PIERO

Live User Guide

VERSION 21

ROSS

Thank You for Choosing Ross

You've made a great choice. We expect you will be very happy with your purchase of Ross Technology.

Our mission is to:

1. Provide a Superior Customer Experience
    - offer the best product quality and support
2. Make Cool Practical Technology
    - develop great products that customers love

Ross has become well known for the Ross Video Code of Ethics. It guides our interactions and empowers our employees. I hope you enjoy reading it below.

If anything at all with your Ross experience does not live up to your expectations be sure to reach out to us at solutions@rossvideo.com.

David Ross

CEO, Ross Video

dross@rossvideo.com

Ross Video Code of Ethics

Any company is the sum total of the people that make things happen. At Ross, our employees are a special group. Our employees truly care about doing a great job and delivering a high quality customer experience every day. This code of ethics hangs on the wall of all Ross Video locations to guide our behavior:

1. We will always act in our customers' best interest.
2. We will do our best to understand our customers' requirements.
3. We will not ship crap.
4. We will be great to work with.
5. We will do something extra for our customers, as an apology, when something big goes wrong and it's our fault.
6. We will keep our promises.
7. We will treat the competition with respect.
8. We will cooperate with and help other friendly companies.
9. We will go above and beyond in times of crisis. *If there's no one to authorize the required action in times of company or customer crisis - do what you know in your heart is right. (You may rent helicopters if necessary.)*

PIERO Live User Guide

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The information contained in this guide is subject to change without notice or obligation.

Copyright

Patents

Patent numbers US 7,034,886; US 7,508,455; US 7,602,446; US 7,802,802 B2; US 7,834,886; US 7,914,332; US 8,307,284; US 8,407,374 B2; US 8,499,019 B2; US 8,519,949 B2; US 8,743,292 B2; GB 2,419,119 B; GB 2,447,380 B; and other patents pending.

Notice

The material in this manual is furnished for informational use only. It is subject to change without notice and should not be construed as commitment by Ross Video Limited. Ross Video Limited assumes no responsibility or liability for errors or inaccuracies that may appear in this manual.

End User Software License Agreement

This End User Software License Agreement is a legal agreement between you (the "**Licensee**") and Ross Video Limited ("**Ross Video**") specifying the terms and conditions of your installation and use of the Software and all Documentation (as those terms are defined herein).

IMPORTANT:

BY DOWNLOADING, ACCESSING, INSTALLING OR USING THE SOFTWARE AND/OR DOCUMENTATION AND/OR BY AUTHORIZING ANY THIRD PARTY, INCLUDING WITHOUT LIMITATION AN INSTALLER OR COMMISSIONER ACTING ON YOUR BEHALF TO DO SO, LICENSEE AGREES TO THE TERMS OF THIS AGREEMENT AND THE LICENSE GRANTED HEREUNDER SHALL BE EFFECTIVE AS OF AND FROM SUCH DATE. IF YOU DO NOT WISH TO ACCEPT THE TERMS AND CONDITIONS OF THIS AGREEMENT, DO NOT DOWNLOAD, ACCESS, INSTALL, REFER TO OR OTHERWISE USE THE SOFTWARE AND/OR DOCUMENTATION.

1. **INTERPRETATION.** In this Agreement, (a) words signifying the singular number include the plural and vice versa, and words signifying gender include all genders; (b) every use of the words "herein", "hereof", "hereto" "hereunder" and similar words shall be construed to refer to this Agreement in its entirety and not to any particular provision hereof; (c) reference to any agreement or other document herein will be construed as referring to such agreement or other document as from time to time amended, modified or supplemented (subject to any restrictions on such amendment, modification or supplement set forth therein); (d) every use of the words "including" or "includes" is to be construed as meaning "including, without limitation" or "includes, without limitation", respectively; and (e) references to an Article or a Section are to be construed as references to an Article or Section of or to this Agreement unless otherwise specified.

2. **DEFINITIONS.** In this Agreement, in addition to the terms defined elsewhere in this Agreement, the following terms have the meanings set out below:

   "**Affiliate**" means, with respect to any Person, any other Person who directly or indirectly controls, is controlled by, or is under direct or indirect common control with, such Person. A Person shall be deemed to control a Person if such Person possesses, directly or indirectly, the power to direct or cause the direction of the management and policies of such Person, whether through the ownership of voting securities, by contract or otherwise; and the term "controlled" and "controlling" shall have a similar meaning.

   "**Agreement**" means this End User Software License Agreement including the recitals hereto, as the same may be amended from time to time in accordance with the provisions hereof.

   "**Backup System**" means the secondary piece of Designated Equipment upon which the Software is installed and mirrored for the sole purpose of replacing a Primary System in the event such Primary System is not available or functioning properly for any reason.

   "**Change of Control**" means (a) the direct or indirect sale, transfer or exchange by the shareholders of a Party of more than fifty percent (50%) of the voting securities of such Party, (b) a merger or amalgamation or reorganization or other transaction to which a Party is party after which the shareholders of such Party immediately prior to such transaction hold less than fifty percent (50%) of the voting securities of the surviving entity, (c) the sale, exchange, or transfer of all or substantially all of the assets of a Party.

"Confidential Information" means all data and information relating to the business and management of either Party, including the Software, trade secrets and other technology to which access is obtained or granted hereunder by the other Party, and any materials provided by Ross Video to Licensee; provided, however, that Confidential Information shall not include any data or information which:

(i) is or becomes publicly available through no fault of the other Party;

(ii) is already in the rightful possession of the other Party prior to its receipt from the other Party;

(iii) is already known to the receiving Party at the time of its disclosure to the receiving Party by the disclosing Party and is not the subject of an obligation of confidence of any kind;

(iv) is independently developed by the other Party;

(v) is rightfully obtained by the other Party from a third party; or

(vi) is disclosed with the written consent of the Party whose information it is.

"Designated Equipment" shall mean (a) the hardware products sold by Ross Video to Licensee on which the Software is installed and licensed for use, as the same may be replaced from time to time by Ross Video; or (b) in the case of Software licensed on a stand-alone basis, the equipment of Licensee on which the Software is to be installed and meets the minimum specifications set out in the Documentation.

"Documentation" shall mean manuals, instruction guides, user documentation and other related materials of any kind pertaining to the Software (whether in electronic, hard-copy or other media format) that are furnished to Licensee by or on behalf of Ross Video in relation to the Software.

"Freeware" means Software that is available free of charge from Ross Video, and includes, without limitation the master control system software known as "DashBoard".

"Governmental Authority" means (a) any federal, provincial, state, local, municipal, regional, territorial, aboriginal, or other government, governmental or public department, branch, ministry, or court, domestic or foreign, including any district, agency, commission, board, arbitration panel or authority and any subdivision of any of them exercising or entitled to exercise any administrative, executive, judicial, ministerial, prerogative, legislative, regulatory, or taxing authority or power of any nature; and (b) any quasi-governmental or private body exercising any regulatory, expropriation or taxing authority under or for the account of any of them, and any subdivision of any of them.

"Improvements" means all inventions, works, discoveries, improvements and innovations of or in connection with the Software, including error corrections, bug fixes, patches and other updates in Object Code form to the extent made available to Licensee in accordance with Ross Video's release schedule.

"License Fee" means the fee(s), if any, payable in respect of the Software in accordance with the relevant invoice(s) or other purchase documents delivered in connection with this Agreement.

"License Period" means the period of time that Licensee will have the rights granted under this Agreement, as may be specified in an Order.

"**Modifications**" means any enhancements, changes, corrections, translations, adaptations, revisions, developments, upgrades or updates thereto; and "Modify" shall mean the creation of any of the foregoing.

"**Object Code**" means the machine readable executable form of a computer software program.

"Open Source Components" means third party Open Source software, libraries or other components.

"Open Source License" means the license that governs each Open Source Component.

"Order" means the documents provided by Ross Video to Licensee detailing the Ross Video products contemplated for purchase, the corresponding fees and License Period that may apply to the Software, including any and all quotations, purchase orders, acknowledgments, pro formas, invoices and other purchase documentation.

"**Parties**" means both Ross Video and Licensee and "Party" means either one of them as the context requires.

"**Person**" will be broadly interpreted and includes (a) a natural person, whether acting in his or her own capacity, or in his or her capacity as executor, administrator, estate trustee, trustee or personal or legal representative; (b) a corporation or a company of any kind, a partnership of any kind, a sole proprietorship, a trust, a joint venture, an association, an unincorporated association, an unincorporated syndicate, an unincorporated organization or any other association, organization or entity of any kind; and (c) a Governmental Authority.

"**Primary System**" means the Designated Equipment upon which the Software is installed and executed to deliver its intended functionality.

"Released Claims" has the meaning ascribed to it in Section 9(b).

"Released Parties" has the meaning ascribed to it in Section 9(b).

"Ross Video" means Ross Video Limited and its Affiliates.

"Software" means the version of the Object Code licensed and delivered to Licensee by Ross Video concurrently with delivery of this Agreement, including without limitation the Freeware, and any subsequent error corrections, updates, Modifications or Improvements provided to Licensee by Ross Video pursuant to this Agreement, but specifically excluding any features or plug-ins that may be purchased by you directly from third parties as upgrades or enhancements to the Software.

"**Source Code**" means the human readable form of a computer software program, and all tools and documentation necessary for a reasonably competent computer programmer to understand, maintain and Modify the Software.

"**Third Party Software**" means those portions of the Software, if any, which are owned or controlled by third parties and licensed to Ross Video pursuant to certain license agreements or arrangements with such third parties, including the Open Source Components and NDI®[1] software (http://NDI.video); and

"**Use**" means to execute, run, display, store, merge, network, Modify, translate, host or integrate with Licensee's products or other third party software.

[1] NDI® is a registered trademark of Vizrt NDI AB.

3. **LICENSE.** Subject to the terms and conditions of this Agreement, upon payment of the applicable License Fee by Licensee, or, in the case of Freeware only, upon download of the Software by Licensee onto its Designated Equipment, Ross Video hereby grants to Licensee a non-transferable and non-exclusive right to Use the Software and Documentation solely for the internal use of Licensee (the "License"), during the License Period. In the event that a License Period is not identified on the Order, such License Period shall be deemed to be perpetual, subject to paragraph 10 (c) of this Agreement. The Software shall only be used in connection with or installed on the Designated Equipment and, where applicable, shall only be used on the Primary System, provided such Primary System is operating properly."

   If the Primary System is not operating properly for any reason, the Software may be used on the designated Backup System for that Primary System until such time that the Primary System begins operating properly. The Software and Documentation are provided to Licensee for the exclusive use by Licensee's organization for its ordinary business purposes and shall not be used by any third party for any purposes. Licensee may make copies of the Software as required for internal backup and archival purposes. To the extent permitted hereunder, Licensee may distribute copies of the Software and/or Documentation to members of its organization, provided (a) this Agreement is included with each copy, (b) any member of its organization who uses the Software and/or Documentation accepts and agrees to be bound by the terms of this Agreement and by any other license agreements or other agreement incorporated by reference into this Agreement, and (c) Licensee has paid any applicable additional License Fees in respect of copying and redistributing of the Software. To the extent Licensee is permitted to make copies of the Software under this Agreement, Licensee agrees to reproduce and include on any copy made or portion merged into another work, all Ross Video proprietary notices, including any notices with respect to copyrights, trademarks and this License. With the exception of copying the Software for backup or archival purposes, Licensee agrees to keep a record of the number and location of all such copies and will make such record available at Ross Video's request. The Software may include mechanisms to limit or inhibit copying.

4. **LICENSE RESTRICTIONS.** Except as otherwise provided in section 3 above, Licensee shall not: (1) copy any Software or Documentation, or part thereof, which is provided to Licensee by Ross Video pursuant to this Agreement, in Object Code form, Source Code form or other human or machine readable form, including written or printed documents, without the prior written consent of Ross Video; (2) in any way market, distribute, export, translate, transmit, merge, Modify, transfer, adapt, loan, rent, lease, assign, share, sub-license, sell, make available for download on any website or make available to another Person, the Software and/or Documentation, in whole or in part, provided that Licensee shall not be prohibited from renting or leasing the Software if Ross Video has consented, in writing, to Licensee engaging in such activities in respect of the Software; (3) reverse engineer, decompile or disassemble the Software or electronically transfer it into another computer language; or (4) use the Software or Documentation in a manner that is inconsistent with the License granted hereunder or that will result in a breach of this Agreement. Licensee agrees to take all reasonable precautions to prevent third parties from using the Software and/or Documentation in any way that would constitute a breach of this Agreement, including such precautions Licensee would ordinarily take to protect its own proprietary software, hardware or information.

5. **DELIVERY.** Ross Video shall deliver to Licensee one (1) master copy of the Software in compiled binary (executable) form suitable for reproduction in electronic files only and Ross Video shall deliver to Licensee a minimum of one copy of the Documentation.

6. **IMPROVEMENTS.** Licensee may from time to time request Ross Video to incorporate certain Improvements into the Software. Ross Video may, in its sole discretion, undertake to incorporate and provide such Improvements to Licensee with or without payment of a fee to be negotiated at the time of such request. All Improvements, whether recommended and developed by Ross Video or Licensee, shall be considered the sole property of Ross Video and shall be used by Licensee pursuant to the terms of the License granted under this Agreement.

7. **FREEWARE.** Other than the obligation to pay a License Fee, which does not apply to the Freeware, all other provisions of this End User Software License Agreement apply to the Freeware in the same way as they apply to all other Software that is the subject of this Agreement. In addition, in connection with the Freeware, the following provisions apply:

    a. Licensee will not Use the Freeware to engage in or allow others to engage in any illegal activity.

    b. Licensee will not Use the Freeware in any way that will interfere with or damage the operation of the services of any third parties by overburdening/disabling network resources through automated queries, excessive usage or similar conduct.

    c. Licensee will not Use the Freeware to engage in any activity that will violate the rights of others, including, without limitation, by using it for operations that involve child labour, suppressing the right of freedom of expression or endangering the security of person.

8. **OWNERSHIP.** The Parties acknowledge and agree that, as between the Parties, Ross Video shall be the owner of all intellectual property rights in the Software, Documentation and all related Modifications and Improvements, written materials, logos, trademarks, trade names, copyright, patents, trade secrets and moral rights, registered or unregistered. No proprietary interest or title in or to the intellectual property in the Software, Documentation or any Improvements or Modifications is transferred to Licensee by this Agreement. Ross Video reserves all rights not expressly licensed to Licensee under section 3.

9. **OPEN SOURCE SOFTWARE.**

    a. Software may use and/or be provided with Open Source Components, including those detailed in the Third Party section below. To the extent stipulated by its Open Source License, each such Open Source Component is licensed directly to Licensee from its respective licensors and not sub-licensed to Licensee by Ross Video, and such Open Source Component is subject to its respective Open Source License, and not to this Agreement. If, and to the extent, an Open Source Component requires that this Agreement effectively impose, or incorporate by reference, certain disclaimers, permissions, provisions, prohibitions or restrictions, then such disclaimers, permissions, provisions, prohibitions or restrictions shall be deemed to be imposed, or incorporated by reference into this Agreement, as required, and shall supersede any conflicting provision of this Agreement, solely with respect to the corresponding Open Source Component which is governed by such Open Source License.

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    c. If an Open Source License requires that the source code of its corresponding Open Source Component be made available to Licensee, and such source code was not delivered to Licensee with the Software, then Ross Video hereby extends a written offer, valid for the period prescribed in such Open Source License, to obtain a copy of the source code of the corresponding Open Source Component, from Ross Video from https://www.rossvideo.com/open-source-information/.

10. **THIRD PARTY SOFTWARE.**

a. Licensee acknowledges that the Third Party Software is not owned by Ross Video. Notwithstanding any other provision of this Agreement, Ross Video, to the extent permitted by applicable law, offers no warranties (whether express, implied, statutory or by course of communication or dealing with Licensee, or otherwise) with respect to the Third Party Software. Ross Video may pass through to Licensee, if and to the extent permitted by applicable law, any warranties expressly provided by such third parties to Ross Video for such Third Party Software.

b. FFmpeg Notice. The Software may utilize FFmpeg video components and their included libraries. FFmpeg is a trademark of Fabrice Bellard (originator of the FFmpeg project). Ross Video disclaims any ownership claim to FFmpeg. Please refer to http://ffmpeg.org (copyright is in the FFmpeg developers). FFmpeg is licensed under the GNU Lesser General Public License v2.1 or Lesser General Public License v3.0. GNU Lesser General Public License contact information: Free Software Foundation, Inc., 51 Franklin Street, Fifth Floor, Boston, MA 02110-1301 USA. Licensee can distribute it and/or modify it under the terms of such licenses.

11. **INTELLECTUAL PROPERTY INDEMNITY.**

a. Ross Video agrees to defend, indemnify and hold harmless Licensee from final damages awarded by a court of competent jurisdiction (hereinafter referred to as the "**Losses**"), which Licensee, or any of its officers or directors, may incur, suffer or become liable for as a result of, or in connection with, any third party claim asserted against Licensee to the extent such claim is based on a contention that the Software, Documentation or any portion thereof, infringes any valid, registered, enforceable patents, copyrights, trade secrets, trademarks or other intellectual property rights of any third party, provided that (a) the allegedly infringing Software or Documentation has been used within the scope of and in accordance with the terms of this Agreement, and (b) Licensee notifies Ross Video in writing of such claim within ten (10) days of a responsible officer of Licensee becoming aware of such claim. If the Software, Documentation or any portion thereof is held to constitute an infringement of a third party's intellectual property rights, and use thereof is enjoined, Ross Video shall, at its election and expense, either (i) procure the right to use the infringing element of the Software or Documentation; or (ii) replace or modify the element of the Software or Documentation so that the infringing portion is no longer infringing and still performs the same function without any material loss of functionality. Ross Video shall make every reasonable effort to correct the situation with minimal effect upon the operations of Licensee.

b. Notwithstanding the above, Ross Video reserves the right to terminate this Agreement and the License granted hereunder on immediate notice to Licensee, and without liability to Licensee, in the event that the Software or Documentation constitutes or may, in Ross Video's determination, constitute, an infringement of the rights of a third party that Ross Video, in its sole discretion, does not consider to be affordably remediable.

c. Either party may terminate this Agreement immediately should any Software become, or in either party's opinion be likely to become, the subject of a claim of infringement of any intellectual property right and, in such event, there shall be no claim by either Licensee or Ross Video against the other arising out of such termination, provided that the foregoing shall not apply to a claim for infringement by Ross Video against Licensee in the event that Licensee is alleged to have infringed Ross Video's intellectual property rights, in which case Licensee shall remain liable for all outstanding License Fees and other amounts owing to Ross Video.

d. Notwithstanding the foregoing, Ross Video shall have no liability for any claim of infringement based on use of other than a current, unaltered release of the Software and/or Documentation available from Ross Video if such infringement would have been avoided by the use of a current, unaltered release of the Software and/or Documentation provided that such current, unaltered release performs substantially in conformity with the specifications set out in the Documentation and was provided, at no additional cost by Ross Video, to those subscribing for maintenance services for the Software or Documentation.

12. **CONFIDENTIALITY.** Each Party shall maintain in confidence all Confidential Information of the other Party, shall use such Confidential Information only for the purpose of exercising its rights and fulfilling its obligations under this Agreement, and shall not disclose any Confidential Information of the disclosing Party to any third party except as expressly permitted hereunder or make any unauthorized use thereof. Each Party shall disclose the Confidential Information only to those of its employees, consultants, advisors, and/or subcontractors who have a need to know the Confidential Information. Each Party shall, prior to disclosing the Confidential Information to such employees, consultants, advisors and/or subcontractors, obtain their agreement to receive and use the Confidential Information on a confidential basis on the same terms and conditions contained in this Agreement. The receiving Party shall treat the Confidential Information of the disclosing Party with the same degree of care against disclosure and/or unauthorized use as it affords to its own information of a similar nature, or a reasonable degree of care, whichever is greater. The receiving Party further agrees not to remove or destroy any proprietary or confidential legends or markings placed upon any documents or other materials of the disclosing Party. The obligations of confidence set forth in this Agreement shall extend to any Affiliates that have received Confidential Information of the disclosing Party and shall also cover Confidential Information disclosed by any Affiliate. The receiving Party shall be responsible for any actions or omissions of its Affiliates as if such actions or omissions were its own.

    Either party may disclose certain Confidential Information if it is expressly required to do so pursuant to legal, judicial, or administrative proceedings, or otherwise required by law, provided that (i) such Party provides the other Party with reasonable written notice prior to such disclosure; (ii) such Party seeks confidential treatment for such Confidential Information; (iii) the extent of such disclosure is only to the extent expressly required by law or under the applicable court order; and (iv) such Party complies with any applicable protective or equivalent order.

    Each of Ross Video and Licensee (the **"Indemnifying Party"**, as applicable) agree to indemnify the other (the **"Indemnified Party"**, as applicable) for all Losses incurred by the Indemnified Party as a result of a failure of the Indemnifying Party to comply with its obligations under this Section 12 provided that the Indemnified Party has given prompt notice of any such claim and, to the extent that a claim may lie against a third party for the unauthorized disclosure of such Confidential Information, the right to control and direct the investigation, preparation, action and settlement of each such claim and, further, provided that the Indemnified Party reasonably co-operates with the Indemnifying Party in connection with the foregoing and provides the Indemnifying Party with all information in the Indemnified Party's possession related to such claim and such further assistance as reasonably requested by the Indemnifying Party.

    The Parties acknowledge and agree that any breach of the confidentiality provisions of this Agreement by one Party may cause significant and irreparable injury to the other Party that is not compensable monetarily, as well as damages that may be difficult to ascertain, and agrees that, in addition to such other remedies that may be available at law or in equity, the other Party shall be entitled to seek injunctive relief (including temporary restraining orders, interim injunctions and permanent injunctions) in a court of competent jurisdiction in the event of the breach or threatened breach by such party of any of the confidentiality provisions of this Agreement. The relief contemplated in this Section shall be available to each Party without the necessity of having to prove actual damages and without the necessity of having to post any bond or other security. Each Party further agrees to notify the other Party in the event that it learns of or has reason to believe that any Person has breached the confidentiality provisions of this Agreement.

13. **LIMITATION OF LIABILITY.** The limitation of liability provisions of this Agreement reflect an informed voluntary allocation of the risks (known and unknown) that may exist in connection with the licensing of the Software or Documentation hereunder by Ross Video, and that voluntary risk allocation represents a material part of the Agreement reached between Ross Video and Licensee. Should Ross Video be in breach of any obligation, Licensee agrees that Licensee's remedies will be limited to those set forth in this Agreement. No action, regardless of form, arising out of this Agreement may be brought by Licensee more than twelve (12) months after the facts giving rise to the cause of action have occurred, regardless of whether those facts by that time are known to, or reasonably ought to have been discovered by, Licensee.

    (A) EXCEPT AS EXPRESSLY PROVIDED IN THIS AGREEMENT, THE SOFTWARE AND DOCUMENTATION ARE PROVIDED "AS IS" AND ROSS VIDEO (I) MAKES NO OTHER REPRESENTATIONS, AND PROVIDES NO WARRANTIES OR CONDITIONS OF ANY KIND, EXPRESS OR IMPLIED, STATUTORY, BY USAGE OF TRADE CUSTOM OF DEALING, OR OTHERWISE, AND (II) SPECIFICALLY DISCLAIMS ALL IMPLIED WARRANTIES INCLUDING ANY IMPLIED WARRANTY OF UNINTERRUPTED OR ERROR FREE OPERATION, MERCHANTABILITY, QUALITY OR FITNESS FOR A PARTICULAR PURPOSE. ROSS VIDEO DOES NOT REPRESENT OR WARRANT THAT THE SOFTWARE WILL MEET ANY OR ALL OF LICENSEE'S PARTICULAR REQUIREMENTS, THAT THE USE AND OPERATION OF THE SOFTWARE WILL OPERATE ERROR-FREE OR UNINTERRUPTED, THAT ALL PROGRAMMING ERRORS IN THE SOFTWARE CAN BE FOUND IN ORDER TO BE CORRECTED, OR THAT THE SOFTWARE WILL BE COMPATIBLE WITH OTHER PROGRAMS, SYSTEMS, AND HARDWARE.

    (B) IN NO EVENT SHALL ROSS VIDEO, ITS AFFILIATES AND LICENSORS, AND THEIR RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES AND AGENTS, BE LIABLE FOR ANY CLAIM FOR INDIRECT, CONSEQUENTIAL, SPECIAL, INCIDENTAL, PUNITIVE, EXEMPLARY, AGGRAVATED DAMAGES; LOST PROFITS, OR LOST REVENUE ARISING FROM OR IN CONNECTION WITH THIS AGREEMENT, REGARDLESS OF THE FORM OF ACTION, WHETHER IN CONTRACT, OR IN TORT, EVEN IF THE PARTY HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

    (C) IN ANY EVENT THE AGGREGATE LIABILITY OF ROSS VIDEO, ITS AFFILIATES AND LICENSORS, AND THEIR RESPECTIVE DIRECTORS, OFFICERS, EMPLOYEES AND AGENTS, FOR ANY CLAIM FOR DIRECT DAMAGES WITH RESPECT TO THE SUBJECT MATTER OF THIS AGREEMENT SHALL NOT EXCEED THE AMOUNT OF THE PURCHASE PRICE PAID TO ROSS VIDEO UNDER THIS AGREEMENT.

14. **TERM AND TERMINATION**.

    (1) Unless terminated earlier in accordance with the terms of this Agreement, the term of this Agreement shall commence upon Licensee's first download, access, installation, or other use of the Software or Documentation and continues until, in the case of Software licensed with Designated Equipment provided by Ross Video, the earliest of (a) the end of the License Period, or (b) if the Designated Equipment is assigned or transferred in accordance with this Agreement, the date on which the Designated Equipment is no longer owned by Licensee;

    (2) Either Party shall have the right to terminate this Agreement on notice to the other Party if:

        (a) the other Party fails to pay any fees or other amounts when due hereunder or under any other agreement between the Parties (or any Affiliates of the Parties, as applicable) in connection with the Software and/or Designated Equipment and such breach is not cured within thirty (30) days after written notice of such failure to pay is given to the defaulting Party by the non-defaulting Party;

        (b) the other Party shall file a voluntary petition in bankruptcy or insolvency or shall petition for reorganization under any bankruptcy law, consent to an involuntary petition in bankruptcy, or if a receiving order is given against it under the Bankruptcy and Insolvency Act (Canada) or the comparable law of any other jurisdiction (and such is not dismissed within ten (10) days);

(c) there shall be entered an order, judgment or decree by a court of competent jurisdiction, upon the application of a creditor, approving a petition seeking reorganization or appointing a receiver, trustee or liquidator of all or a substantial part of the other Party's assets and such order, judgment or decree continues in effect for a period of thirty (30) consecutive days; or

(d) the other Party shall fail to perform any of the other material obligations set forth in this Agreement and such default, in the case of a default which is remediable, continues for a period of thirty (30) days after written notice of such failure has been given by the non-defaulting Party or, in the case of a non-remediable default, immediately upon notice.

(3) Notwithstanding anything to the contrary contained in this Agreement:

(a) Ross Video may forthwith terminate this Agreement if Licensee is in breach of any of sections 3, 4 or 12 of this Agreement. For greater certainty, in such instances Ross Video shall provide written notice of such termination as soon as practicable but written notice shall not be a necessary prerequisite to such termination; and

(b) in the event of a Change of Control of Licensee, Ross Video shall have the right to terminate this Agreement and the License granted hereunder upon thirty (30) days' prior written notice to Licensee. For greater certainty, Ross Video's right to terminate in the event of a Change of Control of Licensee shall continue for a period of six (6) months from the date Licensee delivers notice of such Change of Control to Ross Video.

(c) Ross Video may terminate the License immediately on the date on which it provides notice to Licensee, if its agreements for Third Party Software are terminated.

(4) Upon the termination or expiry of this Agreement:

(a) Licensee shall immediately cease and desist all use of the Software and Documentation;

(b) Licensee shall immediately deliver to Ross Video any of Ross Video's Confidential Information provided hereunder (including the Software and Documentation) then in its possession or control, if any, and shall deliver a certificate of an officer of Licensee certifying the completeness of same;

(c) Licensee shall refrain from further use of such Confidential Information; and

(d) Licensee shall forthwith pay all amounts owing to Ross Video or any of its Affiliates hereunder.

15. **SURVIVAL.** The provisions of sections 1, 2, 6, 8, 9, 10, 11, 12, 13, 14, 18, 22, 23, and 24 herein shall survive the expiry or termination of this Agreement.

16. **FORCE MAJEURE.** Dates and times by which Ross Video is required to render performance under this Agreement shall be automatically postponed to the extent and for the period that Ross Video is prevented from meeting them by reason of events of force majeure or any cause beyond its reasonable control provided Ross Video notifies Licensee of the commencement and nature of such cause and uses its reasonable efforts to render performance in a timely manner.

17. **ASSIGNMENT.** Ross Video may assign this Agreement, or any of its rights or obligations hereunder, in whole or in part, upon notice to Licensee. Licensee shall not assign this Agreement, or any of its rights or obligations hereunder, in whole or in part, without the prior written consent of Ross Video, which consent may not be unreasonably withheld. This Agreement enures to the benefit of and is binding upon each of the Parties and their respective successors and permitted assigns.

18. **GOVERNING LAW.** If Licensee acquired the Ross Product(s) in the United States or Canada, the laws of the state or province where Licensee's principal place of business is located govern the interpretation of this Agreement, claims for its breach, and all other claims regardless of conflict of laws principles. If Licensee acquired the Ross Product(s) in the European Union or the United Kingdom, then the laws of England and Wales apply. If Licensee acquired the Ross Product(s) in any other country, then the laws of the Province of Ontario, Canada shall apply.

19. **LANGUAGE.** The Parties have expressly required that this Agreement and all documents relating thereto be prepared in English. Les parties ont expressément exigé que cette convention ainsi que tous les documents qui s'y rattachent soient rédigés en anglais.

20. **GOVERNMENT CONTRACTS.** If the Software and/or Documentation to be furnished to Licensee hereunder are to be used in the performance of a government contract or subcontract, the Software and/or Documentation shall be provided on a "restricted rights" basis only and Licensee shall place a legend, in addition to applicable copyright notices, in the form provided under the applicable governmental regulations. For greater certainty, Ross Video shall not be subject to any flow-down provisions required by any customer of Licensee that is a Governmental Authority unless Ross Video expressly agrees to be bound by such flow-down provisions in writing.

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22. **AMENDMENT AND WAIVER.** No amendment, discharge, modification, restatement, supplement, termination or waiver of this Agreement or any Section of this Agreement is binding unless it is in writing and executed by the Party to be bound. No waiver of, failure to exercise or delay in exercising, any Section of this Agreement constitutes a waiver of any other Section (whether or not similar) nor does any waiver constitute a continuing waiver unless otherwise expressly provided.

23. **SEVERABILITY.** Each Section of this Agreement is distinct and severable. If any Section of this Agreement, in whole or in part, is or becomes illegal, invalid, void, voidable or unenforceable in any jurisdiction by any court of competent jurisdiction, the illegality, invalidity or unenforceability of that Section, in whole or in part, will not affect (a) the legality, validity or enforceability of the remaining Sections of this Agreement, in whole or in part; or (b) the legality, validity or enforceability of that Section, in whole or in part, in any other jurisdiction.

24. **ENTIRE AGREEMENT.** This Agreement, and any other documents referred to herein, constitutes the entire agreement between the Parties relating to the subject matter of this Agreement and supersedes all prior written or oral agreements, representations and other communications between the Parties.

Updated: November 1, 2023

Ross Video Limited (Ross) warrants its PIERO systems to be free from defects under normal use and service for the following time periods from the date of shipment:

- PIERO Server — 12 months
- PIERO Software Upgrades — 12 months free of charge
- System and Media hard drives — 12 months
- Solid State Drives - 5 years

If an item becomes defective within the warranty period Ross will repair or replace the defective item, as determined solely by Ross.

Warranty repairs will be conducted at Ross, with all shipping FOB Ross dock. If repairs are conducted at the customer site, reasonable out-of-pocket charges will apply. At the discretion of Ross, and on a temporary loan basis, plug in circuit boards or other replacement parts may be supplied free of charge while defective items undergo repair. Return packing, shipping, and special handling costs are the responsibility of the customer.

This warranty is void if products are subjected to misuse, neglect, accident, improper installation or application, or unauthorized modification.

In no event shall Ross Video Limited be liable for direct, indirect, special, incidental, or consequential damages (including loss of profit). Implied warranties, including that of merchantability and fitness for a particular purpose, are expressly limited to the duration of this warranty.

This warranty is TRANSFERABLE to subsequent owners, subject to Ross' notification of change of ownership.

Extended Warranty

For customers that require a longer warranty period, Ross offers an extended warranty plan to extend the standard warranty period by one year increments. For more information about an extended warranty for your PIERO system, contact your regional sales manager.

Environmental Information

The equipment that you purchased required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

To avoid the potential release of those substances into the environment and to diminish the need for the extraction of natural resources, Ross Video encourages you to use the appropriate take-back systems. These systems will reuse or recycle most of the materials from your end-of-life equipment in an environmentally friendly and health conscious manner.

The crossed-out wheeled bin symbol invites you to use these systems.

If you need more information on the collection, reuse, and recycling systems, please contact your local or regional waste administration.

You can also contact Ross Video for more information on the environmental performances of our products.

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Australia/Sydney Local Support:	1300 007 677*
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E-mail for General Information:	solutions@rossvideo.com
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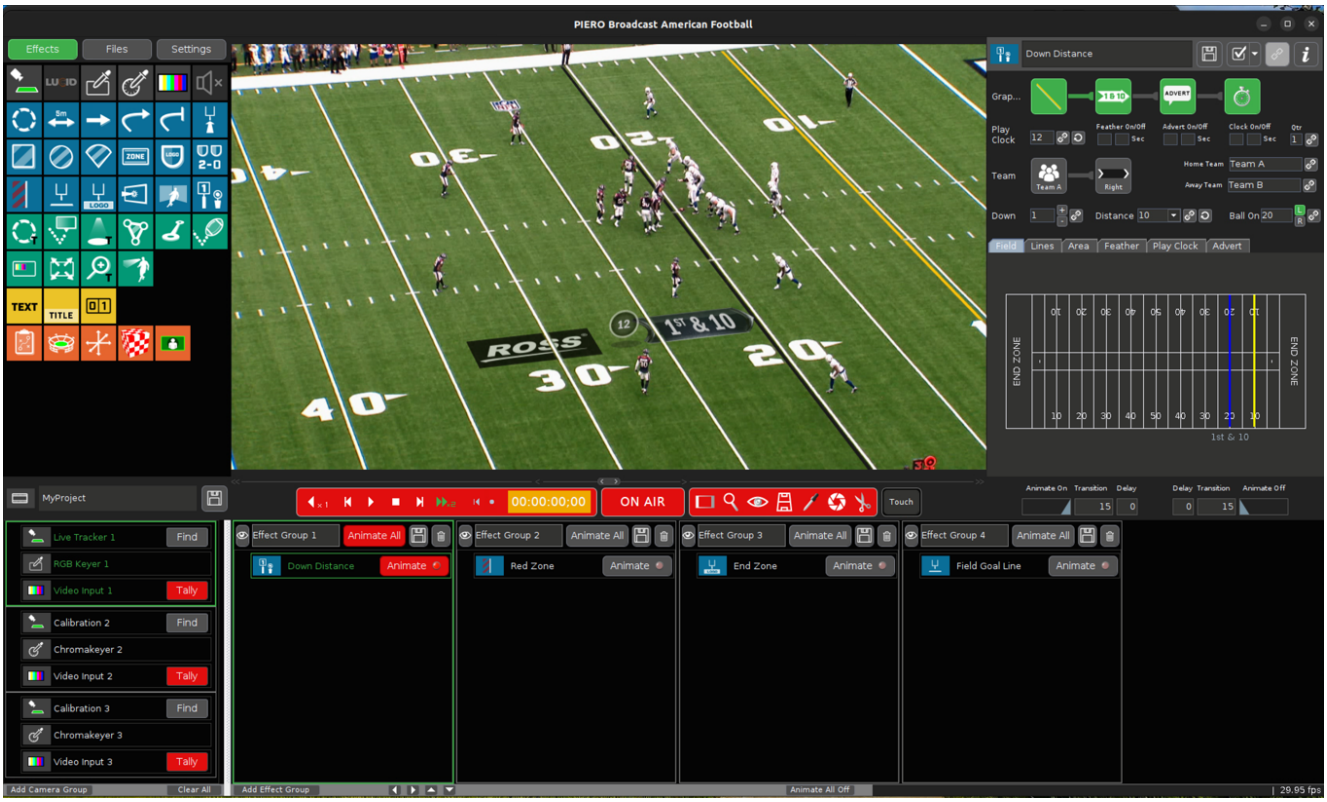
*If the local support specialist is not available, your call will be transferred automatically to our North America center.

Contents

Introduction

PIERO Live is a studio graphics system powered by an industry-leading sports graphics and analysis engine. Designed for speed, it renders all graphics in real-time and features a user interface optimized for live broadcasts. With support for a wide range of encoded camera heads, PIERO Live connects to data feeds for NFL, soccer, basketball, and baseball, enabling the creation of studio-augmented reality effects, VAR-style offside replays, 1st and 10 markers, distance-to-goal indicators in rugby and soccer, and much more.



PIERO Live User Interface

About This Guide

This guide covers the use of the PIERO system.

If, at any time, you have questions pertaining to the operation of PIERO, please contact us at the numbers listed in the section Getting Help 3. Our technical staff is always available for consultation, training, or service.

Documentation Conventions

Special text formats are used in this guide to identify parts of the user interface, text that a user must enter, or a sequence of menus and sub-menus that must be followed to reach a particular command.

Bold text	Bold text identifies a user interface element such as a dialog box, menu item, or button. For example: In the **Slug** column, type a slug name for the story.
Italic text	Italic text is used to identify the titles of referenced guides, manuals, or documents. For example: For more information, refer to the *DashBoard User Guide.*
`Courier text`	Courier text identifies text that a user must type. For example: In the **Username** box, type `postgres`.
Menu Sequences	Menu arrows are used in procedures to identify a sequence of menu items that you must follow. For example: If a step reads **Server > Save As**, you would select the **Server** menu and then select **Save As**.
Hypertext	Identifies a hyperlink to a related topic.

Getting Help

PIERO documentation is accessible by selecting the **Documents** icon in the PIERO Launcher.

Contacting Technical Support

At Ross Video, we take pride in the quality of our products, but if problems occur, help is as close as the nearest telephone.

Our 24-hour Hot Line service ensures you have access to technical expertise around the clock. After-sales service and technical support is provided directly by Ross Video personnel. During business hours (Eastern Time), technical support personnel are available by telephone. After hours and on weekends, a direct emergency technical support phone line is available. If the technical support person who is on call does not answer this line immediately, a voice message can be left and the call will be returned shortly. This team of highly trained staff is available to react to any problem and to do whatever is necessary to ensure customer satisfaction.

Technical Support:

- 1-613-686-1557
- 1-833-859-0499 (Toll free within North America)
- +800 3540 3545 (Toll free International)
- 1300 007 677 (Australia/Sydney)*
- E-mail: techsupport@rossvideo.com
- Website: http://www.rossvideo.com

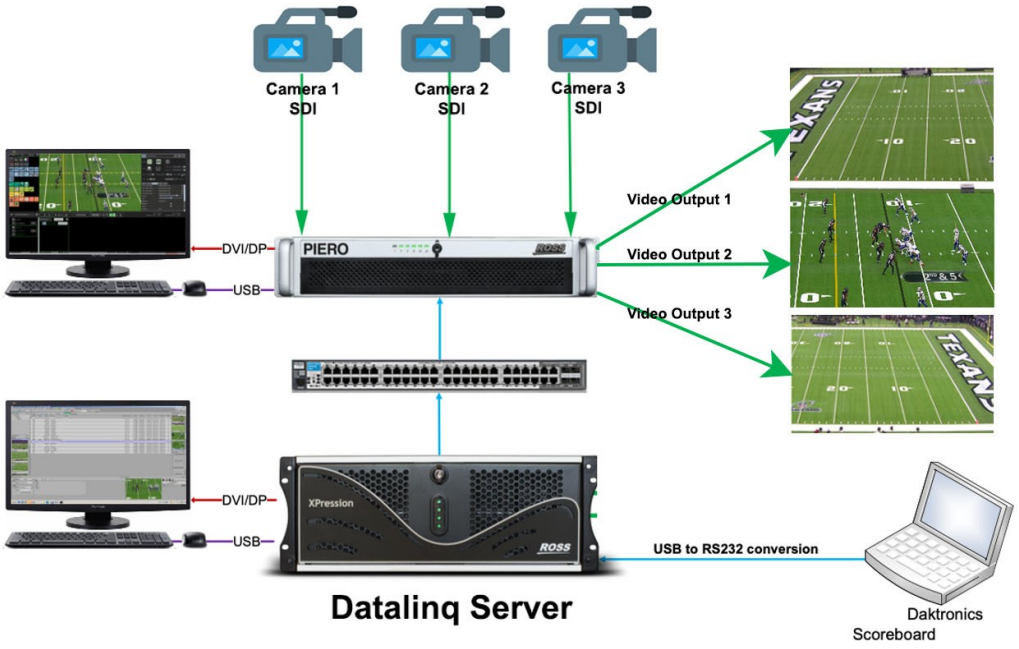
*If the local support specialist is not available, your call will be transferred automatically to our North America center.

Hardware Setup

This section covers configuring the PIERO system hardware, including recommendations for video connections to ensure optimal performance and reliability.

You will need to connect the camera SDI inputs and outputs of PIERO according to your live production requirements.

The below schematic shows a typical three camera setup for a live down and distance PIERO system:



Hardware Schematic - Three Camera Setup

A networked DataLinq server must run on a separate Windows computer to receive data feeds in PIERO Live. Obtain the DataLinq software by contacting Ross Video Technical Support. For information on setting up and using DataLinq, see the *XPression User Guide*.

Refer to the *PIERO Tech Guide* for detailed instructions on connecting your PIERO computer.

Video Delay

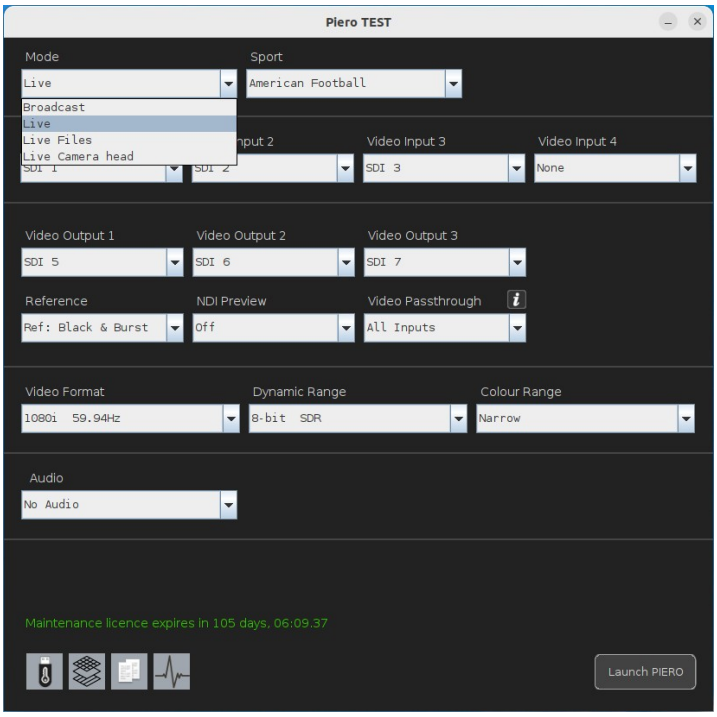
The frames delay added when passing video through PIERO is:

- **Six frames** for non-4K resolutions
- **Seven frames** for 4K resolutions

★**Note:** sound may need to be delayed by a similar amount when sound is not being passed through PIERO.

PIERO Launcher

Use the PIERO launcher to configure PIERO by double-clicking the PIERO icon on the desktop.



PIERO Launcher

To configure the parameters for Live usage:

- **Mode**: Select **Live**.
- **Sport**: Select a sport compatible with Live usage, such as American football, basketball, baseball, etc.
- **SDI Video Inputs**: Select up to four cameras.
- **SDI Video Outputs**: Select up to three outputs, with or without passthrough.
- **Video Passthrough**: Typically set to **All Inputs** (see the Video Passthrough 6 section).
- **Reference**: Select the relevant input reference, usually **Ref: Black & Burst**.
- **Video Format**: Choose the appropriate video format for your production, including HDR settings if needed.
- **Audio**: Select whether you want audio to be passed through PIERO or **No Audio** if audio is not required.

To start the PIERO application:

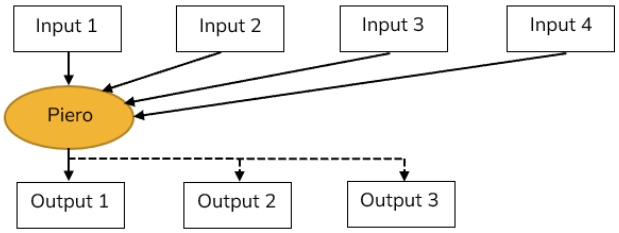
- Select the **Launch PIERO** button.

★If you need to change the parameters after launching PIERO, you will need to close your project and adjust the parameters in the Launcher.

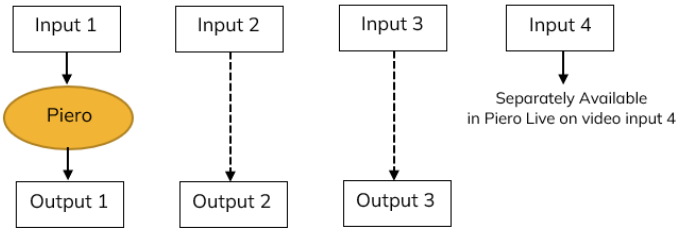
Video Passthrough

PIERO can output up to three SDI outputs, although only one of output can include optical tracking and graphics. The outputs depend on the video passthrough option selected in the launcher. The **Information** button next to the selector displays a diagram summarizing the available options. Choose the option required for your live scenario (typically **All Inputs** or **Off**).

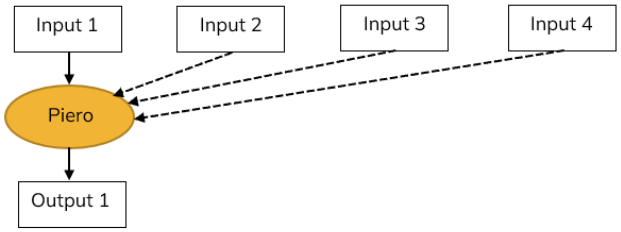
1. **"Off":** Normal Piero use case - all inputs passed into Piero. Outputs can be optionally duplicated.



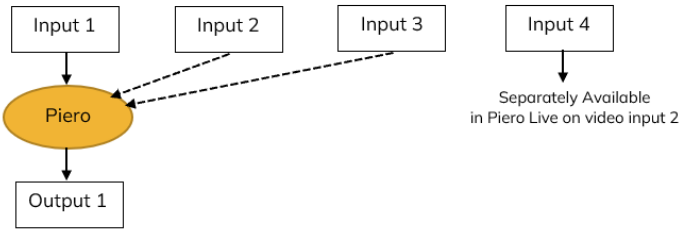
2. **"All Inputs":** Only active input passed into Piero. Other inputs passed through.



3. **"Single Switched Input":** Only active input is 'switched' into Piero – other inputs not available.



4. **"Dual Switched Input":** Only active input is 'switched' into Piero - other inputs not available apart from input 4.



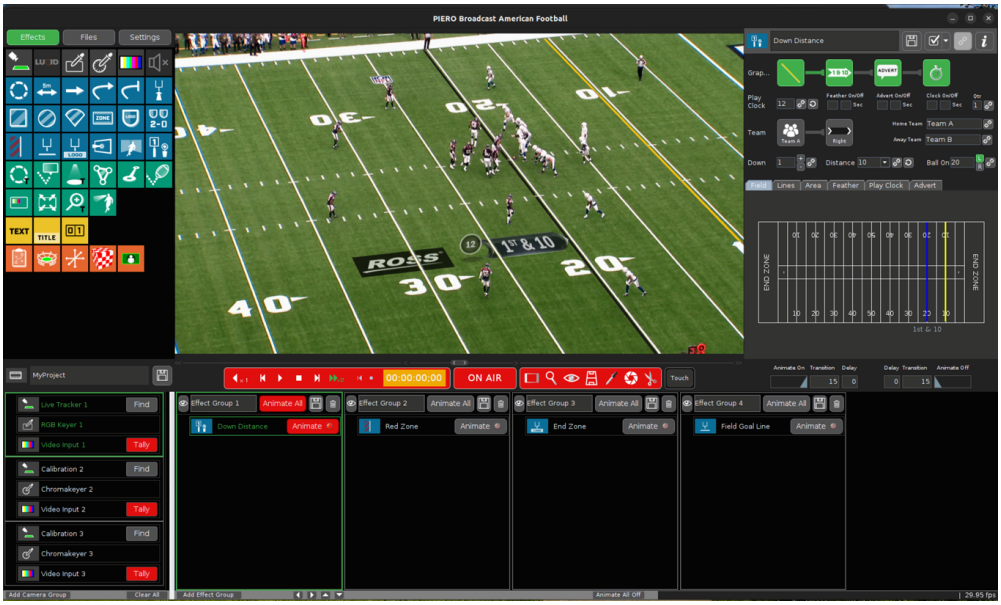
Note changing the Piero active input is achieved by using the video input effect (only available in Piero live).

Video Passthrough Options

Using more than one input or output affects PIERO's performance. Address performance issues, particularly on older PIERO M8s with progressive or HDR formats, by using the 'switched input' passthrough option with only one SDI output.

PIERO Live User Interface

This section provides an overview of the PIERO live user interface, detailing its layout and key components for managing graphics and video inputs during live broadcasts.



PIERO Live User Interface

The interface is divided into the following sections:

Effects Panel

At the top-left of the user interface is the Effects Panel. This section contains multicolor icons representing effects and tools available for use. At the top are grey tool icons, including calibration, keyers, and video switching. Below them are colored icons for graphic effects, such as the **Down and Distance** effect, the **Red Zone** effect, and the **Field Goal Line** effect. The displayed icons depend on the sport chosen in the PIERO launcher.

Video Viewer and Control Bar

In the center of the user interface is the Video Viewer and the Control Bar. This section displays the current input video overlaid with active graphics. The control bar below provides various controls for this video UI. The most critical control is the **ON AIR** button, which users should activate when going live. Refer to the Control Bar 8 section for further details on these controls.

Properties Panel

At the top-right of the user interface is the Parameter Panel. This area contains the property sheet for the currently selected effect or tool.

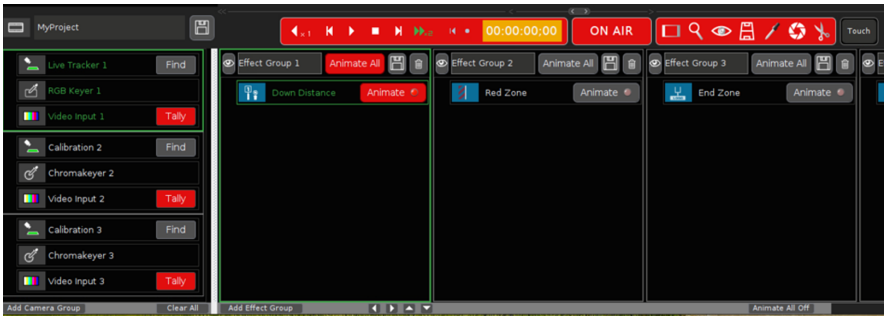
Project Panel

At the bottom of the user interface is the Project Panel. This section displays current tool effects, including calibrations, keyers, and video input switchers. Tools can be grouped by using the **Add Camera Group** button, allowing each group to represent a physical camera input feed into PIERO.

Additionally, in the bottom-right section of the user interface are the columns for active graphic effects, where each column represents a group of effects that can be animated together.

Control Bar

In the Live user interface, effects are switched on and off using buttons rather than time codes, which allows effects to be drawn on-demand. The **ON AIR** highlight indicates whether an effect is visible. When switching between **Analysis** and **Live** modes, all effects will be turned **OFF** to optimize workflow and reduce potential problems when going on air.



Live UI - Control Bar Highlighted in Red

Multi-calibrations

The Live interface allows the use of multiple calibrations simultaneously. Add as many calibrations as needed, depending on the number of live feeds connected to the EVS, and ensure that the **FIND** command can be used on all of them.

The active calibration will be displayed in green, and a **FIND** will be automatically performed each time the user selects a calibration effect, enabling quick switching between cameras and recalibration. In football, this feature is useful when working with both the main match camera and the 18-yard camera.

Cut Detection

Cut detection is useful when working live on an edited feed, as it allows the operator to avoid guessing when the next cut will happen and safely apply graphics to the pitch.

This tool analyzes the live parameters of both the **Calibration** and the **RGB Keyer**.

In order for the cuts to be detected, the **Calibration** and **RGB Keyer** must be active and properly set.

Cut Detection can be turned on at any time, in either **EDIT** or **ON AIR** mode.

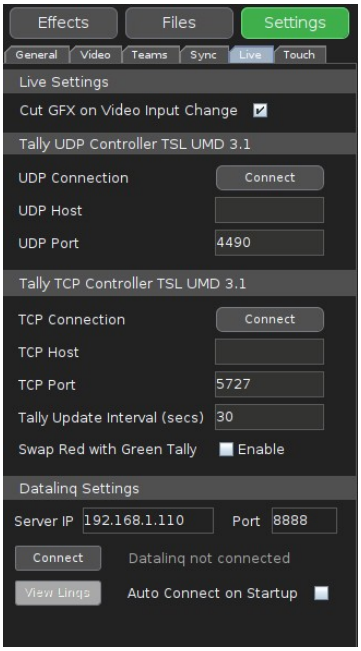
To turn on Cut Detection:

- Select the **Cut Detection** button located in the Control Bar.

  Once **Cut Detection** is activated, it will begin monitoring the RGB Keyer and Calibration parameters, automatically turning all effects off. Before turning **Cut Detection** on, set the RGB Keyer, Calibration and Tracking.

Settings

The **Settings** tab, which is available at the top left of the PIERO UI, allows for configuration of various PIERO settings.For more detailed information on these settings, refer to the *PIERO Broadcast User Guide*. The **Live** sub-tab contains the settings relevant to the live interface, including tally and DataLinq settings.



Settings Tab

Live Settings

The **Live Settings** section contains the options available for the Live interface. Currently, this includes the **Cut GFX on video input change** setting, which automatically de-animates all on-air effects when switching video inputs by selecting a camera group.

Tally Settings

The **Tally Settings** section contains the options needed to configure PIERO's tally integration. PIERO can connect to a tally system over UDP or TCP. The tally ID will automatically change according to the selected camera within a camera group on the Live UI. This allows a camera operator to view which camera is being output from PIERO.

Setting Up Tally TSL UMD v3.1

When PIERO is operated in Live mode, Tally settings can be used to specify network details of your tally controllers, how frequently (in seconds) a complete update should be sent, and whether the tally red or tally green is used to indicate a feed is in use by PIERO.

The connection process is manual and required each time the PIERO software is started. If there is a network issue, PIERO will not reconnect automatically—you must return to **Tally Settings** and connect again.

As some tally controller solutions interpret tally red and tally green differently, there is the option to swap the state being set.

★PIERO reserves the UMD ID values 1 through 8 as a mapping of the SDI inputs 1 through 8. Currently, only SDI inputs 1, 2, and, 3 are used. The remaining UMD ID values are reserved for future use.

To set up Tally:

1. Enter the host name and port needed to access the **Tally Controller**.
2. Select **Connect**.
   - The button turns green if the network details are valid.
   - If it remains grey, check the user information panel on the lower right of the PIERO operator interface.

   ★TSL UMD v3.1 protocol is one-way, which means connection issues may not be reflected immediately.
3. In the **Tally Update Interval** field, enter how many seconds PIERO should wait before refreshing the tally state.

   ★PIERO will stop refreshing the tally state when "0" is entered.

Tally Workflow

This section describes the Tally workflow during live operation once the tally connection has been established.

To use Tally:

1. In PIERO's **Live** mode, open **General Settings** and select **Tally Settings**.
2. Confirm the network settings and select **Connect**.
3. While operating in **Live** mode with **Triple Input**, prepare **Camera Groups** with **Video Input Effects** by selecting the respective SDI inputs.
4. Select a **Camera Group** containing a **Video Input Effect**—or select that **Video Input Effect** itself—to trigger a tally event.

   The **Tally** button in the effect entry turns red when active.
5. Click the **Tally** button to toggle the current state of the **Video Input Effect** and notify the tally system of its status.

   Any other **Video Input Effects** sharing the same SDI input number will also reflect the same **Tally** button state.
6. Select **Connect** a second time to disconnect from the controller.

TSL UMD v3.1 Support

PIERO can send out tally using the Tally TSL UMD v3.1 protocol, which is triggered when a **Video Input Effect** is made active. This is useful in installations where cameras can be tallied when the PIERO operator has selected their feed. It is assumed the tally delegation and distribution is handled by the customer's tally controller.

DataLinq Settings

The **DataLinq Settings** section contains the options needed to connect PIERO to live data feeds such as scoreboards and play clocks.

Ross Video's DataLinq technology allows PIERO to use a separate DataLinq Windows PC server that is configured with the relevant data feed from the scoreboard. Supported scoreboard feeds include systems such as OES and Daktronics. Configuring the DataLinq PC server is beyond the scope of this document – further information is available from Ross Video support. For additional information on setting up and using DataLinq, see the *XPression User Guide*.

Connecting PIERO to the DataLinq server is done using the **DataLinq Settings** section in the Live tab of PIERO Settings.

To connect to the DataLinq Server:

1. In the **DataLinq Settings**, enter the correct hostname or IP address and port for the DataLinq server (default port: 8888).
2. Select **Connect**.
3. (Optional) Enable **Auto Connect** if you want PIERO to connect to the DataLinq server automatically on startup.

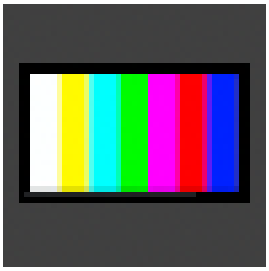
Once DataLinq is successfully connected, you can preview the available tables and fields using the **View Linqs** button in the **DataLinq Settings**. These DataLinq table fields can then be linked to PIERO effects—for example, as described in the Down and Distance 46 section.

Camera Setup

PIERO Live can accept up to three SDI camera inputs, each corresponding to one of the physical cameras in the stadium. In typical American Football terminology, the camera layout is:

- **Camera 1** — Left 20-yard camera
- **Camera 2** — Center camera (50-yard line)
- **Camera 3** — Right 20-yard camera

Switching camera inputs within PIERO Live is managed using the **Video Switcher** tool, represented by the color bars icon in the Effects Panel.



Video Switcher

Adding a **Video Switcher** tool places a row in the tools column at the bottom-left of the UI. From its property sheet, select the relevant SDI input—usually **SDI-1**, **SDI-2**, or **SDI-3**, based on the inputs configured in the Launcher.

The concept is to add a **Video Switcher** tool for each camera, resulting in three rows at the bottom-left of the UI. Selecting a **Video Switcher** row automatically switches PIERO to that camera's video input.

Camera Grouping

In normal use, it is more practical to group tools together so that each group represents a physical stadium camera. Selecting anywhere within that group switches the PIERO video input, key, and calibration for that camera. You may also use the **F1**, **F2**, **F3** etc. hotkeys, to quickly choose the camera groups 1, 2, 3, and so on. Up to seven camera groups can be created.

Add Camera Group

To set up a camera group:

1. Use the **Add Camera Group** button at the very bottom left of the UI.
2. Add a **Video Input Switcher** Tool, **Calibration,** and a **Keyer** to represent the physical camera setup.

   For additional information, see the sections on Calibration 17 and Keying 14.

★Naming the tools according to their camera ID is often helpful during live operation. You can rename effects in the property sheet on the top-right of the Live UI.

Keying

The **RGB Keyer** allows a selection of RGB colors to be keyed.

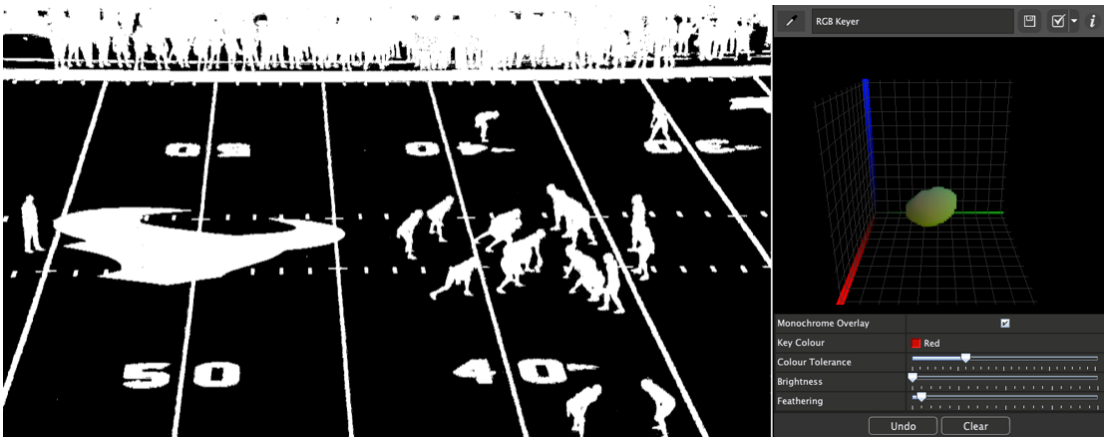
Keying is used in PIERO to make players appear to walk over the graphics. It is also used within the Calibration tool to help identify field lines. The goal is to key the color of the grass or court—not colors found on the players—for each physical camera. Logos physically painted on the field can cause issues. For this reason, the **RGB Keyer** tool is normally recommended, as it can handle multiple color ranges.

To set up an RGB keyer:

1. Add an **RGB Keyer** tool.
2. In the keyer property sheet on the top right of the UI, select **Clear**.

   This will empty the key of any default colors. By default when adding an **RGB keyer** it will try to calculate a useful key using the input video. However, this approximation is often too general for live use, so clearing the initial selection is recommended.
3. Use the mouse to drag a rectangle over some grass in the video window.
   - Repeat the process until a successful key is achieved.
   - Include all potential grass variations such as shadows, stadium dirt, or field-level advert colors if graphics must appear above them.
4. Use the **Monochrome Overlay** property to ensure all grass has been keyed correctly.

   Additionally, you can use the **TAB** shortcut key for a monochrome overlay.
5. Adjust the color tolerance, brightness, and feathering as needed to account for differing lighting levels over a game.



RGB Keyer

6. Use **Feathering** to further improve the keyer.
   - Feathering adds softness to the edge of the key.
   - Its default value is 3 pixels.

7. Use **Environmental Luminance** to improve keying over shadows on a football field.
   - This setting is off by default and can be enabled to add a different style of blending to the keyed graphics.

★Hot keys are available in PIERO live to quickly access the keyers for the different camera inputs.

- **Shift+F1** will quickly access the first keyer.
- **Shift+F2** will quickly access the second keyer and so on up to Shift+F7.

ChromaKeying

An alternative to RGB keying is the Vectorscope tool, which offers a hue-based approach. This method can be more useful for outdoor stadiums, but it is limited to a single hue—typically the green of the grass. For this reason, its use is recommended only in specific scenarios with rapidly changing weather conditions.

See the *PIERO User Guide* for more information on Vectorscope configuration.

AI Player Tracking

AI Player Tracking uses machine learning (ML) to automatically detect and track players during Live operation in PIERO.

AI-enabled effects are identified by the AI label displayed on the effect icon.

AI-Enabled Live Effects Identified by the AI Label

AI-enabled effects operate similarly to their standard Live effect equivalents, but use AI-generated player detections for player tracking.

To use an AI-enabled effect in Live mode:

1. In the PIERO project, add an AI-enabled effect to the project.
2. Enable preview display using the **Show the Selected Effect Only** button.
3. Select a player in the video preview.
4. Animate the effect on air.

   When preview display is enabled, PIERO displays player detection boxes around players available for tracking along with a preview of the selected player before the effect is animated on air.

Live Mode Displaying AI Tracking Effects and Player Detection Boxes

When animated on air, the effect automatically follows the selected player while the player continues to be tracked.

If tracking is temporarily lost, the effect remains active until the configured Stale Threshold value is reached. Once the threshold is exceeded, the effect automatically animates or cuts off. The Stale Threshold settings can be configured in the **AI** tab of the **Settings** menu. For more information on AI tracking settings, see the *PIERO User Guide*.

American Football Calibration

PIERO uses real-time optical tracking for American Football to detect camera movements, including panning, tilting, and field of view changes. This method relies on a relative-only mathematical algorithm, which requires an initial camera position to enable accurate optical tracking. The calibration process to determine each camera's position in the stadium should be completed before the game, as described below.

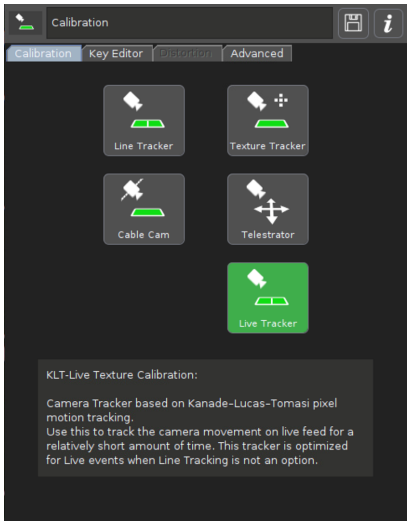
The following topics are covered in this section:

Before the Game

Once a physical camera has been rigged in its final position, a live calibration process should be performed to determine its location within the stadium.

To perform a live calibration process:

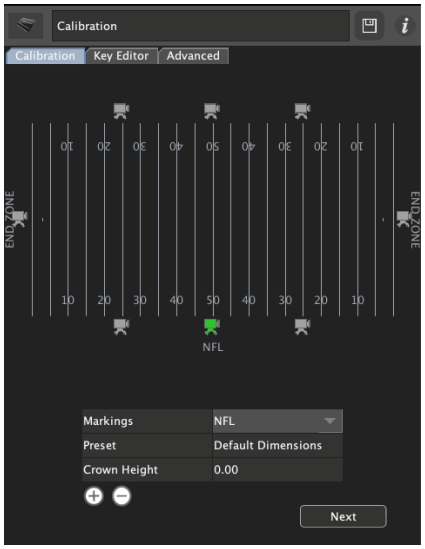
1. Add a **Calibration Tool**, and in the parameter sheet, select the **Live Tracker**.



Parameter Sheet - Live Tracker

2. In the **Calibration** tab, select where the camera is approximately located in the stadium by selecting the grey camera icons around the field lines.
3. In the **Markings** dropdown, select the type of markings (NFL, college, etc.).

   Do not enter a value for the **Crown Height** (not supported in the current release).
4. Select **Next**.

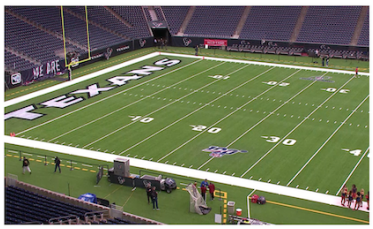


Calibration Tab - Camera Positions

Calibrating Center Camera

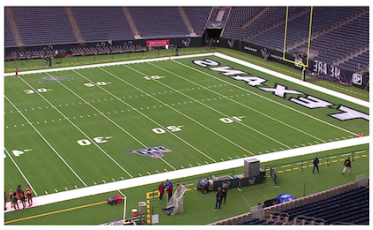
Calibrating the center camera involves determining its exact position in the stadium using three reference shots. This process aligns the field lines visible in the video with the corresponding field positions in the calibration property sheet, allowing PIERO to derive an accurate camera pose for live tracking. The example images below illustrate three typical shot angles used for calibrating the center camera.

1. Left Goal Line to 30 yards



2. Center 40 to 40 yards

3. Right Goal Line to 30 yards



Camera positions

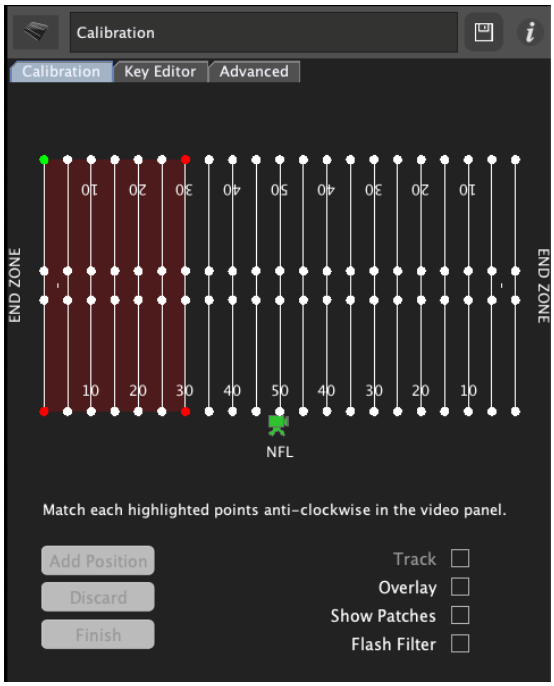
To calibrate the center camera:

1. Instruct the camera operator to obtain an angle of the left side of the field, similar to the example show above.

   ★**Note:** the field of view should be tight enough to just show the farside and nearside lines, as well as contain the goal line and 30 yard line. This tighter shot is to minimize lens distortion.

2. In the **Calibration** property sheet, drag the mouse over the same region - from the goal line to the 30 yard line on the left side of the field.

   The region is highlighted with four corner points, with one of the corner points highlighted green.



Region Highlighted and Showing Four Corner Points

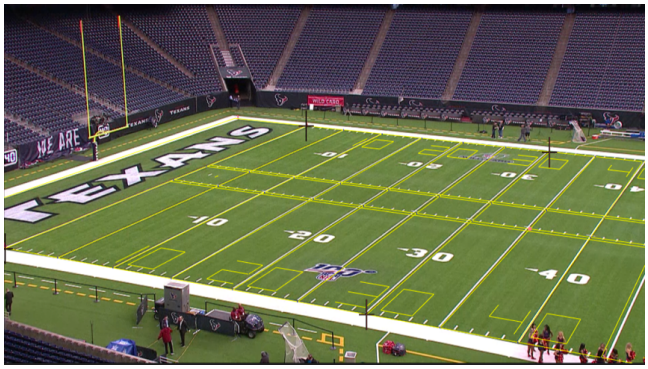
3. Select this same field position in the video window; a small cross will appear (see the small black crosses in the example screen shot below).

   Additionally, you can drag this cross if the placement needs adjustment.

   The next corner point is now highlighted in green in the property sheet.

4. Select that field position in the video window and continue until all four corner points have been positioned.

   After placing the fourth corner point, yellow field lines should appear on the PIERO video window, as shown in the screenshot below.



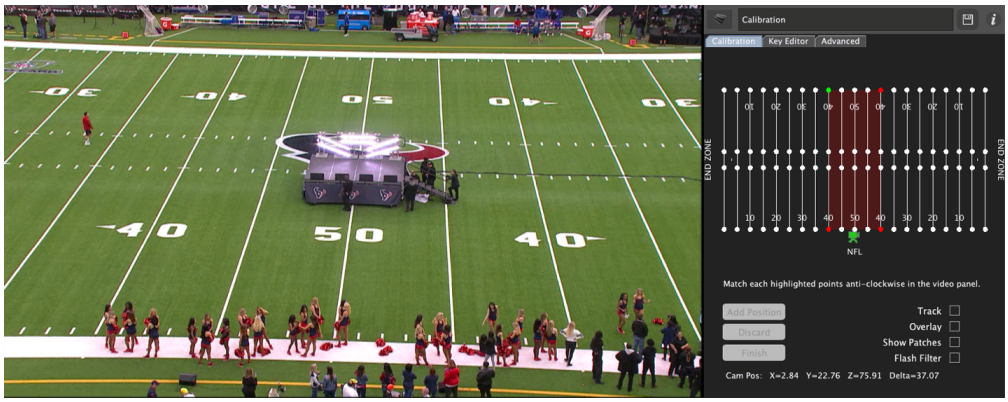
Video UI - Yellow Field Lines

   The yellow lines may not align precisely with the real field lines. If any misalignment is visible, move the mouse to the incorrect point in the video window and click the position where the line should be. The yellow field lines will then adjust to a closer location. Continue this process until you are satisfied that most of the lines align with the real field lines. (Note that it may not be possible to achieve perfect alignment at the edges of the video window due to camera lens and field distortion.)

5. Once the alignment appears correct, select **Add Position** in the property sheet before proceeding to the next shot.

   The property sheet will now show the currently calculated camera position.

6. Repeat the process for the second angle of the center camera (shown below) by dragging the appropriate area on the calibration property sheet (now 40 yard to 40 yard as shown below) and clicking on the relevant points in the video window:



40 Yard to 40 Yard Highlighted

7. Correct any misalignment issues and then select **Add Position**.

★**Note:** The camera position refinement in the property sheet will update, and the refinement value will typically decrease. This value represents the distance between the newly calculated camera position and the previous one, and the goal is for it to approach zero.

10 Yards to Goal Line Highlighted

8. Finally, repeat the same process for the final shot which should be of the right hand side of the field from 30 yards to the goal line.

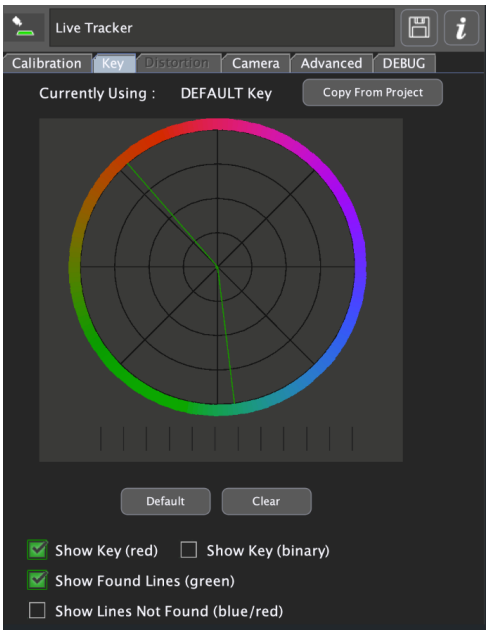
★The above screenshot only shows 10 yards to goal line because the cameraman wasn't instructed correctly.

9. Select **Add Position** and then select **Finish**.

PIERO will automatically enter tracking mode and begin tracking the camera.

Calibration Key

The calibration uses a key to help determine the location of the real field lines. The key is defined in the **Key** tab on the calibration property sheet.



Calibration Property Sheet - Key Tab

The live calibration uses the **DEFAULT Key**, a generic green color, as the default. This is recommended for most American Football use cases, but can be changed if necessary—for example on very muddy grass.

The calibration key can be changed by either adding new key colors 22 or linking to an existing PIERO 22 key.

To add new key colors:

1. In the **Calibration** property sheet, select the **Key** tab.
2. Left-click and drag over the video window to sample and select additional key colors.

To link to an existing PIERO key:

1. In your project, select the **Keyer**.
2. In the **Calibration** sheet, select the **Key** tab.
3. Select **Copy From Project**.

   The calibration now uses the selected key instead of the default.

   For additional information on maintaining better control over keying, refer to the Keying 14 section.

★**Important**: Do not leave the **Key** tab active when using the calibration on air, as this could result in accidental changes to the key. It is recommended to have the **Calibration** tab active when using the calibration on air.

Saving

You have now completed the setup for a camera calibration for in game use.

It is recommended you now save this camera calibration.

To save the camera calibration:

1. Select the  **Save** button at the top right of the property sheet.
2. Rename the calibration after its camera number.
3. Test out the calibration before the game by having the camera operator simulate play.

   See the section, Calibration During the Game 26 to test the calibration.

Calibrating Left Camera

Follow the same calibration procedure described in the Calibrating Center Camera 19 section to determine the camera's physical position on the left 20 yard line. The three camera shots for this camera are shown below. They are also attached full size in the Camera Calibration Shots 29 section.

1. Left Goal Line to 20 yards

2. 20 yards to 40 yards

3. 40 yards to 40 yards

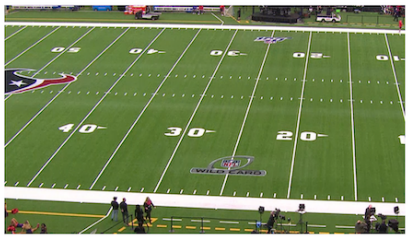
Left Camera Shots

Calibrating Right Camera

Follow the same calibration procedure for the camera on the right 20 yard line. The three camera shots recommended for this camera are shown below. They are also attached full size in the Camera Calibration Shots 29 section.

1. Right Goal Line to 20 Yards

2. 20 yards to 40 yards



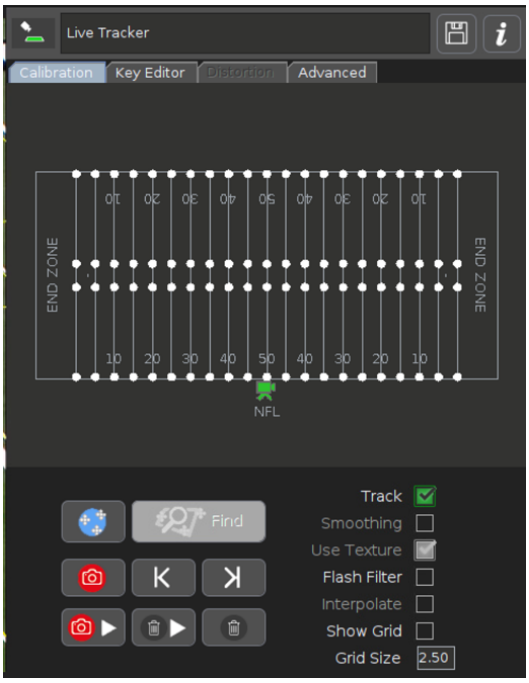
3. 40 yards to 40 yards

Right Camera Shots

Calibration Usage During the Game

During the game, the current calibration will track as long as the **Track** checkbox is selected in the calibration property sheet. The optical tracking algorithm works by tracking small image patches over the field, thereby detecting camera movements in a relative manner. The patches can be viewed by selecting the **Show textures** checkbox in the **Advanced** tab.

Note: Viewing textures is not recommended during live use, as it consumes processor resources.



Calibration Tab - Track Enabled

Due to the limitations of relative optical tracking, the calibration needs to be continually reviewed during the game. For this reason, it is recommended that the **Field Lines Calibration** control button is highlighted during the game. This will then permanently show the yellow field lines overlaid onto the video so the calibration can be constantly reviewed. The **Preview Control** (eye) can also be active, enabling the effect to be previewed before animating on air. In addition, the eyedropper tool on the right can be used at any time to review the current key.

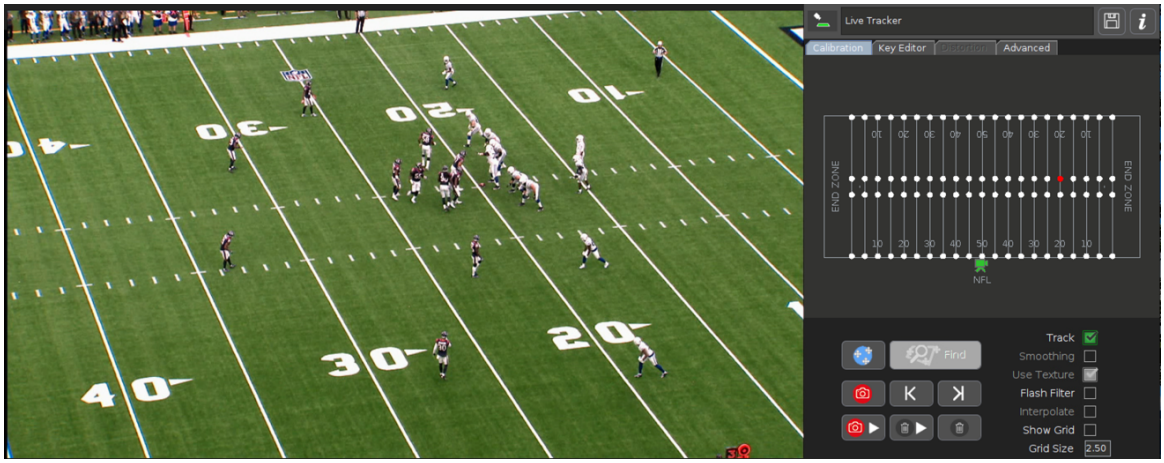
Preview Control (Eye) and Field Lines Calibration Tool Enabled

Correcting Tracking with Click-Find

Because of the relative nature of the optical tracking algorithm, it is necessary to correct the calibration between plays so that the virtual yellow lines are realigned with the real stadium lines.

To correct the calibration between plays:

1. In the **Calibration** tab, select a point on the field close to the first down line.



Calibration Tab - 20 Yard Point Selected

In the example above, the 20 yard point has been selected.

2. Select the same point in the video image.

The virtual lines should realign back to the real field lines.

★**Note:** Hotkeys can be used to speed up selecting a calibration point. For example, pressing **8** selects the right-hand 20-yard point, and pressing **1–9** selects any 10-yard point. Pressing **d** selects the point closest to the current ball-on yardage. A full list of hotkeys is available in the help info (**i**) button at the top right of the property sheet.

Correcting Tracking with Line-Find

The Click-Find method can be time-consuming and may occasionally result in field lines that do not align perfectly. In situations where only minor adjustments are needed, the line-finding algorithm offers an alternative approach. This method is especially useful for close shots where the far side of the field is not visible.

To execute a line find:

- Press the **Find** button in the calibration row on the bottom-left of the live user interface.

★The hotkey for performing this on the current active calibration is **F10**.

Calibration Row - Find Button

With sufficient experience, operators can determine when this algorithm is most effective and when the more precise but time-intensive Click-Find method 27 is the better choice. 27

Camera Calibration Shots Summary

Ensure camera shots are zoomed tight on nearside/farside lines to minimize distortion.

Right Camera Calibration Shots

1. Right Goal Line to 20 Yards

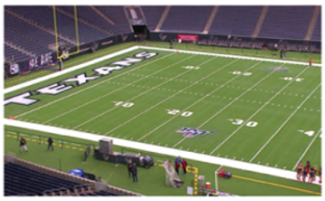
2. 20 yards to 40 yards

3. 40 yards to 40 yards

Right Camera Calibration Shots

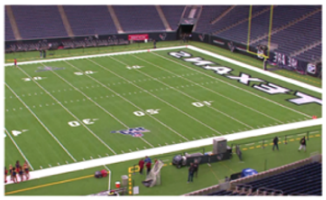
Center Camera Calibration Shots

1. Left Goal Line to 30 yards



2. Center 40 to 40 yards

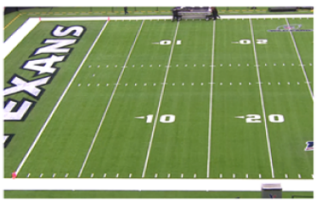
3. Right Goal Line to 30 yards



Center Camera Calibration Shots

Left Camera Calibration Shots

1. Left Goal Line to 20 yards



2. 20 yards to 40 yards

3. 40 yards to 40 yards

Left Camera Calibration Shots

Basketball Calibration

Basketball can utilize the Line Tracker feature, even on courts without traditional white lines. Because the court surface often includes non-white markings and varied color zones, a few additional setup steps are required to achieve accurate tracking.

This chapter provides a detailed guide to configuring a basketball line tracker, using the example court shown in the image below. The varied colors and non-standard line treatments visible in this court will be referenced throughout the walkthrough.

Example Basketball Court

This section covers the following procedures:

Calibrating for Basketball 31

Using the Point Method 33

Setting up the Key 34

Optimization of Lines 35

Saving the Calibration 36

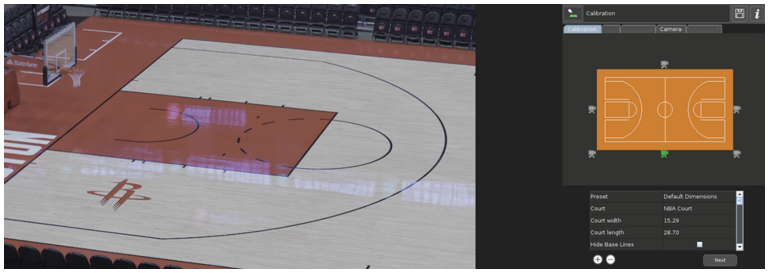
Calibrating for Basketball

This section covers how to calibrate for basketball.

To calibrate for basketball:

1. In the **Calibration** parameter sheet, select **Line Tracker**.

   The model of the world it will track is displayed in the property sheet.



   Calibration Tab

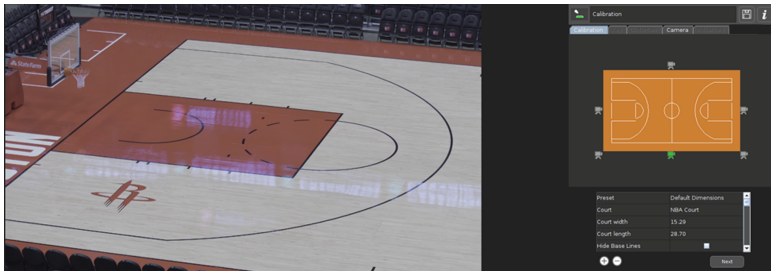
   ★When calibrating, you should still 'pose' the calibration model at each end of the court separately, aligning it to specific points in the video as per the standard procedure. In the **Calibration** property sheet image above, the court shown in the video window does not yet match the model, but as you proceed through the basketball calibration steps, the model will update accordingly.

2. Remove any lines in the model that do not exist in the video.

   In this step, it is important that the **Court** property matches the actual court type. In this example it is set to NBA, as that reflects the general layout of the court. Since the inner lane lines are not visible in the video, they must be removed from the model. This can be done in one of two ways:

   - Scroll down the list of properties in the table below the model and find the **Inner Lane Line** property and change its value to **NONE**.
   - Right-click on the line on the model that is not present in the video and a pop-up menu will appear where you can select **NONE**.

   Either method will remove the line from the model, and your model should now match the image below, with the inner lane lines removed.



   Calibration Tab - Model with Inner Lane Lines Removed

   ★Note: At this stage, the structure of the model matches the layout seen in the video, but the line colors do not yet correspond.

3. Select **Next**.

Video - Line Colors Not Matching

4. Continue with the To use the point method 33 procedure to pose a basketball calibration.

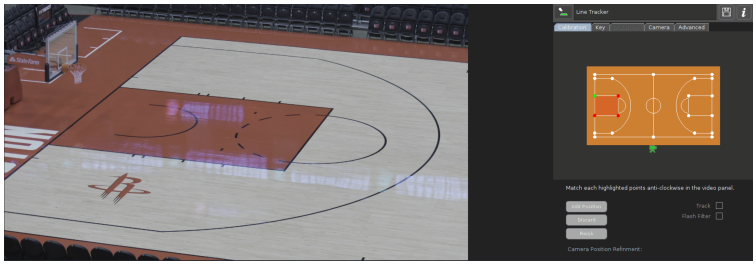
Using the Point Method

This section covers how to use the point method.

To use the point method:

1. Select a number of white calibration points on the model that are visible in the video window.
2. In the video window, select the point that matches the green highlighted point on the model.

   Once added, the green point moves on the model to indicate to the user which point in the video window should be added next.



Calibration Tab - Model Showing Green Point

   Once all the calibration points have been placed in the video window, the calibration will snap to a "pose".

3. Ensure the yellow lines align as closely as possible with the actual court lines, refining the alignment by clicking the line intersections in the video—where small pink dots appear—to make precise adjustments.

Yellow Lines Matching Court

   ★**IMPORTANT**: Do not press **Add Position** at this stage. Once **Add Position** is selected, the basketball model will attempt to optimize for the lines beneath the yellow overlays, and it requires the Key to be correctly set for this process to work effectively.

4. Go to the To set up the Key 34 procedure.

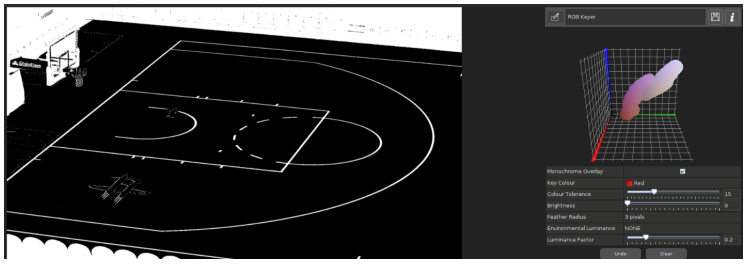
Setting up the Key

This section covers how to set up the Key.

To set up the Key:

1. Add an **RGB Keyer** effect to your project.
2. In the video window, click and drag a box around different regions of the court.

   Ideally, include only the court surface in the key while excluding the lines. This same key can also be used for graphics.



   Key Operated in the Monochrome Overlay Mode

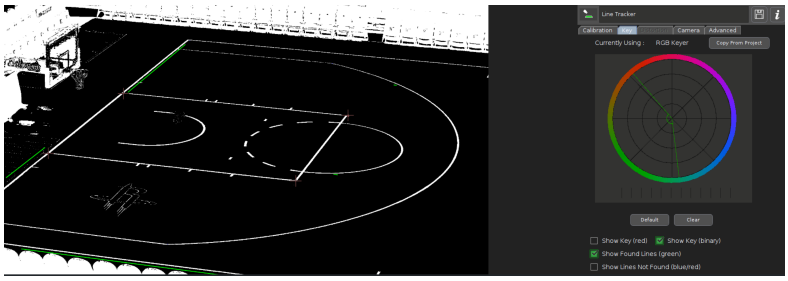
   The image above shows the key setup for the example. Notice how the court is set to black in monochrome overlay mode while the lines are not included in the key and appear white. Aim for a key that resembles white lines on a black background, with the white lines matching those in your model.

3. Re-select the calibration effect and select the **Key** tab, then select the **Copy From Project** button.

   The values in the **RGB Keyer** are copied into the calibration's internal key.

4. Select the **Show Key (binary)** checkbox.

   The key is displayed in the **Calibration** effect and the property sheet displays **Currently Using: RGB Keyer**.



   Key Copied From the RGB Keyer Effect

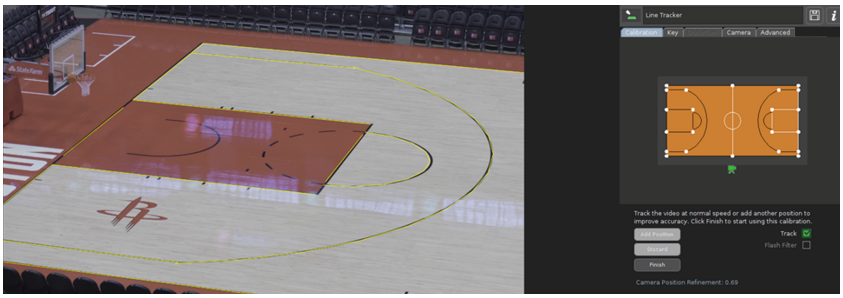
   At this stage, only a few green lines may appear in the video window, which is expected and indicates that the line finder is not yet detecting the required lines. Confirmation can be obtained by selecting the **Show Lines Not Found** checkbox. Blue lines will appear where lines are expected, and the fact that they are blue rather than green shows that the line finder has not recognized them. Line optimization is required at this point.

5. Go to the Optimization of Lines 35 section.

Optimization of Lines

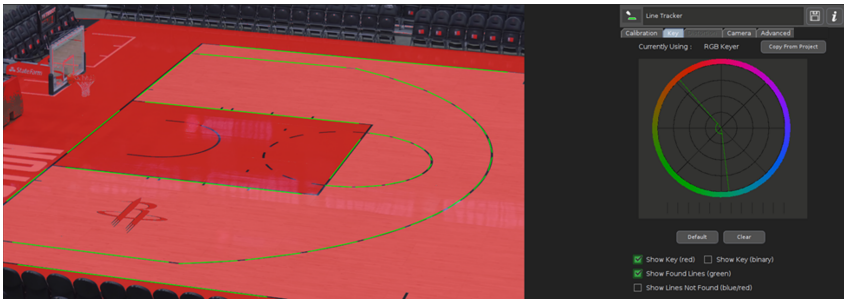
Once the model has been initially aligned and the key set, the user can select the **Add Position** button. In basketball, selecting this button adds the pose to the system for camera position refinement, while also scanning the image along the yellow overlay lines to determine the optimal line-finding parameters for each line in the model.

Once completed, the model on the property sheet updates to visually reflect the different types of lines. The system can only optimize lines currently visible in the video window. However, accounting for certain symmetries in the court, it can predict lines not in view. As shown in the image below, where the initial model had all white lines, some have now changed to black, and an edge has appeared around the court.



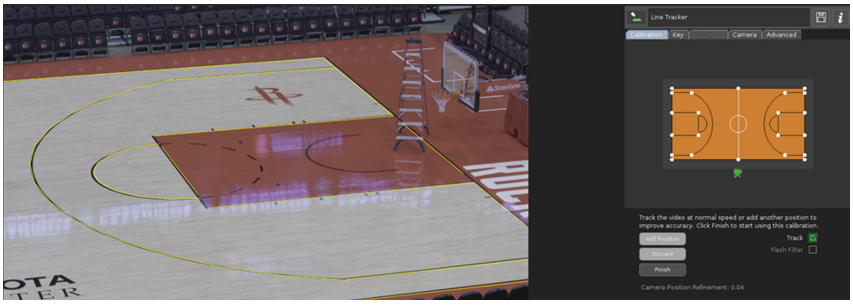
The Model Displaying the Optimized Lines

Selecting the **Key** tab now displays all the expected lines being found.



Expected Lines Shown in Green

After optimization, all expected lines appear in green, indicating that they have been successfully detected and can be used for tracking the scene. This initial view of the court begins the optimization process for the model. In this example, the calibration will next be posed at the opposite end of the court so the tracker can detect additional lines and further refine the model. Repeating the posing at the opposite end of the court optimizes these additional lines, as shown in the image below.



Calibration - Opposite End of the Court

At this stage of the calibration process, two views of the environment have been incorporated into the calibration, and these views are used to calculate a consistent camera position. The halfway line remains white, even though it should be black based on the video, because the calibration has not yet detected this line for optimization. Manual optimization of visible lines can be performed by pressing the **O** shortcut key.

With the line tracker active and the **Finish** button not yet selected, lines can continue to be optimized manually using the **O** shortcut key while the calibration simultaneously tracks through the video and refines the camera position.

In this scenario, play the video until the center line appears in view (or request the camera operator to pan to the center of the court for live video). Once the center line becomes visible, press the **O** shortcut key to correctly set it. The **Camera Position Refinement** value is displayed at the bottom of the calibration property sheet; as the camera pans around the court, this value should decrease and eventually stabilize. Once it stabilizes, the calibration is complete.

Saving the Calibration

After completing your calibration, saving it will add a new value called **Last Dimensions** to the **Preset** property for future calibrations. Alternatively, Alternatively, the optimized model can be saved by following these steps:

1. Rename the calibration effect to something new.
2. Press the **U Shortcut Key**.

   Any new calibration will now include the updated name of the calibration in its **Preset** property list.

Lucid Calibration

The **Lucid Calibration** tool in PIERO Live enables live camera head position data to be received directly from Lucid Track, Ross Video's external camera tracking software product. This integration provides precise, real-time camera calibration for virtual graphics and live production applications.

Once connected, PIERO automatically reads live camera tracking data — including field of view, pan, tilt, roll, and XYZ position — from Lucid Track, ensuring alignment between camera movement and virtual overlays.

Before performing Lucid calibration, ensure that:

- Lucid Track is installed and configured on the same network as the PIERO Live system.
- The PIERO Renderer IP address is added to the Renderers list in Lucid Track.
  - This must match the PIERO system's IP and the Lucid Track's communication port.
  - If multiple camera heads are used, each may transmit on a unique port number.

Note: This chapter describes how to use the **Lucid Calibration** tool within PIERO Live. It does not cover the setup, configuration, or operation of Lucid Track itself. For detailed information on Lucid Track, refer to the *Lucid User Guide.*

The following topics are covered in this section:

Connecting to Lucid Track

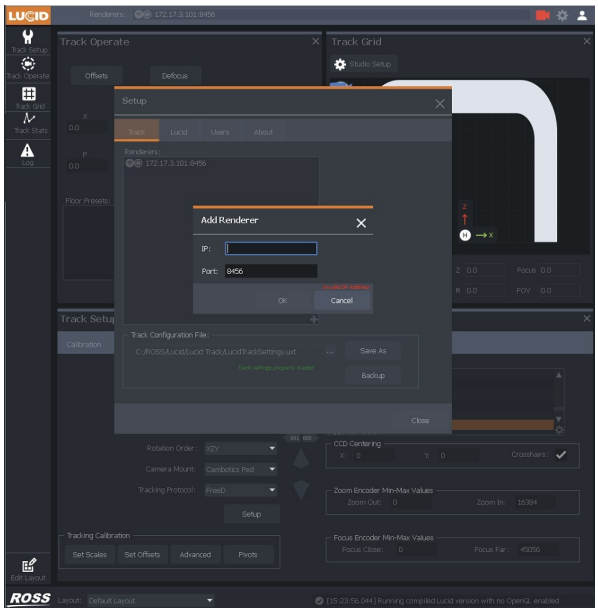
The Lucid Calibration tool requires a live connection between PIERO and the Lucid Track system. This connection allows PIERO to receive real-time camera head position and lens data for accurate synchronization between virtual and live video.

Before proceeding, ensure that Lucid Track is running and configured on the same network as the PIERO workstation.

To connect PIERO to Lucid Track:

1. Launch Lucid Track and open the **Setup** window.
2. In the **Track** tab, add the PIERO system's Renderer IP address to the Renderers list.

   The IP address must match the PIERO workstation.



Setup Window - Track Tab

3. Confirm that the communication port (default 8456) is available and correctly assigned.

   Additionally, if multiple camera heads are used, assign a unique port number for each.
4. Leave Lucid Track running and connected.
5. Open the PIERO Launcher and configure the following parameters:
   - **Mode**: Live Camera Head.

     ★This parameter tells PIERO to expect live calibration data and reduces the delay between input and output video.
   - **Video Input / Output**: Configure SDI as required for your setup.
   - Configure all other Launcher parameters according to your production requirements.
6. Select **Launch PIERO**.

   PIERO opens the standard Live user interface.
7. In PIERO Live, select the **Lucid Calibration** tool.

8. In the **Lucid Calibration** parameter sheet, verify the following:

   - The **Lucid Port** matches the port configured in Lucid Track.
   - The **Connection Status** reads *Connected*.

   PIERO begins receiving live tracking data (field of view, pan, tilt, roll, and XYZ position) from Lucid Track.

   For more details, see Using the Lucid Calibration Tool 40.

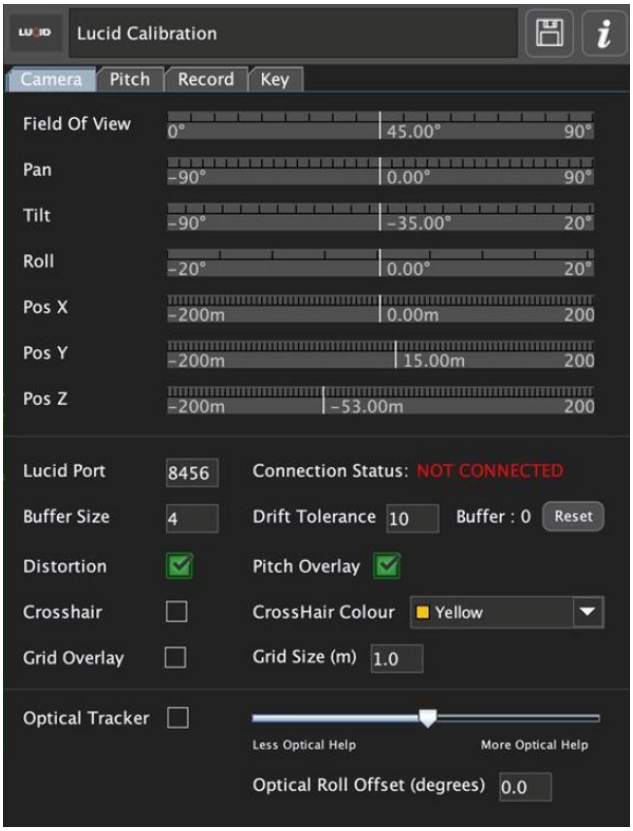
Using the Lucid Track Tool

Once PIERO is connected to Lucid Track, the system begins receiving continuous camera position and lens data in real time. The **Lucid Calibration** tool can then be used to monitor this live data, verify synchronization between tracking and video, and confirm that virtual graphics align accurately with the playing surface.

The **Lucid Calibration** parameter sheet interface is divided into several tabs. Each tab provides tools and parameters for monitoring and adjusting different aspects of calibration and alignment.

Camera Tab Settings

The Camera tab displays the live tracking data received from Lucid Track and includes settings that affect synchronization, display overlays, and optical-tracking behavior. These controls are typically adjusted during initial setup or troubleshooting.



Lucid Calibration - Camera Tab

The following table describes the available fields and their functions in this tab.

Setting	Description
Field of View / Pan / Tilt / Roll / Position (X/Y/Z)	Real-time values representing the camera's orientation and position as reported by Lucid Track. These fields are read-only.
Lucid Port	Specifies the network port used by PIERO to communicate with Lucid Track.
Connection Status	Displays whether PIERO is actively connected to Lucid Track. When communication is established, this

Setting	Description
	reads **Connected**.
Buffer Size	Defines the number of frames used to buffer tracking data for synchronization with incoming video. Adjust this value if the virtual graphics appear out of sync.
Drift Tolerance	Determines how long (in frames) the actual buffer size can deviate from the target before PIERO automatically resets synchronization. Default value: **10**.
Reset	Manually resets the data buffer to rebuild synchronization.
Distortion	Enables or disables lens distortion correction, based on calibration parameters set in Lucid Track.
Pitch Overlay	Displays or hides a pitch overlay in the video output. Useful for verifying field alignment.
Crosshair /Crosshair Colour	Displays a central crosshair overlay for camera alignment. The **Crosshair Colour** field allows selection of the display color.
Grid Overlay / Grid Size (m)	Displays a visual grid over the pitch to assist with calibration. The **Grid Size (m)** parameter controls the spacing between grid lines.
Optical Tracker / Optical Slider	Activates optical assistance that helps the camera head remain aligned with field markings. Use the slider to adjust the amount of optical correction applied.
Optical Roll Offset	Specifies a roll offset value copied from Lucid Track. Used when the physical camera head is not perfectly level.

Notes:

- PIERO passively receives tracking data from Lucid Track, with all positional adjustments and offsets configured within Lucid Track itself.
- The **Buffer Size** and **Drift Tolerance** settings maintain synchronization between live video and tracking data, which may vary when traversing through different network paths.
- The **Crosshair**, **Pitch Overlay**, and **Grid Overlay** options are visual aids only and do not affect calibration parameters.

Pitch Tab Settings

The **Pitch** tab defines the playing-surface dimensions used for calibration. Adjusting these values ensures the virtual pitch aligns correctly with the real playing field.

Lucid Calibration - Pitch Tab

This tab lets you:

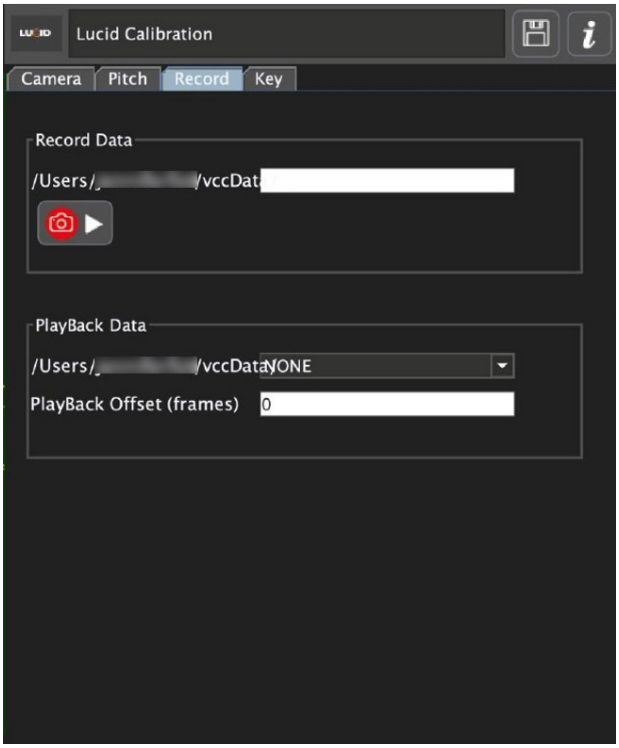
- Set the playing-field dimensions, such as width and length.

  ★These values can be entered manually or loaded automatically using the available **Preset** options.

- Restore previous measurements using **Last Dimensions**, which reverts the field to the most recently used values.

Record Tab Settings

The **Record** tab is primarily for testing and diagnostic use. It allows operators to record Lucid tracking data, play back previous sessions, and test synchronization without a live Lucid feed.



Lucid Calibration - Record Tab

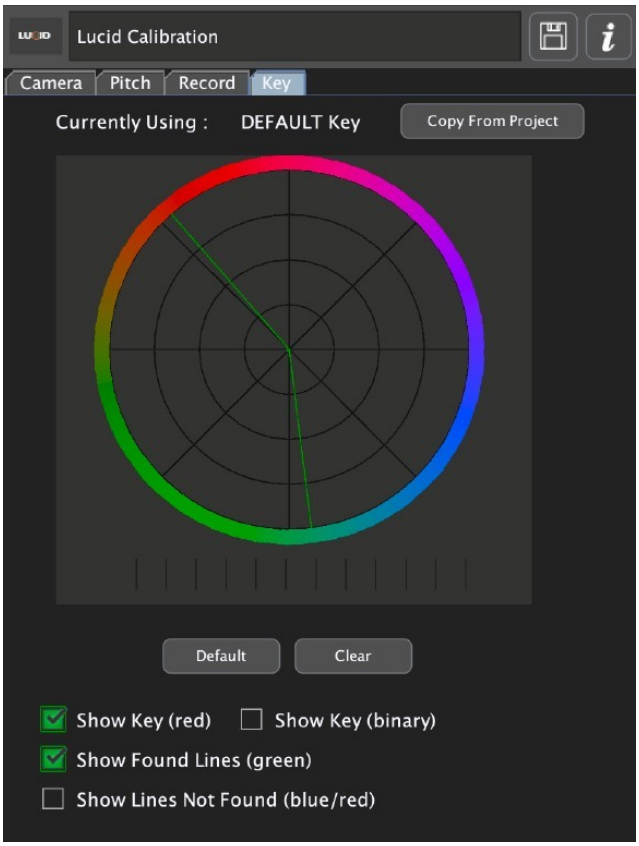
The following table describes the available fields and their functions in this tab.

Setting	Description
Record Data	Begins recording the tracking data stream from Lucid Track to a local file. Useful for debugging or playback testing.
Playback Data	Loads previously recorded Lucid tracking data for review when no live connection is available.
Playback Offset (frames)	Offsets playback relative to live video for synchronization analysis.

Key Tab

The **Key** tab defines the optical key used for Lucid-based tracking. This process is identical to the standard Keying workflow used elsewhere in PIERO.

For full details on defining and adjusting optical keys, refer to the **Keying** section of this user guide and the *PIERO User Guide*.



Lucid Calibration - Key Tab

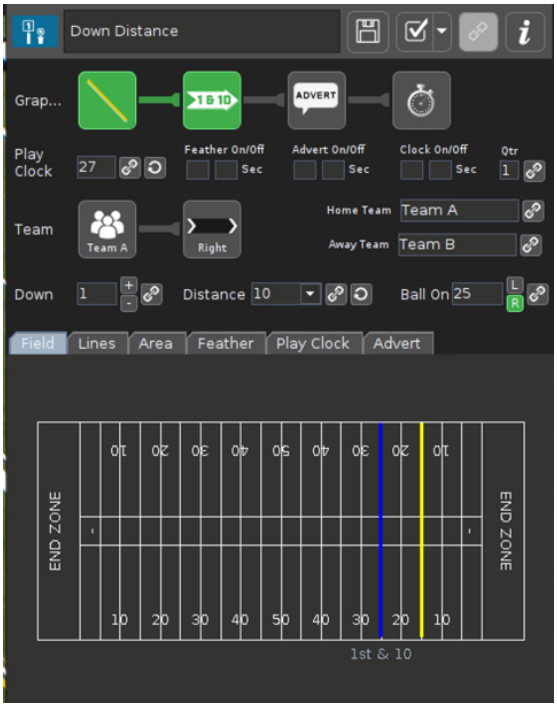
American Football Effects

This chapter provides a comprehensive guide to configuring and operating American football effects in PIERO. It covers the **Down and Distance** effect in detail, including setup instructions, operational guidelines, shortcut keys, and DataLinq integration for automatic updates. Additionally, the chapter offers an overview of other essential effects for football broadcasts, such as the **Red Zone**, **Field Goal Line**, **End Zone**, and **Scores and Badges**, to enhance viewer engagement and deliver accurate, dynamic in-game graphics.

Down and Distance Effect

The Down and Distance effect is used for American Football to display the first down line and the line of scrimmage, as well as a distance marker and timer. Once cameras, keyers and calibrations have been set up, the Down and Distance effect can be added.

The Down and Distance property sheet is shown below:



Down and Distance Property Sheet

The following table summarizes the primary components shown in the property sheet:

Setting	Description
Graphics	Toggle controls for the down lines, feather, advert, and play clock (green indicates active). The inter-connecting icons can be toggled and determine whether a parent graphic controls a child graphic's visibility.
Play Clock	Settings for the current play clock display and its on/off trigger values. The triggers allow each graphic (feather, play clock, or advert) to be automatically animated on or off at the inputted play clock seconds value. See Animating Graphics On/Off 48 for information on how to animate these graphics.
Team	Indicators for current team in play and play direction These values can be connected if needed.

Setting	Description
Down	Displays the current down, distance, and ball yardage. Ball yardage may also be referred to as “ball on.”
Property Tabs	Additional property tabs for line styles, area styles, feather graphics, play clock graphics, and adverts.
Field Overview	A visual representation of the field showing the current position of the first down and scrimmage lines.

Animating Graphics On/Off

The current **Play Clock** settings and on/off triggers allow you to control the animation timing for each graphic, such as a feather, play clock, or advert. By entering specific play clock values in the on/off trigger text boxes, you can automatically animate graphics at the desired times. When the connecting line of the preceding graphic is activated, trigger seconds are calculated relative to the moment the parent graphic was manually clicked.

To animate graphics on/off:

- In the **On/Off** trigger text boxes, enter the desired play clock values to set the automated animation timing for the desired graphic, such as feather, play clock, or advert.

  Alternatively, if no values are entered in the trigger boxes, the graphic must be animated manually by pressing the relevant button.

  For example: Automatically animate an advert on when the play clock reaches 20 by entering “20” into the “on” trigger textbox, and animate it off when the play clock resets by entering “40” into the “off” trigger textbox. These trigger seconds are interpreted differently when the connecting line of the preceding graphic is activated. In this scenario, the seconds become relative to when the parent graphic was manually clicked.

Configuration

Before play, configure the following settings for the Down and Distance effect. When configuration is complete, save the effect before continuing.

Setting	Description
Home / Away Team	Enter team names into the **Home/Away Team**, text fields of the property sheet. These can be DataLinqed. 49
Line Style	Set the desired line style and colors using the **Lines** tab on the property sheet.
Area Style	Set the desired area style (which is drawn between the scrimmage line and the first down line) by using the **Area** tab of the property sheet.
Feather Graphics	Set the Home/Away feather graphics by using the **Feather** tab on the property sheet. Feathers can be images (PNG recommended) or TGA sequences.
Play Clock Graphics	Set the Home/Away play clock graphic by using the **Play Clock** tab on the property sheet
Adverts	Configure the adverts in the **Advert** tab. Adverts can be images (PNG files recommended) or movies (TGA folders). Adverts can be configured per down.

DataLinq

DataLinq can be used to automatically drive the Down and Distance properties using a DataLinq connection to the stadium scoreboard. Attempting to drive the Down and Distance manually is possible but requires a lot of concentration.

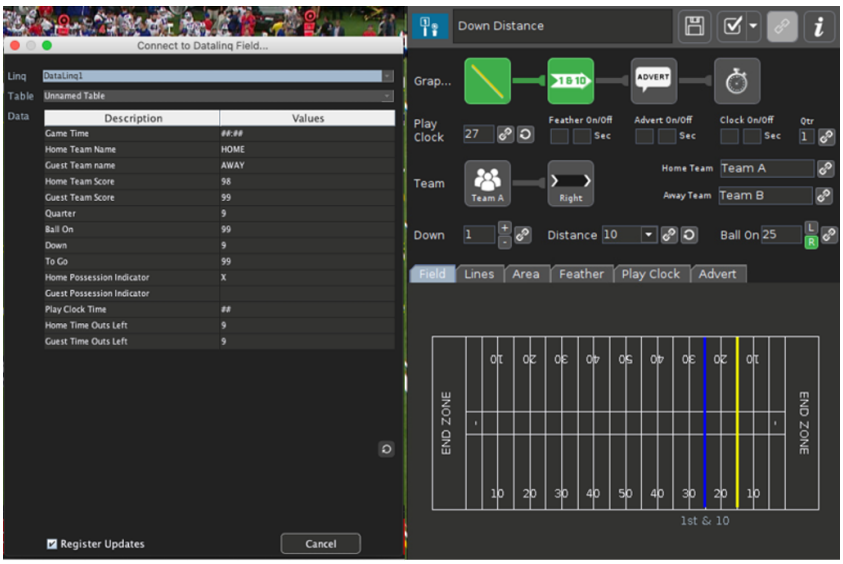
The following parameters can be connected to the relevant DataLinq scoreboard fields:

- **Down**
- **Distance**
- **Yardage (or ball-on)**
- **Play Clock**
- **Quarter**
- **Home Team Name**
- **Away Team Name**

To use DataLinq:

1. Connect to DataLinq using the **PIERO Settings** tab as described in the DataLinq configuration 48 section.
2. Select one of the chain icons in the property sheet.

   A DataLinq pop-up window appears.



DataLinq Pop-Up Window

3. Select the relevant cell in the table that matches the property in the property sheet to be linked.

   For example, to connect the **Down** property, select the second-column table cell that contains the matching down value. Do not select the text description cell in the first column – it must be the number value in the second column.

Scoreboards do not generally indicate which side of the field play is on, as American Football yardage from 50 to 0 appears on both sides of the field. Because of this, the operator must check which side of the field play is currently on and manually set the left/right buttons in the Down and Distance property sheet.

Down and Distance Property Sheet - Left / Right Buttons

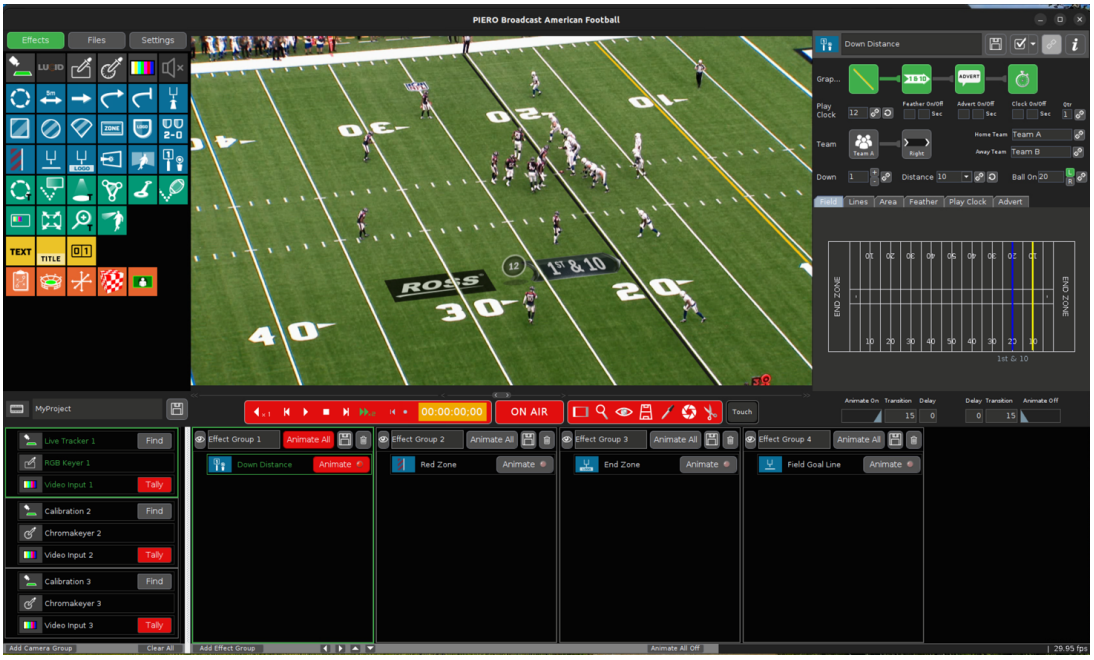
Shortcut Keys

There are a number of shortcut keys available for the down and distance effect the most important of which are summarised below. A complete list of hot keys and mouse usage are available in the "**i**" help icon at the top right of the property sheet.

Hot key	Behaviour
2 Digit numbers	Typing two digits can be used to quickly choose the current ball on yardage. For example typing "21" will choose the 21st yard.
l	Selects the left side of the field.
r	Selects the right side of the field.
,	Increases down number.
.	Decreases down number.
d	Resets to 1st down and 10 yards.

Live Down and Distance Operation

Live operational use of the down and distance effect (with 3 cameras) is illustrated below.



Down and Distance - Live Operational Use

For each play, the following steps should be executed:

To operate the Down and Distance effect during each play:

1. Ensure that PIERO is "ON AIR" and that the **Preview** and **Field Control** buttons are active.

   ON AIR, Preview, and Field Control Buttons Activated

   This allows calibration and graphics to be previewed before anything is animated on air.

2. Select the current active camera (center, left or right) by clicking on the relevant camera group previously set up on the bottom-right of the PIERO UI.

   Additionally, hot keys are available to perform this action: **F1** selects the first camera, **F2** the second camera, and **F3** the third, etc.

3. Ensure the calibration is correct using the yellow field lines as a visual guide.

4. If the calibration is incorrect, use the calibration find procedures outlined in the calibration section 17.

   Additionally, the **F1**, **F2,** or **F3** hotkeys will automatically select the calibration effect for fast workflow use.

5. Ensure the keying is correct by using the eye dropper tool (on the left of the **Field Lines** tool) to show the current key.

   ★Hot keys **Shift+F1**, **Shift+F2** etc., can be used to quickly select the relevant keyer for camera 1, 2, and so on.

6. Verify the Down and Distance effect is positioned correctly and displaying the correct information.
   - Use the **Preview** tool to display the effect in the video window without sending it to air.
   - Use the **F8** hotkey to automatically select the Down and Distance effect.
7. When calibration and graphics appear correct, use the **Animate** button (or press the space bar) to animate the Down and Distance effect on air.

   The **Animate** button turns red when the effect is active.

Active Animate Button

8. When the play is complete, animate off the graphic by selecting the **Animate** button again or press the space bar.
9. Repeat **Steps 2 through 6** as each new play begins.

Live Shortcut Keys

Several hot keys are available to speed up live operation. The most important hot keys are listed below.

A complete list for the Live user interface can be viewed using the **Shortcuts** button in the general settings of the PIERO user interface. Hot keys specific to each effect can be viewed using the "i" icon in the effect property sheet at the top right of the Live user interface.

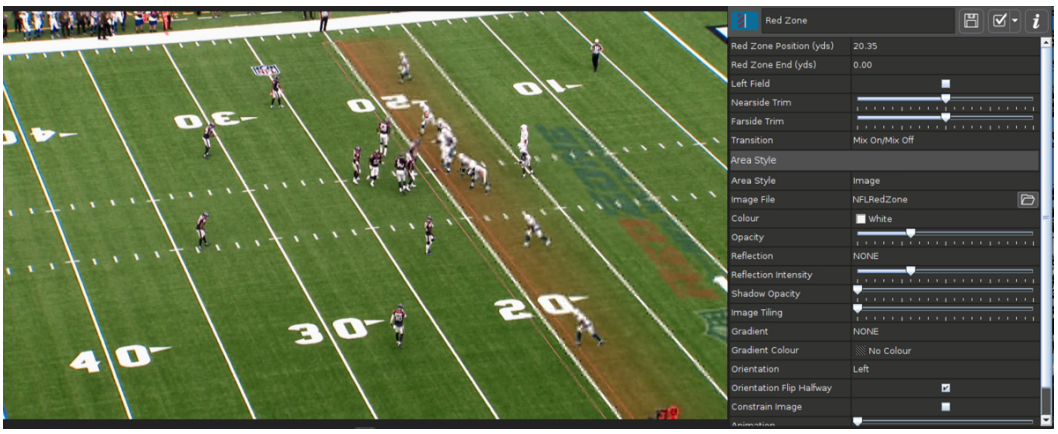
Hot key	Behaviour
F1, F2, F3, etc.	Selects the camera group and calibration for camera 1, 2, 3, etc.
Shift+F1, Shift+F2, etc.	Selects the keyer for camera 1, 2, 3, etc.
F8	Selects the Down and Distance effect (or if D&D effect not found, then the first effect in effect group 1).
F9	Toggles key overlay.
F10	Executes a "Find" on the current calibration.
<Space>	Animates the selected effect on or off.
d	Selects the nearest calibration click-find point to the current ball-on yardage from the Down and Distance effect (only when a calibration is selected).

Other Effects

The following effects are covered in this section:

Red Zone

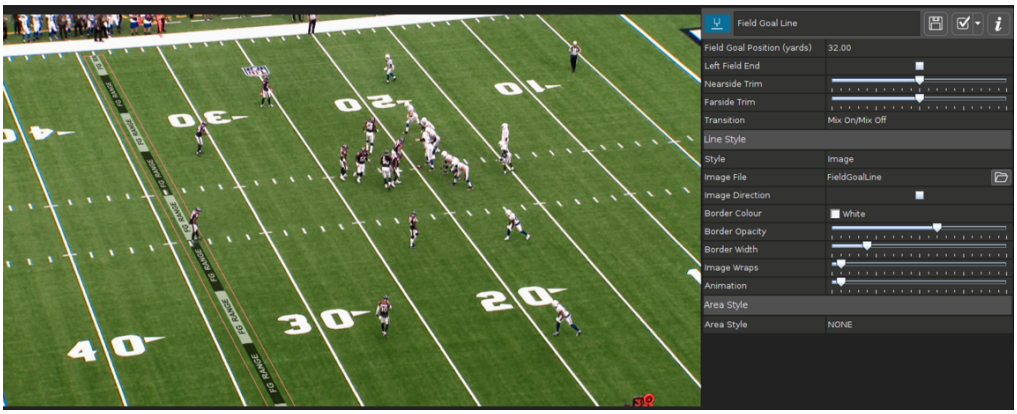
The Red Zone effect paints a 20-yard area of the field in red (or applies a user-selectable image, as shown below). The start and end positions of the red zone can be configured in the property sheet. Shortcut keys are available—see the "i" help info icon.



Red Zone

Field Goal Line

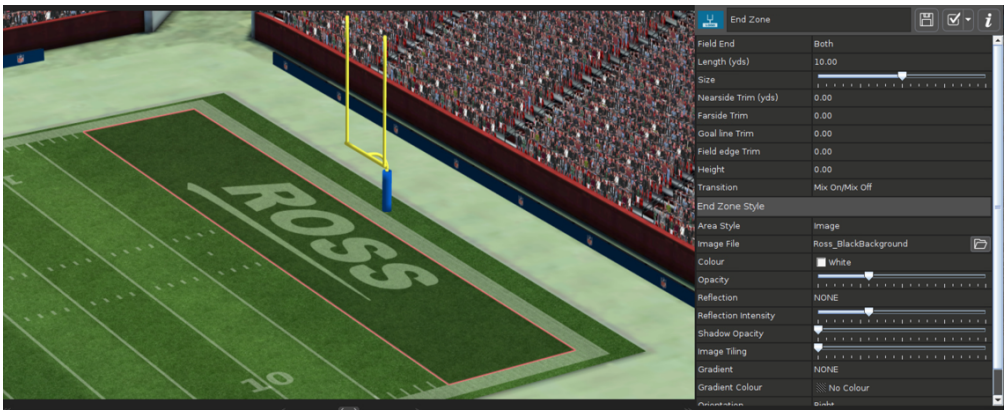
The Field Goal Line represents the theoretical distance a goal kicker can kick a field goal during play. It can be placed anywhere along the field. The line style and animation can be adjusted using the property sheet. Shortcut keys are available—see the "i" help info icon.



Field Goal Line

End Zone

An End Zone graphic can be added to either or both sides of the field using the End Zone effect. This graphic can be used for an advert or a team logo. Shortcut keys are available—see the "i" help info icon.



End Zone

Scores and Badges

The Scores and Badges effect allows the current score and team logos to be placed onto the field to inform viewers of the score. The scores can be connected to the scoreboard via DataLinq using the chain icons in the property sheet (ensure connection to DataLinq is established first). The team logos can also be changed in the property sheet.

Scores and Badges

Basketball Effects

This chapter provides an overview of essential basketball effects, including the **Shot Clock** and **3-Point Line**, aimed at captivating viewers and presenting precise, dynamic in-game visuals.

3-Point Line

The **3-point Line** effect for basketball highlights the 3-point line or free throw line with customizable styles, such as laser or glow effects, adding visual impact to enhance the viewing experience.

The **3-Point Line effect** requires calibration 17 and a key 14.

Three Point Line Effect (showing Line Selection for Three Point or Free Throw Line)

To use the 3-Point Line effect:

1. In the Launcher, select basketball for the sport mode.
2. Add the **3-point Line** effect to the project.
3. Select which end of the court you want the effect to appear on.
4. In the **Properties** tab, configure the following:

Property	Description
Line Selection	Select **Three Point Line** or **Free Throw Line** to choose which line to highlight.
Court End	Select which end of the court the effect appears on.
Transition	Choose an animation option: **On, Off, or Mix On/Mix Off**.

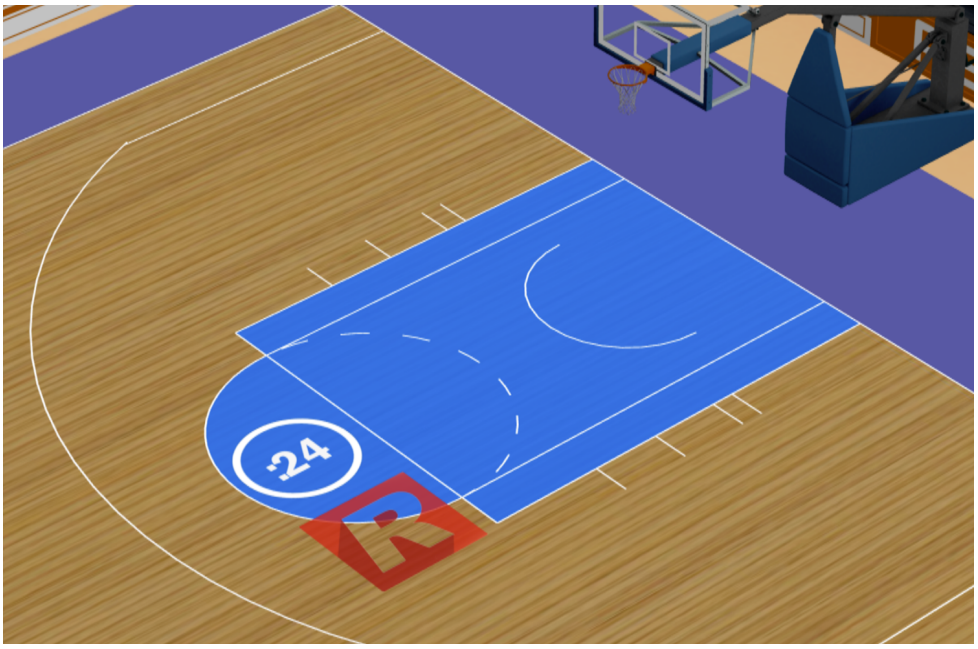
5. In the **Properties** tab, customize the **Line Style** as follows:

Property	Description
Border Style	Select a visual style for the line, such as **Glow** or **Laser**.
Border Colour	Choose a color for the line.
Border Opacity	Adjust the transparency of the line border.
Border Width	Define the thickness of the line border.
Border Animation	Set the animation rate for the line border.
Pulse Animation	Adjust the rate at which the border pulses.

★The **Pulse Animation** slider controls the rate at which the border pulses.

Shot Clock

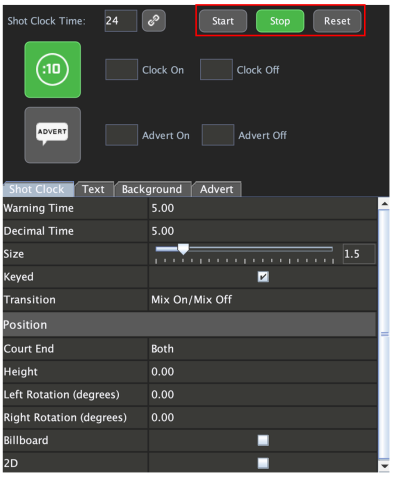
The **Shot Clock** effect draws a countdown clock graphic at each end of the court (or field for other sports). It is mainly used for basketball, but can be used for other sports. Optional advert properties are available, should an advert need to be placed beneath the shot clock.



Shot Clock

To manually control the Shot Clock:

1. Add the **Shot Clock** effect to the project.
2. In the effect's parameter sheet, control the time of the clock by selecting the **Start**, **Stop**, and **Reset** buttons.

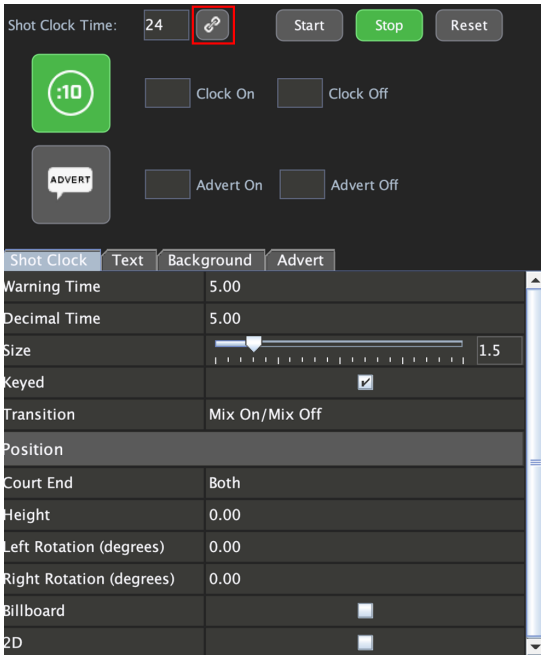


Shot Clock Parameter Sheet - Control Buttons

To enable automatic control of the Shot Clock:

★Requires DataLinq integration.

1. Ensure DataLinq is configured.
2. In the **Shot Clock** parameter sheet, select the **Linq** button next to the **Shot Clock Time** field.



Shot Clock Parameter Sheet - Linq Button

The **Shot Clock** can now be driven automatically from a DataLinq feed.

Additional Shot Clock Properties

This section describes the available options for customizing the shot clock's appearance, behavior, and accompanying elements through various tabs in the user interface.

Shot Clock Tab

- Control graphics using the **Shot Clock** and **Advert** buttons on the top-left of the property sheet.
- Trigger animations with the **Clock On/Off** or **Advert On/Off** text boxes.

  Entering a time (in seconds) will trigger the graphic to animate at that time.
- Configure visual cues using **Warning Time** and **Decimal Time** settings to change the shot clock's color or display decimals at specified times.
- Customize the Shot Clock using the **Position** options such as height, rotation, and position. For example, the shot clock can be placed at both ends of the court or within a 2D box.

Text Tab

- Customize the style and appearance of the Shot Clock's text, including font, size, and color.

Background Tab

- Configure the background behind the Shot Clock, with options to change its style and appearance. The default background is a white circle.

Advert Tab

- Customize the advert's style, selecting from an image, a movie, or a video input to appear beneath the Shot Clock.

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