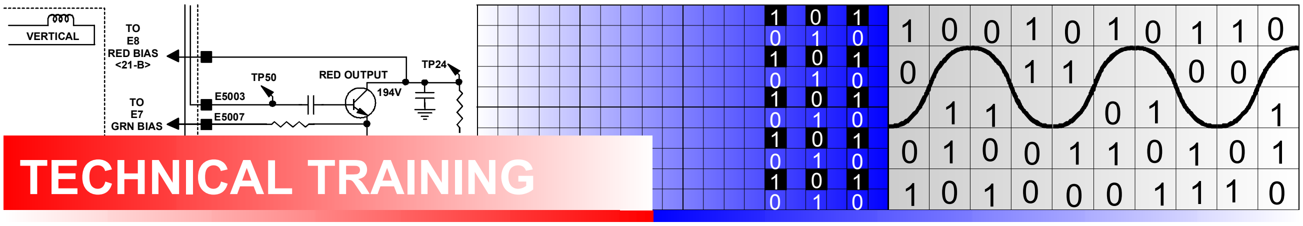
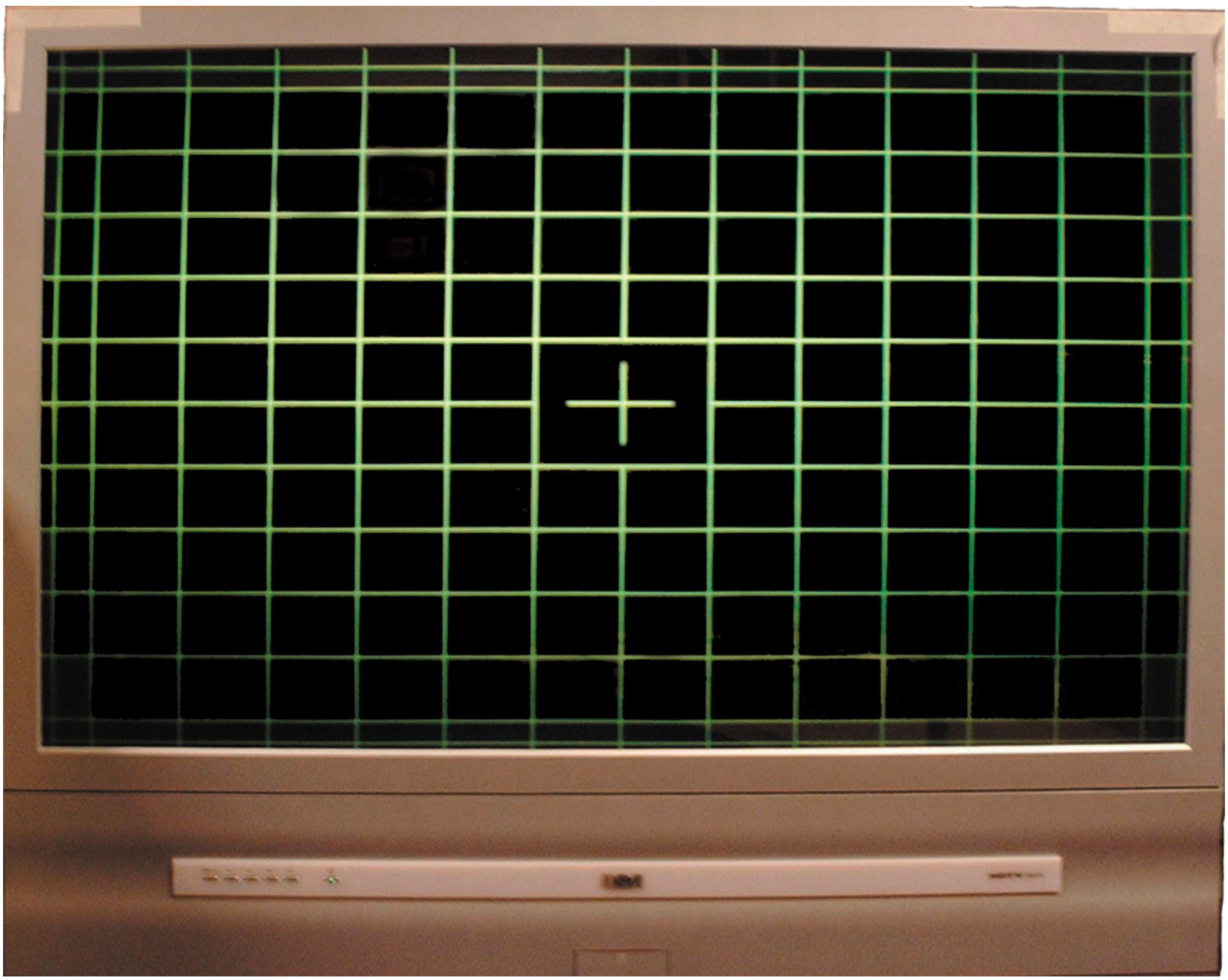
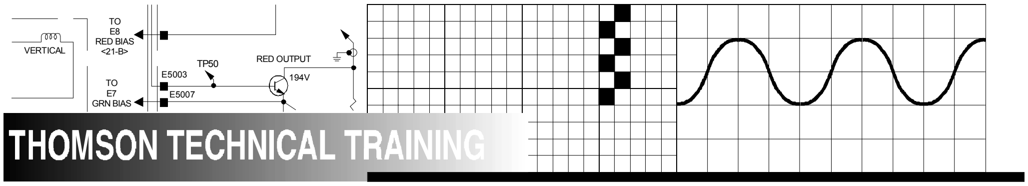


ITC222

Convergence & Geometry



TTE



FOREWORD

This publication is intended to aid the technician in servicing the ITC222 television chassis and is directed at convergence and geometry procedures   Although some theory is involved, the manual concentrates on correct adjustment and alignment of geometry and convergence after an SSB module replacement or after other repairs that may require full or partial geometry or convergence alignment. It is designed to assist the technician to become more familiar with convergence and autoconvergence operation, increase confidence and improve overall efficiency in servicing the product.

Note: This publication is intended for use only as a training aid. It is not meant to replace service data. Thomson Service Data for these instruments contain specific information about parts, safety and alignment procedures and must be consulted before performing any service. The information in this manual is as accurate as possible at the time of publication. Circuit designs and drawings are subject to change without notice.

SAFETY INFORMATION CAUTION

Safety information is contained in the appropriate Thomson Service Data. All product safety requirements must be complied with prior to returning the instrument to the consumer. Servicers who defeat safety features or fail to perform safety checks may be liable for any resulting damages and may expose themselves and others to possible injury.

All integrated circuits, all surface mounted devices, and many other semiconductors are electrostatically sensitive and therefore require special handling techniques.

RCA   RCA SCENIUM

First Edition 0516 - First Printing

Printed in U.S.A.

Prepared by
Thomson, Inc for TTE Technology, Inc.
Technical Training Department, INH905
PO Box 1976
Indianapolis, Indiana 46206 U.S.A.

ITC222 Convergence & Geometry

Publication Overview

This publication is intended to detail procedures for returning the convergence of an ITC222 instrument to manufacturing specifications and assuring the performance of Autoconvergence. Procedures to do so begin the manual. Informational and tutorial sections are included only as Appendix items.

The manual details convergence procedures and steps required to perform them. It is arranged by procedures and listed in the order they should be performed. Typically these procedures depend on the individual repair issue. Begin with the Overview, first determining what repairs are required, then proceed through the manual as it is written. Geometry is critical to convergence. Care should be taken to understand how geometry affects convergence. If at all possible geometry should not be disturbed especially if Sensor Calibration runs successfully.

While the procedures given in the main Overview may look simple do not mistake the complexity! Alignments are sensitive and interactive. Make certain it is understood which procedures are required and leave other alignments alone. Changing alignments that do not need to be done will always complicate the procedures required.

Appendix A, Chipper Check, fully explains how to use Chipper Check to transfer existing convergence EEPROM files to a replacement SSB module. Appendix B, Field Service Menu, documents how to use the Field Service Menu for those technicians not yet familiar with its operation. Also included in the Appendix are tables for screen size dimensions and decimal to fraction conversions.

General Information

This training material assumes a knowledge of the current Thomson ITC222 television chassis. The material has been prepared using general reference to geometry and convergence operation with specific reference to the ITC222. Standard procedures and operation may change over time so in all cases Electronic Service Data for the instrument should be consulted for the most accurate component values and voltages.

EEPROM's or ***E****lectrically* ***E****rasable* ***P****rogrammable* ***R****ead* ***O****nly* ***M****emory*, are sometimes referred to as NVM's or ***N****on****V****olatile* ***M****emory* devices. They are the same device simply called by different names.

Chipper Check© is Thomson, Inc PC based diagnostic and alignment system.

Contents

Introduction

Geometry and convergence for the ITC222 are more interactive than previous chassis designs. If geometry is not correct or too far from nominal settings, even though geometry and convergence both look acceptable, autoconvergence may not operate. While it may be tempting for the technician to return the set to the consumer with both agreeing autoconvergence will not work, it is not a recommended or endorsed completion to a repair.

The purpose of this manual is to show the interaction of geometry and convergence and how it affects screen geometry, sensor location (sensor calibration) and autoconvergence. Autoconvergence and manual convergence must be considered separate processes to be understood. Convergence is digital and follows a similar process done in previous years. A technician must manually converge the instrument using digital convergence. Autoconvergence is the process of determining where manufacturing (or the technician) manually aligned convergence for acceptable performance, then automatically return it to that alignment appearance when necessary.

It also must be understood that Geometry is controlled globally via the main deflection yokes using individual adjustments in the Geometry menu. Geometry controls all three colors at the same time in the same way. Convergence is independent of geometry being controlled and adjusted by individual convergence yokes on each of the three CRT's. But if Geometry is misadjusted convergence may not have enough power to overcome it and proper convergence would be in jeopardy.

There are two steps to the Autoconvergence routine; Sensor Calibration and Autoconvergence. When the "Sensor Location" routine is run, convergence is set to a "neutral" state and the sensor location blocks are influenced more by geometry. So if geometry is too far off, sensor location (calibration) will fail. If sensor calibration fails, autoconvergence will also fail.

It is also possible for geometry to be misadjusted just far enough to allow sensor location to complete yet proper convergence of all three CRT's may not be possible because the convergence amplifiers are railed trying to overcome the geometry yokes in order to correct the alignment points. The correct geometry alignment is one that puts geometry in more of a nominal state allowing convergence the greatest range.

This manual is arranged so the Geometry and Convergence procedures appear in order. However that is not necessarily how they should be done, nor does every detail of each procedure have to be done. Which procedures and details are required for each repair depend more on the situation. The answer to the following questions have considerable influence over which procedures must be used and how critical each is.

1.) Is convergence being done as the result of one or more CRT replacements?

2.) Is convergence needed after replacement of an SSB module?

3.) Is convergence needed after replacement of a convergence amplifier?

3.) Is convergence required as the result of a consumer complaint?

- a.) Misconvergence, or
- b.) Autoconvergence routine not functioning

The remainder of the manual is based on answers to these questions.

CRT Replacement

If one or more CRT's have been replaced, always spend time realigning the yoke and centering rings of the replacement(s) to existing CRT's. **Do not touch** geometry and **do not adjust** the convergence alignments of the CRT(s) not replaced. Centering and size are the two most important mechanical alignments. Two video patterns are required; a full crosshatch pattern with known horizontal and vertical centerlines and the internal convergence pattern. The results of these procedures is to make certain the center crosshair lines of the replacement CRT are on top of the existing CRT patterns and the raster is the same size and orientation.

The procedures for CRT replacement are:

1. Once the CRT has been replaced, place the video pattern with full width and height center crosshairs on the screen. Orient the center crosshair pattern vertically and horizontally by rotating the yoke matching it with the CRT(s) not replaced.
2. Using the convergence pattern, determine the proper raster size by comparing the replacement to the existing CRT patterns. Move the yoke up and down on the CRT neck until the size of the replacement pattern matches the size of the existing patterns. Fix the yoke when size and orientation are acceptable.
3. Still using the convergence pattern, if required use the "Centering Ring Setup" procedure in the Geometry section, adjusting the centering rings to provide the proper alignment of the crosshairs of the replacement to the existing CRTs. See the section on Geometry for more detailed centering ring alignments.
4. This completes the CRT mechanical alignments. Electrical adjustments should not be required.
5. In the Field Service Menu enter the Convergence menu. If convergence appears acceptable run "Sensor Calibration". If "Sensor Calibration" is successful, run autoconvergence and again observe convergence. If it is acceptable repairs are complete. If it is not continue with convergence procedures to realign the instrument.

SSB Module Replacement

If convergence is required due to an SSB module replacement always attempt to download the convergence alignments from the original SSB module. Refer to Appendix A, Chipper Check, for the procedures. When the original settings are uploaded to the new SSB the convergence alignments will not be perfect. However they will provide a better starting point than any default values could. Before beginning realignment of convergence always check the "Tube Type" settings via the service menu making certain it matches the CRT type of the instrument. Once the proper Tube Type has been selected default values for first convergence and then geometry should be loaded. There are several "fixed" values for geometry that should be set prior to geometry alignments. If one or more CRTs have been replaced with the SSB, refer to the CRT Replacement procedures making certain they are completed prior to doing any further convergence or geometry alignments. Only then should the remainder of the geometry alignments be done. Once geometry is completed may convergence be done. There are also instructions in the event the original alignments are not available.

So the proper steps when replacing an SSB module are:

1. Use Chipper Check (Appendix A) to either move the original SSB alignments or place the default SSB file into the replacement module.
2. Use the Field Service Menu to load the default geometry and convergence files and set the "Tube Type".
3. Unless a CRT has also been replaced, make no mechanical adjustments to the CRT and DO NOT MOVE THE CENTERING RINGS!
4. Refer to the section on Geometry procedures to properly align Geometry but if only one or two CRT's have been replaced it is not recommended to change any geometry alignments.
5. Converge the set using the Field Service Convergence Menu following the Convergence Procedures.

Convergence Amplifier Failure

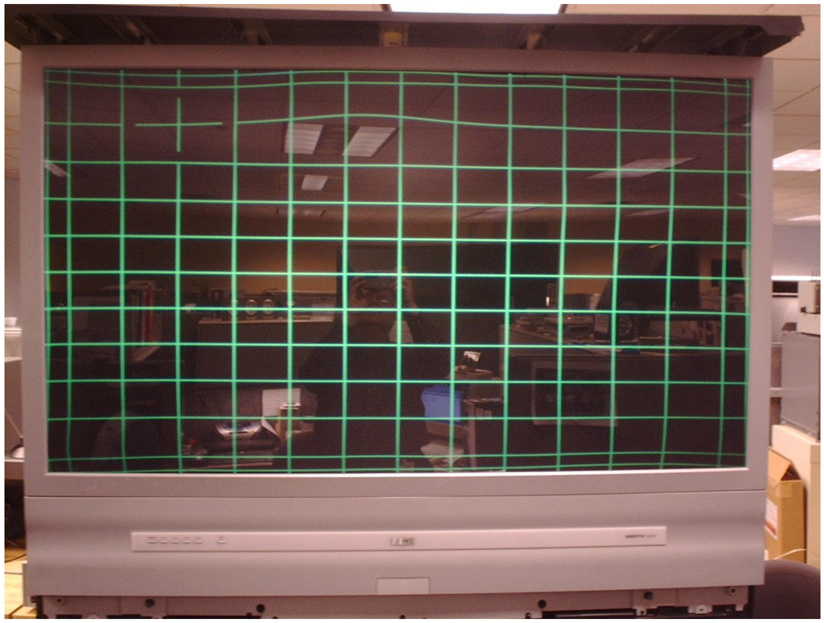
The convergence amplifier board, whether replaced as a complete module or repaired to the component level should have little affect on convergence. All convergence alignments are stored on the SSB module so only minor corrections due to individual component and circuit tolerances should be all that is required. Only Level 3 alignments will be used.

Consumer Complaint

Most consumer complaints will center on convergence errors rather than geometry. Consumer complaints of poor convergence and/or autoconvergence failure should be treated as separate issues. Geometry errors can adversely affect sensor calibration, which in turn will cause autoconvergence failure. If autoconvergence fails during the Sensor Calibration routine, suspect geometry errors, particularly if failure occurs on the first (red) sensors. If all red sensors are located properly it indicates geometry is most likely OK but gross convergence errors are causing autoconvergence failures.

Always determine from the consumer if convergence was ever acceptable. If it was, but has drifted too far off for autoconvergence to bring in successfully, carefully observe the screen before doing anything. Convergence errors, some less than 1/4", can drift in over time and may be too far out for autoconvergence to successfully return to an acceptable condition. In most cases errors of this nature may be manually returned to acceptance using FSM convergence menu. The only screen required for these types of errors is Level 3 (15 x 13). Refer to Convergence Procedures for detailed instructions on manual convergence.

If sensor calibration completes successfully and convergence is close but autoconvergence fails, suspect one or more of the outer points, those adjustment locations located outside the frame perimeter, are too far off to allow convergence to bring it in. This is the most difficult scenario as the points cannot be seen. The failure location and careful observance of the screen may provide a clue as to where the pattern is off. For example, in the next screen,



the upper mid lines are distorted upwards. In this case only green was affected so only the green adjustment pattern is required. The remainder of the pattern appears to be acceptable. By observing the pattern it can be determined it is not the third line down that is the problem. If that point is adjusted it will be found that it cannot be moved downward. That indicates the convergence amplifier has railed and no longer has the ability to push the adjustment point down. Turning attention to the lines above it, note the entire top line is distorted, with some of the lines being too close to the screen frame boundary and others too far away. Notice where the adjustment crosshair is located. That is where the distortion begins. By going two points above that location the adjustment crosshair is now off-screen. That point should be pushed upwards moving the lines closer to the frame, flattening the border lines. Moving to the right two places the adjustment point should be lowered which pushes the lines away from the frame again flattening out the border lines. Using this method pressure on the distorted third line weakens and adjustment returns.

If convergence was *never* acceptable pull up the convergence pattern and observe it for gross errors in small portions of the screen or in only one color. If errors affect only one color or are minor in appearance convergence alignment is probably all that is necessary. Refer to the Convergence Procedures section.

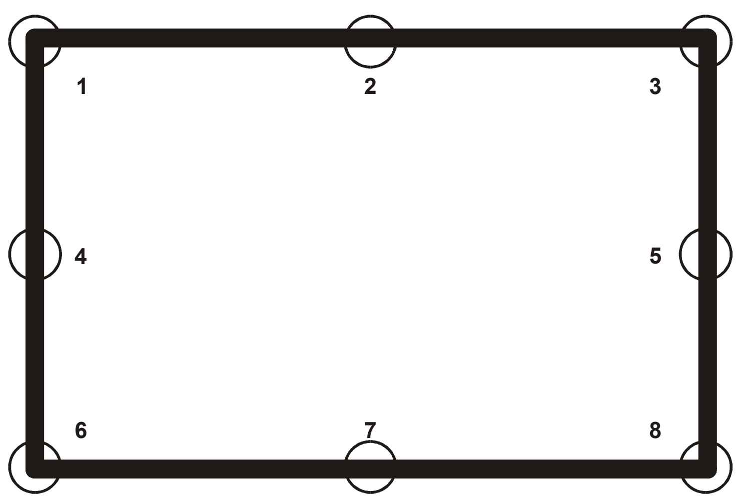
Remember there are six convergence amplifiers, one each for Green, Red and Blue horizontal, and one each for Green, Red and Blue Vertical corrections. If any one amplifier fails only one color in one direction will fail. The resulting pattern will have no convergence correction in either the horizontal or vertical direction and in only one color. The test is to determine if the alignment points can be moved. If they cannot be moved either up/down, or right/left and only one or more colors, amplifier failure is indicated. However if all three colors are affected similarly suspect convergence power supply problems or SSB failure.

Autoconvergence Failure

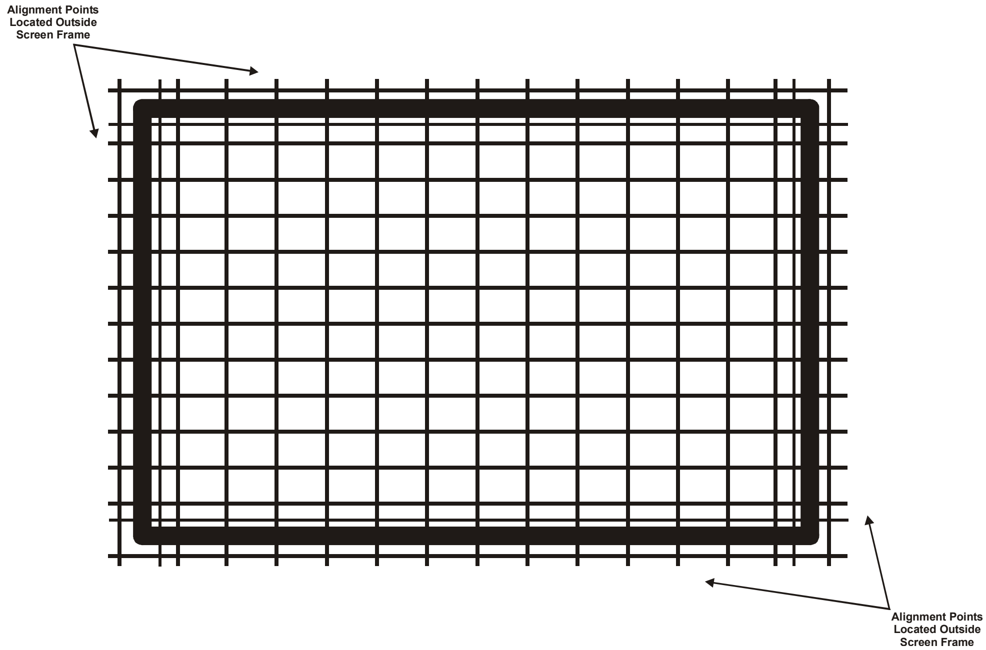
Autoconvergence failures can happen for two reasons. Autoconvergence consists of two separate routines, Sensor Calibration and Autoconvergence. When autoconvergence fails the most recent successful autoconvergence alignment values are placed back into the registers. So if autoconvergence fails during sensor calibration but convergence is otherwise very close or even acceptable, geometry misalignment is indicated. That is because during sensor calibration convergence is loaded with “neutral” values to make certain there is the least influence of convergence while the circuit is attempting to find the screen sensors. Since the sensors are actually located off-screen neutralizing convergence is the safest way to assure the sensors are found. When Sensor Calibration fails, check the Event History. If the Test results indicate “Brightness” has failed geometry is probably at fault. The geometry service menu may be used to make geometry adjustments (See Geometry Procedures).

If the sensor calibration routine completes successfully, but autoconvergence fails, then one or more convergence alignments are too far off for the autoconvergence amplifiers to correct. Once sensor calibration completes and autoconvergence begins the convergence alignment points are loaded with convergence values that are stored in the current mode EEPROM. If autoconvergence fails at this point, the values that were in RAM are reloaded so the screen will have the original appearance. The values in RAM may differ from the current mode EEPROM. Refer to Appendix D, Field Service Menu to determine how to identify the color and area convergence stops on and work on that specific area.

The ITC222 service adjustments are forgiving. In most cases it is not necessary to store adjustments immediately!!! The service menu will remember the values before adjustments began allowing the return to previous alignment values if necessary. Once alignments are verified to provide acceptable performance, always return to the geometry menu and store the new values so they become the defaults. Sensor calibration failure is also logged in the Event History screen of the service menu. It will list the sensor number and color that failed during the sensor location routine. The location of the failure is also a reasonable clue as to where the problem is. The eight screen sensors are located in order by color beginning with Red, then Blue, then Green. If there is a failure of the red color in the first attempt chances are geometry is too far off. Noting which side of the screen the sensor failed indicates which geometry adjustment should be made.

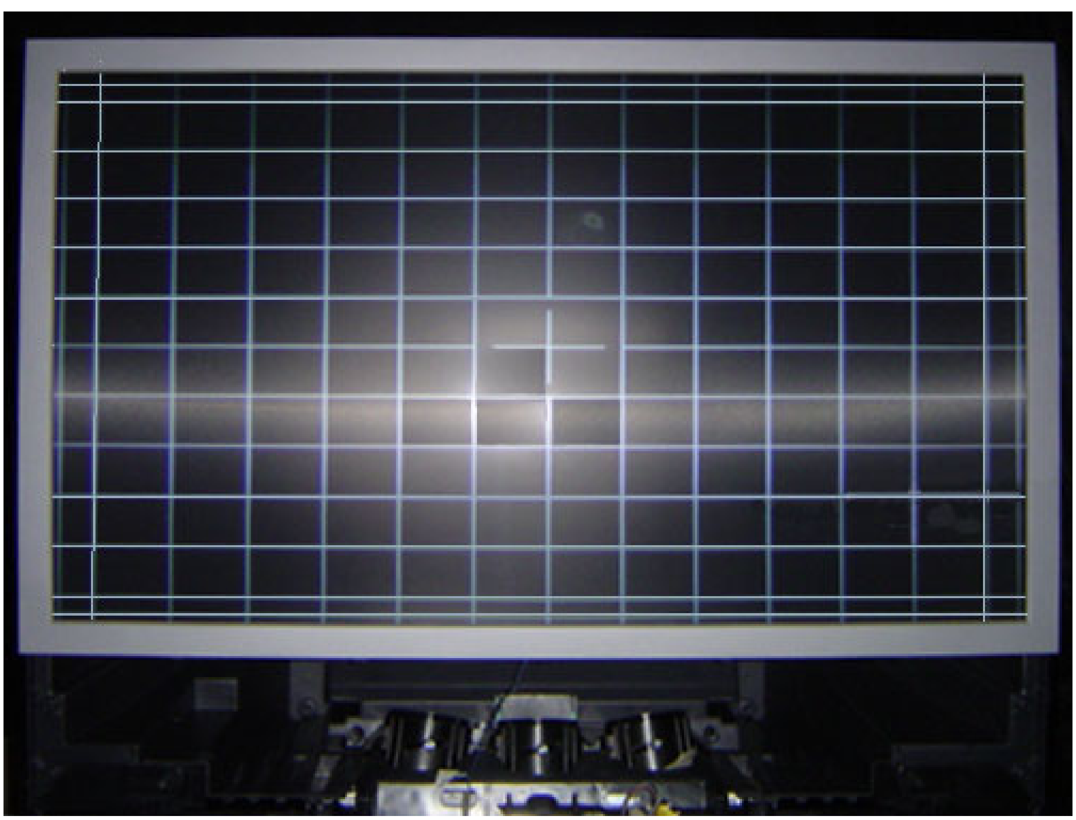


Remember there are 11 individual vertical points on each side of the screen and 13 horizontal points on the top and 15 on the bottom of the screen plus one point on each corner that are actually located “off” the screen. Those adjustments can actually drive the sensor position too far causing autoconvergence to fail. That is the relationship between geometry and convergence. Both must be successful for the complete autoconvergence routine to work.



Convergence Pattern

The object of any convergence procedure is to return convergence to the out of box alignment condition. A properly converged pattern will appear similar to the following picture of an ITC222 instrument at the end of the production facility. (Some enhancement has been done to highlight the onscreen pattern.) The display represents a properly convergence instrument and how it should look before being returned to a consumer.

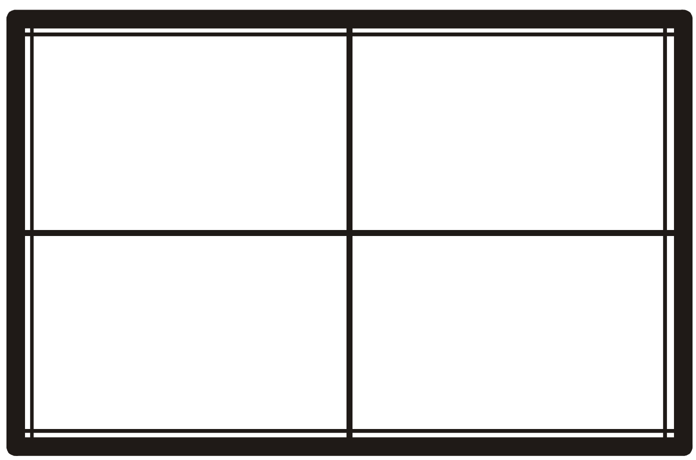


Geometry

Overview

Although a convergence pattern is available internally successful geometry alignment depends on a good external test pattern with center crosshair and outer border lines in both 2H and 2.14H scan rates. (Using the component inputs may be easier as it is the only analog input capable of both scan rates.) Alternately the component inputs may be used for the 2.14H pattern input and either the baseband or RF inputs used for 2H.

> **NOTE:** As with other Thomson chassis, the service menu will make adjustments on the scan rate that is currently onscreen. In other words if the onscreen display is 2H, when the service mode is entered all adjustments will be performed in the 2H mode. However, if the "Input" button is used to change the video input, a different scan mode could be entered. Pay attention to which scan mode is currently being adjusted and make certain that scan mode is not accidently changed.



The geometry service menu has the alignments listed in the recommended order they should be performed. There are also several that have default settings and probably not require adjustment in PTV instruments. All adjustments are listed below with their functions and default values.

Title	**Default**	**Description**
V-Slope (480 Only)	B0	Vertical Slope adjusts center value of Vert IC inputs
V-Amplitude	68	Vertical Amplitude adjusts size of vertical raster
V-Position	A0	Vertical Position adjusts the up/down position of the raster. Normally in PTV instruments this will not require adjustment.
V-Linearity	60 (Fixed)	Adjusts raster Vertical linearity. If Geometry linearity is close, this should not be adjusted.
H-Position	AC	Adjusts the right/left video location on the raster.
H-Amplitude	64	Adjusts the raster width

EW-Amplitude	AC	Adjusts the EW Amplifier strength
EW-Trap	80	Adjusts the EW tilt of the raster
EW-Symmetry	70	Adjusts the right/left sides to be equal in tilt. Used sparingly.
EW-Up Corner	A4	Adjusts the upper corners right/left location
EW-Low Corner	90	Adjusts the lower corners right/left location
H-Parallel	70	Adjusts the right/left sides to be parallel.
Breathing	A0 (Fixed)	Adjusts the effect of beam current on raster size. If excessive breathing is noted when switching from dark to light scenes, make adjustments two steps at a time until breathing is minimized. Normally in PTV instruments this will not require adjustment.

Before attempting geometry adjustments, there are several steps that must be taken.

1. Connect the proper signals to place the instrument in the desired scan mode. (Remember there are two scan modes, 480P, 2H and 1080I, 2.14H that must be aligned separately.) **480P will always be done first!!!**
2. Enter the service menu from the standby mode by pressing and holding CH DN and VOL DN for more than 8 seconds.
3. Select the proper input by pressing the "Input" button on the remote until the desired signal is onscreen or select a channel by direct accessing it via the remote control.
4. In the service menu select Convergence Adjustments, Defaults and select the R/G/B Default. This loads the default convergence alignments.
5. Return to the "Tube" menu and make certain the correct Tube Type is selected. The Tube type may be confirmed by looking at the chassis service label. The Tube Type number will appear in the format "P16LTG000RFA" where P16 is the tube size and the next three letters, in this case "LTG" signify the Tube Type that will be selected in the Tube service menu.
6. Return to the "Geometry" menu and select "Vertical Slope". The bottom half of the screen will be blanked. With a test pattern onscreen that has center crosshairs, adjust until the center horizontal line is just visible. It may be easier to block the red and blue CRTs since Green is the only important pattern at this time.
7. Store the new setting by scrolling down to the "Store" selection and pressing "OK" on the remote control.

The next steps depend on how far from nominal geometry seems to be. If the prior SSB alignments were uploaded into a replacement SSB geometry should be very close. Adjustments may be better made by using the internal convergence pattern and an external crosshair or convergence block pattern. If a CRT or main yoke has been replaced continue to the Centering Ring Adjustments. Otherwise skip to the "Horizontal Position" setup.

Centering Ring Adjustment

Centering Ring adjustment **is not** required under the following circumstances.

- If no CRT's, CRT Drivers or main yokes were changed, centering ring adjustment should not be necessary and it is highly recommended not to move or otherwise adjust them!
- If an SSB module has been replaced that may otherwise cause geometry or convergence issues, as long as a CRT or main yoke **was not changed**, the centering rings do not require adjustment!

Centering Ring adjustment may be required for the following circumstances.

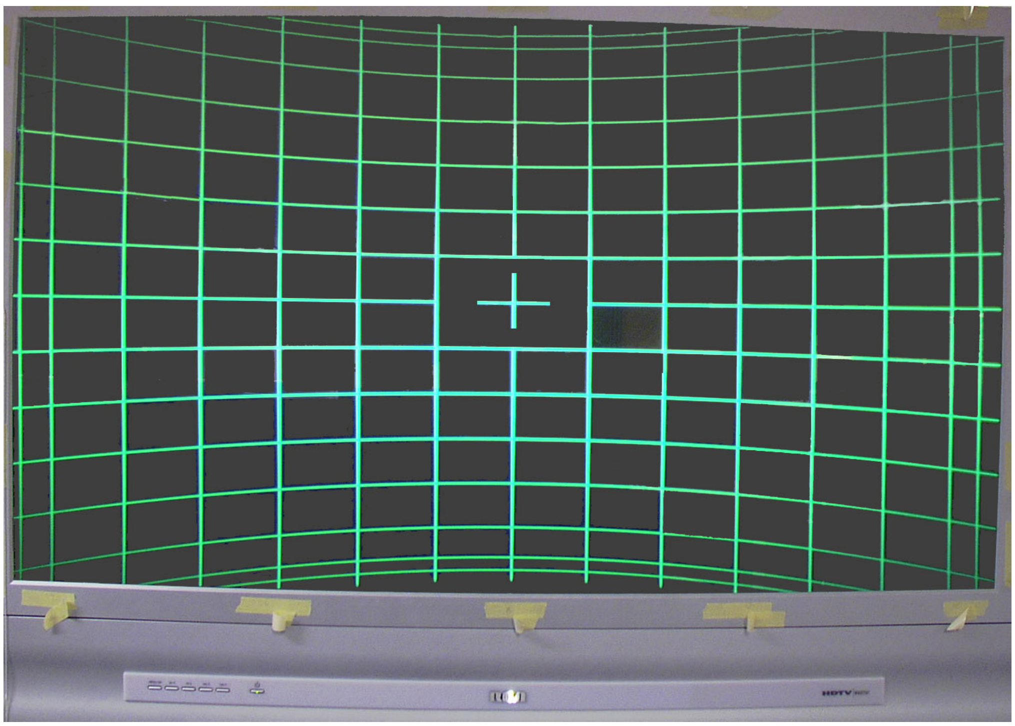
- If only one CRT, CRT Driver Board or Main Yoke was replaced use the convergence pattern and centering rings for the replacement color to align the pattern back to the patterns on the CRT's not replaced.
- If multiple CRTs, CRT driver boards or Main Yokes have been replaced Centering Ring adjustment will be required.

To begin Centering Ring adjustment disconnect the convergence amplifiers from the convergence yoke (connector BW001/002) thereby providing a pattern free from convergence influence for the next steps.

1. Connect the proper signals to provide sync to the instrument. Centering Ring alignment is not dependant on the deflection frequency but the pattern generator needs sync to provide a stable display.
2. Enter the service menu from the standby mode by pressing and holding CH DN and VOL DN for more than 8 seconds.
3. Select the proper input by pressing the "Input" button on the remote until the desired signal is onscreen or select a channel by direct access via the remote control.
4. In the service menu select and enter the Convergence menu. Select the Level 3 (15X13) adjustment menu and press OK. Then enter the pattern by selecting "Alignment Mode" and again press OK. This brings up the convergence pattern which makes an excellent reference for geometry related adjustments.
5. Toggle through the patterns by pressing "OK" until all three colors are visible. The color patterns will be offset from each other with Green being closest to exact center. The following steps depend on the repair. Always align a replacement CRT or yoke to the ones not replaced!
6. If Green was replaced, use the centering rings on the green CRT to place the center crosshair of the convergence pattern in the center of the screen both horizontally and vertically. (If Green was not replaced, do not move it! Align the red or blue CRT pattern to the green.)
7. If red or blue was replaced adjust the Red and Blue crosshair such that the center horizontal lines lay exactly on top of the green center line. Adjust the Red crosshair such that the center vertical line is to the left of the Green or the Blue crosshair such that the center vertical line is to the right of the Green. Use the following table to determine how far right or left the lines should be.

Screen Size	Red Center Line Set Left of Green by:	Blue Center Line Set Right of Green by:
40"	1"	1"
52"	1 1/4"	1 1/4"
56"	1 5/16"	1 5/16"
61"	1 3/8"	1 3/8"

The final pattern will appear similar to the next graphic:



This completes the Centering Ring setup. Exit the Field Service Menu, turn the set off and reconnect the convergence amplifiers. Turn the set back on, enter the service menu and proceed to the "Horizontal Position" alignment.

Horizontal Position

Enter the Geometry Menu and select "Horizontal Position". With a standard crosshair pattern onscreen, adjust horizontal position to place the vertical crosshair in the center of the screen.

Neither Vertical Slope, Horizontal Position or the centering rings should be adjusted again regardless of other changes to convergence or geometry!!! Horizontal Position may require additional alignment but only after all other convergence and geometry alignments are completed.

Geometry Alignment

Once preliminary geometry setup and/or Centering Ring adjustments have been completed, geometry alignment may proceed. Geometry alignment, while not being critical must be reasonably close to the final convergence pattern. The two main purposes of geometry alignment in the ITC222 are to assure the convergence amplifiers are not overworked and to provide a reference for the sensor calibration routine. A diagram of the final geometry pattern appearance ***without*** convergence correction is shown below. Note that although the pattern is shown above the frame, it cannot be seen during the alignments. It is shown below simply as a reference to how the pattern would actually appear if no convergence corrections are available. The important alignment points are circled and refer to the third vertical line outward from the center line. That point should "bump" the frame very closely as shown. Remember that while the pattern may not exactly match the one below, it should appear very similar.

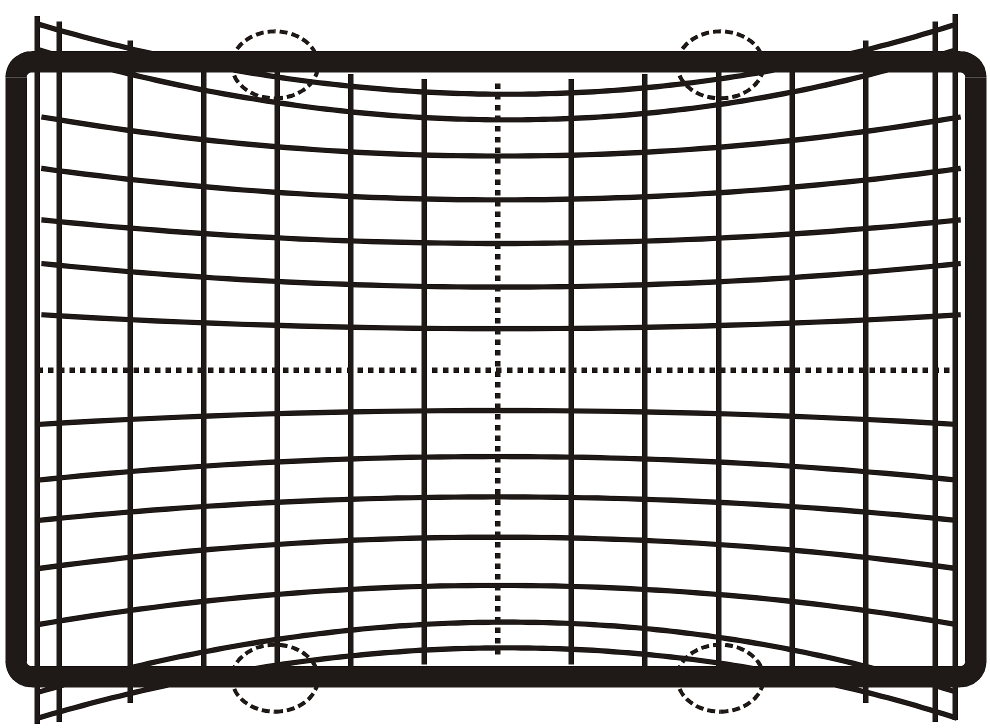
Geometry (and later convergence) procedures are simplified if the initial adjustments are done without convergence correction. All geometry adjustments can be properly setup using a pattern without convergence correction. But to finalize Linearity and EW corrections it is best to reconnect the convergence yokes then bounce back and forth between the geometry menu with an external pattern to perform adjustments, and the convergence menu with the internal convergence pattern to view the results. After geometry adjustments are completed and the convergence yokes are reconnected it is best not to make further adjustments on the following alignments:

Vertical Amplitude,

Vertical Position,

Horizontal Amplitude.

Small changes may still be required on the other geometry adjustments however they should be very minor. Also remember that Horizontal Position should not be adjusted until all geometry and convergence alignments are completed.



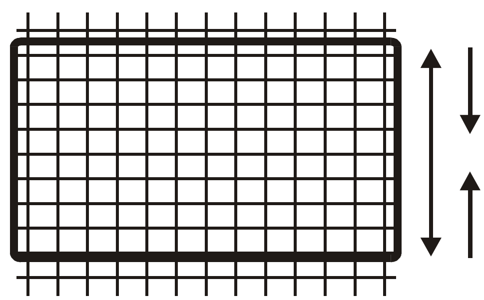
Geometry Controls

Once all preliminary setups and alignments are complete use the template shown to guide geometry alignments. The Field Service Menu has alignments in a specific order which should be followed the first time through any geometry setup particularly after an SSB module replacement. Once all adjustments have been made in order at least once, further corrections performed in random order are acceptable. The first settings should also be done with the convergence yokes unplugged so that only geometry corrections are affecting the raster. Once the pattern appears correct, the convergence yokes can be reconnected.

The following illustrations demonstrate the effect of each geometry adjustment on the raster. Keep in mind the proper way to adjust geometry in the ITC222 is to make small adjustments using a test pattern with known centerlines and outer boundaries, but always doing critical observance by returning to the internal convergence pattern.

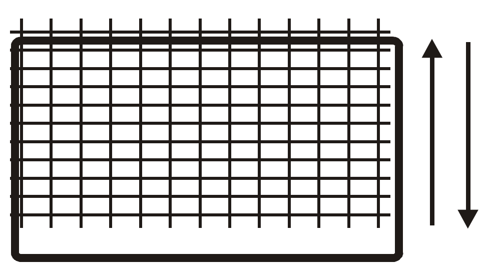
V-Slope — Vertical Slope adjusts the center value of the Vertical IC inputs. It has been previously set and should not be changed at this point.

V-Amplitude — Vertical Amplitude adjusts the height of the vertical raster. As previously described when the convergence yokes are disconnected it is set such that the third vertical lines from the centerline are just touching the frame.



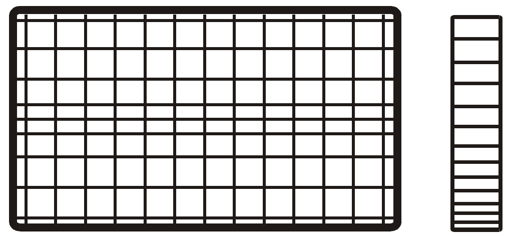
Vertical Amplitude

V-Position — Vertical Position adjusts the up/down position of the raster. It is adjusted to center the vertical raster from top to bottom. It is acceptable to return to Vertical Amplitude if required.



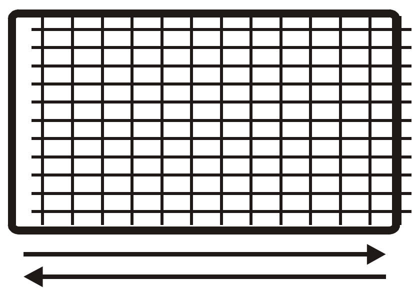
Vertical Position

V-Linearity Adjusts raster Vertical linearity. Caution! Changing linearity too much also affects vertical position. If linearity is close, this should not be adjusted! If it is not, monitor vertical position and amplitude carefully making certain the vertical size is still correct and location is centered.



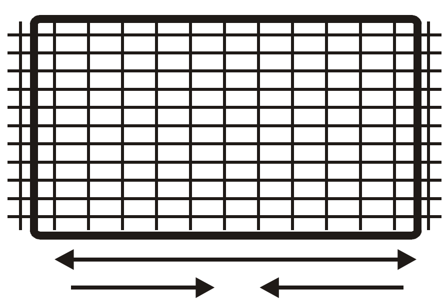
Vertical Linearity

H-Position Adjusts the right/left video location on the raster. Since this affects video rather than raster, it should not be adjusted until geometry and convergence are completed.



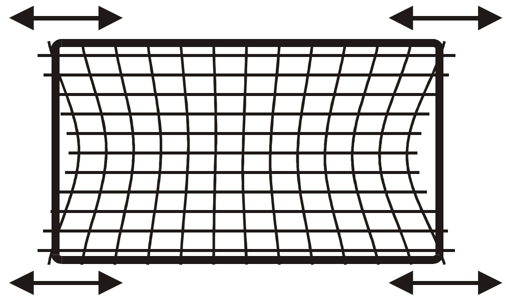
Horizontal Position

H-Amplitude Adjusts the raster width. Refer to the example screen. The outermost pattern lines should be about 1/2" from the frame. If the raster cannot be perfectly centered it should always be closer to the left than the right.



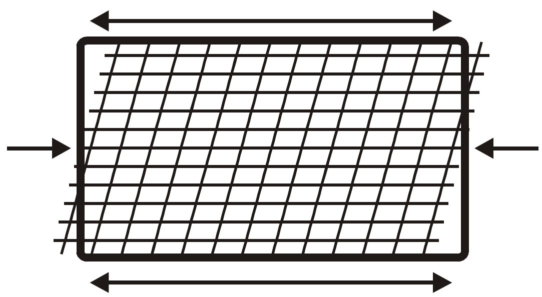
Horizontal Amplitude

EW-Amplitude Adjusts the EW Amplifier strength. Monitor the corners of the pattern to provide equal amplitude on the top and bottom.



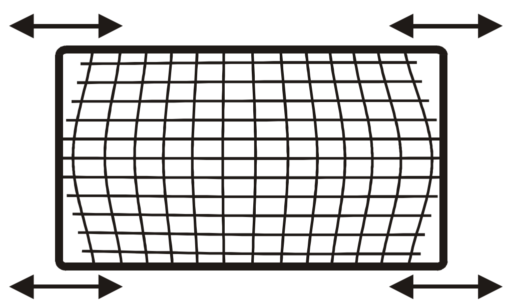
EW Amplitude

EW-Trap Adjusts the EW tilt of the raster. Adjust for raster appearance closest to the template.



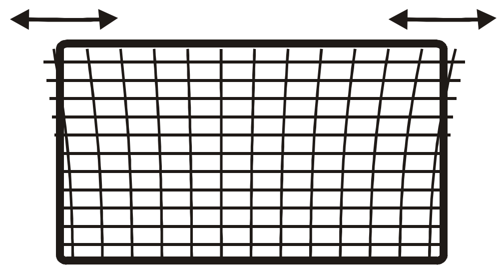
EW Trap

EW-Symmetry Adjusts the right/left sides to be equal in tilt. Adjust for raster appearance closest to the example.



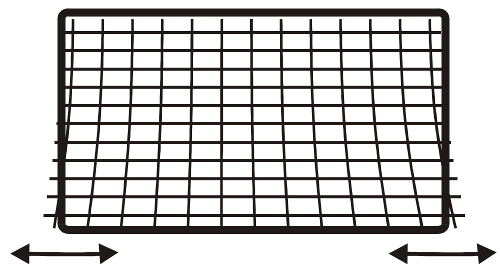
EW Symmetry

EW-Up Corner Adjusts the upper corners right/left location. Adjust for raster appearance closest to the template. Typically this adjustment will not be changed from default.



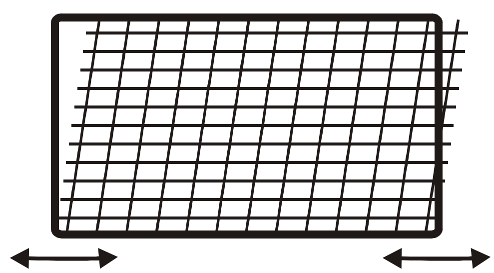
EW Upper Corners

EW-Low Corner Adjusts the lower corners right/left location. Adjust for raster appearance closest to the template. Typically this adjustment will not be changed from default.



EW Lower Corners

H-Parallel Adjusts the right/left sides to be parallel. Adjust for raster appearance closest to the template.



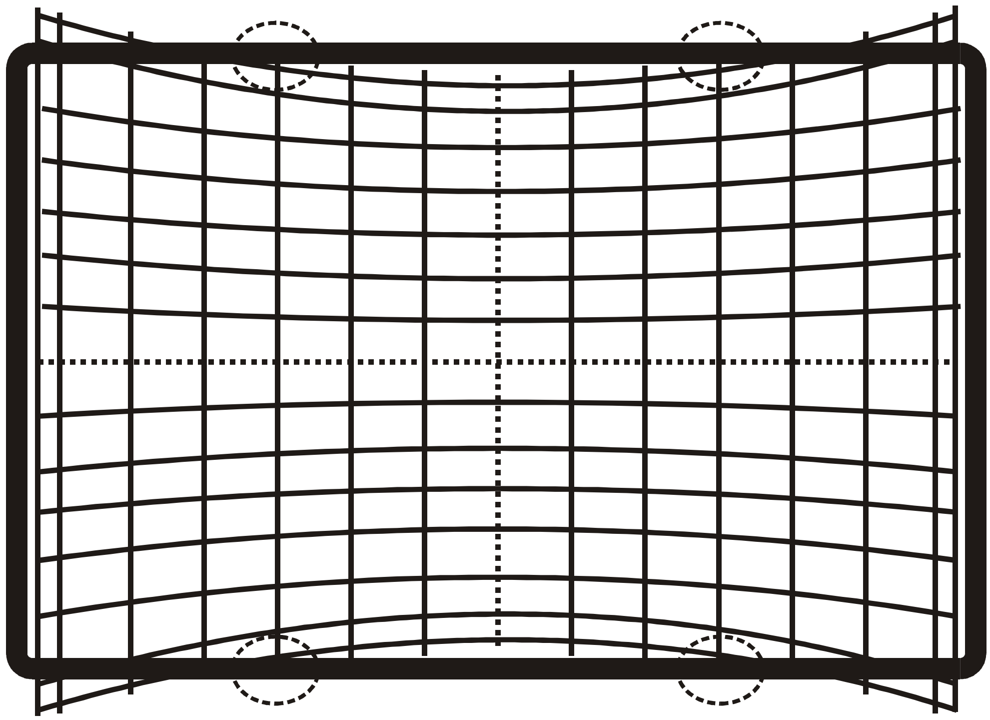
H Parallel

Breathing Adjusts the effect of beam current on raster size. If excessive breathing is noted when switching from dark to light scenes, make adjustments two steps at a time until breathing is minimized. Normally in PTV instruments this will not require adjustment.

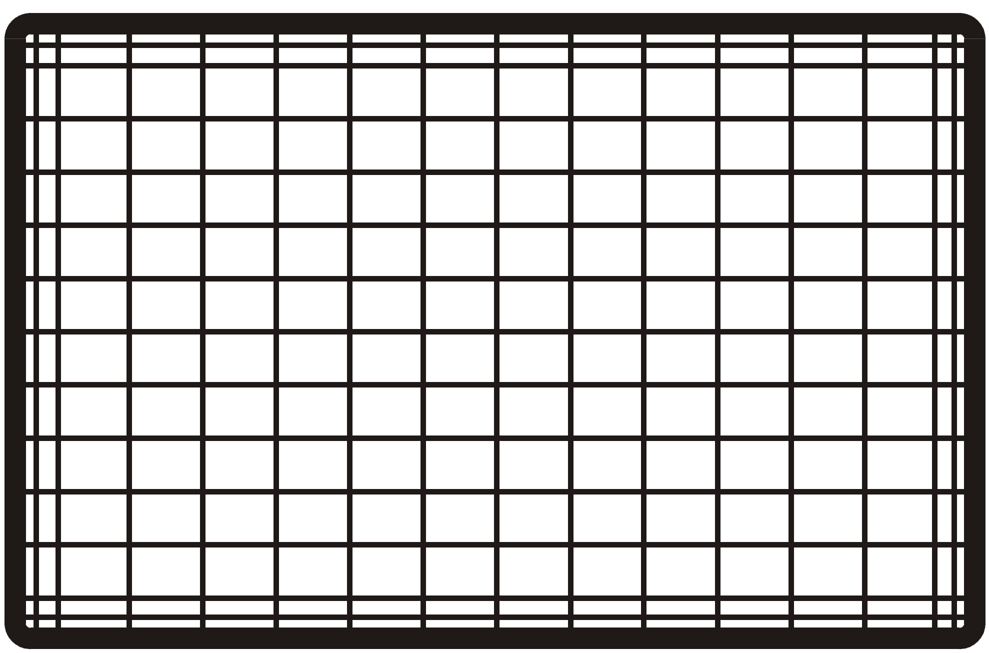
Geometry Templates

The following diagrams show a pattern as it should appear correctly adjusted for geometry. Remember that geometry cannot create a perfect pattern, but aligning the pattern to appear similar to the patterns shown will allow sensor calibration and autoconvergence to operate properly and efficiently.

Of course the second pattern will not instantly appear when the convergence yokes are reconnected. It is the result of both correct geometry and convergence alignments.



Geometry Template without Convergence



Geometry Template with Convergence

Convergence

Manual Convergence Procedures

Once it is determined autoconvergence cannot return the screen to acceptable convergence, manual convergence must be done. There are 195 manual convergence alignment points. There are three convergence alignment routines meant to cover different convergence scenarios. The first two levels are meant to reduce setup time and use microprocessor algorithms to decide where most of the alignment points should be based where the technician places a few. The three levels and their functions are:

Level 1 (3x3): Has only 9 adjustment points and does not allow Green adjustments assuming the green convergence alignment is the template. Used to make very course adjustments when either red or blue convergence has been catastrophically disturbed. In most instances, this screen should not be used.

Level 2 (5x5): Has 25 adjustments points in all three colors. This is normally the first level used after catastrophic failure causes SSB or CRT replacement. Level 2 uses algorithms to interpolate where the 170 points that lie between the 25 manual adjustment points should be located. If no previous patterns or the templates are available this will be the starting level as it sets linearity and raster size for the technician. If the SSB values of the original board were transferred to the replacement SSB, the technician should use only Level 3. If they have not, this will be the first screen used. If at least one CRT convergence has not been disturbed this screen may be used to quickly bring the remaining convergence patterns close. Level 2 adjustments will never return convergence to consumer acceptable appearance but may reduce the total setup time required for convergence.

Level 3 (15x13): This is the "fine-tuning" mechanism for convergence. Each alignment point is adjustable and all three colors are accessible allowing a technician to go directly to problem areas and perform specific alignments. If a mylar pattern is available this is the only level required.

Remote Control Button Assignments

Appendix B, Field Service Menu, details the remote control button assignments for most of the service menus. In addition there are various other remote control buttons that enable convergence alignments. Most buttons are global having the same function on each Level. There are a few that are different and will be noted.

Global Button Assignments

There are several buttons that perform the same functions in all alignment levels. The navigation buttons always move the alignment point, right/left/up/down. To change the alignment location in level 3 use the 2/4/6/8 buttons. In Level 1 & 2, use only the 2 button. It toggles the alignment point through a specific pattern required by the convergence program to not only set alignment points that occur between the reduced number of alignment points, but also allows the convergence program to determine horizontal and vertical linearity and size with some precision.

The "Clear" button takes the alignment back one screen returning the technician to the previous service screen. "OK" initiates the highlighted command in the text screens, and toggles the alignment color in the alignment screens.

Convergence Template Design

The convergence pattern is developed on specific formulas intended to provide consistent linearity and uniformity from one instrument and screen size to the next. The best template to return an instrument to factory appearance is the internally generated patterns. If an original pattern is not available because all three CRT's must be changed or the SSB module must be replaced without the benefit of saving the original convergence EEPROM data, then an external template must be provided for the technician to place the instrument back to manufacturing specification.

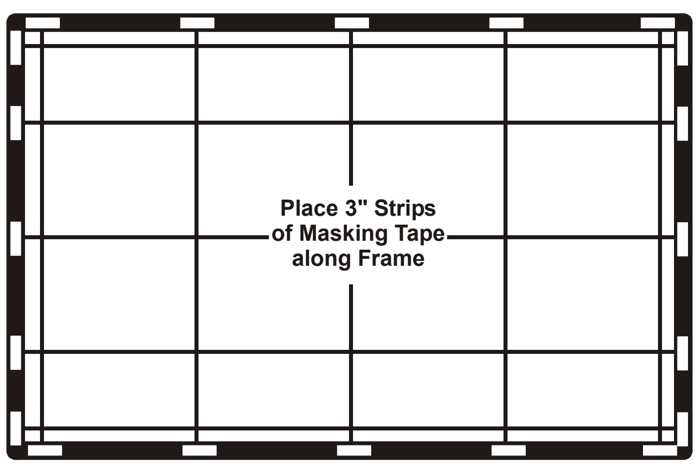
There are two types of templates available for reconverging the ITC222 instrument line; mylar and string. Part number MTITC222 contains individual mylar templates for the four common screen sizes, 40", 52", 56" and 61". The kit is available for purchase on the TSN website, <http://www.thomsonnetwork.com>.

The templates are fixed to the inside of the screen frame and provide a full convergence pattern. Typically only Level 3, 15x13 alignments are required when this template is available as raster size, linearity and position are set by matching the onscreen pattern to the template.

If the mylar templates are unavailable a simple string pattern may be used. Using a few strings, math, a measuring device, masking tape, carpenters string and a formula, an accurate template may be easily made. Using the 5x5 Level 2 convergence points, algorithms in the convergence microprocessor will roughly locate most convergence points setting both raster size, position and linearity very closely. Then using the 15x13 Level 3 adjustment convergence can be dialed in more precisely. Remember the 5x5 menu is only meant as a "course" alignment however making several full rounds will locate the convergence points closer and closer reducing the time required for the more labor intense 15x13 alignments.

Cautions

Do not place marks on the frame to locate the strings. Begin by placing 3" strips of masking tape at the approximate frame locations shown. Mark the measurement points in pencil on the tape rather than directly on the frame.

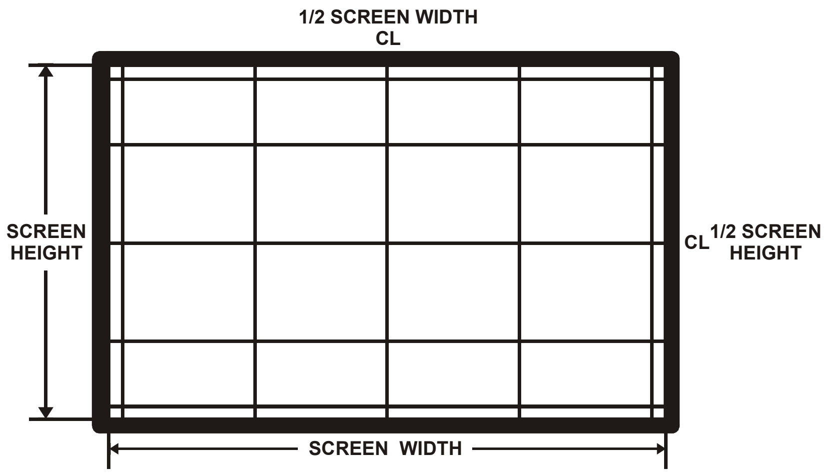


The strings may now be stretched over the pencil mark for accuracy. Once the string has been properly located, fix its position by placing another piece of tape over it. (A second piece of tape on the side of the frame may help hold string tension better.) The final string template will appear similar to the above example.

Centerline

The string template is based on knowing the precise location of the vertical and horizontal centerlines. There are two ways to accurately determine those locations. First the convergence sensors may be located on the inside of the screen frame and a mark placed on the outer frame at the location of the photosensor center. The photosensors are visible from the outside. The center of the photosensor appears as a channel in the mounting bracket. Since the sensor calibration routine relies on these sensors it is the most accurate way to locate the center lines.

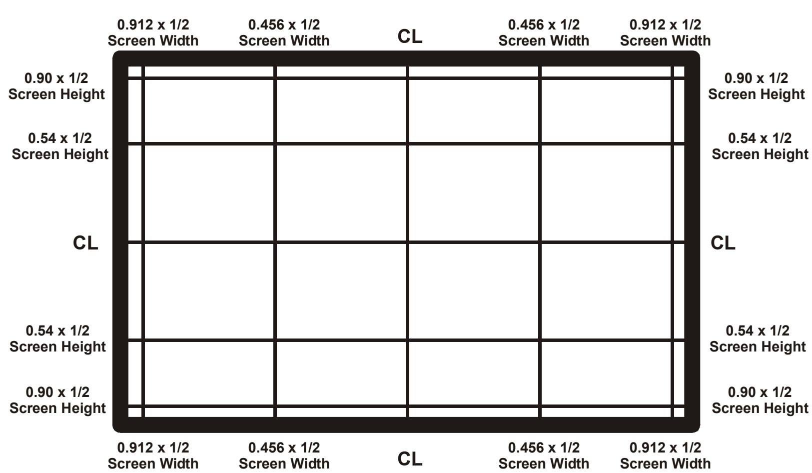
Alternately the full distance between the right/left and top/bottom screen frames may be measured. Use the inside of the frames, corresponding to only the visible area of the screen for this measurement! Dividing those values in half gives the distance from any inside frame to the center lines.



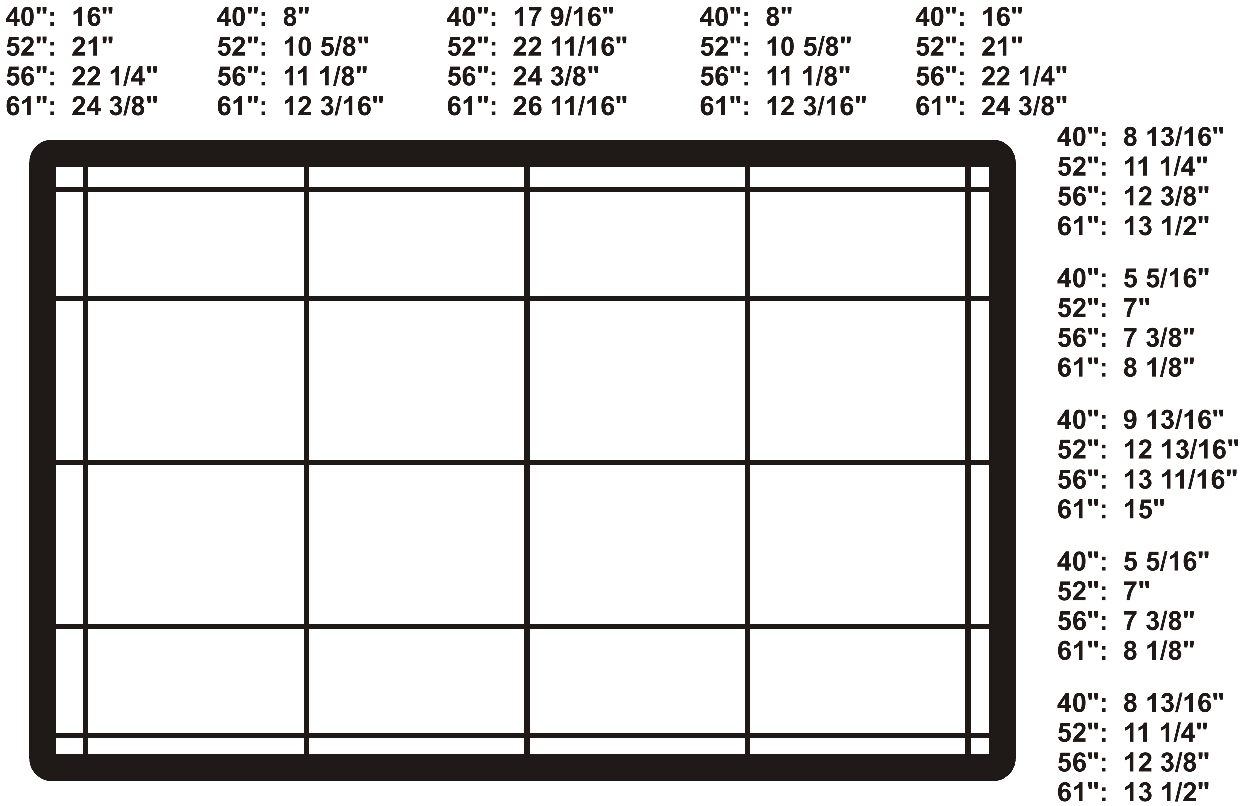
The centerlines should be marked and the first two strings representing the exact centerlines of the visible picture area, placed on the screen. All further measurements will be calculated in relation to these centerlines so their accuracy is important.

String Calculations

The remainder of the strings are measured away from the horizontal and vertical centerline. Those measurements are the result of a precise formula shown in the following graphic.



The formula is the same for all screen sizes and is a constant ratio of screen width to screen height. The following table shows the measurements for the 40”, 52”, 56” and 61” screen sizes. Any future additional screen sizes based on the ITC222 may be calculated using the previous formula.



Horizontal & Vertical Strings

Horizontal strings actually measure the vertical dimensions. Vertical strings measure the horizontal dimensions. Do not confuse the dimensions. The middle dimensions are for the CL and are 1/2 the full screen width or height. Due to screen frame variations, use the dimensions from your own measurements to string the centerlines! ***The other dimensions are measurements away from the center lines!*** Once the tape strips are marked in the proper places, simply cut strings and drape them between the marks on the frame and secure them with additional masking tape. The final template should appear similar to the diagram.

Level 2 Convergence Alignment

Remember all geometry alignment must be done prior to any convergence procedures. Level 2 is the highest level of adjustment recommended and should be used to speed up convergence procedures when all three colors must be redone due to SSB module replacement or if all three CRT’s must be replaced. Using the string template and placing the level 2 alignment points at the exact centers of the string intersections, horizontal and vertical linearity and uniformity for points between the template intersections will be calculated by the convergence microprocessor. The Level 2 pattern only provides the 25 points shown. Pressing the “2” button on the remote control moves the alignment position in a specific order around the grid. All 195 alignment points are adjusted by the microprocessor in relation to each other as the cursor moves to the next point. Therefore when moving one of the 25 alignment points in Level 2, if there needs to be more than 1/2” of movement it is good practice to only move the point about 1/2 of the necessary distance on the first pass. That will increase the accuracy of the interpolation being done by the microprocessor. It is recommended when making adjustments the technician assume at least three full passes around the screen are required to bring the pattern into a position for the final alignment in the Level 3 mode. Occasionally the interpolation routine makes errors in judgement. Be patient. Continue going through the alignment routine until there appear to be no further improvements. At that point, go to the Level 3 alignments for final adjustments. Always begin with green and complete one color before going to the next. This assures a better template for comparison as convergence proceeds.

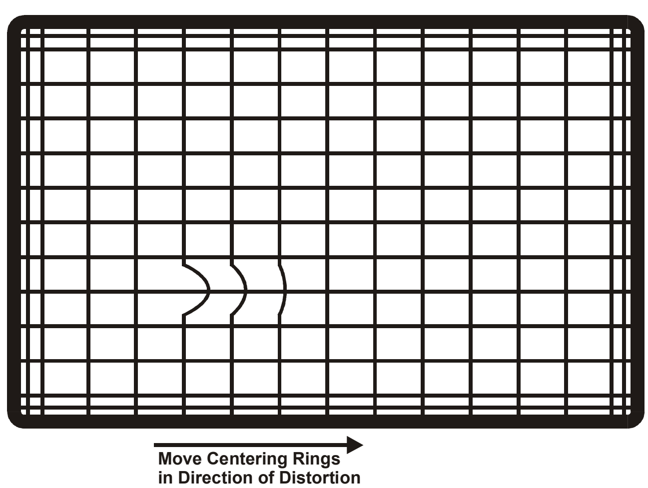
Level 3 Convergence Alignment

Level 3 is the "fine tuning" mechanism for convergence. All 195 points are adjustable in all three colors. There are no algorithms performed by the microprocessor however there are limits to the adjustments.

The first limitation is that no two points can be closer together than geometrically allowed. If a point moves too close to an adjacent adjustment, the adjacent adjustment will also begin moving in an attempt to maintain the proper distance. If this is observed cease moving the point and find out why the points are too close together. It may be necessary to go to the alignment point being affected or even the next further point and relocate it. (See Hints & Tricks later in this manual.)

The second limitation is on the outermost DAC adjustment values. The DAC's have a full adjustment range of 255 steps designated differentially from 127-0-127. However the outermost 10% DAC range is limited reducing the effective range to around 110-0-110 or less depending on the location of the adjustment. The 5x5 Level 2 adjustment range does not have this limitation on itself but does prevent manual adjustment at the alignment points if the DAC is in the restricted zone. In some cases if a Level 2 microprocessor adjustment left a DAC in that zone, the technician may not be able to move it in the Level 3 adjustment. If there are several points that cannot be moved in the Level 3 adjustments it indicates either the template is incorrect and several points are not spaced correctly, or geometry could be misadjusted just to the point sensor calibration works, but convergence is working too hard to provide a proper screen pattern. See Hints & Tricks later in this section to correct the issue.

Another limitation is in the amplifiers themselves. If they must utilize excessive correction current to bring an alignment to the proper grid point they may simply run out of power. That generally appears similar to the following graphic.



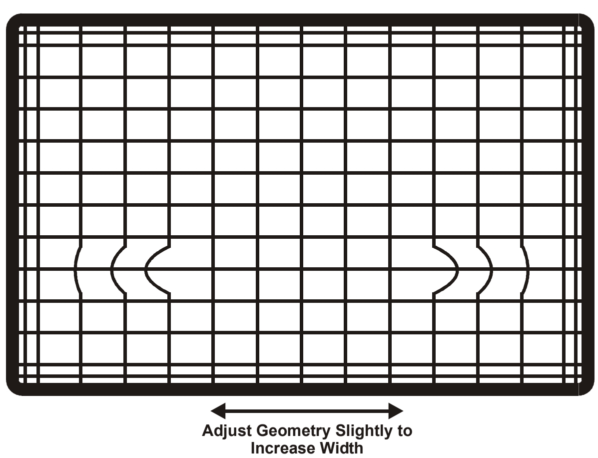
The amplifier has reached maximum deflection current causing the distinct plateau effect. The proper adjustment location will probably never be reached however the flattened pattern may provide clues as to how to correct the issue without completely redoing geometry and convergence.

If the flattened side of the adjustment is to the right, one of two things is occurring. First, geometry may be misadjusted too far to the left. Chances are other adjustments will also rail in that direction. It may take some experimentation but using the centering rings move the entire raster for that color to the right about 1/2". This of course will probably require complete reconvergence of the red raster, however it should resolve the railed adjustment. If the flattened side is on the left geometry is probably too far to the right. The same occurs with the up/down alignments. If the flattened side is on the top, the raster for that color is too far down. If it is on the bottom, the raster is too far up. Use the centering rings to move the entire raster up or down about 1/2". The rule of thumb is to move the raster the ***same direction*** as the flat part of the pattern. And always remember that if this is occurring in only one color, DO NOT ADJUST GEOMETRY!!! Geometry will affect all three colors equally possibly causing the need for readjustment of the other two colors. Carefully use the centering ring for the affected color for readjustments.

Always recheck sensor calibration any time geometry or the centering rings are changed for any reason. If sensor calibration fails after moving the centering rings, compromise the original movement until it completes successfully once again. Once the amplifiers regain additional range, convergence may proceed. The same procedure may be used regardless of whether more than one flattened area is noted as long as the flattened patterns are in the same direction.

If a flattened area occurs in different directions, correction becomes complex and problems in the original geometry setup are indicated. That is because the centering ring trick may be used successfully for only one CRT and one direction at a time. However if flattened areas go in different directions, raster size problems are indicated and global geometry adjustments must be used. Those adjustments affect all three colors exactly the same amount and at the same time.

For example if the flattened areas are on different sides of the centerline and point away from the centerline the raster is too narrow. But using the horizontal width control to increase the width also increases the width of the two colors that may not be experiencing the same issue. Care must be taken to change the width enough to gain adjustment headroom without causing sensor calibration to fail. Conversely if the patterns flatten to the inside towards the center line the raster is too wide. Horizontal width must be decreased.



The same is true if patterns are flat either side of the horizontal center line. If they point to each other, vertical size is too tall. If they point away from the center line vertical size is too narrow.

Convergence Specific Functions

One pattern is available for convergence but the number of alignment points are determined by which level is entered. The following table shows the number of alignment points and pattern color available during manual convergence. Both are determined by the Level entered. When in a Level 1, 2 or 3 of the Convergence Menu the OK button toggles through the pattern color as noted below.

Grid Display	Color Adjusted	Level 1 3x3	Level 2 5x5	Level 3 15x13
Red/Green	Red	1	1	1
Blue/Green	Blue	2	2	2
Green	Green		3	3
Red/Blue/Green	Green		4	4

Notice Level 1 is limited to Red and Blue adjustment only. The OK button toggles back and forth between the two. Again, the Level 1 adjustments are not recommended for any field service circumstances!

Level 2 and Level 3 add two patterns. A full green grid allows course adjustment of the green pattern in Level 2 and fine tuning in Level 3. There is also a full grid with all three colors available. The three color pattern allows all three colors to be easily compared to each other. In the three color pattern only green is adjustable. The OK button toggles through the colors as shown in the table.

Convergence EEPROM

EEPROMs are not fast devices. Therefore during normal chassis operation (including service mode) all EEPROM convergence data is downloaded to the convergence RAM for use. Any changes that are made by the technician during alignment efforts are done in RAM. The EEPROM values are not changed until they are “stored’ by the technician. They will stay in RAM until AC power is removed from the instrument or the next Autoconvergence is done.

If a technician converges an instrument but forgets to store it into EEPROM, the next time power is removed or the consumer accesses and runs autoconvergence, convergence will return to its state prior to the technician alignment efforts. Always Store alignments after any convergence efforts!!!

Hints & Tricks

There are a few shortcuts and other hints for the convergence procedures. Following are some suggestions for reducing convergence time, enhancing convergence capability and providing more accurate alignment.

Collapse Geometry

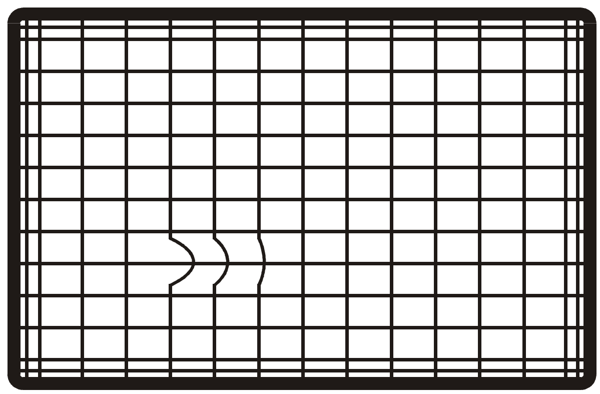
Occasionally convergence is so far off the pattern may wrap around itself. That makes it difficult for even the Level 2 procedure to return a pattern to acceptable convergence. If the edges are too far off, go back to geometry, note the settings, then collapse horizontal and vertical size enough to view the overscan convergence points. Then return to Level 3 Convergence and move the alignment points to their proper location. Go to only those points that appear to be wrapped or otherwise distorted and straighten them. At this point ignore proper convergence. Just make certain the points are not wrapped around each other. In the following picture the very top alignment point, which should normally not be visible, has actually moved below the alignment point next to the frame.

Unfortunately, once this method is used, Level 2 cannot be used again. All further alignments will be limited to Level 3. If the wraparound phenomena is observed, continue with Level 2 alignments until all other areas of the pattern appear as good as possible. Then collapse geometry and proceed to Level 3, straighten out the wraparound, return geometry to its original settings, then continue with convergence adjustment using only Level 3.

Convergence Adjustment Rails

At some point if geometry is not quite correct or the convergence amplifiers are working too hard for other reasons, convergence may seem to run out of movement. Since the vertical amplifiers do not work as hard as the horizontal amps, yet have the same capability it is rare they will rail. But in either case, horizontal or vertical adjustment railing, the solution is not simple. One of several things may be occurring.

First, as noted previously, convergence points may be too close together. If an alignment point is too close to an adjacent alignment point, it will typically push the adjacent point away in an attempt to maintain the proper distance. But if the adjacent point is already railed the current alignment point will stop movement in that direction. It may still move the other three directions but will cease movement in the direction of the railed alignment point.



There is also a possibility that DAC alignment values are changing although the amplifiers themselves cannot move the alignment point. The microprocessor changes the alignment points by readjusting the register values in the DAC based on its own algorithm. It really doesn't know exactly where the points are, except for the 8 sensor locations. In cases where the alignment point doesn't seem to be moving in Level 2, move to the next point. If pattern realignment is noticed continue with alignments. The alignments will probably correct themselves normally and full control will return. If the pattern does not seem to move then the DAC's have run out of range. Most likely geometry is misadjusted. Place the default values back into the convergence points and return to Geometry for realignment.

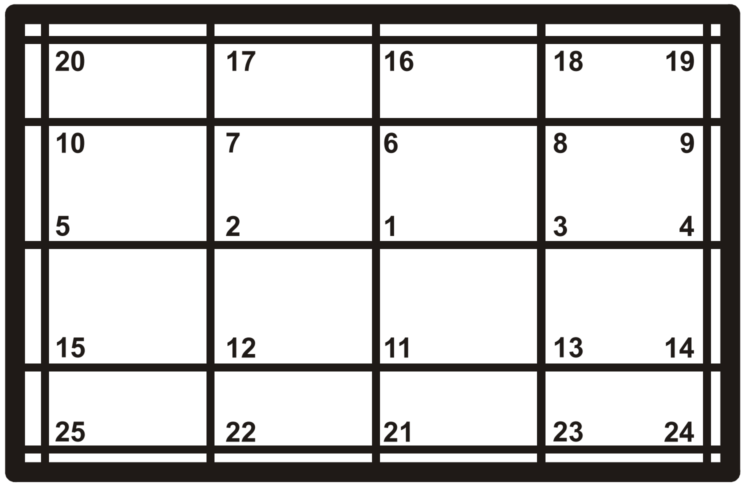
In other cases where only one or two "humps" are noticed, use Level 3 alignments and go to the last noticeable "hump". Move it towards correct alignment but only about half of what is required to place it in perfect alignment. Then move to the next "hump" correcting it about half as much as needed, then to the third again correcting it by half. Return to the third line and correct it fully, then move to the next correcting it about half, then the third and correct it by half. Return to the second hump and correct it fully, then correct the third. This "walking" method of ironing out humps such as this may be used at any opportunity.

Good Convergence-Autoconvergence failure on Sensor 0 or Sensor 2

In most cases if the convergence pattern looks good and geometry is thought to be acceptable, sensor calibration may still fail at either Sensor 0 or Sensor 2 (the middle sensor) vertical size should be suspected. Go back to Geometry and increase vertical size by one or two DAC settings then rerun sensor calibration. Most times sensor calibration will now be successful although it is possible minor readjustment of convergence may be required.

Alignment Route

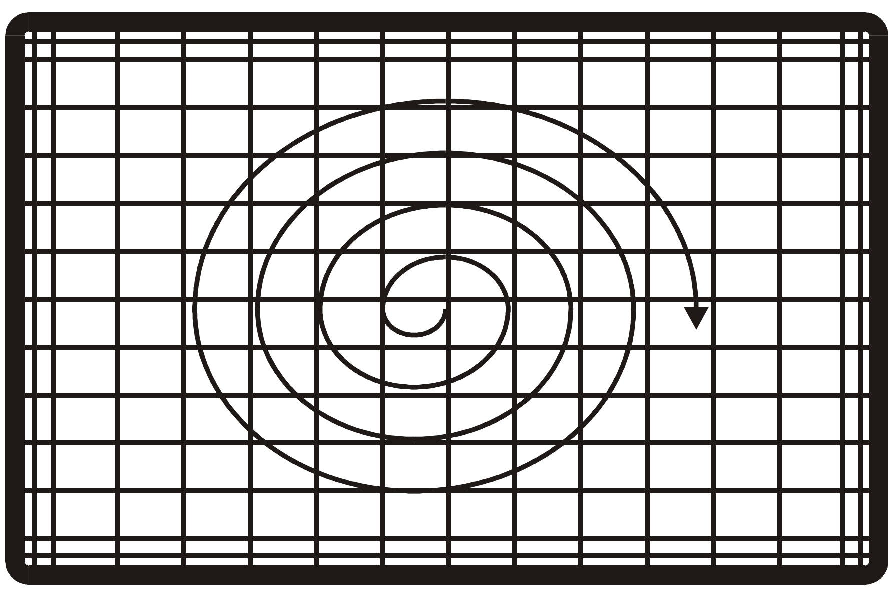
In Level 2 adjustments a specific route is mandatory as shown in the next diagram.



Level 3 has no restrictions on either direction or which alignment points may be adjusted. There is also very little restriction on how much adjustment is available. But for the same reason a definite route is followed in Level 2, a consistent route should be followed in Level 3. In extreme instances there may be interaction between the points. Following a route that "irons out" alignments following a spiral pattern from interior to exterior (shown below) tends to minimize cross-influence of the alignment values. Always line up the center crosshair points first, the begin the spiral pattern.

Off-Screen Alignment Points

Remember there are 52 alignment points (13 across the top, 13 across the bottom, 11 down the right, 11 down the left, and one on each of the four corners) located outside the screen frame where they cannot be seen yet are adjustable. Their influence can be noted by the position of the lines trailing off screen. All 52 may be moved in the horizontal and vertical directions the same as the onscreen alignment points. Use the points wisely. If they are too far from the correct locations, sensor calibration and thus autoconvergence will fail.



Begin in Center Moving Outward Clockwise

Appendix A

Chipper Check & the ITC222

Chipper Check performs one extremely important function in the ITC222 chassis line. It has the ability to download critical geometry and convergence information and alignment data from one SSB module and transfer them to another without affecting SSB related adjustments such as tuner, IF and audio alignments. That gives the technician a better starting point for time-consuming alignments such as convergence. Although it would be rare to transfer settings from the original SSB module to a replacement module and not have to perform any convergence or geometry alignments at all, transferring previous alignment data can cut most alignment time by greater than 50%.

SSB EEPROM Data Replacement

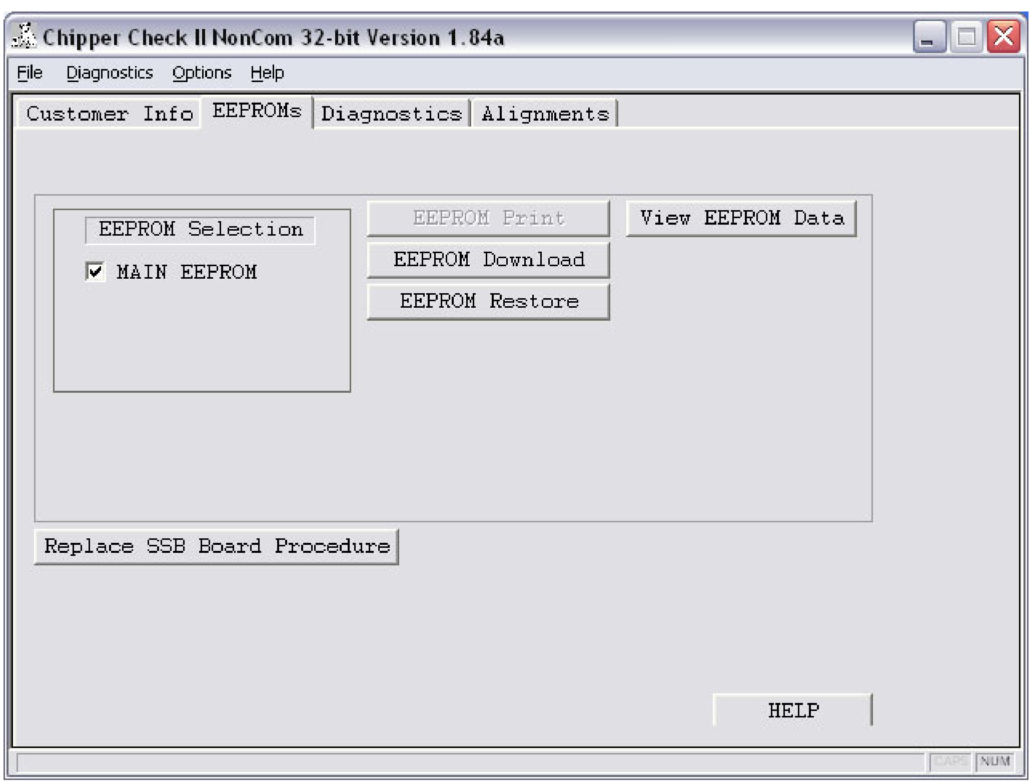
If troubleshooting efforts require changing the SSB, note all convergence, geometry and color temperature setups are located on that board stored in EEPROMs. If the module is replaced the geometry and convergence alignments for the deflection and convergence amplifiers are lost unless they can be retrieved from the original module. If they cannot a time consuming setup of convergence, color temp and geometry would be required.

However, if the defective SSB is available, those settings may be downloaded using Chipper Check and uploaded into the replacement SSB. That provides a significantly better starting point than using the “default” convergence settings or worse, random settings from a replacement SSB.

There are two conditions once the decision is made to replace an SSB module

1) The original EEPROMs can be read, and

2) The original EEPROMs cannot be read.



Appendix A, Chipper Check

Differences between "EEPROM Download" and "SSB Replacement" Routine

There are three Chipper Check routines located in two areas capable of downloading and restoring EEPROM data. The two index tabs of Chipper Check are titled "EEPROMs" and "Diagnostics".

The ITC222 Chipper Check screen (shown), contains an "EEPROMs" tab which provides the ability to upload and download main EEPROM data. It also provides a means to view individual EEPROM address data for troubleshooting purposes.

The "SSB Replacement" routine, also located on the "EEPROMs" tab, is capable of reading and writing data to/from the Default Convergence EEPROM plus it can read and write all geometry and color temperature setup data from the main EEPROM. It cannot check the EEPROMs for valid data or electrical integrity.

The "Diagnostics" tab contains a routine capable of reading and writing to/from the main EEPROM testing it for data accuracy and the ability to read and write every location thus confirming proper EEPROM operation. However it can only check certain locations for valid data so it is not 100% accurate when checking for data that might cause improper chassis operation or functions. This tab also provides a way to view error code data stored in the main EEPROM however it is not capable of presenting the same data available in the Field Service Menu "Event History".

SSB Module Replacement

If at all possible when replacement of an SSB module must be done, it is best to use the convergence alignment values from the original module.

The "SSB Replacement" routine copies instrument level alignment data from the defective SSB and places them into the replacement SSB copying only those alignments previously noted. The result should be an instrument that requires only minor touchups to geometry, color temperature and convergence.

There are two ways to transfer the EEPROM files using Chipper Check; "Dead Set" and the normal Chipper Check service menu "Select Chassis" mode. "Dead Set" is the preferred procedure as the instrument only needs to be in standby mode. In the following pages both are outlined. After either procedure the final step is to transfer the new alignments into current mode EEPROMs. Be certain to follow that last operation!

If Original SSB EEPROM can be Read

Using Chipper Check, convergence and geometry alignments may be retrieved from the original module. To begin follow either "Procedure Using Dead Set" or "Procedure Using Select Chassis" taking care to name the file so that it may be easily retrieved after the replacement board is installed into the chassis. Using either of the two routines all convergence, color temperature and geometry settings from the original SSB can be transferred to the replacement SSB. Those alignments should return the raster very close to its original appearance. Some minor touchup may be required.

If the original SSB EEPROM cannot be read see a later section under that title. The procedures are identical except a default file, provided by Chipper Check will be used instead of one from the original SSB.

NOTE: It is always a good idea to store the original alignments for any ITC222 SSB module before beginning procedures that may change those alignments. In the event of catastrophic errors due to manipulation of EEPROM data, the original file may always be used to put the module back to its original condition.

PROCEDURE USING "DEAD SET":

1. Apply AC Power to the instrument and wait for it to reach Standby mode.
2. With the PC and CC interface box already connected and running, first connect the interface box to the chassis via the TECI connection on the SSB module. Then launch Chipper Check and enter the "Dead Set" mode. Select the ITC222.
3. Follow the on screen instructions to establish a Chipper Check connection with the chassis. **NOTE:** It is suggested to fill out the information screen with at least a model and serial number and save the information for possible future use.
4. Enter the "EEPROMs" tab on the Chipper Check screen and select "Replace SSB Board Procedure".
5. Press <Copy SSB to File>. Chipper Check will prompt for a file name. Be certain to give the file a name that can be associated with only this chassis. The chassis serial number is recommended. The EEPROM data will be stored in the customer file location normally used by Chipper Check.
6. Remove AC power from the instrument, disconnect the Chipper Check connector from the chassis and change the SSB board.

   NOTE: Chipper Check does not have to be shut down. Simply leave it in its current state.
7. Using an alligator clip or jumper wire, enable EEPROM writing on the replacement board by shorting the two pins of BK200 together. BK200 is located on the replacement SSB at location I9. A location diagram is on the "Replace SSB Board" page of Chipper Check.
8. Apply AC power to the chassis and allow the instrument to enter standby mode. Reconnect Chipper Check via the TECI connector.

NOTE: If Chipper Check fails to acknowledge the chassis, remove the CC connection, shut down Chipper Check and start the software again using "Dead Set" mode as described in step 2-4.

9. On the "EEPROMs" tab select "Replace SSB Board Procedure". This time press <Paste File to SSB>. Chipper Check will prompt for a file name. Select the previously stored file associated with this chassis. The stored EEPROM data will be placed into the new SSB EEPROM locations.
10. When the upload is completed, disconnect Chipper Check, remove AC power from the chassis and remove the jumper from BK200. **Wait at least 30 seconds for the chassis to power completely down.**
11. Proceed to the instructions titled "**TRANSFER NEW ALIGNMENTS TO EEPROM**"

PROCEDURE USING “SELECT CHASSIS”:

1. Apply AC power to the instrument and wait 20 seconds for it to reach “Standby” mode.
2. Enter the service menu by pressing and holding “<VOL DN> and <CH DN>” for 8 seconds.
3. When the service menu appears, scroll to “Miscellaneous” and press “OK”.
4. Select “Bus Quiet” by holding down the “OK” button for ≥2.5 seconds to place the set in Chipper Check Mode.
5. With the PC and Chipper Check Interface connected, start Chipper Check and highlight the ITC222 under “Select Chassis” on the main menu.
6. Follow the on screen instructions to establish a Chipper Check connection with the chassis.

   NOTE: It is suggested to fill out the information screen with at least a model and serial number and save the information.
7. Enter the “EEPROMs” tab on the Chipper Check screen and select “Replace SSB Board Procedure”.
8. Press <Copy SSB to File>. Chipper Check will prompt for a file name. Be certain to give the file a name that can be associated with only this chassis (the chassis serial number is recommended). The EEPROM data will be stored in the customer file location normally used by Chipper Check.
9. Remove AC power from the instrument, disconnect the Chipper Check connector from the chassis, then change the SSB board. Shut the Chipper Check software down.
10. Using an alligator clip or jumper wire, enable EEPROM writing by shorting the two pins of BK200 together. BK200 is located on the replacement SSB at location I9.
11. Apply AC power to the chassis and allow the instrument to enter standby mode.
12. Enter the service menu by pressing and holding “<VOL DN> and <CH DN>” for 8 seconds.
13. When the service menu appears, scroll to “Miscellaneous” and press “OK”.
14. Select “Bus Quiet” by holding down the “OK” button for ≥2.5 seconds to place the set in Chipper Check Mode.
15. Now start Chipper Check and highlight the ITC222 under “Select Chassis” on the main menu.
16. Follow the on screen instructions to establish a Chipper Check connection with the chassis. **NOTE**: It is suggested to open the previously saved customer information screen.
17. Again enter the “EEPROMs” tab, and select “Replace SSB Board Procedure”. This time press <Paste File to SSB>. Chipper Check will prompt for a file name. Be certain to select the previously stored file associated with this chassis. The stored EEPROM data will be placed into the new SSB EEPROM locations.
18. When the upload is completed, disconnect Chipper Check, remove AC power from the chassis and remove the jumper from BK200. Wait at least 30 seconds for the chassis to power completely down.
19. Proceed to “**TRANSFER NEW ALIGNMENTS TO EEPROM**”

TRANSFER NEW ALIGNMENTS TO EEPROM

There are two separate files downloaded to the SSB during the SSB Download operation; the geometry and convergence data. The Geometry files are uploaded from the main EEPROM to the current mode RAM immediately when the instrument is turned on. However the ITC222 uses the convergence values from the current mode EEPROM, not the default. The uploaded convergence files remain in the default convergence EEPROM until manually moved. So the new default file values now need to be placed in the current mode EEPROMs for use. Otherwise the current mode EEPROM's still have the previous values, not the newly downloaded ones. The following instructions take the default EEPROM values and transfer them to each of the current mode EEPROM's and RAM for immediate use.

1. After the instrument has been powered down for >30 seconds, reapply AC power and wait for it to reach standby operation.
2. With the chassis in standby mode, enter the service menu by pressing and holding "<VOL DN> and <CH DN>" for 8 seconds.
3. Using the remote control or FPA, select <Convergence>, <Defaults>, and place a check mark in <Default Red/Green/Blue>. Select <Return> to return to the previous menu.
4. Now select <Store> and place a checkmark in <Store Defaults>. This places the stored settings from the EEPROM transfer into the current mode EEPROM.
5. Select sensor calibration by placing a check mark in <Sensor Calibration> to set up autoconvergence.

NOTE: If <Sensor Calibration> returns a red screen, autoconvergence will never be successful. The first portion of autoconvergence is actually the same sensor calibration routine that runs here. One or more geometry alignments may be too far off for the routine to properly locate the screen sensors. Refer to service data and the "Geometry" section of this manual for geometry alignments. It is suggested to first perform any minor tweaks that are noticeable onscreen using the geometry alignment instructions. If only minor tweaks are required it may be possible to do them, then run Sensor Calibration again. If geometry is adjusted too much, sensor calibration may be successful however convergence may be disturbed enough to require touchups. Only after successful Sensor Calibration will autoconvergence run. However it is possible for Sensor Calibration to be successful, yet autoconvergence fails.

Once Sensor Calibration is successful, if convergence requires adjustment always use Level 3!

Also be aware there are always electrical differences between SSB modules. Even though the same DAC settings have been transferred it may still be necessary to do some "fine tuning" to convergence and possibly geometry.

If Original SSB EEPROM Can Not be Read

To place a standard "default" set of geometry and convergence alignments into a replacement SSB, again use the "Replace Small Signal Board Procedure" routine, but skip the steps that involve downloading the original SSB settings to a file.

1. Remove AC Power from the instrument.
2. Replace the SSB module.
3. Using an alligator clip or jumper wire, enable EEPROM writing on the replacement board by shorting the two pins of BK200 together. BK200 is located on the replacement SSB at location I9. A location diagram is on the "Replace SSB Board Procedure" page of Chipper Check.
4. Apply AC power to the chassis and allow the instrument to enter standby mode.
5. With the PC and CC interface box already connected and running, first connect the interface box to the chassis via the TECI connection on the SSB module. Then launch Chipper Check and enter the "Dead Set" mode. Select the ITC222.
6. Follow the on screen instructions to establish a Chipper Check connection with the chassis. **NOTE:** It is suggested to fill out the information screen with at least a model and serial number and save the information for possible future use.
7. Enter the "EEPROMs" tab, and select "Replace SSB Board Procedure". This time press <Paste File to SSB>. Chipper Check will prompt for a file name from the CUST directory. Select the default file "ITC222_convergence_default.ssb". The stored EEPROM data will be placed into the new SSB EEPROM locations.

4. When the upload is completed, disconnect Chipper Check, remove AC power from the chassis and remove the jumper from BK200. **Wait at least 30 seconds for the chassis to power completely down.**
5. Return to the previous instructions titled "**Transfer New Alignments to EEPROM**".

Once the new EEPROM data is transferred to the current mode EEPROM a factory default set of alignment values are placed into the geometry, color temp and convergence locations. Although the alignments will require touchup they should be closer than using random values that may be in a replacement SSB module.

Color temperature should not require adjustment. AKB will track the CRT setup within a few minutes. Unless there was a change in the screen control setting, no further adjustments to color temperature should be required.

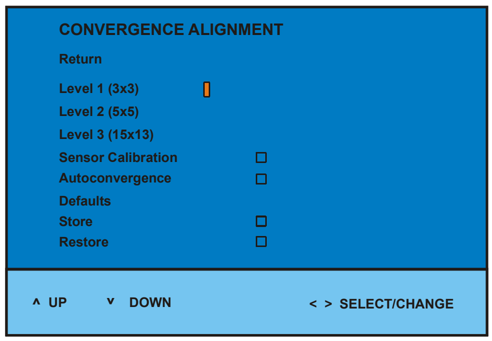
Appendix B

Field Service Menu

Field Service Mode

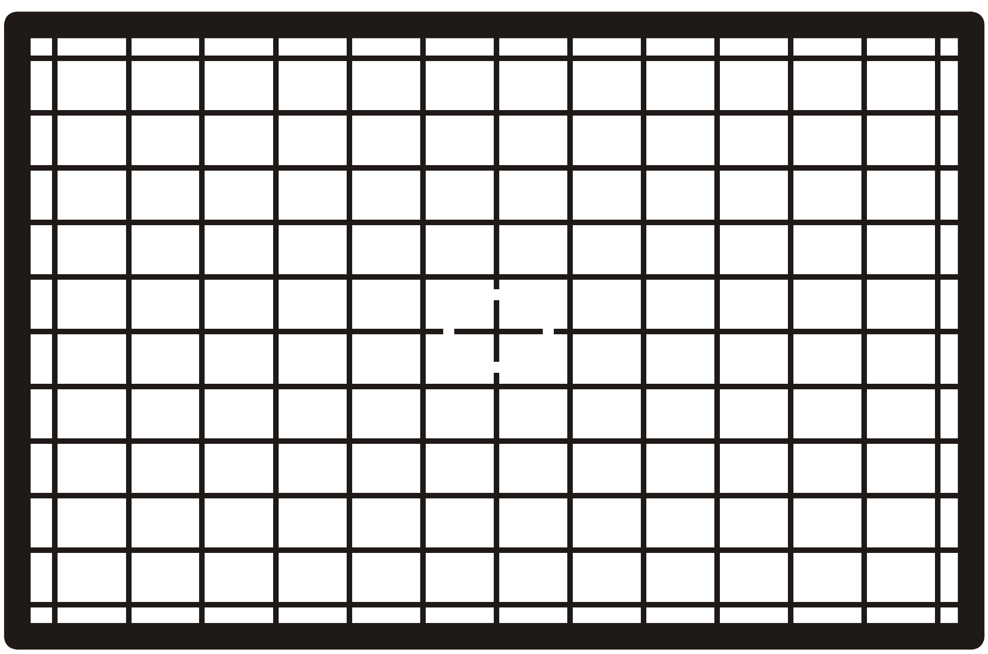
The Field Service Menu screens are used for most adjustments and alignments in the ITC222. Generally there are two types of screens; Text and Alignment.

The Text screens provide information on the menus and for specific alignments and appear similar to the graphic below:

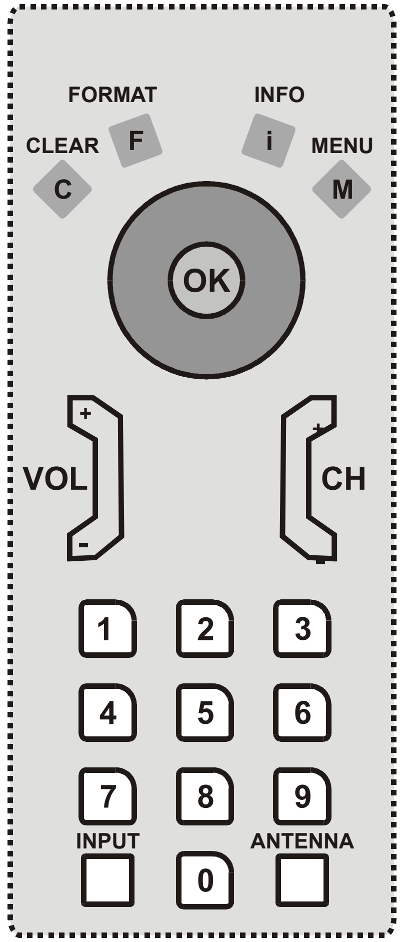


Note there are no alignments that can be performed using this menu. Its only function is menu description and a gateway to either more text menus or alignment screens.

Alignment screens are where button presses are translated into real alignments. Generally when entering an alignment screen all menus disappear leaving the technician with a full screen view as alignments are done. Therefore the technician must either remember the alignment buttons that are active on each screen or refer to a printout of those buttons. The screen below is the convergence alignment screen.



Notice the only indication onscreen is the cross hair in the center indicating the current adjustment point. There are no onscreen help files or hints to guide the technician.



Field Service Mode Remote Control Button Functions

The graphic shows only a portion of the remote used for the ITC222. There are several versions of this remote however the button functions will remain the same regardless of where they are located on the remote. The field service remote control commands are also universal across most RCA and RCA Scenium CRK76 style remote so the original remote is not necessarily required. However a remote control is required for most Field Service adjustments since the front panel only has the Channel, Volume, OK/Menu and Power buttons. The navigation buttons, shown on this RCN615T remote as a large disc with the “OK” button in the center, are not available on the front panel. The disc works identical to the discrete navigation buttons of previous remote control designs. For alignments that either increment or decrement in value, pressing the disc on the right increases the alignment value. Pressing it on the left decreases the alignment value. In the convergence pattern there are four alignment directions for right/left and for up/down movement of the convergence alignment position. Pressing the disc (or the navigation arrows) on the top moves the alignment upward, and pressing it on the bottom moves the alignment downward. Pressing on the right moves the alignment to the right and pressing on the left moves it left.

Other remote control button functions include:

CLEAR/Exit: Exits the current alignment menu and returns to the previous service menu. Additionally when in the main service menu removes the service menu and displays active video full screen.

MENU: Not active when in the Field Service Menu. When the FSM has been removed by pressing **CLEAR**, pressing and holding the **MENU** button for about 8 seconds returns to the FSM from active video at the same point it was exited.

OK: Active in specific menus. When in the main menu, selects sub-menus. In the convergence screens it is used to toggle the color being aligned.

When using the remote control the navigation buttons move up and down the service menu list and enter the individual alignments. The key assignments are:

Up/Dn : Move up and down the service menus in the main and sub-alignment screens.

Right/Left: When in the main FSM, selects the highlighted menu item. In the sub-alignment menus changes the values of the individual alignment.

In addition to the remote control, the FPA may be used to perform all alignments except convergence. The FPA button assignments follow:

VOL+/VOL- : Multifunction depending on which menu is active. They can be used to select a highlighted menu item in any service menu. Also when a specific alignment menu is entered they are used to increment or decrement the value.

CH+/CH- : Used to navigate up and down the various service menus.

OK: Active in specific menus. When in the main menu, selects sub-menus. In the convergence screens it is used to toggle the color being aligned.

For a full understanding of the Field Service Menu several terms that are common to all the menus and submenus should be understood. General descriptions of those items follow.

RETURN: When RETURN is selected (highlighted), pressing OK will close the submenu and return to the main FSM.

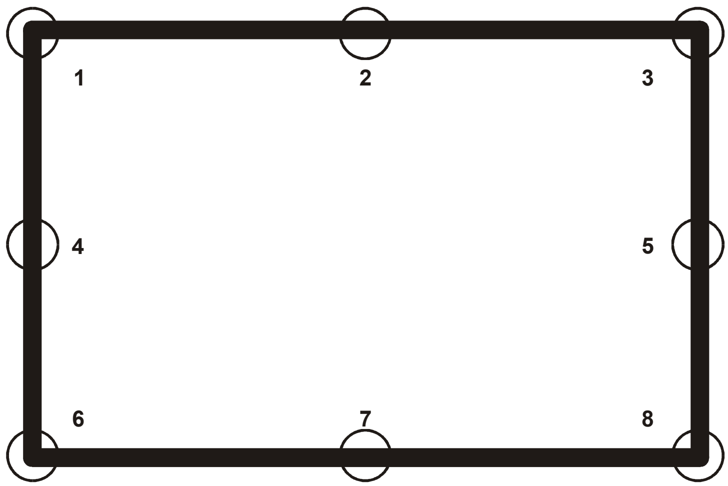
DEFAULTS: When DEFAULTS is selected, default values for the current menu group are copied from the EEPROM into RAM ***replacing*** any current RAM values.

STORE: When STORE is selected all RAM values in the current menu group are stored into the EEPROM. STORE is sometimes activated by a long press of the OK button. When STORE is completed a check mark is placed into the empty box next to the STORE text. (Menu text messages will inform the technician whether a long press is required.)

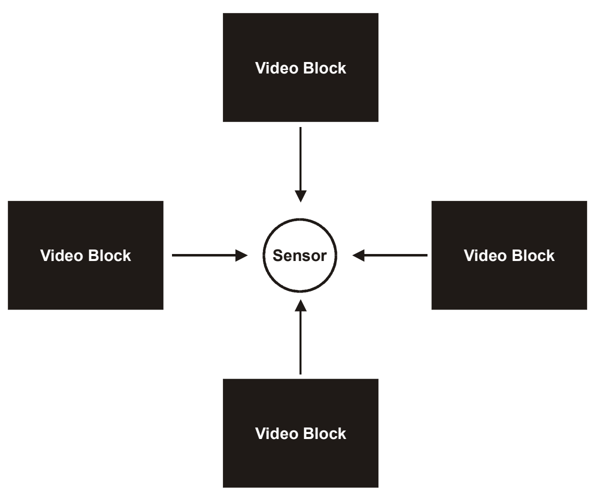
RESTORE: When RESTORE is selected the last stored values for the menu group are copied from the EEPROM into RAM. When RESTORE is completed a check mark is placed into the empty box next to the RESTORE text.

Convergence Error Codes

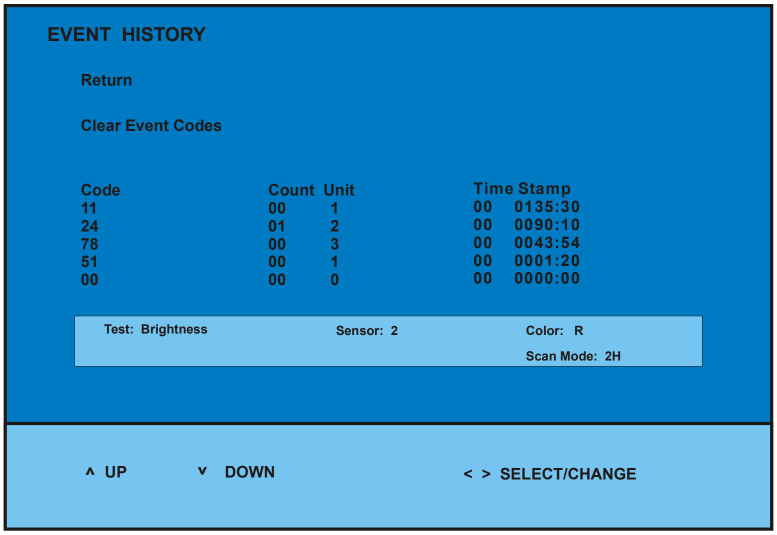
There are a number of error codes linked with specific convergence failures. Remember that "Sensor Calibration" and "Autoconvergence" are two separate functions of convergence. Sensor Calibration is done in two parts. Setting luma levels is done with convergence essentially "zeroed" such that it has little effect on the sensor calibration routine at that point. Location of the sensors is done by loading the default EEPROM values into the convergence micro DAC's, then finding the 8 screen sensors. The figure below shows where those sensors are physically located and how they are numbered.



The sensor calibration software projects a small block of video in each color and at each sensor location. It first moves the block in from the top, then bottom, then each side until the sensor "sees" the light. At the moment the light is "seen" the DAC reading is taken.



By averaging the combined DAC values of these blocks, the sensor may be precisely located. The important point to remember is the error codes that are logged if a sensor is not located. The error codes are located in the "Event History" menu of the Field Service Menu.



Event History

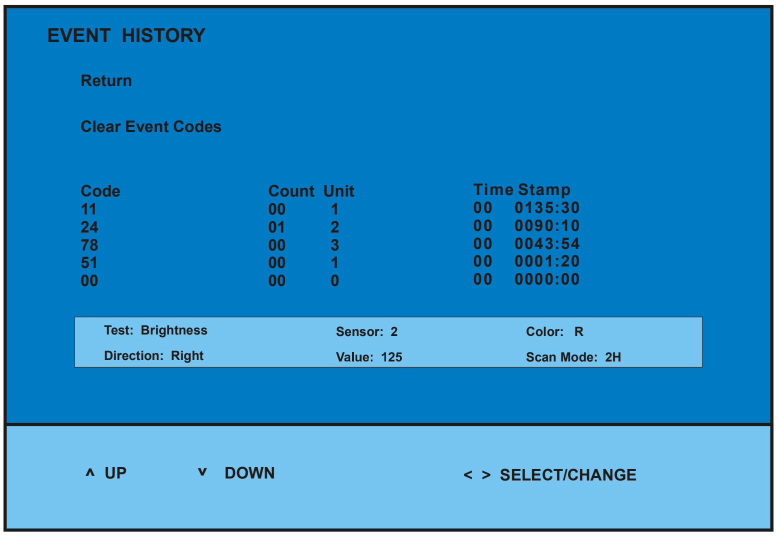
The Event History is where all errors are stored and available to the technician. There is a specific section for the Sensor Calibration errors. Notice the Test information rectangle. There are two tests performed during sensor calibration. First the video block luma (brightness) levels are set for enough brightness to overcome ambient room light and intra-cabinet reflections. For this test the sensor "luma level" is measured first with the CRT's cut off setting the "dark" level. Then a single video block is generated fully covering the sensor. The video luma level is adjusted high enough to overcome ambient light yet not so bright it creates reflections inside the cabinet. If the routine fails at any point, a full red screen will be immediately flashed, the routine will return to the Convergence Menu and the failure error code will be logged into the Event History. Several things may be discovered by checking these errors.

The brightness levels are set for each of the eight sensors in each color, first green, then red, then blue. At the start, geometry DAC's are collapsed by several notches to reduce the effects of overscan bringing the video block closer to being centered on top the sensor. Green of course is affected less than red or blue. So if green does not pass the luma test it is probable there is too much ambient light. Move the cabinet out of direct lighting and try the routine again. However it is also possible geometry is too far off to allow the video block to cover the sensor. If green passes, but red or blue fails (and a visible video block can be seen), the most likely issue is incorrect geometry, not luma levels. Remember that when green passes the luma test, the sensors and the sensor system are working and may be eliminated as a cause of failure. It also means ambient light has been compensated for and there is enough brightness to trigger the sensors. While excessive ambient lighting is still possible, as long as the first pass is made successfully it is unlikely.

The sensor number on the error code corresponds to the same location identified in the previous sensor location chart. The sensor that fails is a good indication of which geometry adjustment could be incorrect. In this case sensor 2, the upper middle sensor did not see the video block. That probably means vertical size is too short or too tall. By running the routine again and paying attention to whether the video block is visible it can be reliably determined whether to increase or decrease vertical size. If the block is seen onscreen, vertical size is too small and should be increased at least 2 steps. The routine should then be run again. Most failures will be due to horizontal or vertical size being incorrect since position, both horizontal and vertical are easier to determine with the internally generated convergence pattern. However as a hint, if sensor 2 now passes but sensor 7 fails, chances are vertical size was OK before, but vertical position was too far down. Return the vertical size to its original setting and move vertical position up a few notches. In this manner geometry can be dialed in reliably.

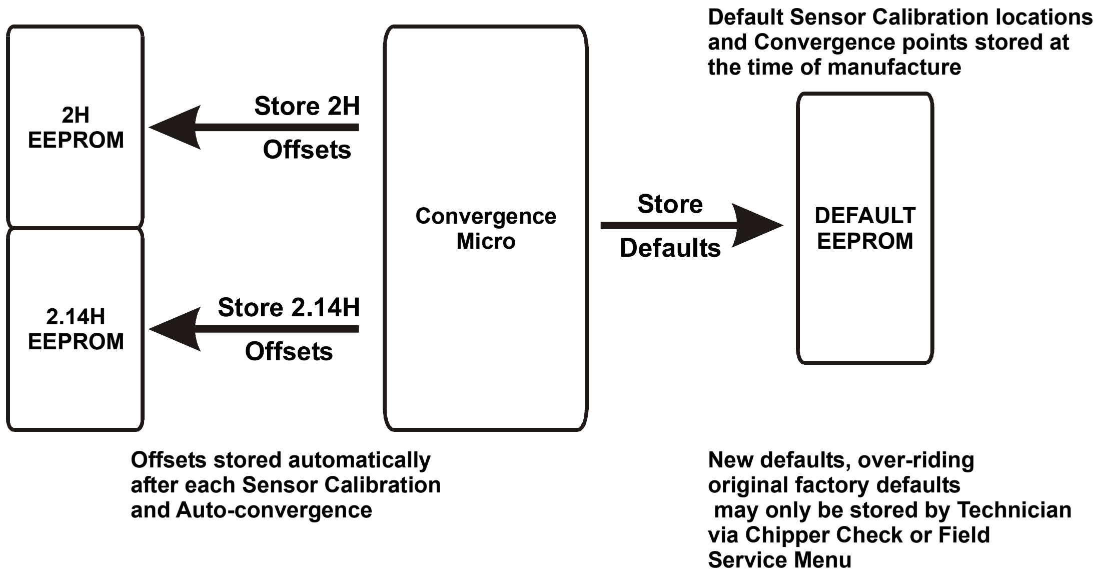
The most difficult failures are the corners. In those locations it is difficult to determine whether horizontal or vertical size is at fault. And on the four corners, other geometry adjustments such as E-W Corrections may affect the routine.

Once the proper video luma levels have been set, the sensors are located by the second part of the Sensor Calibration routine. It involves the same video block generated by the luma level routine, however this time geometry is placed back to its normal alignment settings. If the sensor location routine fails to locate a sensor, the procedure stops immediately, flashing a full red screen and logging an error in the Event History. This code is slightly different.



Notice the addition of two headings, Direction and Value. "Direction" is the side of the sensor that did not see the video block as viewed from the front of the instrument. "Value" is the DAC setting it stopped on before giving up the search. Since the DACs are 255 steps but formatted in a 127-0-127 mode, the value will generally be 127 or -127 or very close to it. The above error code would indicate the middle upper red sensor was not located from the right. That probably means the raster is shifted too far to the right for the DAC to bring the block back to the left enough to be seen by the sensor. The sensor location part of the routine begins with red, then moves to green, then blue. Since it is red, the first color in the sequence, it is likely geometry may be shifted to the left. However carefully observe the raster. It is also possible to move only the red raster to the left using the centering rings. If the other two colors appear acceptable this is the proper approach.

Once the "Sensor Calibration" routine is successful the convergence microprocessor knows the exact locations of the 8 sensors, autoconvergence can proceed. This may be confusing as the first part of the autoconvergence routine appears to replicate the sensor calibration. What is really occurring is the convergence microprocessor has the last location of the sensors and must find out whether any changes have occurred that require an offset of those values. For instance, if the original location of the #1 Red sensor, as determined by the Sensor Calibration routine, was at X,Y coordinate +10, +250, yet the new sensor calibration located it at +10, +240 then the microprocessor would realize the entire raster has shifted 10 steps downward and would now readjust the other coordinates accordingly. When the consumer runs the autoconvergence routine, the new values are stored in the "Current Mode" (2H or 2.14H) EEPROM depending on which scan rate mode is onscreen when autoconvergence is run. The original default EEPROM does not contain any of the changes. The technician has the only possibility to change the original EEPROM Sensor Calibration and Convergence coordinates by storing any new coordinates into the default EEPROM using “Defaults” in the Autoconvergence menu.



Convergence Circuit Operation

The convergence circuitry must be understood in order to prevent errors in procedures. The convergence microprocessor directs all convergence operation independently of the main chassis microprocessor. Geometry is independent of convergence except for modifications to geometry done during the “Sensor Calibration” routine.

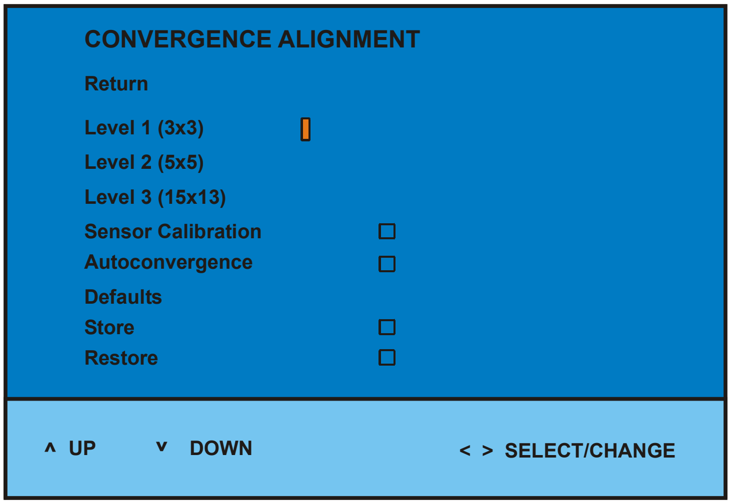
Of great importance is understanding where convergence alignments are stored and how they are dealt with during different operations. The Default EEPROM holds the convergence alignment values used during any autoconvergence procedure. The 2H and 2.14H Mode EEPROMs contain only the differences between the Default EEPROM values and the values found by the autoconvergence routine representing current ideal convergence. So during a 2H autoconvergence attempt if the Default EEPROM says a specific alignment point should be at +155, +20 yet autoconvergence locates it at +160, +15, the 2H EEPROM for that location will be +5, -5. The same is true for all 195 alignment points for all three colors. The Default EEPROM values will not change unless the technician changes them using the “Store Defaults” routines.

During the final convergence of the instrument at manufacturing all convergence alignments, both 2H and 2.14H, are stored into the “Default” EEPROM. Since at this time the “Default” values are identical to the current autoconvergence values the offset values held in the 2H and 2.14H EEPROMs are null.

When autoconvergence runs there are typically many of the convergence points that have changed from the original manufacturing setup due to environmental conditions. The original manufacturing values are not changed. All changes are stored in the 2H (or 2.14H depending upon the mode) EEPROM so that the original alignment values are always available by accessing the Default EEPROM.

Understanding the Convergence Menu

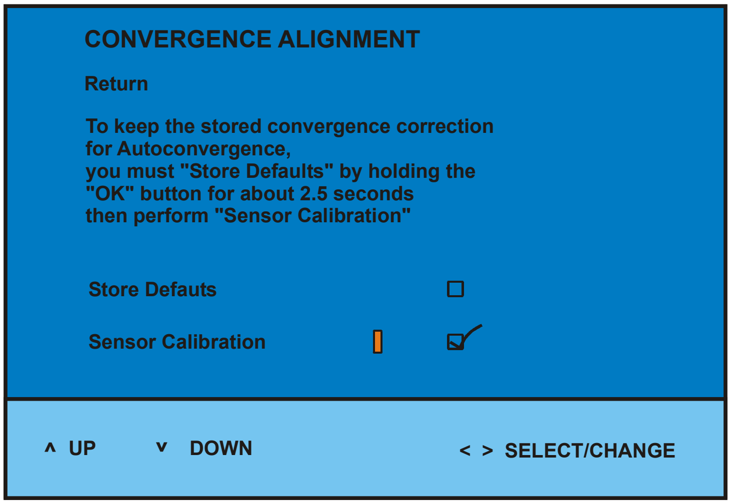
As with previous chassis, many steps are required after manual convergence to make certain the instrument will successfully restore the instrument to acceptable convergence over time. The convergence service menu is used for these steps. The main convergence menu appears below.



Under normal conditions there is a check mark in the “Sensor Calibration” box indicating the convergence micro knows where the sensors are. When the check mark is visible, autoconvergence will run successfully. If it is not, it means the most recent sensor calibration attempt was not successful. Error codes will be logged in the “Event” screen indicating where calibration failed (see previous discussions).

The Autoconvergence selection will never have a check mark. Selecting Autoconvergence by navigating to it, then pressing “OK” starts the autoconvergence routine. The routine is identical to the consumer routine except no opportunity is provided to adjust the center crosshairs. It merely allows the technician to run autoconvergence as an indication the convergence circuitry is functioning properly.

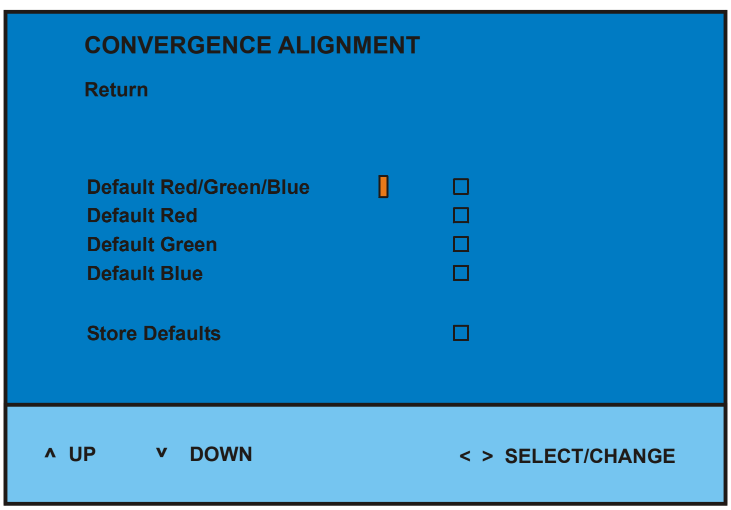
If the Autoconvergence routine runs successfully and convergence is acceptable, the current values should be stored into the EEPROM making them the new default values. The next routine “Store” is used for that purpose.



When the "Default" menu selection is chosen the next screen appears. Since sensor calibration has been previously successful, the check mark will remain. Navigate up to the "Store Defaults" selection and press "OK" on the FPA or remote control for more than 2.5 Seconds. The current convergence data will now overwrite the default values in the default EEPROM and become the new default values. When the routine is complete, the menu will automatically drop to the "Sensor Calibration" routine and the check mark will disappear. The sensor calibration routine should now be run to place the checkmark back into the box before exiting this menu.

Defaults

The "Defaults" menu is the backup plan for technicians that find themselves in a hopeless convergence situation. The Default menu places the most recent correct alignment values for convergence from the default EEPROM into the current mode EEPROM and RAM overwriting all current values. It also breaks those alignment values down into the Red/Green/Blue alignments so that if only one or two color alignments are off, they can be returned independently of the others.



NOTE: Changes made using this screen are dangerous. The changes are instantaneous, causing the loss of any onscreen adjustments done since the previous store. Make very certain returning the convergence alignments to the default values is a desired operation before using this screen!

Pressing "Default Red/Green/Blue" will return all three colors to the values held in the factory default EEPROM. If only one or two colors need to be returned to that state, select the one or ones desired.

"Store Defaults" is essentially the same procedure as the "Store Defaults" function in the "Store" routine except it is not required to do another "Sensor Calibration". It is not recommended this one be used.

Also note that when "Sensor Calibration" is unsuccessful, the last known good convergence values are placed in RAM for use. The last known good values are probably the values in the Default EEPROM so take great care and use caution when deciding to overwrite the values.

Appendix C

Screen Dimensions & Mylar Pattern

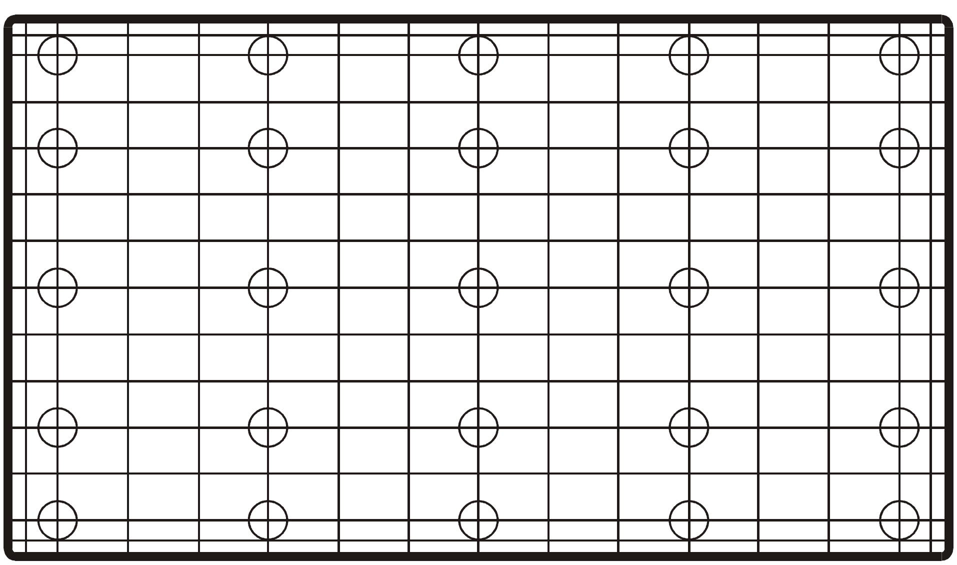
Screen Dimensions

The following chart contains the physical dimensions, in inches, for the most common Thomson instrument screen sizes. The conversion is from the typical diagonal size to an X, Y measurement. Frame dimensions may change over different cabinet styles so it is a good idea to measure the full height and width on each instrument assuring the centerline is as accurate as possible.

Screen Size	Width	Height	Horizontal Center	Vertical Center
65	57	32.2	28.5	16.1
61	53.4	30	26.7	15
56	48.8	27.5	24.4	13.7
52	45.6	25.5	22.8	12.8
50	43.6	24.5	21.8	12.3
44	38.4	21.6	19.2	10.8
40	35.1	19.7	17.5	9.8

Level 2 Template

To reduce convergence alignment time when catastrophic problems have developed requiring full convergence without the benefit of the original patterns, the mylar templates may be used with Level 2 alignments. This diagram locates the 25 alignment points available in Level 2. Place the mylar template on the screen then use the diagram to locate the alignment points. A small square is on the template to locate the exact center point. The center circle corresponds to that square. Locate the remaining alignment points by counting the lines from the center outward.



Level 2 Alignment Point Locations on MylarTemplate

Appendix D

Decimal to Fraction Conversion

Measurement Conversion Chart

The following conversion chart converts decimals to carpentry dimensions. It may prove useful when using the string dimension formulas.

Decimal		Carpentry		Decimal		Carpentry
0.05	=	1/16		0.55	=	9/16
0.10	=	1/8		0.60	=	5/8
0.15	=	5/32		0.65	=	21/32
0.20	=	3/16		0.70	=	11/16
0.25	=	1/4		0.75	=	3/4
0.30	=	5/16		0.80	=	13/16
0.35	=	11/32		0.85	=	27/32
0.40	=	3/8		0.90	=	7/8
0.45	=	7/16		0.95	=	15/16
0.50	=	1/2				

The convergence pattern easily tolerates variations up to about 5% which equates to about $\pm$1/16". Therefore using the nearest 16th inch measurement is adequate. In other words if the percentage of full screen worked out to 11.32, either 11 5/16" or 11 11/32" would be accurate enough. In this case measuring 5/16" is much easier and more accurate than 11/32" so select the easier dimension; 5/16".

SUMMARY

This manual has attempted to cover all aspects of the convergence and geometry alignments required for the ITC222 chassis series. It provides the correct procedure for setting geometry and explained that if geometry is incorrect, autoconvergence may not operate. While it is still possible for severe convergence problems to affect the sensor calibration, in most cases resolving geometry errors will allow sensor calibration to operate. The manual also documents the proper procedure for realignment of convergence after either an SSB module replacement or replacement of other components that directly or indirectly affect geometry or convergence.

Normally little attention will be paid to generating a full convergence pattern. As previously stated the only time a string or mylar template is required is when;

- The SSB module is replaced and the original convergence file is not available,
- The SSB module is replaced and the original file is available but the resulting convergence is not acceptable,
- All three CRT's are replaced.

In all other instances a template is available by using the existing internal convergence pattern.

Appendix A, Chipper Check, fully explains how to use Chipper Check to transfer existing convergence EEPROM files to a replacement SSB module.

Appendix B, Field Service Menu, documents how to use the Field Service Menu for those technicians not yet familiar with its operation. Even though all instructions center on convergence and geometry, the navigation and selection portions of the instructions are universal to all ATC221/ITC222 Field Service Menus. Once understood, the FSM may be used to align geometry and convergence and any of the various menus of the FSM may be accessed utilizing similar procedures and commands.

Manual convergence is a time consuming process. Procedures that may assist the technician in reducing that time are documented. Newly developed processes involving Chipper Check plus the recently released mylar templates now provide procedures to resolve all convergence and geometry errors. As new or modified procedures are developed they will be communicated through normal Authorized Service Center channels.

T-ITC222 Convergence

First Edition 0516 - First Printing
Prepared by
Thomson, Inc for TTE Technology, Inc.
PO Box 1976
Indianapolis, IN 46206 U.S.A.