

Westell INTELIPORT® SL 2W/4W SHORT-LOOP DATA STATION TERMINATION MODEL ISL5490i3 (ISSUE 3)

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1. GENERAL

1.1 Document Purpose

This practice provides general and installation information for the Westell Short-loop Data Station Termination module, INTELIPORT SL, Model ISL5490i3 shown in Figure 1.

- NOTE -

Hereafter, the Westell Westell Short-loop Data Station Termination module, INTELIPORT SL, Model ISL5490i3 will be referred to as the "ISL5490i3" or the "INTELIPORT."

1.2 Document Status

Whenever this document is updated or revised, the reason will be stated in this paragraph. The ISL5490 changes to 200Mechanics® platform with Issue 3. Revision A created this document. Revision B updates the Applications section. Revision C updates Figure 2 and Table 4.

1.3 Product Purpose and Description

Westell's Short-loop Data Station Termination module, INTELIPORT SL, Model ISL5490i3, provides an interface between a 4-wire facility and a 600-ohm, 2W or 4W data modem. As a member of Westell's family of Intelligent Network Channel Terminating Equipment (INCTE), the ISL5490i3 provides all the functions of a standard DST plus remote and automatic alignment capability. The integral microprocessor of INTELIPORT controls the intelligent functions of the unit while the oscillator circuit generates test tones. Both circuits allow comprehensive remote alignment and testing of the circuit when activated from the Serving Test Center (STC).

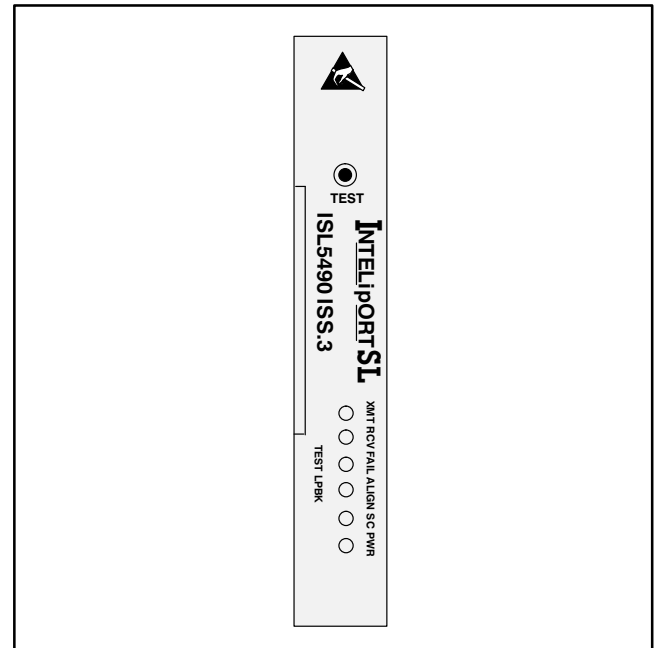


Figure 1. INTELIPORT ISL 5490i3 Front View

1.4 Product Mounting

The ISL5490i3 module can be mounted into Westell's DAS290 for single module installation, Westell's USA pre-wired 500-type shelf assembly, Westell's un-wired 500-type shelf assembly, or a standard 400-type shelf assembly.

1.5 Product Features

The ISL5490i3 module offers the following features.

- Operates in either 2W or 4W data modem applications.
- Microprocessor controlled.
- Facility-and-equipment-side impedance is 600 Ohms, fixed.
- Sealing current TERM operation.
- Manual or tone-activated loopback.
- Remote and automatic 3- or 4-tone alignment capability or 1-tone quick alignment feature (at 1004 Hz only).
- Automatically adjusts 1004 Hz response characteristics (up to 15 dB).

- Automatically adjusts receive path for proper level coordination between facility and data modem with respect to TLP (Transmission Level Point) or DLP (Data Level Point).
- Four-tone auto-sweep or full-range transponder operation with quiet termination mode permits remote testing of noise and tone level measurements; Also provides 4-tone, 0 dB auto transponder over RCV IN port.
- Front panel TEST switch used to manually activate INTELIPORT's test mode for verifying station wiring or to manually activate INTELIPORT's auto-align feature.
- Acknowledgement tone (alternating 1008/2808 Hz) identifies unit as INTELIPORT when circuit is accessed.
- Escape to command mode via 2604 Hz; Escape to idle via 2713 Hz.
- Front panel LEDs provide quick visual indication to the status and operational mode of the unit.
- Non-volatile memory circuit retains programmed information in the even of power loss.
- Mounts in one position of a Westell 200Mechanics® mounting assembly, a standard 400-type assembly, or equivalent.
- Operates from -22 to -56 VDC at 50mA, typical or from 20 to 28 VAC, typical.
- 7-year warranty.

2. APPLICATIONS

2.1 Westell's Short-loop DST (INTELIPORT SL) ISL5490i3 module is used to interface a 4W facility with a 600-ohm, 2W or 4W data modem and is normally located on the same premises as the modem. INTELIPORT is a microprocessor-controlled, intelligent DST that allows comprehensive remote testing of the circuit when activated from a manual or automated Serving Test Center (STC).

2.2 The INTELIPORT SL incorporates a command mode in which all functions, except manual and tone-activated loop-back, are accessed. The command mode is the operational state in which ISL5490i3 monitors its transmission ports of incoming frequencies and interprets these frequencies as commands to carry out a specific function. The command mode is remotely activated from the STC by sending 2713Hz to INTELIPORT's RCV IN port for more than 30 seconds. After meeting this requirement, INTELIPORT sends a steady 1008Hz tone at +5dBm (TLP) indicating command mode initiation. The STC, at this point, can remove the 2713Hz tone.

2.3 While in the command mode, the STC can access any one of INTELIPORT's intelligent functions which include

- toggling from TLP reference to DLP (data level) reference,
- activating the remote 1-tone quick alignment mode, the 3-tone alignment mode, or the 4-tone alignment mode,
- initiating the automatic alignment sequence,
- activating a 4-tone auto-sweep transponder mode of operation that allows for a quick level verification of tone over the RCV IN port,
- activating the full-range quiet term/transponder mode of operation for performing a more detailed level verification test function,
- activating the power supply status query feature, and
- exiting the command mode and returning to idle.

- NOTE -

To exit the command mode and return to idle, the STC sends a second 2713Hz tone for five seconds or longer.

Details of each operating mode are discussed in section 3 of this document.

3. CIRCUIT & FUNCTIONAL OPERATION

Refer to Figure 2, the ISL5490i3 (Issue 3) Block Diagram, as needed, while reading the following paragraphs.

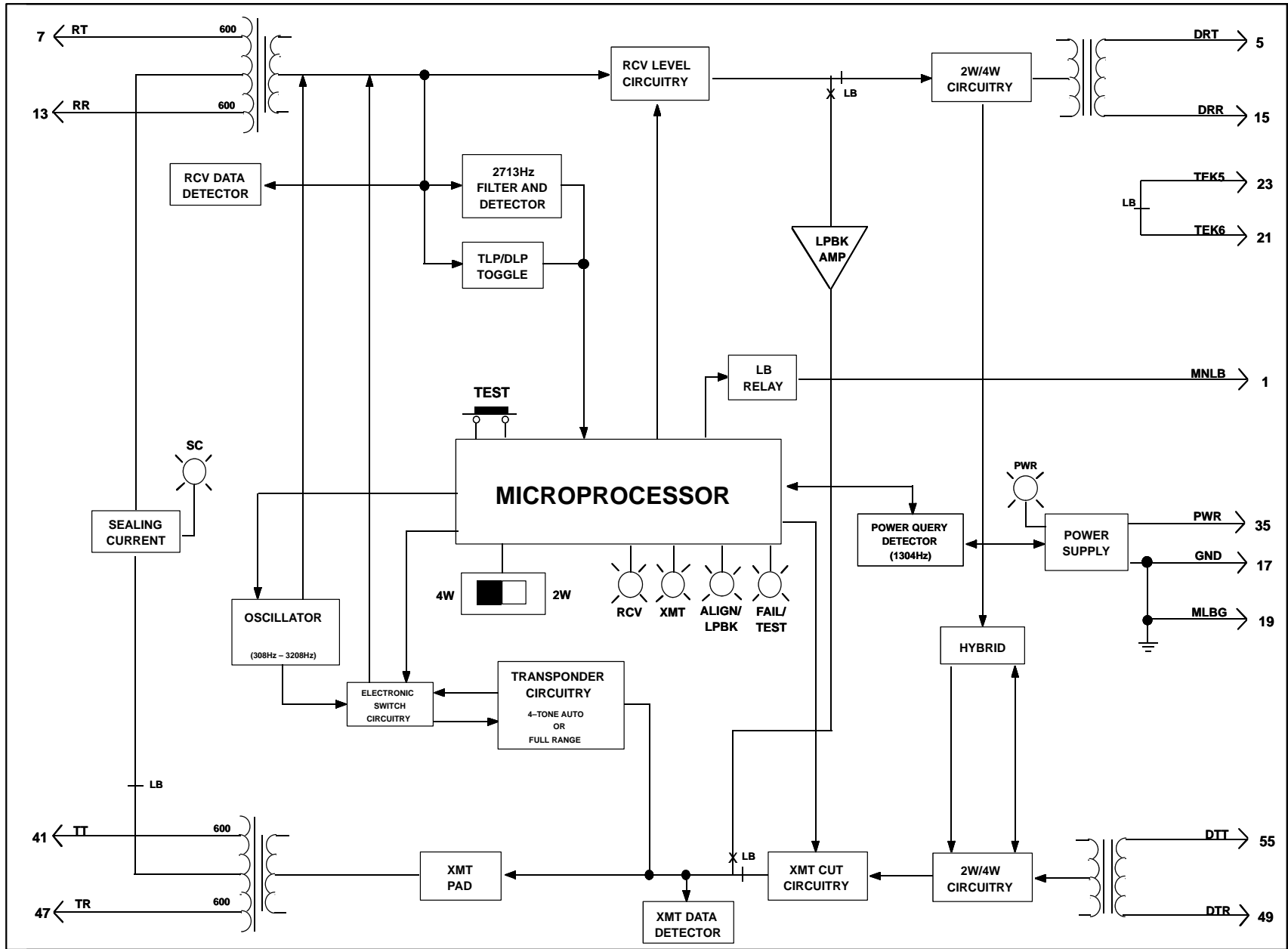


Figure 2. INTELIPORT ISL5490i3 (Short-Loop DST) Block Diagram

3.1 LED Status Indicators

INTELIPOINT is equipped with six front-panel LEDs that provide a quick visual indication to the status and mode. Table 1 summarizes the LED functions.

LED	ON	OFF	FLASHING
PWR	Power Applied	No Power	NA
SC	Sealing Current Present	No Sealing Current	NA
ALIGN/LPBK (See Note)	Command/Alignment/Transponder Mode	Idle	Loopback Mode (See Note)
FAIL/TEST (See Note)	Logic Failure Mode	Idle	Test/Align Mode (See Note)
XMT	Receiving Data From Equipment	No Data	Receiving Data From Equipment
RCV	Transmitting Data To Equipment	No Data	Transmitting Data To Equipment

Table 1. INTELIPOINT ISL5490i3 LED Status Indication

- NOTE -

When a DST to ETO AUTO ALIGN is initiated via the TEST switch (i.e. TEST switch pressed for >5 but <10 seconds), the ALIGN/LPBK and FAIL/TEST LEDs will light steady. Upon releasing the TEST switch before 10 seconds has elapsed, the ALIGN/LPBK and FAIL/TEST LEDs will remain on, steady. When DST to DST AUTO ALIGN is initiated via the TEST switch (i.e., TEST switch pressed for >10 seconds), the ALIGN/LPBK and FAIL/TEST LEDs will flash. Upon releasing the TEST switch after 10 seconds has elapsed, the ALIGN/LPBK and FAIL/TEST LEDs will light steady.

3.2 Wiring Test Mode

Once the installer connections are complete and the unit is installed, it is recommended that the installer manually activate INTELIPOINT's test mode to verify installation and station wiring. Pressing the recessed push-button TEST switch, located on INTELIPOINT's front panel, for greater than 1.5 but less than five seconds (see the following NOTE) causes the FAIL/TEST LED to flash and steady 1008Hz to be applied to the RCV transmission ports (both the line side and drop side) and interrupted 1008Hz (approximately 1/2 OFF; 1/2 second ON) on the XMT transmission ports. After 10 minutes, the steady 1008Hz on the RCV transmission port changes to an interrupted 1008Hz tone (approximately 4 seconds ON; 1 second OFF). Station wiring is verified by connecting a Transmission Test Set with a built-in speaker or other suitable listening device to the receive and transmit channel pairs at the cable connection and demarcation points, and listening for the appropriate tones. Refer to Table 2 for a summary of the INTELIPOINT's RCV and XMT tones when operating in 2W or 4W applications. After verifying the tones, press the TEST switch again to end the test mode. If the TEST switch is not pressed a second time, the test mode auto-

matically times out one hour after the initial activation or the STC can release the test mode by sending 2713Hz, 10 to 60 minutes after initial activation.

- NOTE -

If the TEST switch is pressed and held for longer than five seconds but less than 10 seconds, INTELIPOINT recognizes this as a command to enter the DST to ETO AUTO-ALIGN sequence (see paragraph 3.18, 3.19, and 3.21). If the TEST switch is pressed and held for longer than 10 seconds, INTELIPOINT recognizes this as a command to enter the DST to DST AUTO-ALIGN sequence (see paragraph 3.17, 3.20, and 3.21).

PORT	4W	2W
RCV IN	Continuous 1008Hz (See Note 1)	Continuous 1008Hz (See Note 1)
RCV OUT	Continuous 1008Hz (See Note 1)	See NOTE 1 & 2
XMT IN	Interrupted 1008Hz	Continuous 1008Hz (See Note 1)
XMT OUT	Interrupted 1008Hz	Interrupted 1008Hz

Table 2. INTELIPOINT ISL5490i3 Wiring Test Mode

- NOTE -

Pressing the TEST switch for greater than 1.5 but less than 5 seconds, causes steady 1008 Hz tone to be applied to the RCV transmission ports for 10 minutes. After 10 minutes, the steady 1008Hz changes to interrupted 1008Hz (Approx. 4 sec ON; 1 sec OFF). In 2W applications, the RCV OUT and XMT IN ports utilize the same transmission pairs (XMT IN). Therefore, interrupted 1008Hz (Approx. 1/2 sec ON; 1/2 sec OFF) will be present.

3.3 Command Mode

The command mode is activated from the STC by sending 2713Hz to the RCV IN port (pins 7 and 13) for more than 30 seconds. INTELIPOINT sends steady 1008Hz at the XMT OUT port (pins 41 and 47) indicating command mode initiation.

- NOTE -

If 2713 Hz is present for more than 1.5 seconds but removed in less than 30 seconds, INTELIPOINT enters loopback.

3.4 2W/4W Option Setting

The 2W/4W option setting is a hardware switch selection on the printed circuit board, set at the time of installation. The ISL5490i3 is a factory set for 4-wire and needs to be reset for 2-wire circuit applications.

3.5 TLP/DLP Toggle

INTELIPOINT is initially programmed to align and transpond at TLP. This feature can, however, be programmed to have the unit align and transpond at DLP (data level). Toggling from TLP to DLP is accomplished while in command mode by sending 2804Hz. Upon detecting 2804Hz, INTELIPOINT toggles to the DLP mode, corrects the internal circuitry to accommodate the change in levels, then returns to command mode. Toggling is ver-

ified by monitoring the level for a change of 13dB. To return to TLP, the STC sends another 2804Hz.

- NOTE -

Each time INTELIPORT returns to idle, the TLP/DLP circuit automatically returns to the TLP mode. Therefore, whenever the command mode is re-assessed from an idle state and testing or alignment is to be done at data level, the STC must send 2804Hz to toggle the DLP mode.

3.6 Alignment

INTELIPORT features both remote and automatic alignment capability with respect to either 3 or 4 tones. Remote alignment is used to align the ISL5490i3 and is activated from the STC, while in command mode, by sending 1004Hz (see paragraph 3.7). The STC can also align the ISL with respect to 1004Hz only (i.e., 1-tone quick alignment, see paragraph 3.8). Automatic alignment is used to align INTELIPORT with the distant end in a point-to-point application and is activated from the STC, while in command mode, by sending 1804Hz (see paragraph 3.18). In either the remote or automatic alignment mode, INTELIPORT automatically adjusts the gain for proper level coordination. INTELIPORT is initially programmed to align at TLP, but can be programmed to align at data level (DLP) (see paragraph 3.5). When programmed to align at TLP, INTELIPORT outputs is respective tones at +5 dBm. When set to align at DLP, INTELIPORT outputs is respective tones at -8 dBm. The operating levels for the ISL5490i3 are given in Table 3.

- NOTE -

DST to ETO Auto-Align can be activated from an on-site location by pressing the TEST switch for longer than five seconds but less than 10 seconds. DST to DST Auto-Align can be activated from an on-site location by pressing the TEST switch for longer than 10 seconds.

PORT	LEVELS (IN DBM)	
	TLP	DLP
RCV IN	+5 to -10	-8 to -23
RCV OUT	-3	-16
XMT IN	+13	0
XMT OUT	+5	-8

Table 3. INTELIPORT ISL5490i3 Operating Levels

3.7 Remote 3- or 4-Tone Alignment

While in command mode (1008Hz present), the STC should record the level received, then initiate the alignment mode by sending 1004Hz to INTELIPORT. Upon detecting 1004Hz, INTELIPORT sends 2808Hz. The STC should record the level received, then send 2804Hz to INTELIPORT. Upon detecting 2804Hz, INTELIPORT sends 408Hz. The STC should record the level received, then send 404Hz to INTELIPORT. Upon detecting 404Hz, INTELIPORT sends 1808Hz for 60 seconds. The STC should record the level received, and then either send 1804Hz to INTELIPORT before 60 seconds times out (performing a 4-tone alignment), or ignore the tone (performing a 3-tone alignment). Upon completion, INTELIPORT sets the gain required and returns either a ramp-up tone or a ramp-down

tone (see paragraph 3.9). Please note that during 3-tone alignment, the 60-second time out feature can be bypassed by sending 1004Hz within the 60-second time frame.

3.8 Remote 1-Tone Quick Alignment

While in command mode (1008Hz present), the STC should record the level received, then initiate the quick alignment mode by sending 1004Hz to INTELIPORT. Upon detecting 1004Hz, INTELIPORT sends 2808Hz. The STC should record the level received, then remove 1004Hz being sent to INTELIPORT. Upon detecting removal of 1004Hz, INTELIPORT sends either a ramp-up tone or a ramp-down tone.

3.9 Ramp-Up/Ramp-Down Tone Sequence

Once the levels are set, INTELIPORT sends a ramp-up or ramp-down tone sequence. The ramp-up sequence, consisting of a series of tones ranging from 308Hz to 3008Hz in ascending order, indicates alignment is within 0 to 4dB of cable loss. The ramp-down sequence, consisting of a series of tones ranging from 3008Hz to 308Hz in descending order, indicates alignment is greater than 4 dB of cable loss. The tone sequence is applied for approximately 1.5 seconds with the last tone (3008 Hz in the ramp-up; 308 Hz in the ramp-down) being applied for approximately 5 seconds. After 5 seconds, INTELIPORT enters loopback.

3.10 Loopback

While in loopback, the receive path is interconnected to the transmit path via a loopback amplifier and allows the STC to verify alignment settings and facility frequency response. The loopback circuit automatically inserts 16dB of gain to provide an equal-level loopback condition. During loopback, the STC sends tones (404, 1004, 1804, and 2804Hz), one at a time, to INTELIPORT. The STC should verify/record the level of each tone as it is looped back by INTELIPORT.

3.11 Loopback Release

Loopback is equipped with an automatic time out feature that releases the loopback condition 20 minutes after initial activation. If release from loopback is desired before the 20-minute time frame, it can be accomplished by sending 2713Hz for 0.9 seconds, or longer then removing the tone. Loopback releases when 2713Hz is detected. The automatic time out release feature ensures restoration of the transmission paths in the event the 2713Hz tone is not sent. Loopback can be initiated any time the unit is idle by applying 2713 Hz for a period greater than 2.5 seconds but less than 30 seconds. INTELIPORT returns an alternating 1008/2808 Hz indicating the circuit accessed for testing as Westell's ISL5490i3, Short-loop DST intelligent unit.

- NOTE -

If 2713 Hz is present for more than 30 seconds, INTELIPORT enters the command mode.

3.12 Manual Loopback Activation

Manual loopback activation can also be accomplished by placing a ground on the MNLB lead, pin 1. When manually activated, neither automatic time out nor detection of 2713Hz will effect

loopback release. Release of a manually activated loopback condition can only occur by removing the ground.

3.13 4-Tone Auto-Sweep (RCV IN Port)

INTELIPOINT features a 4-tone automatic sweep transponder mode that allows for a quick level verification test over the receive in port. To activate this 4-tone auto sweep, the STC sends 604Hz while in command mode. Upon detecting 604Hz, INTELIPOINT sends 1008Hz for 60 seconds, followed by 60 seconds of quiet termination, then begins a sweep at tones of 408Hz, 1808Hz, and 2808Hz at 0dBm, each for 30 seconds, then returns to command mode.

- NOTE -

To bypass the 60-second quiet termination portion and quickly enter the auto-sweep portion of the test, the STC sends 1004 Hz for five seconds, subsequently removing the tone. To abort this test and return to command mode, the STC sends 2604 Hz (during quiet termination only) for longer than five seconds, subsequently removing the tone.

3.14 Quiet Term/Transponder

INTELIPOINT incorporates a quiet term/transponder mode of operation that allows the STC to remotely conduct noise and tone level measurements. While in the command mode, the STC activates the quiet term/transponder by sending 404Hz. Upon detecting 404Hz, INTELIPOINT applies a quiet termination at the XMT IN port and isolates signals from the data modem. During quiet termination, the STC performs noise measurements. Quiet termination remains in affect for 20 minutes or until another tone (to enter the transponder operation or return to command mode) is sent. Please note that if no tone is sent within the 20-minute time frame, INTELIPOINT times out and returns to idle. Escape to command mode can also be done by sending 2604Hz for more than five seconds, subsequently removing the tone. INTELIPOINT sends an interrupted 1008Hz tone and returns to command mode. Escape to idle can also be done by sending 2713Hz for more than five seconds.

3.15 Transponder Operation

INTELIPOINT features a 4-tone automatic sweep transponder mode and a full range transponder mode of operation. The 4-tone auto-sweep transponder allows for a quick level verification test over the transmit port. The full-range transponder allows for a more detailed level verification test over a range of frequencies from 304Hz to 3804Hz over the transmit port. Both transponder modes are activated from the quiet termination mode only.

3.16 4-Tone Auto-Sweep

To activate the 4-tone auto-sweep transponder, the STC sends 404 Hz as the first tone while in quiet termination. Upon detecting this 404 Hz, INTELIPOINT begins a sweep sequence at tones of 408 Hz, 1008 Hz, 1808 Hz and 2808 Hz, each for 30 seconds, then returns to quiet termination and resets the 20-minute timer circuit.

3.17 Full-Range Transponder

To activate the full-range transponder, the STC sends any tone from 304Hz to 3804Hz (except 400Hz, 2600Hz and 2700Hz). As tone is received, INTELIPOINT responds by sending a similar tone (but at an offset) for the same duration tone is received from the STC or 15 seconds (whichever is longer). Each tone transmitted by the STC is sent in increments of 100Hz. Upon completion and if no other tone is sent by the STC, INTELIPOINT reapplies quiet termination and resets the 20 minute timer circuit. If no tone is sent within the 20-minute time frame, INTELIPOINT times out and returns to idle. To release and return to command mode before the 20-minute time out, the STC sends 2604Hz for five seconds, or longer. INTELIPOINT sends an interrupted 1008Hz tone and returns to command mode. To release and return to idle before the 20-minute time out, the STC sends 2713Hz for five seconds, or longer.

3.18 Auto-Align

Auto-Align is used to align INTELIPOINT with the distant end in a point-to-point application and can be initiated remotely from the STC while in command mode (see paragraph 3.21).

- NOTE -

Auto-Align can also be initiated from an on-site location by pressing and holding the TEST switch. The TEST switch, however, should be pressed only when instructed; otherwise pressing this switch at an inappropriate time may cause circuit disruption. Please also note that when auto-align is initiated via the TEST switch, alignment at TLP takes place.

3.19 DST-ETO Alignment Via TEST Switch

When the TEST switch is pressed and held for more than 5 seconds but less than 10 seconds (the FAIL/TEST and ALIGN/LPBK LEDs will light steady), INTELIPOINT recognizes this as a command to perform a DST to ESO alignment. When activated, INTELIPOINT outputs 2913Hz via the RCV IN port (i.e., reversed) to Station Z (see paragraph 3.21).

3.20 DST-DST Alignment Via TEST Switch

When the TEST switch is pressed and held for more than 10 seconds (the FAIL/TEST and ALIGN/LPBK LEDs will flash), INTELIPOINT recognizes this as a command to perform a DST to DST alignment. When activated, INTELIPOINT outputs 2713Hz via the XMT OUT port to Station Z (see paragraph 3.21).

3.21 Alignment Via Command Mode

While in command mode and before auto-align is initiated, the STC must decide if alignment is to be done at TLP or DLP (see paragraph 3.5). To activate auto-align from the command mode, the STC sends 1804 Hz.

- NOTE -

For purposes of discussion, the unit accessed is referred to as Station A while the unit at the distant end is referred to Station Z.

Station A, upon detecting the command to enter the automatic alignment sequence (either by detection of the TEST switch be-

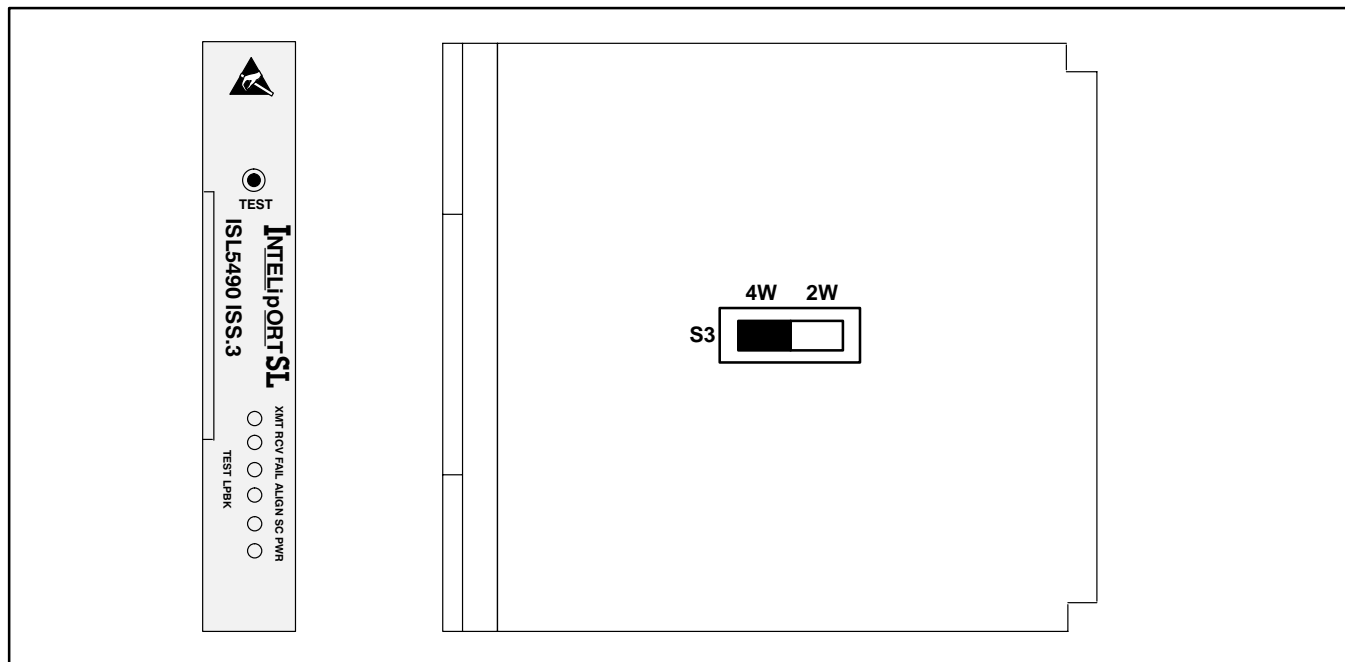


Figure 3. INTELIPOINT ISL5490i3 Front Panel Switch Option Diagram

ing pressed and held for longer than five but less than 10 seconds (DST-ETO Align); via detection of the TEST switch being pressed and held for longer than 10 seconds (DST-DST Align); or via detection of 1804Hz from the STC), sends 2913Hz to Station Z for 60 seconds via the RCV IN port. After 60 seconds, 2913Hz is removed. If a command mode tone from the distant end is detected (i.e., 1004Hz, $\pm 1\%$), Station A assumes the distant end (Station Z) is an intelligent 4W ETO and automatic alignment continues. If command mode tone is not detected after sending 2913Hz, Station A sends 2713Hz for 60 seconds via the XMT OUT port. If a command mode tone from the distant end is detected at this point, automatic alignment continues.

- NOTE -

If no response from 2913 Hz/2713 Hz is detected, Station A re-sends 2713 Hz (more than five seconds) and returns to idle.

With both stations set, tones are automatically sent and received between both ends. Upon completion of the last tone and detection of the ramp-up or ramp-down tone sequence (approximately two to three minutes), Station A re-sends 2913Hz (if the unit at the distant end is an intelligent ETO) or 2713Hz (if the unit at the distant end is an intelligent DST) and returns to idle. Station Z, upon detecting 2913Hz (for an ETO) or 2713Hz (for a DST), also returns to idle. Gain is automatically set and alignment is complete.

- NOTE -

If, at the end of the alignment (DST-DST or DST-ETO), INTELIPOINT determines that the loop is more than 4 dB, the FAIL/TEST and ALIGN/LPBK LEDs will flash (alternately) for five minutes. This indication lets the installer know to check the equalization to verify that the circuit meets specification.

3.22 Align Query Mode

The alignment query mode permits the STC to verify whether INTELIPOINT returned the ramp-up tone sequence (indicating alignment is within 4 dB of cable loss) or the ramp-down tone sequence (indicating loss is greater than 4 dB). The alignment query mode is activated from the command mode by sending 1204 Hz. Upon detecting 1204 Hz, INTELIPOINT returns the ramp-up or ramp-down tone, then returns to command mode.

3.23 Sealing Current

Sealing current is recommended on all metallic facilities to help prevent transmission path noise. Sealing current is a low-value DC current (approx. 20mA) applied to the 4-wire dry cable pairs, on a simplex basis, to break down resistance which may build up at non-soldered cable splices. Continuous application of sealing current helps prevent degradation of transmission performance. The internal sealing current circuit provides a current-limiting load to the simplex leads when sealing current is supplied from the distant end. The SC LED will light when sealing current is present.

3.24 Power Query Mode

INTELIPOINT provides a power query mode that permits the STC to verify the status of the power supply to determine if power was interrupted for whatever reason. The power query mode is activated by sending 1304 Hz while in command mode. Upon detecting 1304 Hz, INTELIPOINT returns either a ramp-up tone (308 Hz to 3008 Hz) indicating power has not been interrupted since last alignment or query or a ramp-down tone (3008 Hz to 308 Hz), indicating an interruption in power has occurred. After the ramp-up or ramp-down tone, INTELIPOINT returns to command mode.

3.25 Switch Options

Westell's ISL5490i3 (Issue 3) contains an option switch that is used to set the unit for either 2W or 4W applications (see paragraph 3.4) and should be set during installation. The front-panel TEST switch is used to manually activate INTELIPORT's wire test mode (when pressed for greater than 1.5, but less than five seconds) for verifying station wiring. In addition, the TEST switch can also be used to manually activate INTELIPORT's auto-align feature (DST-ETO, when pressed for more than five but less than 10 seconds or DST-DST when pressed for more than 10 seconds). Refer to Figure 3, INTELIPOR SL (ISL5490i3) Front Panel Switch Option Diagram.

- CAUTION -

The test switch should be pressed only when instructed; otherwise pressing this switch at an inappropriate time may cause circuit disruption.

4. INSTALLATION INFORMATION

Installation consists of examining some pre-mounting considerations (proper safety precautions, inspecting the unit for damages, considering the mounting location), gathering the proper installation tools and equipment, performing the physical installation, making the assembly's ground and power connections, making the facility and customer wiring and line connections, installing the plug-in modules (if required at time of assembly installation), and testing the installation.

4.1 Proper Safety Precautions

Before installing the unit, please observe the following safety precautions and notes.

- INSPECTION NOTE -

If not previously inspected at the time of delivery, visually inspect the unit for damages prior to installation. If the equipment has been damaged in transit, immediately report the extent of the damage to the transportation company and to Westell (see Part 6.1 for telephone number).

CAUTION - STATIC-SENSITIVE

This product contains static-sensitive components! Proper electrostatic discharge procedures must be followed to maintain personal and equipment safety. Do not store units near magnetic, electromagnetic or electrostatic fields. Always store or ship units in the original static-protective packaging from Westell. Use anti-static mats when working on units.

- PRECAUTIONARY STATEMENT -

- Never install telephone wiring during a lightning storm.
- Never install telephone jacks in wet locations unless the jack is specifically designed for wet locations.
- Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- Use caution when installing or modifying telephone lines.
- This unit is intended to be used behind devices that provide primary lightning protection.

- CAUTION -

Do not apply power until all wiring and installation is complete.

- CAUTION -

Use care when installing and removing modules - *do not force a module into place.* If a module resists insertion, remove it and check for obstructions in or near the module's or shelf's connectors and mounting slots. The module may then be carefully aligned and gently re-inserted.

4.2 Installer Connections

When installing the unit into Westell's USA mounting (pre-wired Type 550 shelf), connections are accomplished via 25-pair cables mating to the appropriate 25-pair cable connectors located on the rear of the mounting assembly. When installing the unit into Westell's un-wired Type 550 mounting (Type-400 equivalent), connections are made by wire-wrapping the appropriate leads from the facility and data modem to the proper pins of the appropriate 56-pin connector in which the module is to be installed. Pin identifications for proper wiring are listed in Table 4, Installer Connections. Recommended power for proper operation is -22 to - 56VDC (-48VDC nominal) at 50mA during normal operation; 80mA maximum, during testing and alignment or 20 to 28VAC (24VAC nominal) at 70mA during normal operation; 100mA maximum, during testing and alignment. Set the 2W/4W switch to 2W, if required.

LEAD DESIGNATIONS	PIN
RT-Receive IN (Tip)	7
RR-Receive IN (Ring)	13
TT-Transmit Out (Tip) FACILITY	41
TR-Transmit Out (Ring)	47
DRT-4W Receive Out (Tip)	5
DRR-4W Receive Out (Ring)	15
DTT-Transmit In/2W (Tip) MODEM	55
DTR-Transmit In/2W (Ring)	49
TEK5-Data Set Disable	23
TEK6-Data Set Disable	21
MNLB-Manual Loopback	1
MLBG-Manual Loopback Ground	19
PWR-Power MISC.	35
GND-Ground	17

Table 4. INTELIPORT ISL5490i3 Installer Connections

STEP	ACTION	NOTE															
1.	<p>Installer's Procedures: Install unit and apply power. Verify PWR LED on, SC LED on (if applicable), and ALIGN/LPBK and FAIL/TEST LEDs off. Note: if FAIL/TEST LED is on steady, replace unit and repeat Step 1. If FAIL/TEST LED continues to flash, momentarily press the recessed front-panel TEST switch.</p>	None															
2.	<p>Test Mode: Momentarily press front-panel tEST switch (> 1.5 but <5 seconds). Verify FAIL/TEST LED flashing. Connect TMS with built-in speaker, or other suitable listening device, to:</p> <table border="1" data-bbox="269 466 1118 701"> <thead> <tr> <th>PORT</th> <th>VERIFY 4W APPLICATIONS</th> <th>VERIFY 2W APPLICATIONS</th> </tr> </thead> <tbody> <tr> <td>RCV IN (at cable entry)</td> <td>Steady 1008Hz for first 10 minutes, followed by Interrupted 1008Hz (4 sec. ON; 1 sec. OFF)</td> <td>Steady 1008Hz for first 10 minutes, followed by Interrupted 1008Hz (4 sec. ON; 1 sec. OFF)</td> </tr> <tr> <td>RCV OUT (at demarcation)</td> <td>Steady 1008Hz for first 10 minutes, followed by Interrupted 1008Hz (4 sec. ON; 1 sec. OFF)</td> <td></td> </tr> <tr> <td>XMT IN (at demarcation)</td> <td>Interrupted 1008Hz (1/2 sec. ON; 1/2 sec. OFF)</td> <td>Interrupted 1008Hz (1/2 sec. ON; 1/2 sec. OFF)</td> </tr> <tr> <td>XMT OUT (at cable entry)</td> <td>Interrupted 1208Hz (1/2 sec. ON; 1/2 sec. OFF)</td> <td>Interrupted 1008Hz (1/2 sec. ON; 1/2 sec. OFF)</td> </tr> </tbody> </table> <p>Press TEST switch to end test mode. Verify FAIL/TEST LED off.</p>	PORT	VERIFY 4W APPLICATIONS	VERIFY 2W APPLICATIONS	RCV IN (at cable entry)	Steady 1008Hz for first 10 minutes, followed by Interrupted 1008Hz (4 sec. ON; 1 sec. OFF)	Steady 1008Hz for first 10 minutes, followed by Interrupted 1008Hz (4 sec. ON; 1 sec. OFF)	RCV OUT (at demarcation)	Steady 1008Hz for first 10 minutes, followed by Interrupted 1008Hz (4 sec. ON; 1 sec. OFF)		XMT IN (at demarcation)	Interrupted 1008Hz (1/2 sec. ON; 1/2 sec. OFF)	Interrupted 1008Hz (1/2 sec. ON; 1/2 sec. OFF)	XMT OUT (at cable entry)	Interrupted 1208Hz (1/2 sec. ON; 1/2 sec. OFF)	Interrupted 1008Hz (1/2 sec. ON; 1/2 sec. OFF)	<p>INTELIPOINT places 1008 Hz on the transmission pairs when test mode is activated. Be sure INTELIPOINT is not connected to an in-service circuit where this tone may cause interference. If the TEST switch is pressed for longer than five seconds, INTELIPOINT enters AUTO-ALIGN mode.</p> <p>Test mode automatically releases one hour after initial activation if TEST switch is not pressed. If desired, STC can release test mode by sending 2713 Hz, 10 to 60 minutes after initial activation.</p>
PORT	VERIFY 4W APPLICATIONS	VERIFY 2W APPLICATIONS															
RCV IN (at cable entry)	Steady 1008Hz for first 10 minutes, followed by Interrupted 1008Hz (4 sec. ON; 1 sec. OFF)	Steady 1008Hz for first 10 minutes, followed by Interrupted 1008Hz (4 sec. ON; 1 sec. OFF)															
RCV OUT (at demarcation)	Steady 1008Hz for first 10 minutes, followed by Interrupted 1008Hz (4 sec. ON; 1 sec. OFF)																
XMT IN (at demarcation)	Interrupted 1008Hz (1/2 sec. ON; 1/2 sec. OFF)	Interrupted 1008Hz (1/2 sec. ON; 1/2 sec. OFF)															
XMT OUT (at cable entry)	Interrupted 1208Hz (1/2 sec. ON; 1/2 sec. OFF)	Interrupted 1008Hz (1/2 sec. ON; 1/2 sec. OFF)															
3.	<p>Test Center's Procedures Command Mode: Send 2713 Hz (>30 seconds). INTELIPOINT returns 1008 Hz at +5 dBm (TLP). STC removes 2713 Hz. Command mode initiated. NOTE: If 2713 Hz is present for >1.5 seconds but <30 seconds, INTELIPOINT enters loopback.</p>	If 2713 Hz is present for > 1.5 seconds but <30 seconds, the INTELIPOINT enters loopback.															
4.	<p>TLP/DLP: Perform this step only if aligning at DLP. INTELIPOINT is initially set to align at TLP. From command mode, send 2804 Hz. INTELIPOINT toggles to DLP mode, then returns to command mode. Toggling is verified by monitoring level for a change of 13 dB. To toggle back to TLP, send another 2804 Hz.</p>	INTELIPOINT automatically returns to TLP mode whenever unit returns to idle. Therefore, when aligning at DLP, unit must be reset to DLP mode.															
5.	<p>Remote 3- or 4-Tone Alignment: From command mode (1008 Hz present), record level received, then send 1004 Hz to INTELIPOINT. INTELIPOINT sends 2808Hz. Record level received, then send 2804 Hz to INTELIPOINT. INTELIPOINT sends 408Hz. Record level received, then send 404 Hz to INTELIPOINT. INTELIPOINT sends 1808Hz for 60 seconds. Record level received. STC now has option: -Send 1804Hz within 60 seconds. INTELIPOINT aligns to 4 tones, sends ramp-up/ramp-down tone, then enters loopback. -Ignore 1804Hz. 1808Hz tone times out after 60 seconds. INTELIPOINT aligns to 3 tones, sends ramp-up/ramp-down tone, then enters loopback.</p>	The 60-second timer circuit can be bypassed by sending 1004Hz.															
6.	<p>Remote (Manual) 1-Tone Alignment: From command mode (1008Hz present), record level received, then send 1004 Hz to INTELIPOINT. INTELIPOINT sends 2808Hz. Record level received, then remove 1004Hz to INTELIPOINT. INTELIPOINT aligns to 1004Hz tone, sends ramp-up/ramp-down tone, then enters loopback.</p>	None															
7.	<p>Loopback: While in loopback, STC sends tones (404,1004, 1804 and 2804Hz), one at a time, to INTELIPOINT. The STC should record the level of each tone as it is looped back by INTELIPOINT. Release from loopback. Loopback is equipped with an automatic time-out feature that releases the loopback condition after 20 minutes. INTELIPOINT returns to idle. If release is desired before the 20-minute time frame, STC can send 2713 Hz (0.9) sec, or longer). INTELIPOINT returns to idle upon detecting 2713 Hz.</p>	None															

Table 5. INTELIPOINT ISL5490i3 Testing and Alignment Procedures

STEP	ACTION	NOTE
8.	<p>4-Tone Auto-Sweep (RCV IN Port):</p> <p>From command mode, send 60 Hz. INTELIPORT sends 1008 Hz for 60 seconds, followed by 60 seconds of quiet termination, then sweeps 408 Hz, 1808 Hz, and 2808 Hz at 0 dBm, each for 30 seconds, then returns to command mode.</p>	<p><i>To bypass the 60-second quiet termination portion and quickly enter the auto-sweep portion of the test, send 1004 Hz (>5sec), subsequently removing the tone. Toescape and return to command mode, send 2604 Hz (during quiet termination only) for >5 seconds.</i></p>
9.	<p>Quiet Term/Transponder Operation:</p> <p>From command mode, send 404 Hz. INTELIPORT applies quiet termination at the XMT IN port and sets 20-minute timer. STC performs noise measurements. Quiet termination remains in affect for 20 minutes or until another tone is sent (i.e., enter 4-tone auto or full-range transponder, or exit and return to command mode). If no tone is sent within the 20-minute time frame, INTELIPORT times out and returns to idle.</p> <p>From Quiet Termination, STC has Option: Enter 4-tone Auto-Sweep Transponder. Send 404Hz as first tone. INTELIPORT sweeps 408 Hz, 1008 Hz, 1808 Hz, and 2808 Hz, each for 30 seconds, then reapplies quiet termination and resets 20-minute timer. Enter Full-Range Transponder. Send any tone from 304 Hz to 3804 Hz (except 400, 2600, and 2700 Hz). INTELIPORT returns similar tone (but at an offset) for same duration tone is received or 15 sec (whichever is longer). Tones from the STC are sent in 100 Hz increments. Upon completion, and no other tone is sent from the STC, INTELIPORT reapplies quiet termination and resets 20-minute timer. Release. Accomplished via 20-minute automatic time out (unit returns to idle), or by sending 2604 Hz for >5 seconds (unit returns to command mode). To release to idle, send 2713 Hz for >5 seconds.</p>	<p>None</p>
10.	<p>Auto-Align:</p> <p>From command mode, perform Step 5 (if required), then send 1804 Hz to Station A. Station A first sends 2913 Hz to Station Z for 60 seconds via the REC IN pair (reversed). After 60 seconds, 2913 Hz is removed. If command mode tone is received upon removing 2913 Hz, INTELIPORT assumes distant end (Station Z) is an intelligent 4W ETO and alignment continues. If no command mode tone is detected, INTELIPORT sends 2713 Hz to Station Z via the XMT OUT pair. If command mode tone is received, automatic alignment sequence continues. If no response from 2913 Hz or 2713 Hz is detected, Station A re-sends 2713 Hz and returns to idle.</p> <p>After receiving command mode tone from Station Z, and if Station A is set to align at DLP, Station A sends 2808 Hz to Station Z (TLP/DLP toggle) to make Station Z complete. Upon receiving command mode tone from Station Z, tones are automatically sent and received between both ends. Upon completion (approximately two to three minutes), and through sending and receiving the appropriate tones, both stations return to idle. Gain is automatically set.</p>	<p><i>Auto-Align can also be initiated from an on-site location via the front-panel TEST switch. This switch, however, should be pressed only when instructed; otherwise, pressing this switch at an inappropriate time may cause circuit disruption. When the TEST switch is pressed and held for longer than five seconds but less than 10 seconds, the FAIL/TEST and ALIGN/LPBK LEDs light steady and INTELIPORT activates a DST to ETO automatic alignment. (see 2913 Hz description). When the TEST switch is pressed and held for longer than 10 seconds, the FAIL/TEST and ALIGN/LPBK LEDs flash and INTELIPORT activates a DST to DST automatic alignment (see 2713 Hz description above). Upon releasing the TEST switch, the FAIL/TEST and ALIGN/LPBK LEDs will light steady. When activated via the front-panel TEST switch, alignment is done at TLP only.</i></p>

Table 6. INTELIPORT ISL5490i3 Testing and Alignment Procedures Continued

5. TESTING & TROUBLESHOOTING

5.2 Troubleshooting

5.1 Testing

This equipment should not be field repaired. If the equipment is suspected of being faulty, replace it with another unit, optioned identically, and retest. If the replacement unit appears to operate correctly, the original unit may be faulty and should be returned to Westell for repair or replacement (Paragraph 7.2).

If trouble is encountered, verify all installer connections to the assembly and check that the CO power fuse is not blown. Also verify all module connections and option switch settings, and verify the modules are making a positive connection with the shelf connector. If trouble persists, replace the suspect unit and repeat procedures outlined. These procedures are not designed to effect repairs or modifications. Any tests beyond those outlined herein, or repairs made beyond replacing a faulty unit, are not recommended and may void the warranty.

6. CUSTOMER & TECHNICAL SERVICES

6.1 Customer Service & Technical Assistance

If technical or customer assistance is required, contact Westell by calling or using one of the following options:

Voice: (630) 898-2500
 Voice: (800) 323-6883
 email: global_support@westell.com

Visit the Westell World Wide Web site at <http://www.Westell.com> for additional information about Westell.

6.2 Part Numbers

This equipment is identified by a model number and an issue number. Each time a change is made to the product which changes the form, fit, or function of the product, the issue number is incremented or advanced by one. Be sure to indicate the issue number as well as the model number when making inquiries about the equipment.

7. WARRANTY & REPAIRS

7.1 Warranty

Westell warrants this product to be free of defects at the time of shipment. Westell also warrants this product to be fully functional for the time period specified by the terms and conditions governing the sale of the product. Any attempt to repair or modify the equipment by anyone other than an authorized Westell representative will void the warranty.

7.2 Repair and Return

Westell will repair or replace any defective Westell equipment without cost during the warranty period if the unit is defective

for any reason other than abuse, improper use, or improper installation. Before returning the defective equipment, first request a Return Material Authorization (RMA) number from Westell. Once an RMA number is obtained, return the defective unit, freight prepaid, along with a brief description of the problem, to:

Westell, Inc.
 ATTN: R.G.M. Department
 750 N. Commons Drive
 Aurora, IL 60504-7940

Replacements will be shipped in the fastest manner consistent with the urgency of the situation. Westell will continue to repair or replace faulty equipment beyond the warranty period for a nominal charge. Contact Westell for details.

8. SPECIFICATIONS

The electrical, physical and operational specifications are shown in Table 7.

8.1 Ordering Specification

To order units, call the telephone number shown in paragraph 6.1 and please specify the model number shown in Table 6.

Product Info.	Description & Comments
Model: ILS5490i3	Inteliport SL 2W/4W Short-Loop Data Station Termination <small>CLEI* Code: NCDSFGP1AA Barcode: 260447</small>
Technical Publication	030-101290

*CLEI is a trademark of Telcordia Technologies.

Table 6. Ordering and Option Information

Feature	U.S.	Metric
Height	5.58 inches	14.17 cm
Width	1.42 inches	3.6 cm
Depth	5.9 inches	15 cm
Weight (approximate)	1.4 pounds	0.68 Kg
Operating Environment	32° to 122°F (ambient)	0° to 50°C
Humidity	0 to 95% (non-condensing)	
Idle Noise	17 dBrnC0, max.	
Transhybrid Loss	>30 dB, minimum; 45 dB typical	
Transmission Level	Automatically inserts 16 dB of gain to provide equal-level (± 1 dB) loopback condition	
Loopback Level	-24dBm (typically -30) to -3 dBm	
Loopback Release	For tone-activated loopback, 2713 Hz (0.9 sec), or via a 20-minute time-out release feature; For manually activated loopback, removal of ground only.	
Longitudinal Balance	>58 dB at 200 to 3000 Hz	
Harmonic Distortion	<-60 dB at 200 to 3000 Hz	
Impedance	Facility- and Equipment-side, 600 Ohms, fixed	
RCV Level Range	Input -10 to +5 dBm (TLP), -23 to -8 dBm (DLP); Output, -3 dBm (TLP), -16 dBm (DLP), ± 0.5 dB	
XMT Level Range	Input, +13 dBm (TLP), 0 dBm (DLP); Output, +5 dBm (TLP), -8 dBm (DLP), ± 0.5 dBm	
Sealing Current	Provides load to simplex leads when sealing current is supplies from distant end.	
Power	-22 to -56 VDC (-48 VDC, nominal) at 70mA, typical; or 20 to 28 VAC (24 VAC, nominal) at 100mA, typical; Also provides power query mode (activated from command mode via 1304 Hz) for supply's performance	
Command Mode	Activated from STC via 2713 Hz (>30 sec). INTELIPORT returns steady 1008 Hz indicating command mode initiation; Release, second 2713 Hz (>5 sec), or via 5-minute time out if no tone sent. (Note: If tone present for 1.5 sec but <30 sec, INTELIPORT sends an alternating 1008/2808 Hz tone and enters loopback).	
Test Mode	Activated via TEST switch (pressed for less > 1.5 but < 5 sec) applies steady 1008 Hz to the transmission pairs. After 10 minutes, interrupted 1008 Hz (4 sec ON; 1/2 sec OFF) is applied to RCV pairs (both line side and drop side), and a slightly faster interrupted 1008 Hz (1/2 sec ON; 1/2 sec OFF) is applied to the XMT pairs. Reference Table 2. Release, TEST switch pressed a second time, releases automatically 1-hour after initial activation, or can be released from STC, 10 to 60 minutes after activation via 2713 Hz >5 seconds. (Note: If switch is pressed for >5 seconds, INTELIPORT enters into AUTO-ALIGN mode.	
TLP/DLP	Factory programmed to align at TLP but can be programmed to align at data level (DLP). To toggle, send 2804 Hz while in command mode. Verify level change of 13 dB. Unit returns to command mode after toggling (NOTE: Unit automatically returns to TLP whenever unit returns to idle).	
Remote (manual) 3-4-Tone Alignment	Activated from command mode via 1004 Hz in response to INTELIPORT's 1008 Hz and repeated with frequencies of 2804, 404 and 1804 Hz in response to INTELIPORT's 2808, 408 and 1808 Hz, respectively. INTELIPORT sends ramp- or ramp-down completion, then enters loopback; Escape to command mode: 2604 Hz (>5 sec); Escape to idle: 2713 Hz (>5 sec).	
Remote (manual) 1-Tone Alignment	Activated from command mode via 1004Hz in response to INTELIPORT'S 1008 HZ INTELIPORT returns 2808 Hz. Upon detecting removal of 1004 Hz from STC, INTELIPORT sends ramp-up tone or ramp-down tone then enters loopback; Escape to command mode: 2604 Hz (>5 sec); Escape to idle: 2713 Hz (>5 sec).	
Auto-Alignment	Activated from command mode via 1804 Hz; Activated via TEST switch (pressed and held for >5 but <10 sec activates DST-ETO Auto Align; pressed and held for >10 sec activates DST-DST Auto Align). When activated from command mode, alignment at TLP or DLP takes place. When activated via TEST switch, alignment at TLP takes place; Release, automatically returns to idle at completion (2-3 minutes).	
Loopbck Activation	Tone-activated via 2713 Hz (± 7 Hz) >1.5 but <30 sec (followed by removal of tone) must detect to operate; ± 37 Hz must not operate. If tone applied for >30 sec, INTELIPORT enters command mode; Manual loopback, activated via grounding pin 1 (MNLB lead).	
Quiet Termination Mode	Activated from command mode via 404Hz. INTELIPORT applies quiet termination at the XMT IN port and sets 20 min timer. STC performs noise measurements; Escape and return to command mode: 2604 Hz (>5 sec); Escape and return to idle: 2713 Hz (>5 sec) or via 20-min automatic time out (unit returns to idle) if no tone sent.	
4-Tone Auto-Sweep Transponder (RCV IN)	Activated from command mode via 604 Hz. INTELIPORT sends 60 seconds of 1008 Hz, 60 sec of quiet term, then sweeps tones of 408, 1808, and 2808 Hz at 0 dBm (@ 600 Ohms), each for 30 sec, then returns command mode; Escape to command mode: 2604 Hz (>5 sec) during quiet termination cycle.	
4-Tone Auto-Sweep Transponder Operation	Activated from quiet termination mode only via 404 Hz as first tone. INTELIPORT sweeps tones of 408, 1008, 1808, and 2808 Hz, each for 30 sec, then reapplies quiet termination and resets 20-minute timer; Escape and return to command mode: 2604 Hz (>5 sec); Escape and return to idle: 2604 Hz (>5 sec); Escape and return to idle: 2713 Hz (>5 sec) or via 20-minute automatic time out (unit returns to idle) if no tone sent.	
Full-Range Transponder Operation	Activated from quiet termination mode only via any tone from 304 Hz to 3804 Hz (except 400 Hz, 2600 and 2700 Hz). INTELIPORT responds by sending a similar tone (but at an offset) for same duration tone is received for 15 sec (whichever is longer). Tones sent from the STC must be in increments of 100 Hz. Upon completion no other tone is sent from the STC. INTELIPORT reapplies quiet termination and resets the 20-minute timer; Escape and return to command mode: 2604 Hz (>5 sec) Escape and return to idle: 2713 Hz (>5 sec) or via 20-minute automatic time out (unit returns to idle) if no tone is sent.	

Table 7. INTELIPORT ISL5490i3 Specifications

9. ACRONYMS & ABBREVIATIONS

The following acronyms, abbreviations, and trademarks are found in this practice.

Amp-	Amphere	LPBK-	Loopback
CLEI-	CLEI™ is a trademark of Telcordia Technologies	Max-	Maximum
cm-	Centimeter	MLBG-	Manual Loopback Ground
DLP-	Data Level Point	MNLB-	Manual Loopback
DST-	Data Station Termination	PWR-	Power
GND-	Ground	RCV-	Receive
Hz-	Hertz	RMA -	Return Materials Authorization
INCTE-	Intelligent Network Channel Terminating Equipment	STC-	Servicing Test Center
ISL-	Inteliport Short-loop	TLP-	Transmission Level Point
LED-	Light Emitting Diode	UL-	Underwriter's Laboratories
		V-	Volt(s)
		VAC -	Volts Alternating Current
		VDC-	Volts Direct Current
		XMT-	Transmit

