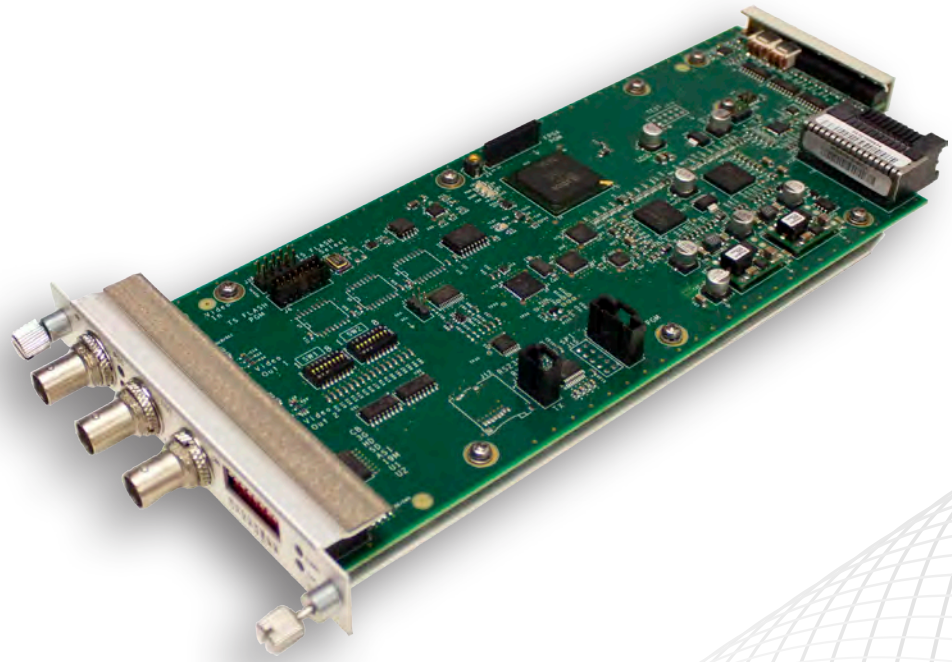
MANUAL



DIGILINK DLT710 FUNCTION MODULE



Multi-Format Digital Video Generator and Tester

Installation and Operations Manual

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DLT710 Generator/Test Module

Multi-Format Digital Video Generator and Test Module

Installation and Operations Manual

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Revision history for the *DLT710 Generator/Test Module Installation and Operations Manual*.

Revision History

Revision	Document Number	Date	Reason for Change
A	AR200-008150-B00_K	January, 2012	Initial release.
B	AR200-008150-B00_L	February, 2016	Updated Artel logo.

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About This Manual

This manual provides instructions for installing, configuring, and operating the DLT710 generator and test module.

Audience

This manual is intended for the following trained and qualified service personnel who are responsible for installing and operating the DLT710:

- System installer
- Hardware technician
- System operator

Related Documentation

The following documentation contains material related to the DLT710:

Document	Provides . . .
DLT710 Data Sheet	Product operating and environmental specifications, and regulatory conformance information.
DL Manager Setup and Operations Manual	Overview and operating instructions for the DL Manager element management system.
DL4000 Video Transport System Chassis Installation and Operations Manual	Overview and installation procedures for the various chassis products available with the DL4000 platform.
DL4000 Data Sheet	Overview of the DL4000 platform.

Note: To obtain the latest versions of this guide and related documents, go to www.artel.com.

Symbols and Conventions

This manual uses the following symbols and conventions:

Caution

A caution means that a specific action you take or fail to take could cause harm to the equipment or to the data transmission.

Warning

A warning describes an action you take or fail to take that could result in death, serious physical injury, or destruction of property.

Note: Important related information, reminders, and recommendations.

Italics—used for emphasis, for indicating the first occurrence of a new term, and for book titles

1. Numbered list—where the order of the items is important
    - Bulleted list—where the items are of equal importance and their order is unimportant

Artel Customer Service

You can reach Customer Service by e-mail at customercare@artel.com or by telephone:

In the US call (800) 225-0228, then select 1 for technical support.

Outside the US call (978) 263-5775, then select 1 for technical support.

When requesting assistance, please be ready to provide the following information:

- Your name and telephone number
- Product model and serial number
- Brief description of the problem
- List of symptoms
- Steps you have already taken to try to resolve the problem

If the product is damaged

If any portion of the unit is damaged, forward an immediate request to the delivering carrier to perform an inspection of the product and to prepare a damage report. Save the container and all packing materials until the contents are verified.

Concurrently, report the nature and extent of the damage to Artel Customer Service so that action can be initiated to either repair or replace the damaged items.

Do not return any items to Artel until you obtain instructions from Customer Service.

Report the problem or deficiency to Customer Service along with the model number and serial number. Upon receipt of this information, Artel will provide service instructions, or a *Return Authorization Number* and shipping information.

DLT710 Generator/Test Module

Multi-Format Digital Video Generator and Test Module

Information About the DLT710

This manual introduces the DLT710 module, which is a multi-format digital video physical layer tester that can verify the integrity of the physical layer for video standards from 19.39 Mb/s ATSC through 2.97 Gb/s. Depending on the application, you can configure this module to operate as a *generator* to transmit test signals, a *checker* to receive and analyze the test signals, or as both generator and checker. Using separate DLT710 modules as generator and a checker, you can test a circuit between two remote locations. Using a single DLT710 to operate as both a generator and checker, you can test a circuit link locally by looping the transmitted test signal back to the same DLT710 for analysis.

When operating as a monitor (checker), you can use the DLT710 to continually monitor link integrity and indicate an error when the signal has dropped or has a higher than acceptable bit error rate.

The DLT710 allows you to select and test multi-rate digital video links for the following signal types: 3G-SDI, HD-SDI, SD-SDI, DVB-ASI, and SMPTE 310M/ATSC.

Testing to verify the physical layer operation of the link between BNC to BNC demarcation points includes data checking using EDH/CRC, verifying that the frequency of the video standard is within prescribed limits, verifying MPEG-2 transport stream format, and testing for inversion of DVB-ASI. The DLT710 can also measure the BNC input signal level to identify double terminated inputs.

When operating as a generator, the DLT710 SDI test signals are SMPTE compliant video, either 75% color bars or SDI Checkfield (pathologicals), with ancillary audio data that can be passed on to your terminal equipment. For ASI and ATSC compressed data, the DLT710 outputs an MPEG-2 transport stream that consists of SMPTE bars with a moving block and an audio tone.

When operating as a checker, the DLT710 accepts 3G, HD, SD, ASI, or ATSC video standards, which means that you can provide your own video for testing the circuit link.

Provisioning and monitoring of the DLT710 module is accomplished by using internal and external DIP switches, a front panel toggle switch, LEDs, and monitor jack, or Artel's DL Manager, which is an element management system (for more information, see the *DL Manager Setup and Operations Guide*).

DLT710 Operational Overview and Applications

This section describes how the DLT710 operates and shows the different ways in which you can deploy these modules to test physical layer link integrity. For most modes of operation, a DLT710 operates as both a generator and checker; always generating test signals that are available at its BNC OUT connectors and always capable of receiving test signals for analysis through its BNC IN connector. These signals can also be transmitted or received using the module backplane connector, permitting the exchange of signals with other modules in a host chassis.

Note: The only time a DLT710 does not operate as both a generator and checker is when you configure it to operate in monitor mode, in which case, the test signal generator is not functional. For more information about the different operating modes, see the "DLT710 Test Modes" section on page 9.

Because the DLT710 can operate as both a generator and a checker, you can use a single DLT710 to transmit test signals across a link and then loop the signal back to the same DLT710 for analysis. However, you typically set up one DLT710 module as a link generator to transmit one or more video standards over the link to another DLT710 module that you set up as a checker to receive and analyze the test signals.

Note: When using two DLT710 modules, you must configure both modules similarly to prevent the checker from reporting unwanted errors.

You can configure the DLT710 generator to perform either a single-pass test or continually repeat the test in an endless loop.

The DLT710 modules on either end of the test link provide status LEDs that indicate the status of the test signals and the link test. The toggle switch on the module front panel determines whether the status LEDs operate as generator status indicators or checker status indicators.

To obtain detailed results of the testing, you can enable the use of EMS and use DL Manager to view the data that the DLT710 checker collects during the test. The data includes error counts for each signal type. For more information about DL Manager, see the *DL Manager Setup and Operations Guide*.

Figure 1 shows how to use a single DLT710 to test the link between two devices. This application is typically used to test the link between two devices locally before setting them up in different locations.

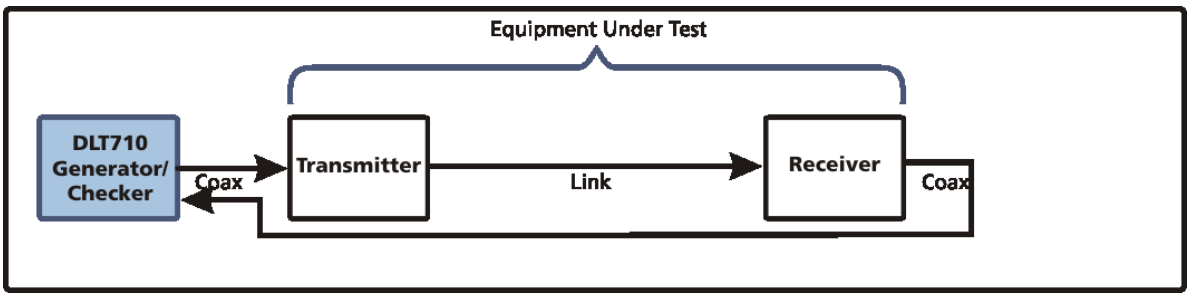

Figure 1. End-to-End Check Using One DLT710

Figure 2 shows how to use two DLT710 modules in an end-to-end application for testing a unidirection link between two locations. In this application, you configure one DLT710 to operate as a generator, transmitting test signals over the link to another DLT710 that you configure to operate as a checker to analyze the integrity of the test signals. You configure both DLT710 modules to use the same signal types.

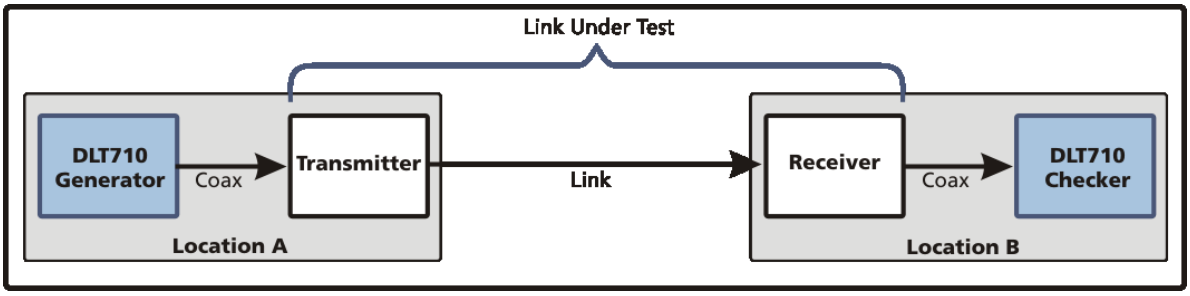

Figure 2. End-to-End Check Using Two DLT710 Modules

Figure 3 shows how you can use a DLT710 solely as a generator to transmit test signals over a link for analysis by your own terminal equipment.

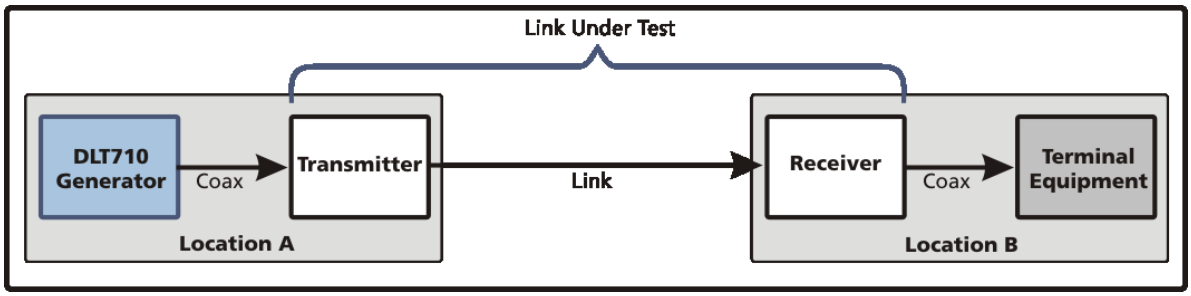

Figure 3. DLT710 Test Video Delivered To Terminal Equipment

Figure 4 shows how you use two DLT710 modules to monitor the signal transmitted by your terminal equipment before and after the link being tested. In this application, you configure both DLT710 modules to operate as checkers and connect them to the monitor jacks of the transmitter/receiver devices.

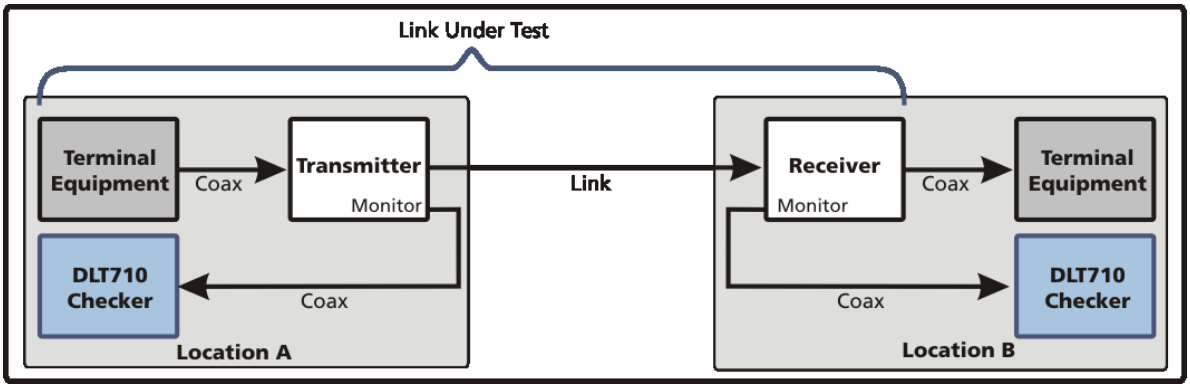

Figure 4. DLT710 Monitoring Two Live Links Using Coax

Figure 5 shows a similar application to Figure 4; however, in this application the signals being monitored are transmitted to the DLT710 modules over the host chassis backplane connections rather than the external BNC connections.

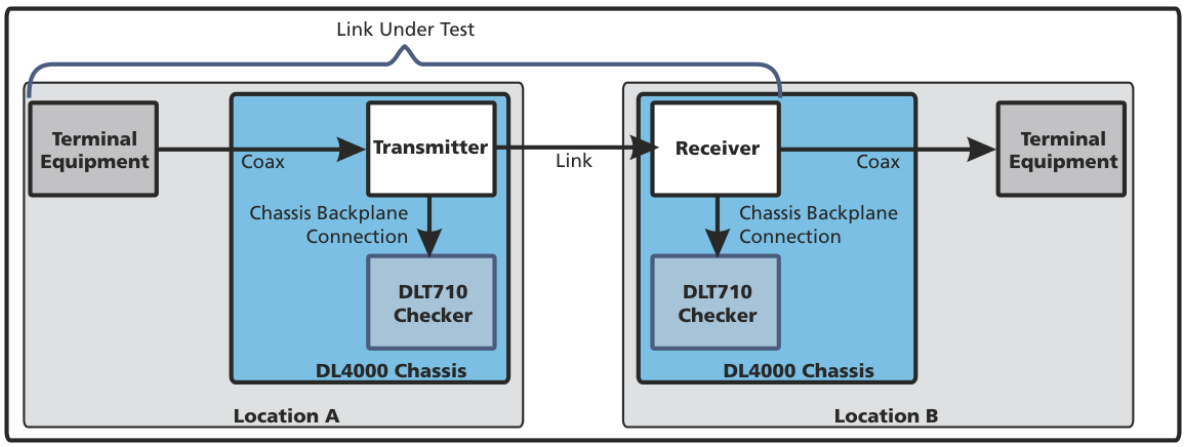

Figure 5. DLT710 Monitoring Two Live Links Using Host Chassis Backplane Connections

DLT710 Testing Capabilities

This section describes the DLT710 link testing capabilities, including the test patterns that it transmits as a generator and the how it analyzes the signals that it receives as a checker.

This section contains the following topics:

- DLT710 Generator Functions (page 5)
- DLT710 Checker Functions (page 8)
- DLT710 Test Modes (page 9)

DLT710 Generator Functions

This section describes the test signals that the DLT710 transmits when you configure it to operate as a link generator.

As a generator, the DLT710 provides the following functionality:

- Generates the following signal types (selectable):
  - 3G-SDI (SMPTE 424M, 2970 Mb/s or 2970/1.001 Mb/s)
  - HD-SDI (SMPTE 292M, 1485 Mb/s or 1485/1.001 Mb/s)
  - SD-SDI (SMPTE 259M, 270 Mb/s)
  - DVB-ASI (270 Mb/s)
  - SMPTE 310M/ATSC (19.39 Mb/s)
- 1 kHz audio tone embedded in all generated video standards
- Continuous generation of a single video standard or automatically sequences through all selected standards
- Generates either a color bar or pathological SDI test pattern

This section includes the following topics:

- SDI Signals (page 6)
- ASI and ATSC Transport Stream Signals (page 7)

SDI Signals

The SDI test patterns each contain 1 kHz audio tone at -20 dBfs in all four channels of audio group 1. You can choose either of the following two patterns:

- Color bar pattern—Full screen bars at 75% (see Table 1).

Table 1.Color Bar 75% Values

Color		SD Value	HD Value	Color		SD Value	HD Value
White	Y	940	940	Magenta	Y	335	251
	Cb	512	512		Cb	735	771
	Cr	512	512		Cr	793	817
Yellow	Y	646	674	Red	Y	260	204
	Cb	176	176		Cb	399	435
	Cr	567	543		Cr	848	848
Cyan	Y	525	581	Blue	Y	139	111
	Cb	626	589		Cb	848	848
	Cr	176	176		Cr	457	481
Green	Y	450	534	Black	Y	64	64
	Cb	290	253		Cb	512	512
	Cr	231	207		Cr	512	512

Figure 6 shows the color bar pattern.

Figure 6. 3G/HD and SD Color Bar Patterns

- Video pathological pattern—Pattern for testing the cable equalizer and receiver phase lock loop (PLL) lock. This pattern conforms with SMPTE-RP-198 and SMPTE-RP-178 specifications for bit-serial digital checkfield for use in high-definition interfaces and SD interfaces.

  Figure 7 shows the video pathological pattern.

Figure 7. 3G/HD and SD Pathological Patterns

You can set the vertical resolution of the HD generator signal using DIP switch SW2 or DL Manager. The default setting is 1080i and the alternative setting is 720p. You can also set the fields/frames rate for each of the SDI generator signals using DIP switch SW2 or DL Manager. The default setting is 29.97 fields/frames per second and the alternative setting is 50 fields/frames per second. For more information, see the "Configuring the Test Signal, Signal Type, and Test Mode" section on page 20 or the "Using DL Manager to Monitor and Configure the DLT710" section on page 28.

ASI and ATSC Transport Stream Signals

The ASI and ATSC transport streams are MPEG-2 single program transport streams with a payload rate of 19.393 Mb/s. The packets in the transport stream are 188 bytes long. The single program consists of two channels of audio and a video signal.

The video signal is a SMPTE color bar background with a moving block in the foreground. The video format is standard definition with a resolution of 720 X 480 interlaced at a rate of 29.97 frames per second. The audio is left and right channel, 1 kHz tone at -20 dBfs in the AC-3 format. Figure 8 shows the transport stream pattern.

When the DLT710 is set for a single video standard test with either ASI or ATSC enabled, the transport stream plays for approximately 64 seconds before the stream loops back to the beginning of the transport stream. These loops continue to occur at 64 second intervals.

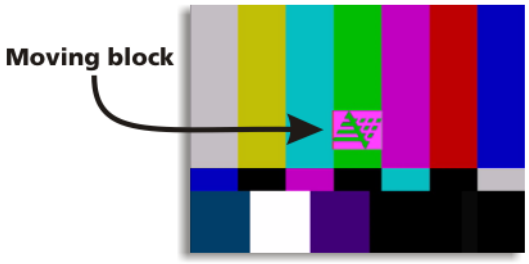

Figure 8. Transport Stream Pattern

Table 2 identifies the transport stream PID numbers.

Table 2. Transport Stream PID Numbers

PID (Decimal)	PID (Hex)	Description
0	0	PAT
16	10	NIT
32	20	PMT
33	21	Video
36	24	Audio
60	3C	PCR
8187	1FFB	MGT, TVCT, RRT, STT
8191	1FFF	Null packet

DLT710 Checker Functions

The DLT710 checker analyzes the signals that it receives from a DLT710 generator or your terminal equipment and provides the following checker functions:

- Tests for:
  - EDH and CRC errors
  - Valid ASI and ATSC transport stream
  - Inverted DVB-ASI
  - Frequency offset
- Automatically detects input signal standard
- Verifies selected video standards
- Provides user-selectable test duration setting

Table 3 describes the items that the DLT710 checker analyzes in a signal depending on the signal type.

Table 3. DLT710 Checker Functions

Signal Type	Items Analyzed
SD/HD/3G	EDH/CRC
ASI	• CRC when using a DLT710 generator source • Valid MPEG-2 transport stream • 8B/10B encoding • Polarity inversion

Table 3. DLT710 Checker Functions (Continued)

Signal Type	Items Analyzed
ATSC	• CRC when using a DLT710 generator source • Valid MPEG-2 transport stream
All	• Interval duration when using a DLT710 generator source • Video standard frequency offset within 40 ppm • Missing signal test for selected video standard • Detects non-selected video standard • Signal level check

DLT710 Test Modes

This section describes the four test modes that you can configure the DLT710 to operate in: single format mode; multi-format, single pass mode; multi-format, continuous mode; or monitor mode. You configure the test mode using the DLT710 DIP switches as described in the "Configuring the DLT710 Module Operation" section on page 17.

Note: Both the generator and checker functions of a DLT710 are affected by the test mode and cannot be set independently.

This section contains the following topics:

- Test Mode Sync and Test Intervals (page 9)
- Single Video Standard Mode (page 10)
- Multi-Format, Single Pass Mode (page 11)
- Multi-Format, Continuous Mode (page 12)
- Monitor Mode (page 12)

Test Mode Sync and Test Intervals

The DLT710 test modes include two user time interval settings: *sync interval* and *test interval*. The sync interval sets the amount of time allotted to allow each video standard to be established through the link between the generator and the checker before error checking begins. The DLT710 normal value for the sync interval is 10 seconds. You can set the sync interval to an alternative value by using the module's DIP switch SW1 (see the "Configuring ASI Inversion Test, Frequency Test, and Signal Interval with DIP Switch SW1" section on page 18) or DL Manager. The default alternative value is 15 seconds, which can be set to other values using DL Manager.

The test interval sets the amount of time that the checker tests each enabled video standard for errors. The DLT710 normal value for the test interval is 60 seconds. You can set the test interval to an alternative value by using the module's rear panel DIP switch (see the "Configuring the Test Signal, Signal Type, and Test Mode" section on page 20) or DL Manager. The default alternative value is 10 seconds, which can be set to other values using DL Manager.

The total time period that the generator generates each enabled video standard when configured for a multi format test is equal to the sum of the sync interval and the test interval. Therefore, with both settings set to normal, a complete test sequence of all five video standards takes approximately 6 minutes.

Single Video Standard Mode

The single video standard mode continuously generates and tests the one signal type that you select. Figure 9 shows the relationship of the DLT710 generator test signal output to the checker during the single video standard mode test.

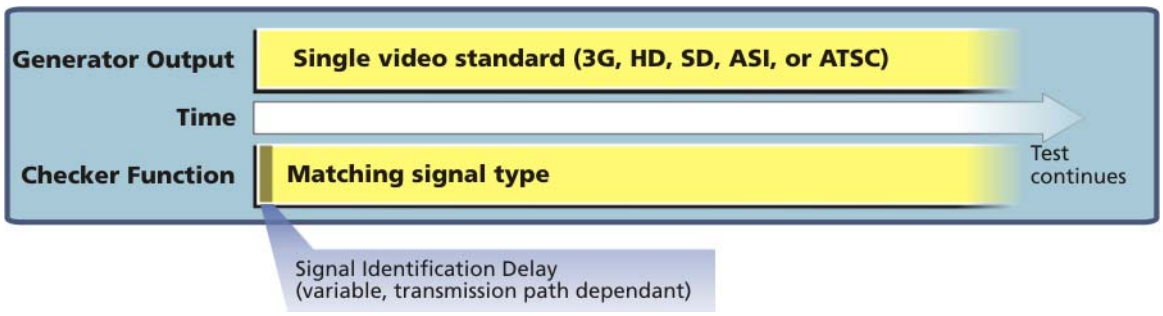

Figure 9. Single Video Standard Mode

To put the DLT710 into single video standard mode, you enable only one video standard. In this test mode, the checker indicates any input signal that is not enabled by flashing the corresponding video standard LED green. The LED for the enabled video standard is yellow and will flash yellow while the signal is being detected. The GOOD LED turns green if no errors are detected during the selected test interval time period, but turns red immediately if any errors are detected during the entire time that the signal is connected.

Note: The single video standard mode is useful for monitoring the output of your terminal equipment.

Multi-Format, Single Pass Mode

The multi-format, single pass mode performs a single test on more than one video standard. To put the DLT710 into the multi-format, single pass mode, you select the video standards and set the mode to single pass using the module's rear panel DIP switch (see the "Configuring the Test Signal, Signal Type, and Test Mode" section on page 20) or DL Manager. Figure 10 shows a test suite that consists of all five available signal types.

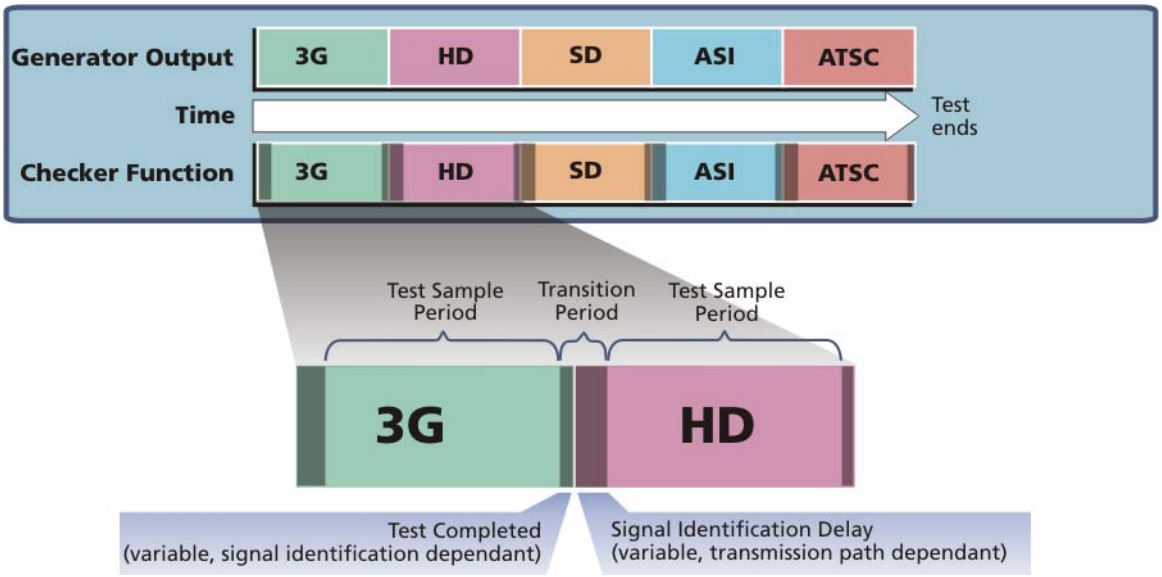

Figure 10. Multi-Format, Single Pass Mode

The generator sequences through all enabled video standards starting with the highest rate and proceeding to the lowest rate. For example, when all five video standards are enabled, the sequence is 3G–HD–SD–ASI–ATSC. This sequence repeats in an infinite loop.

The checker indicates and begins testing the first standard that it detects. It then waits for, and tests each of the enabled rates. If errors are detected during any video standard, the GOOD LED turns red immediately. After all the enabled standards have been received and if no errors are detected, the GOOD LED turns green and there is no further error checking; the test is complete.

Note: The DLT710 generator and checker must have identical video standards selected; otherwise, "missing" or "unexpected" video standard errors occur. If a single DLT710 is used to generate and check the link, then this issue is not applicable.

Multi-Format, Continuous Mode

The multi-format, continuous mode performs a continuous test on more than one video standard. To put the DLT710 into the multi-format, continuous mode, you select the video standards and set the mode to continuous using the module's rear panel DIP switch (see the "Configuring the Test Signal, Signal Type, and Test Mode" section on page 20) or DL Manager. Figure 11 shows a test suite that consists of all five available signal types.

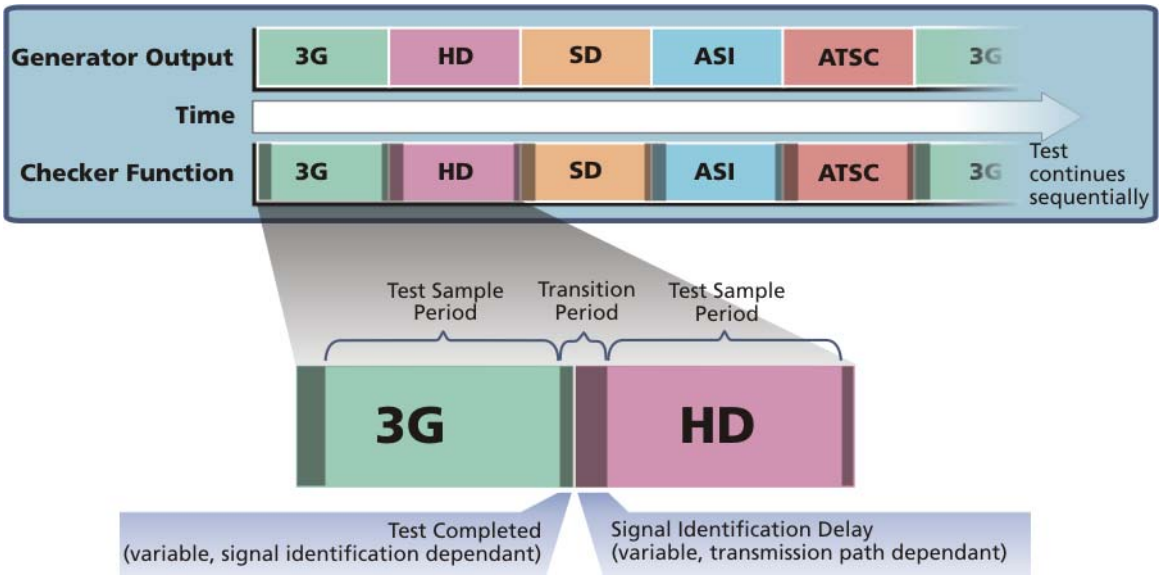

Figure 11. Multi-Format, Continuous Mode

The generator sequences through all enabled video standards starting at the highest rate and proceeding to the lowest rate. For example, when all five video standards are enabled, the sequence is 3G–HD–SD–ASI–ATSC. This sequence repeats in an infinite loop.

The checker indicates and begins testing the first standard it detects. It then waits for, and tests each of the enabled rates. If errors are detected during any video standard, the GOOD LED turns red immediately. After all the enabled standards have been received and if no errors are detected, the GOOD LED turns green. As the sequence repeats, each enabled video standard is again evaluated for errors. If an error is detected, the GOOD LED turns red and testing continues.

Note: The DLT710 generator and checker must have identical video standards selected; otherwise, "missing" or "unexpected" video standard errors occur. If a single DLT710 is used to generate and check the link, then this issue is not applicable.

Monitor Mode

Monitor mode continuously monitors and tests the input signal to the checker and is intended for use with Artel's DL Manager. When the DLT710 is operating in monitor mode, the test signal generator is not functional. To put the DLT710 into monitor mode, set all five video standards to off using either the module's rear panel DIP switch (see the "Configuring the Test Signal, Signal Type, and Test Mode" section on page 20) or DL Manager.

When a video standard is detected in monitor mode, the corresponding rate LED flashes yellow. The LED remains flashing yellow as long as the video standard is present even if errors are detected. DL Manager provides detailed information about the detected signal and whether errors are detected. Monitor mode applications include error monitoring of live video, detection of intermittent signals, and other diagnostic activity. The error log, which is accessible through the DL Manager, logs each event with a time stamp.

DLT710 Module Functional Description

Figure 12 shows the functional block diagram for the DLT710.

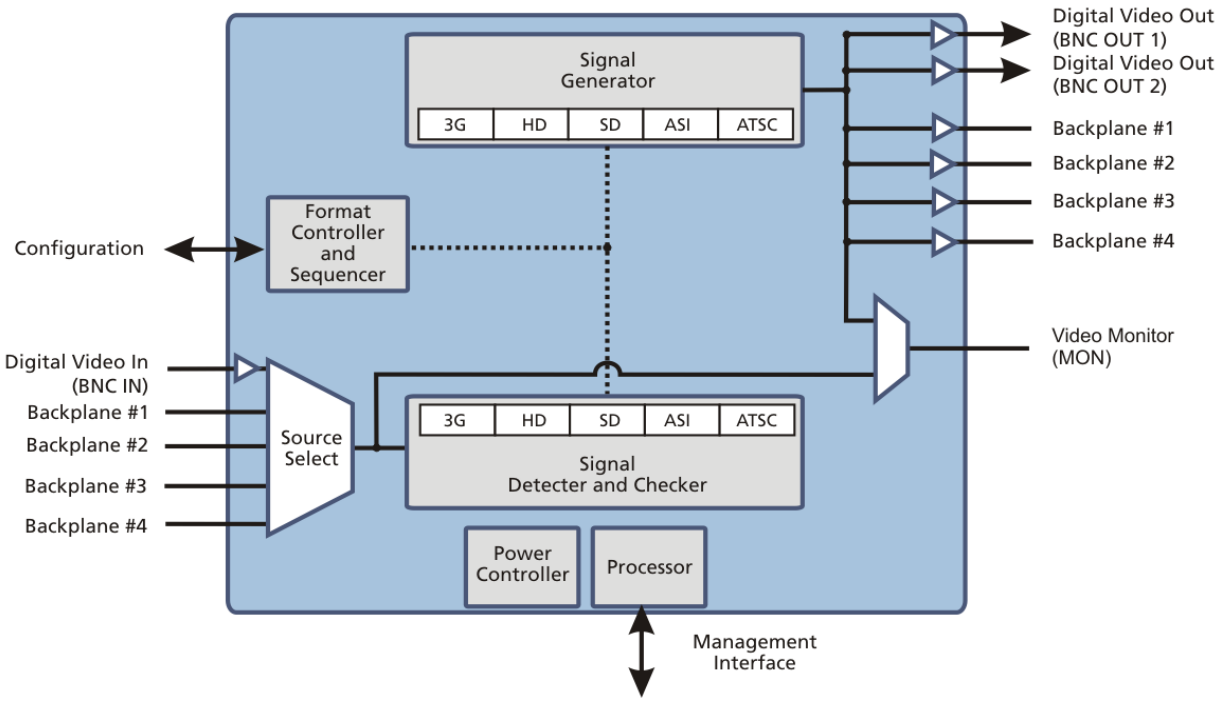

Figure 12. DLT710 Module Functional Block Diagram

The DLT710 supports the following video formats:

- 3G-SDI (SMPTE 424M, 2970 Mb/s or 2970/1.001 Mb/s)
- HD-SDI (SMPTE 292M, 1485 Mb/s or 1485/1.001 Mb/s)
- SD-SDI (SMPTE 259M, 270 Mb/s)
- DVB-ASI (270 Mb/s)
- SMPTE 310M/ATSC (19.39 Mb/s)

This section contains the following topics:

- Signal Paths (page 14)
- Electrical Input (page 14)
- Electrical Outputs (page 14)

Signal Paths

The primary signal path of the DLT710 is determined by the mode in which it operates as follows:

- Generator—Uses the two BNC output connectors, monitor jack, and backplane I/O connector.
- Checker—Uses the BNC input connector, monitor jack, and backplane I/O connector.
- Dual generator/checker—Uses both types of BNC connector, monitor jack, and backplane I/O connector.

Electrical Input

The electrical input is a precision 75 Ohm BNC and includes an automatic cable equalizer.

Using the backplane connector, the electrical input signal can also be received from the other function modules mounted in the host chassis.

Note: For optimal performance, follow the recommendations stated in the DLT710 data sheet for cable lengths and cable types.

Electrical Outputs

The electrical outputs are two precision 75 Ohm BNCs with multirate cable drivers.

The mini 75 Ohm SMB monitor jack (MON) located on the front panel also provides an electrical output. The monitor jack output depends on the setting of the front panel toggle switch as follows:

- With the front panel toggle switch set to generator (GEN), the monitor jack outputs the generator signal.
- With the front panel toggle switch set to checker (CHK), the monitor jack outputs the checker input signal.

Using the backplane connector, the electrical output signal is also available to the other function modules mounted in the host chassis.

Note: For optimal performance, follow the recommendations stated in the DLT710 data sheet for cable lengths and cable types.

DLT710 Module Overview

Figure 13 provides a view of the major components of the DLT710.

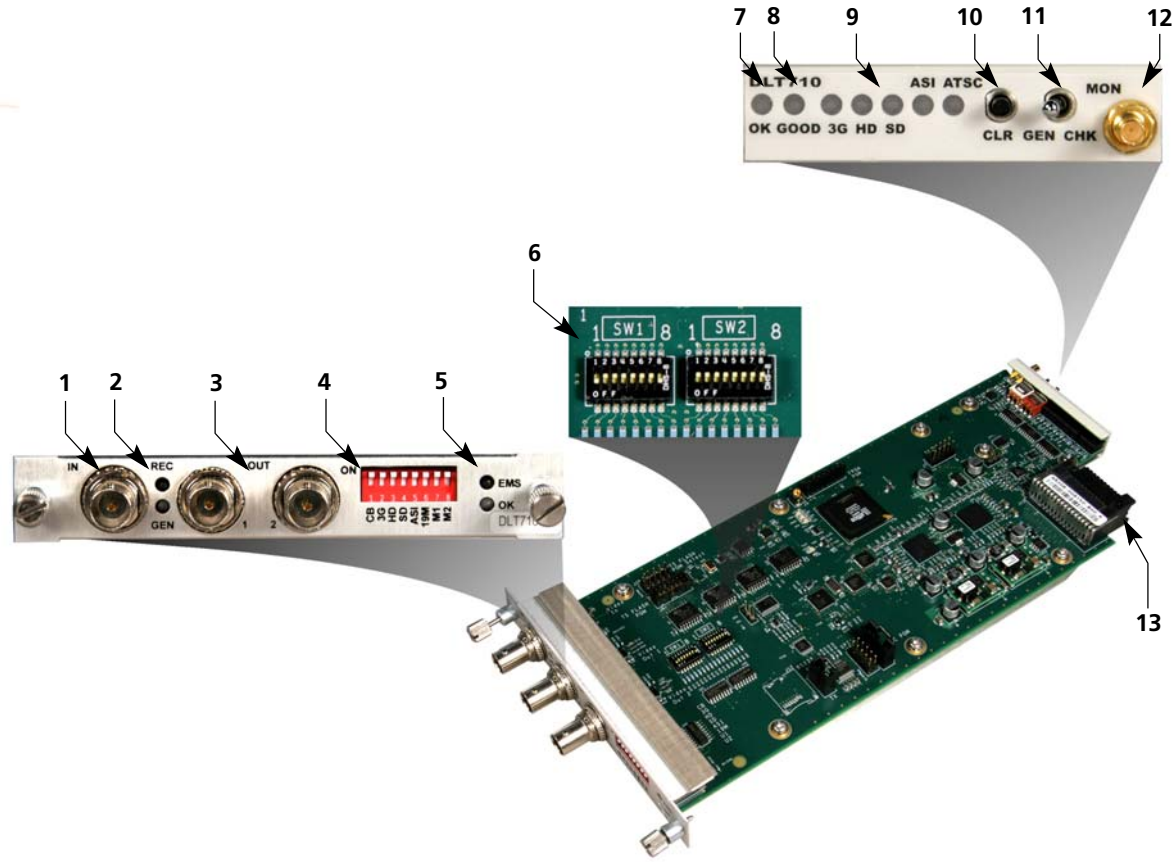

Figure 13. DLT710 Module Major Components

Table 4 describes the components called out in Figure 13.

Table 4. DLT710 Elements

Item	DLT710 Element	for details, see . . .
1	Rear panel video in BNC connector (IN) for receiving test signals.	Cabling the DLT710 Module (page 22)
2	Rear panel test signal status LEDs: • REC—Receive signal indicator. • GEN—Generator signal indicator.	Understanding the Rear Panel Status LEDs (page 27)
3	Rear panel video out BNC connectors (OUT 1 and 2) for outputting test signals.	Cabling the DLT710 Module (page 22)
4	Rear panel test signal selection DIP switch.	Configuring the DLT710 Module Operation (page 17)

Table 4. DLT710 Elements (Continued)

Item	DLT710 Element	for details, see . . .
5	Rear panel module status LEDs: • OK—Alarm indicator • EMS—Element Management System indicator	Understanding the Rear Panel Status LEDs (page 16-23)
6	Configuration DIP switches SW1 and SW2.	Configuring the DLT710 Module Operation (page 17)
7	Front panel module status LED (OK).	Understanding the Front Panel Status LEDs (page 24)
8	Front panel test status LED (GOOD).	
9	Front panel test suite status LEDs for the video standards 3G, HD, SD, ASI, and ATSC.	
10	Front panel test restart/clear button (CLR).	Using the Restart/Clear Button (page 24)
11	Generator/Checker operations toggle switch (GEN/CHCK).	Using the Generator/Checker Toggle Switch (page 23)
12	Front panel monitor mini 75 Ohm SMB output jack (MON).	Using the Monitor Jack (page 27)
13	Backplane connector—Provides power to the module, allows the module to share signals with other function modules, and is used for alarm and management signals.	Configuring the DLT710 Module Operation (page 17)

Configuring the DLT710 Module Operation

This section describes how to configure the DLT710 mode of operation and the function of the transmit and receive signal connections. You configure the DLT710 to operate as a link generator or checker and specify the video signal standards to use during the link test.

The switches that control the functionality of the DLT710 are as follows:

- Internal DIP switches:
  - SW1—Determines a portion of the test timing and enables some test features.
  - SW2—Determines signal format, input source, and EMS functionality.

  Note: You configure the SW1 and SW2 DIP switches while the DLT710 module is out of the host chassis because the switches are mounted to the top of the module PCB.
- Rear panel DIP switch—Determines the test pattern type, signal type, test mode (continuous or single pass), and length of test.
- Front panel GEN/CHK toggle switch.

Default Configuration Settings

Artel ships the DLT710 configured as follows:

- All signal types enabled (3G, HD, SD, DVB-ASI, ATSC)
- Electrical input set to BNC
- Front panel GEN/CHK (generator/checker) toggle switch set to CHK
  - LEDs indicate checker status
  - Monitor jack provides a copy of input BNC
- Multi-format, continuous test mode enabled
- Signal check test interval set to 60 seconds
- Signal check synchronization interval set to 10 seconds
- SDI generator pattern set to color bars, full screen @ 75%
  - 1080p 59.94 frames per second (fps)
  - 1080i 29.97 fps
  - 525i 29.97 fps
  - Embedded audio is 1 kHz tone @ -20 dBfs, all 4 channels of audio group 1
- DVB-ASI and ATSC generator transport stream
  - SMPTE color bars with moving block
  - MPEG-2 single program at 19.393 Mb/s
  - SD video format, 720 x 480i, 29.97 fps
  - Embedded audio is left/right channel, 1 kHz tone at -20 dBfs, AC-3 format

- Report data rate frequency errors > 40 ppm
- Report inverted DVB-ASI format
- EMS override is allowed (DL Manager can change the DLT710 configuration)

This section contains the following topics:

- Configuring ASI Inversion Test, Frequency Test, and Signal Interval with DIP Switch SW1 (page 18)
- Configuring Signal Format, Checker Source, and EMS with DIP Switch SW2 (page 19)
- Configuring the Test Signal, Signal Type, and Test Mode (page 20)

Configuring ASI Inversion Test, Frequency Test, and Signal Interval with DIP Switch SW1

The SW1 configuration DIP switch (see Figure 14) enables the ASI inversion and frequency tests, and determines the signal test interval of a DLT710 generator or checker.

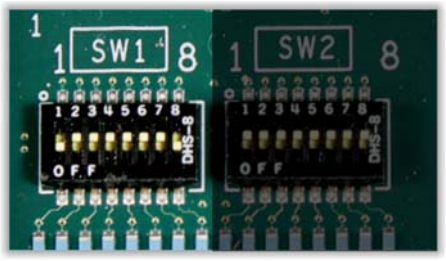

Figure 14. DLT710 SW1 Configuration DIP Switch

Table 5 describes the functions of SW1. The switch settings shown in bold type represent the factory-set configuration settings.

Table 5. SW1 DIP Switch: ASI Inversion Test and Video Rate

Function	Selected Operation	Position							
		S1	S2	S3	S4	S5	S6	S7	S8
Reserved	Must be ON.	**ON**	**ON**	**ON**	**ON**	**ON**			
ASI Inversion Test	Enabled						**ON**		
	Disabled						OFF		
Frequency Test	Enabled							**ON**	
	Disabled							OFF	

Table 5. SW1 DIP Switch: ASI Inversion Test and Video Rate (Continued)

Function	Selected Operation	Position							
		S1	S2	S3	S4	S5	S6	S7	S8
Sync interval	Normal: 10 seconds								**ON**
	Alternate: 15 seconds (this setting can be customized from the DLT710 Override screen in DL Manager)								OFF

Configuring Signal Format, Checker Source, and EMS with DIP Switch SW2

The SW2 configuration DIP switch (see Figure 15) determines the SDI signal format, source of the DLT710 checker input signal, and EMS functionality of a DLT710 generator or checker.

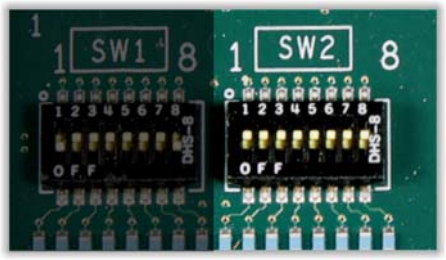

Figure 15. DLT710 SW2 Configuration DIP Switch

Table 6 describes the configuration options that SW2 manages. The switch setting shown in bold type represents the factory-set configuration setting.

Table 6. SW2 DIP Switch: Signal Format, Checker Input Source, EMS

Function	Selected Operation	Position							
		S1	S2	S3	S4	S5	S6	S7	S8
HD Vertical Resolution	1080i	**ON**							
	720p	OFF							
Format	525 Line (SD) / 59.94 Field (HD/3G)		**ON**						
	625 Line (SD) / 50 Field (HD/3G)		OFF						
Reserved	Must be **ON**			**ON**	**ON**				

Table 6. SW2 DIP Switch: Signal Format, Checker Input Source, EMS (Continued)

Function	Selected Operation	Position							
		S1	S2	S3	S4	S5	S6	S7	S8
Checker Source Input	BNC IN					**ON**	**ON**	**ON**	
	Backplane #1					OFF	OFF	OFF	
	Backplane #2					OFF	ON	OFF	
	Backplane #3					OFF	OFF	ON	
	Backplane #4					OFF	ON	ON	
EMS Override	Enabled: DL Manager can change the DLT710 module configuration.								**ON**
	Disabled: DL Manager cannot change the DLT710 module configuration.[1]								OFF

1. If the module is operating in EMS Override mode, as indicated by a green EMS LED on the rear panel, then the EMS Override DIP switch has no effect until you use DL Manager to take the module out of override mode and set it to local mode (see the *DL Manager Setup and Operations Guide*).

Configuring the Test Signal, Signal Type, and Test Mode

The DIP switch located on the DLT710 rear panel (see Figure 16) determines the following operations:

- Test signal pattern—Color bar or pathological
- Signal type—3G SDI, HD-SDI, SD-SDI, ASI, ATSC
- Check mode—Continuous or single pass
- Signal standard intervals—Normal (60 seconds) or alternate

Figure 16. DLT710 Rear Panel Configuration DIP Switch

Note: When using both a DLT710 generator and checker to check a link, be sure to enable the same signal types on both modules to avoid unwanted error detections.

Table 7 describes the configuration options that rear panel configuration DIP switch manages. The Up (On) switch settings are the factory-set configuration setting.

Table 7. DLT710 Rear Panel DIP Switch

Function	Up (On)	Down (Off)
CB	Color bars test pattern (for SDI standards)	Video pathological test pattern (for SDI standards)
3G	3G-SDI test standard enabled	3G-SDI test standard disabled
HD	HD-SDI test standard enabled	HD-SDI test standard disabled
SD	SD-SDI test standard enabled	SD-SDI test standard disabled
ASI	DVB-ASI test standard enabled	DVB-ASI test standard disabled
19M	ATSC standard enabled	ATSC test standard disabled
M1	Continuous test mode	Single pass test mode
M2	Normal test interval: 60 seconds	Alternate test interval: 10 seconds (this setting can be customized from the DLT710 Override screen in DL Manager)

Note: To configure the DLT710 to operate in monitor mode, set the 3G, HD, SD, ASI, and 19M switches to the Down (Off) position. For more information about monitor mode, see the "Monitor Mode" section on page 12.

Installing the DLT710 Module

The DLT710 is hot swappable, enabling you to safely install or remove it when power is applied to the host chassis. Before you install the DLT710, see the DLT710 Module data sheet for a detailed description of the DLT710 product specifications, including environmental requirements that you must adhere to when installing the module.

To install the DLT710 in the host chassis, perform the following steps (see Figure 17):

1. From the back of the chassis, remove the two screws that secure the blank tray to one of the unused function module slots (if necessary). Use any available function module slot.
2. Slide the DLT710 into the slot using the printed circuit board guide rails located on both sides of the slot.
3. Push the DLT710 in until it is firmly seated into the backplane and flush with the chassis.
4. Tighten the two mounting screws that secure the module to the chassis.

   Note: Failure to properly secure the DLT710 to the chassis with the two mounting screws can result in disconnecting the module from the backplane when you attach a cable to the monitor connector located on the front panel or you press the reset/clear (CLR) button.

Figure 17. DLT710 Module Installation

Note: Insert a blank tray in any unused chassis module slots to maintain proper ventilation.

Cabling the DLT710 Module

The DLT710 allows you to transmit and receive signals over BNC electrical connections. The cabling configuration that you use depends on your application. The connectors are located on the back panel of the DLT710 (see Figure 18).

Note: The cabling information provided in this section applies only to applications requiring the use of the module BNC connectors for either transmitting or receiving test signals. If you have the modules configured to transmit and receive the test signals over the chassis backplane connectors to other modules in the chassis, then you can skip this section. For more information, see the "Configuring Signal Format, Checker Source, and EMS with DIP Switch SW2" section on page 19.

Figure 18. DLT710 BNC Electrical Connectors

To connect to the BNC connectors on the DLT710, use a high quality 75 Ohm precision video coax cable, such as Belden 1694A cable.

To cable the electrical connections, perform the following tasks:

- Output signal—(DLT710 generator) Connect the electrical cable to the DLT710 transmit connector (OUT) and the destination device's electrical receive connector. Note that both OUT BNC connectors provide the same output and you can use either one or both connectors.
- Input signal—(DLT710 checker) Connect the electrical cable to the DLT710 receive connector (IN) and the source device's electrical transmit connector.

Managing and Monitoring the DLT710 Module Operations

You can monitor the operation of the DLT710 using the status LEDs located on the module front and rear panels and the monitor jack located on the front panel. From the front panel, you can also determine the operation of the signal type status LEDs and the output of the monitor jack.

This section contains the following topics:

- Using the Generator/Checker Toggle Switch (page 23)
- Using the Restart/Clear Button (page 24)
- Understanding the Front Panel Status LEDs (page 24)
- Using the Monitor Jack (page 27)
- Understanding the Rear Panel Status LEDs (page 27)
- Using DL Manager to Monitor and Configure the DLT710 (page 28)

Using the Generator/Checker Toggle Switch

This section describes how to use the DLT710 front panel generator/checker toggle switch to control the operation of the front panel's signal type status LEDs and the monitor jack. Set the toggle switch to one of the following positions:

- Generator (GEN)—The signal status LEDs indicate the status of the signals that you have selected to transmit and the monitor jack provides access to the transmitted signals. The GOOD LED is always off when the toggle switch is set to this position.
- Checker (CHK)—The signal status LEDs indicate the status of the signals that the DLT710 receives and the monitor jack provides access to the received signals. The status indicators react not only to selected signal types, but to signals that are not selected to let you know when unexpected signal types are received. The GOOD LED is green or red to indicate test results, or off if testing is not complete.

For information about interpreting the status LEDs, see the "Understanding the Front Panel Status LEDs" section on page 24. For information about the monitor jack, see the "Using the Monitor Jack" section on page 27.

Using the Restart/Clear Button

This section describes how to use the DLT710 front panel restart/clear (CLR) button (see Figure 19). This button affects both the generator and checker operations each time it is pressed as follows:

- When you press and hold the CLR button, all functions are suspended and the video standard LEDs are off.
- When you press and release the CLR button, the DLT710 does the following:
  - The generator output immediately resumes repeatedly sequencing through all enabled video standards starting at the highest enabled rate. For example, if all five rates are enabled, the sequence is 3G–HD–SD–ASI–ATSC. If only one standard is enabled, the generator outputs that standard continuously.
  - The checker results are immediately cleared and the test mode is restarted. The checker begins to indicate the input signal's video standard as soon as it is detected.

Understanding the Front Panel Status LEDs

The DLT710 front panel includes a set of status LEDs as shown Figure 19.

Figure 19. DLT710 Front Panel Status LEDs and Monitor Connector

The OK status LED, which is also located on the module's rear panel, indicates the operating status of the DLT710 module. The GOOD status LED works in conjunction with the signal status LEDs (3G, HD, SD, ASI, and ATSC) to indicate the status of the signal being detected and tested.

This section contains the following topics:

- Understanding the Status LEDs (page 24)
- Understanding How the GOOD and Signal Status LEDs Work Together (page 25)

Understanding the Status LEDs

Table 8 describes the different states of the DLT710 status LEDs as shown in Figure 19.

Table 8. DLT710 Status LEDs

LED	Indicates . . .	State	Description
OK	Module status	Green	Normal operation, no alarms exist.
		Yellow	Minor alarm exists.
		Red	Major alarm exists.

Table 8. DLT710 Status LEDs (Continued)

LED	Indicates . . .	State	Description
GOOD	Test status	Off	Test sequence not completed and no errors detected.
		Green	Test completed with no errors.
		Yellow	Inverted ASI signal detected and warning is enabled using switch SW1, switch 6.
		Red	Test sequence complete, one or more errors detected.
3G HD SD ASI ATSC	Checker video rate	Off	Indicated signal rate not selected or not detected.
		Yellow	Indicated signal rate enabled but not yet tested.
		Yellow (flashing)	Indicated signal rate detected, testing in progress.
		Green	Indicated signal rate enabled, test complete with no errors detected.
		Green (flashing)	Indicated signal rate detected, but not being tested.
		Red	Selected signal rate enabled, signal not being detected, and one or more errors detected.
		Red (flashing)	Selected signal rate detected, one or more errors detected. **Note**: When the DLT710 is operating in monitor mode, detected errors do not cause a red flashing LED state (for more information, see the "Monitor Mode" section on page 12).
	Generator video rate	Off	Indicated signal rate not enabled.
		Green	Indicated signal rate enabled but not yet generated.
		Green (flashing)	Indicated signal rate is being generated.

For information about the rear panel status LEDs, see the "Understanding the Rear Panel Status LEDs" section on page 27.

Understanding How the GOOD and Signal Status LEDs Work Together

In check mode, the front panel GEN/CHK toggle switch is set to CHK and the GOOD and signal status LEDs work together to indicate the status of the signal type being tested. Table 9 shows how these two status LEDs operate depending on which of the following tests the DLT710 is preforming: the single video standard test; the multi-format, single pass test; or the multi-format, continuous test.

Table 9. Good and Signal Type Status LED Operations

Test Mode	Signal Status LED Operation
Single format	The enabled signal type status LED turns yellow immediately after the start of the test. When the DLT710 detects the selected signal type, the corresponding status LED flashes yellow (all other signal LEDs are off). After the specified test period, the GOOD status LED turns green to indicate an error-free test. If an error is detected during the test, both the signal and the GOOD status LEDs turn red. If the DLT710 detects a different video standard, the corresponding LED flashes green to indicate that it is present but is not being checked for errors. When the rate changes, the LED goes off.
Multi-format, single pass	All enabled signal type status LEDs are yellow immediately after the test has started. When the DLT710 detects the first incoming signal, the corresponding LED flashes green during the test sync interval, then flashes yellow while the signal is being tested, and then flashes green again until the next input rate is detected. At this point, the LED turns solid green to indicate no errors or solid red if errors are detected. The same LED sequence continues until all enabled rates have been tested. At this point, the GOOD LED turns solid green. If errors were detected, the GOOD LED turns solid RED. If a video standard is not enabled, the corresponding LED is off. If the DLT710 detects a signal type that is not enabled, the corresponding LED flashes green to indicate that it is present but not being checked for errors. When the rate changes, this LED goes off.
Multi-format, continuous	All enabled signal type status LEDs are yellow immediately after the test has started. When the DLT710 detects the first incoming signal, the corresponding LED flashes green during the test sync interval, then flashes yellow while the signal is being tested, and then flashes green again until the next input rate is detected. At this point, the LED turns solid green to indicate no errors or solid red if errors are detected. The same LED sequence continues until all enabled rates have been tested. At this point, the GOOD LED turns solid green. If errors were detected, the GOOD LED turns solid RED. On the next cycle, the LEDs that are green will once again flash yellow to indicate error testing, then flash green, and then solid green as before. If the DLT710 detects an error at any time on an enabled signal type, the corresponding LED and the GOOD LED turn red.
Monitor	All signal type status LEDs are off immediately after the DLT710 is set to monitor mode. When the DLT710 detects an incoming signal, the corresponding LED flashes green during the test sync interval and then flashes yellow while the signal is being monitored. As long as the signal is present, the LED continues to flash yellow even if errors are detected. If the signal goes away or changes, the LED turns off. This cycle repeats for any standard signal applied to the checker. The GOOD LED is always off in monitor mode.

For more information about the three test modes, see the "DLT710 Test Modes" section on page 9.

Using the Monitor Jack

To monitor the DLT710 transmit and receive signals, connect the monitor cable to the mini 75 Ohm SMB monitor jack (MON) located on the DLT710 front panel (see Figure 19) and set the front panel toggle switch to the appropriate signal to monitor: generated signal (GEN) or received signal being checked (CHK).

For a DLT710 generator, the monitor output signal is the same as the BNC output signal on the back panel (see Figure 20). For a DLT710 checker, the monitor output signal is the same as the BNC input signal on the back panel.

Understanding the Rear Panel Status LEDs

The DLT710 rear panel contains a set of status LEDs as show in Figure 20.

Figure 20. DLT710 Rear Panel Status LEDs

Table 10 describes the different states of the rear panel Receive (REC), Generate (GEN), and element management system (EMS) LEDs.

Table 10. DLT710 Rear Panel SFP Connector Status LEDs

LED	Indicates...	State	Description
REC	Receiver status	Off	Backplane input is selected.
		Green	Input is present at BNC.
		Yellow	Double termination or low input level detected.
		Red	BNC input is enabled but no signal is detected.
GEN	Generator status	Off	Generator is inactive.
		Green	Generator is active.
EMS	Element management system, DL Manager, operating status	Off	The DLT710 is in local mode and its configuration is controlled by the onboard configuration switches.
		Green	The DLT710 is in remote mode and the configuration has been set by DL Manager. When in remote mode, the actual configuration of the module will likely not match the settings of the configuration switches and changing the configuration switches will have no effect on the module operation.
OK	Module status	Green	Normal operation, no alarms exist.
		Yellow	Minor alarm exists.
		Red	Major alarm exists.

For information about the front panel status LEDs, see the "Understanding the Front Panel Status LEDs" section on page 24.

Using DL Manager to Monitor and Configure the DLT710

For a more detailed analysis of the circuit link test, we recommend using DL Manager, Artel's element management system to monitor the module operations. For more information about DL Manager, see the *DL Manager Setup and Operations Guide*.

Figure 21 shows the DLT710 module data and configuration override settings, including information about the current signal test being performed. To access the override settings from the Module Data screen, click **Override**.

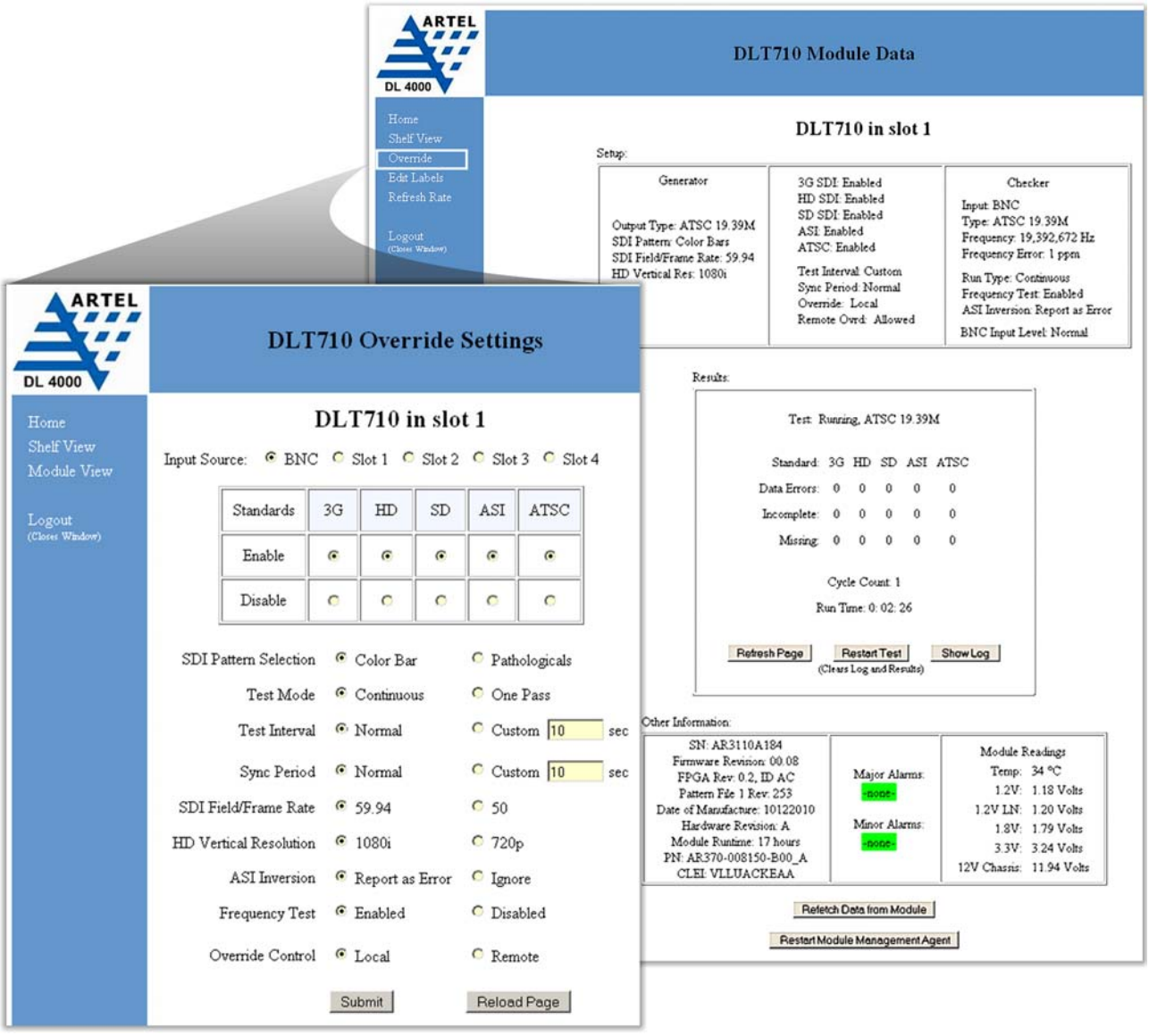

Figure 21. DLT710 Module Data and Override Settings

To view the error log, from the Results pane in the DLT710 Module Data screen, click **Show Log**. The error log records only the first 100 events. Events that occur after the first 100 are not recorded. From a diagnostics perspective, practical experience has shown that when log overflow conditions occur, the initial recorded events are often the most informative.

Table 11 describes the error log messages that the DLT710 provides.

Table 11. DLT710 Error Log Messages

Error	Description
ATSC Data Error	ATSC CRC error detected with using an Artel generator as the signal source.
ASI Data Error	ASI CRC error detected with using an Artel generator as the signal source or 8B/10B error when using a standard ASI source.
SD Data Error	SD-SDI CRC or EDH error detected.
HD Data Error	HD-SDI CRC or EDH error detected.
3G Data Error	3G-SDI CRC or EDH error detected.
Frequency Error	Frequency exceeds the +/- 40 ppm limit (in single rate mode only and when the warning message is enabled).
ATSC Frequency Error	ATSC frequency exceeds the +/- 40 ppm limit (only first occurrence logged).
ASI Frequency Error	ASI frequency exceeds the +/- 40 ppm limit (only first occurrence logged).
SD Frequency Error	SD-SDI frequency exceeds the +/- 40 ppm limit (only first occurrence logged).
HD Frequency Error	HD-SDI frequency exceeds the +/- 40 ppm limit (only first occurrence logged).
3G Frequency Error	3G-SDI frequency exceeds the +/- 40 ppm limit (only first occurrence logged).
ATSC Missing	ATSC checking is enabled, but ATSC is not detected (multi-rate mode).
ASI Missing	ASI checking is enabled, but ASI is not detected (multi-rate mode).
SD Missing	SD checking is enabled, but SD is not detected (multi-rate mode).
HD Missing	HD checking is enabled, but HD is not detected (multi-rate mode).
3G Missing	3G checking is enabled, but 3G is not detected (multi-rate mode).
ATSC Absent	ATSC signal has been interrupted. In single video standard mode, the signal is removed after being present for *x* seconds or more (single rate or monitor mode).
ASI Absent	ASI signal has been interrupted. In single video standard mode, the signal is removed after being present for *x* seconds or more (single rate or monitor mode).
SD Absent	SD signal has been interrupted. In single video standard mode, the signal is removed after being present for *x* seconds or more (single rate or monitor mode).
HD Absent	HD signal has been interrupted. In single video standard mode, the signal is removed after being present for *x* seconds or more (single rate or monitor mode).
3G Absent	3G signal has been interrupted. In single video standard mode, the signal is removed after being present for *x* seconds or more (single rate or monitor mode).

Table 11. DLT710 Error Log Messages (Continued)

Error	Description
Signal detected but not enabled	ATSC signal detected but not enabled on checker (single rate mode).
Unexpected ATSC Detected	ATSC signal detected but not enabled on checker (only first occurrence logged).
Unexpected ASI Detected	ASI signal detected but not enabled on checker (only first occurrence logged).
Unexpected SD Detected	SD-SDI signal detected but not enabled on checker (only first occurrence logged).
Unexpected HD Detected	HD-SDI signal detected but not enabled on checker (only first occurrence logged).
Unexpected 3G Detected	3G-SDI signal detected but not enabled on checker (only first occurrence logged).
ATSC test incomplete	ATSC test interval too short or ATSC signal terminated prematurely.
ASI test incomplete	ASI test interval too short or ASI signal terminated prematurely.
SD test incomplete	SD test interval too short or SD signal terminated prematurely.
HD test incomplete	HD test interval too short or HD signal terminated prematurely.
3G test incomplete	3G test interval too short or 3G signal terminated prematurely.
Start Test	Test start log entry valid for all test modes.
End Test	Test end log entry valid only for multi-format, single-pass test mode.
DLMxxx Startup	Occurs when DLM*xxx* is restarted while test is in progress.
Signal Level Low	BNC input signal level below acceptable limits (single rate mode).
ATSC Signal Level Low	BNC input signal level below acceptable limits (only first occurrence logged).
ASI Signal Level Low	BNC input signal level below acceptable limits (only first occurrence logged).
SD Signal Level Low	BNC input signal level below acceptable limits (only first occurrence logged).
HD Signal Level Low	BNC input signal level below acceptable limits (only first occurrence logged).
3G Signal Level Low	BNC input signal level below acceptable limits (only first occurrence logged).
ATSC Detected	ATSC detected (monitor mode).
ASI Detected	ASI detected (monitor mode).
SD Detected	SD detected (monitor mode).
HD Detected	HD detected (monitor mode).
3G Detected	3G detected (monitor mode).
Inverted ASI Detected	Inverted ASI detected when warning message enabled.

Removing the DLT710 Module

You can safely remove the DLT710 from the host chassis while power is applied to the module.

To remove the DLT710 from the host chassis, perform the following steps:

1. Remove the coaxial cables from the BNC connectors.
2. Loosen the two mounting screws that secure the DLT710 to the chassis.
3. Using the two mounting screws, pull the DLT710 out of the chassis.

Caution

To avoid problems associated with overheating, do not leave a function module slot open when power is applied to the chassis. Every module slot must contain a module or blank tray to ensure proper ventilation when power is applied.

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