYLON SAFETY CONTROLLED
	211-0101-00			1		SCREW, MACHINE; 4-40 X 0.25, FLH, 100 DEG, STL CD PL, POZ
-18	337-3738-00			1		SHIELD,ELEC:POWER SUPPLY,
-19	671-5274-05			1		A3 - CONNECTOR BD CKT BD ASSY
	671-8002-00			1		A3 - CONNECTOR BD CKT BD ASSY, OPT ELSW
						MOUNTING PARTS
-20	211-1117-00			2		SCREW, MACHINE; 4-40 X 0.187, PAN HEAD, STL, CD PL,
						T-10, TORX DR
-21	129-1449-00			2		SPACER,POST:ECO422D,1.282 L
-22	220-0256-00			18		NUT; NICKEL PLATED, VENDOR P/N B90010
-23	210-0199-00			18		WASHER, LOCK; NICKEL PLATED, VENDOR P/N B91008
						END MOUNTING PARTS
-24	337-4007-00			1		SHIELD,ELECT:ECO422D
-25	671-8001-01			1		A2 - MAIN BOARD CKT BD ASSY
-26	211-1117-00			6		SCREW, MACHINE; 4-40 X 0.187, PAN HEAD, STL, CD PL,
						T-10, TORX DR
-27	220-0497-00			15		NUT,PLAIN,HEX:0.5-28 X 0.562 HEX,BRS CD PL
-28	210-1039-00			14		WASHER,LOCK:0.521 ID,INT,0.025 THK,SST
-29	337-4008-01			1		SHIELD,ELEC:ECO422D

Fig. & index no.	Tektronix part no.	Serial number effective	Serial number discontinued	Qty	12345	Name & Description
-30	131-4131-00			1		CONN,PLUG,ELEC:MALE W/LOCKING ADPTR,EXT MTG *MOUNTING PARTS*
-31	211-0012-00			2		SCREW,MACHINE:4-40 X 0.375,PNH,STL *END MOUNTING PARTS*
-32	351-0104-03			1		SL SECT,DWR EXT:12.625 L,W/O HARDWARE *MOUNTING PARTS*
-33	212-0158-00			8		SCREW,MACH:8-32 X 0.375,PNH,STL,CDPL,T-20 TORX DR *END MOUNTING PARTS*
-34	441-2625-00			1		CHASSIS: ECO422D
-35	159-5016-00			1		FUSE; 2.0A,125V,FAST BLOW,0.1 X 0.1 X 0.24,UL REG,CSA CERT,SAFETY CONTROLLED (A2F1, on Main Board)
-36	386-7347-00			1		PLATE, SPACER; REAR PANEL, BNC, 0.090 AL, 5052-H3X *ATTACHED PARTS*
	162-0531-00			1		INSUL SLVG,ELEC:HT SHRINK,0.165 IDPOLYOLEFIN,BLK, 0.02 THK W
	220-0187-00			1		NUT,HEX:4-40,NYLON *END ATTACHED PARTS*
-37	119-1536-00			1		FILTER,RFI:3A,250VAC,50/60HZ (FL100 Line Filter)
-38	210-0457-00			1		NUT, PL, ASSEM WA; 6-32 X 0.312, W/LOCKWASHER, STEEL, ZINC FINISH
-39	174-5825-00			1		CA ASSY,SP; HV,BR,A LITTLE LONGER THAN 15.00 L & 4.00 L;CONN EACH END;LINE FILTER TO PWR SUPPLY,SAFETY CONTROLLED
	175-9877-00			1		CA ASSY,SP,ELEC:10,28 AWG,12.5 L,RIBBON (J100) (CONNECTS FROM REAR PANEL “REMOTE” TO A2J17) *MOUNTING PARTS*
	214-3903-01			2		SCREW,JACK:4-40 X 0.312 EXT THD,4-40 INT THD,0.188 HEX,STEEL,CADPLATE *END MOUNTING PARTS*
	174-1495-00			1		CA ASSY,SP,ELEC:20,28 AWG,3.0 L,RIBBONSAF CONT (W18) (CONNECTS FROM A2J18 TO A3J19)
	174-3370-01			1		CA ASSY,SP:DESCRETE;PSC,6,18 AWG,12.0 L,0.156 CTR,1X6,0.156 CTR,RCPT,W/FRICTION LOCK BOTH ENDS,GOLD PL (W21) (CONNECTS FROM A2J21 TO A4J2)
	335-1453-00			1		MARKER IDENT; ECO422D ELSW CONN; SAFETY CONTROLLED (OPTION ELSW ONLY)

Fig. & index no.	Tektronix part no.	Serial number effective	Serial number discontinued	Qty	12345	Name & Description
						STANDARD ACCESSORIES
	061-4234-xx			1		CARD,INFO:REFERENCE,ECO422D
	071-2683-xx			1		MANUAL,TECH:INSTALLATION & SAFETY INSTRUCTIONS, EC0422D
	063-4252-xx			1		DOCUMENTATION: USER MANUAL,ENGLISH,CD; ECO422D
-40	351-0751-01			1		TRK SL OUT SECT:STATIONARY & INTERMEDIATE SAFETY CONTROLLED
-41	161-0216-00			1		CABLE ASSY,PWR,:3,18 AWG,2.5M L,BLACK (STANDARD ONLY)
						OPTIONAL ACCESSORIES
	161-0215-00			1		CABLE ASSY,PWR,:3,0.75MU,2.5MM L,GREY (EUROPEAN OPTION A1 ONLY)
	161-0066-10			1		CA ASSY, PWR: 3,0.1MM SQ, 250V/10A, 2.5 METER,STR, IEC320,RCPT X 13A, FUSED UK PLUG (13A FUSE), UNITED KINGDOM, SAFTEY CONTROLLED
	161-0066-11			1		CA ASSY,PWR:250V/10A,2.5 METER,STR, IEC320,RCPT, (AUSTRALIAN OPTION A3 ONLY)
	161-0154-00			1		CA ASSY,PWR:3,1.0MM SQ,250V/10A,2.5 METER,STR, (SWISS OPTION A5 ONLY)
	161-A008-00			1		CA ASSY, PWR:THREE 2.0MM SQ, 125V, 15A, 12M L W/HOLDER &LATCH;SAFETY CONTROLLED (JAPAN OPTION A6 ONLY)

FIG. 1 EXPLODED VIEW



ECO422D

Appendices

Appendix A: Options

This section describes the instrument options available for the ECO422D Changeover Unit.

Option ELSW

Option ELSW provides electronic switching on channels four, five, and six, instead of the mechanical relay switching used in the standard instrument. This enhancement provides faster, glitch-free switching for analog sync signals. If the Primary and Backup generators are properly genlocked the customer may not even notice the switchover. Option ELSW is fully documented in this manual.

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