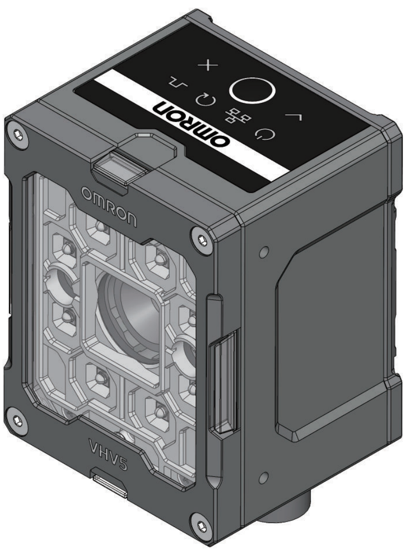
OMRON

Autofocus Multicode Reader

VHV5-F Series

User Manual



Z476-E-03 (84-9000470-02-C)

Introduction

Thank you for purchasing the VHV5-F Autofocus Multicode Reader.
This manual contains information that is necessary for using the VHV5-F.
Please read this manual and make sure you understand the functions and capabilities before you attempt to use it in a control system.
Keep this manual in a safe place where it will be available for reference during operation.

Intended Audience

This manual is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent).

- Personnel in charge of introducing barcoding systems.
- Personnel in charge of designing barcoding systems.
- Personnel in charge of installing and maintaining barcoding systems.
- Personnel in charge of managing barcoding systems and facilities.

Applicable Products

This manual covers the following products:

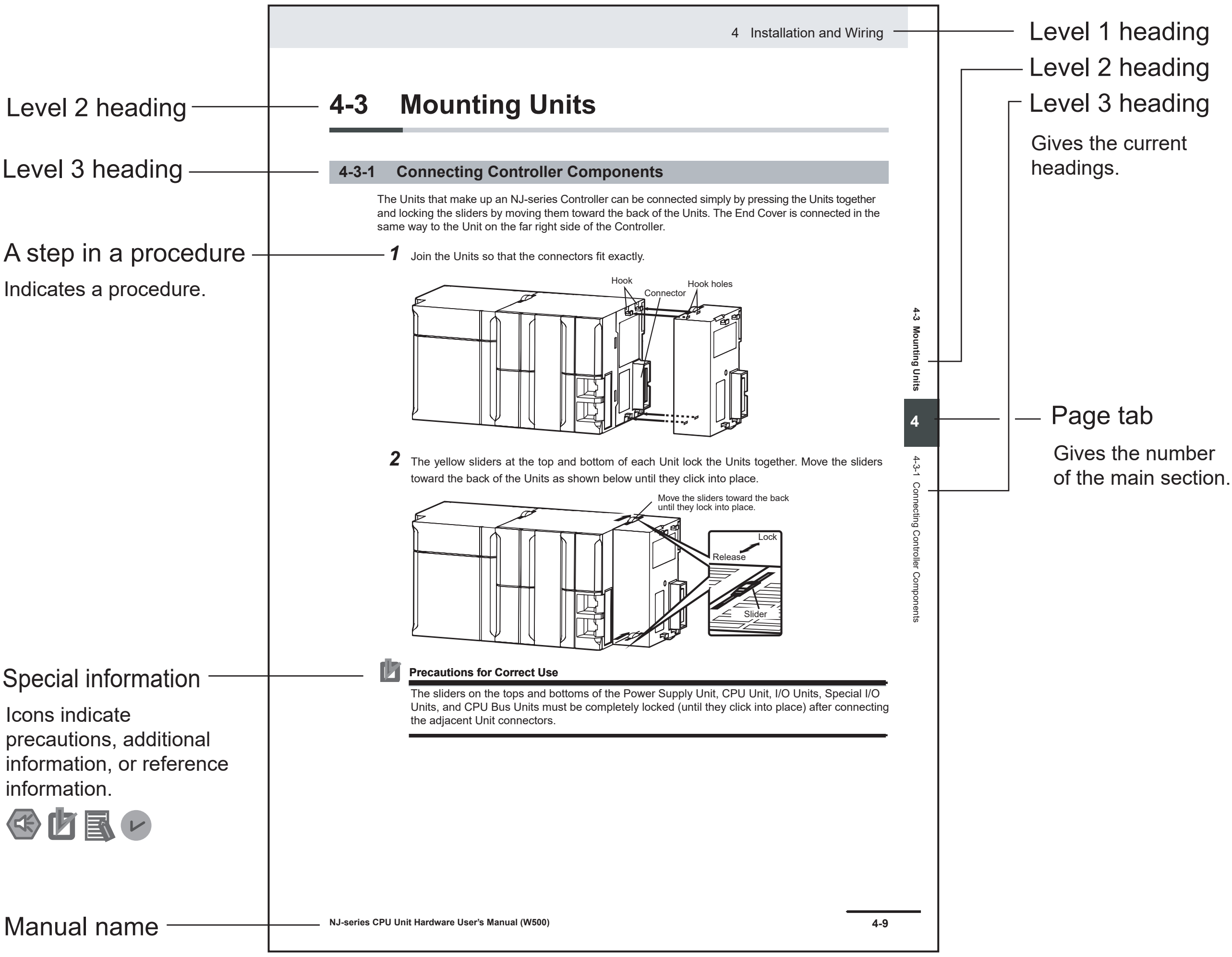
- VHV5-F Autofocus Multicode Reader

Parts of the specifications and restrictions for each product may be listed in other manuals. Please refer to *Related Manuals*.

Manual Structure

Page Structure

The following page structure is used in this manual.



Note : This page is a sample for the purpose of describing the page structure. It differs in its actual content.

Icons

The icons used in this manual have the following meanings.

Precautions for Safe Use

Precautions on what to do and what to avoid doing to ensure the safe use of the product.

Precautions for Correct Use

Precautions on what to do and what to avoid doing to ensure proper operation and performance.

Additional Information

Additional information to read as required.
This information is provided to increase understanding or make operation easier.

Version Information

Information on differences in specifications and functionality for Product with different product versions is given.

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Terms and Conditions Agreement

Warranty, Limitations of Liability

Warranties

- **Exclusive Warranty**

  Omron’s exclusive warranty is that the Products will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Omron (or such other period expressed in writing by Omron). Omron disclaims all other warranties, express or implied.

- **Limitations**

  OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, ABOUT NON-INFRINGEMENT, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OF THE PRODUCTS. BUYER ACKNOWLEDGES THAT IT ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE.

  Omron further disclaims all warranties and responsibility of any type for claims or expenses based on infringement by the Products or otherwise of any intellectual property right.

- **Buyer Remedy**

  Omron’s sole obligation hereunder shall be, at Omron’s election, to (i) replace (in the form originally shipped with Buyer responsible for labor charges for removal or replacement thereof) the non-complying Product, (ii) repair the non-complying Product, or (iii) repay or credit Buyer an amount equal to the purchase price of the non-complying Product; provided that in no event shall Omron be responsible for warranty, repair, indemnity or any other claims or expenses regarding the Products unless Omron’s analysis confirms that the Products were properly handled, stored, installed and maintained and not subject to contamination, abuse, misuse or inappropriate modification. Return of any Products by Buyer must be approved in writing by Omron before shipment. Omron Companies shall not be liable for the suitability or unsuitability or the results from the use of Products in combination with any electrical or electronic components, circuits, system assemblies or any other materials or substances or environments. Any advice, recommendations or information given orally or in writing, are not to be construed as an amendment or addition to the above warranty.

  See http://www.omron.com/global/ or contact your Omron representative for published information.

Limitation on Liability; Etc

OMRON COMPANIES SHALL NOT BE LIABLE FOR SPECIAL, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR PRODUCTION OR COMMERCIAL LOSS IN

ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED IN CONTRACT, WARRANTY, NEGLIGENCE OR STRICT LIABILITY.

Further, in no event shall liability of Omron Companies exceed the individual price of the Product on which liability is asserted.

Application Considerations

Suitability of Use

Omron Companies shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Product in the Buyer’s application or use of the Product. At Buyer’s request, Omron will provide applicable third party certification documents identifying ratings and limitations of use which apply to the Product. This information by itself is not sufficient for a complete determination of the suitability of the Product in combination with the end product, machine, system, or other application or use. Buyer shall be solely responsible for determining appropriateness of the particular Product with respect to Buyer’s application, product or system. Buyer shall take application responsibility in all cases.

NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY OR IN LARGE QUANTITIES WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCT(S) IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

Programmable Products

Omron Companies shall not be responsible for the user’s programming of a programmable Product, or any consequence thereof.

Disclaimers

Performance Data

Data presented in Omron Company websites, catalogs and other materials is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of Omron’s test conditions, and the user must correlate it to actual application requirements. Actual performance is subject to the Omron’s Warranty and Limitations of Liability.

Change in Specifications

Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the

Product may be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.

Errors and Omissions

Information presented by Omron Companies has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or omissions.

Safety Precautions

Definition of Precautionary Information

The following notation is used in this manual to provide precautions required to ensure safe usage of the VHV5-F Autofocus Multicode Reader.
The safety precautions that are provided are extremely important for safety. Always read and heed the information provided in all safety precautions.
The following notation is used.

⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. Additionally, there may be severe property damage.
⚠ Caution	Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury, or property damage.

Symbols

General Prohibition	Indicates general prohibitions, including warnings, for which there is no specific symbol.
General Caution	Indicates general cautions, including warnings, for which there is no specific symbol.
Electrical Hazard	Indicates the possible danger of electric shock under specific conditions.
High Temperature	Indicates the possibility of injuries by high temperature under specific conditions.
General instructions	Instructions on unspecified general action.

WARNING

⚠ WARNING

This product must be used according to this document. Failure to observe this may result in impairment of functions and performance of the product.

This product is not designed or rated for ensuring safety of persons. Do not use it for such purposes.	
When using equipment that is connected to an AC power source such as an AC adapter or PoE injector, use it within the rated voltage range. Usage with a voltage higher than what it is rated for may cause serious personal injury due to electric shock, or serious physical damage due to fire or equipment failure. Do not touch any part of the device while in operation, or immediately after turning OFF the power.	

Security Measures

Anti-virus protection
Install the latest commercial-quality antivirus software on the computer connected to the control system and maintain to keep the software up-to-date.

Security measures to prevent unauthorized access
Take the following measures to prevent unauthorized access to our products.
- Install physical controls so that only authorized personnel can access control systems and equipment.
- Reduce connections to control systems and equipment via networks to prevent access from untrusted devices.
- Install firewalls to shut down unused communications ports and limit communications hosts and isolate control systems and equipment from the IT network.
- Use a virtual private network (VPN) for remote access to control systems and equipment.
- Adopt multifactor authentication to devices with remote access to control systems and equipment.
- Set strong passwords and change them frequently.
- Scan virus to ensure safety of USB drives or other external storages before connecting them to control systems and equipment.

Data input and output protection
Validate backups and ranges to cope with unintentional modification of input/output data to control systems and equipment.
- Checking the scope of data
- Checking validity of backups and preparing data for restore in case of falsification and abnormalities
- Safety design, such as emergency shutdown and fail-soft operation in case of data tampering and abnormalities

Data recovery
Backup data and keep the data up-to-date periodically to prepare for data loss.

When using an intranet environment through a global address, connecting to a SCADA or an unauthorized terminal such as an HMI or to an unauthorized server may result in network security issues such as spoofing and tampering. You must take sufficient measures such as restricting access to the terminal, using a terminal equipped with a secure function, and locking the installation area by yourself.

When constructing an intranet, communication failure may occur due to cable disconnection or the influence of unauthorized network equipment. Take adequate measures, such as restricting physical access to network devices, by means such as locking the installation area.

When using a device equipped with the SD Memory Card function, there is a security risk that a third party may acquire, alter, or replace the files and data in the removable media by removing the removable media or unmounting the removable media. Please take sufficient measures, such as restricting physical access to the Controller or taking appropriate management measures for removable media, by means of locking the installation area, entrance management, etc., by yourself.

Software

To prevent computer viruses, install antivirus software on a computer where you use this software. Make sure to keep the antivirus software updated.

Keep your computer's OS updated to avoid security risks caused by a vulnerability in the OS.

Always use the highest version of this software to add new features, increase operability, and enhance security.

Manage usernames and passwords for this software carefully to protect them from unauthorized uses.

Set up a firewall (E.g., disabling unused communication ports, limiting communication hosts, etc.) on a network for a control system and devices to separate them from other IT networks. Make sure to connect to the control system inside the firewall.

Use a virtual private network (VPN) for remote access to a control system and devices from this software.

Caution

⚠ Caution

Danger of burns. Do not touch the case while the code reader is running or just after power is turned OFF, since it remains extremely hot.

Be careful when connecting devices to the external light connector. The connector provides 1.5A @ 24V.

Consignes de sécurité

Définition des informations de précaution

La mention suivante est utilisée dans ce manuel pour indiquer les précautions à prendre pour garantir une utilisation sûre du lecteur de codes VHV5-F.
Les précautions indiquées sont extrêmement importantes pour la sécurité. Lisez et respectez toujours les informations fournies dans toutes les consignes de sécurité.
La notation suivante est utilisée.

AVERTISSEMENT	Indique une situation potentiellement dangereuse qui, si elle n'est pas évitée, peut entraîner la mort ou des blessures graves. En outre, des dommages matériels importants peuvent être causés.
Attention	Indique une situation potentiellement dangereuse qui, si elle n'est pas évitée, peut entraîner des blessures mineures ou modérées, ou des dommages matériels.

Symboles

	Interdiction générale Indique des interdictions générales, y compris des avertissements, pour lesquelles il n'existe pas de symbole précis.
	Précautions générales Indique des mises en garde générales, y compris des avertissements, pour lesquelles il n'existe pas de symbole précis.
	Danger électrique Indique le risque possible de décharge électrique dans des conditions spécifiques.
	Température élevée Indique la possibilité de blessures causées par des températures élevées dans des conditions précises.
	Instructions générales Instructions liées à une action générale non précisée.

AVERTISSEMENT

AVERTISSEMENT

Ce produit doit être utilisé conformément au présent document. Le non-respect de cette consigne peut entraîner une altération des fonctions et des performances du produit.	

Ce produit n'est pas conçu ni évalué pour assurer la sécurité des personnes. Ne l'utilisez pas à de telles fins.

Lorsque vous utilisez un équipement connecté à une source d'alimentation CA, comme un adaptateur CA ou un injecteur PoE utilisez-le dans la plage de tension nominale. L'utilisation d'une tension supérieure à celle pour laquelle l'appareil est conçu peut provoquer des blessures graves par électrocution ou des dommages physiques importants par incendie ou défaillance de l'équipement. Ne touchez aucune partie de l'appareil lorsqu'il est en fonctionnement ou immédiatement après l'avoir éteint.

Mesures de sécurité

Protection antivirus
Installez le plus récent logiciel antivirus de qualité commerciale sur l'ordinateur connecté au système de contrôle et maintenez-le à jour.

Mesures de sécurité visant à empêcher tout accès non autorisé
Prenez les mesures suivantes pour empêcher l'accès non autorisé à nos produits.

- Installez des contrôles physiques afin que seul le personnel autorisé puisse accéder aux systèmes et équipements de contrôle.
- Réduisez les connexions aux systèmes et équipements de contrôle via les réseaux afin d'empêcher l'accès de dispositifs non fiables.
- Installez des pare-feu pour fermer les ports de communication inutilisés, limiter les hôtes de communication et isoler les systèmes et équipements de contrôle du réseau informatique.
- Utilisez un réseau privé virtuel (RPV) pour l'accès à distance aux systèmes et équipements de contrôle.
- Adoptez l'authentification multifactorielle pour les dispositifs d'accès à distance aux systèmes et équipements de contrôle.
- Définissez des mots de passe solides et changez-les fréquemment.
- Effectuez une analyse antivirus pour garantir la sécurité des clés USB ou d'autres supports de stockage externes avant de les connecter aux systèmes et équipements de contrôle.

Protection de l'entrée et de la sortie des données
Validez les sauvegardes et les gammes pour faire face aux modifications involontaires des données d'entrée/sortie des systèmes et équipements de contrôle.

- Contrôle de la portée des données
- Contrôle de la validité des sauvegardes et préparation des données à restaurer en cas de falsification ou d'anomalie
- Conception de sécurité, comme l'arrêt d'urgence et le fonctionnement en mode « à sûreté intégrée » en cas de falsification des données et d'anomalies

Récupération de données
Effectuez des copies de sauvegarde des données et tenez-les à jour régulièrement pour vous préparer à une perte de données.

Lors de l'utilisation d'un environnement intranet par le biais d'une adresse globale, la connexion à un SCADA ou à un terminal non autorisé comme une IHM ou à un serveur non autorisé peut entraîner des problèmes de sécurité du réseau comme l'usurpation et la falsification. Vous devez prendre des mesures adéquates comme restreindre l'accès au terminal, utiliser un terminal équipé d'une fonction de sécurité et verrouiller vous-même la zone d'installation.

Lors de la construction d'un intranet, des pannes de communication peuvent se produire en raison d'une déconnexion de câble ou de l'influence d'un équipement réseau non autorisé. Prenez des mesures adéquates, comme la restriction de l'accès physique aux dispositifs réseau, par exemple en verrouillant la zone d'installation.

Lorsque vous utilisez un appareil doté d'une carte SD, il existe un risque de sécurité qu’un tiers puisse acquérir, modifier ou remplacer les fichiers et les données du support amovible en retirant ou en démontant le support amovible. Veuillez prendre des mesures adéquates, comme restreindre l’accès physique au contrôleur ou prendre des mesures de gestion appropriées pour les supports amovibles, en verrouillant la zone d’installation, en gérant les entrées, etc.

Logiciel
Pour éviter les virus informatiques, installez un logiciel antivirus sur l’ordinateur où vous utilisez ce logiciel. Veillez à ce que votre logiciel antivirus soit toujours à jour.

Maintenez le système d’exploitation de votre ordinateur à jour pour éviter les risques de sécurité causés par une vulnérabilité du système d’exploitation.

Utilisez toujours la version la plus récente de ce logiciel afin d’ajouter de nouvelles fonctionnalités, d’améliorer l’efficacité opérationnelle et de renforcer la sécurité.

Gérez soigneusement les noms d’utilisateur et les mots de passe de ce logiciel afin de les protéger contre les utilisations non autorisées.

Mettez en place un pare-feu (par exemple, pour désactiver les ports de communication inutilisés, limiter les hôtes de communication, etc.) sur le réseau du système et des dispositifs de contrôle afin de les séparer d’autres réseaux informatiques. Veillez à vous connecter au système de contrôle à l’intérieur du pare-feu.

Utilisez un réseau privé virtuel (RPV) pour accéder à distance au système et aux dispositifs de contrôle à partir de ce logiciel.

Attention

⚠ Attention

Risque de brûlures. Ne touchez pas le boîtier lorsque le lecteur de codes est en marche ou juste après la mise hors tension, car il reste extrêmement chaud.

Soyez prudent lorsque vous connectez des appareils au connecteur de lumière externe. Le connecteur fournit 1,5 A à 24 V.

Precautions for Safe Use

Conditions for the Safe Use of This Product

- Be careful when handling product. Dropping it may cause injury to you or others or may cause the product to malfunction.
- Be careful when unpacking and handling product. Avoid sharp edges that may cause injury.
- Ensure the product is mounted securely and all mounting hardware is firmly attached when installing and using the product.
- Use only with a correctly functioning power supply. Application of a voltage that exceeds the specification may damage the product and cause it to malfunction.
- Use only cables that are designed for the application. Use of cables that are longer than needed may introduce excess noise into the image.
- Do not bend cables more than recommended by the cable specifications. The product may malfunction.
- Always use the lens cover when storing the product.
- While the power is ON or immediately after the power is turned OFF, the case is still hot. Do not touch the case.
- Do not look directly into the lens of this product. The lights may be bright enough to cause discomfort or injury to the eyes and eyesight.
- When disposing of the product, treat it as an industrial waste.

Précautions à prendre pour une utilisation adéquate et sécuritaire

Conditions d’utilisation sécuritaire de ce produit

- Manipuler le produit avec soin. Le laisser tomber peut causer des blessures à vous, à d’autres personnes ou peut causer un dysfonctionnement du produit.
- Déballez et manipulez le produit avec prudence. Évitez les côtés et coins pointus qui peuvent causer des blessures.
- Assurez-vous que le produit est monté en toute sécurité et que tout le matériel de montage est fermement attaché lors de l’installation et de l’utilisation du produit.
- Utilisez uniquement avec une alimentation fonctionnant correctement. L’application d’une tension qui dépasse les spécifications peut endommager le produit et le faire mal fonctionner.
- Utilisez uniquement les câbles conçus pour l’application. L’utilisation de câbles plus longs que nécessaire peut introduire un excès de bruit dans l’image.
- Ne pliez pas les câbles plus que ce qui est recommandé par les spécifications du câble. Le produit peut mal fonctionner.
- Protéger adéquatement la lentille avec un couvercle avant l’entreposage.
- Lors de la mise en tension, boitier devient chaud et reste chaud un certain temps lors de la mise hors tension. Ne touchez pas le boitier.
- Ne regardez pas directement dans la lentille de ce produit. Les lumières peuvent être suffisamment brillantes pour causer de l’inconfort ou des blessures aux yeux et à la vue.
- Traitez ce produit comme un déchet industriel pour en disposer.

Precautions for Correct Use

Conditions for the Correct Use of This Product

- Install, store and use the product in a location that meets the following conditions:
  - The ambient temperature does not fall below 0°C. (-25°C for storage)
  - The ambient temperature does not rise above +45°C (+65°C for storage)
  - Relative humidity of between 25% to 85%
  - No rapid changes in temperature (dew does not form)
  - There is no presence of corrosive or flammable gases
  - Is free of dust, salts and iron particles
  - Is free of vibration and shock
  - Is out of direct sunlight
  - Product will not come into contact with water, oils or chemicals
  - Product will not be affected by strong electro-magnetic waves
  - Is not near to high-voltage, or high-power equipment
- Be careful when connecting or removing cables. Applying excessive force to the cables or connectors may cause damage or injury.
- Use only cables that are designed for the application and that are in good condition. Use of poor quality or worn cables may cause damage to the product or cause it to malfunction.
- Be careful when connecting or removing cables. Pinching or other injury may occur.
- If you notice any abnormalities, immediately stop use, turn OFF the power supply, and contact your OMRON representative.
- If using this product in an area where airborn oils or water are present, clean the lens and the exterior surface of the product frequently and inspect for deterioration of the plastics. Stop using the product if damage is identified.
- For good heat dissipation, maintain adequate clearance around the product.
- Do not use this product in an environment with excessive noise.
- Turn OFF the power to ensure safety before maintenance.
- Use an airbrush to clean the lens.
- Do not attempt to dismantle, repair, or modify the product.

Précautions à prendre pour une utilisation efficace

Conditions pour une utilisation efficace de ce produit

- Installez, stockez et utilisez le produit dans un endroit qui répond aux conditions suivantes:
  - La température ambiante ne descend pas en dessous de 0°C. (-25°C pour le stockage);
  - La température ambiante ne dépasse pas +45°C (+65°C pour le stockage);
  - Humidité relative entre 25% et 85%;
  - Pas de changements rapides de température (il ne se forme pas de rosée);
  - Il n’y a pas de présence de gaz corrosifs ou inflammables;
  - Est exempt de poussière, de sels et de particules de fer;
  - Est exempt de vibrations et de chocs;
  - Est à l’abri de la lumière directe du soleil;
  - Le produit n’entrera pas en contact avec de l’eau, des huiles ou des produits chimiques;
  - Le produit ne sera pas affecté par les fortes ondes électromagnétiques;
  - N’est pas à proximité d’un équipement à haute tension ou à haute puissance.
- Soyez prudent lors de la connexion ou du retrait de câbles. L’application d’une force excessive aux câbles ou aux connecteurs peut causer des dommages ou des blessures.
- Utilisez uniquement les câbles conçus pour l’application et en bon état. L’utilisation de câbles de mauvaise qualité ou usés peut endommager le produit ou le faire mal fonctionner.
- Soyez prudent lors de la connexion ou du retrait de câbles. Des pincements ou d’autres blessures peuvent survenir.
- Si vous remarquez des anomalies, arrêtez immédiatement l’utilisation, éteignez le bloc d’alimentation et contactez votre représentant OMRON.
- Si vous utilisez ce produit dans un environnement où des huiles ou de l’eau sont présentes dans l’air, nettoyez fréquemment la lentille et la surface extérieure du produit et inspectez la détérioration des plastiques. Arrêtez d’utiliser le produit si des dommages sont identifiés.
- Pour une bonne dissipation de la chaleur, maintenir un dégagement adéquat autour du produit.
- N’utilisez pas ce produit dans un environnement avec un bruit excessif.
- Éteignez l’alimentation pour assurer la sécurité avant l’entretien.
- Nettoyer la lentille à l’aide d’air comprimé.
- N’essayez pas de démonter, de réparer ou de modifier le produit.

Regulations and Standards

Using Product Outside Japan

This regulation applies to the VHV5-F and peripheral devices.
If you export (or provide a non-resident with) this product or a part of this product that falls under the category of goods (or technologies) specified by the Foreign Exchange and Foreign Trade Control Law as those which require permission or approval for export, you must obtain permission or approval (or service transaction permission) pursuant to the law.

Conformance to EC/EU Directives

This regulation applies to the VHV5-F and peripheral devices.

- This product is in compliance with all applicable directives, 2014/30/EU, 2014/35/EU, and 2011/65/EU.
- This product complies with EC/EU Directives. EMC-related performance of the Omron devices that comply with EC/EU Directives will vary depending on the configuration, wiring, and other conditions of the equipment or control panel on which the Omron devices are installed.
- The customer must, therefore, perform the final check to confirm that devices and the overall machine conform to EMC standards.

Conformance to Standards

This regulation applies to the VHV5-F and peripheral devices.

- This product complies with UL Standards.
  UL60950-1 2nd-edition, 2014 (Class III).
- IEC/EN 62368-1, 2nd and 3rd Ed
- UL 60950-1, 2nd Edition, 2019-05-09 (Information Technology Equipment - Safety - Part 1: General Requirements)
- CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10 (Information Technology Equipment - Safety - Part 1: General Requirements)

RISK GROUP 2
Retinal blue light hazard - 300 nm to 700 nm.
CAUTION: Possibly hazardous optical radiation emitted from this product. Do not stare at operating lamp. May be harmful to the eyes.

Caution: Use of controls, adjustments, or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Korean Radio Regulation (KC)

사 용 자 안 내 문
이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

Guide for Users

This equipment has been evaluated for conformity in a commercial environment. When used in a residential environment, it may cause radio interference.

Règlements et normes

Utilisation du produit en dehors du Japon

Ce règlement s’applique au lecteur de codes VHV5-F et à ses périphériques.
Si vous exportez (ou fournissez à un non-résident) ce produit ou une partie de ce produit qui entre dans la catégorie des biens (ou technologies) spécifiés par la loi sur le contrôle des changes et du commerce extérieur comme étant ceux qui nécessitent une autorisation ou une approbation pour l’exportation, vous devez obtenir une autorisation ou une approbation (ou une autorisation de transaction de service) conformément à la loi.

Conformité aux directives CE/UE

Ce règlement s’applique au lecteur de codes VHV5-F et à ses périphériques.

- Ce produit est conforme à toutes les directives applicables, 2014/30/UE, 2014/35/UE et 2011/65/UE.
- Ce produit est conforme aux directives CE/UE. Les performances des appareils Omron conformes aux directives CE/UE en matière de CEM varient en fonction de la configuration, du câblage et d’autres conditions de l’équipement ou du panneau de commande sur lequel les appareils Omron sont installés.
- Le client doit donc effectuer le contrôle final pour confirmer que les appareils et l’ensemble de la machine sont conformes aux normes CEM.

Conformité aux normes UL

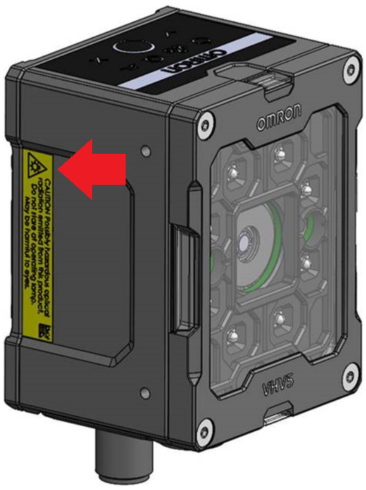
Ce règlement s’applique au lecteur de codes VHV5-F et à ses périphériques.

- Ce produit est conforme aux normes UL.
- UL60950-1 2e édition, 2014 (classe III).

GROUPE DE RISQUE 2

Risque de lumière bleue rétinienne – 300 nm à 700 nm.

ATTENTION : Possibles rayonnements optiques dangereux émis par ce produit. Ne pas regarder fixement la lampe. Peut être dangereux pour les yeux.



Attention : l’utilisation de commandes, de réglages ou l’exécution de procédures autres que celles spécifiées dans le présent document peut entraîner une exposition dangereuse aux rayonnements.

Règlement coréen sur les équipements radio (KC)

사 용 자 안 내 문
이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

Guide pour les utilisateurs
La conformité de cet équipement a été évaluée dans un environnement commercial. Utilisé dans un environnement résidentiel, il peut provoquer des interférences radio.

Radio Frequency Interference Requirements: FCC

This equipment has been tested for compliance with FCC (Federal Communications Commission) requirements and has been found to conform to applicable FCC standards. To comply with FCC RF exposure compliance requirements, this device must not be co-located with or operate in conjunction with any other antenna or transmitter. Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

Class A Statement

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Class B Statement

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
Reorient or relocate the receiving antenna.
Increase the separation between the equipment and receiver.
Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
Consult the dealer or an experienced radio/TV technician for help.

Radio Frequency Interference Requirements: Canada

This device complies with Industry Canada ICES-003. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Cet appareil est conforme à la norme ICES-003 d'Industrie Canada. Son fonctionnement est soumis aux deux conditions suivantes: (1) l’appareil ne doit pas produire de brouillage, et (2) l’utilisateur de l’appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d’en compromettre le fonctionnement.

Related Manuals

The followings are the manuals related to this manual. Use these manuals for reference.

Name of Manual	Cat. No.	Model	Usage	Description
VHV5-F Autofocus Multicode Reader User Manual	Z476	VHV5-F	When you want to know the product specifications and basic settings for using the VHV5-F .	VHV5-F specifications, getting started, explanation of settings, command parameters.
VHV5-F Autofocus Multicode Reader Communication Manual	Z477		When you want to operate the VHV5-F from an external device.	It describes the system configuration, control methods, I/O specifications, supported network types and communication setting for using the VHV5-F.

Revision History

A manual revision code appears as a suffix to the catalog number on the front and back covers of the manual.

Cat. No.	Z476-E-03 (84-9000470-02 Rev C)

Revision code

Revision code	Date	Revised content
01	April 2024	First publication.
02	August 2024	Updated Quebecois translation of Precautions in front matter.
03	September 2024	General improvements.

1

1

Introduction

1-1 Feature Overview

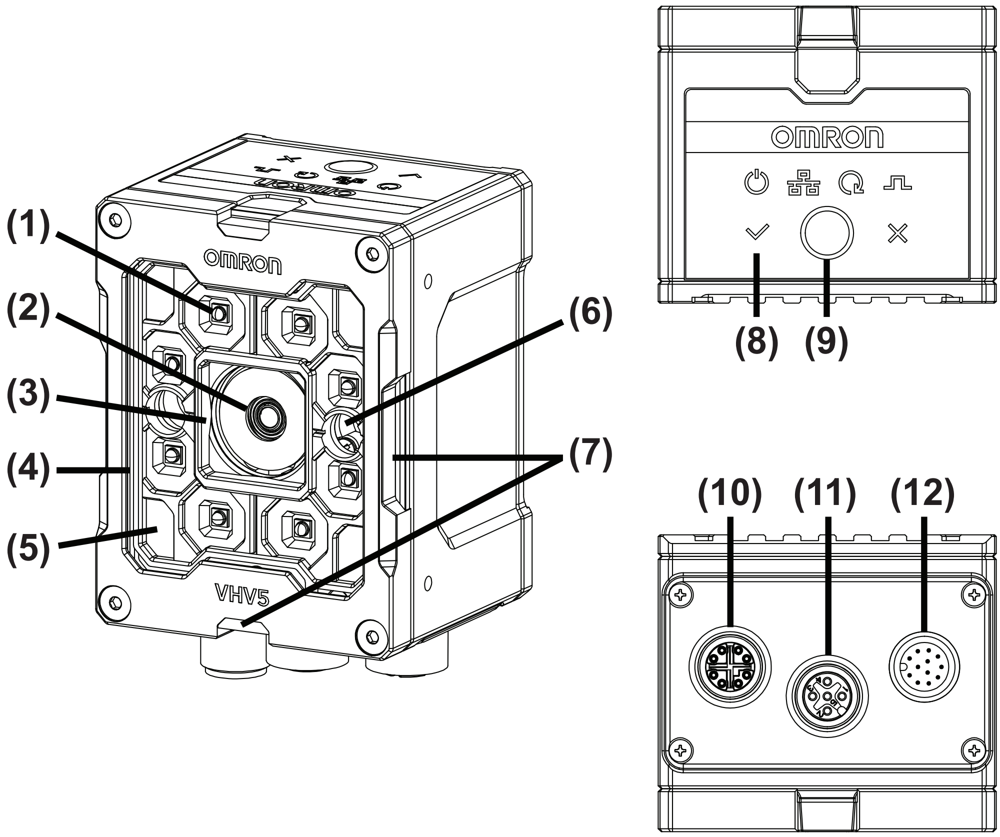
The VHV5-F Autofocus Multicode Reader is designed to meet the diverse needs and demands of industries such as Food and Commodities, Automotive, Electronics, Logistics, and Clinical. With this solution, you can cover every application across your factory floor with just one code reader.

1-1-1 Key Features and Benefits

1. **Versatility:** The VHV5-F features a robust algorithm that can read labels and direct part marks. Choose from various models within the code reader product family that most closely matches your application requirements.
2. **Easy to Use:** The VHV5-F comes with a single software interface that runs on all models and can handle all applications. With a simple and intuitive mode of usage, operators and technicians can quickly learn and operate the code reader.
3. **Flexible Installation:** The VHV5-F is designed to be installed in any environment. It is IP69K-rated, ensuring durability and protection against dust and water. Choose from various mounting options to suit your specific needs.
4. **Superior Imaging and Processing:** The VHV5-F offers superior imaging, processing, and setup capabilities. With options like ultra-uniform lighting and front window options, you can achieve high-quality images. The X-Mode algorithm enables reading codes on both labels and directly marked parts. WebLink 4.0 software simplifies the setup process, allowing you to get your code reader into production quickly.
5. **High-Speed Performance:** The VHV5-F is designed to meet the demands of high-speed production lines. Achieve and maintain high production rates with the VHV5-F, capturing images with very short exposure times and providing non-stop image acquisition and fast decoding.
6. **Robust Reading:** The VHV5-F ensures a high read success rate for both good and poor quality codes. With the X-Mode 5.0 algorithm, this solution covers damaged, distorted, or low-contrast codes. Smart Assist and Advanced Decode Settings further optimize the read rate, even in challenging conditions.
7. **Easy Integration:** Integrating the VHV5-F into your assembly line is easy. Save time and cost with easy connections to PLCs through multiple communication channels. The intuitive setup and monitoring tool, Weblink, eliminates the need for complex PC tool installations. The Digital Softscope provides a graphical display of the entire read cycle, aiding in system health monitoring and debugging.

1-2 VHV5-F Reader and Accessories

1-2-1 Description of Reader



#	Name	Description	Options
1	**Lighting**	Illuminates part to be read.	Red or white.
2	**Autofocus Lens**	Focuses on part to be read.	8.5, 12.5, and 20 mm focal length.
3	**Sensor**	Captures image of part.	2.3 MP and 5.0 MP.
4	**Front Window**	Encloses camera; provides mounting area for filters.	Flat for 8.5 mm lens. Focused for 12.5 and 20 mm lens.
5	**Filter Accessories**	Modifies lighting for different applications.	None, Diffuser, Full Polarizer, Half Polarizer.
6	**Targeting Optics**	Indicates the center of the reading field of view.	
7	**360 Degree Pass/Fail Indicators**	Indicates whether the Read Cycle has passed or failed.	
8	**Membrane Indicators**	Shows power, network connectivity, reader online/offline status, trigger indicator, pass and fail status.	
9	**Membrane Button**	Multifunction Control button. Resets reader IP address to factory default.	
10	**X-Coded Ethernet Port**	1000BASE-T Ethernet port; Power over Ethernet (PoE).	
11	**External Light Port**	Provides power and strobe signal to external lighting.	
12	**DIO (Parallel IO) Port**	Breakout for power, trigger, digital inputs/outputs, RS-232.	

Targeting Optics

The VHV5-F is equipped with targeting optics to provide a visual reference when mounting the camera. The targeting optics consist of two bright green parallel spots which indicate the center of the reading area, as well as the orientation of the camera relative to the part.

Reader Status Indicators and Control Button Functions

● Reader Status Indicators

Reader Status Indicators		
#	**Name**	**Status Indication**
1	Power	**Off –** No power; **Solid Green –** Unit has powered up.
2	Network	**Off –** No network connection; **Solid Amber –** Unit has a network connection; **Flashing Amber –** Unit is communicating.

Reader Status Indicators		
#	Name	Status Indication
3	**Mode**	**Off –** Unit is offline; **Solid Green –** Unit is online with loaded job.
4	**Trigger**	**Off –** Waiting for trigger; **Blinking Amber –** Unit has received a trigger.
5	**Pass**	**Off –** In Read Cycle; **Solid On or Blinking Green –** Read Cycle has passed.
6	**Fail**	**Off –** In Read Cycle; **Solid On or Blinking Red –** Read Cycle has failed.
7	**Button**	**Reset IP Address to Factory Default –** Press button for ~5 seconds. Wait until the 360 degree lights do a double flash and then release the button. The unit will now be reset to factory IP.

● Control Button Functions

Control Button Functions		
#	Name	Function
7	**Button**	**Reset IP address to factory default**. Press for ~5 seconds. Wait until the 360 degree lights do a double flash and then release the button. The unit will now be reset to factory IP (192.168.188.2, 255.255.0.0).

1-2-2 Model Number Structure

Use the table below to determine the product specifications of your reader from the model number on the label.

Important: Please see the next section for the full list of orderable model numbers. All other variations should be assembled using standard models combined with available accessories.

VHV5-F – Autofocus Multicode Reader, IP69K Enclosure, 24V/PoE, with Serial, Digital IO, and Ethernet.

VHV5-F□□□□□□□□-□□□-□

1 2 3 4 5 6 7

No.	Classification	Code	Meaning
1	Focus Distance (mm)	000	Autofocus
		###	Focus Distance in mm
2	Lens / Field of View	M	Medium
		N	Narrow
		L	Long Range
3	Sensor Type	023M	2.3 Megapixel, Monochrome, Global Shutter
		050M	5 Megapixel, Monochrome, Global Shutter
4	Front Window Filter Type[*1]	S	Clear Front Window
		D	Light-Diffusing Front Window
		P	Polarizing Window to Eliminate Glare
		H	Half-Polarizing Window (Gives the user the option to use either polarized or standard lighting in the same unit)
5	Light Color	N	None
		R	Red
		W	White
6	License	X	High-Speed X-Mode Decoder
7	Custom (0 – Z)	D	Reserved
		0 to 9, A to Z	OEMs and Large Customers

*1. See *2-2 Hardware Selection and Installation Flow* on page 2-8 for reader mounting and lighting.

1-2-3 Standard Orderable Reader Models

Standard Red 2.3 MP and Standard Red 5 MP

Appearance	Standard Red 2.3 MP	Part Number
	VHV5-F, Autofocus, Medium Lens, 2.3 MP, Standard Red Light, X-Mode Reader	VHV5-F000M023M-SRX
	VHV5-F, Autofocus, Narrow Lens, 2.3 MP, Standard Red Light, X-Mode Reader	VHV5-F000N023M-SRX
	VHV5-F, Autofocus, Long Lens, 2.3 MP, Standard Red Light, X-Mode Reader	VHV5-F000L023M-SRX
	Standard Red 5 MP	**Part Number**
	VHV5-F, Autofocus, Medium Lens, 5.0 MP, Standard Red Light, X-Mode Reader	VHV5-F000M050M-SRX
	VHV5-F, Autofocus, Narrow Lens, 5.0 MP, Standard Red Light, X-Mode Reader	VHV5-F000N050M-SRX
	VHV5-F, Autofocus, Long Lens, 5.0 MP, Standard Red Light, X-Mode Reader	VHV5-F000L050M-SRX

Note 1: VHV5-F readers are sold without cables or mounting. These items can be found in later sections.

Note 2: The VHV5-F uses the same Parallel IO cables and interconnect accessories as the MicroHAWK V430-F and V440-F.

Note 3: X-Mode is suitable for all labels as well as low-print-grade codes and DPM.

Standard White 2.3 MP and Standard White 5 MP

Appearance	Standard White 2.3 MP	Part Number
	VHV5-F, Autofocus, Medium Lens, 2.3 MP, Standard White Light, X-Mode Reader	VHV5-F000M023M-SWX
	VHV5-F, Autofocus, Narrow Lens, 2.3 MP, Standard White Light, X-Mode Reader	VHV5-F000N023M-SWX
	VHV5-F, Autofocus, Long Lens, 2.3 MP, Standard White Light, X-Mode Reader	VHV5-F000L023M-SWX
	Standard White 5 MP	**Part Number**
	VHV5-F, Autofocus, Medium Lens, 5.0 MP, Standard White Light, X-Mode Reader	VHV5-F000M050M-SWX
	VHV5-F, Autofocus, Narrow Lens, 5.0 MP, Standard White Light, X-Mode Reader	VHV5-F000N050M-SWX
	VHV5-F, Autofocus, Long Lens, 5.0 MP, Standard White Light, X-Mode Reader	VHV5-F000L050M-SWX

Note 1: VHV5-F readers are sold without cables or mounting. These items can be found in later sections.

Note 2: The VHV5-F uses the same Parallel IO cables and interconnect accessories as the MicroHAWK V430-F and V440-F.

Note 3: X-Mode is suitable for all labels as well as low-print-grade codes and DPM.

Standard Red 2.3 MP with Half Polarizer and Standard Red 5 MP with Half Polarizer

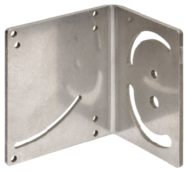
Appearance	Standard Red 2.3 MP with Half Polarizer	Part Number
	VHV5-F, Autofocus, Medium Lens, 2.3 MP, Standard Red Light, Half-Polarized Window, X-Mode Reader	VHV5-F000M023M-HRX
	VHV5-F, Autofocus, Narrow Lens, 2.3 MP, Standard Red Light, Half-Polarized Window, X-Mode Reader	VHV5-F000N023M-HRX
	VHV5-F, Autofocus, Long Lens, 2.3 MP, Standard Red Light, Half-Polarized Window, X-Mode Reader	VHV5-F000L023M-HRX
	Standard Red 5 MP with Half Polarizer	**Part Number**
	VHV5-F, Autofocus, Medium Lens, 5.0 MP, Standard Red Light, Half-Polarized Window, X-Mode Reader	VHV5-F000M050M-HRX
	VHV5-F, Autofocus, Narrow Lens, 5.0 MP, Standard Red Light, Half-Polarized Window, X-Mode Reader	VHV5-F000N050M-HRX
	VHV5-F, Autofocus, Long Lens, 5.0 MP, Standard Red Light, Half-Polarized Window, X-Mode Reader	VHV5-F000L050M-HRX

Note 1: VHV5-F readers are sold without cables or mounting. These items can be found in later sections.

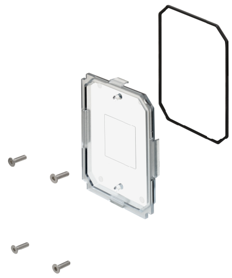
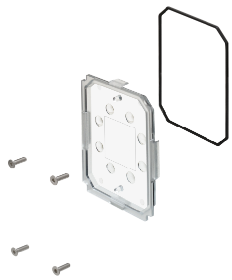
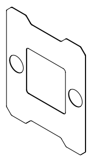
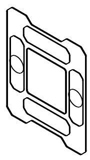
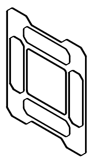
Note 2: The VHV5-F uses the same Parallel IO cables and interconnect accessories as the MicroHAWK V430-F and V440-F.

Note 3: X-Mode is suitable for all labels as well as low-print-grade codes and DPM.

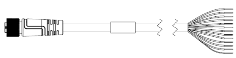
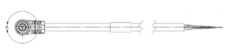
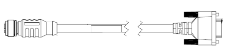
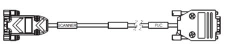
1-2-4 Mounting Accessories

Appearance	Type	Part Number
	VHV5-F L-Bracket Adjustable Angle Mounting Kit (VHV5-F only)	VHV5-AM0
	Universal Mounting Block and Heatsink Kit (VHV5-F only)	VHV5-AM1
	VHV5-F APG Pan and Tilt Camera Mount Kit (VHV5-F only)	VHV5-AM2

1-2-5 Front Window Accessories

Appearance	Type	Part Number
	VHV5-F Standard Window (for Medium Lens Models)	VHV5-AF0
	VHV5-F Lensed Window (for Narrow and Long Lens Models)	VHV5-AF1
	VHV5-F Diffuser Accessory	VHV5-AF2
	VHV5-F Polarizer Accessory	VHV5-AF3
	VHV5-F Half Polarizer Accessory	VHV5-AF4

1-2-6 Cables

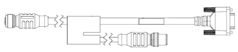
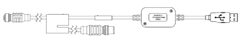
Appearance	Category	Length / Spec	Part Number
	X-Code to RJ45 Ethernet Cable (High Flex, Straight, Black Jacket)	1 Meter	61-9000134-01
		3 Meters	61-9000134-02
		5 Meters	61-9000134-03
		10 Meters	61-9000134-04
	X-Code to RJ45 Ethernet Cable (High Flex, Straight, Black Jacket)	2 Meters	FHV-VNB2 2M
		3 Meters	FHV-VNB2 3M
		5 Meters	FHV-VNB2 5M
		10 Meters	FHV-VNB2 10M
		20 Meters	FHV-VNB2 20M
	X-Code to RJ45 Ethernet Cable (High Flex, Right-Angle, Black Jacket)	2 Meters	FHV-VNLB2 2M
		3 Meters	FHV-VNLB2 3M
		5 Meters	FHV-VNLB2 5M
		10 Meters	FHV-VNLB2 10M
		20 Meters	FHV-VNLB2 20M
	M12 to Flying Leads Cable – Parallel IO (Power, DIO, RS-232)	3 Meters	V430-W8-3M
		5 Meters	V430-W8-5M
		10 Meters	V430-W8-10M
	M12 to Flying Leads Cable – Parallel IO (Powe , DIO, RS-232) – Right Angle Back	3 Meters	V430-W8LD-3M
	M12 to Flying Leads Cable – Parallel IO (Powe , DIO, RS-232) – Right Angle Front	3 Meters	V430-W8LU-3M
	Reader M12 to RS-232 Breakout Cable	1 Meter	V430-WR-1M
		3 Meters	V430-WR-3M
	VHV5-F to External Light – 5 Pin M12 Plug to 5 Pin M12 Socket	1 Meter	61-000184-01
	Cable, Adapter, Omron PLC	2 Meters	V430-WPLC-2M

***Important:** Standard Omron FJ-VSG Ethernet cables are available in alternative and longer lengths.

1-2-7 Power Supplies

Appearance	Category	Length / Spec	Part Number
	Standard Reader 24V Power Supply (2.1 A)	1 Meter, U.S. / Euro Plug	97-000012-01
	Single Port PoE Injector, 30W, IEEE802.3at Compliant, 2 x RJ45 Connector, 90 to 264VAC	Power Cord NOT Included	98-9000311-01

1-2-8 Legacy QX-1 Cabling and Accessories

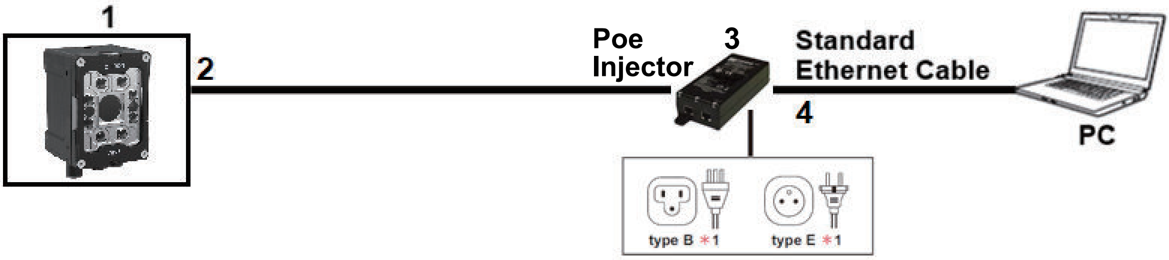
Appearance	Category	Length / Spec	Part Number
	QX-1 Interconnect Module – Power Input, Photo Sensor and Trigger Input, Smart Light Control (Power and Strobe)	N/A	98-000103-02
	Reader to QX-1 Interconnect Cable – M12 Socket to M12 Plug (QX1 is used as breakout module for Power input, Trigger input, and Strobe Output)	1 Meter	V430-WQ-1M
		3 Meters	V430-WQ-3M
		5 Meters	V430-WQ-5M
	Reader to QX-1 Interconnect Cable – M12 Socket to M12 Plug – Right Angle Back	1 Meter	61-000162-03
		3 Meters	61-000148-03
	Reader to QX-1 Interconnect Cable – M12 Socket to M12 Plug – Right Angle Front	1 Meter	61-000162-04
		3 Meters	61-000148-04
	Reader to QX-1 Interconnect Cables with RS-232 Breakout	3 Meters	V430-WQR-3M
		5 Meters	V430-WQR-5M
	Reader to QX-1 Interconnect Cables with USB Keyboard Wedge Breakout	3 Meters	V430-WQK-3M
	QX-1 Photo Sensor, M12 4-Pin Plug, NPN, Light ON / Dark ON	2 Meters	99-9000016-01
	QX-1 Field-Wireable M12 4-Pin Plug for Any Trigger Source or Photo Sensor	Screw Terminal Connector	98-9000239-01

2

System Configuration and Setup Flow

2-1 System Configurations

2-1-1 Minimum Configuration to Set Up the Reader with WebLink UI



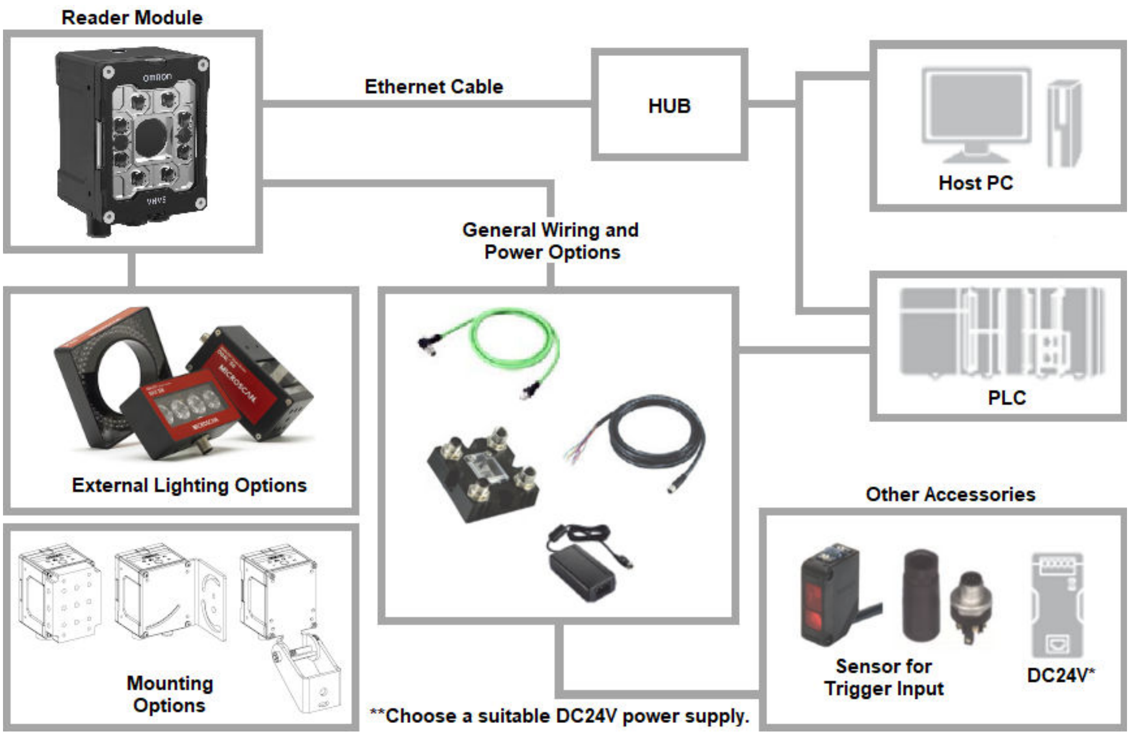
Drawing Reference	Category	Part Number
1	VHV5-F Reader	VHV5-F□□□□□□□□□-SRX
2	Industrial GigE X-Code Ethernet Cable, M12 to RJ45 Connector	61-900013□-0□ (Black) or FHV-VNB2, FHV-VNLB (Green)
3	Single Port PoE Injector, 30W, IEEE802.3at Compliant*1	98-9000311-01
4	Standard or Industrial Ethernet CAT5E or CAT6 Network Cable	Example: XS6W-5PUR8SS□□□□CM-G

*1. Power cord NOT included with 98-9000311-01. There are many types of outlet plugs for the PoE Injector (C13 connector required). Select a suitable plug type for your environment.

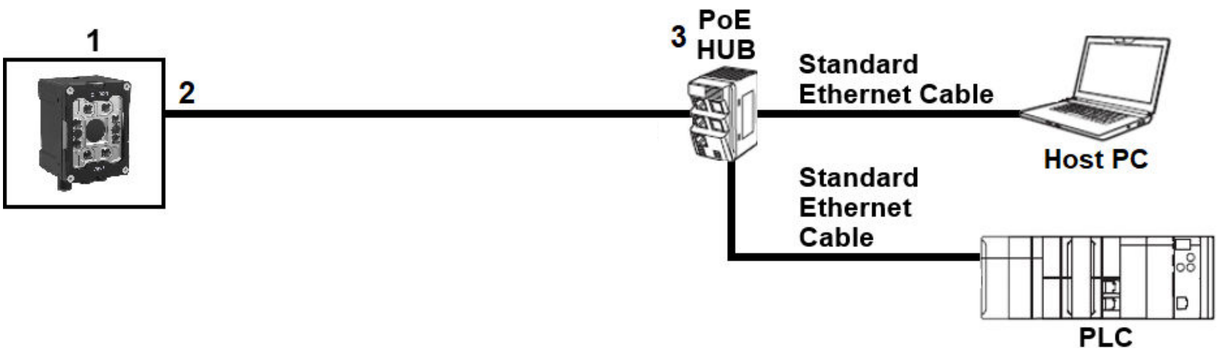
C13 Connector

Description	Part Number
AC Power Cable, 1.8 M, Japan, C13 Conn.	12-9001046-01
AC Power Cable, 1.8 M, U.S., C13 Conn.	12-9000959-01
AC Power Cable, 1.8 M, EU, C13 Conn.	12-9000960-01
AC Power Cable, 1.8 M, UK, C13 Conn.	12-9000961-01
AC Power Cable, 1.8 M, China, C13 Conn.	12-9000962-01

2-1-2 Runtime Configuration Options

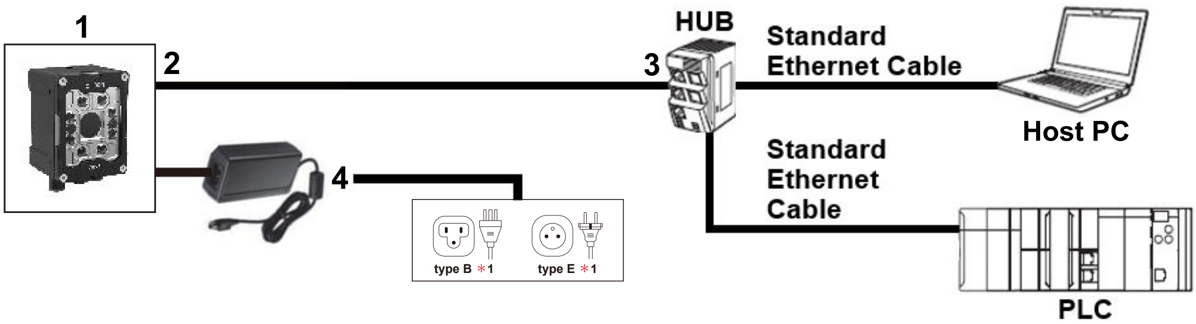


2-1-3 Minimum Power over Ethernet (PoE) Configuration



Drawing Reference	Category	Part Number
1	VHV5-F Reader	VHV5-F□□□□□□□□-SRX
2	Industrial GigE X-Code Ethernet Cable, M12 to RJ45 Connector	61-900013□-0□ (Black) or FHV-VNB2, FHV-VNLB (Green)
3	PoE (Power over Ethernet) HUB that supports Power over Ethernet (IEEE 802.3at-compliant)	Example: Cisco, Netgear, etc.

2-1-4 Minimum Direct Power Configuration



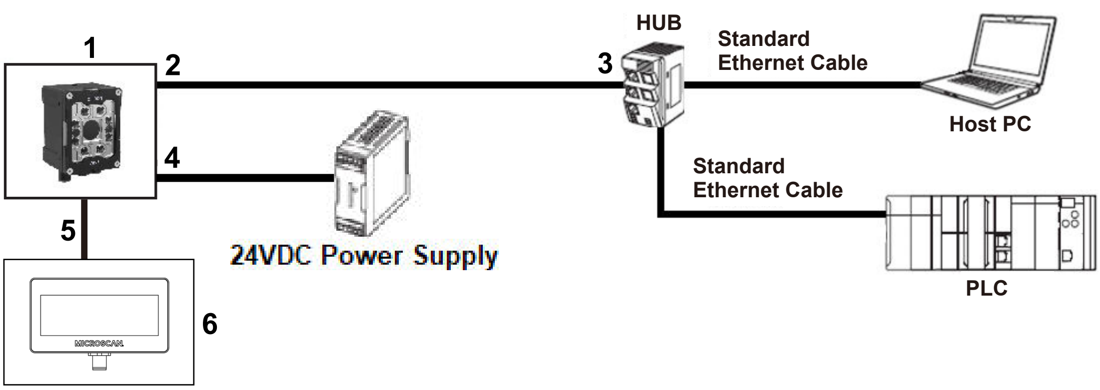
Drawing Reference	Category	Part Number
1	VHV5-F Reader	VHV5-F□□□□□□□□-SRX
2	Industrial GigE X-Code Ethernet Cable, M12 to RJ45 Connector	61-900013□-0□ (Black) or FHV-VNB2, FHV-VNLB (Green)
3	Industrial Switching HUB	Example: W4S1-□□□ Series
4	Power Supply, 100-240VAC, +24VDC @ 2.1A, M12 12-Pin Socket*1	97-000012-01

*1. There are many types of outlet plugs for the power supply (C13 connector required). Select a suitable plug type for your environment.

C13 Connector

Description	Part Number
AC Power Cable, 1.8 M, Japan, C13 Conn.	12-9001046-01
AC Power Cable, 1.8 M, U.S., C13 Conn.	12-9000959-01
AC Power Cable, 1.8 M, EU, C13 Conn.	12-9000960-01
AC Power Cable, 1.8 M, UK, C13 Conn.	12-9000961-01
AC Power Cable, 1.8 M, China, C13 Conn.	12-9000962-01

2-1-5 Direct Power Configuration with External Light

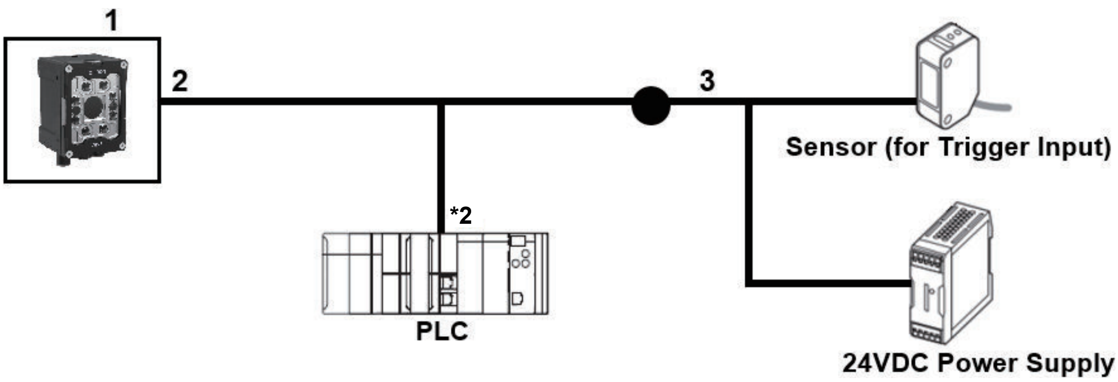


Drawing Reference	Category	Part Number
1	VHV5-F Reader	VHV5-F□□□□□□□□-SRX
2	Industrial GigE X-Code Ethernet Cable, M12 to RJ45 Connector	61-900013□-0□ (Black) or FHV-VNB2, FHV-VNLB (Green)
3	Industrial Switching HUB	Example: W4S1-□□□ Series
4	M12-to-Flying Leads Cable	V430-W8□□□-□M
5	VHV5-F to External Light – 5 Pin M12 Plug to 5 Pin M12 Socket	61-000184-01
6	NERLITE Smart Series Light (Example: Smart Series MAX, 100 mm, Red, M12 Connector)	Example: NER-011660201G

Precautions for Correct Use

Must use direct 24V power when using external light option to ensure adequate power to run the light and reader.

2-1-6 RS-232C Configuration

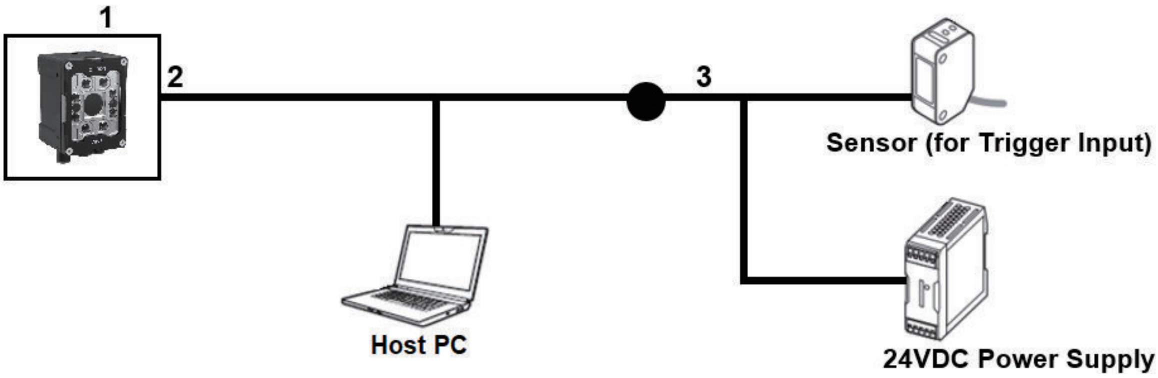


Drawing Reference	Category	Part Number
1	VHV5-F Reader	VHV5-F□□□□□□□□-SRX
2	Reader-to-QX-1 Interconnect Cable with RS-232 Breakout	V430-WQR-3M*1
3	M12-to-Flying Leads Cable	V430-W8□□□-□M
4	RS-232C Conversion Cable Required for Legacy Omron PLCs	V430-WPLC-2M*2

*1. Insert the V430-WQR-3M cable between the VHV5-F and the V430-W8□□□-□M cable.

*2. When connecting Omron's CS/CJ/NJ Legacy Controller, the additional RS-232C conversion cable is required. If connecting to Omron's current-generation NX Machine Automation Controller, no additional RS-232C cable is required.

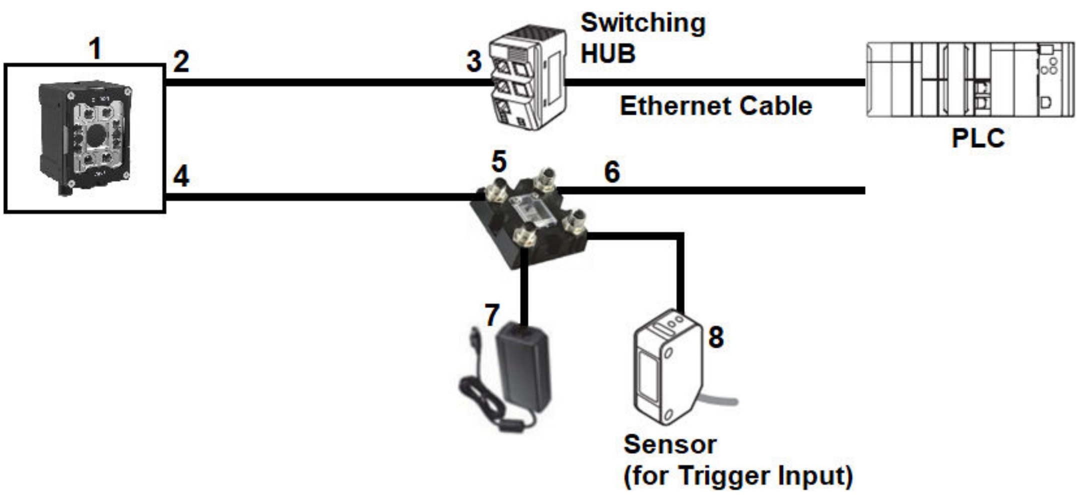
2-1-7 USB Keyboard Wedge Configuration



Drawing Reference	Category	Part Number
1	VHV5-F Reader	VHV5-F□□□□□□□□-SRX
2	Reader-to-QX-1 Interconnect Cable with USB Keyboard Wedge Breakout	V430-WQK-3M*1
3	M12-to-Flying Leads Cable	V430-W8□□□-□M

*1. Insert the V430-WQK-3M cable between the VHV5-F and the V430-W8□□□-□M cable.

2-1-8 Typical Configuration using Legacy QX-1 Cables and Accessories



Drawing Reference	Category	Part Number
1	VHV5-F Reader	VHV5-F□□□□□□□□-SRX
2	Industrial GigE X-Code Ethernet Cable, M12-to-RJ45 Connector	61-900013□-0□ (Black) or FHV-VNB2, FHV-VNLB (Green)
3	Industrial Switching HUB	Example: W4S1-□□□ Series
4	Reader-to-QX-1 Interconnect Cable (Various)	V430-WQ□-□M

Drawing Reference	Category	Part Number
5	VHV5-F-to-External Light – 5-Pin M12 Plug to 5-Pin M12 Socket	61-000184-01
6	M12-to-Flying Leads Cable	V430-W8□□□-□M
7	Power Supply, 100-240VAC, +24VDC @ 2.1A, M12 12-Pin Socket	97-000012-01
8	QX-1 Photo Sensor, or QX-1 Field-Wireable Trigger Connector Input	99-9000016-01
		98-9000239-01

2-2 Hardware Selection and Installation Flow

This flow is designed to guide the user through 1) Selecting the correct VHV5-F reader model to meet the field of view and resolution application requirements; 2) Mounting, wiring, and powering the reader; 3) Setting up a network connection between the reader and a PC; and 4) Starting the WebLink user interface to program the reader.

Section 5 Quick Start Guide for Programming the Reader on page 5-1 provides a similar quick start flow for programming the reader for the first time.

#	Hardware Selection and Installation Flow	Reference
1	Determine the Correct Reader Model for the Application	page 2-8
2	Mount the Reader	page 2-14
3	Wire and Power the Reader	page 2-17
4	Set Up Network Connection between Host PC and Reader	page 2-26
5	Starting WebLink User Interface using the DDU or Browser	page 2-29

2-2-1 Determine the Correct Reader Model for the Application

There are six basic models of the autofocus VHV5-F. The models are derived from two sensor resolutions: **2.3 MP** and **5.0 MP**; and three different autofocus lenses: **Medium, Narrow,** and **Long**.The charts below show the key specifications for the two sensors and three lenses.

Sensor	Pixels	Pixel Size	Frame Rate
2.3 MP	1920 x 1200	3.0 µm	80 FPS
5.0 MP	2472 x 2048	2.74 µm	40 FPS

Lens Name	Lens Focal Length (mm)	Focus Range (mm)
Medium	8.50	55-500
Narrow	12.50	100-1,000
Long	20.00	100-2,000

These models, derived from the two sensor types and three lens types, provide maximum flexibility to match the reader to the application.

Step 1 – The first step in determining the correct model is to evaluate the application by collecting five key pieces of information. This process is described in the section below titled *Evaluate the Application* on page 2-9.

Step 2 – The second step is to use that data to look up the best sensor / lens combination in the *Distance, Field of View, and Readability Tables* on page 2-10 section below that best satisfies the application requirements.

Evaluate the Application

To choose the correct reader, perform an application evaluation and gather the following information:

- **Desired Mounting Distance –** Measured from the front of the reader to the code. Distance is usually dictated by mounting constraints.
- **Required Field of View –** View area required to see all codes. This should include the nominal code position, size, and expected variation in position while running.
- **Code Type –** Either 1D or 2D. Composite codes count as 2D.
- **Code Quality –** Two levels: (1.) High-quality, high-contrast codes. (2.) Lower-quality, lower-contrast codes marked with laser, dot peen, etc., generally referred to as direct part marks (DPM).
- **Code Size (Mils) –** For 1D codes, code size is the width of the narrowest bar in the code. For 2D codes, code size is the width / height of an individual cell or block (square element) in the code. Code size is typically specified in Mils, where 1 Mil = 1/1,000th of an inch. (0.0254 mm).
- **Code Color –** Code color can sometimes be a consideration. The most common light color for code readers is red. However, in the case of red print, Red light will cause the red print to disappear. The user should take this into consideration and order the unit with white LEDs instead.

- **Key Point:** Code Size is not the overall size of the code, but is the size of the smallest element in the code. Theexample below shows that for 1D codes, the Code size specified as the width of the thinnest bar or space. For 2D codes, Code Size is the width / height of one of the black or white squares.

1D Barcode *2D Code*

Choose the Model

The readability tables below show the sensor/lens combinations or VHV5-F models. For each reader-to-part distance, the tables show the resulting field of view, as well as the smallest code size that can be decoded reliably at that Distance in that Field of View.

Use the distance and field of view requirements determined in your application evaluation to choose the model that will provide the highest resolution for reading your Code Type (1D or 2D) and Code Quality (High-Contrast Label quality, Lower Contrast, DPM quality).

Note: Codes with sizes that are larger than the stated minimum can be assumed to be readable.

The following chart shows how the minimum code sizes in the readability tables have been determined. High-contrast (label-quality) marks need fewer pixels per element (lower PPE) to be decoded reliably. Low-print-quality and DPM (direct part mark) codes often require a higher PPE to get the same high read rates. Code grading, which involves actual measurements of the cells themselves, requires an even higher PPE.

Code Type	Minimum PPE	Preferred PPE	PPE for Code Grading
1D Code – Label Quality	1.6	2	5
1D Code – Direct Part Mark	2	2.5	5
2D Code – Label Quality	2.75	3.5 to 5	6-8
2D Code – Direct Part Mark	3.5	4 to 5	6-8

Distance, Field of View, and Readability Tables

Use the following tables to identify the Sensor/Lens combination that most closely matches the application requirements. The tables below use the Minimum PPE values from the table above.

For example: If the Code Type is a 2D DPM, and the Code Size is 15 mils, the first table shows that a 2D DPM code as small as 13.9 Mils can be read all the way out to 200 mm, in a field of view of 194 x 121 mm.

● 2.3 MP Sensor Readability Tables

Medium Lens – 2.3 MP		Minimum Readable Code Size			
Distance [mm]	Field of View [mm x mm]	1D Label [Mils (mm)]	1D DPM [Mils (mm)]	2D Label [Mils (mm)]	2D DPM [Mils (mm)]
55	48 x 30	1.6 (0.040)	2.0 (0.051)	2.7 (0.069)	3.5 (0.088)
75	62 x 39	2.0 (0.052)	2.5 (0.065)	3.5 (0.089)	4.5 (0.113)
100	79 x 49	2.6 (0.066)	3.2 (0.082)	4.5 (0.113)	5.7 (0.144)
200	147 x 92	4.8 (0.122)	6.0 (0.153)	8.3 (0.210)	10.5 (0.268)
250	181 x 113	5.9 (0.151)	7.4 (0.188)	10.2 (0.259)	13.0 (0.329)
300	215 x 134	7.0 (0.179)	8.8 (0.223)	12.1 (0.307)	15.4 (0.391)
350	248 x 155	8.1 (0.207)	10.2 (0.259)	14.0 (0.356)	17.8 (0.453)
400	282 x 176	9.3 (0.235)	11.6 (0.294)	15.9 (0.404)	20.3 (0.515)
450	316 x 198	10.4 (0.263)	13.0 (0.329)	17.8 (0.453)	22.7 (0.576)
500	350 x 219	11.5 (0.292)	14.4 (0.365)	19.7 (0.501)	25.1 (0.638)

Narrow Lens – 2.3 MP		Minimum Readable Code Size			
Distance [mm]	Field of View [mm x mm]	1D Label [Mils (mm)]	1D DPM [Mils (mm)]	2D Label [Mils (mm)]	2D DPM [Mils (mm)]
100	50 x 31	1.6 (0.042)	2.1 (0.052)	2.8 (0.072)	3.6 (0.092)
150	73 x 46	2.4 (0.061)	3.0 (0.076)	4.1 (0.105)	5.3 (0.134)
200	96 x 60	3.2 (0.080)	3.9 (0.100)	5.4 (0.138)	6.9 (0.176)
250	119 x 75	3.9 (0.099)	4.9 (0.124)	6.7 (0.171)	8.6 (0.218)
300	142 x 89	4.7 (0.119)	5.8 (0.148)	8.0 (0.204)	10.2 (0.260)
350	165 x 103	5.4 (0.138)	6.8 (0.172)	9.3 (0.237)	11.9 (0.302)
400	188 x 118	6.2 (0.157)	7.7 (0.196)	10.6 (0.270)	13.5 (0.344)
450	212 x 132	6.9 (0.176)	8.7 (0.220)	11.9 (0.303)	15.2 (0.386)
500	235 x 147	7.7 (0.195)	9.6 (0.244)	13.2 (0.336)	16.8 (0.428)
600	281 x 175	9.2 (0.234)	11.5 (0.292)	15.8 (0.402)	20.1 (0.512)
700	327 x 204	10.7 (0.272)	13.4 (0.340)	18.4 (0.468)	23.4 (0.596)
800	373 x 233	12.2 (0.311)	15.3 (0.388)	21.0 (0.534)	26.8 (0.680)
900	419 x 262	13.7 (0.349)	17.2 (0.436)	23.6 (0.600)	30.1 (0.764)
1000	465 x 291	15.3 (0.387)	19.1 (0.484)	26.2 (0.666)	33.4 (0.848)

Long Lens – 2.3 MP		Minimum Readable Code Size			
Distance [mm]	Field of View [mm x mm]	1D Label [Mils (mm)]	1D DPM [Mils (mm)]	2D Label [Mils (mm)]	2D DPM [Mils (mm)]
100	31 x 20	1.2 (0.029)	1.3 (0.033)	1.8 (0.045)	2.3 (0.057)
150	46 x 29	1.7 (0.043)	1.9 (0.048)	2.6 (0.066)	3.3 (0.083)
200	60 x 38	2.2 (0.056)	2.5 (0.063)	3.4 (0.086)	4.3 (0.110)
250	75 x 47	2.8 (0.070)	3.1 (0.078)	4.2 (0.107)	5.4 (0.136)
300	89 x 56	3.3 (0.083)	3.6 (0.093)	5.0 (0.127)	6.4 (0.162)
350	103 x 65	3.8 (0.097)	4.2 (0.108)	5.8 (0.148)	7.4 (0.188)
400	118 x 74	4.3 (0.110)	4.8 (0.123)	6.6 (0.169)	8.5 (0.215)
450	132 x 83	4.9 (0.124)	5.4 (0.138)	7.5 (0.189)	9.5 (0.241)
500	147 x 92	5.4 (0.137)	6.0 (0.153)	8.3 (0.210)	10.5 (0.267)
600	175 x 110	6.5 (0.164)	7.2 (0.183)	9.9 (0.251)	12.6 (0.320)
700	204 x 128	7.5 (0.191)	8.4 (0.213)	11.5 (0.292)	14.7 (0.372)
800	233 x 146	8.6 (0.218)	9.6 (0.243)	13.1 (0.334)	16.7 (0.425)
900	262 x 164	9.7 (0.245)	10.7 (0.273)	14.8 (0.375)	18.8 (0.477)
1000	291 x 182	10.7 (0.272)	11.9 (0.303)	16.4 (0.416)	20.9 (0.530)
1100	319 x 200	11.8 (0.299)	13.1 (0.333)	18.0 (0.457)	22.9 (0.582)
1200	348 x 218	12.9 (0.326)	14.3 (0.363)	19.6 (0.499)	25.0 (0.635)
1300	377 x 236	13.9 (0.353)	15.5 (0.393)	21.3 (0.540)	27.1 (0.687)
1400	406 x 254	15.0 (0.380)	16.6 (0.423)	22.9 (0.581)	29.1 (0.740)
1500	435 x 272	16.0 (0.407)	17.8 (0.453)	24.5 (0.622)	31.2 (0.792)
1600	463 x 290	17.1 (0.434)	19.0 (0.483)	26.1 (0.664)	33.3 (0.845)
1700	492 x 308	18.2 (0.461)	20.2 (0.513)	27.8 (0.705)	35.3 (0.897)
1800	521 x 326	19.2 (0.488)	21.4 (0.543)	29.4 (0.746)	37.4 (0.950)
1900	550 x 344	20.3 (0.515)	22.5 (0.573)	31.0 (0.787)	39.5 (1.002)
2000	579 x 362	21.4 (0.542)	23.7 (0.603)	32.6 (0.829)	41.5 (1.055)

● 5.0 MP Sensor Readability Tables

Medium Lens – 5 MP		Minimum Readable Code Size			
Distance [mm]	Field of View [mm x mm]	1D Label [Mils (mm)]	1D DPM [Mils (mm)]	2D Label [Mils (mm)]	2D DPM [Mils (mm)]
55	56 x 47	1.5 (0.037)	1.8 (0.046)	2.5 (0.063)	3.2 (0.081)
75	72 x 60	1.9 (0.047)	2.3 (0.059)	3.2 (0.081)	4.1 (0.103)
100	92 x 77	2.4 (0.060)	3.0 (0.075)	4.1 (0.103)	5.2 (0.132)
150	131 x 110	3.4 (0.086)	4.2 (0.107)	5.8 (0.148)	7.4 (0.188)
200	171 x 143	4.4 (0.112)	5.5 (0.140)	7.6 (0.192)	9.6 (0.244)
250	210 x 176	5.4 (0.137)	6.8 (0.172)	9.3 (0.236)	11.8 (0.301)
350	289 x 242	7.4 (0.189)	9.3 (0.236)	12.8 (0.325)	16.3 (0.414)
400	329 x 275	8.5 (0.215)	10.6 (0.269)	14.5 (0.369)	18.5 (0.470)
450	368 x 308	9.5 (0.241)	11.8 (0.301)	16.3 (0.414)	20.7 (0.526)
500	408 x 341	10.5 (0.266)	13.1 (0.333)	18.0 (0.458)	22.9 (0.583)

Narrow Lens – 5 MP		Minimum Readable Code Size			
Distance [mm]	Field of View [mm x mm]	1D Label [Mils (mm)]	1D DPM [Mils (mm)]	2D Label [Mils (mm)]	2D DPM [Mils (mm)]
100	58 x 49	1.5 (0.038)	1.9 (0.048)	2.6 (0.066)	3.3 (0.084)
150	85 x 71	2.2 (0.056)	2.7 (0.070)	3.8 (0.096)	4.8 (0.122)
200	112 x 94	2.9 (0.073)	3.6 (0.092)	5.0 (0.126)	6.3 (0.160)
250	139 x 116	3.6 (0.091)	4.5 (0.114)	6.1 (0.156)	7.8 (0.199)
300	166 x 139	4.3 (0.108)	5.3 (0.135)	7.3 (0.186)	9.3 (0.237)
350	193 x 161	5.0 (0.126)	6.2 (0.157)	8.5 (0.216)	10.8 (0.275)
400	219 x 184	5.6 (0.143)	7.1 (0.179)	9.7 (0.247)	12.4 (0.314)
450	246 x 206	6.3 (0.161)	7.9 (0.201)	10.9 (0.277)	13.9 (0.352)
500	273 x 229	7.0 (0.179)	8.8 (0.223)	12.1 (0.307)	15.4 (0.391)
600	327 x 273	8.4 (0.214)	10.5 (0.267)	14.5 (0.367)	18.4 (0.467)
700	380 x 318	9.8 (0.249)	12.2 (0.311)	16.8 (0.427)	21.4 (0.544)
800	434 x 363	11.2 (0.284)	14.0 (0.355)	19.2 (0.488)	24.4 (0.621)
900	488 x 408	12.6 (0.319)	15.7 (0.399)	21.6 (0.548)	27.5 (0.697)
1000	541 x 453	13.9 (0.354)	17.4 (0.442)	23.9 (0.608)	30.5 (0.774)

Long Lens – 5 MP		Minimum Readable Code Size			
Distance [mm]	Field of View [mm x mm]	1D Label [Mils (mm)]	1D DPM [Mils (mm)]	2D Label [Mils (mm)]	2D DPM [Mils (mm)]
100	37 x 31	1.0 (0.027)	1.2 (0.030)	1.6 (0.041)	2.1 (0.052)
150	53 x 45	1.5 (0.039)	1.7 (0.044)	2.4 (0.060)	3.0 (0.076)
200	70 x 59	2.0 (0.051)	2.3 (0.057)	3.1 (0.079)	3.9 (0.100)
250	87 x 73	2.5 (0.063)	2.8 (0.071)	3.8 (0.098)	4.9 (0.124)
300	104 x 87	3.0 (0.075)	3.3 (0.085)	4.6 (0.116)	5.8 (0.148)
350	120 x 101	3.5 (0.088)	3.9 (0.098)	5.3 (0.135)	6.8 (0.172)
400	137 x 115	3.9 (0.100)	4.4 (0.112)	6.1 (0.154)	7.7 (0.196)
450	154 x 129	4.4 (0.112)	5.0 (0.126)	6.8 (0.173)	8.7 (0.220)
500	171 x 143	4.9 (0.124)	5.5 (0.139)	7.5 (0.192)	9.6 (0.244)
600	204 x 171	5.9 (0.149)	6.6 (0.167)	9.0 (0.229)	11.5 (0.292)
700	238 x 199	6.8 (0.173)	7.6 (0.194)	10.5 (0.267)	13.4 (0.340)
800	271 x 227	7.8 (0.198)	8.7 (0.222)	12.0 (0.305)	15.3 (0.388)
900	305 x 255	8.7 (0.222)	9.8 (0.249)	13.5 (0.342)	17.2 (0.436)
1000	338 x 283	9.7 (0.246)	10.9 (0.276)	15.0 (0.380)	19.0 (0.484)
1100	372 x 311	10.7 (0.271)	12.0 (0.304)	16.4 (0.418)	20.9 (0.532)
1200	405 x 339	11.6 (0.295)	13.0 (0.331)	17.9 (0.455)	22.8 (0.580)
1300	439 x 367	12.6 (0.320)	14.1 (0.359)	19.4 (0.493)	24.7 (0.628)
1400	473 x 395	13.5 (0.344)	15.2 (0.386)	20.9 (0.531)	26.6 (0.676)
1500	506 x 423	14.5 (0.368)	16.3 (0.413)	22.4 (0.568)	28.5 (0.724)
1600	540 x 451	15.5 (0.393)	17.4 (0.441)	23.9 (0.606)	30.4 (0.771)
1700	573 x 479	16.4 (0.417)	18.4 (0.468)	25.3 (0.644)	32.3 (0.819)
1800	607 x 508	17.4 (0.442)	19.5 (0.496)	26.8 (0.682)	34.1 (0.867)
1900	640 x 536	18.4 (0.466)	20.6 (0.523)	28.3 (0.719)	36.0 (0.915)
2000	674 x 564	19.3 (0.491)	21.7 (0.550)	29.8 (0.757)	37.9 (0.963)

2-2-2 Mount the Reader

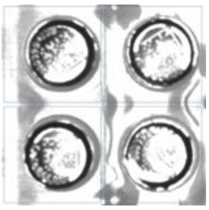
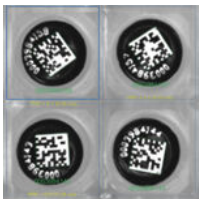
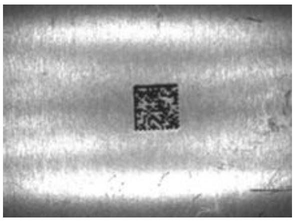
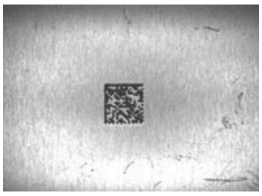
Proper Mounting Considerations and Techniques

The entire front face of the reader is a light. The primary goal for the user is to mount the reader at the optimum angle relative to the part, and/or with the correct front window accessory, that results in the highest-contrast view of the code relative to the background of the part, ensuring that the codes are read quickly and accurately.

The Common Code Reading Lighting Problems and Solutions table below illustrates basic lighting and imaging concepts, the problems that can occur, and the common solutions using either mounting angle or front-end light accessories.

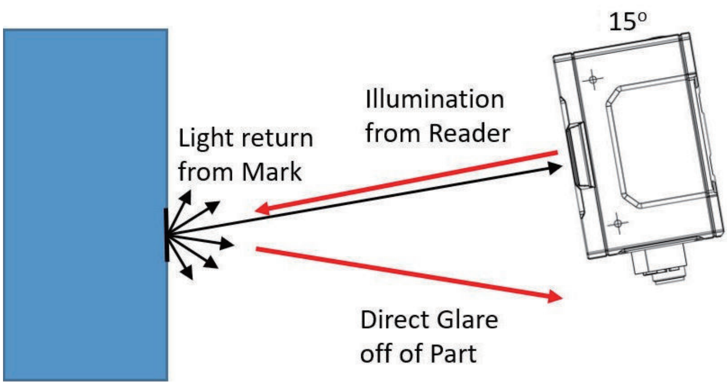
This is followed by four depictions of industry standard mounting scenarios using the built-in light,the built-in light along with the diffuser, polarizer, or half-polarizer accessory, or with only an external light.

Common Code Reading Lighting Problems and Solutions

Problem: Standard Window, Perpendicular Mounting	Solution: Change Mounting Angle and/or Use Front Window Filter Accessory	Description – Problem and Solution
Standard Window – Reader at 0 Degrees 	Standard Window – Reader at 15 Degrees 	When readers are mounted perpendicular to semi-reflective parts, they are subject to glare directly off the part face. Mounting the reader at an angle to the part is an easy way to eliminate glare, obtaining a good image of the part and the code.
Standard Window – Reader at 0 Degrees 	Polarizer or Half-Polarizer Window – Reader at 0 Degrees 	When readers are required to be mounted perpendicular to a reflective part, direct glare can make the code unreadable. Adding the cross-polarizing filter accessory, which covers both the reader light and lens, is capable of blocking 99% of the glare reflecting off the part.
Standard Window 	Diffused Window 	Readers viewing reflective parts, especially ones with underlying texture, often see highlights from the individual LEDs on the reader, making the code and background non-uniform. Adding a diffuser blends all the individual LEDs into one large light, eliminating the highlights, and making the code and background more uniform.

Angled Mounting Using Standard Light

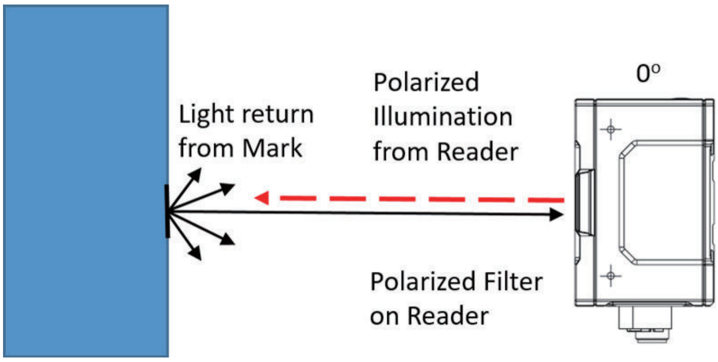
Install the reader at an angle of 15° relative to the surface of the part to avoid direct reflections from the part back into the camera. The light will still provide sufficient illumination to read the code.



Perpendicular Mounting Using Polarized Light Accessory

When it is required or preferable to mount the reader directly perpendicular to the part (0°), install the polarizing filter accessory on the front face of the reader. The polarizer will eliminate all glare and will provide a clear view of the code.

Note: Polarization reduces overall light intensity. It may be necessary to apply extra gain to achieve sufficient contrast when low exposure times are already being employed to reduce motion blur.

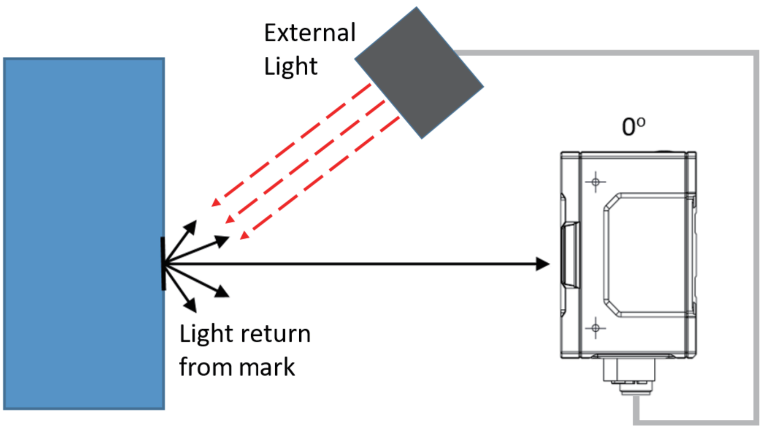


Flexible Mounting Using Half-Polarizer Accessory

The half-polarizer accessory allows maximum flexibility, giving you the choice to use either standard or polarized lighting. Two of the four light banks are used for standard lighting, and two are used for polarized lighting. You can switch between the two in WebLink's lighting control dialog.

Mounting with External Light

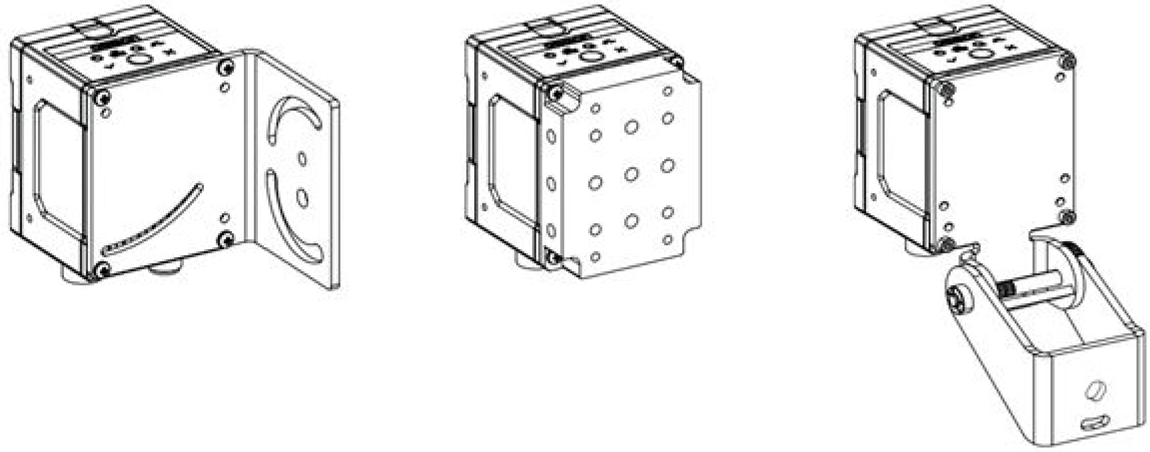
The reader can be used with external lights. External lights can be used to accomplish lighting geometry configurations not achievable by using the reader's built-in illumination alone. 24V continuous or strobe lights can be wired directly to the reader's External Light Port connector.



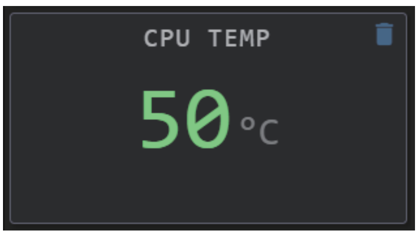
Mounting and Heatsinking Accessories

The Universal Mounting Block and Heatsink, L-Bracket Adjustable Angle Mounting Kit, and APG Pan and Tilt Camera Mount are three versatile mounting accessories that allow you to achieve the angles shown in the previous three sections.

VHV5-AM0 – L Bracket Adjustable Angle Mounting Kit | **VHV5-AM1 – Universal Mounting and Heatsink Kit** | **VHV5-AM2 – APG Pan and Tilt Camera Mounting Kit**



Heatsinking Considerations



The CPU temperature can be checked in the Dashboard view. If the CPU temperatures rises above 55-60C, mount the camera to directly to metal, or using one of the camera mounts shown above. Proper mounting and heatsinking will allow the camera to be used in ambient temperature environments up to 45C , as well as under the most stressful lighting and processing conditions.

It is not necessary to provide additional heatsinking for the reader when it is operating under normal conditions, although it is always the best practice to mount the camera to a sturdy metal base for stability, and to keep it as cool to the touch as possible.

For example, when unmounted, with ambient temperature < 75F (24C), with high power strobe enabled, and when running under a medium to heavy processing load, the CPU temperature will normally be between 45-55C. The CPU temperature is allowed to reach 85C.

2-2-3 Wire and Power the Reader

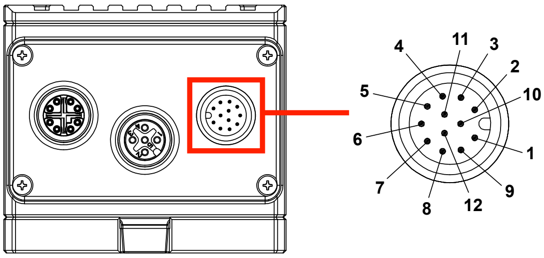
To connect the reader fully, you will need:

- A DIO (Parallel IO) cable, which includes connections for digital inputs, outputs, RS-232, and Power.
- An external light interconnect cable (optional – if external illumination will be used.)
- An X-Code Ethernet communications cable.

Key Point: Not all applications require all connections. The minimum required wiring is the X-Code Ethernet cable alone when using Power over Ethernet (PoE).

DIO (Parallel IO) Port Pins, Signals, and Flying Lead Colors

The Parallel IO Port connector is used for Digital Inputs (Trigger), Digital Outputs, RS-232, and Power. The following sections describe how to wire the Inputs, Outputs, and Power.

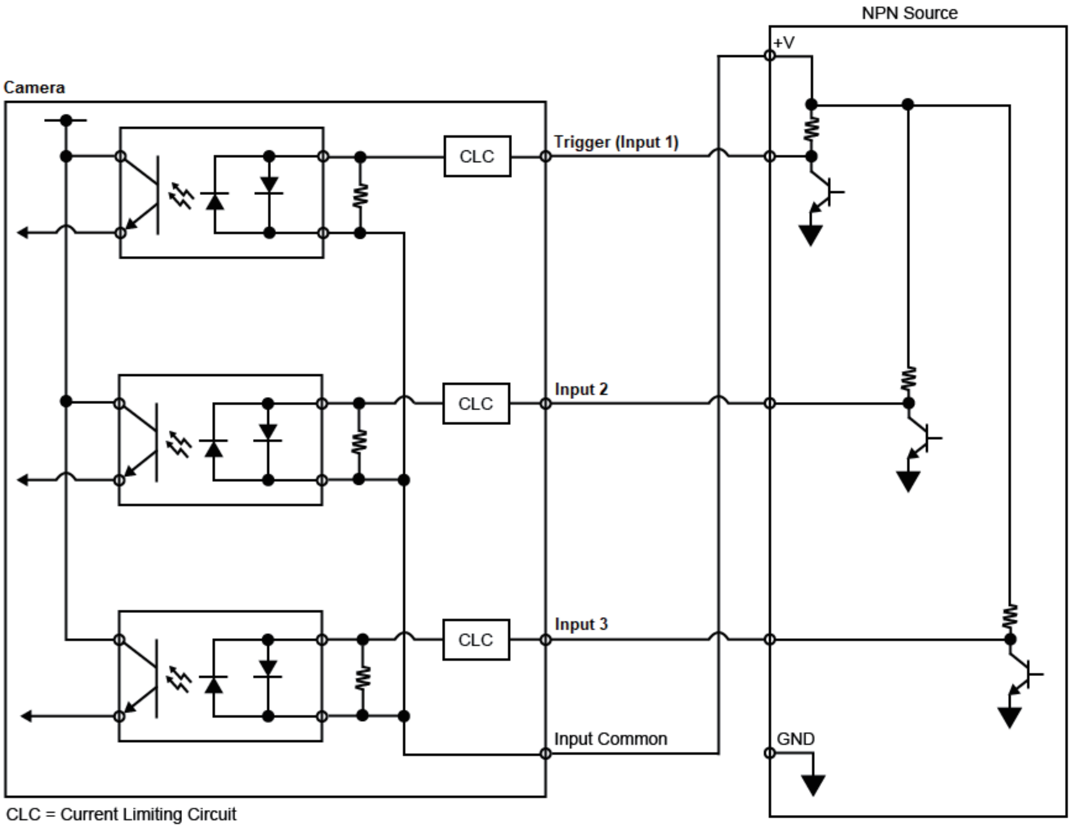


Pin	Name	Function	Flying Lead Color
1	Trigger (Input 1)	Trigger	WHITE
2	Power (+VIN)	24 Volts	BROWN
3	Input 3	General Purpose Input	GREEN
4	Input 2	General Purpose Input	YELLOW
5	Output 1	General Purpose Output	GRAY
6	Output 3	General Purpose Output	PINK
7	Ground (-VIN)	24V Reference (GND)	BLUE
8	Input Common	NPN or PNP Common for Input	RED
9	RS-232 (Host) RxD	Serial Command Input	BLACK
10	RS-232 (Host) TxD	Serial Data Output	VIOLET
11	Output 2	General Purpose Output	GRAY STRIPED
12	Output Common	NPN or PNP Common for Output	RED STRIPED

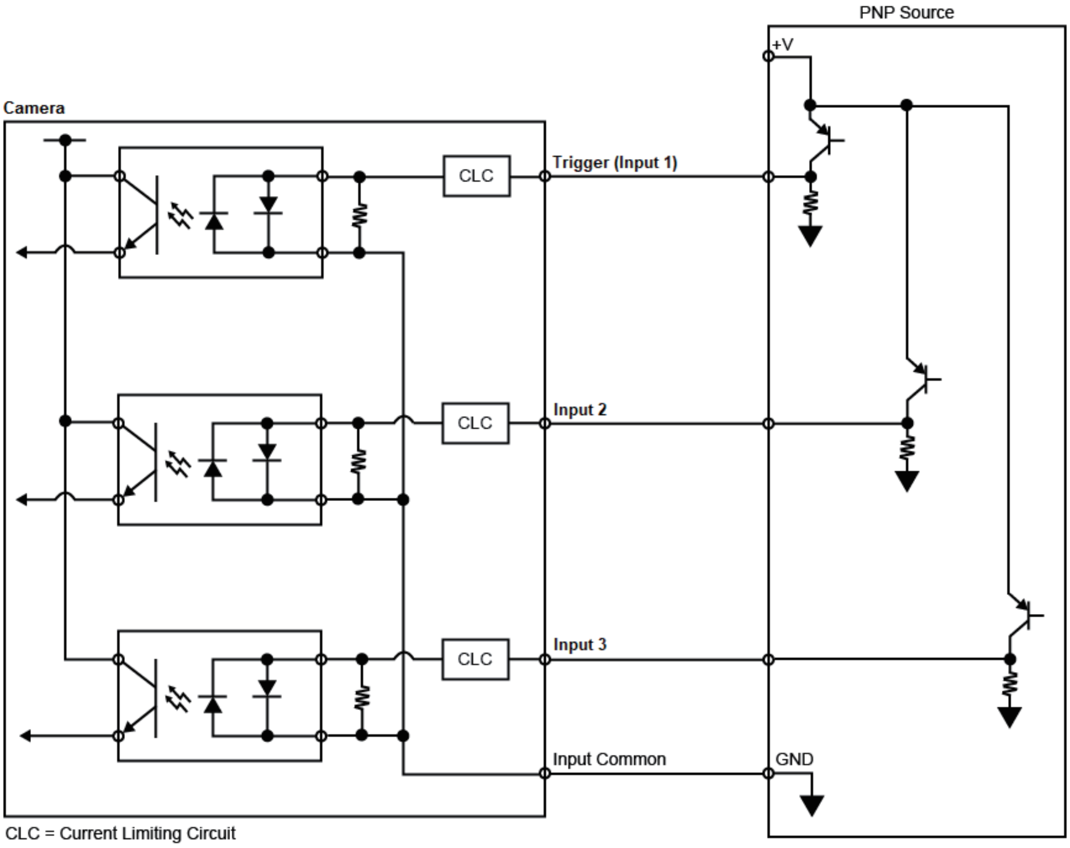
Digital Input Wiring

There are three digital inputs: Trigger (Input1), Input 2, and Input 3, as well as Input Common. The Trigger input is a high-speed, very-low-latency input for the fastest response from trigger to image acquisition. All inputs are wired the same. See the figures below for NPN and PNP Input wiring.

NPN Input


NPN Source
+V
Camera
CLC
Trigger (Input 1)
CLC
Input 2
CLC
Input 3
Input Common
GND
CLC = Current Limiting Circuit

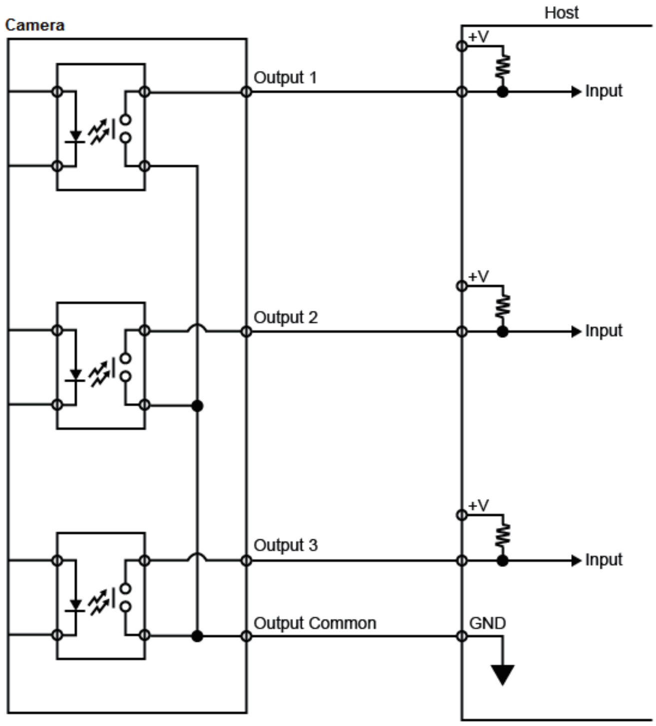
PNP Input



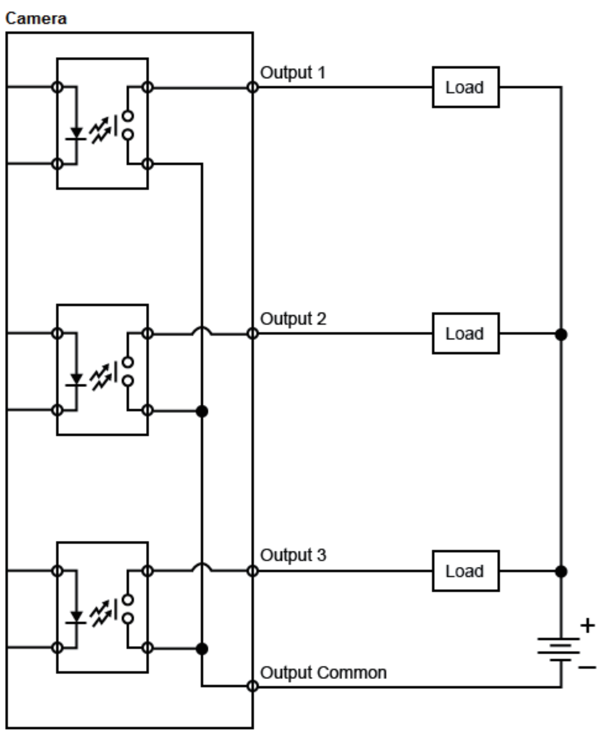
Digital Output Wiring

There are three digital outputs available for general use: Output 1, Output 2, and Output 3, as well as Output Common. Output 3 is a very-high-speed output that can be used for general purpose or as a strobe trigger to an external light other than the one connected to the reader's dedicated lighting port. See the figures below for NPN and PNP Output wiring.

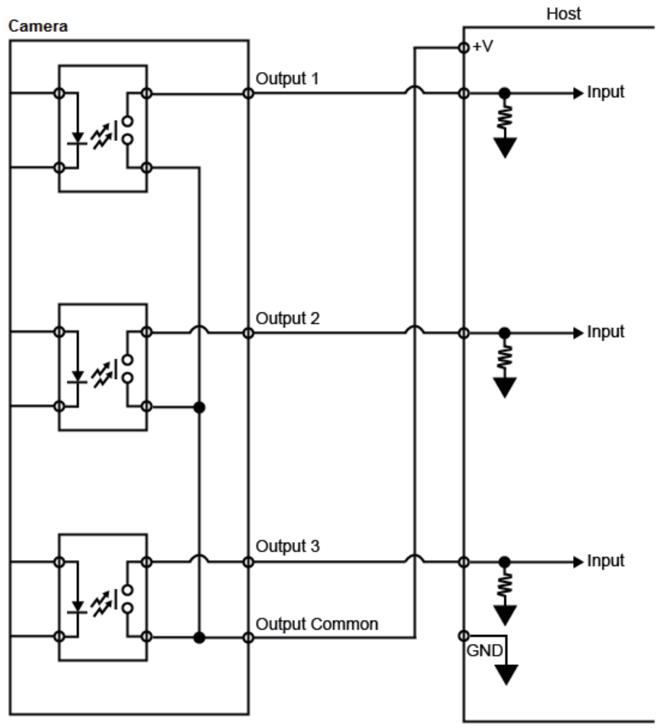
NPN Output for Host Input



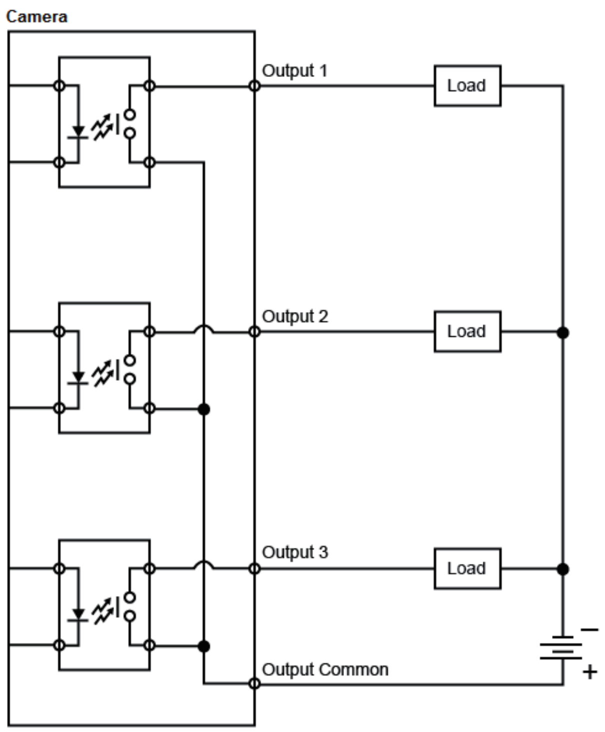
NPN Output for External Load



PNP Output for Host Input



PNP Output for External Load



Connect Power

● Power Options and Requirements

Power Options and Requirements

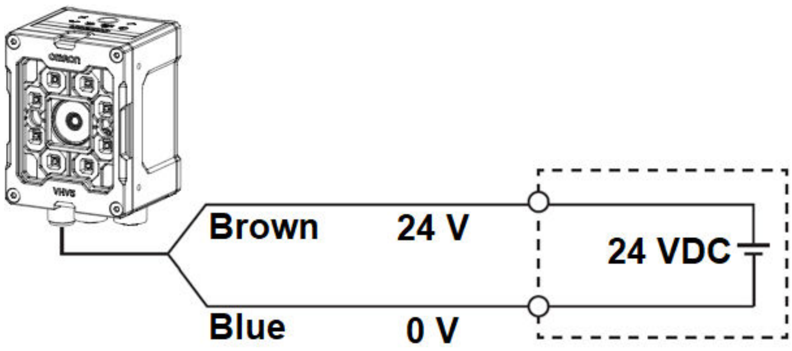
- 24 VDC +/- 10% through the DIO port connector
- Power over Ethernet

Note 1: If direct 24V and PoE are connected at the same time, the reader will automatically use direct 24V.

Note 2: To use the external light port, the unit must be powered from direct 24V.

Power Supply Voltage and Current Consumption	
Power Supply Voltage	Power over Ethernet (IEEE 802.3at) / 24 VDC +/– 10%
Current Consumption	PoE+: 44-57 VDC @ 0.6 A (Max.); Direct: 24 VDC @ 1.875 A (Max.); External Light Port Connector: 24 VDC @ 1.5 A (Max) (Internally Current-Limited)

● **Power Wiring**

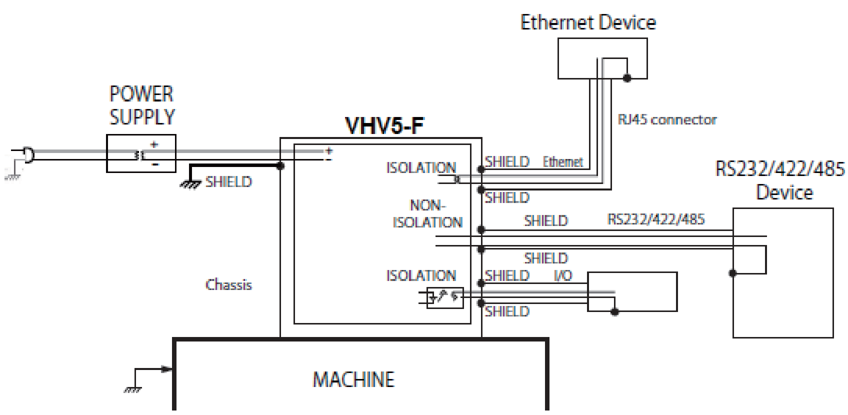


Pin	Name	Function	Flying Lead Color
2	Power (+VIN)	24 Volts	BROWN
7	Ground (–VIN)	24V Reference (GND)	BLUE

Proper Power and Grounding

● **Ground and Shield Considerations**

Proper grounding is necessary for operator safety, noise reduction, and the protection of equipment from voltage transients. Buildings, including any steelwork, all circuits, and all junction boxes must be grounded directly to an earth ground in compliance with local and national electrical codes.



An earth ground is provided through the cable shields and chassis of the reader. If the VHV5-F malfunctions due to influence of the environment by shield cables grounded, try any of the suggestions below.

- Disconnect the chassis and the shield cable of the power supply from the earth.
- Ground the shield cable of the power supply to –(0V). Ground any of one part of the shield cable, chassis, or RJ-45 connector of Ethernet cable to earth with D class grounding. Use a Class 2 power supply for the DC source.

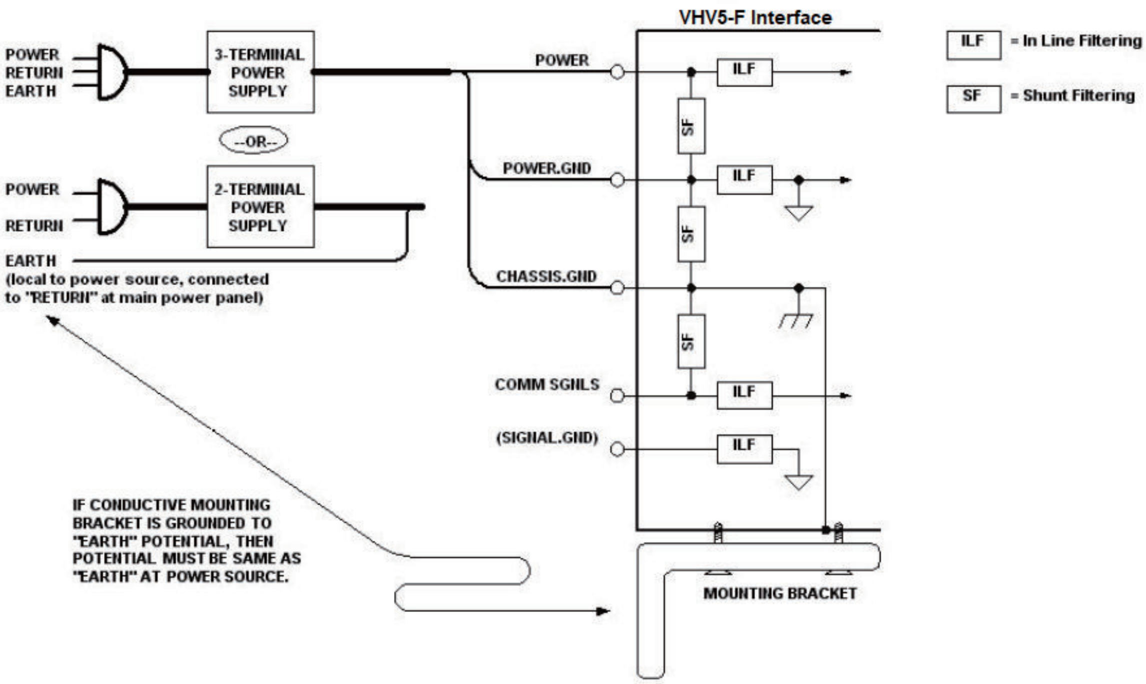
Note: In the case of this connection, must not ground the +(24V) of the power supply. If connected, the device will break down due to a short circuit.

● Ground Loops

Ground loops (signal degradation due to different ground potentials in communicating devices) can be eliminated or minimized by ensuring that both the host, imager, and their power supplies are connected to a common earth ground.

- **Note:** If a malfunction occurred to your reader by noise, mount a noise filter (RSAL2001W manufactured by TDK-Lambda Corp.) close to the reader's power-supply terminals and ground the chassis of the filter.

● Expected Power and Ground Connections for Proper Operation



● Grounding Notes

- Ensure that mounting bracket "Earth" is at the same potential as power source "Earth".
- Supply "Return" and "Earth" ground must be stable, low-impedance reference points.
- "2-Terminal Power Supply" must still provide an "Earth" connection to the imager.
- "Signal Ground" can be used for communications and/or discrete signal ground reference. It must not be used as Power Ground or Earth Ground.

Connect External Light (Optional)

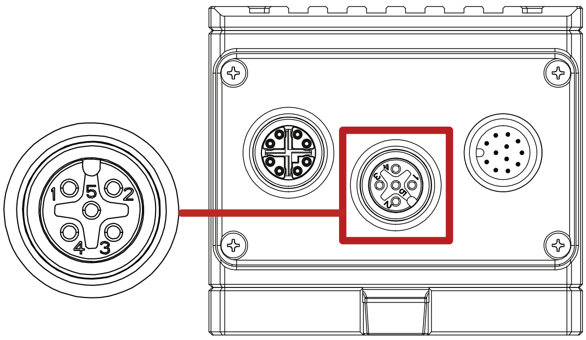
Note: The external light can only be used when the reader is powered via Direct 24V, not PoE.

● External Light Port

The third connector on the VHV5-F is used to drive an external light. The 5-pin female M12 provides 24V power, a Strobe Trigger output signal, and an optional Analog Intensity Control output signal. This five-pin assignment is compatible with many common machine vision light vendor's input connector requirements.

Precautions for Correct Use

The user must check the power and wiring specifications for their choice of external light and only connect the relevant signals. For example, pins 4 and 3 would be used to provide just a 24V strobe trigger signal output to an external strobe controller.



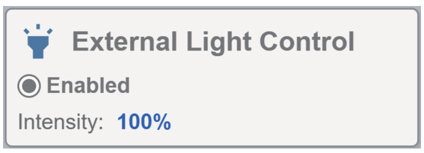
Pin	Signal	Description
1	+24 VDC	Provides up to 1.5 amps of current to light at 24V
2	Strobe Trig –	Strobe Trigger – (NPN referenced to DC Ground)
3	DC Ground	Ground
4	Strobe Trig +	Strobe Trigger + (PNP referenced to 24VDC Ground)
5	Analog Out	Selectable 0-10V analog output for intensity control

Examples:

- NERLITE Smart Series light with built-in strobe controller.
- Smart Vision lights with NanoDrive™ or Multi-Drive™ light control.

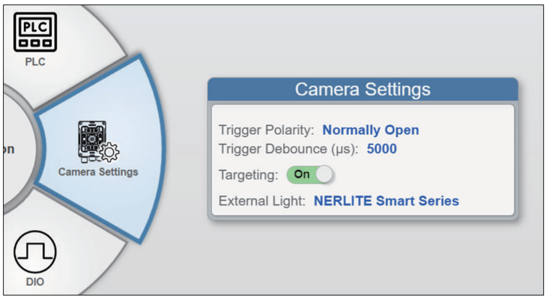
● External Light Enable

To use the External Light for a capture, it must be enabled in the Capture Settings dialog for that capture. A single capture cannot use both internal and external light at the same time. The Enable control acts like a radio button, turning off internal illumination. It is acceptable, however, to have captures that use internal light and others that use external light mixed in the same job.



- **Intensity Control**

Intensity Control is accomplished through a variable analog voltage output set on Pin 5. Each light vendor may have different voltage limits for intensity, so the user must select the proper vendor from the list in the Camera Settings dialog on the Device Page. This will limit the analog voltage output range that controls intensity to be compatible with that vendor's light. Pin 5 is set to 0V by default so this connector can be used to drive any external light that requires just power and strobe, or just strobe.



- **External Light Wiring Notes**

Note 1: Pin 2 is a sinking circuit (NPN). It provides a current-limited connection to ground when active and will float when not active. NPN requires an external 24VDC pullup for correct function.

Note 2: Pin 4 is a sourcing circuit (PNP). It provides a current-limited connection to 24VDC when active and will float when not active. PNP requires an external 24VDC pulldown for correct function.

Note 3: Both the PNP and NPN are non-isolated and reference to the same Power/GND as the M12 connector on the reader.

Note 4: NPN/PNP only function when the VHV5-F is connected to a 24VDC power supply (not PoE).

2-2-4 Set Up Network Connection between Host PC and Reader

Ethernet Communications

The VHV5-F uses a standard X-Code cable for 1000BASE-T communication and programming. The cable can also provide full power to the reader when used with a suitable PoE injector or PoE switch.

Ethernet communication requires that the reader and host be on the same network. The reader is shipped from the factory with a default IP address and Subnet.

The simplest method to connect is to set the Host PC to the same Subnet. Otherwise, you can use the Device Discovery Utility (DDU) to set the reader IP to be on the same network as the PC.

Reader Factory Default IP Setting

Factory Default Settings	
IP Address	192.168.188.2
Subnet Mask	255.255.0.0
Gateway	Not set

Resetting IP Address to Default Using Membrane Control Button on the Reader

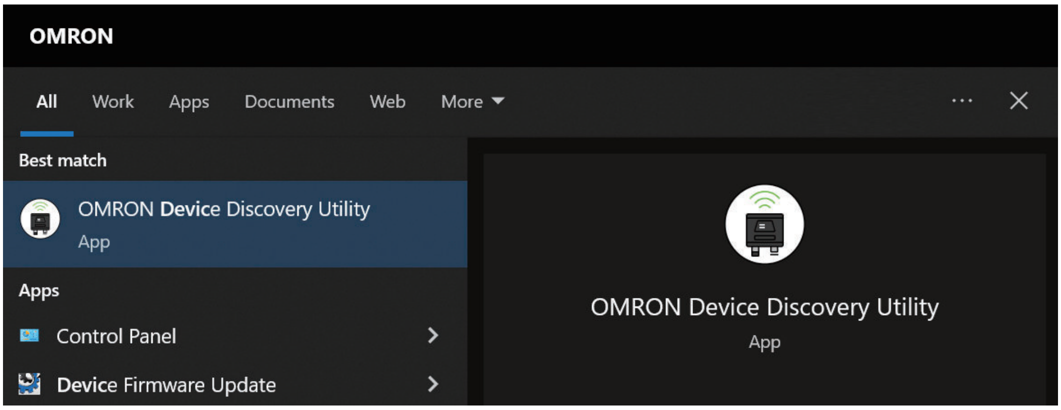
The IP address can be reset to factory default using the membrane switch on the back of the reader. Press the reader membrane button down and hold it. The lights will blink once after two seconds, and then will blink twice after five seconds. Release the membrane button after the double-blink. The IP address and subnet are now reset to factory default.

2-2-5 Setting the Network Connection using the Device Discovery Utility (DDU)

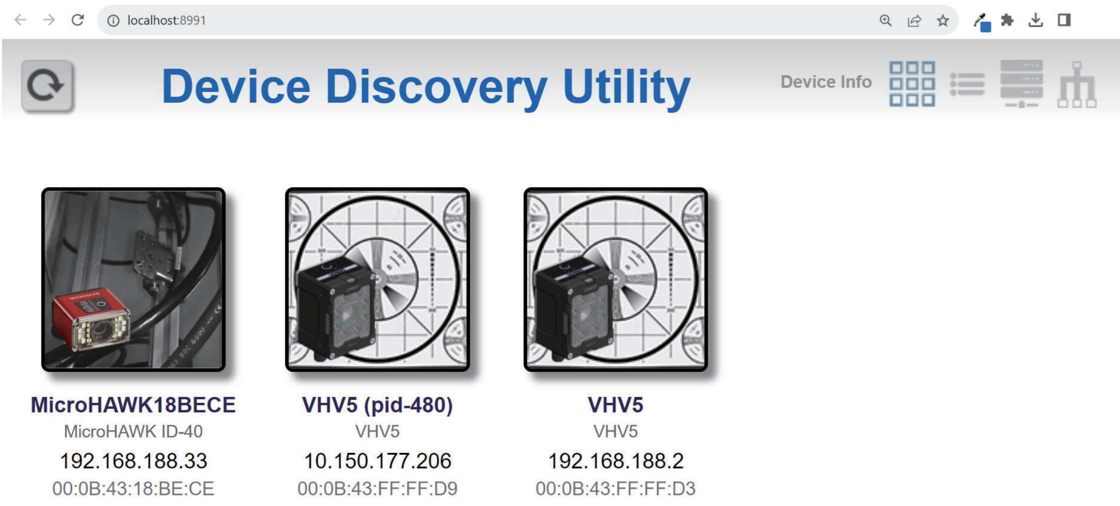
The Device Discovery Utility or DDU is a utility program that runs on the PC. It is used to search the network for any VHV5-F Autofocus Multicode Reader. It enumerates the devices so the user can connect to them, change basic device parameters, load software, and start the user interface. The DDU can be downloaded from the Omron Automation website. Search for "DDU".

Using Device Discovery Utility (DDU) to Discover All Readers on the Network

Start the **Omron Device Discovery Utility** application on the PC.

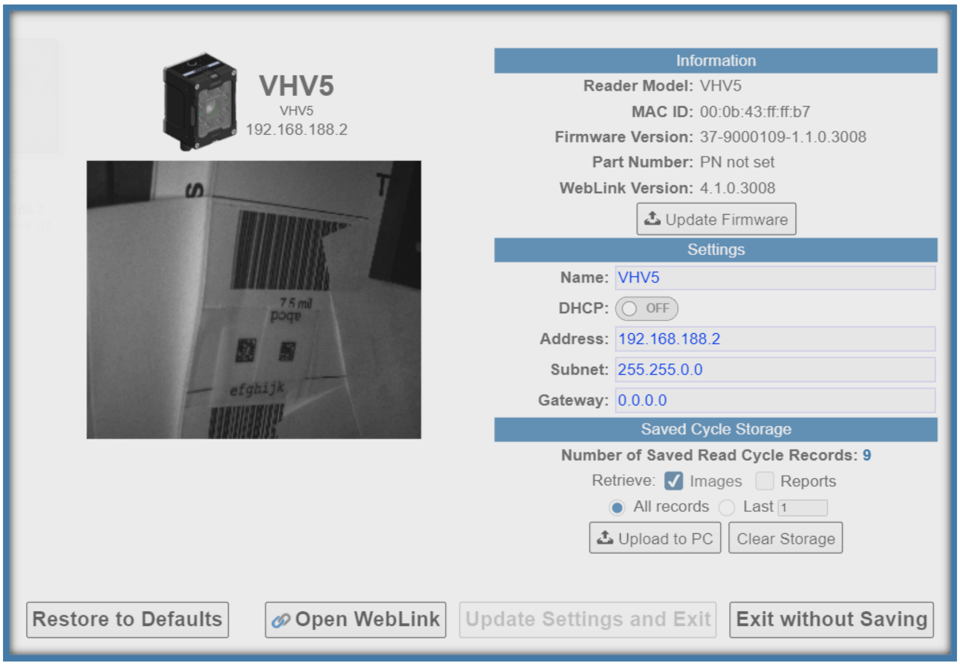


The DDU automatically discovers all readers that are reachable on the network, regardless of IP address and Subnet. Each reader on the network is displayed with its own icon and with basic information about the device.



Using DDU to Change Reader IP Address and Network Settings

Click on the icon for the specific reader to see the current device settings.



All readers are shipped with the IP address set to the factory default of **192.168.188.2 (255.255.0.0)**.

To deploy multiple readers on a production floor, assign a unique IP address to each reader by typing the new IP address. Set Subnet appropriately. Ensure that any PC used to program the readers is also on that same Subnet.

Click the **Update Settings and Exit** button to update the reader. The reader will reboot and come up with new settings.

2-2-6 Setting the Camera Name and Updating the Software using the DDU

Using DDU to Change Reader Name

The factory default name for each camera is **VHVF######**, where the **#**s are the last three octets of the reader's MAC ID. This guarantees a unique name for each reader. You can change the reader name by typing the new name and then clicking the **Update Settings and Exit** button.

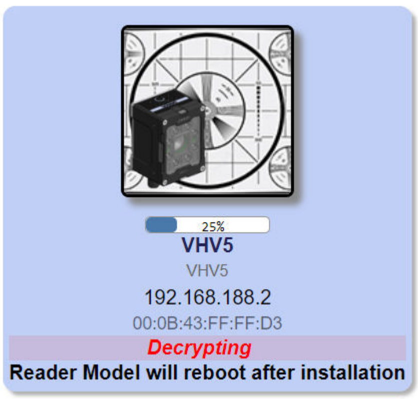
Using DDU to Update Firmware on the Reader

The DDU can also be used to update the reader's firmware.

Click the **Update** button, navigate to the folder containing the firmware, and select it. The firmware name is the version number with the extension **.enc**.

Example: 37-9000109-1.0.0_3003_arm64_release.enc

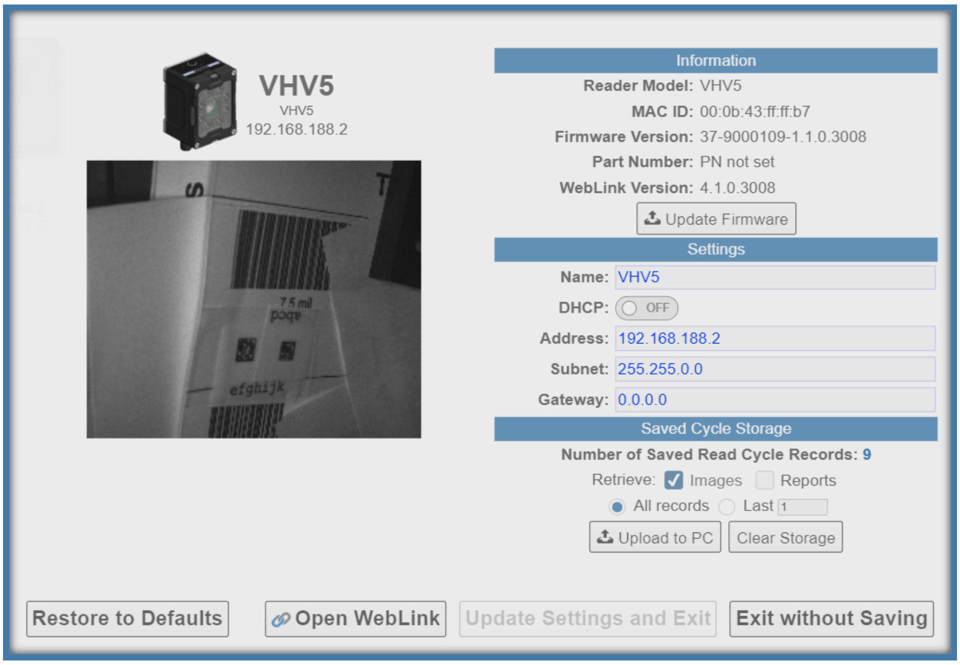
The DDU displays update progress and reboots the reader when it is complete. The DDU automatically rediscovers the reader and re-displays it with current settings after the reboot.



2-2-7 Starting WebLink User Interface using the DDU or Browser

Using DDU to Start WebLink on the Reader

Click the **Open WebLink** button to begin programming the reader.
See *4-1-2 WebLink System Requirements* on page 4-4.



Standard WebLink Start Method

The VHV5-F does not require user interface software to be installed on the PC to program the reader or to monitor it in Run mode. WebLink is a a web application that is hosted by the camera. This means there will never be any version mismatch issues between the user interface and the software that is running on the reader.

To access the WebLink user interface, open a browser and type the IP address of the reader in the address bar. The user interface will appear as a fully interactive web page.

3

Theory of Operation

3-1 Theory of Operation

Previous sections concerning application evaluation and reader model selection detail the initial steps required to choose the correct reader, ensuring a successful installation. A full understanding of the theory of operation for the reader is also essential to deploy it to its best advantage.

Theory of Operation describes

- Device Settings and Communications
- Jobs (Read Cycle Types)
- The Read Cycle (Sequence of Steps)
- The Decode Tool (Operation and Qualification)
- Processing Optimization

3-2 Device Settings and Communications

Settings for the reader are divided into two distinct types. First are the Device settings. These parameters normally remain fixed, based on the line or station with which the reader is integrated, and they primarily deal with communications. Second are the Job settings, which vary based on the requirements of each unique reading application.

3-2-1 Device Settings

Device settings are those that remain fixed no matter what reading application is being run. Device settings include the IP Address of the camera, RS-232 communication configuration, Socket communication configuration (UDP, TCP, Client and Server), Digital IO settings, EtherNet/IP settings, and PROFINET settings.

The understanding is that the reader will be deployed on a single production line and will communicate with the host by the same method for all jobs. It is logical for these settings remain fixed.

3-2-2 Communications Channels

The VHV5-F has five parallel and independent communications channels for receiving commands and sending out data. Commands can be entered through any of the ports and the reader will respond on that port. The read cycle result string and data is automatically sent through all enabled ports. These channels are:

- RS-232
- TCP/IP Server
- TCP/IP Client
- UDP Server
- UDP/IP Client
- EtherNet/IP and PROFINET

Key Point: All communications channels operate independently of one another. They can all be active at the same time. Settings made for TCP/IP, UDP, and the industrial protocols have no effect on each other. All of them simply share the same 1000BASE-T line.

The only exception is EtherNet/IP and PROFINET. Only one or the other protocol can be active.

3-3 Jobs

3-3-1 Jobs and Job Slots

Virtually every reading application is different. Applications can vary in the code types to be read, the number and position of the codes on the part, and the lighting, sensor, and focus settings required to image all of the codes.

WebLink allows the user to quickly and easily program the VHV5-F for each new reading application. These programs are called Jobs. Once a Job is created, it is stored on the camera in one of 31 memory Slots.

During production, Jobs are loaded by selecting the slot the Job is stored in. This can be done manually or programmatically. The file system allows Jobs to be deleted or even moved from one Slot to another.

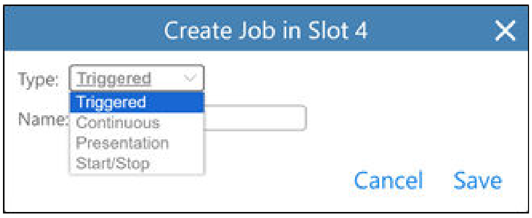
Job archive files can be saved from the reader to the PC or loaded from the PC to the reader. This allows for Job backup, as well as for sharing Jobs between readers on the factory floor.
Key Point: Job changes on the VHV5-F are extremely fast. Job changes can be accomplished almost on a trigger to trigger basis.

Note: Slot 00 is reserved for a default Demo Job installed at the factory. It is set as the Boot job. All cameras will load and run this job when first powered up. This job cannot be deleted or changed. Modifications and be made to this job however, and then saved to another Slot. New Jobs can be created. Any Job can be set to the Boot Job which will then be loaded at power up rather than the default Demo Job.

3-3-2 Job Types

There are four user selectable Job types that determine how the reader will be triggered, acquire images, process, and send results. **The sequence the reader runs through from trigger to result is**

called the Read Cycle. The four basic types are Triggered, Continuous, Presentation Mode (Supermarket Mode), and Start Stop. When Creating a New Job in a Slot, the user selects the type of Job (or Read Cycle). This sets all the correct parameter defaults for that Job type.



Triggered

Triggered is the most common Read Cycle type. Here, the system receives a specific trigger indicating the part is in front of the reader. The trigger starts the Read Cycle. Within the read cycle, the reader acquires a fixed set of images and attempts to read within those images. The read cycle ends either when it has read, or when it runs out of images and still fails to decode. The next read cycle starts when a new trigger is received.

Continuous

For Continuous mode, the reader starts acquiring images automatically upon entering Run Mode and attempts to read within those images. The reader will continue indefinitely to acquire and process until a part enters the field of view and the codes on that part are read. **Only a successful read will end the read cycle.** At the end of the read cycle, the data is output, and then the next read cycle is started automatically, again waiting for a part to pass in front of the reader and be read. **Note:** Continuous mode will read the same code over and over in this mode until the part is moved out of the field of view.

Presentation

Presentation mode is exactly the same as Continuous mode, except that once a code is read, the reader will wait a user-defined amount of time before starting the next read cycle. This is to prevent duplicate reads of the same part. This is the same principle as supermarket scanners.

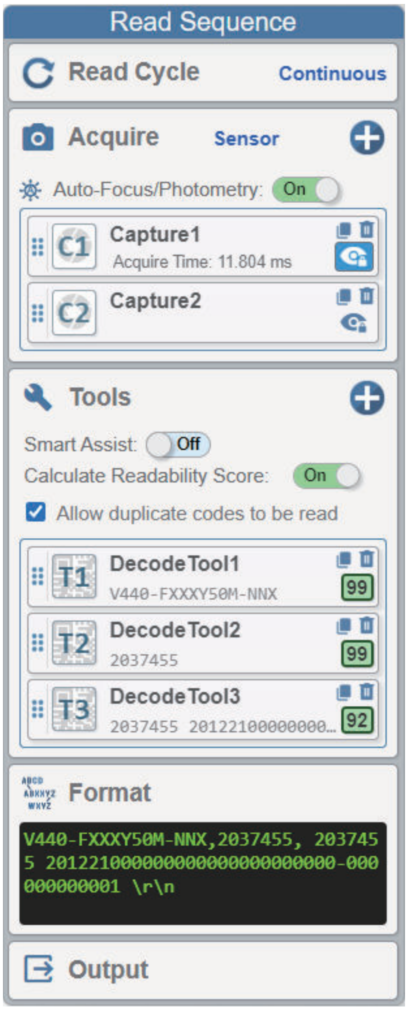
Start/Stop

Start/Stop is a combination of Triggered and Continuous. Like Triggered, the Read Cycle is started with a Trigger Signal. Like Continuous, within the read cycle, the reader acquires images continuously and attempts to decode while the trigger is held on. If it decodes successfully, it sends the data out immediately (or after the Stop signal, depending on user settings). The read cycle ends when the host sends the reader a Stop Trigger signal. It begins the next Read Cycle on the next Start Trigger.

3-4 Read Cycle Theory of Operation

3-4-1 The Read Cycle

The reader runs read cycles. Each read cycle is different based on the Job Type, but it generally starts with a trigger event, and ends with the read data transmitted out of the device to the host.



There are four Read Cycle, or Job types. Triggered, Continuous, Presentation Mode (sometimes called Supermarket Mode), and Start/Stop.

The sequence of steps within the Read Cycle is shown in the dialog and is described in the following sections.

3-4-2 Read Cycle Triggering

A Read Cycle is normally started by a physical trigger indicating that the part is in front of the camera. (Note, however for some Read Cycle modes such as “Continuous Read”, the trigger is an event, i.e. the completion of the prior Read Cycle.)

3-4-3 Image Acquisition

Once triggered, the reader acquires one or more Captures of the part while it is in front of the camera. Each capture can be set up with a unique combination of Exposure, Gain, Focus, and Lighting to ensure that all targeted codes can be read under all conditions in at least one of the images. As soon as the first capture is available, the Decode Tools are run.

3-4-4 Running the Decode Tools

Within the job, the user inserts one Decode Tool for each individual code that is meant to be read. That Decode Tool is programmed with a set of “Qualification” criteria that steers the Decode Tool to find one specific target code out of what could be many codes in the field of view. As each image becomes available, each Decode Tool will run in that image to try to find and read their “qualified” code. Once a DecodeTool has found its qualified code, it is marked as Passed and that Decode Tool shuts down. It will not run in any pending captures. Any Decode Tool that has not yet succeeded will continue to run in all available captures until it qualifies, or until there are no more captures for it to process, in which case the Decode Tool is marked as Failed.

The final processing step for each Decode Tool is the formation of a result string that is sent up to the read cycle to be included in the final read cycle output. The string normally just contains the decoded data string from the code, but the user can add other code specific data as well such as the X, Y and Theta coordinates of the code in the field of view, or a quality score for that code. The string for Decode Tools that have failed is generally “NOREAD”.

See the Decode Tool Theory of Operation section below.

3-4-5 Read Cycle End

The Read Cycle image processing phase ends once all Decode Tools have completed, and have passed their result back up.

If all Decode tools have succeeded early, all pending Captures in the Acquire step will be cancelled and the Read Sequence will move directly to the Format and Output stage.

3-4-6 Read Cycle Pass / Fail Determination

All Decode Tools within the job must Pass for the Read Cycle to Pass. If any of the Decode Tools Fail , the Read Cycle will Fail. The calculation for Decode Tool Pass/Fail is described in the *3-5 Decode Tool Theory of Operation* on page 3-9 below.

3-4-7 Data Output String Formatting

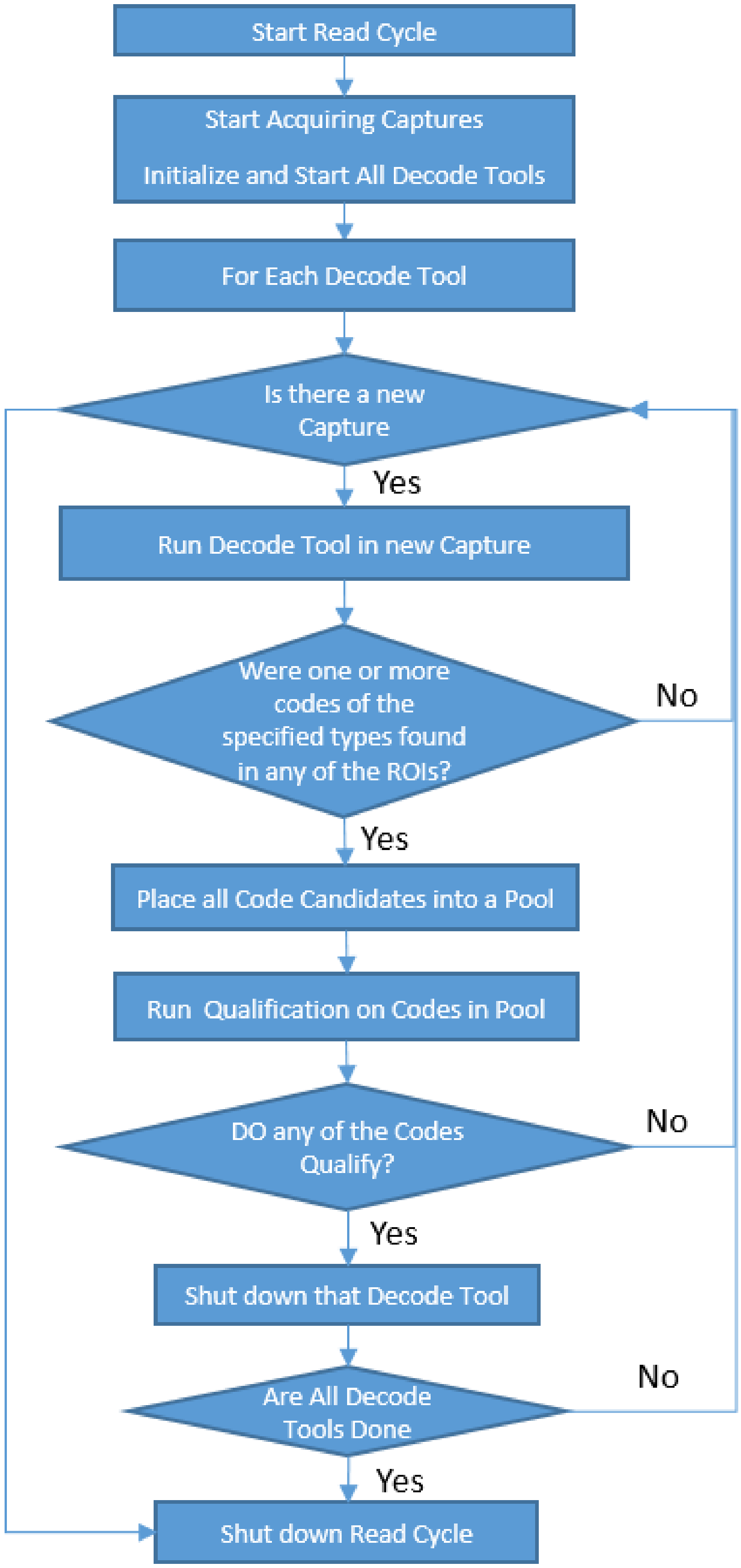
In the next-to-last step in the Read Cycle, the formatted output string from each Decode Tool is passed to the Read Cycle Format Output step. Here, the final output string is constructed prior to being transmitted out as the final Read Cycle result.

By default, each Decode Tool’s string is simply appended to the final result string. The user also has the capability to add user-defined text, as well as Read Cycle-specific data such as the Trigger Time Stamp, or Read Cycle duration, into the final string.

3-4-8 Read Cycle Output Data Transmit

The read cycle ends with reporting. Here, the final formatted output string is sent to the WebLink results screen, as well as sent out all active data channels (RS-232, Socket,Ethernet/IP, PROFINET, etc.). The Digital Output signals indicating read cycle status such as Pass/ Fail are set at this time as well.

3-4-9 Read Cycle Flow Chart



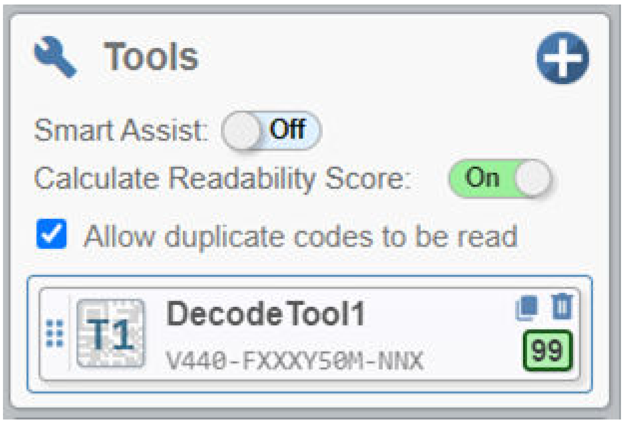
3-5 Decode Tool Theory of Operation

3-5-1 The Decode Tool

The Decode Tool is at the core of the reader. One Decode Tool is added to the Job for each code on the part that needs to be read.

The Decode Tool runs the X-Mode reading algorithm in each and every image presented to it. X-Mode searches each image for code candidates. Each candidate is passed to the decoding section of X-Mode to see if it can be read. If it does read, the Decode Tool goes on to perform matching and grading on that code.

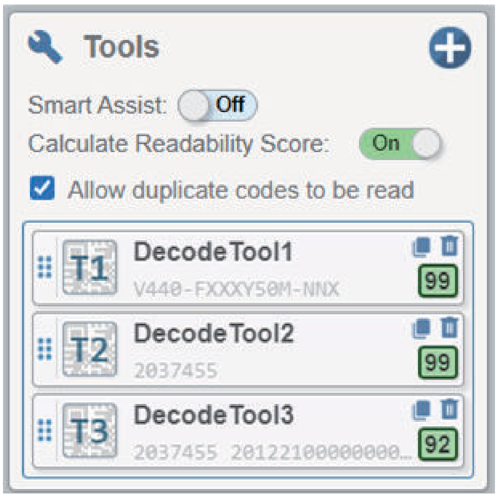
Finally, the Decode Tool constructs a result string. This string generally contains the decoded data, but can also be formatted to contain an abundance of other data such as the position of the code in the field of view, the time it took the Decode Tool to run, or even a code quality grade report.



Note: The normal mode for the Decode Tool is one tool per code. The **LEARN CODES** button does exactly this, adding one tool for each code it finds in the image. This provides the greatest amount of control over each read. The Tool provides a secondary option called Multicode Mode. This option allows the user to set up a single tool to find 1 to n codes. See *7-8 Decode Tool Dialog Details* on page 7-32 for additional information.

3-5-2 Decode Tool List

A Job can contain one Decode Tool or many, depending on the requirements of the reading application. Typically, one Decode Tool is inserted into the Decode Tool list for each code that is meant to be read. Tools are added via **LEARN CODES**, or by clicking the **+** icon. Clicking on each tool will open its parameter settings page.

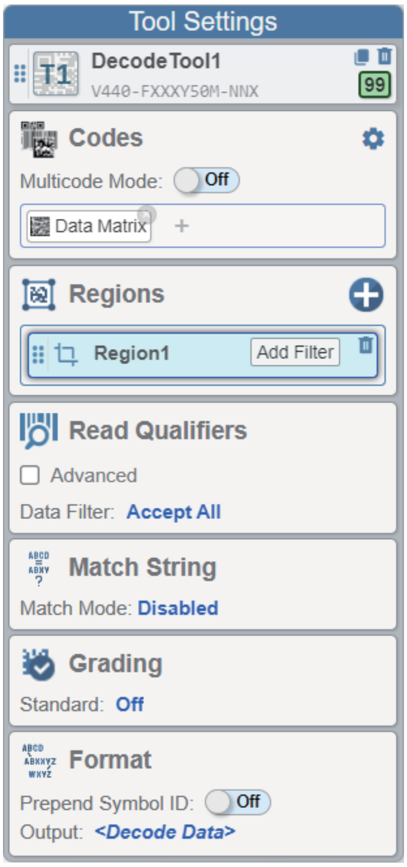


3-5-3 Decode Tool Qualification

Clicking on a Decode Tool in the Tools list opens the Decode Tool settings dialog for that tool.

The Decode Tool Dialog is used to set up how the Decode Tool will run by setting up specific Qualification Criteria that are used to drive the tool to find and decode the exact code of interest.

For example, the Decode Tool can be programmed to find a QR Code that lies within a certain Region of Interest, and that starts with the letters “ABC”. The algorithm will sort through all code candidates it finds, and will only decode and output the one that “qualifies”. If no code is found that meets the qualification criteria, the Decode Tool will output a NOREAD message.



Qualification is nothing more than a set of tests or gates that each candidate code found by the decoding algorithm must get through to be considered the fully-qualified or "actual" code the tool was meant to find. The various gates are described below.

Code Found

Code Found is the first gate. This simply means that the algorithm has found a code that is of the correct type, and it is found within one of the regions or interest (ROIs) the user has set up.

Code types is set up in the Codes section of the dialog. It can be set to just one type like Data Matrix, or a list of types like Data Matrix or QR. If a code is found that is not one of these types, it is filtered out.

ROIs – Regions of Interest are used as implicit filters as well. The user can set ROIs only around the area of the image where the code is expected to be, eliminating any other codes in the image from consideration. Multiple Regions of Interest can be set up in case the code can be expected to be found in more that one position. For example, if the part can be in front of the camera in multiple orientations.

Code Read

Read Qualification is the second gate and is set up in the Read Qualifiers section of the dialog. Normally the Read Qualifier Data Filter is set up to accept any code that is found of the correct type within the ROIs the user has set up. It can be used as a much more powerful Logic Filter however when Advanced is selected.

Example 1: It can be used to make a more refined choice between multiple codes that are in a single ROI where one is the code of interest and the other is not.
For instance if there are two Data Matrix codes within a ROI, The qualification statement can be set to pick the code that is “The Data Matrix Code that Starts with the string “XYZ”. Now, if there is a Data Matrix code that starts with ABC, and another with XYZ, the algorithm will reject the candidate that starts with ABC if that is decoded first, and choose the code that starts with XYZ.

Example 2: As a second example, it can be set up to qualify on more than one code if both are acceptable. It would do this using Logic set up such as “If the Code is a Data Matrix Code and Starts with the string “ABC”, OR If the Code is a QR Code and Starts with “XYZ”. This would allow either of these codes to pass the Read Qualification Gate.

Match String

Match String is the final gate or filter. This is where the full contents of the code can be checked. For example, if there are two Data Matrix codes that start with ABC, but the user wants to assure that the one that reads ABC456 is read, they would set ABC456 in the match string list. If ABC123 is read first, the Match String gate would reject it, and the decoder would continue to provide candidates until ABC456 is presented and Match String passes.

3-5-4 Decode Tool Pass / Fail Calculation

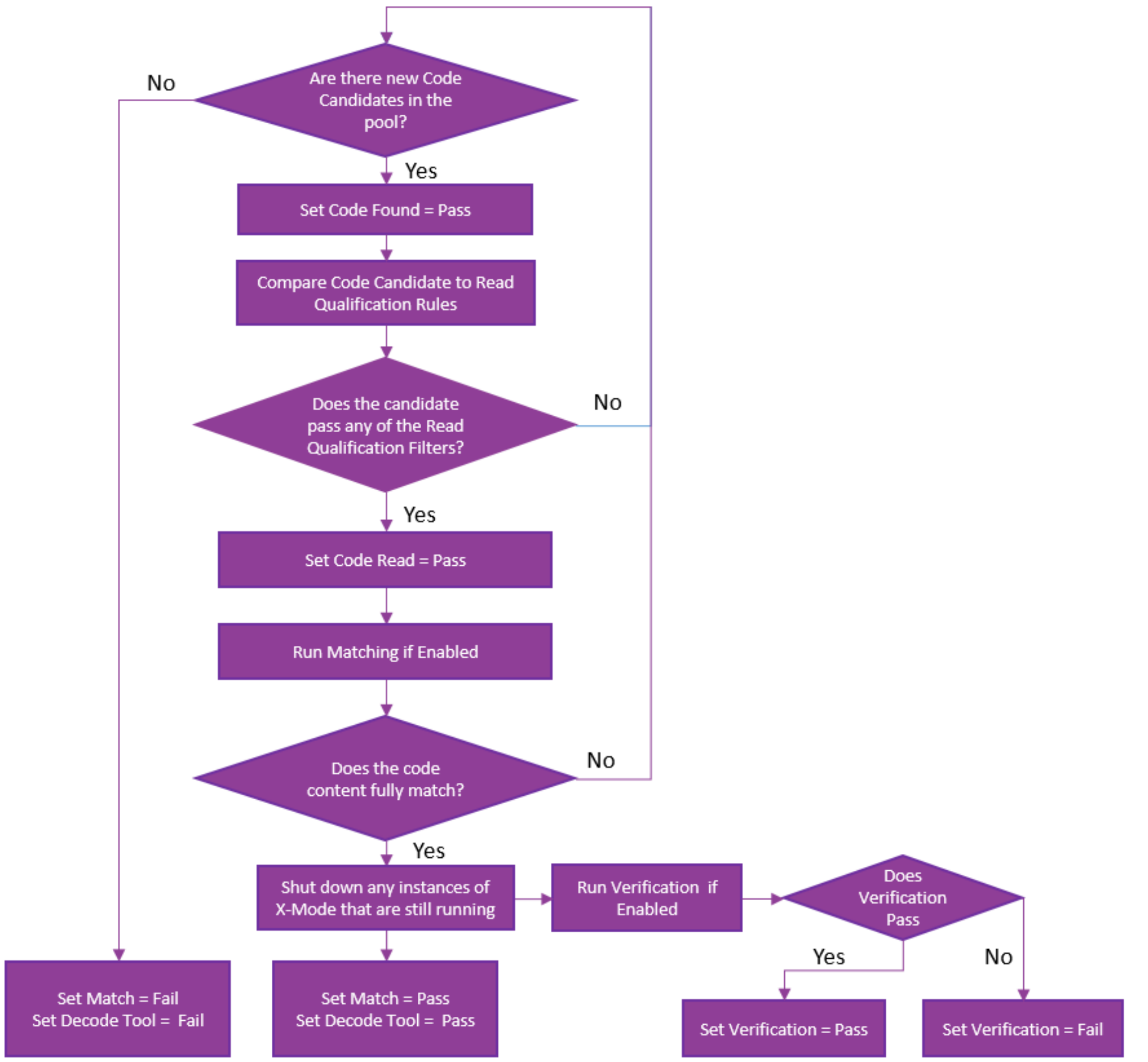
As indicated above, the Decode Tool runs code candidates through a series of qualification steps to ensure it finds exactly the right code the user is targeting to be read even though there may be many similar codes within the search area. If qualification criteria, or gates, are passed, the Decode Tool passes. Otherwise the Decode Tool fails. It is important to note that each of the individual qualification steps or gates (Code Found, Code Read, Match String) also have an associated Pass / Fail signal that can be transmitted to provide useful process information. For example, if the Decode Tool finds a code of the correct type within the ROI, but rather than starting with "ABC," as desired, it starts with "DEF". This would indicate to the host that parts are being mixed on the line.

Qualification is discussed more thoroughly in the Read Cycle Details section.

3-5-5 Decode Tool Data Formatting

Once the target code is found, each Decode tool has the capability to individually format its data output. The default output is the decoded data string. However, the user can insert custom text, as well as other code-specific data that has been computed, such as the position and angle of the code.

3-5-6 Decode Tool Read Qualification Flow Chart



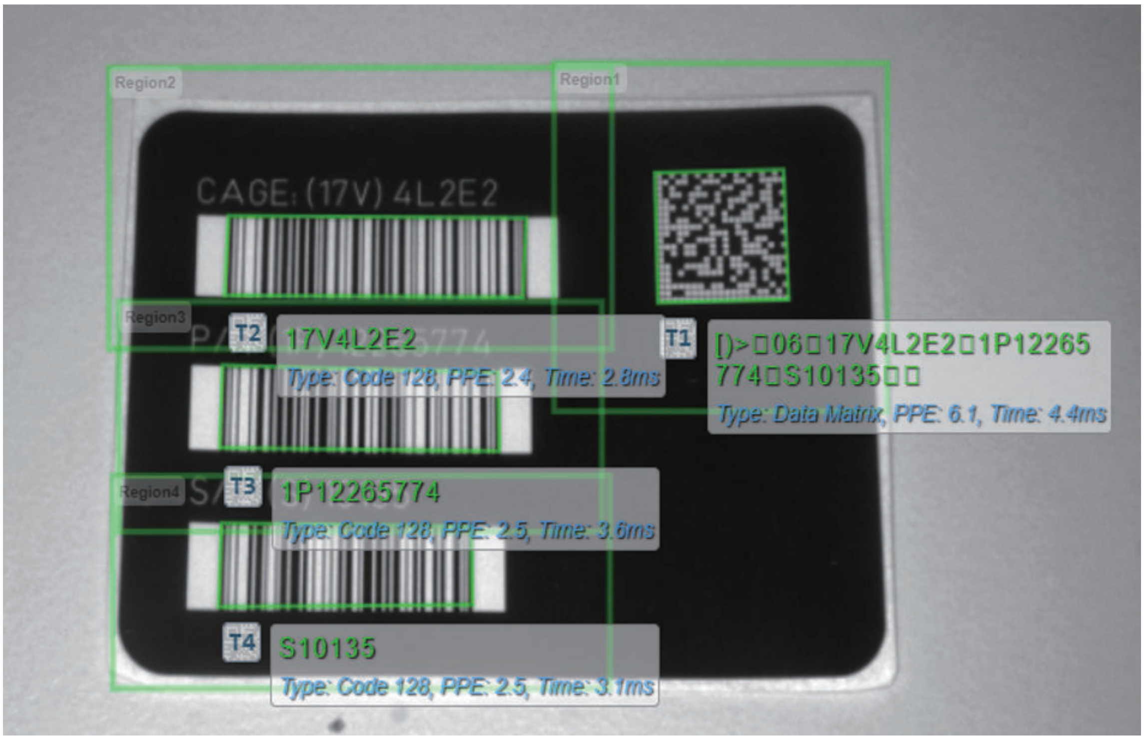
3-6 Read Cycle Processing Optimization

The reader has been designed for high resolution (2.3MP and a 5.0 MP sensors) and high speed. High resolution means more pixels to process. Processing more pixels means more time. The VHV5-F employs two mechanisms to minimize processing time. One: Regions of interest is under user control. Two: Pipelined Acquisition and Parallel Processing Operation and part of the system.

3-6-1 Regions of Interest

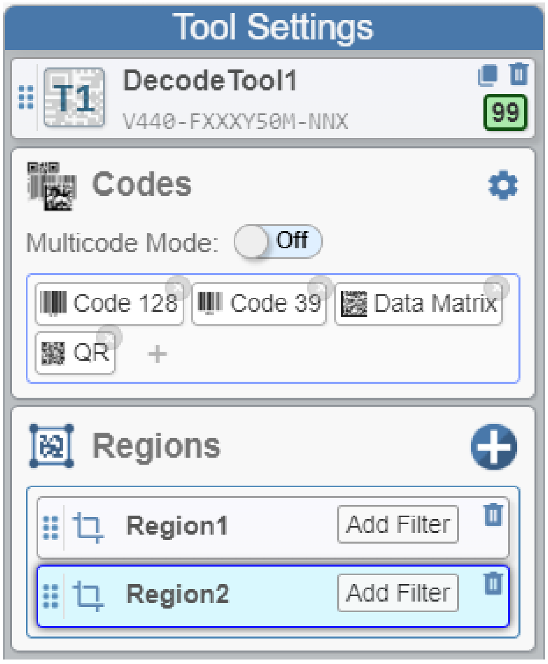
Default Region of Interest

When a Decode Tool is inserted, it is created with a default ROI (Region of Interest) that the user is able to adjust for code position, size and expected positional uncertainty. Limiting the size of the Decode Tool read area reduces the number of pixels the system has to process thus decreasing overall read time. The ROIs also allow the user to target certain codes, and ignore other codes that may be in the image. The Learn Codes function automatically places and sizes the ROIs for the user. Users can adjust the ROIs.



Multiple Regions of Interest per Decode Tool

A single decode tool can have more than one ROI. For example if a code is in the corner of the part, and the part can be presented at any of four orientations, 4 separate ROIs can be set to cover each corner, again limiting the number of pixels the system has to process. The example below shows the Decode Tool set up with two regions, the lower left and upper right to account for two orientations the part can be presented in.



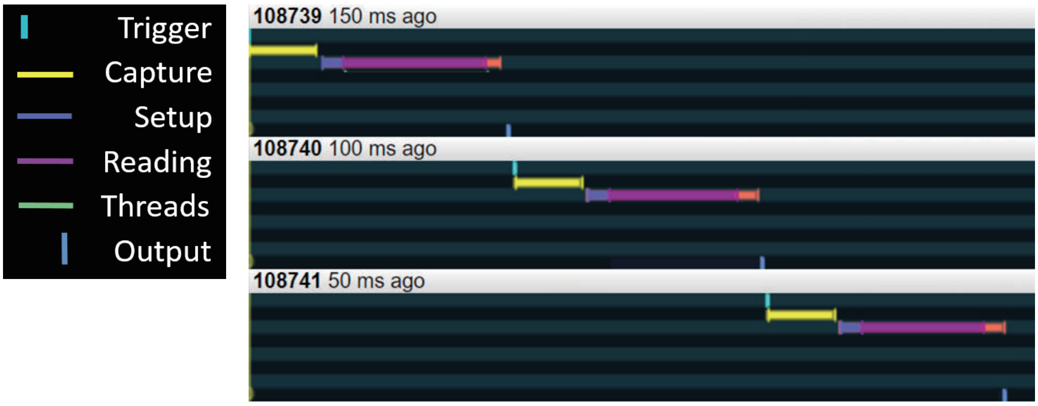
3-6-2 Pipelined Acquisition and Parallel Processing Operation

The VHV5-F is capable of both Pipelined Acquisition and Parallel Processing within the images enabling it to achieve nearly frame rates on well-tuned jobs. Frame rate processing means that the VHV5-F can run on the fastest production lines without affecting line throughput performance.

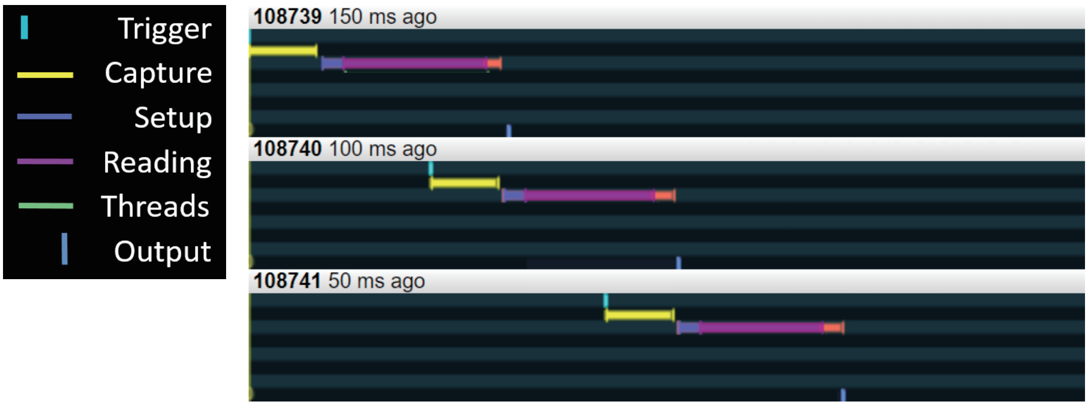
Pipelined Acquisition

The VHV5-F is capable of running multiple tasks at the same time. The two main tasks are image acquisiton and image processing. Pipelined Acquisition means that the reader can get a second trigger and begin acquiring images for the next read cycle while it is still processing the images from the first trigger. The effect an increase in read rate.

The following diagram from the Digital Softscope (Timing Profiler) within WebLink shows normal operation of a reader that follows a serial operation. Here a trigger is received, the image is acquired, then the image is processed and the data is output. The next trigger is sent once the output is received.

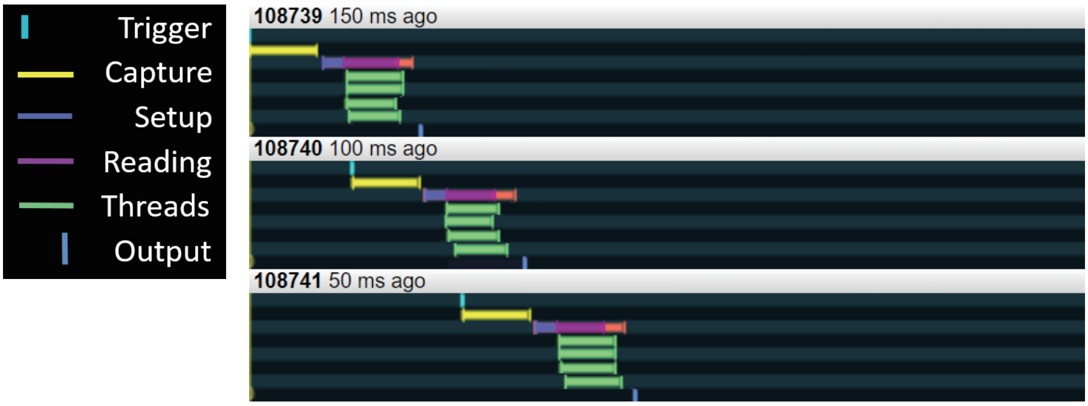


The next diagram shows the effect of Pipelined Acquisition. The trigger rate is increased so acquisition of next image occurs while previous one is still being processed. Rate is increased by the acquire time.



Parallel Processing

The VHV5-F is capable of using multiple cores simultaneously for image processing or reading. By efficiently breaking the processing task up amongst the cores the system can be triggered at an even higher rate. Depending on the image complexity and difficulty of reading, the system can approach operation at the frame rate of the reader.


Trigger
Capture
Setup
Reading
Threads
Output
108739 150 ms ago
108740 100 ms ago
108741 50 ms ago

4

Overview of WebLink 4.0 User Interface

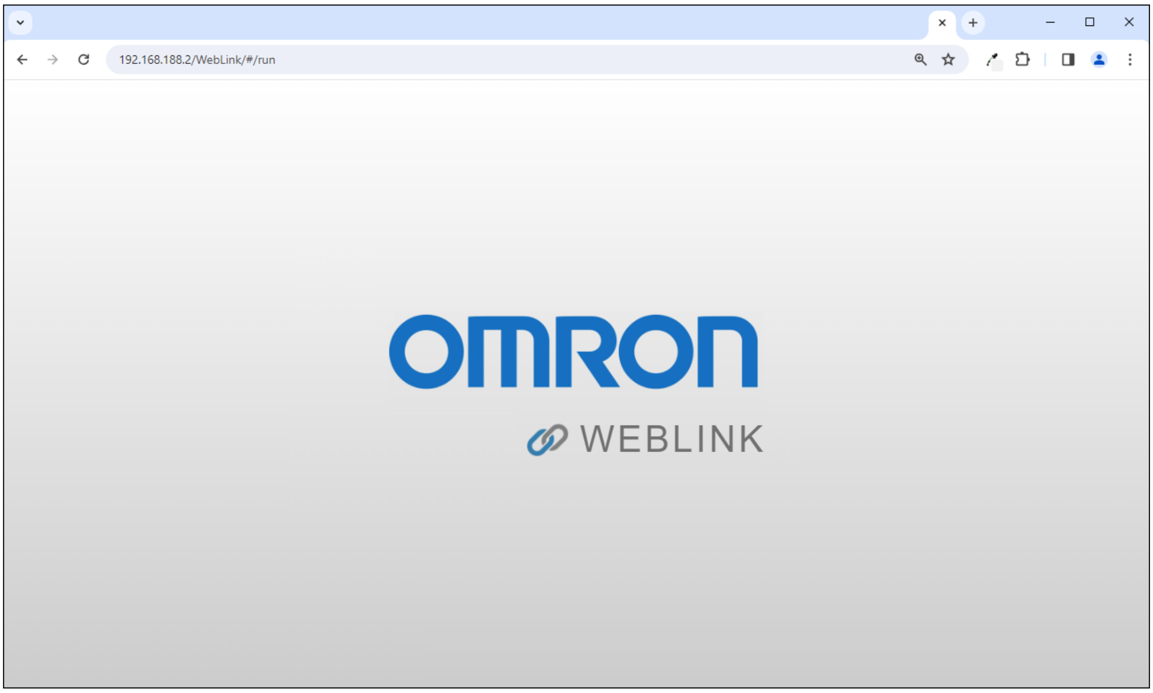
4-1 WebLink Overview and WebLink System Requirements

4-1-1 WebLink Overview

This section provides a quick high-level view of the VHV5-F WebLink programming interface as well as some of the main features in that interface. All elements of the user interface are described in detail in User Interface Details and Read Sequence Dialog.

WebLink is the main programming interface for the VHV5-F reader. It is a browser-based user interface hosted by the reader itself. **No PC install of software is required.**

To start WebLink, either use the DDU as described in System Configuration and Setup Flow, or simply type the IP address of the VHV5-F you wish to program in an approved browser on the programmer's PC.


192.168.188.2/WebLink/#/run
OMRON
WEBLINK

4-1-2 WebLink System Requirements

Operating System Requirements

- Microsoft Windows 10 (64-Bit) or Microsoft Windows 7 (64-Bit) (**Note:** Using an Embedded OS (Windows CE) and / or an underpowered machine (limited RAM or limited disk space) is not recommended.)

Minimum Hardware and Performance Requirements

- Intel Core i3 Duo Processor or AMD Equivalent
- 2 GB RAM / 128 MB Video RAM
- 1 GB Hard Drive Space
- 32-Bit Color Display
- 4.0 Windows Experience Index

Browser Requirements

- Google Chrome (Recommended)
- Firefox
- Microsoft Edge
- Opera
- Safari (Mac-Only)

Browser Feature Requirements

WebLink requires certain features to be supported by the hosting browser. Support for these features is checked before WebLink loads, and if it is not available, an error message is displayed. The following features are required by WebLink and are checked at startup:
- Web Sockets
- HTML5 Canvas
- HTML5 Audio

4-1-3 Navigating WebLink

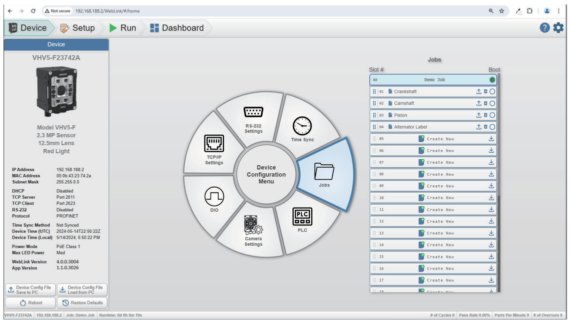
Mode Navigation

The WebLink user interface has four main views or modes that lead the user through the process of setting up the reader, programming it, and then deploying it on a line for reading applications. These are the **Device** view, the **Setup** view, the **Run** view, and the **Dashboard** view.

The chevrons at the top left of the UI are used to navigate between the different modes. Because the UI is actually running on the VHV5-F and being accessed by a browser, there is no need to upload or download jobs or settings between the UI and reader before changing from **Setup** mode to **Run** mode.

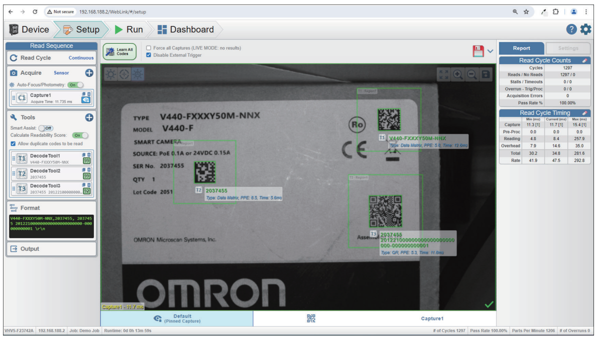
Device View

The **Device** view is used to set up VHV5-F hardware and communications channels to match the requirements of the line. These settings are persistent for all Jobs that are set up to run on that line. The **Device** view is also used as the file manager to create and manage reading **Jobs**.



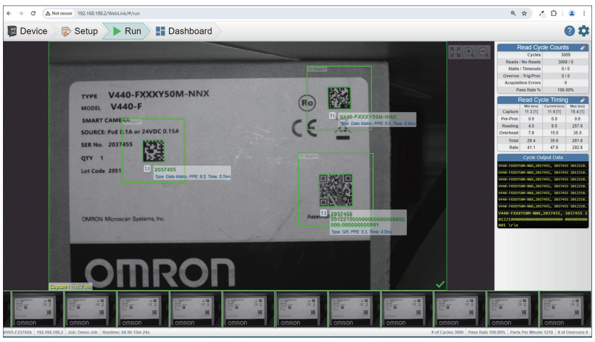
Setup View

Once a Job is created or loaded in **Device** view, the **Setup** view allows the user to program, test, and tune the reading job before deploying it on the line. Job setup is aided by a number of high-level functions, such as Learn, that set up the Job automatically for the user.



Run View

The **Run** view is the main interface for real-time monitoring of the system as it is running on the line. It shows all images as well as counts, statistics, and read data for the production run.
Note: The UI does not need to be connected when the system is in **Run** mode.



Dashboard View

The **Dashboard** view is a highly visual monitoring alternative to the Run view, showing images as well as key counts and statistics at a glance in an easy-to-view format.
Three different Dashboard layouts can be created to suit the needs of users off all levels of expertise.

5

Quick Start Guide for Programming the Reader

5-1 Basic Programming Flow

Section 2 is designed to guide the user through choosing a reader, unboxing it, getting the reader mounted and powered up, and then establishing a network connection to it to start the WebLink user interface.
Section 3 provides a short tutorial on how the reader operates, and allows the user to take full advantage of the power and flexibility of the reader.
Section 4 provides a quick map for navigating the different modes of the WebLink user interface from Setup to Runtime monitoring.
Section 5 serves as a Quick Start Guide. It walks the user through the six basic steps to program a standard code reading job. It begins with connecting to the device to access the user interface, creating a new job, programming and testing the job, and then deploying and monitoring the job as it runs on a production line.

No.	Basic Programming Flow
1	Set Up Device Parameters
2	Create Job
3	Set Up Job
4	Configure Outputs
5	Test Job
6	Deploy Job

5-1-1 Example: Programming a Triggered Reading Job on a Production Line

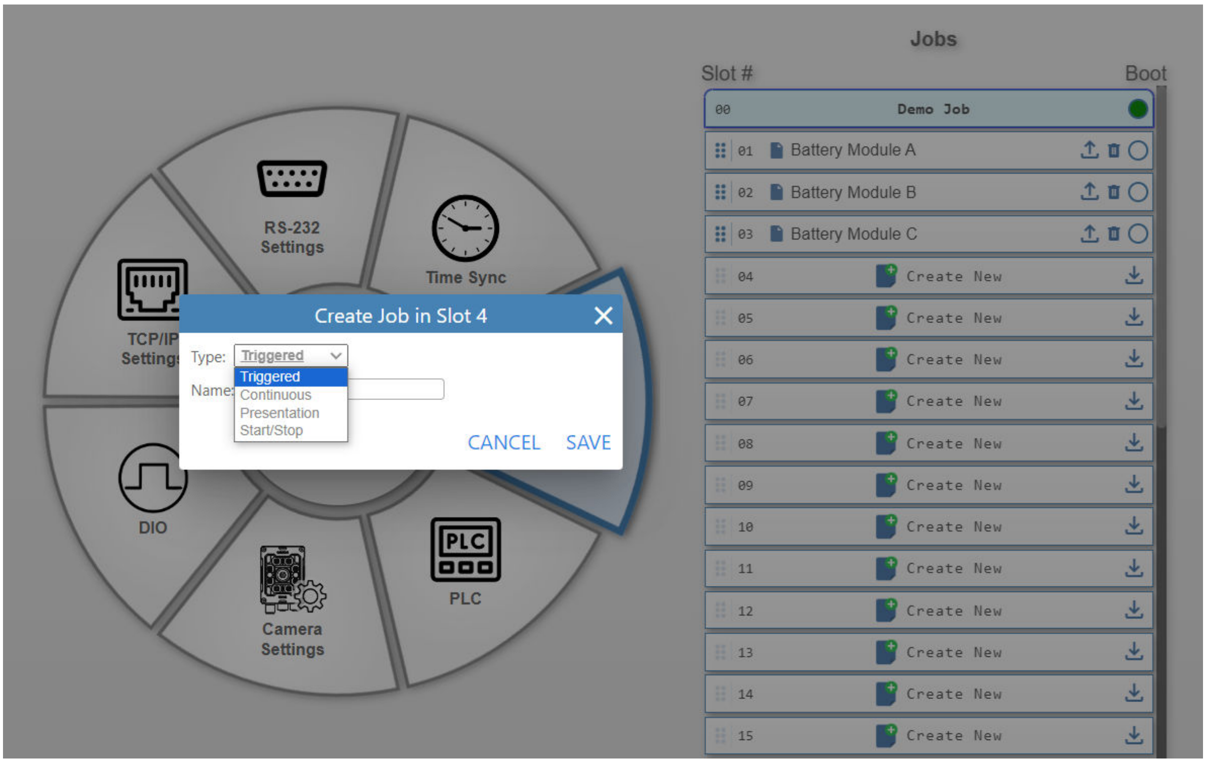
1 **Set Up Device Parameters**

1) Connect to the reader by typing its IP address into your web browser's address bar.
2) Go to **Device** View and review current reader settings.

IP Address	192.168.188.2
MAC Address	00:0b:43:23:74:2a
Subnet Mask	255.255.0.0
DHCP	Disabled
TCP Server	Port 2011
TCP Client	Disabled
RS-232	115.2K,8,None,1,None
Protocol	EtherNet/IP
Time Sync State	Manually Set
Device Time (UTC)	2024-05-30T16:51:51Z
Device Time (Local)	5/30/2024, 12:51:51 PM
Power Mode	Direct 24V
Max LED Power	Ultra
WebLink Version	4.1.0.3007
App Version	1.1.0.3007

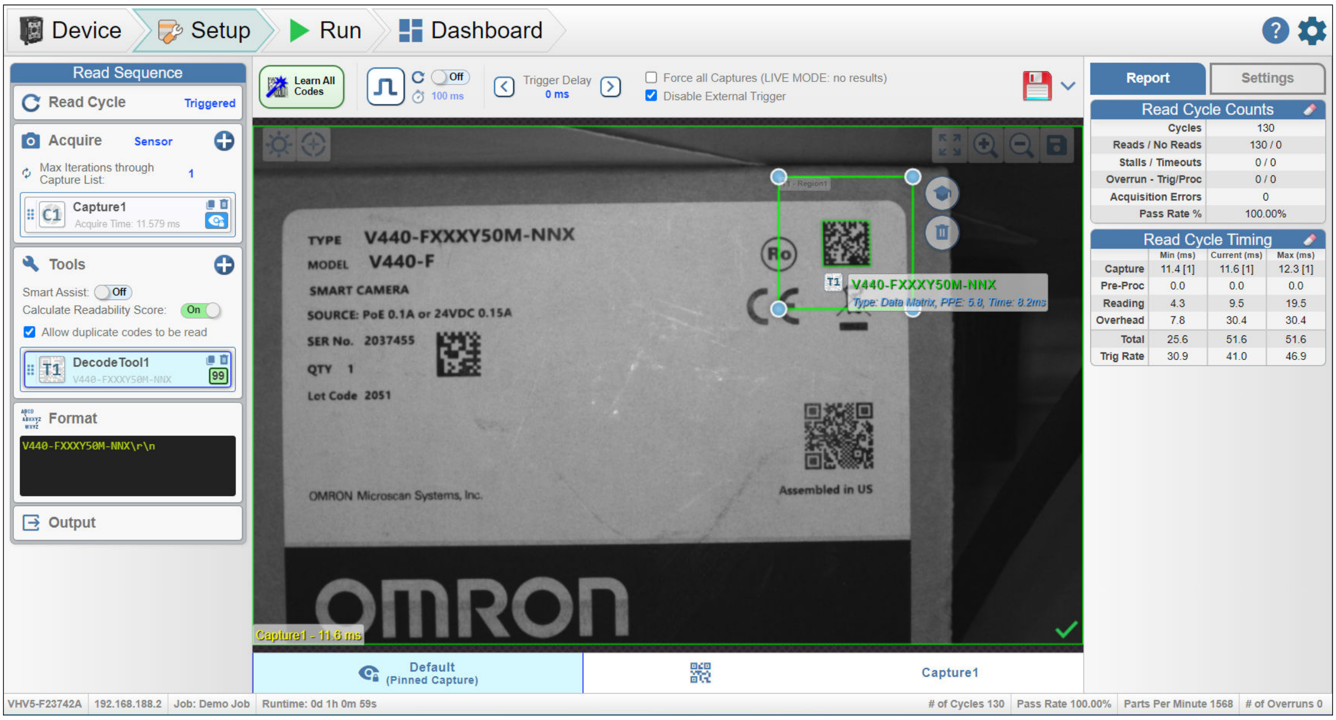
2 Create Job

1) To create a job, select Jobs from the **Device Configuration** Menu.
2) Click on **Create New** in memory Slot 01 in the Jobs list. There are 32 possible slots to hold different reading jobs.
3) Choose a Job Type (in this case, select **Triggered**).
4) Give the job a name and click **Save**.
5) A new Triggered job is created and the user interface automatically switches to **Setup** view.

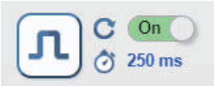


3 Set Up Job

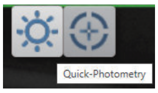
1) While in **Setup** view, place the part to be read in front of the reader in the same position it will occupy while the line is running.


Device
Setup
Run
Dashboard
Read Sequence
Read Cycle
Triggered
Acquire
Sensor
Max Iterations through Capture List: 1
Capture1
Tools
Smart Assist: Off
Calculate Readability Score: On
Allow duplicate codes to be read
DecodeTool1
Format
V440-FXXXY50M-NNX\r\n
Output
Learn All Codes
Trigger Delay
0 ms
Force all Captures (LIVE MODE: no results)
Disable External Trigger
Report
Settings
Read Cycle Counts
Cycles 130
Reads / No Reads 130 / 0
Stalls / Timeouts 0 / 0
Overrun - Trig/Proc 0 / 0
Acquisition Errors 0
Pass Rate % 100.00%
Read Cycle Timing
V440-FXXXY50M-NNX
Capture1 - 11.6 ms
Default (Pinned Capture)
Capture1
VHV5-F23742A
192.168.188.2
Job: Demo Job
Runtime: 0d 1h 0m 59s
# of Cycles 130
Pass Rate 100.00%
Parts Per Minute 1568
# of Overruns 0

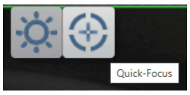
2) For triggered jobs, turn on virtual triggers at an interval of 250 ms. This will trigger the system without the line needing to be run. The read cycle will be run every 250 ms. If the line is running, the reader will respond to triggers coming in.



3) Click the **Quick Photometry** button at the upper left of the image. Click in the image and drag around the area of the code to be read. The system will automatically set the sensor exposure time to read that code.

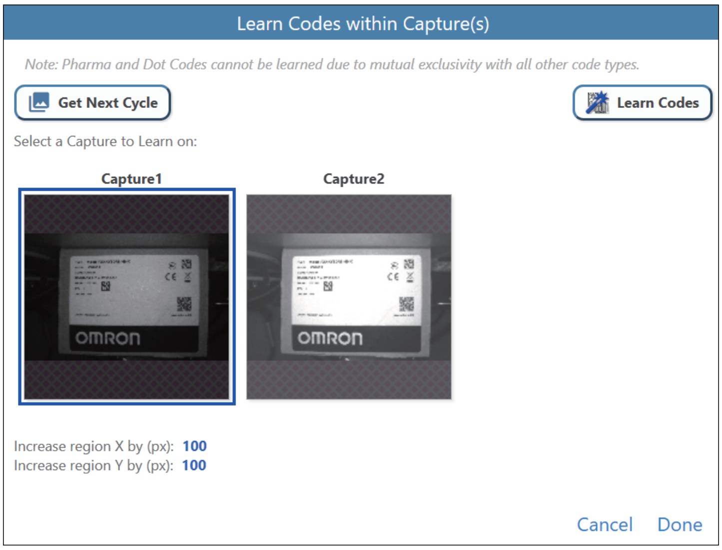


4) Click the **Quick Focus** button at the upper left of the image. Click in the image and drag around the area of the code to be focused. The system will automatically set the best focus to read that code.



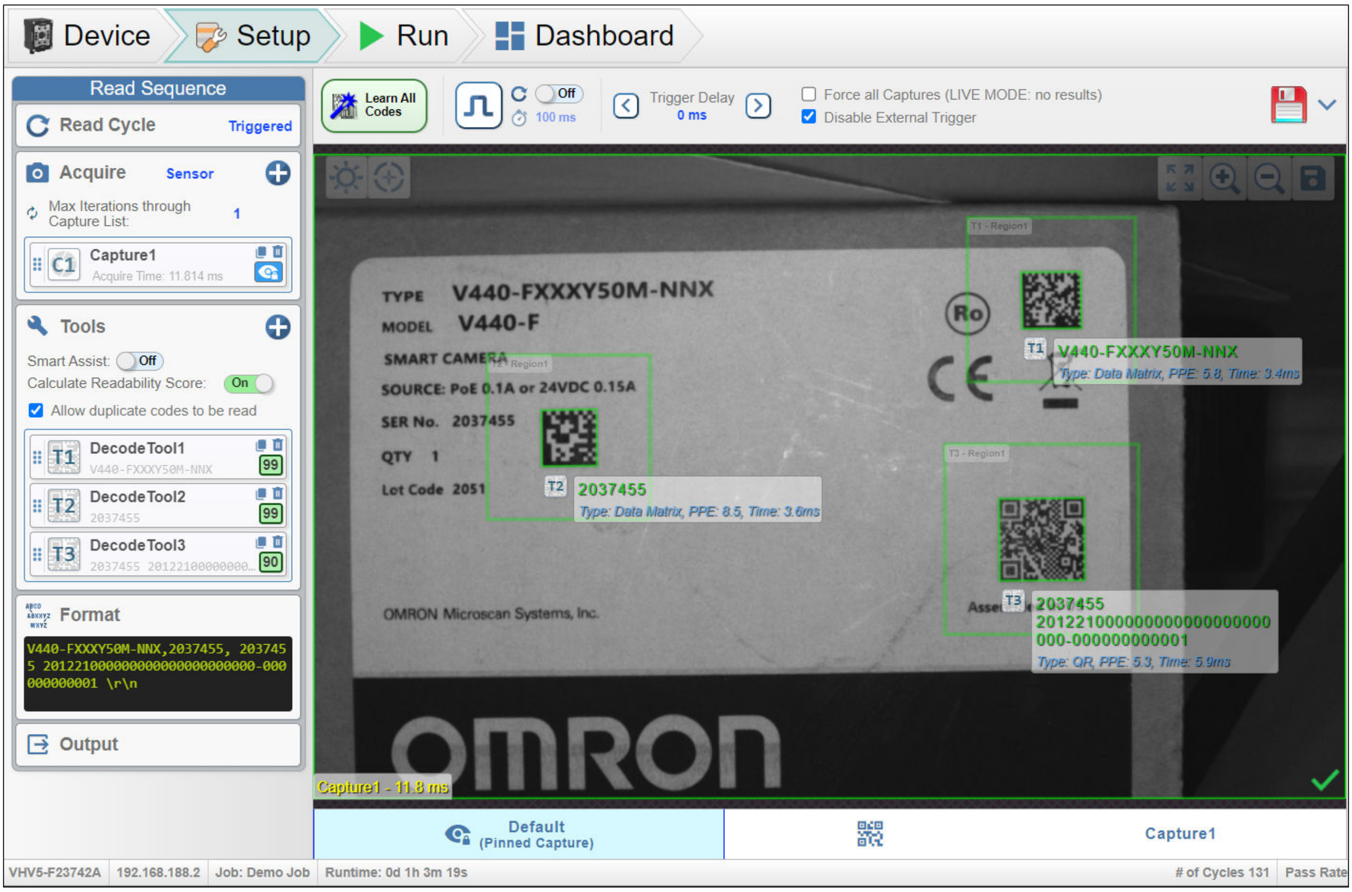
5) Click the **Learn Codes** button.

6) The system will display the following dialog box with the most recent image of the part in on the left side.



7) Change the values of Increase region X by (px) and Increase region Y by (px) to account for any positional uncertainty that is expected in the placement of the part as the line is running.

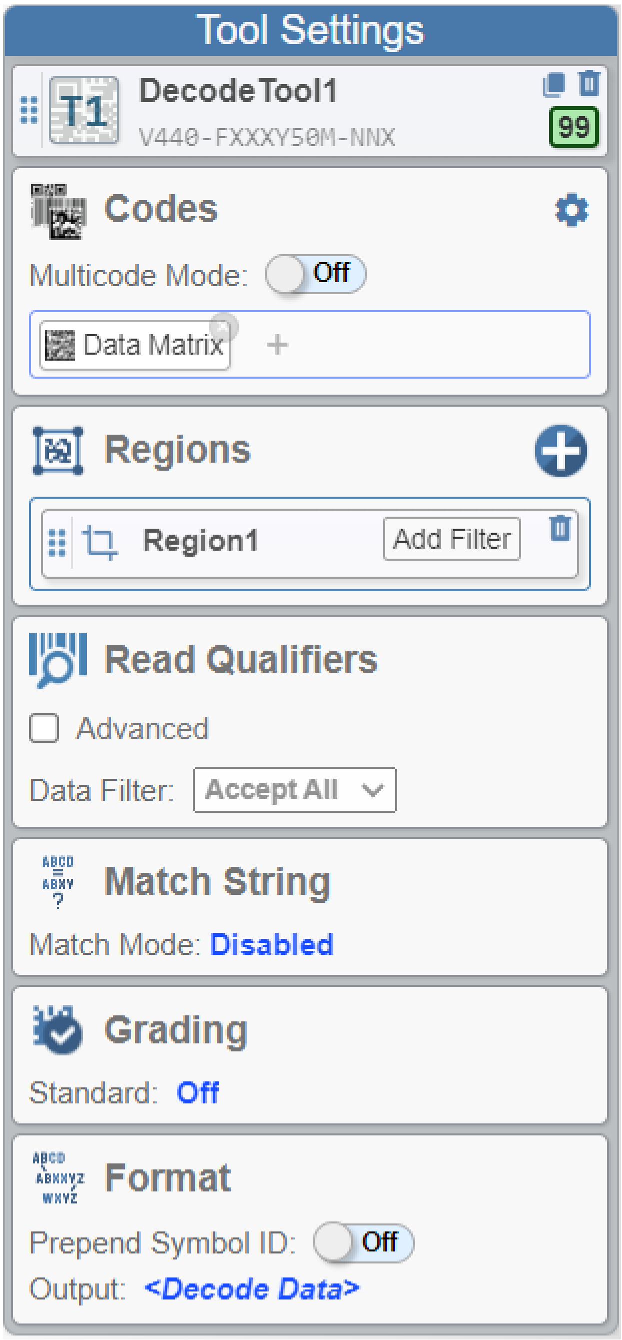
8) Click the **Learn Codes** button. When prompted, select **Replace all Decode Tools in the List** and click **Done**.
9) The system will automatically identify all codes of all types within the image and will create a Decode Tool with a region of interest for each one so they can be considered individually.

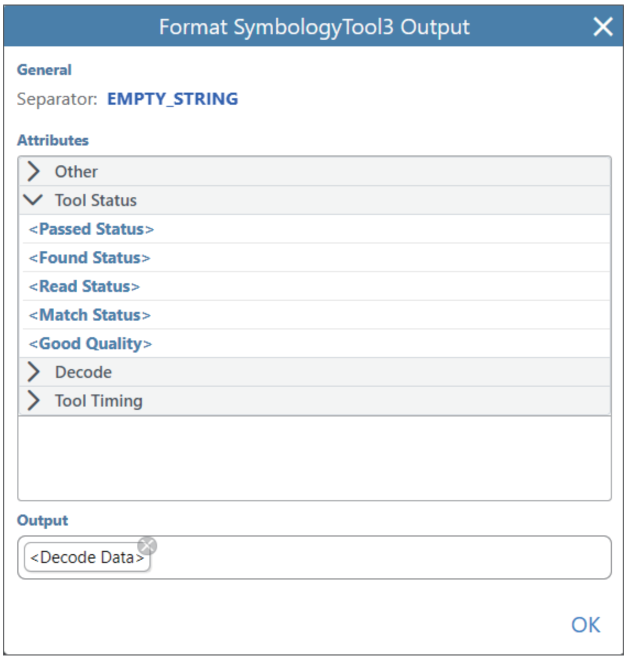


Device
Setup
Run
Dashboard
Read Sequence
Read Cycle
Triggered
Acquire
Sensor
Max Iterations through Capture List: 1
Capture1
Acquire Time: 11.814 ms
Tools
Smart Assist: Off
Calculate Readability Score: On
Allow duplicate codes to be read
DecodeTool1
V440-FXXXY50M-NNX
DecodeTool2
2037455
DecodeTool3
Format
V440-FXXXY50M-NNX,2037455, 2037455 20122100000000000000000000-000000000001 \r\n
Output
Learn All Codes
Off
100 ms
Trigger Delay
0 ms
Force all Captures (LIVE MODE: no results)
Disable External Trigger
V440-FXXXY50M-NNX
Type: Data Matrix, PPE: 5.8, Time: 3.4ms
2037455
Type: Data Matrix, PPE: 8.5, Time: 3.6ms
2037455
20122100000000000000000000
000-000000000001
Type: QR, PPE: 5.3, Time: 5.9ms
Capture1 - 11.8 ms
Default
(Pinned Capture)
Capture1
VHV5-F23742A
192.168.188.2
Job: Demo Job
Runtime: 0d 1h 3m 19s
# of Cycles 131
Pass Rate

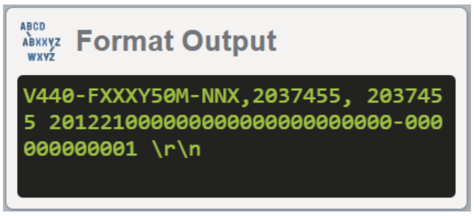
4 Configure Outputs

1) At the end of the Read Cycle, the system sends the resulting output as a string to the UI, as well as out the TCP port, RS-232 port, and through the Protocol assembly. Each Decode Tool generates a string result. By default it is just the decoded text of that tool. Other decode tool data, as well as user text, can be added to the string by clicking on **Decode Data** in the output section of the **Tool settings** dialog. It will bring up an editor for this purpose. Each Decode Tool generates a string result.





2) Next, the string from each Decode Tool is passed back to the Read Cycle Format Output step, which appends all of the individual result strings into a final result output string.
3) The user can view the final output result in the **Format Output** box. The user is able to add additional Read Cycle data to this string by clicking on the Format Output step in the Read Cycle and then working with that editor.



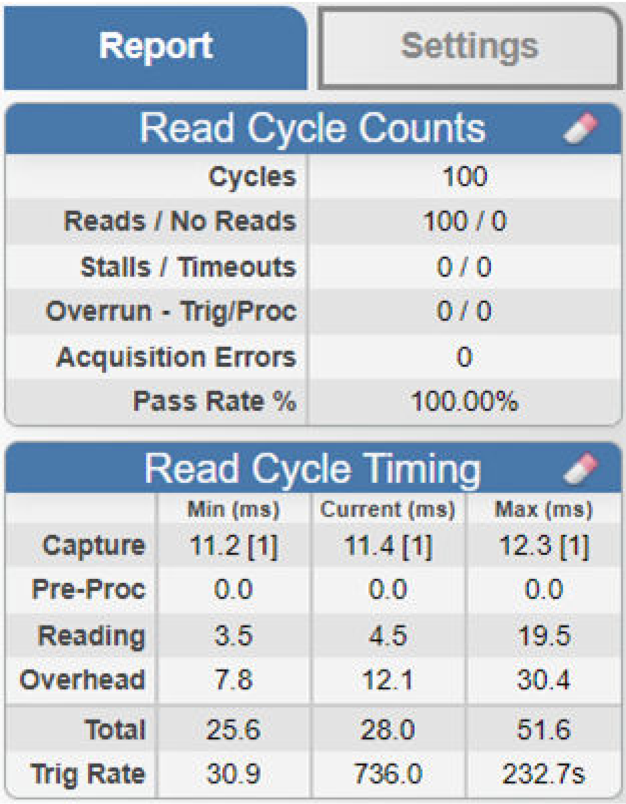
4) Digital Outputs are set up from the **Device** View. The default settings send a **Read Cycle Pass** on Output 1, **Read Cycle Fail** on Output 2 and any error signal on Output 3.

	Output 1	Output 2	Output 3
Read Cycle Complete	☐	☐	☐
Read Cycle Pass	☑	☐	☐
Read Cycle Fail	☐	☑	☐
Error Signals	☐	☐	☑
Output Configuration			
Normal State	Closed	Closed	Open
Mode	Pulsed	Pulsed	Pulsed
Pulse On Time	1000 μs	2000 μs	1000 μs
Pulse Off Time	1000 μs	2000 μs	1000 μs

5) Protocol Outputs are set into the standard Input Assembly.

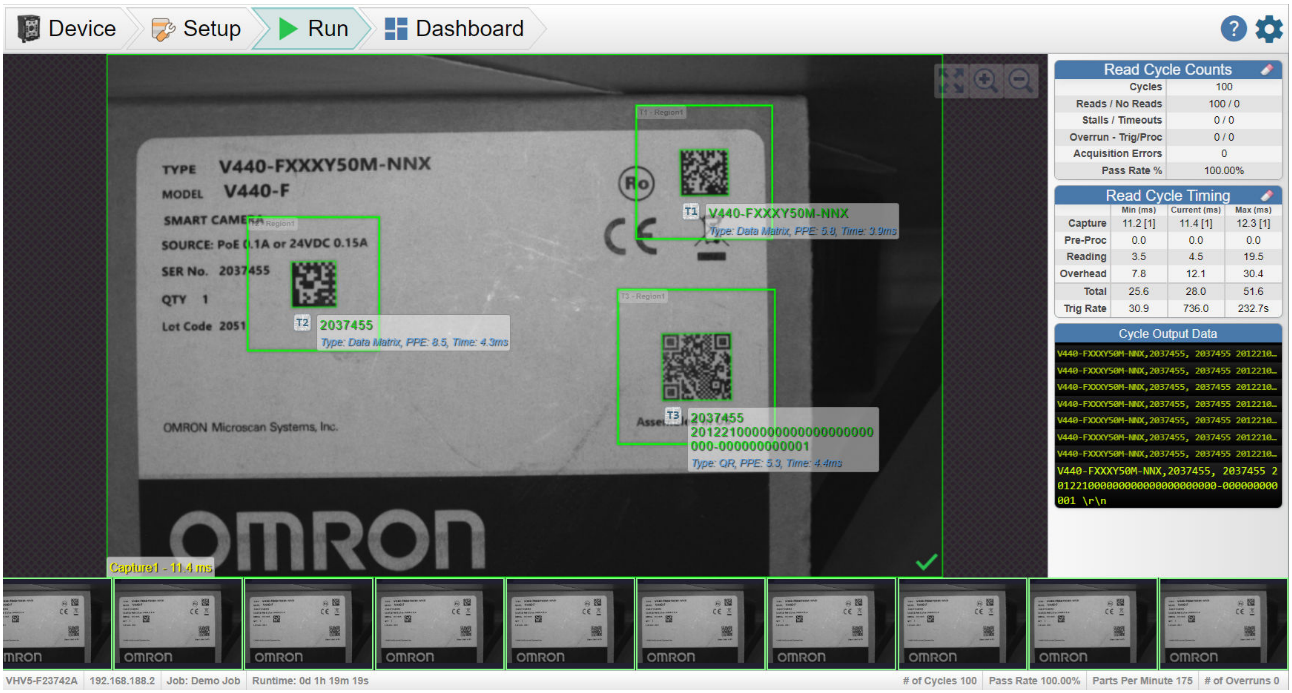
5 **Test Job**

1) While in **Setup** view, test the job. With virtual or machine triggers running, the image constantly updates, showing the results of the read cycle.
2) The counts and statistics display shows pass / fail and timing for the read cycle. These values show the rate at which the reader can be run.
3) The Total time is the time from the trigger to when the read cycle results have been sent.
4) In the example below, it can be seen that the Total Read Cycle time varies between 24.6 and 54.5 msec.
5) You can confidently assume that a trigger rate of 50-60 msec can be sustained.
6) Faster rates can be sustained if the system is allowed to go into "pipeline" mode, where it is capturing the next image while the previous one is being processed.
7) Verify that this is the case by increasing the virtual trigger rate to 60 msec.



6 Deploy Job

1) Turn off the virtual trigger. Clear the read cycle counts and timing by clicking on the eraser icons.
2) The job is now waiting for actual triggers. There are multiple ways to trigger the reader from the running line. The following are the four trigger options that are active by default.
   - Virtual Trigger – Pulse generator in the user interface.
   - Serial Trigger – Via RS-232 or TCP-IP socket.
   - Industrial Protocol – PROFINET or EtherNet/IP.
   - Digital Trigger – High-speed trigger input on DIO port.
3) Enter Run mode by clicking the **Run** button. The system will now respond to actual triggers from the running line. Both the **Run** view and the **Dashboard** view are options for monitoring the production run.


Device
Setup
Run
Dashboard
Read Cycle Counts
Cycles 100
Reads / No Reads 100 / 0
Stalls / Timeouts 0 / 0
Overrun - Trig/Proc 0 / 0
Acquisition Errors 0
Pass Rate % 100.00%
Read Cycle Timing
Min (ms) Current (ms) Max (ms)
Capture 11.2 [1] 11.4 [1] 12.3 [1]
Pre-Proc 0.0 0.0 0.0
Reading 3.5 4.5 19.5
Overhead 7.8 12.1 30.4
Total 25.6 28.0 51.6
Trig Rate 30.9 736.0 232.7s
Cycle Output Data
V440-FXXXY50M-NNX,2037455, 2037455 2012210000000000000000000-000000000001 \r\n
V440-FXXXY50M-NNX
Type: Data Matrix, PPE: 5.8, Time: 3.9ms
2037455
Type: Data Matrix, PPE: 8.5, Time: 4.3ms
2037455
20122100000000000000000000
000-000000000001
Type: QR, PPE: 5.3, Time: 4.4ms
Capture1 - 11.4 ms
VHV5-F23742A
192.168.188.2
Job: Demo Job
Runtime: 0d 1h 19m 19s
# of Cycles 100
Pass Rate 100.00%
Parts Per Minute 175
# of Overruns 0

6

User Interface Details

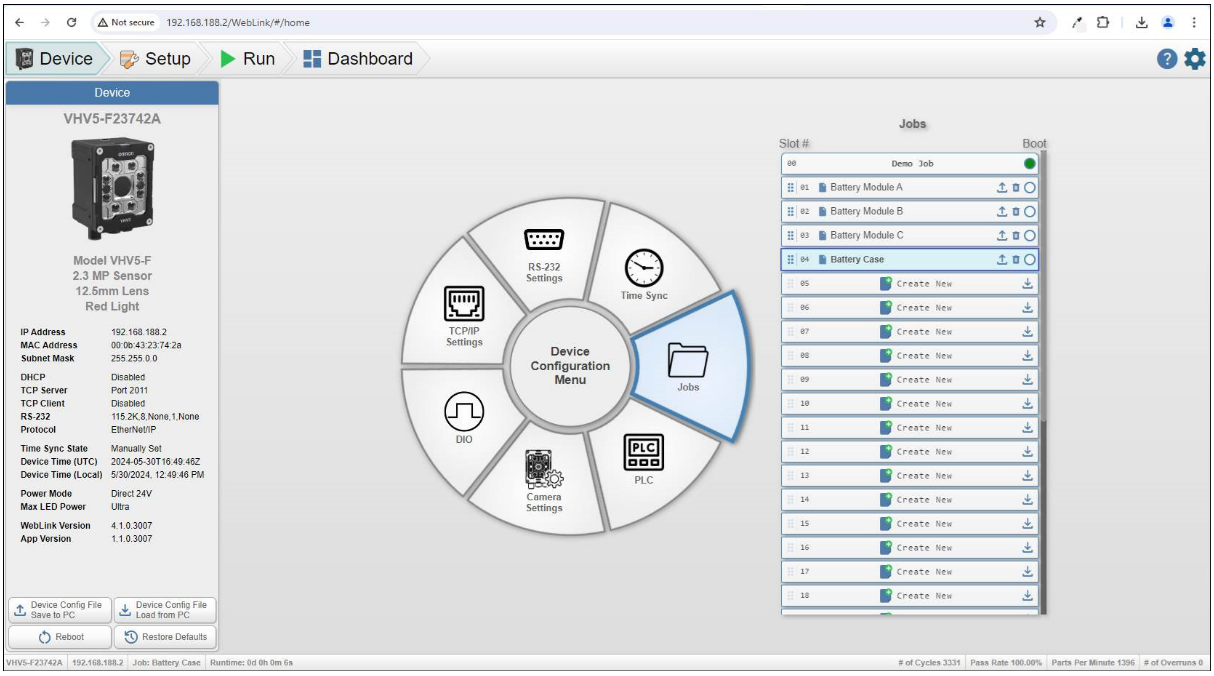
6-1 Device View

6-1-1 Overview

The **Device** view shows the current status and settings of the reader in the left-hand pane. The rotary menu in the middle is used to set up communication, industrial protocols, and other unique sensor and device settings. When menu items are selected, settings dialogs appear to the right of the menu wheel. If a parameter is changed, the user will be prompted to apply the settings.

The main control the user will access in the device view after the device has been set up is the Jobs menu. The Jobs dialog allows the user to Create, Save, and Load reading jobs.

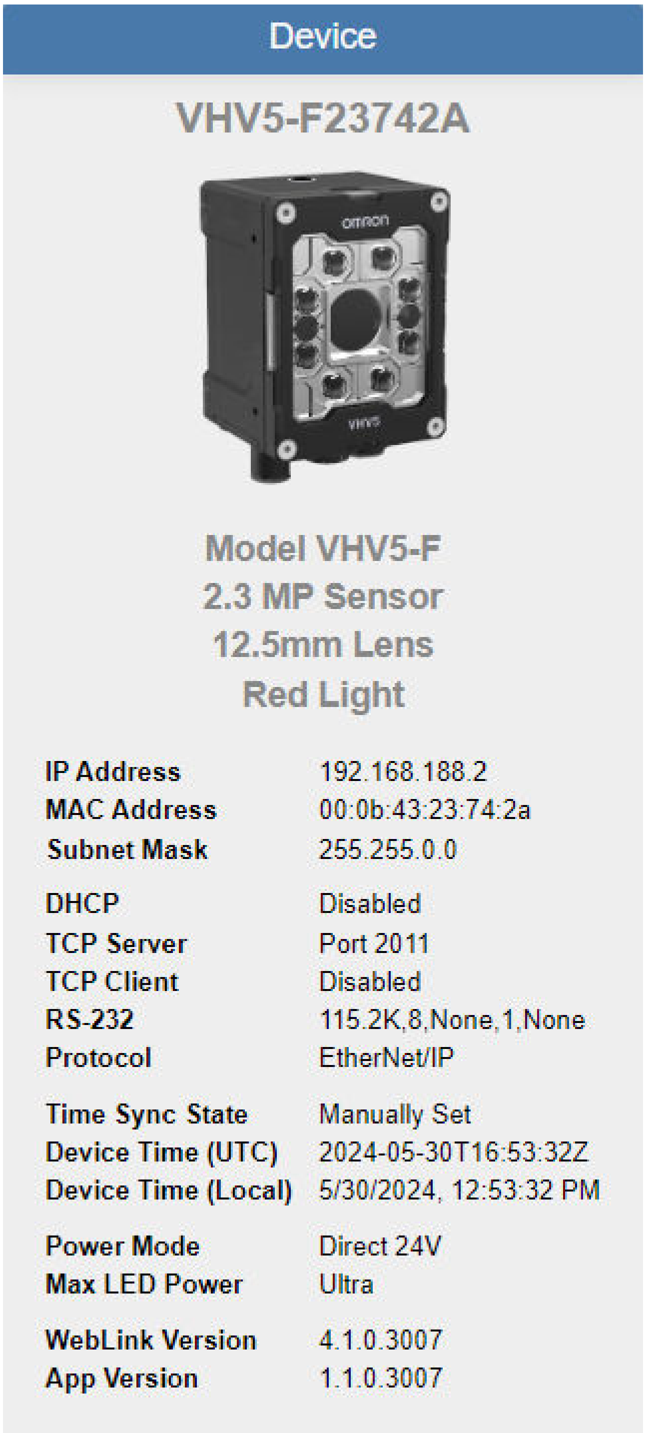
Key Point: Settings within the Device view, such as communications, Digital IO, and sensor settings apply to all reading jobs. The understanding is that the device (reader) will be deployed on a line and will communicate with the host by the same methods for all jobs, so it is logical for these setting remain fixed.



6-1-2 State of the Reader when in Device View

- **Mode** = **Offline**. The Job is stopped. No read cycles are running.
- **Triggering –** Triggers are dropped in this mode.
- **Device Settings –** All device settings can be changed in this mode.
- **Job Change –** Jobs can be created, deleted, and changed in this mode.

6-1-3 Device Description Display



See details below for all elements displayed in the Device View as well as descriptions of how to set up the unit using the Device Configuration menu and dialogs.

Device Description and Status

The Device pane at the left side of the Device View is a summary showing the reader name, model details, communication settings, time and power settings, and the software versions currently loaded and running on the unit.

The information contains a combination of fixed data, such as the sensor and lens that is set at the factory, application settings such as RS-232 communications, which are changed through dialogs here in the Device Page, and finally, settings such as the IP Address and Camera Name that require the Device Discovery Utility (DDU) to change.

● Fixed Settings

The following settings are factory-configured and not changeable by the user.

- Model Details – Shows the Sensor, Lens, and Light. These are set based on part number of the unit that was purchased.
- MAC Address – The MAC Address is unique for each device that is manufactured. The initial name of the device is based on the Model name and the MAC Address so that it will be guaranteed unique as well. For example, this device name is VHV5-F23742A. Whereas the MAC Address cannot be changed, the name can be changed with the DDU.

● Settings Controlled through the Device Configuration Menu Dialogs

The following communication parameters can be set directly from this page.

- TCP Server, TCP Client, RS-232, Industrial Protocols, Camera Time.
- Digital IO and various reader hardware settings such as Trigger polarity and debounce.

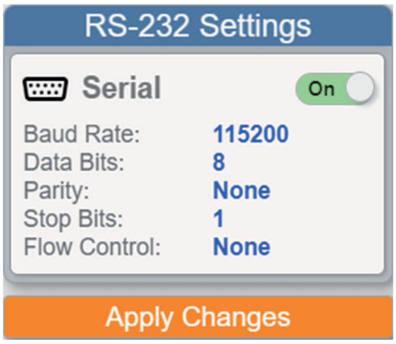
● Settings Made Using Device Discovery Utility (DDU)

- **Device Name –** By default the device name is set to “VHV5-F” + “MAC Address” of the reader. This guarantees a unique name out of the factory for each and every reader. The name can be changed using the DDU.
- **WebLink Version and App Version. –** This indicates the software versions that are loaded on the camera. Software updates can be performed using the DDU.
- **IP Address**, **Subnet Mask**, **DHCP –** These IP settings can be changed through the Device Discover utility. Factory default for the unit is static address 192.168.188.2, 255.255.0.0, DHCP off.

6-1-4 Setting Up RS-232 Communications

RS-232 Settings Dialog

When enabled, the RS-232 channel can be used for both command input to the reader as well as for data output.



The default reader data output is the string constructed by the Format Output step in the Read Sequence. This is same string that is displayed in the UI, as well as the string that is sent over TCP/IP, and that is sent to the PLC.

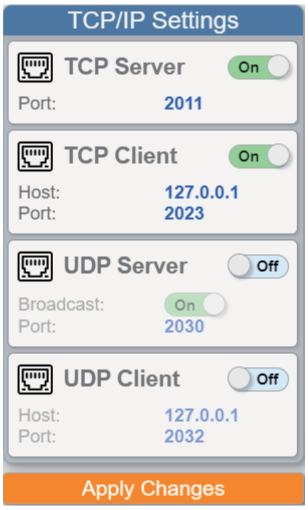
RS-232 Settings

Item	Setting value [Job Default]	Description
Enabled	**[On]**, Off	The default setting of the Serial port is on. If this setting is changed, the reader must be rebooted for it to take effect.
Baud Rate	600, 1200, 2400, 4800, 9600, 19.2K, 38.4K, 57.6K, **[115.2k],** 230.4k	The rate at which the reader and host transfer data back and forth.
Data Bits	7, **[8]**	Seven or 8 bits comprising the data content
Parity	**[None]**, Even, Odd	An error detection routine in which one data bit per character is set to 1 or 0 so that the total number of bits in the data field is either even or odd.
Stop Bits	**[1]**, 2	One or two bits added to the end of each character to indicate the end of the character
Flow Control	**[None]**, Software (XOn/XOff), Hardware	Software flow control is a method of flow control used in RS-232 serial. It uses special codes, transmitted in-band, over the primary communications channel.

6-1-5 Setting Up TCP/IP Communications

TCP/IP Settings Dialog

TCP and UDP communication channels permit the establishment of connections with the reader on any port. The channels can be used for both command input to the reader as well as data output from the reader. The default reader output is the string constructed by the Format Output step in the Read Cycle. This is the same string that is displayed in the UI, as well as the string that is sent over RS-232, and that is sent to the PLC.



The reader can be set up as a TCP Server, TCP Client, UDP Server and UDP Client for maximum flexibility. The channels are not exclusive. Any combination of channels can be set up and will function simultaneously. Each channel operates in parallel with the others. Settings for one do not affect the others.

● Default Settings

By default, the reader operates as a TCP server, and communicates with the host (set up as a TCP client) over TCP/IP for both commands and data. If any setting is changed, the Apply Changes button appears. Settings are effective immediately after Apply.

● TCP Server Implementation

When the reader endpoint is configured as a TCP server, it is able to handle up to 10 simultaneous client connections. For TCP, the reader will refuse the connection when the limit has been reached.

● TCP Client Implementation

This allows the reader endpoint to be configured as a client that can then connect to a host server.

Note: The user must first set up and start an external TCP Server for the reader to be able to connect. The Host IP and Port are the IP and Port of the Server. The reader can only connect to one server at a time.

● UDP Server Implementation

When the reader endpoint is configured as a UDP Server, it is able to handle up to 10 simultaneous connections. For UDP, the reader will simply ignore the connection request due to the connectionless nature of the transport layer. By default, the UDP server will be in “Broadcast” mode, meaning it will send the V5 output data to all devices on its network or subnet. Any devices listening for UDP broadcast data on the same network as the VHV5-F can receive that data. Client UDP devices may send commands to the V5 by specifying its IP and the UDP Server port number (2030 by default). If the Broadcast mode is turned off, then the UDP Server will only communicate with devices that communicate with it first. For example, if a UDP client device were to send the “!TRIGGER” serial command, the VHV5-F would respond to that command by triggering an inspection and it would add the IP of that client to an internal list. All subsequent output data would then be sent to all clients in its list directly via UDP.

● UDP Client Implementation

This allows the reader endpoint to be configured as a UDP Client that can connect to a UDP Server running on the host. The reader can only send data out one UDP port. UDP is limited to UDP/IP in order to avoid broadcasting data on the network.

Note: The user must first set up and start an external UDP Server for the reader to be able to connect. The Host IP and Port are the IP and Port of the Server. The reader can only connect to one server at a time.

When in UDP Client mode, you must specify the IP address and port of the external UDP Server you wish to communicate with. All output will be sent directly to that IP and Port via UDP in a connectionless fashion. The VHV5-F will also listen for incoming commands from the specified IP and Port.

TCP/IP Settings

● TCP Server Settings

Item	Setting value [Job Default]	Description
Port	Any **[2011]**	Client devices connect to the reader using the reader's IP and the Port number set in the dialog. There is no limitation on the port number for the reader, so can be set what is best for client.

● TCP Client Settings

Item	Setting value [Job Default]	Description
Host IP	Any	IP address of host running as TCP Server
Port	Any **[2023]**	The reader will connect to the host server using the IP of the host and Port defined by the host server.

● UDP Server Settings

Item	Setting value [Job Default]	Description
Broadcast	Off, **[On]**	If the Broadcast mode is turned on, the V5 data will be sent to all devices on its network or subnet. If the Broadcast mode is turned off, then the UDP Server will only communicate with devices that communicate with it first.
Port	Any **[2030]**	Client UDP devices may send commands to the V5 by specifying its IP and the UDP Server port number (2030 by default). There is no limitation on the port number for the reader, so can be set what is best for client.

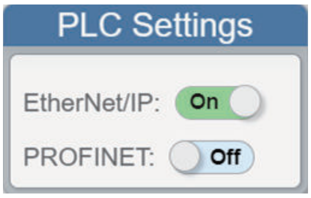
● UDP Client Settings

Item	Setting value [Job Default]	Description
Host IP	Any	IP address of host running as UDP Server
Port	Any **[2032]**	The reader will connect to the host server using the IP of the host and Port defined by the host server.

6-1-6 Enabling PLC Communications

PLC Settings Dialog

Either the EtherNet/IP or PROFINET protocol can be enabled at any one time. They cannot both be on. Both can be set to off.



There is no Apply button in this case. The setting auto-applies.

● Assemblies

Both EtherNet/IP and PROFINET use the same Output (PLC->Reader) and Input (Reader->PLC) Assemblies. The Output and Input Assemblies reflect Reader Control and Reader Status. The Input Assembly optionally provides the string constructed by the Format Output step in the Read Cycle to the PLC, or an Extended report.

See VHV5-F Communications documentation for details.

Output Assembly	Input Assembly
Read Cycle Control	Read Cycle Status
Reader Control	Reader Status
Job Control	Job Status
Command Control	Command Status
Output IO Control	Digital Input and Output Status
	Default and Extended Report

PLC Settings

PLC Settings

Item	Setting value [Job Default]	Description
EtherNet/IP	Off, **[On]**	Enable/Disable EtherNet/IP
PROFINET	**[Off]**, On	Enable/Disable PROFINET

6-1-7 Setting Camera Time

Camera Time Sync Dialog

The camera contains a high-resolution clock that needs to be synchronized to an external clock when powered up for the camera to be able to output “current” time information. This is because the camera does not have battery backup that keeps time when the unit is powered off.

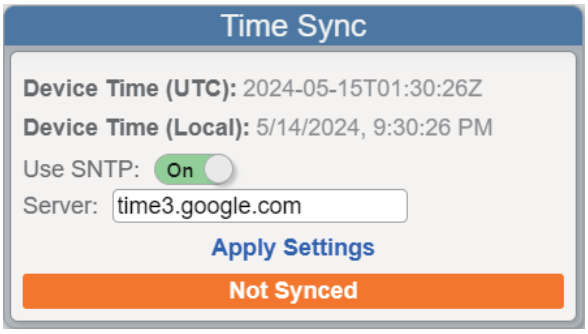
If the camera is not synced to an external clock, the camera clock will reference the base time that was set by the factory reflecting the time at which the camera was manufactured.

● Time Sync Options

The **Time Sync** dialog is used to synchronize the camera to an external clock. The external clock can be an SNTP (Simple Network Time Protocol) time server if the camera is directly plugged into a network that allows internet or intranet access to an SNTP server. If not connected to an SNTP server, time can be set manually using the time from the PC browser that is running WebLink.

● SNTP On

If set to **On**, the camera is set to connect to an SNTP server. As stated, SNTP requires that the camera be on a network that allows access to an SNTP source.The user should enter the IP address or URL representing a known SNTP server, and then click **Apply Settings**.



■ Synced

If successful, the camera clock is updated to UTC (Universal or Greenwich Mean Time) time, and a message is displayed at the bottom of the dialog indicating that the camera is synced. The current device time will be displayed at the top of the dialog in both UTC and Local formats. The camera clock is refreshed automatically every 30 minutes when set to use SNTP to keep it accurate.

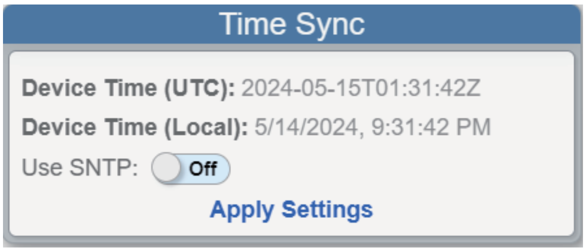
■ Not Synced

If the connection to the server is not successful, the message will be set to **Not Synced** and the camera clock will default to browser time if WebLink is running, or to the time set when the reader was manufactured if no browser is connected.

Key Point: For SNTP to work, the reader must be on a network that allows access to the internet to use the common SNTP servers, or to an intranet that has an SNTP server running. The reader cannot be synced if it is connected directly to the PC on a local-only network.

● SNTP Off

This is the default setting. If SNTP is set to **Off**, the reader will automatically sync to the time obtained from the browser when the reader is connected to WebLink. The Time Sync State reflects that the time is manually set.

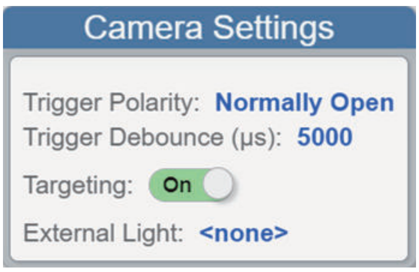


Item	Setting value [Job Default]	Description
Device Time	**N/A**	Displays the time from the camera clock. This will be default camera time if the camera has not been synced, or it will be the time from the source used to set it, either an SNTP server, or time from the browser being used to run WebLink Note: UTC time is used for Time Stamps and for File Names. UTC is Universal, or Greenwich Mean Time. Local time is there for display purposes.
Local Time	**N/A**	Displays Local Time based on the browser.
Use SNTP	**[Off]**, On	When set to Off, the camera time will be set to time from the browser if WebLink is connected and the user clicks Apply Settings. If On, the camera will attempt to get time from the SNTP server when the user clicks Apply Settings.
Apply Settings	**N/A**	Apply will initiate the camera sync operation.
Server	**[blank]**, known internet or intranet factory time server	**Time1.google.com** is one example of a common public SNTP server, but one that requires internet access to use. Consult your IT department for internal SNTP servers accessible on the factory network.
Sync Message	**Not Synced**, Synced	If Use SNTP is on, the message will display **Synced** if the clock is synced to an SNTP server. Otherwise it will display **Not Synced**. If SNPT is off, the message will display **Manually Set** upon obtaining time from the browser.

6-1-8 Setting Basic Camera Hardware Parameters

Camera Settings Dialog

This dialog is used to set basic camera hardware parameters related to Trigger, Targeting, and External Light control using the External Light Port connector.



If settings are changed, the Apply Changes button appears. Settings are effective immediately after Apply is clicked.

Camera Settings

Item	Setting value [Job Default]	Description
Trigger Polarity	**[NormallyOpen]**, Normally Closed	Describes the normal state of trigger input. The reader triggered when the controlling system sets trigger to opposite state.
Trigger Debounce (μs)	10-1,000,000 (1 sec) **[5000]**	Amount of time after receiving a trigger that the system will ignore new triggers. Allows the system to ignore trigger bounce which is common in some lower-cost, older technology hardware.
Targeting	Off, **[On]**	Enable/Disable green targeting lights on front of reader.
External Light	**[Inactive]**, NER Smart Series, NPN and PNP Options, SVL Nano or Multi-Drive Lights	Dictates what signals are active on the 5 pin 3rd connector for external lighting. Signals include Strobe Trigger Output, Power Output, and Analog Output (normally used for dimming control). • **Inactive – No output on 5 pins** • **NER Smart Series –** Power and appropriate strobe outputs for NER Smart Series. (No Dimming function). • **NPN Inverted Strobe Trigger Output –** Power and NPN Strobe Trigger, Active Low • **NPN Strobe Trigger Output –** Power and NPN Strobe Trigger, Active High • **PNP Inverted Strobe Trigger Output –** Power and PNP Strobe Trigger, Active Low, No Dimming • **PNP Strobe Trigger Output–** Power and PNP Strobe Trigger, Active High, No Dimming • **SVL Nano or Multi-Drive Lights –** Power, Strobe and Dimming analog voltage 0-10V.

6-1-9 Creating, Saving, and Managing Reader Jobs

Managing Jobs in the Job Slots Dialog

Jobs Menu: The user is able create a **Job** for each unique reading application that will run on the production line. For example reading a single UPC code on one vendor's bottled of water vs. reading a UPC code and a QR code on another vendor's bottled water.

In practice, the user will create a **Job** for each product, set it up and then test it. Once the job is complete, the user will store it on the camera in 1 of 32 **Job Slots**.
Note: The first slot 00 is reserved for a factory demo job that can be run at any time.

On power up, the reader will load and run the job marked as the **Boot Job**. Jobs can be changed at any time using the Jobs menu by selecting the slot containing the Job to be loaded. Jobs can be changed programmatically as well through RS-232, TCP/IP and using the PLC by issuing a command which references the Slot # for the job to be loaded.

Job Menu Controls

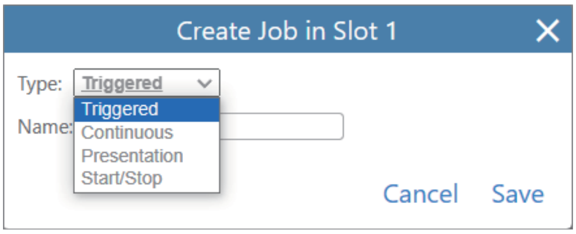
Directions for using the major Job menu functions are detailed below. The available functions are:

- Create New Job
- Save Job, Save As
- Revert Job
- Delete Job
- Change the Order of the Jobs in the Slots
- Set the Boot Job
- Archiving Jobs on the PC
  - Save Job from Slot # to PC
  - Load Job from PC into Slot #
  - View Job on the PC

● Create New Job

A new Job is created by clicking on Create New inside of an empty Job Slot.

The following dialog is displayed. The user is prompted to choose a specific Job Type (see Read Cycle Types) and then give the job a unique name.

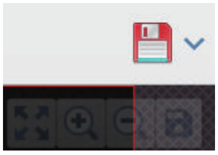


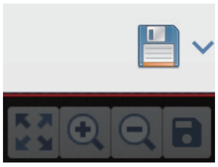
Once the user hits save, the user interface will automatically advance to the Setup View where they user will proceed to set up the actual application.

● Save Job, Save Job As

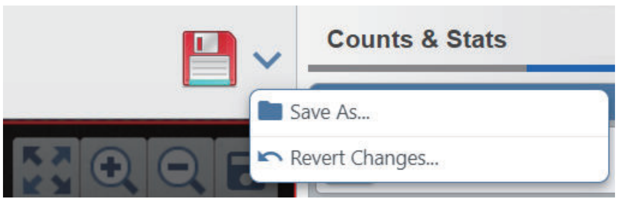
Once the job is complete, the user should save the job. There are two ways to save the job.

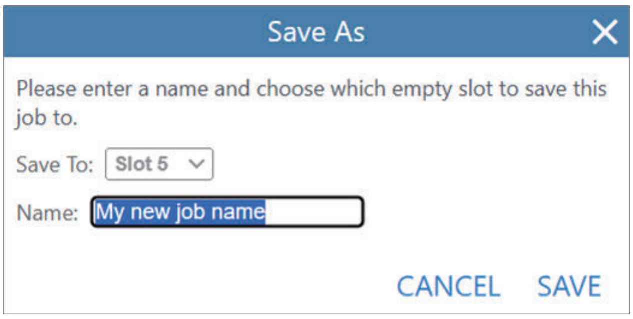
1. One method is to click on the **Save** Icon in the upper right corner of the image in Setup View. The icon will be red if there are pending changes. It will be blue once the job has been saved. The user also has the ability to save the job with another name to a different slot.





The user also has the ability to do a **Save As** from this control by clicking the down arrow next to the disk icon. When the Save As drop down option is selected, the user is presented with a dialog to save the current job with a new name, as well as the slot a new slot in which to save it.





2. The second method is to go back to Device View. The currently selected job text will be red with an *, indicating that the job has changes not have not been saved. Click on the **Save** icon.

● **Revert Job**

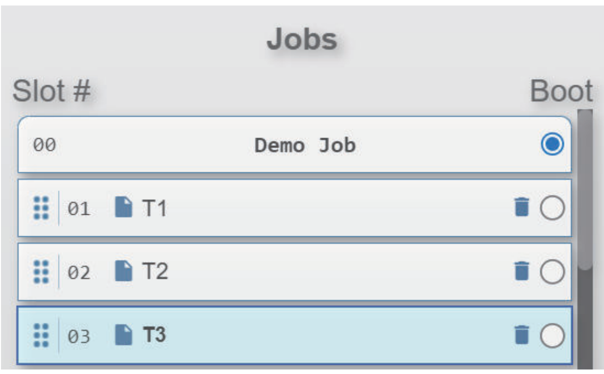
Both methods also present the option to Revert Changes. By selecting this option, any changes made since the job was last saved will be reversed.

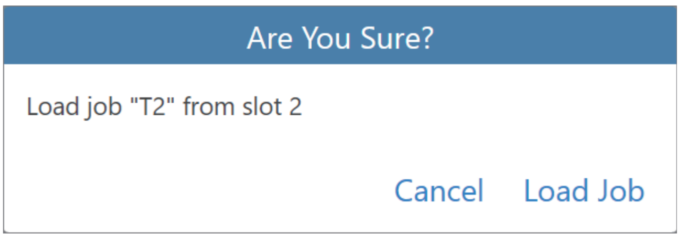
● **Delete Job**

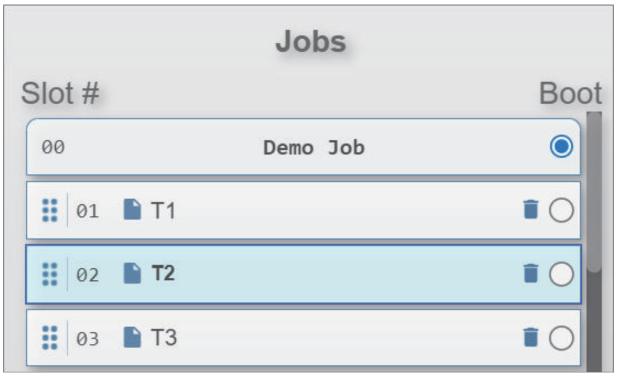
Jobs can be deleted from Slots and from the camera by clicking on the Trash Can icon on the right side of the slot. That slot is now free for user to create and store another job into it.

● **Change Job**

The current selected and loaded job is highlighted in light blue. The user can change jobs simply by clicking on a different slot with a Job stored in it. The user will be prompted if they are sure they want to change the job. The user selects Load Job. The Job change is almost instantaneous, and the newly selected job is now highlighted in light blue.



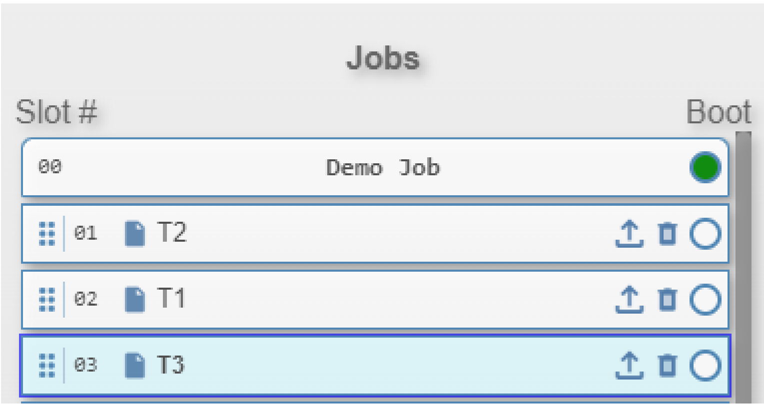




Key Point: Job Change and also be done programmatically from the PLC for from Serial or TCP/IP commands as the reader is running.

● Change the Order of the Jobs in the Slots

The user can rearrange the order of the job slots. This is done by clicking on the icon at the left side of the slot, and then dragging the job selection into a new location. The first example below shows a simple rearrangement. The second example shows shifting jobs down to allow for other jobs to be inserted between them.



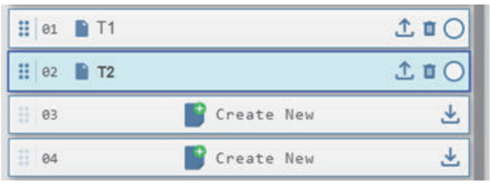
- **Set the Boot Job**

The boot job is the job that will be loaded when the camera is powered up. On power up, the job is loaded, and the reader is automatically put into Run Mode waiting for triggers.

The current Boot Job is indicated by the radio button to at the right side of the job slot. To change the Boot Job, click on the radio button for the Job/Slot that should be loaded and run at power up.

- **Archiving Jobs using the PC**

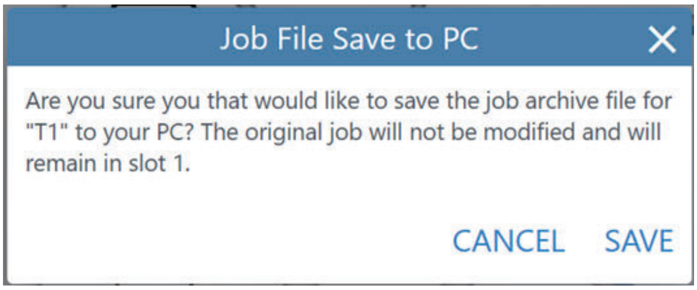
Job archive files can be saved from the reader to the PC, and inversely loaded from the PC into the device. As shown below in the Job Slots list, occupied slots have a button representing **Job File Save to PC**. This is an up arrow indicating that the job in that slot will be saved to the PC. Empty slots have a button representing **Job File Load from PC**. The icon is a down arrow indicating that job will be placed into that slot.



■ Job File Save to PC

Clicking on the **Job File Save to PC** button for an occupied job slot will prompt the user with a confirmation dialog. Clicking **Save** from within this dialog will transfer the job's archive file from the camera to the user's default download folder configured for their browser.

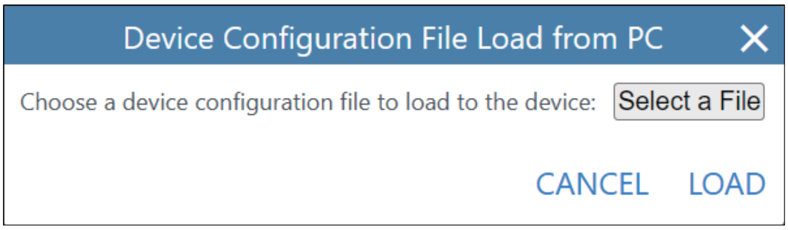
The naming format for the job is "Slot#_Job Name.job", where the Slot number is the slot it was uploaded from, and the Job Name is the name the operator gave the job. The file extension is automatically set as .job.



■ Job File Load from PC

Clicking on the **Job File Load from PC** button in an empty slot will prompt the user to Select a job archive file on the PC and then Load it into that slot.

Select a File will open a standard windows browser for the user the choose the job. The system will do basic error checking and confirm that the selected job file is a valid job archive, compatible with the device, and not using an existing job name. If the job is not compatible, the user is given the option to force the job to load anyway. Some settings may be modified or lost in this case.



■ Viewing Jobs on the PC

When jobs are saved to the Downloads directory on your PC, they follow the naming convention "Slot#_Job Name.job". This file, despite its ".job" extension, is actually a .zip archive. If you need to examine the contents of the job, you can simply rename the file extension from ".job" to ".zip". After renaming, you can extract the contents into a folder. Inside, you will find the actual job configuration in a file named "job.json". This .json file can be opened and viewed with any standard text editor. Additionally, if you need to compare this version of the job to another, you can use a file comparison tool like WinDiff to highlight any differences between the two versions.

6-1-10 Setting Up Digital Outputs

	Output 1	Output 2	Output 3
Read Cycle Complete	☐	☐	☐
Read Cycle Pass	☑	☐	☐
Read Cycle Fail	☐	☑	☐
Error Signals	☐	☐	☑
Output Configuration			
Normal State	Closed	Closed	Open
Mode	Pulsed	Pulsed	Pulsed
Pulse On Time	1000 µs	2000 µs	1000 µs
Pulse Off Time	1000 µs	2000 µs	1000 µs

Using Digital Outputs to Signal Read Cycle Result Status

The reader has three digital outputs (Output 1 - 3) that can be used to provide detailed Read Cycle Pass/Fail information, as well as Reader Error information to an external host system.

● Digital Output Mode of Operation

The three Digital Outputs operate in Pulsed Mode. They will activate (turn on) at end of each Read Cycle to reflect the Read Cycle status. The outputs will be held on for a user to set Pulse On Time, and then will be held off for a user to set Pulse Off Time.

Key Point: The total Pulse On Time and Pulse Off Time will extend the length of the Read Cycle by that combined amount. Setting these values longer than necessary for the host to see the pulse can result in higher Read Cycle times than may be necessary. The default on and off pulse times are 1000 usec. This will add 2 msec to the Read Cycle time.

● Digital Output Normal State

The normal (not activated or off) state of each output can be set to Normally Open or Normally Closed.

● Digital Output Setting Logic

There are multiple check boxes under each Output that give the user a wide range control over how and why that Output will be set. One or more signals can be assigned to the same Output line. If any of the selected states are true, the output line will be activated. **Example:** In the diagram above, both Overrun and General Error are selected under Output 3. If either of these errors occur, the Output will fire. The Output follows OR logic.

● Default Digital Output Settings

The default settings should be adequate for most applications. They provide a pulsed Pass, Fail, and Error signal at the end of each Read Cycle.

- Output 1 – Read Cycle Pass
- Output 2 – Read Cycle Fail
- Output 3 – Error Signals - Read Cycle Trigger and Processing Overrun Error, and General Reader Error.
- Operation
  - Normally Open
  - Pulsed Mode
  - Pulse On and Off Time – 1000 usec (1 msec)

● Alternate Digital Output Signaling Strategies

The default output setting indicates Read Cycle pass/fail, as well as any error that has occurred for each Read Cycle. The outputs can be configured differently than the default to give finer detail for each step in the read cycle as well as the exact error type. Clicking on the down arrows next to Pass Signals, Failed Signal, and Error opens up the Output dialog menu to show the detailed settings.

Positive Logic Example: This example shows, using Positive Logic, a deeper look into what passed or failed in the Read Cycle.

Output1 is set to indicate that all the codes were found, meaning that a code of the correct type was found within the Decode Tool region of interest.

Output2 indicates that not only were the codes found, but they passed the Read Qualification stage, which confirms that the code contained required data content. For example, a code was found that started with ABC.

Output3 is set to indicate that not only were codes present, and passed Read Qualification, they passed the full String Matching test as well.

	Output 1	Output 2	Output 3
Read Cycle Complete	☐	☐	☐
^ Read Cycle Pass	☐	☐	☐
All Codes Present	☑	☐	☐
All Codes Read	☐	☑	☐
All Codes Match	☐	☐	☑
Good Quality Codes	☐	☐	☐
^ Read Cycle Fail	☐	☐	☐
Not All Codes Present	☐	☐	☐
Not All Codes Read	☐	☐	☐
Not All Codes Match	☐	☐	☐
Poor Quality Codes	☐	☐	☐

Negative Logic Example: This example shows, using Negative Logic, a deeper look into what passed or failed in the Read Cycle.

Output1 is set to indicate that at least one of the target codes was not found.

Output2 is set to indicate that at least one of the found codes failed the Read Qualification. For example, none of the codes found started with ABC.

Output3 is set to indicate that at least one of the codes found and qualified ultimately failed String Matching.

	Output 1	Output 2	Output 3
Read Cycle Complete	☐	☐	☐
^ Read Cycle Pass	☐	☐	☐
All Codes Present	☐	☐	☐
All Codes Read	☐	☐	☐
All Codes Match	☐	☐	☐
Good Quality Codes	☐	☐	☐
^ Read Cycle Fail	☐	☐	☐
Not All Codes Present	☑	☐	☐
Not All Codes Read	☐	☑	☐
Not All Codes Match	☐	☐	☑
Poor Quality Codes	☐	☐	☐

Digital Output Settings

● Digital Output Mode of Operation

Item	Setting value [Job Default]	Description
Normal State	**[Normally Open],** Normally Closed	
Mode	**[Pulsed]**	Pulsed Mode. Output will be set on, and then set off according to the Pulse On and Off time.
Pulse On Time (usec)	0 – 10,000,000 (10 sec) [1000]	Amount of time the Output Pulse is set to Active (On) state.
Pulse Off Time (usec)	0 – 10,000,000 (10 sec) [1000]	Amount of time the Output Pulse is set to Off state.

● High-Level Output States

Item	Setting value [Job Default]	Description
Read Cycle Complete	**[Unchecked],** Checked	Read Cycle complete is Pulsed or Latched after Read Cycle Data has been transmitted.
Read Cycle Pass	Unchecked, **[Checked]**	Read Cycle Pass – This high level pass signal means the all codes were found, all codes were the correct type, and all were read and matched (i.e. contained the correct string content)
Read Cycle Fail	Unchecked, **[Checked]**	Read Cycle Fail – This high level fail signal means that either not all codes were code present, were not of the correct type, or did not read or match (did not contain the correct string content)
Error Signal	Unchecked,**[Checked]**	Error Signal – Indicates that at least one of the following errors occurred: Trigger Overrun, Processing Overrun, General Error (which includes Acquisition Error).

● Detailed (Positive Logic) Output States

Item	Setting value [Job Default]	Description
All Codes Present	**[Unchecked],** Checked	All Codes Present – Means that all Decode Tools in the job have found a code of the correct type in the designated search ROIs.
All Codes Read	**[Unchecked],** Checked	All Codes Read – Means that all Decode Tools in the job have found a code that contains the correct identifying data content. (Example:Starts with ABC)

Item	Setting value [Job Default]	Description
All Codes Match	**[Unchecked],** Checked	All Codes Match – Means that all Decode Tools in the job have fully matched the required data content. (Example: Two codes are found that start with ABC, but full match indicates the target code is the one that ends with 123.) ***Key Point:*** The Match function will drive the reader to continue searching until it finds the full matching code if it exists. It will not stop decoding on the first code found that has been read. **Note:** If "All Codes Match" is selected in Output Dialog. The output will still turn on for the case where 1) The Decode Tool passes and 2) Matching is not enabled. Matching is assumed for that case. The Output will fire, and the All Codes Match will be set in the PLC Input Assembly as well.
Good Quality Codes	**[Unchecked],** Checked	Good Quality Codes – Means that for all Decode tools where Verification is enabled, the codes all pass. Note: If the Decode Tools does not find the "qualified" code, it will not do Verification.

● Detailed (Negative Logic) Output States

Item	Setting value [Job Default]	Description
Not All Codes Present	**[Unchecked],** Checked	Not All Codes Present – At least one Decode Tool has not found a code in its search area of the correct type.
Not All Codes Read	**[Unchecked],** Checked	Not All Codes Read – At least one Decode Tool has not found a code that has the correct identifying data content.
Not All Codes Match	**[Unchecked],** Checked	Not All Codes Match - At least one Decode Tool has not Matched.
Poor Quality Codes	**[Unchecked],** Checked	Poor Quality Codes – At least one Decode Tool is of poor quality and failed Verification.

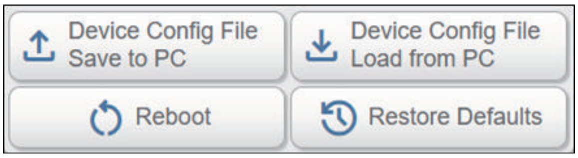
● Error Signals

Item	Setting value [Job Default]	Description
Overrun Error	Unchecked**, [Checked]**	Overrun Errors can be either Trigger or Processing Overrun Errors A Trigger Overrun indicates that a new trigger has been received before the last image was completed A Processing Overrun indicates that triggers are occurring a rate that is faster than the reader can process images. Once the reader runs out of image buffers, it issues the processing overrun signal.
General Error	Unchecked**, [Checked]**	General Error – This indicates and subsystem fault that has occurred with the camera such as a sensor or communication fault.

6-1-11 Device Configuration Save, Load, Restore, and Device Reboot

Buttons at the bottom of the Device Configuration summary are provided for Device Configuration management. The buttons allow the user to save and load specific configurations, and to restore the Device Configuration to factory defaults.

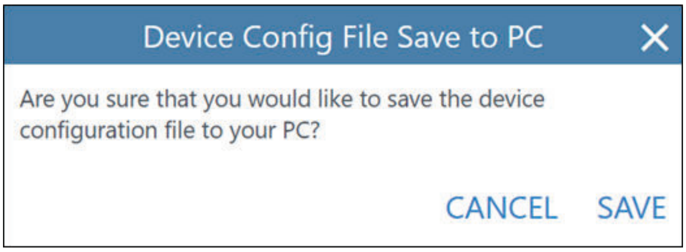
Note: Device Configuration files contain all the settings described in this chapter for RS-232, TCP/IP, DIO, Camera, and PLC settings. They do not include Jobs or Time Sync settings.



Save Device Configuration Settings to PC

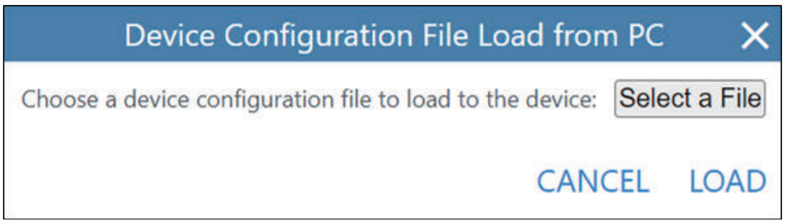
This control allows the user to save the current Device Configuration to the PC. This enables the user to store a backup, and to share the configuration with other cameras on the line.

Clicking the **Device Config File Save to PC** button will prompt the user with a confirmation dialog. Clicking **Save** from within this dialog will download the device config archive file to the user's default download folder configured for their browser. The user should move the config file from their Downloads folder into an appropriate backup location.



Load Device Configuration Settings from PC

Clicking the **Device Config File Load from PC** button will prompt the user to select a Device Configuration archive file on the PC using File Explorer, and will then load that config file onto the reader. The system will do basic error checking and confirm that the archive file is a valid config file, compatible with the device, before loading it.

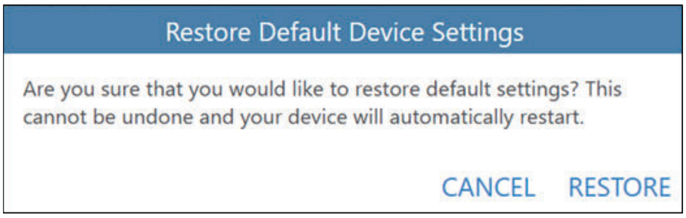


Restore Defaults

Restore Defaults is used to reset all the major Device Configuration settings back to Factory settings with some exceptions. Restore will not reset the Camera Name, Camera IP, or Subnet, nor does it restore the Time Sync Setting.

Finally, All Jobs will remain on the camera, but the Boot Job will be reset to the Demo Job in Slot 00.

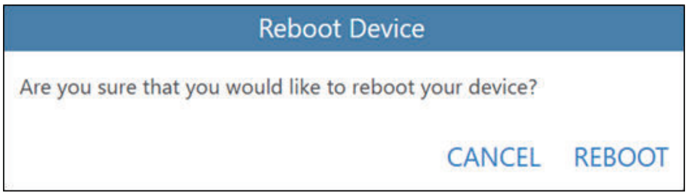
Choosing **Restore Defaults** will launch a dialog to have the user confirm the restore request. Clicking **Restore** will restore the device defaults and then reboot the device. The user interface will automatically reconnect when this process is complete.



Reboot the Device

Choosing **Reboot** will launch a dialog to have the user confirm the reboot request. Clicking **reboot** will trigger a device reboot. The user interface will automatically reconnect when this process is complete.

Note: A reboot has the same effect as a power cycle. Everything is reset. The Boot Job will be loaded and started.



6-2 Setup View

6-2-1 Overview

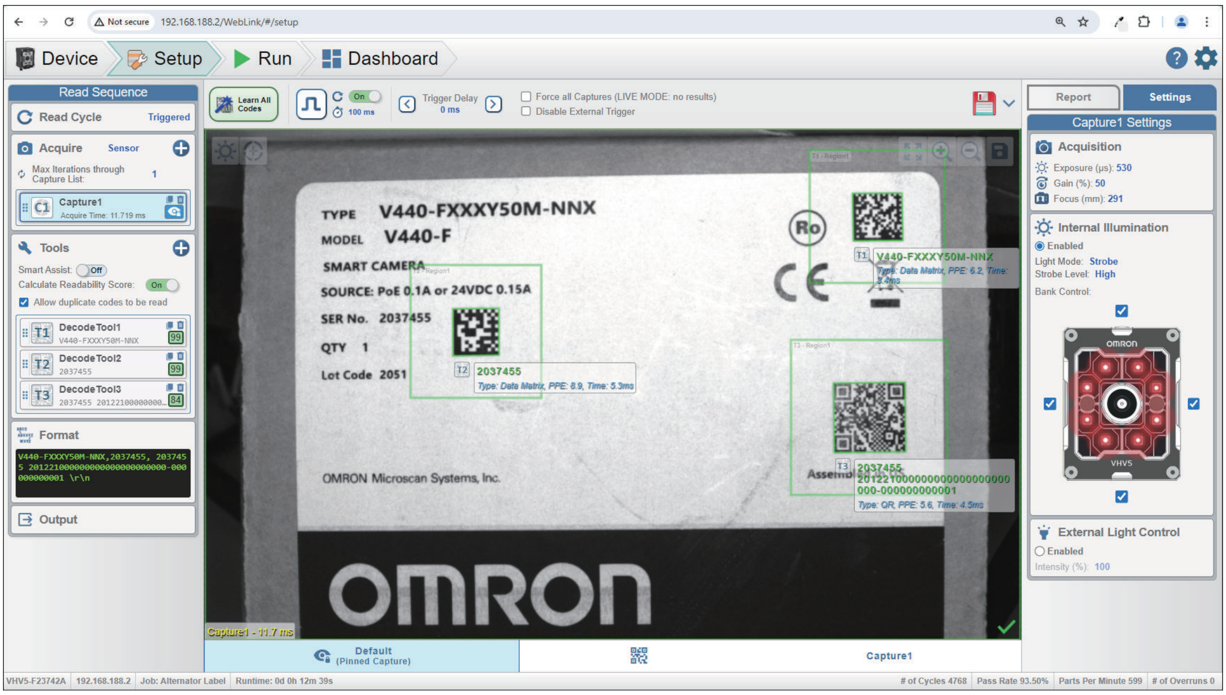
Once a job is created or loaded in Device view, the **Setup** view allows you to set all individual job parameters, and then to test and tune the job before going into Run mode.

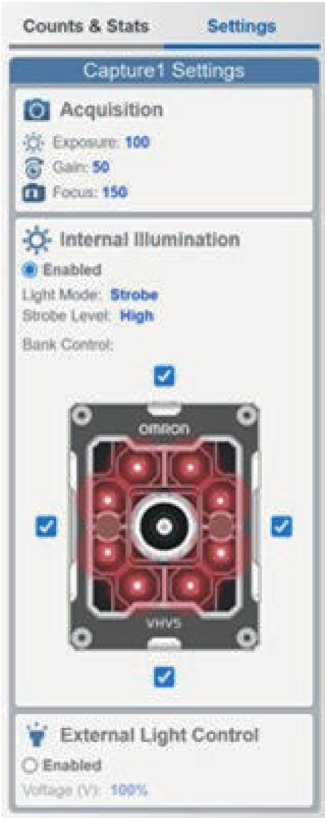
There is virtually no speed performance difference while operating in the Setup view vs. theRun view of the Dashboard. All testing, including with real triggers from a running line can be done in Setup view.

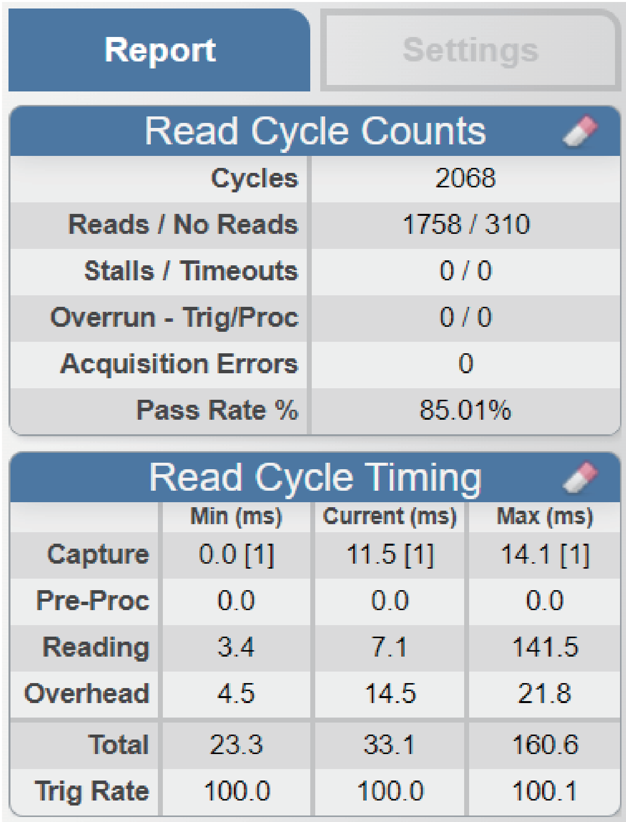
The panel on the left side of the user interface represents the read cycle of the job. During a read cycle the system will (automatically, or upon receiving a trigger,) acquire one or many captures. It will run the decode tools within all of those captures until each decode tool completes. Finally, the decoded data, and any system or read cycle data you have selected, is compiled into a formatted output string that is sent out the various communication channels.

The image in the center of the user interface allows you to see every read cycle.

The panel on the right side of the user interface will either show the parameters for the read cycle step that is selected in the left panel, or it will show the counts and statistics reports as the reading job is tested in Setup mode.







Read Cycle Counts	
Cycles	2068
Reads / No Reads	1758 / 310
Stalls / Timeouts	0 / 0
Overrun - Trig/Proc	0 / 0
Acquisition Errors	0
Pass Rate %	85.01%

Read Cycle Timing

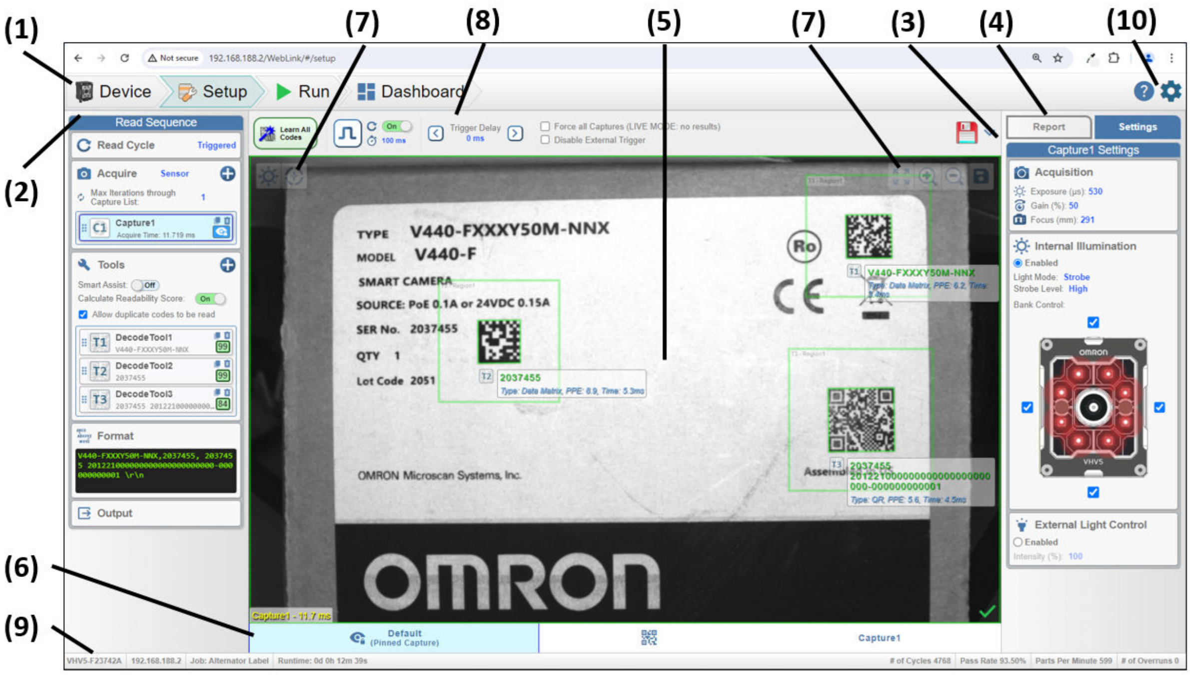
	Min (ms)	Current (ms)	Max (ms)
Capture	0.0 [1]	11.5 [1]	14.1 [1]
Pre-Proc	0.0	0.0	0.0
Reading	3.4	7.1	141.5
Overhead	4.5	14.5	21.8
Total	23.3	33.1	160.6
Trig Rate	100.0	100.0	100.1

6-2-2 State of the Reader when in Setup View

- **Mode –** Setup. A Job is loaded and running.
- **Job Change –** A different Job cannot be loaded until the user goes back into Device View, or until a Job Load change command is received that first takes the system offline.
- **Triggering –** The reader is responding normally to all **virtual triggers** and **real triggers**. The operator can choose to ignore **real triggers** in this mode.
- **Read Cycle –** The **read cycle** engine is running normally. However, it will be interrupted for certain operations such as Quick Photometry and Quick Focus.
- **Parameter Change –** All **job parameters** can be changed while the read cycle is running. Effects of the parameter changes will be seen in the next cycle.
- **Outputs –** All outputs are functioning as they would in run mode. This includes RS-232, TCP/IP, PLC Communications and Digital IO.
- **High-Level Setup Functions –** The user has access to high-level setup functions that allow rapid programming of the job with minimal user input.
  - **Quick Photometry**, **Quick Focus**, and **Auto-Photometry/Focus** interrupt the read cycle, take over the reader, and perform the operation. The read cycle is stopped at this time, and does not respond to triggers. The reader will be set back to normal read cycle operation when complete.
  - **Learn** does not stop the read cycle. It takes the next image(s) from the read cycle and feeds them to a special X-Mode decoding instance which finds all codes in the image(s). For each found code, Learn will insert a new decode tool into the job, replacing those already there. Similar to inline parameter changes, the job will continue running.
  - **Optimize** does not stop the read cycle. It takes the next image(s) from the read cycle and feeds them to the Optimize routine running its own X-Mode decoding instance. Optimize will run in the background until complete. The operator can allow or disallow Optimize to set parameters in the current job. Similar to inline parameter changes, the job will continue running, but with newly optimized settings.

6-2-3 Main Components of the Setup UI

The following are the main components for the Setup View. The numbers correspond to the figure below. Each Element will be explained in subsequent sections.



1. Mode Navigation Chevrons – Located at the top left of the user interface. Used to move between Device, Setup, Run, and Dashboard Views.

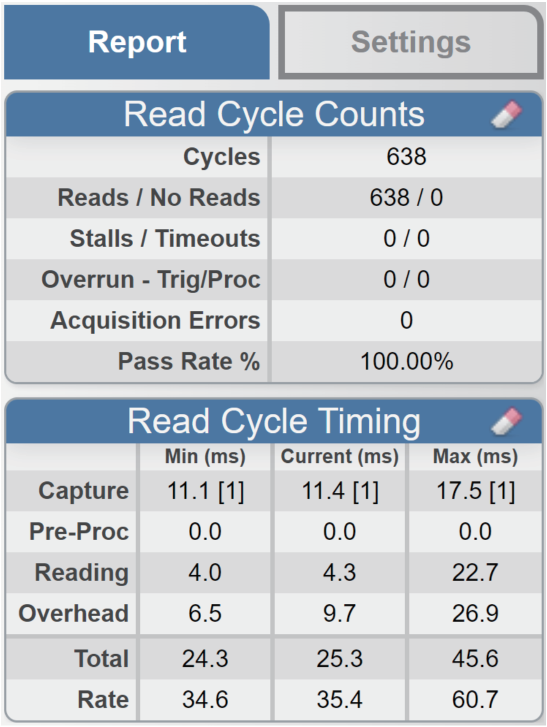
2. Read Sequence Steps and High-Level Step Parameters – Sequence of Steps the reader runs for every read cycle. A limited set of global parameters affecting Acquire or Decode tools are set here.

3. Detail Settings Dialogs for Steps – If the user clicks on a step in the Read Sequence such a Capture, or a Decode Tool, the tool will be highlighted in blue, and then the detailed settings dialog for that step will appear in the right hand pane under the Settings tab, allowing the user to view and change its parameters. See example in image above.

- For Decode Tools, the user can also click on the ROI (Region of Interest) in the image and the settings dialog will appear as well.
- If the user again clicks on the step in the Read Sequence, the step will un-highlight, and the Counts and Stats Read Cycle Report will reappear in the right hand pane.

4. Read Cycle Counts and Stats (Report) –

- The Report tab is shown by default when no step is selected.
- If the user clicks on a step, the Report tab automatically switches to the Settings tab.
- The user can see the Report again by clicking on it in the tab at the top.
- The read cycle report shows Read Cycle Pass/Fail counts in the upper section, and Read Cycle Timing in the lower section.
- The counts allow the user to follow the success or failure of the reading application.
- The Timing information allows the user to understand exactly how much time is required for the read sequence.



1) Read Cycle Counts

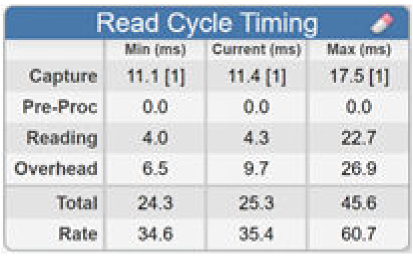
The upper counts section of the report allows the user to follow the success or failure of the reading application during a run.

- The report shows how many cycles have been run. It shows the number of Reads / No Reads and Matches / No Matches as well as the Pass Rate percentage.
- ForWarnings it shows Stalls or Timeouts, indicating that the system is running close to the maximum trigger rate.
- For Errors it shows Trigger or Processing Overruns, which indicate that the system is being triggered faster than it can take pictures or process. It also shows Acquisition Errors, which indicate errors in the digitizer that cause the acquisition to fail.

Item	Description
Port	Client devices connect to the reader using the reader's IP and the Port number set in the dialog. There is no limitation on the port number for the reader, so can be set what is best for client.
Cycles	The number of Read Cycles that have run since the job was loaded, or since the counts were reset with the eraser icon.
Reads / No Reads	The number of Reads vs. No Reads since counts were reset.
Match / No Match	The number of match string pass vs. match string fails since counts were reset. Note: Matches / No Matches will only be displayed if Match String is enabled for one of the Decode Tools in the Job.
Pass Rate %	This is the percentage of Read Cycles that have passed. Note: For a Read Cycle to pass, it must not only read, but also match if matching is enabled.
Stalls	Stalls is a count of how many times the system has stalled since counts were reset. Stalls are a warning. The system will stall if it has completed the next read before finishing the prior read. The system automatically stalls, sending out the result from the latter read until it finishes with the first one. This is an indication that some codes may have more problems being read than others. Code quality should be checked, as well as job settings.
Timeouts	Timeouts is a count of how many Timeouts have occurred since counts were reset. Timeouts are a normal occurrence for codes that cannot be read. It happens when the code cannot be decoded within the Max Allotted Time Per Tool setup by the user. This is an indication that code quality may be insufficient, or that the job is not tuned well to read that code.
Trigger Overrun	Trigger Overrun is a count of how many times this error has occurred since counts were reset. Triggers Overruns are Errors – They indicate that triggers are being sent faster than the sensor can take picture and that the trigger rate must be slowed. Note that a Trigger Overrun indicates that the reader is now out of sync with the host since it did not actually receiver the trigger.
Processing Overrun	Processing Overrun is a count of how many times this error has occurred since counts were reset. Processing Overruns are Errors – They indicate that the reader is being triggered at a faster rate than the images can be processed. There is an image buffer pool that allows normal slowdowns and speed-ups, but if a Processing Overrun occurs, it means that the buffer pool is full. The trigger rate must be slowed, or the job must be tuned to run faster. Note that a Trigger Overrun indicates that the reader is now out of sync with the host since it did not actually receiver the trigger.
Acquistion Error	Acquisition Error is a count of how many times this error has occurred since counts were reset. Acquisition Errors indicate a failure in the digitizer causing the image not to be taken.

2) Read Cycle Timing

- The lower section of the report shows timing statistics for the current run. It shows the Minimum, Current, and Maximum time each of the key read cycle steps has available to execute. This data allows the user to see how fast a read cycle can actually run, as well as expected variation in that execution time. The data is also useful to detect which steps seem to be taking a long time, are not stable, or exhibit anomalies indicating that this step should be further tuned.


Read Cycle Timing

	Min (ms)	Current (ms)	Max (ms)
Capture	11.1 [1]	11.4 [1]	17.5 [1]
Pre-Proc	0.0	0.0	0.0
Reading	4.0	4.3	22.7
Overhead	6.5	9.7	26.9
Total	24.3	25.3	45.6
Rate	34.6	35.4	60.7

Item	Description
Capture[#] (msec)	Capture is the total time spent acquiring all Captures that were required to complete the read cycle. The [#] number indicates how many of the Captures were actually required to read. If all codes were found in the first capture, the result would be something like 12[1]. If three of the Captures were required, this result would be closer to 36[3].
Pre-Proc (msec)	Pre-Proc is the time spent preprocessing the image using Filter Steps within the ROI. Image preprocessing is used to enhance the image prior to deode. If no ROI filters are enabled (such as scale or morphology) this time will be 0.
Reading (msec)	Reading is the total time spent in the X-Mode decoding routine.
Overhead (msec)	Overhead is an accumulation of all time spent in the read cycle performing necessary steps other than pre-proc and reading. Typically the bulk of this time is spent in the post-processing section preparing the report and sending out the data.
Total (msec)	Total is the total cycle time in msec calculated from when the Trigger was received for this read cycle to when the read cycle result sent out.
Trig(ger)Rate (msec)	TheTrig(ger) Rate is the time in msec between the previous and current read cycle Trigger. For example, if the parts on the line are coming at ~600 PPM, this time would be ~100 msec.
Note: Trigger rate (time between triggers) can be faster than the Total read cycle time because of pipelining. In pipeline mode the system is capable of acquiring the image for the current read while processing the previous read.	

5. Image

The image from current read cycle is displayed in the center of the UI. The image will update at the end of every read cycle. Depending on which image view is selected different graphics will appear with Decode and Read Cycle Information. The image view is controlled by the Image View Tab control at the bottom of the image.

6. Image View Option Tabs

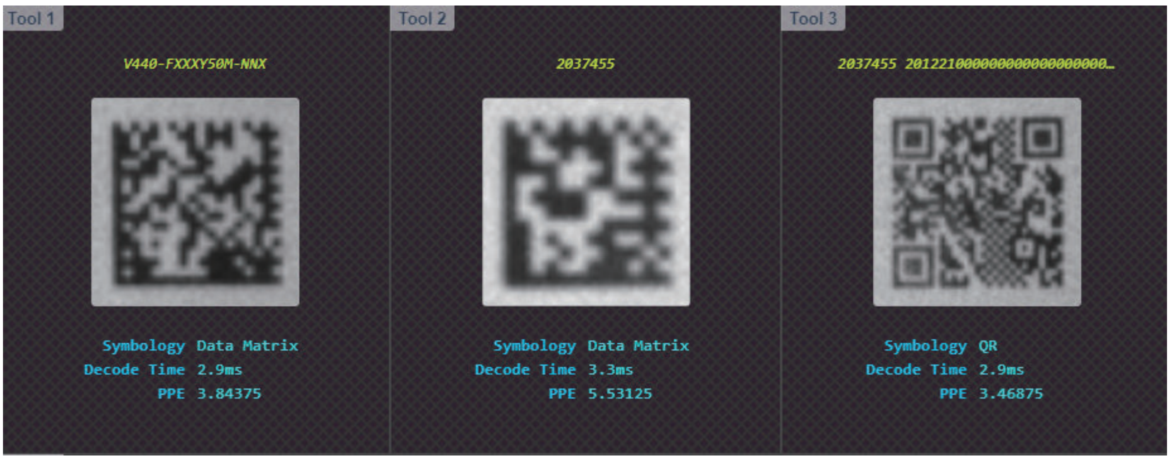
There are 4 main image view options. The Default view, the Tiled view, the Code Detail view (QR Icon), and the individual view of each unique capture set up in the job.

- **Default View –** The Default view shows the Capture in which the largest number of codes were decoded. (Note: Some codes may have been decoded in other images and will not be shown here. These can be seen in the other views described below.) The ROIs and Decode Graphics for each tool are shown. If the read cycle passes, the image is outlined in green and a green check appears at the lower right. If the read cycle fails, the outline is red and a red X appears at the lower right along with a message giving details of the failure.

- **Tile View –** This view appears if the Read Cycle has more than one Capture. This view is designed to show all the captures used for the cycle in a tiled format. The Capture number, and a graphic around and decodes is displayed. Note: A Capture will not be displayed in Tile View if it was not necessary to use that Capture to find a code. For example: If all codes were decoded in the first three Captures, then the 4th Capture will not be shown.

This view is very useful for tuning multiple Capture jobs. It allow the user to see what Capture were required to complete the Read Cycle. A Capture will not be performed if all Decode Tools have already succeeded. In the example below, two of the 3 codes were read in the first Capture. The final Decode Tool was able to read its code in the third Capture. The Read Cycle was satisfied, so ended without need to acquire the fourth image.

-
- **Decode Details –** This view will give a close up view of all codes from all Decode Tools in all Captures. It displays code contents at the top, as well as symbology type, Decode Time and PPE (Pixels Per Element) at the bottom.

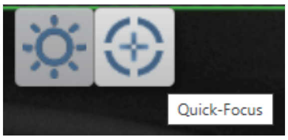


7. Image Controls

There are two sets of Image Controls. In the upper left of the image are the Quick Setup tools; Quick-Photometry, Quick-Focus and Autofocus/Photometry. (See Notes at end of section for more details on the operation of these Quick Setup Tools.) In the upper right of the image are the Zoom and Save Image tools. Scrolling is accomplished by right clicking and dragging on the image.

- **Quick Photometry** automatically sets the exposure time so that the gray values in the image center around the mid-range value of 128 Gray Scale. The user is prompted to click in the image, or to drag around a section of the image for where to set lighting. This is always a good first step to perform when starting with a new job or Capture.

- **Quick Focus** automatically sets the autofocus lens to the distance that the part is at. This requires several images to perform. The user is prompted to click in the image, or to drag around a section of the image for where to set focus. This is always a good second step to perform when starting with a new job or Capture.

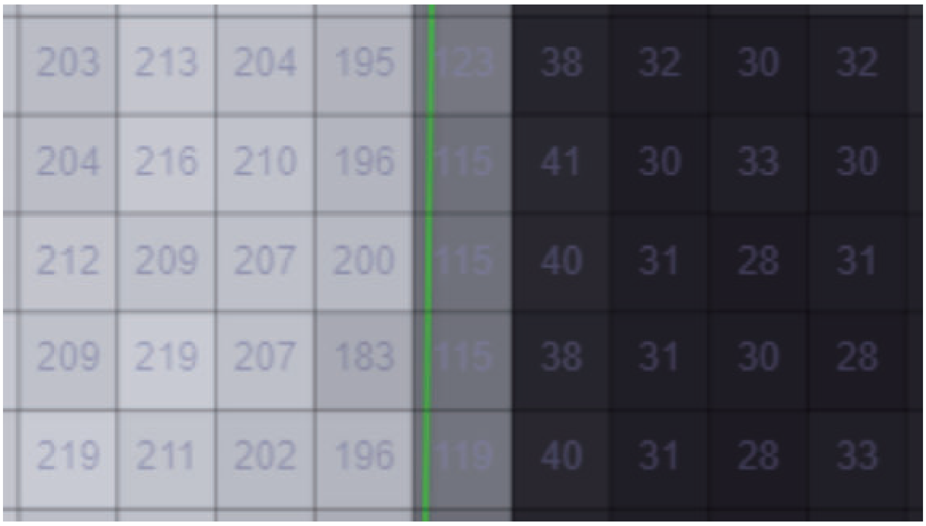


Note: Quick-Photometry and **Quick-Focus** interrupt the read cycle, take over the reader, and perform the operation. The read cycle is stopped at this time, and does not respond to triggers. The reader will be set back to normal read cycle operation when complete.

- **Auto-Focus/Photometry** is an additional control available if the Job Type is set to Continuous or Presentation. Activating this feature will cause the system to automatically call both Quick-Photometry and Quick-Focus after 5 seconds of NOREADS, creating a good image. This is a valuable out of box experience feature that will set up the proper imaging without any user interaction. Note that this feature can be enbabled either through the icon on the screen, or by the On/Off switch in the Acquire step.

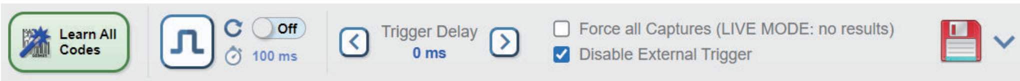
- **Image Zooming and Image Save Utilities:**
  - The left-hand Zoom button zooms the image to fit the extent of the screen.
  - The **+** and **–** zoom in and out.
  - Save saves the current image to the download directory as a .png file.

- **Additional Screen Controls:**
  - The user can click on the image and then scroll in and out with the mouse wheel. Zooming in to the full extent shows the pixels with their numerical grey value.



The image can be panned by right-clicking and dragging.

8. Setup View Utilities and Controls



- **Learn All Codes –** This function will learn all the codes in all the captures creating a unique Decode Tool for each. This function starts by bringing up a dialog that lets you capture the next set of images, determine how large the search ROIs should be set to based on known positional uncertainty of the part on the line, or the marks on the part. See the Learn All Codes section for additional details.
  Note: Learn does not stop read cycle. It will take next image(s) from the read cycle and feed them to a special X-Mode instance which finds all codes in the image(s). For each found code, Learn will insert a new Decode Tool into the job replacing those already there. Similar to inline parameter changes, the job will continue running.

- **Virtual Trigger Generator –** This function is available for Triggered Jobs only and allows the user to run the job without a physical trigger attached. The user can issue a single trigger by clicking on the square wave icon, or turn the generator on with the cycle icon to provide a stream of triggers at a set interval. The interval can be varied to test how fast the job can be run before putting it on the line.

- **Trigger Delay –** This function is for adjusting when the image is taken on a moving line. It inserts a delay between when the reader receives the trigger and when the picture is taken. This allows the user to programmatically slide the part back and forth to center it in the image without going onto the line to physically adjust the trigger position.

- **Force All Captures (Live Mode: No Results) –** This function will force the system to acquire and display all of the Captures the user has set up in the job. This allows the user to view all the Captures and see the effects of adjustments made to lighting and focus. The Captures can be viewed all together in the Tile View, or in the individual tabs for each Capture at the bottom of the screen.

- **Disable External Trigger –** VHV5-F jobs can be set up even on moving lines with active triggers. The physical trigger is active by default. Captures of all parts will occur when the trigger is received.

If the user does not want the system to respond to physical triggers, but to Virtual triggers only, they must select Disable External Trigger.

- **Save Job –** Allows the user to save the job from the Setup view. The icon is when there are un-saved changes to the job. The icon is blue if job is the same. Clicking the icon saves the job. Clicking the down arrow allows the user to Save As the job with another name to another slot. It also allows the user to revert the job to its previous saved state.

9. Status Bar

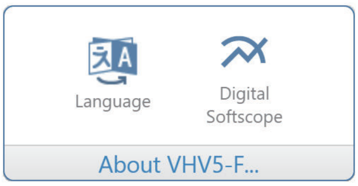
The status bar at the bottom of the user interface is visible in all views.

From left to right, it displays:
- Name of the camera
- IP Address of the camera
- Current loaded job name
- How long the job has been running,
- The total number of cycles (triggers) the reader has run,
- The Pass Rate,
- The run Rate in Parts per Minute (trigger rate)
- The # of overrun errors

10. Help and Advanced Settings

The **question mark icon** brings up this manual.

The **gear icon** brings up this addition dialog that allows access to Change the Language of the UI, to access the Digital Softscope Tool for doing fine tune timing of the application.



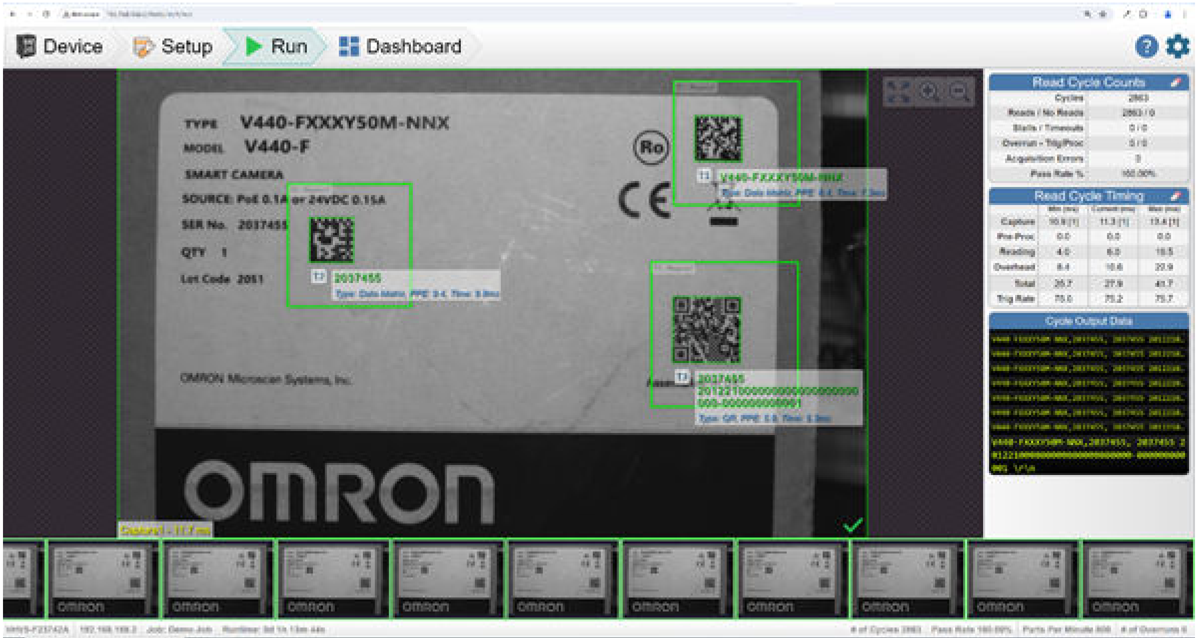
- The run Rate in Parts per Minute (trigger rate)
- Digital Softscope is described in section 6-5.
- The full set of language options is shown below.


Select a Language
English
日本語
中文(简体)
中文(繁體)
Português
Polski
한국어
Italiano
Français
Deutsch
Русский

6-3 Run View

6-3-1 Overview

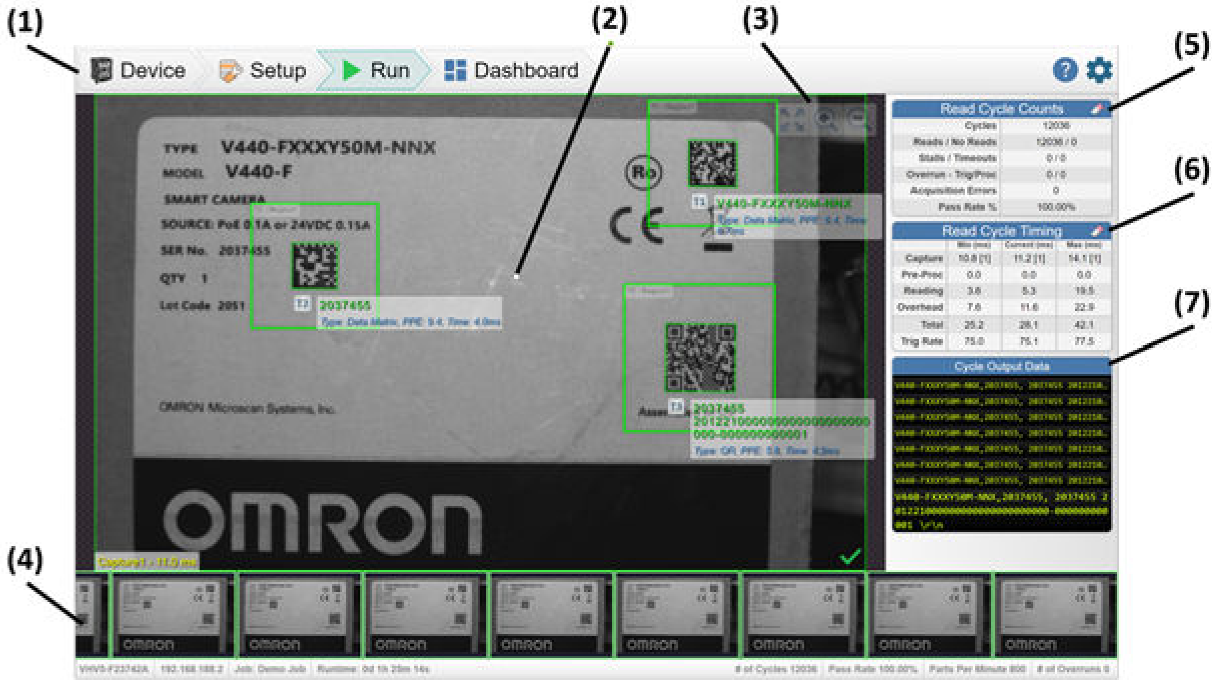
The **Run** view is the main way to monitor the system as it is running online. It shows an image for each trigger. It shows the counts and statistics for the entire production run. At the bottom of the screen it shows a filmstrip of the most recent read cycles.



6-3-2 State of the Reader when in Run View

- **Mode –** Run. A Job is loaded and running.
- **Triggering and Outputs –** The read cycle engine is running, responding to all virtual or real triggers. All outputs are being set.
- **Job Change –** Job changes are allowed in this mode through command input, which first takes the system Offline.
- **High-Level Setup Functions –** Quick Photometry and Quick Focus operations can be performed in this mode. They can be initiated via serial or PLC commands. These operations will override the triggered read cycles and may cause the system to ignore triggers. More complex operations like Optimize are blocked during Run mode.

6-3-3 Main Components of the Run UI



1. **Mode Navigation Chevrons –** Located at the upper left of the UI. Used to move between Device, Setup, Run, and Dashboard Views.
2. **Main Image –** The image from current read cycle is displayed in the center of the UI. The image will update at the end of every read cycle. Depending on which image view is selected different graphics will appear with Decode and Read Cycle Information. The image view is controlled by the Image View Tab control at the bottom of the image.
3. **Image Zoom Utility –** Left-hand Zoom button Zooms the image to the extents of the screen. + and – Zoom in and out.

4. **Filmstrip –** Displays the last N cycles. Images are outlined in Green for Pass, and Red for Fail. If the user hovers over the image, that image is shown full size on the main screen.
5. **Read Cycle Counts –** The counts allow the user to follow the success or failure of the reading application.
   - The report shows how many cycles have been run. It shows how many Read/No Reads and Matches/No Matches and the Pass Rate%.
   - For Warnings it shows Stalls or Timeouts warning that the system is running close to max trigger rate.
   - For Errors it show Trigger or Processing Overruns which indicate system is being trigger faster than it can take pictures or process.

Read Cycle Counts	
Cycles	181
Reads / No Reads	181 / 0
Stalls / Timeouts	0 / 0
Overrun - Trig/Proc	0 / 0
Acquisition Errors	0
Pass Rate %	100.00%

6. **Read Cycle Timing –** The Timing information allows the user to understand exactly how much time is required for the read sequence.
   - The report shows the Min, Current, and Max time for the different steps in the cycle, Capture, Decode Tools, and Overhead (reporting). The report shows the total cycle time trigger to answer.
   - The Trig(ger) Rate is the time from Trigger to Trigger in msec.

Read Cycle Timing

	Min (ms)	Current (ms)	Max (ms)
Capture	10.8 [1]	11.7 [1]	18.4 [1]
Pre-Proc	0.0	0.0	0.0
Reading	1.4	5.0	21.8
Overhead	5.0	6.2	23.9
Total	18.7	23.0	47.9
Trig Rate	75.0	75.0	78.7

7. **Read Cycle Output Data –** Shows final result string from the Read Cycle.

Cycle Output Data

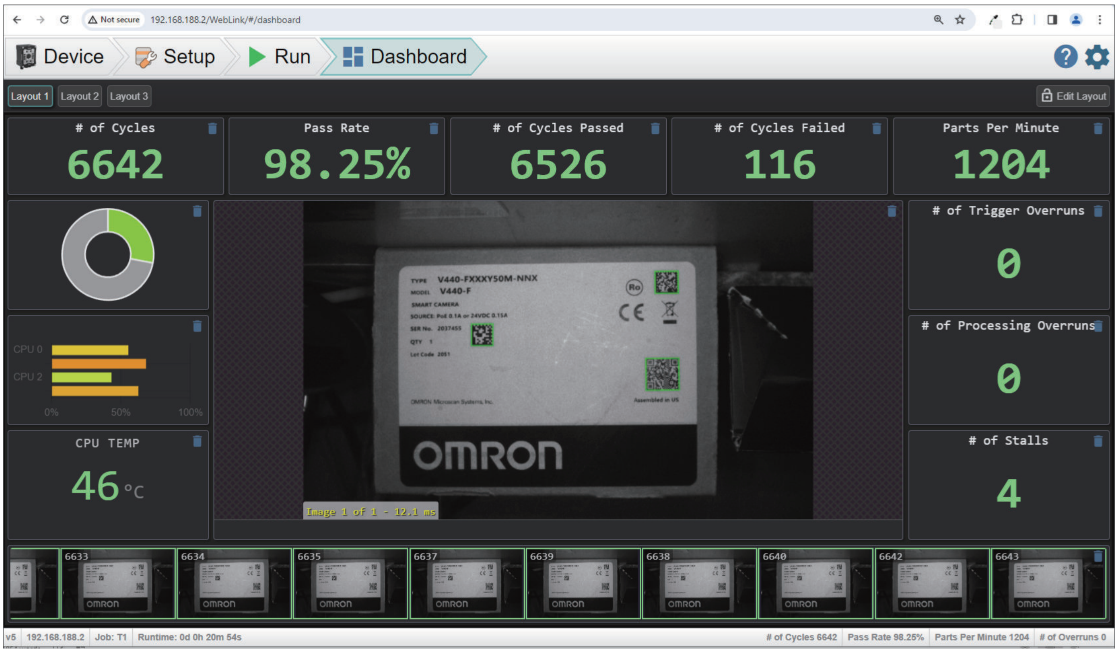
```
V440-FXXXY50M-NNX,2037455, 2037455 2012210…
V440-FXXXY50M-NNX,2037455, 2037455 2012210…
V440-FXXXY50M-NNX,2037455, 2037455 2012210…
V440-FXXXY50M-NNX,2037455, 2037455 2012210…
V440-FXXXY50M-NNX,2037455, 2037455 2012210…
V440-FXXXY50M-NNX,2037455, 2037455 2012210…
V440-FXXXY50M-NNX,2037455, 2037455 2012210…
V440-FXXXY50M-NNX,2037455, 2037455 2
01221000000000000000000000-000000000
001 \r\n
```

6-4 Dashboard

6-4-1 Overview

The **Dashboard** is a highly visual monitoring alternative to the Run view. It shows the image and film-strip as well as the key counts and statistics in an easy-to-view screen. The Dashboard view is fully configurable and can be tailored to show specific data.

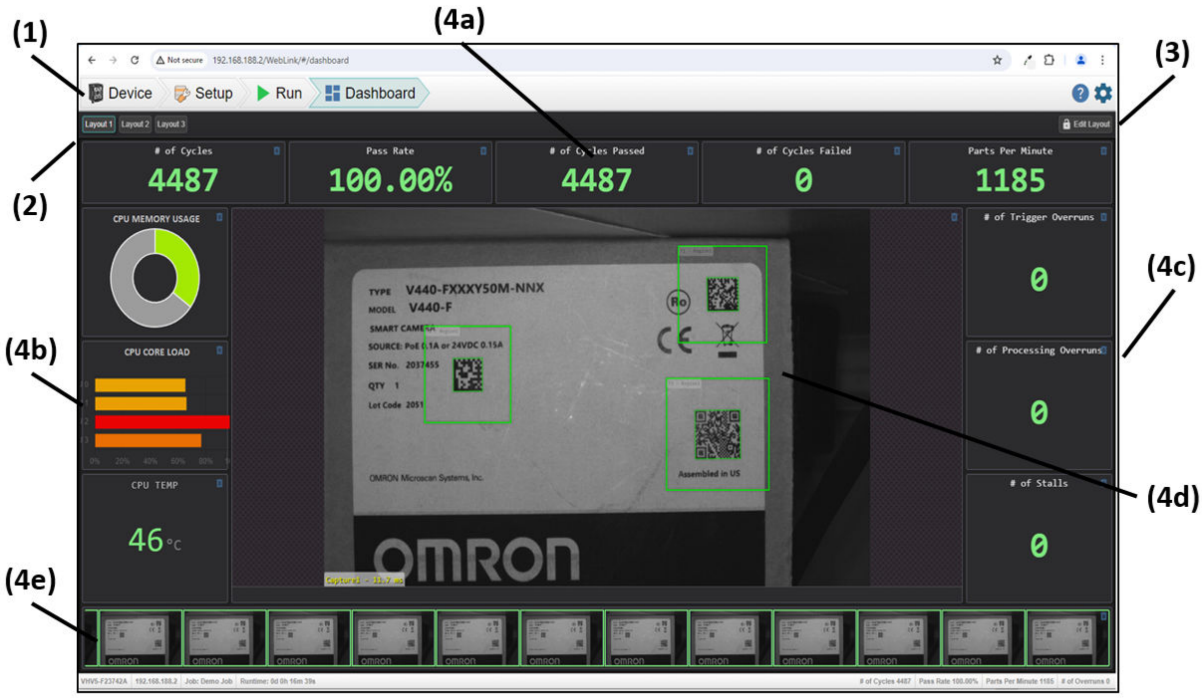
The default Dashboard layout is set at the factory, but can be fully customized in the field. A total of three unique display layouts can be created and selected for use during runtime.



6-4-2 State of the Reader when in Dashboard View

- **Mode –** Run.A Job is loaded and running.
- **Triggering and Outputs –** Theread cycle engine is running, responding to all virtual or real triggers. All outputs are being set.
- **Job Change –** Job changes are allowed in this mode through command input, which first takes the system Offline.
- **High-Level Setup Functions –** Quick Photometry and Quick Focus operations can be performed in this mode. They can be initiated via serial or PLC commands. These operations will override the triggered read cycles and may cause the system to ignore triggers. More complex operations like Optimize are blocked in Dashboard mode.

6-4-3 Main Components of the UI



The Layout Screen is divided into 5 main areas (4a-4e). Each section is populated with a set of dashboard "widgets" designed to show numeric data, graphical data, images or the filmstrip.

Each section can be completely customized. During Edit, the function of each widget can be changed. Widgets can be added and deleted. Widgets can be shifted to different locations within their section, or even dragged from one of the main areas to another.

1. **Mode Navigation Chevrons –** Located at the top left of the user interface. Used to move between Device, Setup, Run and Dashboard Views.
2. **Alternate Dashboard Layouts 1-3 –** The User can create and choose from three alternate layouts of the Dashboard.
3. **Edit Layout Button –** Puts the Dashboard into Edit mode so the user can change the layout of display widgets in the dashboard. The user can:
   1) Shift the order of each result within one of the 5 main sections of the screen.
   2) Shift widgets between sections of the screen.
   3) Alter the values that are displayed by each widget.
   4) Add or delete widget from each section.
4. **Layout Areas 4a-4e –** By default these show:
   1) 4a shows high level run counts and stats.
   2) 4b shows processor usage and camera temperature.

3) 4c shows warning and error counts.

4) 4d shows the main image with graphics and read string results.

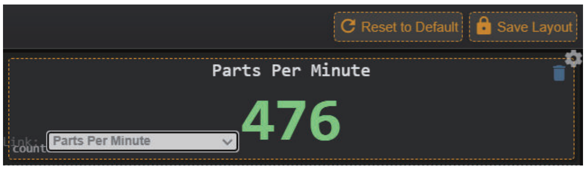
5) 4e shows the filmstrip which displays the last N Read Cycles. Images are outlined in Green for Pass, and Red for Fail. If the user hovers over the image, that image is shown full size on the main screen.

6-4-4 Main Components of the Dashboard UI

Editing Dashboard Layout

The layout of the Dashboard can be customized by clicking on the Edit Layout button. The screen changes. Each display widget is outlined an orange dotted box, and a pull down menu appears allowing the user to change what value is displayed in that widget.

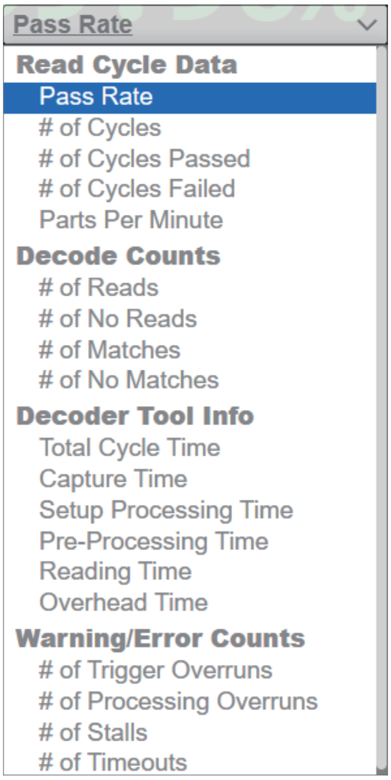
A trash can and a gear icon is located in the upper right of each major display section. These icons allow the user to delete or to add addtional display widgets to each section.



Choosing Displayed Data

Choosing Displayed Data

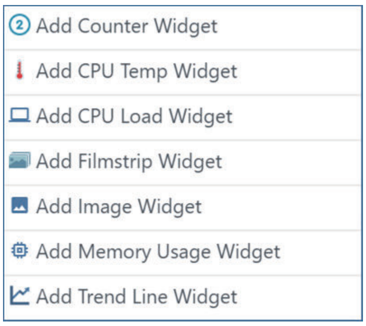
The dropdown menu associated with each display widget allows the user to change the data that is displayed. This is the same data that is available in the reports as well as when formatting the final Read Cycle output string. The user clicks on the value that they want displayed.



Adding Widgets

Adding Widgets

Clicking on the Gear brings up the following choices. Most of the widget choices are already part of the stand- ard display. The user will normally choose to add a new Counter Widget, or Trend Line Widget. After clicking on the choice, the user has the ability to choose what data is displayed in the widget.



Arranging Widgets within the Dashboard

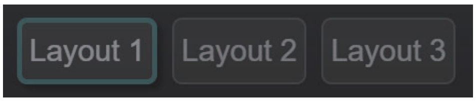
The widgets can be arranged or rearranged easily. The user simply clicks on a widget and drags is to any other location within the current display section, or over to another display section.

Saving or Resetting a Dashboard Layout

Once the user is satisfied with their dashboard layout, they can click on the Save Layout button. The layout may also be reset to the factory default layout.

Alternate Dashboard Layouts

The user can create up to three alternate dashboard layouts to fit the needs of different users such as Operator, Technician, and Engineer. By default, Layout 1 is displayed. Clicking on a different layout changes the display to that layout, and then clicking on Edit Layout allows that screen to be customized.



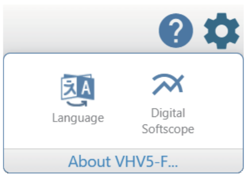
6-5 Digital Softscope (Timing Profiler)

6-5-1 Digital Softscope (Timing Profiler)

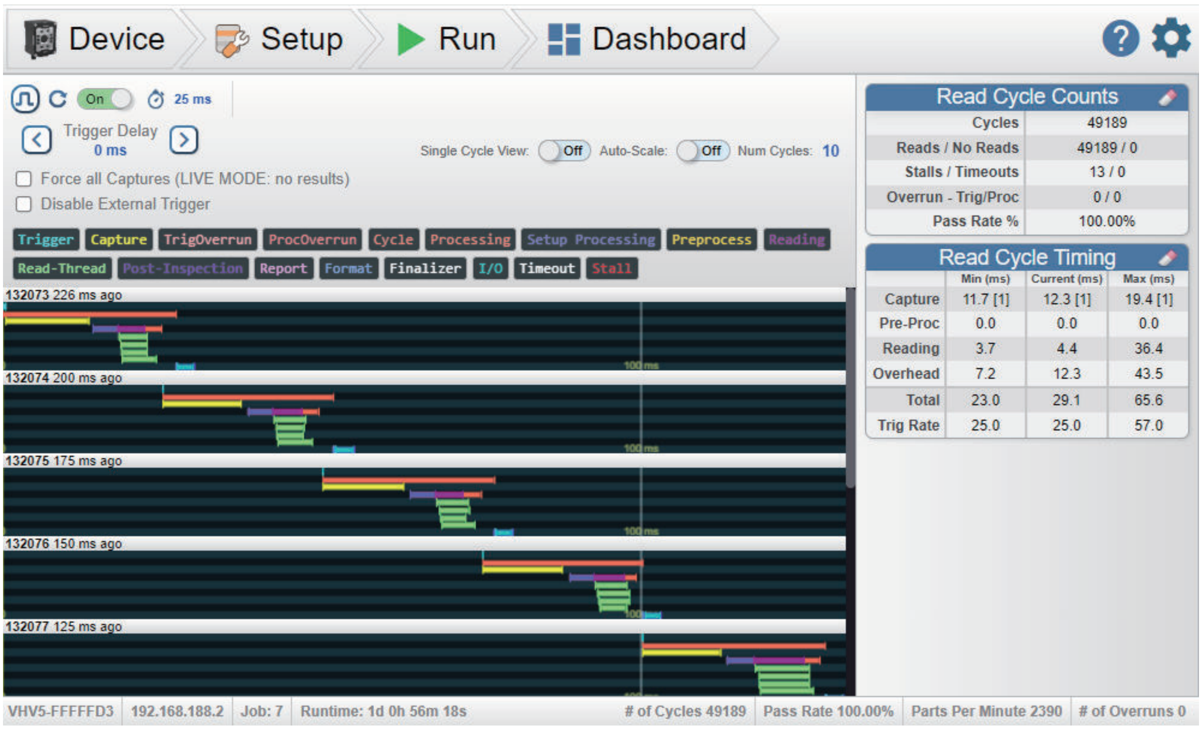
WebLink for the VHV5-F offers a unique tool for Read Cycle optimization called the Digital Softscope. The Digital Softscope.is similar in concept to an oscilliscope. It is designed to show timing for all of the major events and processing that occur on the VHV5-F as it executes Read Cycles. This tool is useful to visualize and then to optimize the performance of the reader as it runs on a production line.

The line operator may not require this feature, but this is an extremely useful tool for system integrators or line technicians as they are bringing up high-performance systems, or as they are trying to troubleshoot runtime performance issues.

Key Point: No processing time is taken from the Read Cycle to gather or display the Digital Softscope data. The timing displayed is extremely accurate, and can help expose issues with the reader, as well as with the controlling PLCs or systems.
The Digital Softscope is accessed via the gear icon in the upper right corner of the user interface.

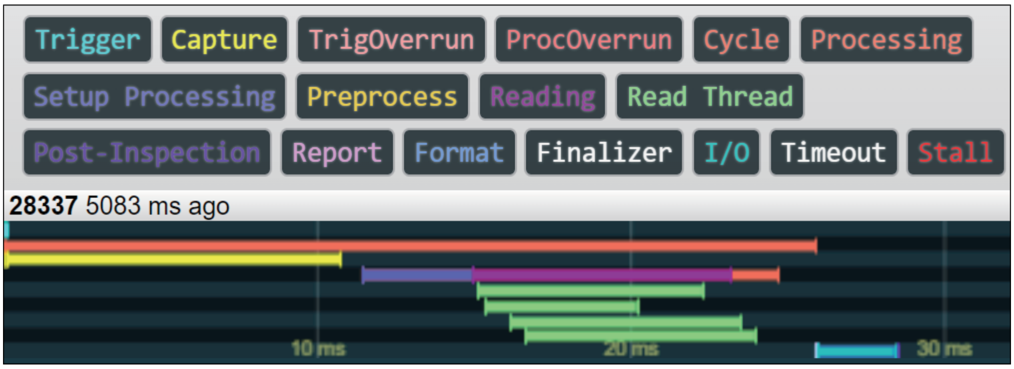


6-5-2 Digital Softscope Quick Start



As the system runs, the Digital Softscope gathers timing data on all significant events and processes and displays them in time based graph format. Each event and process is color coded per the chart below to allow the user to visualize the entire read cycle easily. Events such as Trigger show as blips, or short vertical lines. Processing is shown as horizontal bars, where the start, stop, and length of the bar denote the actual start, stop, and duration times.

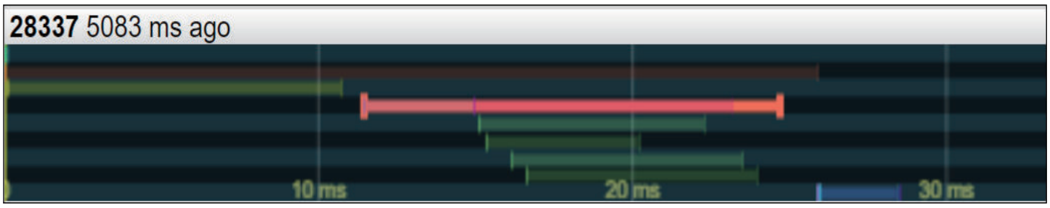
Reading Example: The example below shows a single read cycle starting with a trigger, and ending with data being sent. The full duration is approximately 26 msec from trigger to answer.



1. The Read Cycle starts with a Trigger event shown as a veritical light blue line.
2. Next, the system performs a Capture on an image shown as the yellow horizontal bar.
3. As soon as the image is available, read Processing begins.
4. Processing starts with Setup Processing, which prepares the X-Mode decoding algorithm to run. The next stage is Reading, where X-Mode is run on the image to look for the codes. Reading itself launches multiple instances of a Read Thread, which runs concurrently on the different cores to accelerate decoding.
5. Once the code or codes have been read, the final stage of Processing shuts down any Read Thread that is still running. The read cycle then moves on to the Post-Inspection stage.
6. During Post-Inspection, which is very short, the system compiles the data into a Report, proceeds to Format it, and, when Finalized (Finalizer), sends the report out through all enabled communication channels. The pass, fail, and error digital outputs are sent at this time too. I/O reflects the pulse on and off time of the outputs.

Key Point: Hovering the cursor over any of the event or process labels in the list above the graph will highlight that particular event or process, making it easy to see it in detail on the time plot.

For the example above, if the user hovers over Processing, the display changes to the figure below.



When looked at in comparison with the first figure, it is clear that `Processing` is a high level calling routine taking about 12 msec. Within processing, `Setup Processing` occurs, first taking about 3.5 msec, followed by `Reading`, which takes about 7 msec. The final `Processing` time (2 msec) is spent shutting down the instances of `Read Thread` and cleaning up prior to moving on to `Post-Inspection`.

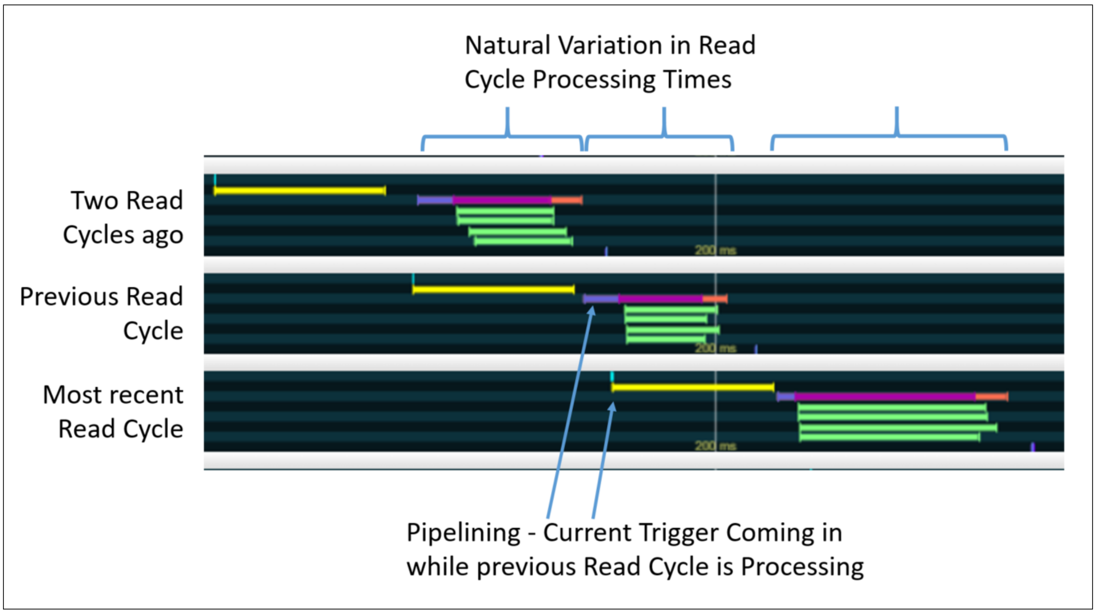
This feature also provides a powerful tool to capture and see occasional rare error or warning events such as Trigger Overruns (`TrigOverrun`), Processing Overruns (`ProcOverrun`), and Stalls (`Stall`). These are errors or warnings which indicate the system is being triggered too fast. Errors will show up as Xs on the screen when you hover over the label. Stalls, which are warnings, will show up as a red line. The example below shows trigger overruns.

6-5-3 Multi-Cycle View

There are two main views for the Digital Softscope. The **Multi-Cycle View** shown here, and the Single Cycle View, which will be shown in the next section.

The Multi-Cycle View shows one read cycle per horizontal lane. Up to 12 back-to-back read cycles can be displayed in the time graph at the same time.

1. **Gear –** The Digital Softscope is accessed by selecting the Gear icon and then clicking on the Digital Softscope icon.
2. **Digital Softscope Controls**
    1) **Single Cycle View vs. Multi-Cycle View –** To choose between display above and display in next section.
    2) **Auto Scale –** When on, the time base is scaled to show at least one full read cycle. When turned off, the user can roll their mouse wheel in the graph area to shorten or lengthen the time scale for optimal viewing.
    3) **Number Cycles –** The User can create and choose from three alternate layouts of the Dashboard.
    4) **Trigger Delay –** Delays time between when trigger occurs and when the picture is taken. Used for aligning the part in the field of view without moving physical trigger.
    5) **Trigger Generator Controls –** Used to simulate triggers allowing the user to determine before the system goes on line what the expected TACT time could be if all codes are similar to the one placed in front of the camera for testing.
3. Items **3** to **6** in the diagram above show the read cycle lanes. Read cycle lanes allow you to see how cycles overlap, as well as how previous read cycles affect the upcoming cycles.**3** shows the most recent read cycle.
4. Shows the previous read cycle.
5. Shows the read cycle before that.
6. Shows the oldest read cycle that fits on the screen depending on what Number of Cycles is set to.
    1) The most recent read cycle scope trace comes in at the bottom right. At each trigger, that trace is moved up and to the left.
    2) This view allows the user to see read cycles over time. It allows the user to see if they are in pipelining mode.
    3) It also allows the user to see Trigger Overruns, Processing Overruns, and Stalls.
    4) The image below shows an extremely well-optimized System capable, in this case, of running at 50 Reads Per Second, or 3,000 PPM.

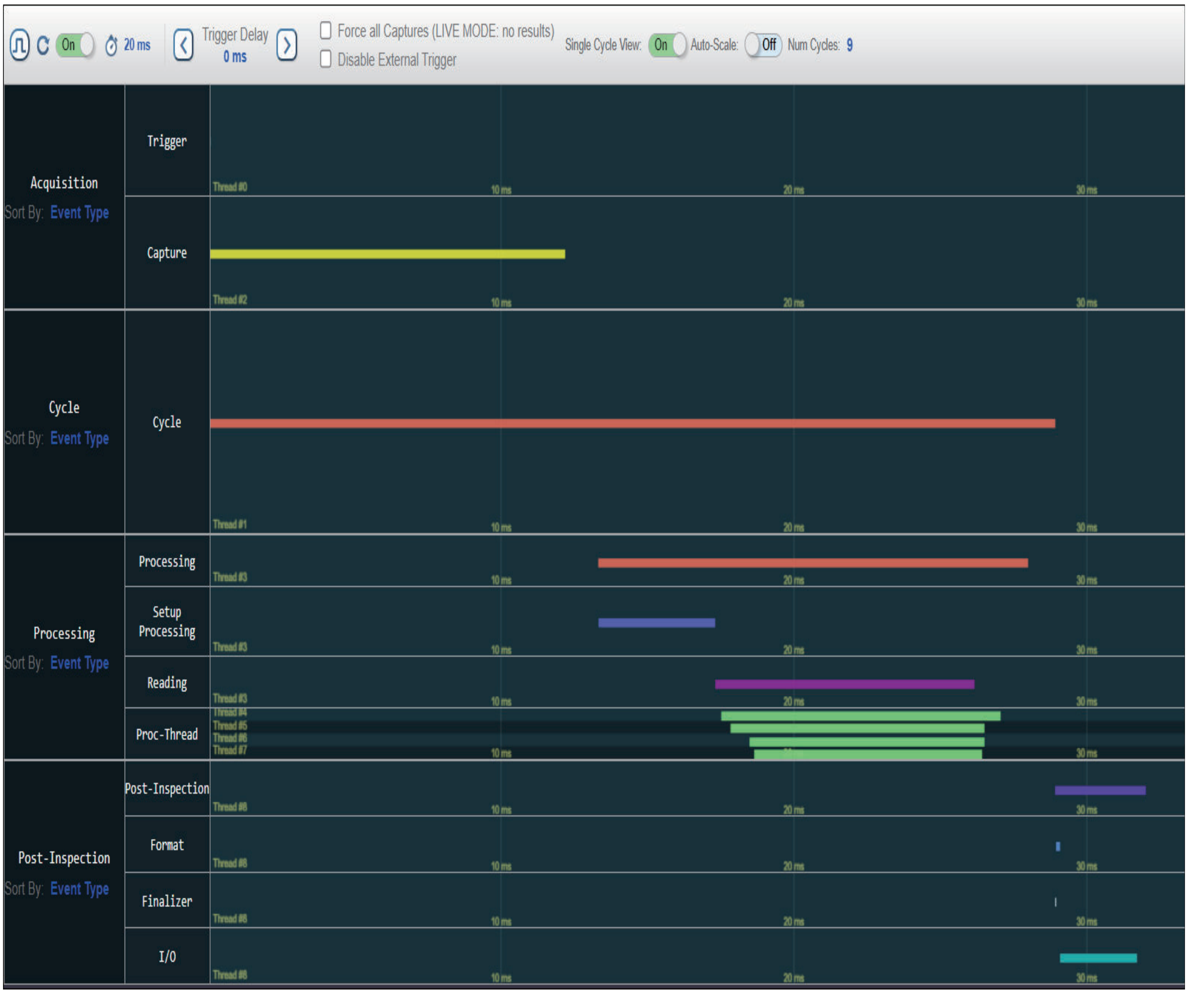


7. **Report –** This section shows the same report as the **Setup** and **Run** views.

6-5-4 Single Cycle View

The **Single Cycle View** only shows read cycle, but in much greater detail than the Multi-Cycle view. It does this by breaking all major events and processing threads up into their own lanes, giving the user a more an exact visualization of, and timing for each.

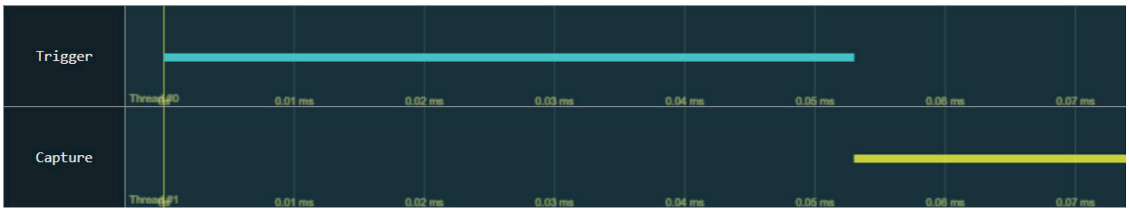
Note: The user can choose to sort by Event Type, which matches the Multi-Cycle View, or by Thread, which more clearly shows the order in which the process threads are created and run. The example below is sorted by Event Type.



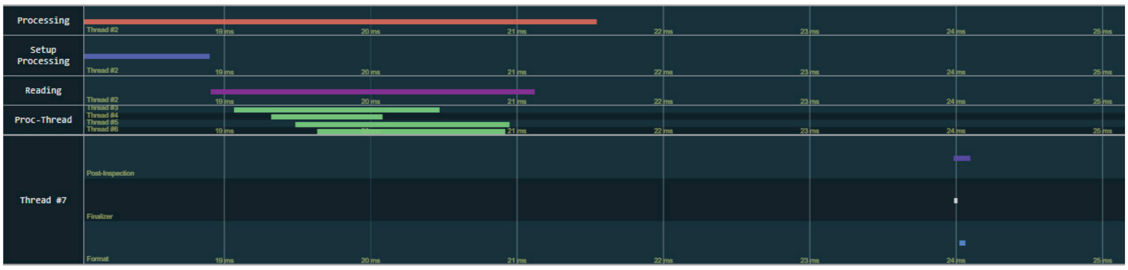
The second major benefit of this view is that the user can 1) turn off Auto Scale and then 2) Click on a signal and then use the mouse wheel to scroll down to an extremely small time base, essentially providing a "time zoom".

The user can also click on and then drag the whole time view left and right to see anywhere in the read cycle from trigger to answer.

Example 1: Here the user drags the view to the right to be able to see before start of the trigger. They then zoom with the mouse wheel to the point where it shows the actual trigger delay in microseconds before the capture starts.



Example 2: Here the user can see the end of the cycle in detail showing that the time between when processing ends and when the result is packaged and sent is approximately 2.5 msec.

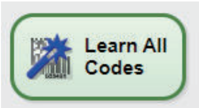


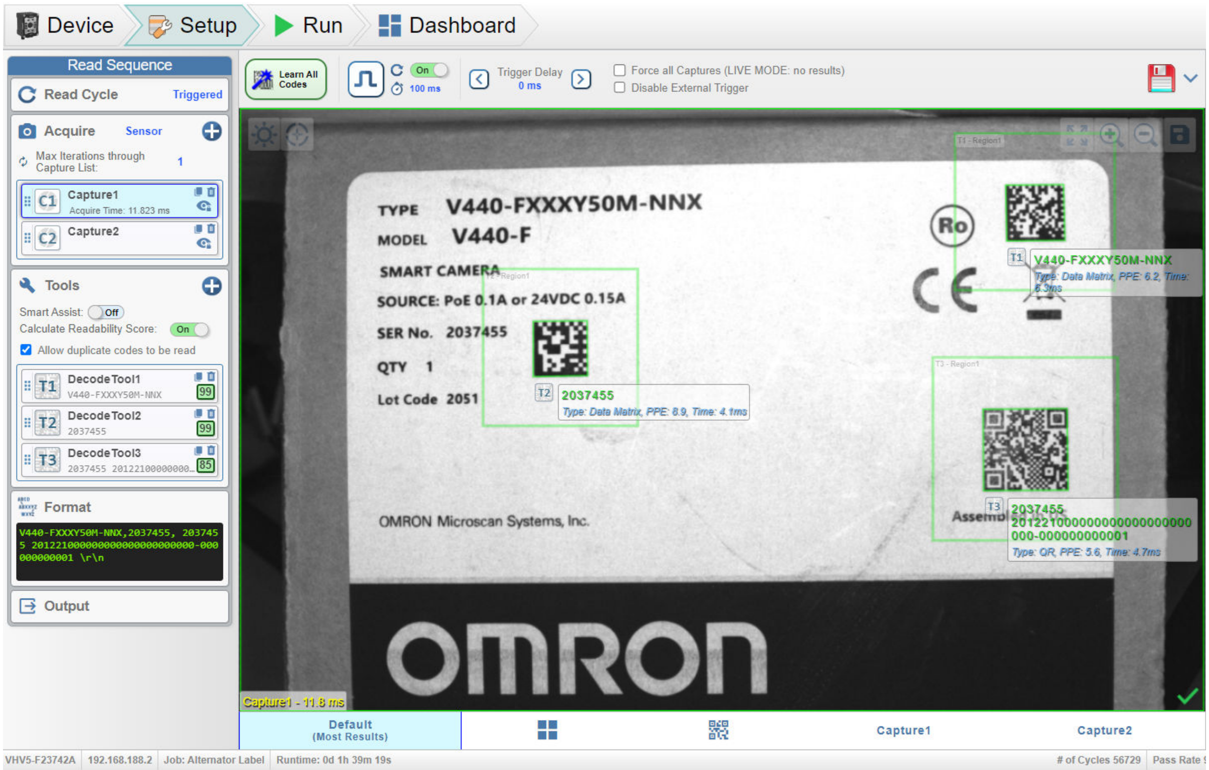
6-5-5 Digital Softscope Signals

Item	Description/Content
Trigger	Actual Trigger event that starts a read cycle.
Capture	Time for exposure and read out of each image, as well as any additional time necessary to set up capture such as sensor, focus and lighting changes.
TrigOverrun	Represented by an X. Occurs when a new trigger is sent while the system is still taking the current set of images. This error that indicates that results will no longer be synchronized with the triggers coming in.
ProcOverrun	Represented by an X. Occurs when images are being acquired faster than processing can keep up with them. If the image buffer is exhausted, new images will be thrown away. This error that indicates that results will no longer be synchronized with the triggers coming in.
Cycle	No Signal
Processing	Processing runs the following routines.
Setup Processing	Prepares the X-Mode Decoder to run.
Preprocess	Performs an image pre-processing set up for each ROI prior to running X-Mode Decoder.
Reading	Parent process for decoding that runs multiple instances of X-Mode in all of the ROIs.
Read Thread	Actual X-Mode decoder running on a region by region basis.
Post Inspection (Report, Format, Finalizer)	During Post Inspection, the report data is compiled, formatted and transmitted in the these three sub-steps.
I/O	Time reflecting both the Pulse On Time and then Pulse Off Time of the digital outputs. Outputs are set as last step in read cycle.
Timeout	Represented by an X. Occurs if Read Cycle is not complete before reaching the user-defined maximum allotted time for the cycle.
Stall	This line shows when current read cycle has to Stall, or wait, for the previous read cycle to be complete and send out its result before allowing the current one to send out its data. The Stall function assures that the order of results coming out of the reader follows the order of the triggers.

6-6 Advanced Functions and Operations

6-6-1 Learn All Codes



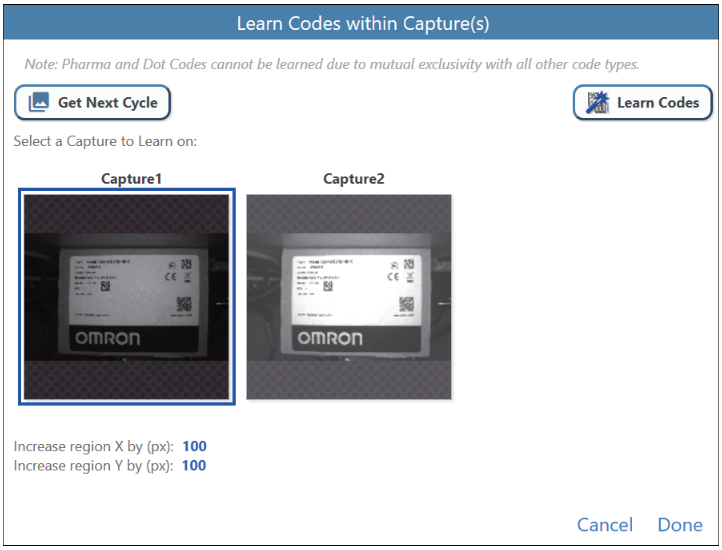


Learn All Codes simplifies the process of creating the Job by adding all necessary Decode Tools for the user. The Learn function searches in a Capture with Smart Assist to find all the codes that are present. Once done, Learn automatically adds a Decode Tool to the Tool list for each of the codes that it finds.

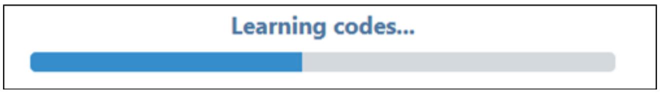
Learn also sets key parameters of the Decode Tool, such as the Code Type that is found. Learn also creates a ROI (region of interest) that will used to search for the code during runtime. The ROI is positioned at the center of the learned code. The ROI is sized with a margin around the code large enough to accommodate any positional uncertainty of the code as it runs. The size of the margin is a user setting.

Operation

1. Set up Capture or Captures.
   1) Start by setting up the Capture (or Captures) to obtain a good image of the part and code.
   2) If the job is being programmed on a moving line, set up the trigger so the part is centered in the image when triggered.
2. Click Learn All Codes.
   1) This will bring up the Learn Codes dialog.
   2) The dialog shows various controls, as well as the Captures from the most recent read cycle.
   3) Capture 1 will be outlined in blue.
3. Get Next Cycle Button
   1) If the Captures that are displayed are not high-quality, the user can click on this button to acquire a new set.
   2) If the Job type is Continuous for Presentation,the system will acquire a new set of Captures immediately.
   3) If the Read Cycle is triggered, and external triggers are enabled, the reader will wait for the next trigger to acquire a fresh set of images of the part. The dialog will give the user the option to Force the Trigger.

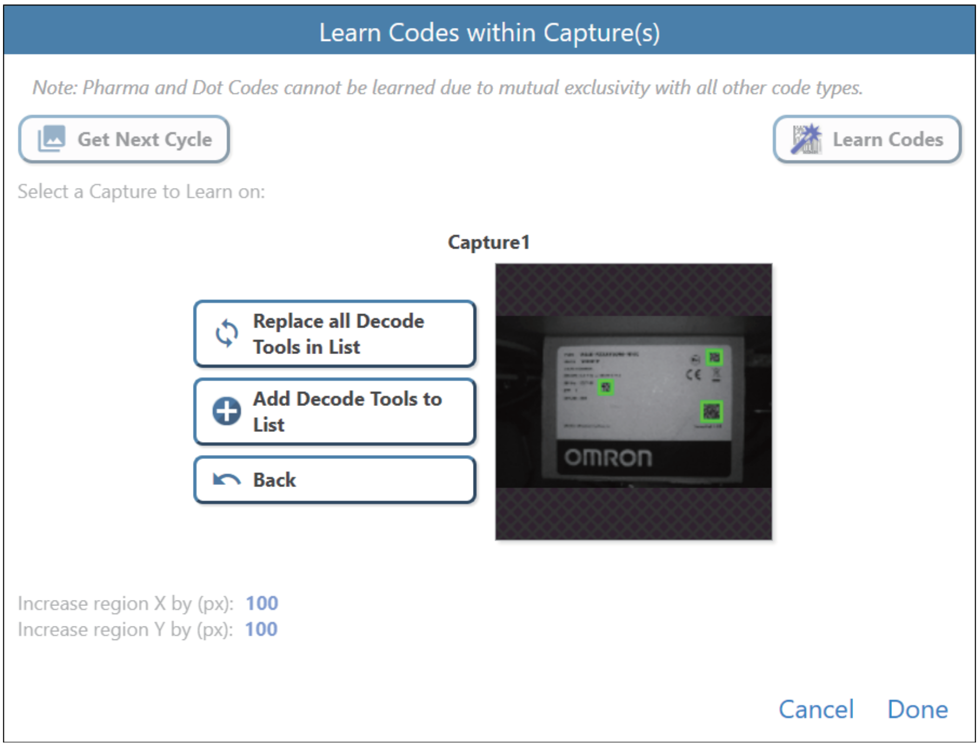


4. Learn Codes
   1) With a good set of Captures, the user can proceed to Learn Codes, which will automatically add all the Decode Tools to the Job.
   2) Set the amount of positional uncertainty expected in the part as it runs on the line. By default, the system will set the size of the ROI with a 100 pixel search buffer around the part.
   3) Click the Capture to Learn in. It will be outlined in blue. This example shows Capture 1 is selected.
   4) Finally, click the Learn Codes button. The following progress bar will appear.



5) The system Learns by running a full image X-Mode with Smart Assist turned on in that capture. Smart Assist assures that it finds all readable codes.

6) When Learn is performed for that Capture, the dialog displays the following:



5. Replace or Add Decode Tools to the Job.

1) The display shows all the codes that have been found on the part outlined in green.

2) The user is given the choice to Replace all Decode Tools in the Jobs tool list. This is the normally the best action. The system will delete all current Decode Tools and add new ones specifically set to read these codes in these positions.

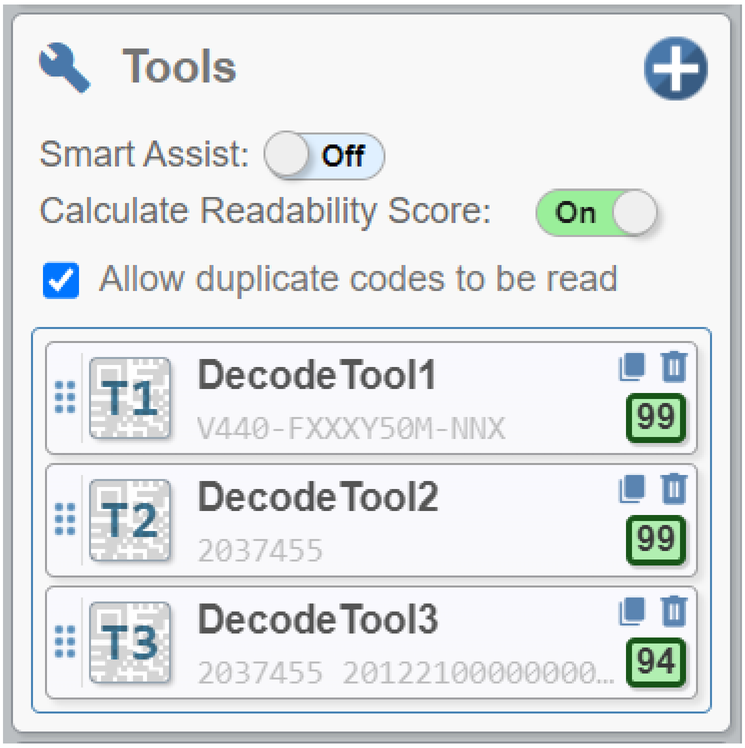
3) If there are codes in other Captures that have not been found in Capture 1, the user can click Back, Select a different Capture, and then click Learn Codes again.

4) The display will show all the new codes the system has found. Now the user can select Add Decode Tools to List to add these additional Decode Tools to the Job.

5) After all codes are Learned and added to the list, click Done to exit.

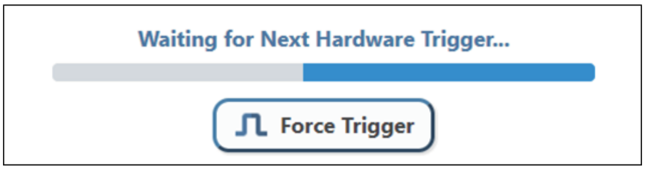
6) The job will reflect the added Decode Tools.

7) The user can trigger the job in Setup mode and see the tools run.



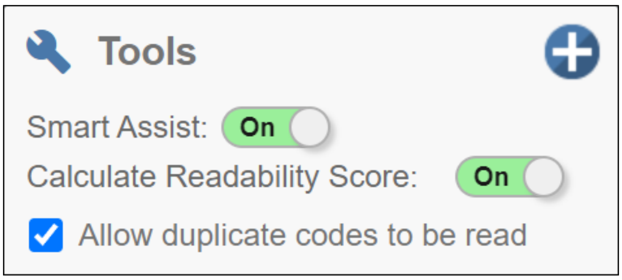
Notes:

1. If the job is Triggered, the progress bar will show an additional control allowing the user to Force a Trigger rather than wait for the external trigger.



2. The user can always add or delete additional Decode Tools from the job by clicking on the **+** icon or the trash can icon.

6-6-2 Smart Assist



Smart Assist and Optimize are designed to improve read rates for very difficult-to-read codes. Smart Assist is the simplest method to implement. It is the first step the user is advised to take when encountering difficulty in code reading. Smart Assist is enabled with a single-parameter setting in the Tools menu. The setting is global, and applies to all Decode Tools within the Job.

The key advantage of Smart Assist is that it automatically delivers all the functionality of the extremely complex and difficult-to-set-up Configuration Database models implemented by others.

When Smart Assist is on, it will automatically and intelligently apply a series of Advanced X-Mode Decoding and Image Preprocessing methods on an as-needed basis to assure successful decoding.

Smart Assist will do this for all Captures in the Read Cycle. The advantage here is that each capture can be set with different Exposure, Gain, Focus, and Light settings, which are already designed to give the algorithm the best chance to read the code by providing optimal images. Smart Assist along with each Capture becomes the equivalent of 24, then 48, then 72 … entries in the traditional Configuration Database.

Operation

1. When Smart Assist is turned on, X-Mode will process normally until it encounters a difficulty.
2. At that time, X-Mode will begin to employ extended processing techniques such as Damaged Mode, Curved Mode etc. to try to decode within that image.
3. If it exhausts these techniques, X-Mode will begin to preprocess the images, changing contrast using Gain, size using Scale, and shape (or fill) of the code bars or cells using Morphology.
4. For each new enhanced image combination it will again try X-Mode normally, and then with the extended techniques.
5. Each additional processing operation is performed only when the previous steps fail to produce a decode.

The clear advantage of Smart Assist is that it is able to decode very low-quality or problematic codes simply by applying a single parameter setting. There is no need for the user to become an expert on advanced parameter settings and complicated image preprocessing techniques.

The main disadvantage is that decode times can vary from very fast when no extraordinary processing is required, to quite slow when every available advanced technique and image preprocessing step must be used to finally decode. When cycle time is not an issue, Smart Assist is the best answer. If time is an issue, then Optimize may be the better answer.

Key Point: If decoding problems that require Smart Assist occur frequently , the user should first review the lens, lighting, and mounting to see if a much better class of images can be produced by altering the basic physical setup. Often, just changing the angle that the camera is mounted relative to the part face is all that may be required. See **Mounting the Camera** in the setup section.

The following table lists the Advanced Parameters and Image preprocessing operations Smart Assist uses.

Parameter	Definition
Damaged Mode	It tries to shift the grid map to reduce error for better readability. It has a low impact on the decode time. Useful for bad cell registration, or aspect distorted.
Curved Mode	This enables the curve detection for Data Matrix and QR on bottles or cylinders. If enough curvature detected, it will adjust the grids accordingly. It has a medium impact on the decode time.
Alignment Pattern Mode	Use alignment patterns (internal Ls and clocks) to re-align the grids before decoding a Data Matrix. It has a medium impact on the decode time

Parameter	Definition
Scale Up	Scale up the image by 2x (4x by area).
Scale Down	Scale down the image to ¼ and 1/16 if necessary for decoding
Apply Morphology	Apply morphology dilation and try decode, if not decoding, then apply erosion and try to decode

6-6-3 Optimize

Optimize is an advanced tool that works similar to Smart Assist and is used for decoding problem images.

Unlike Smart Assist, which takes a generalized approach, Optimize is designed to find the optimum set of parameters and image preprocessing that reliably decodes a specific problem image set. This allows Optimize to run much faster and with more consistent processing times than Smart Assist, but with the same high success rate. Optimize prioritizes read success, but when given two settings with the same success rate, it will chose based on which set decodes faster.

The other Key Difference between Smart Assist and Optimize is that Smart Assist is a global setting for all Decode Tools, whereas Optimize is set up per ROI in a single Decode Tool.

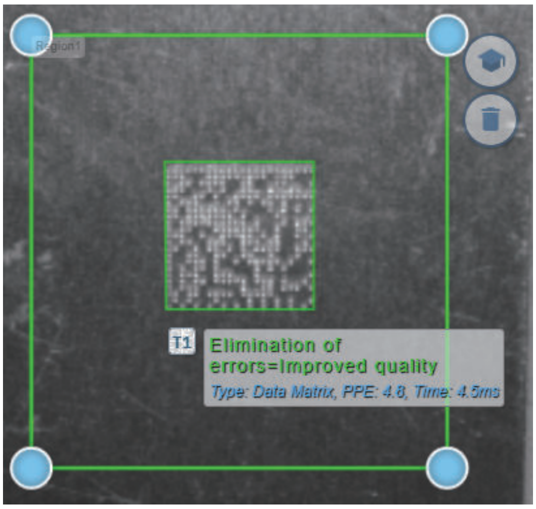
Within a decode tool, the user is able set up multiple ROIs to attempt to get a good read. Each ROI can be set up with a unique image preprocessing set chosen by the operator by using Optimize. If the code is not read in the first ROIs, the algorithm will keep trying the other ROIs until it does, or until it runs out of ROIs and Captures in which case the Decode Tool is marked as a No Read.

Key Point: Smart Assist can be used at the same time as Optimize. The Image Preprocessing from Optimize will be done first. The Advanced Parameters such as Damaged and Curved mode next, and then only as a very last step would it resort to more image preprocessing.

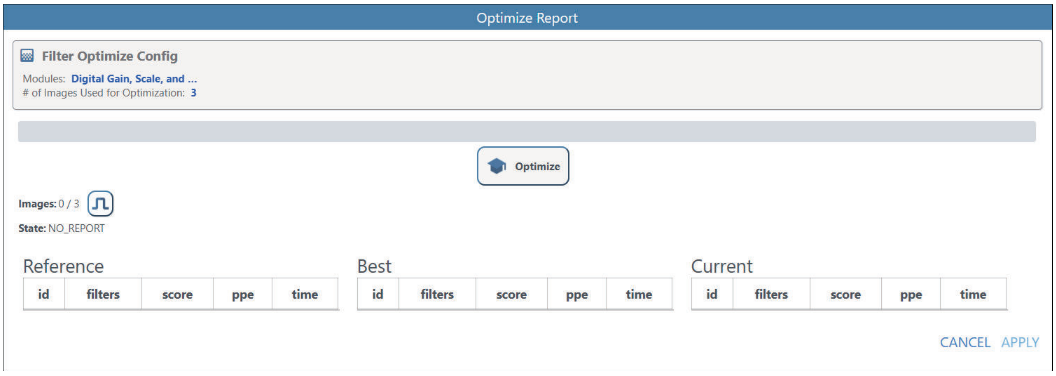
Note: Optimize does not stop read cycle. It will take next image (images) from read cycle and feed it to the Optimize routine running its own instance of X-Mode. Optimize will run in the background until complete. The Operator will allow or disallow Optimize to set parameters in the current job. Similar to inline parameter changes, the job will continue running but with new optimized settings.

Operation

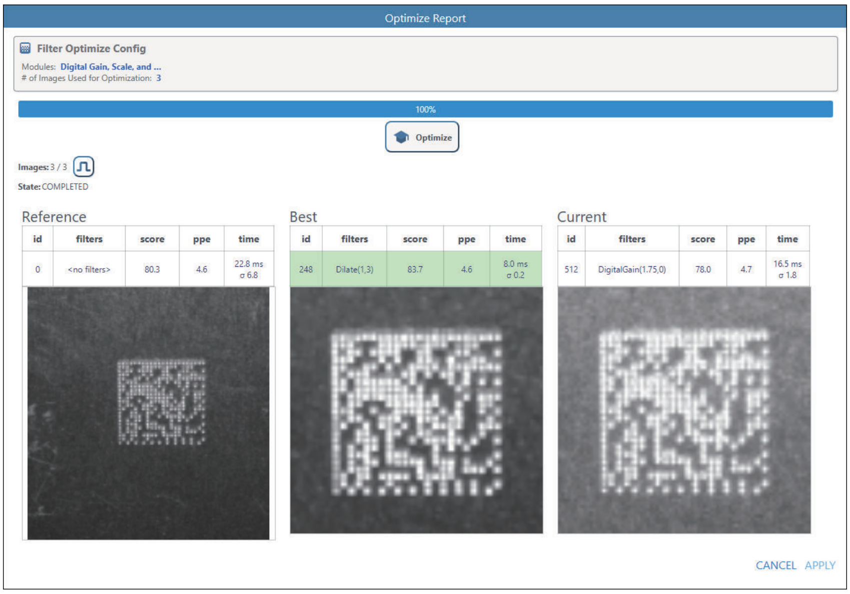
1. Set up a ROI to limit the area the Decode Tool will run in.
2. Run the system to ensure that the ROI is large enough account for the variation in code position
3. Click on the ROI, and then click on the Train hat icon in the upper right.



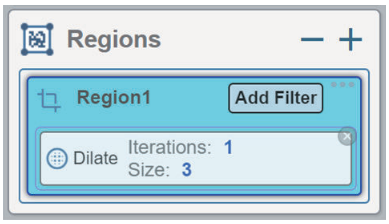
4. This opens up the Optimize Dialog.
5. Choose the Number (#) of images to be used for Optimization. **Key Point:** Optimize can be set up to run on 3 – 10 images. The optimization settings it chooses are the best settings for read success and low decode times based on an average of all images that are included. This takes naturally takes into account part to part marking differences, as well as differences in light return normally seen as the part moves around in the field of view.



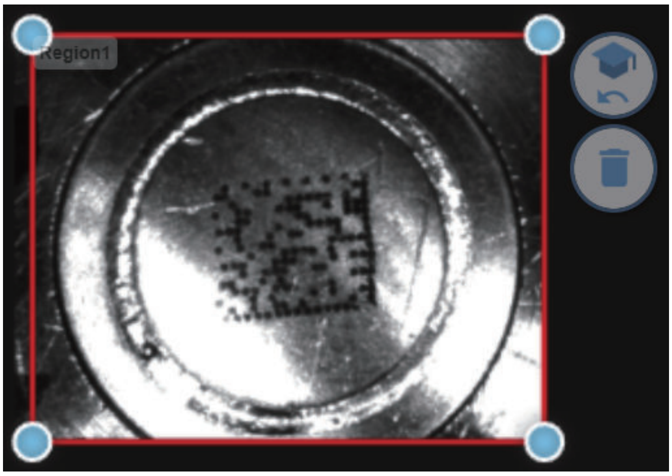
6. With triggers running, the user clicks the Optimize button.
7. The system will acquire the next # captures and then begin the Optimize routine. If trigger are not on, the user can click on the trigger button in the dialog to get the images.
8. Optimize uses “Readability Score” and “Decode Time” to determine the best settings.
   1) It first does a decode with no image preprocessing and shows that image and Readability Score and Decode Time under **Reference**.
   2) As it cycles through the various combinations of Gain, Scale and Morphology, it shows that image, score and time under **Current**.
   3) It compares and then keeps track of the best parameter set, displaying it under Best.



9. Once Optimize has completed, it will ask the user if they want to apply these settings. If yes, Optimize sets these parameters into the ROI.
10. Optimize sets up Filtering.
11. Optimize also sets the Minimum Edge Threshold to 60% of the gradient (edge strength) of the code.This helps the algorithm run quickly, allowing it to ignore low-contrast edges in the image that are not part of the code. This threshold is set based on the lowest-contrast image used during Optimization.
12. **Key Point**: Optimize sets the Minimum Edge Threshold higher than the normal decoder default, which can find codes with as little as 5% contrast between the code and the background. Optimize will set Min Edge Threshold at 60% of the edge strength of the lowest-contrast code in the optimized image set. This high-threshold value can keep it from finding codes that don't have the same high contrast as the optimized codes. If the user experiences No Reads after Optimize, please check by lowering this parameter until the lowest expected contrast codes are read reliably. (Alternately, make sure that the image set used for Optimization includes low contrast codes).



13. Finally, if the user wishes to disable Optimization, they Untrain the ROI by clicking again on the Train hat icon with Undo indicator.

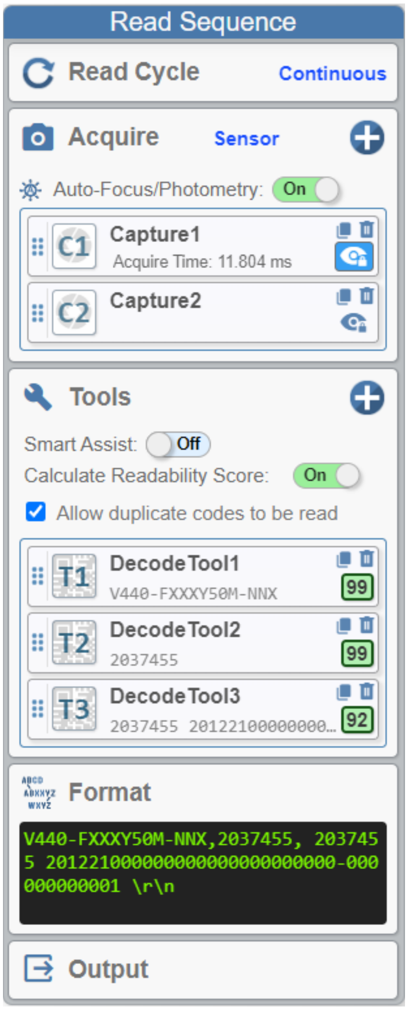

Region1

7

Read Sequence Dialog

7-2 Overview

The reader runs read cycles. The Read Cycle is based on the Job Type. There are four Read Cycles, or Job types: Triggered, Continuous, Presentation Mode (Supermarket Mode), and Start / Stop. The Read Cycle runs through a sequence of steps, starting with some sort of trigger event, and ending by transmitting data out of the device. See the Theory of Operation section for specific definitions of the cycle type, as well as how the Read Cycle operates.
The Read Sequence dialog shows the sequence of steps the reader executes as it runs each cycle. The main steps, or controlling functions, within the Read Sequence are:



Read Cycle Step – This step controls how the Read Cycle operates from Trigger to Answer.

Acquire Step – This step is used to setup and control the acquisition of all the Captures that will be used for reading.

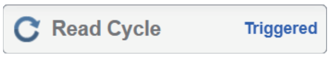
Tools Step – This step is used to set up and run all the Decode Tools that will run and do the actual reading within all the Captures.

Format Output Step – This step manages the data coming back from all the decode tools, and is used format the final reader output string.

7-3 Read Cycle Step

7-3-1 Overview

Read Cycle is the first step in the Read Sequence. This step controls how the Read Cycle operates from Trigger to Answer.



The Read Cycle step exposes one parameter, the Read Cycle Type. This can be changed by the user during setup for testing purposes, but it is recommended that the job be created with the desired Read Cycle type when user “Creates New Job”.

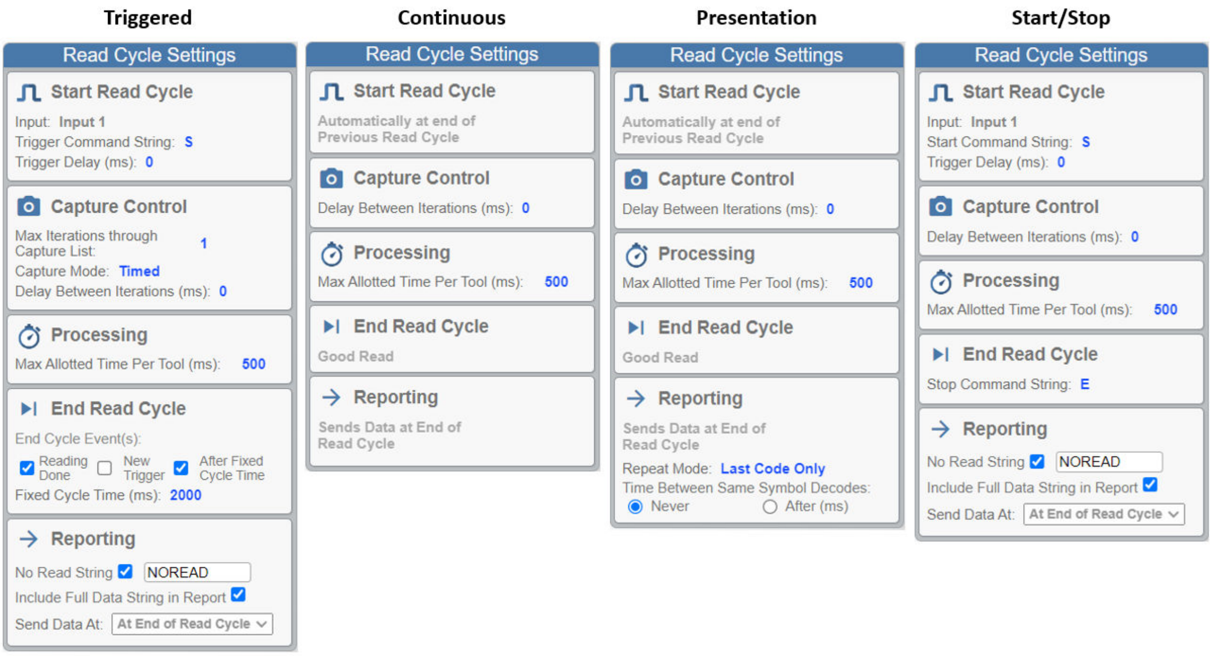
Clicking on the Read Cycle will highlight the step in light blue and will open up the specific Read Cycle Settings dialog in the right hand pane for that read cycle mode. The settings dialog allows the user to change parameters within the five read cycle control sections.

7-4 Read Cycle Settings Dialogs

7-4-1 Overview

When the user clicks on the Read Cycle step on the left side of the UI, the Read Cycle Settings Dialog appears on the right allowing the user to tailor how the read cycle will run.

Below are the four variations of the Read Cycle Settings dialog for the four different read cycle types.The default settings can be used as-is for most applications.



Individual parameter settings for each read cycle type vary, but the control sections are the same for all. **The control sections mimic the flow of operation of the read cycle.** They start at the top of the dialog with the event that Starts the Read Cycle, and conclude at the bottom with the event that Ends the Read Cycle and directions on how and when to report the read cycle data.

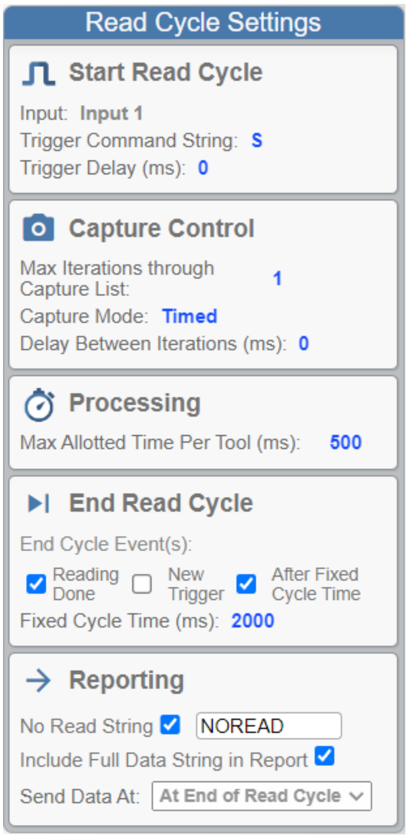
The control sections following the flow of Read Cycle operation are:

1. Start Read Cycle
2. Capture Control
3. Processing
4. End Read Cycle
5. Reporting

7-4-2 Triggered Read Cycle Dialog

Overview

The Triggered read cycle is the most complex. It will be explained in detail here. The following sections for the Continuous, Presentation and Start/Stop read cycle types should be read after reading this section. The read cycle operational flow sections are **Start Read Cycle**, **Capture Control**, **Processing**, **End Read Cycle**, and **Reporting**.



Triggered is the most common Read Cycle type. Here, the system receives a specific trigger indicating the part is in front of the reader. The trigger starts the Read Cycle. Within the read cycle, the reader acquires a fixed set of images, and attempts to read within those images. The read cycle ends either when it has read, or when it runs out of images and still fails to decode. The next read cycle starts when a new trigger is received.

Start Read Cycle

This section allows user to set up how the read cycle will be started or triggered.

Physical Trigger – The cycle can be started with a physical trigger on Input 1.

Start Command String – The cycle can be started with a serial trigger through RS-232 or TCP/IP socket. This is either a character or a string defined by the user.

PLC Trigger – It can always be started via PLC command if the Protocol is active.

Trigger Delay (msec) is used to hold off acquisition for a fixed time after the trigger is received. This allows the user to programmatically align the part in the field of view without having to go onto the line and change the physical trigger location.

Capture Control

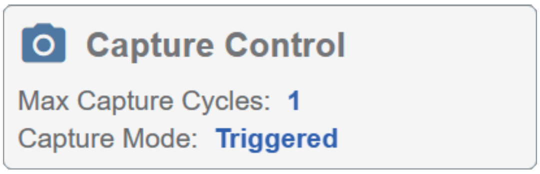
With the read cycle started, this section gives the user detailed control over the image Capture sequence within the Acquire step.

Max Iterations through Capture List – When Iterations is set to one, the system will acquire each image in the Capture List just one time in an attempt to decode. If the codes are not found within those images, then read cycle will fail. When Iterations is set above one, the system will acquire all images in the Capture List over and over until all codes are found, or until reaching the maximum iterations. A good application example for multiple iterations would be waiting for an unknown height part pass in front of a camera. Here, all captures can be set to different focus distances, and the system will cycle through these focus distances over and over while waiting for the part.

Capture Mode (Timed) and Delay Between Iterations (Of the Capture List) – The delay refers to a delay inserted between full iterations, or times to cycle through the Capture List. The main purpose of this is to allow system processing to keep pace with the flood of image that would come in if this value was set to 0.

Note: There is no delay inserted between individual captures in the list. These images are taken back to back.

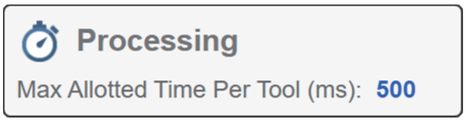
Capture Mode (Triggered) – When this mode is set to Triggered, the system will start the Read Cycle on the first trigger. Each subsequent Iteration through the capture list is started with a secondary trigger. It is a requirement in this mode that the number of triggers sent to the reader equals the number of Iterations, or the reader and controlling system will get out of sync.



Processing

Once the flow of Captured images start, decoding starts. This section gives the user control over X-Mode decode tool processing. The single parameter is:

Max Allotted Time Per Tool (msec) – This parameter sets the maximum amount of time that any instance of the X-Mode decoder will be allowed to run. If X-Mode has not decoded within this amount of time, that X-Mode processing thread will be shut down. This parameter is useful for performance optimization. A good example would be the case of looking at Captures set to different focus heights. If it is known that the target code can be read easily within 20 msec in a focused image, but takes up to 50 msec to fail in an unfocused image, the max time could be set to 25 msec so the system does not waste processing time.



End Read Cycle

This section is used to determine when and for what reason the read cycle ends.

There are three main options. They can be chosen separately or in combination.

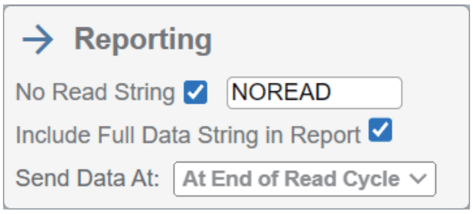
Reading Done – The read cycle will end when all X-Mode processing has completed. It is not required that all X-Modes have found a code, just that they have processed through the entire set of available Captures and conclude with either a Read or a No Read.

New Trigger – The read cycle will end if a new trigger comes in while the current read cycle is still active. The current read cycle will fail, passing on whatever partial result it has in the read cycle report. This mode is useful to prevent the line from falling behind the triggers that are coming in.

After Fixed Cycle Time/Fixed Cycle Time (msec) – These parameters set a fixed time after having received the trigger that the read cycle has to end. It can be used to stop the cycle early. If any processing is still running this will shut it down and the report will be sent. This parameter can also be used to extend the read cycle. If processing is done, but the PLC or other host expects the result at a fixed time after the trigger, this parameter will hold off sending the data until the exact Fixed Cycle Time.

Reporting

This section is used to how the output string is composed, if it should be sent, and when to send it.



No Read String – If checked, the text from the No Read String text box will be used as the string content for any Decode Tools that have failed.

Include Full Data String in Report – By default, the final output string is transmitted out all TCP/IP and RS-232 ports that are enabled When this option is unchecked, the string is not sent.

Note1: This setting does not affect PLC based communication. The output string is always set into the PLC Input Assembly.

Note2: This setting also does not affect Digital Outputs. The outputs will always be set at the end of the Read Cycle reflecting read cycle status.

Send Data At – This controls when the read data is sent.
- **At End of the Read Cycle –** This is the default behavior. The data string is sent at the end of the read cycle. The end of the read cycle is set as when Reading is Done, or when a New Trigger is issued, or After Fixed Cycle Time.
- **As Data is Decoded –** This option is only relevant for the After Fixed Cycle Time option. If this is set, the reader will send the string data to the host immediately, but will not set Pass/Fail or End of Cycle digital outputs until the Fixed Cycle Time is complete.**Note:** This does not affect PLC communication. The PLC data is always set at the end of the read cycle.

7-4-3 Triggered Read Cycle Settings

Item	Setting value [Job Default]	Description
Start Read Cycle		
Input	**[Input 1 - Trigger]**	Digital Input 1 is the dedicated Trigger Input. The Start/Stop cycles starts when the Input is Activated.
Trigger Command String	Any String, **[S]**	Serial string used to Start the read cycle when commanded by RS-232 or Socket. Note: Non printable characters are not allowed, with the exception of space. Here, the user must type in an actual space with space bar. This will be displayed as <SP>.

Item	Setting value [Job Default]	Description
Trigger Delay (msec)	**[0]-1000**	Trigger Delay (msec) is used to hold off acquisition for a fixed time after the trigger is received. This allows the user to programmatically align the part in the field of view without having to go onto the line and change the physical trigger location.
Capture Control		
Max Iterations Through the Capture List	**[1]-N**	When Iterations is set to one, the system will acquire each image in the Capture List just one time in an attempt to decode. If the codes are not found within those images, then read cycle will fail. When Iterations is set greater than one, the system will acquire all images in the Capture List over and over until all codes are found, or until reaching the maximum number of iterations.
Capture Mode	**[Timed]**, Triggered	Timed – Inserts “Delay Between Iterations” between each cycle through the Capture List. The main purpose of this is to allow system processing to keep pace with the flood of image that would come in if this value was set to 0. Triggered - When this mode is set to Triggered, the system will start the Read Cycle on the first trigger. Each subsequent Iteration through the capture list is started with a secondary trigger. It is a requirement in this mode that the number of triggers sent to the reader equals the number of Iterations, or the reader and controlling system will get out of sync.
Delay Between Iterations (msec)	0-10000 **[0]**	Delay inserted between running iterations of the full image Capture List to allow processing to keep up with image acquisition. No delay is inserted between individual Captures within the list. They run back to back.
Processing		
Processing – Max Allotted Time Per Tool (msec)	0-10,000 **[500]**	This parameter sets the maximum amount of time that any instance of the X-Mode decoder will be allowed to run. If X-Mode has not decoded within this amount of time, that X-Mode processing thread will be shut down.
End Read Cycle		
Reading Done	Unchecked, **[Checked]**	The read cycle will end when all X-Mode processing has completed. It is not required that all X-Modes have found a code, just that they have processed through the entire set of available Captures and conclude with either a Read or a No Read.
New Trigger	**[Unchecked],** Checked	The read cycle will end if a new trigger comes in while the current read cycle is still active. The current read cycle will fail, passing on whatever partial result it has in the read cycle report. This mode is useful to prevent the line from falling behind the triggers that are coming in.

Item	Setting value [Job Default]	Description
After Fixed Cycle Time	Unchecked, **[Checked]**	This parameter sets a fixed time after having received the trigger that the read cycle has to end. It can be used to stop the cycle early. If any processing is still running this will shut it down and the report will be sent. This parameter can also be used to extend the read cycle. If processing is done, but the PLC or other host expects the result at a fixed time after the trigger, this parameter will hold off sending the data until the exact Fixed Cycle Time
Fixed Cycle Time (msec)	0-60,000 **[2000]**	Fixed amount of time to end the Read Cycle and send the report data
Reporting		
No Read String	Unchecked,**[Checked]** and string to send **[NOREAD]**	Controls what is output for Decode Tools that fail to Read. By default the string is set to NOREAD.
Include Full Data String In Report	Unchecked, **[Checked]**	By default, the final output string is transmitted out all TCP/IP and RS-232 ports that are enabled When this option is unchecked, the string is not sent. Note1: This setting does not affect PLC based communication. The output string is always set into the PLC Input Assembly at the end of each Read Cycle. Note2: This setting also does not affect Digital Outputs. The digital outputs will always be set at the end of the Read Cycle to reflect the current read cycle status.
Send Data At	**[At End of Read Cycle]**, As Data is Decoded	Determines timing for sending out Format Output string from Read Cycle. Either it sends it out at the end of the cycle, or it sends it out as soon as all Decode Tools Qualify.

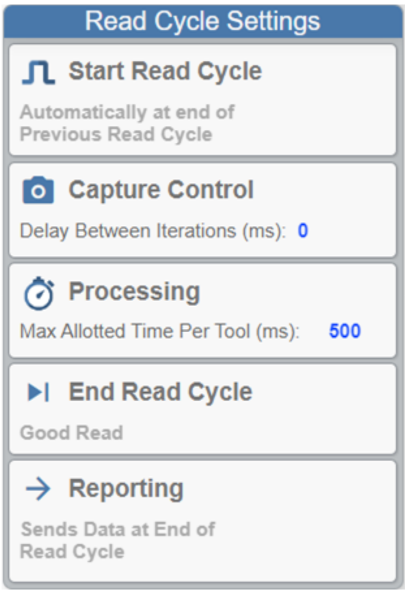
7-4-4 Continuous and Presentation Read Cycle Dialogs

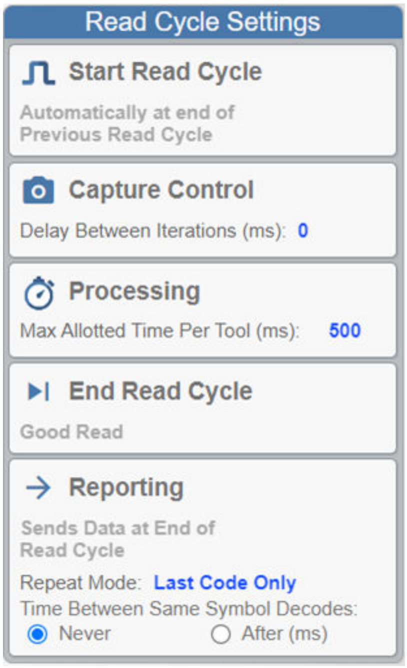
Overview

For Continuous mode, the reader starts acquiring images automatically upon entering Run Mode and attempts to read within those images. The reader will continue indefinitely to acquire and process until a part enters the field of view and the codes on that part are read. **Only a successful read will end the Continuous read cycle.** At the end of the Read Cycle, the read data is output, and then the next read cycle is started automatically, again waiting for a part to pass in front of the reader and be read.

Note: Continuous will read the same codes over and over in this mode until the part is moved out of the field of view.

The Continuous and Presentation Mode read cycles are exactly the same except for one important difference: In Presentation mode, after Reporting, the cycle will pause for a set time before restarting the next read cycle. This is to keep the reader from outputting the string data for the same code multiple times.Presentation mode is sometimes called Supermarket mode. It works like retail scanners, where a delay is inserted after the decode to allow the part to move out of the field of view so the same product won't be scanned multiple times.





Start Read Cycle

Both modes start the first read cycle automatically when the job is loaded, and the restart the next read cycle after all Decode Tools have completed successfully. The read cycle will not end until it has Good Reads for all Decode Tools.

Capture Control

This mode can work with one or multiple Captures in the Acquire Step. The full set of Captures are set up to be able to find the code in all situations, such as at different focus distances the part might be at, at different brightness levels, or even with different lighting.

Delay Between Iterations (of the Capture List) – The reader will cycle through the full Capture List over and over indefinitely until all codes are found. The user normally inserts this delay to allow system processing to keep pace with the flood of image that would come in if this value was set to 0.

Processing

Once the flow of Captured images start, decoding starts. This section gives the user control over X-Mode decode tool processing. The single parameter is:

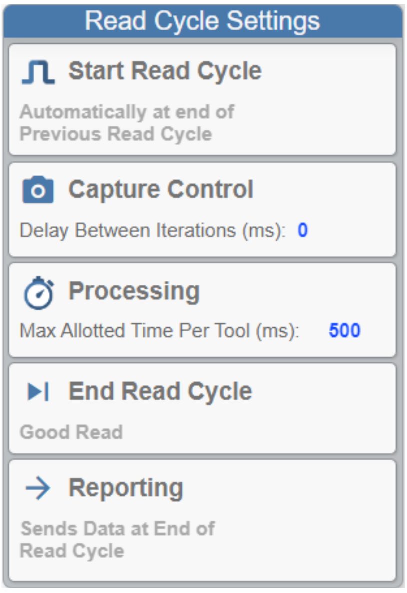
Max Allotted Time Per Tool (msec) – This parameter sets the maximum amount of time that any instance of the X-Mode decoder will be allowed to run. If X-Mode has not decoded within this amount of time, that X-Mode processing thread will be shut down. This parameter is useful for performance optimization. A good example would be the case of looking at Captures set to different focus heights. If it is known that the target code can be read easily within 20 msec in a focused image, but takes up to 50 msec to fail in an unfocused image, the max time could be set by the user to 25 msec so the system does not waste processing time trying to decode within an image that does not have good focus.

End Read Cycle, Reporting, Repeat Reads, and Read Cycle Restart

Continuous Mode is ideal for applications requiring constant and uninterrupted non-triggered code reading, providing robust and reliable performance in dynamic operational environments.

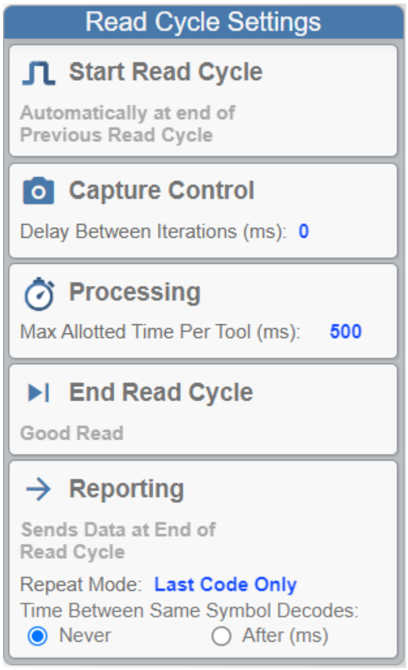
● Continuous Mode

1. In Continuous Mode, the Read Cycle ends on a **Good Read**, meaning that all Decode Tools have fully qualified.
   Note: A single Continuous Read Cycle will continue to run indefinitely until a part comes in front of the camera and there is a successful read.
2. The Report is sent out immediately at the end of the Read Cycle, and the next Read Cycle starts automatically.
3. If the same code or codes are still in the field of view, they will be read and output again.



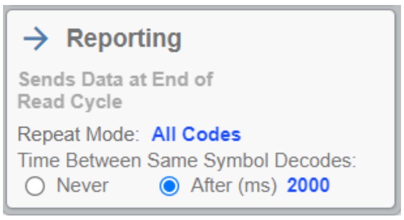
● Presentation Mode

Presentation Mode shares several characteristics with Continuous Mode but includes distinct features specifically designed to manage the repeat reading of the same codes more effectively.



1. **Cycle Completion:** Similar to Continuous Mode, the Read Cycle in Presentation Mode concludes with a Good Read, indicating that all Decode Tools have successfully found, read and qualified their target barcode.
2. **Immediate Reporting and Cycle Continuation:** The output Reports is generated and sent out immediately at the end of each Read Cycle. Following this, the next Read Cycle starts automatically, ensuring a seamless flow of operations.
3. **Handling Repeat Reads:** The primary distinction between Continuous and Presentation Mode lies in their approach to managing repeat reads. Presentation Mode allows configuration settings that prevent the system from repeatedly reading the same code. This feature is particularly useful in environments where repeat reads can cause redundant information to be output.
4. **Configuring Repeat Read Behaviour –** Two settings are used for preventing repeat reads of the same codes, either too soon, or at all.

    1) **Repeat Mode**: Users can select between "Last Code Only" and "All Codes". "Last Code Only" applies repeat read logic solely to the most recently read code, whereas "All Codes" extends this logic to every code read since the start of the job.

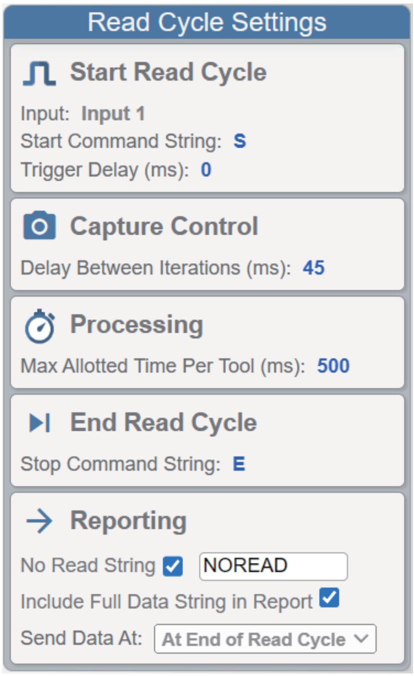
    2) **Time Between Same Symbol Decodes**: This parameter can be set to "Never" or a specified number of milliseconds. If set to "Never", the reader will ignore any code that matches a previously read code, continuously seeking a new, unique code. If a time interval is set (default is 2 seconds), the reader will not output the same code unless the specified duration has elapsed, allowing time-controlled repeat reads.

7-4-5 Continuous and Presentation Read Cycle Settings

Item	Setting value [Job Default]	Description
Start Read Cycle		
Automatically at end of previous Read Cycle	Default. No other choice.	Continuous and Presentation Read Cycles start automatically when job is loaded, and restart automatically at the end of the read cycle.
Capture Control		
Delay Between Iterations (msec)	0-10,000 **[0]**	Delay inserted between running iterations of the full image Capture List to allow processing to keep up with image acquisition. No delay is inserted between individual Captures within the list. They run back to back.
Processing		
Max Allotted Time Per Tool (msec)	0-10,000 **[500]**	This parameter sets the maximum amount of time that any instance of the X-Mode decoder will be allowed to run. If X-Mode has not decoded within this amount of time, that X-Mode processing thread will be shut down.
End Read Cycle		
Good Read	Default. No other choice.	Continuous and Presentation Read Cycles will run indefinitely until they get a good read (all decode tools qualify)
Reporting		
Send Data at End of Read Cycle	Default. No other choice.	The report containing read string data, as well as setting of Digital Output and communication to PLC is done as last step at end of read cycle.
Repeat Mode (Presentation Cycle Only)	[Last Code Only], All Codes	Apply no-repeat read logic to just the previous code read, or to all codes that have been read since the job was started.
Time Between Same Symbol Decodes (msec)	Never 0-1,000,000,000 msec **[2000]**	**Presentation Mode Only** – Time delay before restarting next cycle to allow previous part to clear the field of view. This prevents duplicate reading of the same code. This value is set to 2 seconds by default

7-4-6 Start / Stop Mode Read Cycle Dialog

Start/Stop Mode is the final read cycle type. It is a combination of Triggered and Continuous mode. Please read these sections first for a more complete understanding.



As in Triggered mode, the Read Cycle is started with a Trigger Signal. As in Continuous mode, within the read cycle, the reader acquires images continuously and attempts to decode while the trigger is held on. If it decodes successfully, it sends the data out immediately (or after the Stop signal, depending on user settings). The read cycle ends when the host sends the reader a Stop Trigger signal. It begins the next Read Cycle on the next Start Trigger.

Start Read Cycle

The read cycle starts when the trigger is activated or a Start Command String is received.

Capture Control and Processing

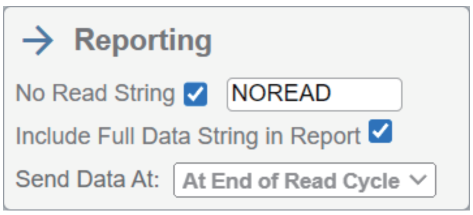
Once received, the read cycle behavior is exactly like continuous mode. It iterates through the Capture List over and over, running all Decode Tools in all Captures until it has a good read. Like for the Triggered Read Cycle described above, a delay can be set between iterations of the Capture list to alleviate processing. The maximum time allowed for each X-Mode instance can be limited as well.

End Read Cycle

The cycle ends when the trigger is deactivated or when a Stop Command String is received. If any Decode Tools have not completed successfully (qualified) by this time, they are shut down and marked as no reads.

Reporting

This section determines how the output string is composed, if it should be sent, and when to send it.



No Read String – If checked, the text from the No Read String text box will be used as the string for any Decode Tools that have failed.

Include Full Data String in Report – By default, the final output string is transmitted out all TCP/IP and RS-232 ports that are enabled When this option is unchecked, the string is not sent.

Note 1: This setting does not affect PLC based communication. The output string is always set into the PLC Input Assembly at the end of each Read Cycle.

Note 2: This setting also does not affect Digital Outputs. The digital outputs will always be set at the end of the Read Cycle to reflect the current read cycle status.

Send Data At – This controls when the read data is sent.

- **At End of the Read Cycle** – This is the default behavior. The data string is sent at the end of the read cycle.
- **As Data is Decoded** – If this is set, the reader will send the string data to the host immediately, but will not set Pass/Fail or End of Cycle digital outputs until the Trigger is deactivated, or the Stop String is received. In Start/Stop mode the user may choose this option to tell the host that the cycle is complete, and they can issue the stop command sooner than expected.

7-4-7 Start/Stop Read Cycle Settings

Item	Setting value [Job Default]	Description
Start Read Cycle		
Input:	**[Input1 - Trigger]**	Digital Input 1 is the dedicated Trigger Input. The Start/Stop cycles starts when the Input is Activated.
Start Command String	Any String, **[S]**	Serial string used to Start the read cycle when commanded by RS-232 or Socket. Note: Non printable characters are not allowed, with the exception of space. Here, the user must type in an actual space with space bar. This will be displayed as <SP>.
Trigger Delay (msec)	[0]-1,000	Trigger Delay (msec) is used to hold off acquisition for a fixed time after the trigger is received. This allows the user to programmatically align the part in the field of view without having to go onto the line and change the physical trigger location.
Capture Control		
Delay Between Iterations (msec)	0-10,000 **[0]**	Delay inserted between running iterations of the full image Capture List to allow processing to keep up with image acquisition. No delay is inserted between individual Captures within the list. They run back to back.
Processing		
Processing – Max Allotted Time Per Tools (msec)	0-10,000 **[500]**	This parameter sets the maximum amount of time that any instance of the X-Mode decoder will be allowed to run. If X-Mode has not decoded within this amount of time, that X-Mode processing thread will be shut down.

Item	Setting value [Job Default]	Description
End Read Cycle		
Stop Command String	Any String, **[E]**	Serial string used to stop the cycle when commanded by RS-232 or Socket. Note that falling edge of Input 1 Trigger will stop cycle if Trigger was used to start the cycle. Note 1: The end command must be different from the start command. Note 2: Non printable characters are not allowed, with the exception of space. Here, the user must type in an actual space with space bar. This will be displayed as <SP>.
Reporting		
No Read String	Unchecked,**[Checked]** and string to send **[NOREAD]**	Controls what is output for Decode Tools that fail to Read. By default the string is set to NOREAD.
Include Full Data String In Report	Unchecked, **[Checked]**	By default, the final output string is transmitted out all TCP/IP and RS-232 ports that are enabled When this option is unchecked, the string is not sent. Note 1: This setting does not affect PLC based communication. The output string is always set into the PLC Input Assembly at the end of each Read Cycle. Note 2: This setting also does not affect Digital Outputs. The digital outputs will always be set at the end of the Read Cycle to reflect the current read cycle status.
Send Data String	**[At End of Read Cycle]**, As Data is Decoded	Determines timing for sending out Format Output string from Read Cycle. Either it sends it when it receives the stop signal, or it sends it out as soon as all Decode Tools Qualify.

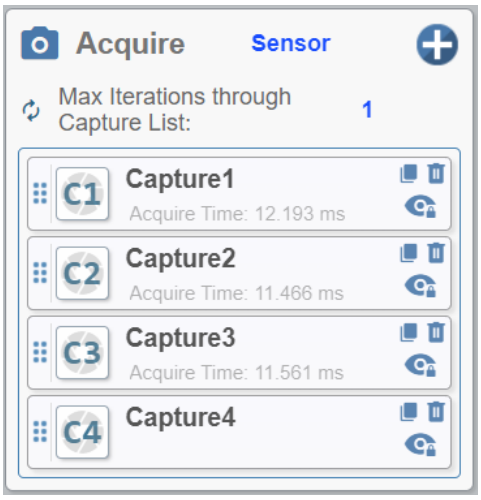
7-5 Acquire Step

7-5-1 Overview

The Acquire Step shows the Acquire source. By default, this is the Image Sensor on the Reader. The Acquire Step also shows a list of all of the individual images, or Captures, the user has set up to be able to find and read all of the codes.

During the Read Cycle, the system use as many of the Captures as necessary to get a successful read.

At the end of each Read Cycle, all Captures will display the amount of time they took to acquire, including the setup time required to change sensor parameters, autofocus distance, and lighting power prior to exposing the sensor.



The Acquire Step UI allows the user to add Multiple Captures into the list.
When the user clicks on a Capture, a parameter dialog opens up allowing the user to set the capture's Exposure, Gain, Focus, and Lighting.

Each Capture in the list can be set up with a unique combination of imaging parameters designed to ensure that all targeted codes can be read under all conditions by at least one of the Captures in the list. For example, if part heights may vary, each capture can be set up for a different focus distance.

In addition to Multiple Captures, the user can set the Read Cycle to iterate through the Capture list multiple times while it is waiting for the part to come into view.

7-5-2 Single and Multiple Captures in the Capture List

The main purpose of the Acquire Step is to set up one or more Captures to ensure that all codes can be read for the current application. Normally, a single Capture is sufficient, however there are situations where multiple Captures may be required or beneficial.

For Example: Codes at different distances requiring Captures with different focus values. Parts that are different colors or have different finishes, requiring Captures with different exposure times or using different lighting banks.

The + control and Trash Can icon are used to add/delete Captures into what is called the Capture List. Captures are shown as C1 – CN. When the user clicks on an individual Capture icon, the Capture Setting dialog appears on the right side of the UI allowing the user to uniquely configure that Capture.

7-5-3 Running Multiple Iterations through the Capture List

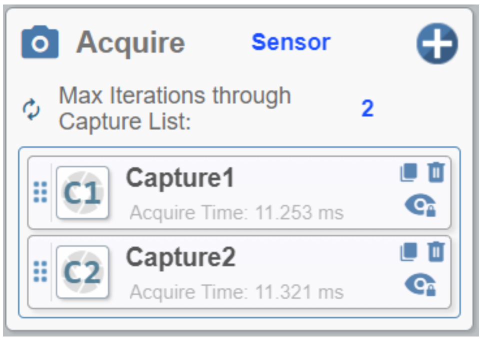
The final parameter in the Acquire Step is Iterations. This controls the maximum amount of times that the Read Cycle will acquire all the Captures in the list in an attempt to read. This value is normally set to one because the part will normally be right in front of the sensor when the read cycle is triggered. There are cases where the part may be moving across the field of view, or where the part may be rotating in the field of view and it necessary to repeat the Capture multiple times until the part is decoded.

Bottling Line Example: When codes are placed on round bottles and are moving across a large field of view, the code may or may not be visible depending on the angle. If the job is set up to iterate through the Capture List, the reader will keep taking images until it finds one where the code can be seen and read clearly. The image below shows the bottle entering from the left in the first iteration, and moving to the right where the code is finally able to be seen and read in the fourth iteration.

Key Point: The Tiled Image View allows the user to see all the images that are used to complete the Read Cycle.

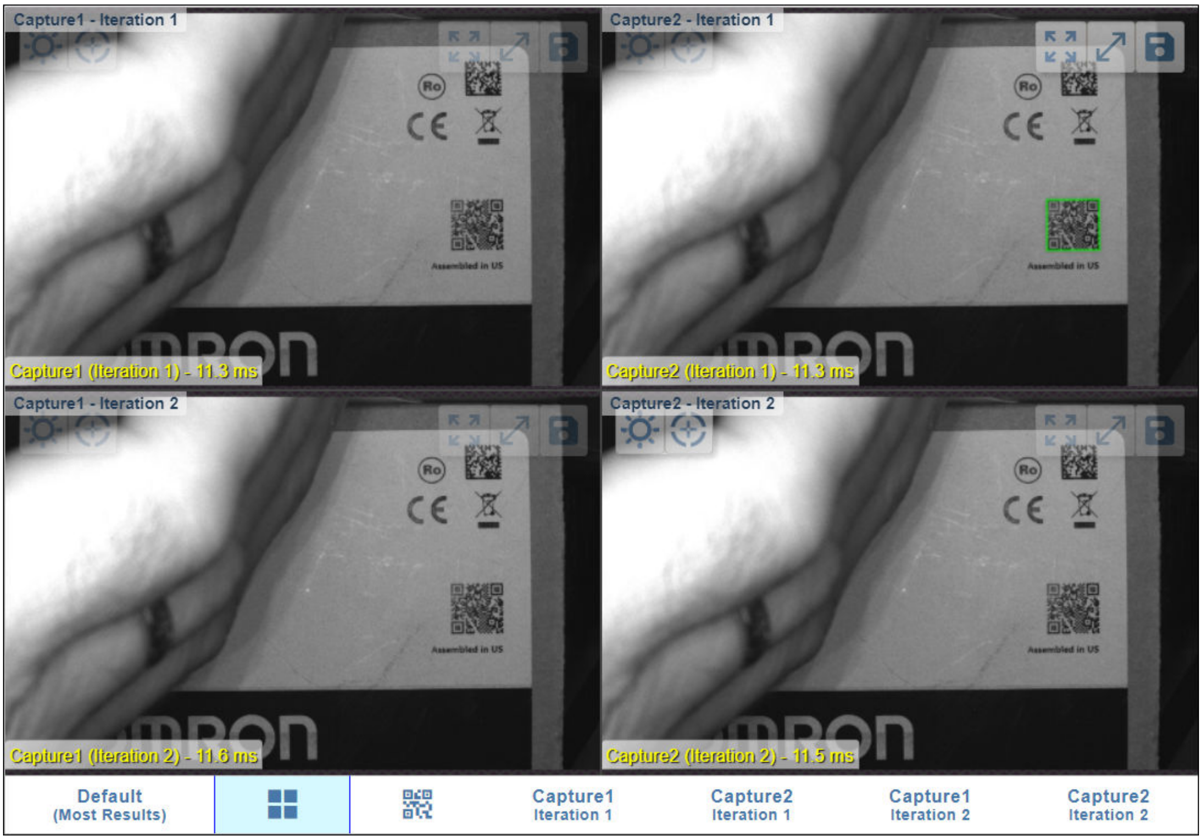
7-5-4 Multiple Captures and Multiple Iterations

There are no limitations on how many Captures there are in the list, or how many Iterations are set up. The Read Cycle will continue to take images until it is finally able to read all the target codes, or until a user set Time Out is reached. The image below shows a combination of the two concepts above.



- Two different captures are set up, one with a low exposure, and one with a high exposures, to be able to read two different colored parts.
- Iterations is set to two to allow the read cycle two chances at reading. The Tile view clearly shows what images are being acquired during the full read cycle.

Note: Captures in the Capture List are taken one after the other. Iterations though the Capture List can be spaced out in time using the **Delay Between Iterations (of the Capture List)** setting in the Read Cycle Dialog.



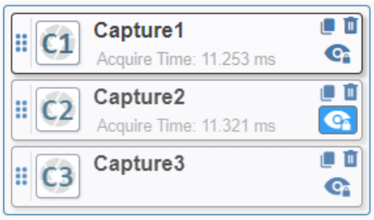
7-5-5 Working Efficiently with Multiple Captures (Pinning Captures)

In the normal operation of the Read Cycle, the reader will start by taking the first Capture and then trying to decode within that Capture. If all the codes are found in the first Capture, the read cycle will end without trying to use (or display) the other Captures.

This default processing can pose challenges during the setup phase, particularly when operators need to evaluate reading capability in multiple Captures that may not run normally.

Consider a scenario where an operator configures a job with three distinct Captures, each set at different focus distances to accommodate objects of varying heights.

Pinning Captures



To address this issue and enhance usability, operators have the option to "Pin" a specific Capture. This action prioritizes the pinned Capture to be used as the first capture of the Read Cycle.

By sequentially pinning and viewing Capture 1, then Capture 2, and finally Capture 3, operators can thoroughly test reading with each image during setup. This allows them to verify tool settings and the accuracy of the regions of interest, thus ensuring successful decoding within each Capture.

To pin a Capture, the operator clicks on the eye icon with a Lock symbol. Upon pinning, the icon changes to a dark blue color, indicating that the pinned Capture will lead in the Read Cycle. Unpinning is achieved by clicking the icon again, which reverts the cycle to its standard operation, starting with Capture.

7-5-6 Acquire Step Settings

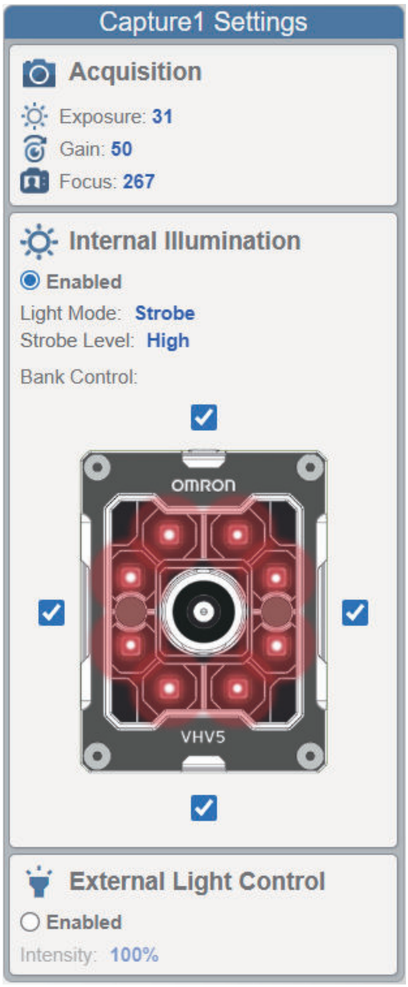
Item	Setting value [Job Default]	Description
Acquisition		
Input Channel Pull Down	**[Sensor]** File	Sensor is the default channel for images when using the camera. File is the default channel when running emulator on the PC.
	**Add Capture**	Add a Capture to the bottom of the list. When this Capture is added, it inherits the same Capture Parameters as the Capture directly above it.
	**Duplicate and Delete Capture**	Duplicate the currently selected Capture and add it to the bottom of the list. When this Capture is added, it inherits the same Capture Parameters as the Capture it was duplicated from.
Max Interations through Capture List	**[1] -** N	Max Iterations controls the maximum number of times the Read Cycle will run through the capture list in an attempt to read. If reading is successful, it will stop acquiring images. If reading is not successful, it will continue up and until it reaches the max allowed iterations.

Item	Setting value [Job Default]	Description
	**Capture Order Shifting**	The user can shift the order of the Captures in the list by clicking this icon and dragging the captures to the desired location. Capture numbering will stay ordered, but the parameters will shift along with the Capture.
Pinning a Capture 	**[Unlocked (not Pinned)]**, Pinned	The read cycle will always start with Capture 1 unless a different Capture is pinned. Pinning a Capture will cause the read cycle to start by taking that image and then trying to decode in it first.

7-6 Capture Settings Dialog

7-6-1 Overview

When the user clicks on the icon of a Capture in the Capture list, the Capture Settings dialog appears in the right side of the UI. The Capture Settings are used to set Exposure, Gain, Focus and Lighting to create a good so that the codes on the part stand out in high contrast.



7-6-2 Capture Settings

Acquisition Settings

Exposure, Gain, and Focus can be set here by hand or can be set using the **Quick-Photometry**, and **Quick-Focus** tools in upper right of the image. These tools are recommended to acquire initial settings, and the UI can be used to adjust the values to suit the application better.

Enabling Internal Illumination or External Lighting

The lighting sections of the dialog control Internal Illumination and External Lighting. Either Internal Illumination or External Lighting can be used within a capture. They can't both be used at the same time. The Enable buttons act as radio buttons.

Internal Illumination Mode, Light Power, and Bank Control

The main control for Internal Illumination is Light Mode and Light Level. These are set to Strobe and High power level by default, and are a good starting choice for most applications. Constant light can be chosen rather than strobe if operators react negatively to having a strobe pulsing near their workspace.

Bank control is available for Internal Illumination. Each bank can be set on or off independently. This is especially useful when using the half-polarizer or when working with certain DPM marks.

The power level of the light can be adjusted in both Constant and Strobe modes from Low to High for Constant, and between Low and Ultra for Strobe.

External Light Control

External Light Control is accomplished through the External Light Port connector on the back of the reader. The connector supplies 24V and a Strobe Trigger to an external light. It can also supply and Intensity Control signal on Finally Pin 5 to vendors who support that option for controlling their lights.

7-6-3 Focus Details

In addition to the 2.3MP and 5.0MP sensor options, there are three lens options for the VHV5-F designed to provide maximum flexibility in mounting distances and fields of view. Each lens has a specific focus range and default focus distance as well.

Lens Name	Lens Focal Length (mm)	Focus Range (mm)	Default Focus Distance for Jobs
Medium	8.50	55-500	135
Narrow	12.50	100-1000	220
Long	20.00	100-2000	250

7-6-4 Light Power Limitations

Duty Cycle Limitations

Strobe lighting has been designed to provide maximum power to the lights without overheating the unit. To accomplish this, the system will automatically limit the duty cycle in the very extreme cases of long strobe times and extremely fast trigger rates. To do this, the system will not take the picture, and will instead return a Trigger Overrun error to the user indicating that he has to slow down triggers, or shorten the pulse time. If this last bit of light is needed, the user can accomplish this by applying a higher gain. For High power, the light must be off for 6x longer than it is pulsed. For Ultra, it must be off for 11x longer than the strobe is pulsed.

Example: For High Power strobe, exposure time = 1 msec the light, the unit must not trigger again for 6 msec. (6:1). In practice this is not an issue since at the high strobe power settings, the required strobe pulse time are generally less than 100 μsec.

Strobe Setting	Power Level	Duty Cycle Limitation
Low	0.65 W	None
Medium	2.0 W	None
High	12 W	6:1
Ultra	22 W	11:1

Constant Setting	Power Level	Duty Cycle Limitation
Low	0.65 W	None
High	2.0 W	None

Maximum Strobe Light Power Limitation Based on Camera Power Source

● 24V DC Power

When the camera is powered with 24V DC, there is no limit for Strobe Output Power. Strobe output can be set from Low (0.65 Watts) to Ultra (22 Watts).

The Power Mode and Max LED Power available is shown in the Device Status pane in the Device View.

Power Mode	Direct 24V
Max LED Power	Ultra

● PoE Power

When the camera is powered via PoE, a limit is imposed on the power available for the lighting. For Class 1 PoE, the Medium, High and Ultra strobe settings will all use 2 watts. For Class 2, High and Ultra wil both use 6 watts.

Power Mode	PoE Class 1
Max LED Power	Med

Power Mode	PoE Class 2
Max LED Power	High

7-6-5 Image-to-Image Wait Time when Changing Parameters

Typically, the total time required to acquire an image includes just the Exposure Time plus the amount of time to read the image out of the sensor into camera memory.

Please note that additional overhead time is required before taking the picture if there are changes to sensor settings (Exposure, Gain), the autofocus lens focus distance, or to the light power level. These changes require time to be set up before the next image can be taken. For instance, autofocus takes 42-50 msec to change. The lens must be allowed to focus to the new distance before the new picture is taken.

The timing is all controlled internally, but when programming multiple Captures in a Capture List, it is important to keep this in mind and change as few things as possible from Capture to Capture, or keep similar settings in adjacent Captures.

Changing Light Power is the most expensive operation in terms of overhead time. It is better to choose one light setting (usually the brightest one that will be required), and then use Exposure and Gain to control brightness. This will save 137 msec on the 2.3 MP reader and 157 msec on the 5.0 MP reader.

The table below describes image-to-image wait time when changing parameters.

Parameter Change	2.3 MP Sensor (80 FPS)	5.0 MP Sensor (40 FPS)
Exposure Time (μsec)	16 – 300,000 μsec	16 – 300,000 μsec
Sensor Read Out Time	12.5 msec	25 msec
Exposure or Gain Change	20 msec	0 msec
Auto Focus Change	42-50 msec	42-50 msec
Light Bank Change	0 msec	0 msec
Light Power Change	157 msec	157 msec

Capture Settings

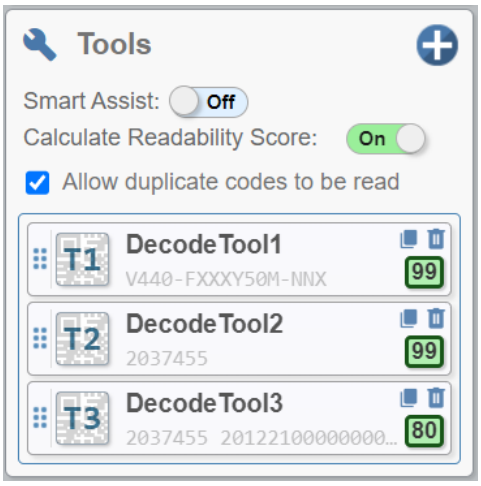
Item	Setting Value [Job Default]	Description
Acquisition		
Exposure (μsec)	16-300,000 (0.3 sec) **Depends on base lens**	Exposure controls the brightness of image. Longer exposure times produce brighter images. Note that for fast moving applications, shorter exposure times are better to prevent blur. High brightness light, or higher gain values to compensate.
Gain (%)	0-100 **[50]**	Gain affect both brightness and contrast because it multiplies the signal strength. Note that at high values is also increases the effect of noise.
Focus (mm)	50-2000 **[Depends on base lens]**	Default Focus Distance and Range Vary based on lens. See table above.
Internal Illumination – Built in lights		
Enabled	**[Enabled],** Disabled	User can enable either built in lighting on the face of camera, or external lighting through the 3rd connector on bottom of camera. Both may not be used at the same time.

Item	Setting Value [Job Default]	Description
Light Mode	**[Strobe],** Constant	Light defaults to strobe to achieve brightest lighting for short exposure times. Constant can also be used if strobing is an issue for people on the line. Longer exposure times will be necessary.
Strobe Level	Low, Medium, **[High],** Ultra	Four strobe power values. User should match light power with exposure and gain to get good image. High is default. Ultra may be needed for long range fast moving operations. See Light power to Duty Cycle note above.
Constant Level	Low, **[High]**	Two Constant power values. Match with exposure and gain to get good image. High is default.
Bank Control	**[Left, Right, Top, Bottom]**	Each bank can be enabled separately. User can pick best combination. All are on by default. Note the ½ Polarizer works with light pairs. Left/Right for non-polarized and Top/Bottom for polarized.
External Illumination – Lights controlled via External Light Port Connector		
Enabled	Enabled, **[Disabled]**	User can enable either external lighting through the External Light Port connector on bottom of camera, or lighting on face of camera. Both may not be used at the same time.
Intensity (%)	0 – **[100]**	Controls 5th pin analog voltage which is used as Intensity function on many major vendors lights.

7-7 Tool Step

7-7-1 Overview

The Tool Step contains the set of Decode Tools will run in all of the Captures. Each Decode Tool listed is responsible for reading one target code and will continue to run in all available images until that code is found. If the code is not found in any of the available images, that tool will be set to No Read.



Controls in the Tool Step are used to Add, Duplicate, or Delete Decode Tools. Decode Tools are added to or deleted from the bottom of the list. Tools can be individually Deleted from within the middle of the list using the Trash Can icon, and they can be Duplicated from here as well. Duplicated Decode Tools are added to the bottom of the list.

The Tool Step is also used to set parameters such as Effort Level, Calculate Readability Score and Allow Duplicates. These three are global settings and apply to all Decode Tool in the Tool list.

At the end of each Read Cycle, all Decode Tools will display the Formatted Output string from that tool, ta Pass/Fail Indication, the Readability Score if it is turned on, or the Verification Score if it is enabled.

Clicking on the icon T1 – TN will open the Decode Tool setting dialog for that particular Decode Tool allowing the user to set up how that individual Decode Tool operates. See the next section for additional information.

7-7-2 Tool Step Settings

Item	Setting value [Job Default]	Description
	**Add Decode Tool Step**	Used to Add Decode Tools to the bottom of the Tool list.
	**Duplicate and Delete Decode Tools**	Duplicates the currently selected DecodeTool, and adds it to the bottom of the list. Deletes the selected Decode Tool from the list.
	**Decode Tool Order Shifting**	The user can shift the order of the Decode Tools in the list by clicking this icon and dragging the Decode Tools to the desired location. Decode Tool numbering will stay ordered, but the parameters will shift along with the tool.

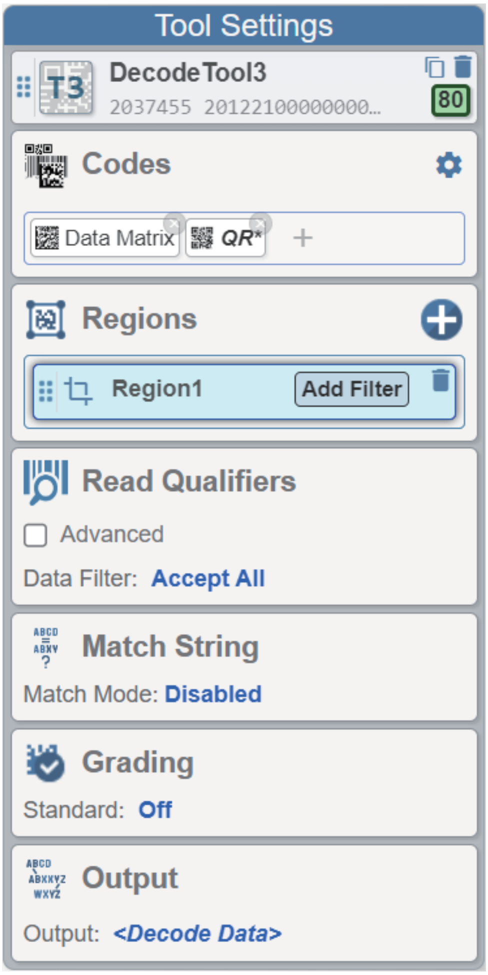
Item	Setting value [Job Default]	Description
Smart Assist	**[Off]**, On	Smart Assist is off by default and uses standard X-Mode processing to decode without employing Advanced Decode Techniques or automatic Image Preprocessing. When Smart Assist is on, it is similar to Configuration Database Mode for reading very difficult codes. It automatically and intelligently applies Advanced Parameters, Scale, Gain, and Image Preprocessing to aid X-Mode processing.
Calculate Readability Score	Off, **[On]**	Enables calculation and display of the Readability Score for DM and QR 2D codes. The Readability Score is an indicator of code quality, or Readability varying from 1-99.**Note:** No score is currently calculated for other 2D code types. Values below 70 typically indicate that the user should check camera mounting, lighting and imaging parameters to improve the base image.
Allow duplicates codes to be read	Unchecked, **[Checked]**	Allows codes with the same string content to be read. If this is not set, the second code with duplicate string content will fail.

Note: Effort Level, Calculate Readability Score, and Allow Duplicates are Global Settings and apply to all Decode Tools in the list.

7-8 Decode Tool Dialog Details

7-8-1 Decode Tool Qualification

Clicking on any tool icon T1 – TN in the Tool Step opens the Decode Tool Settings dialog for that particular Decode Tool. The dialog is used to setup how the decoder will run, and is used to set the Qualification (Pass/Fail) criteria for the tool.



Setup includes:

- Choosing target Symbology types
- Defining ROIs (regions of interest) where the tool will run
- Defining any image pre-processing per ROI done prior to decode
- Setting Effort Mode to control Config DB and Advanced Params
- Setting Read Qualification, Match String, Grading and Output

When run, each Decode Tool executes in all Captures until the tool qualifies/passes, or until there are no more Captures to process and the tool is marked as No Read/ Failed.

Qualification

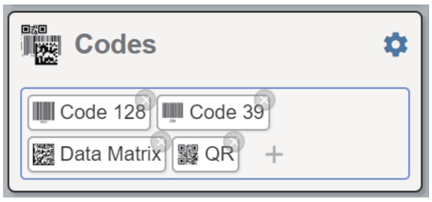
Each Decode Tool is set to find or qualify one specific code in the image. As potential candidate codes are read by X-Mode, they are subjected to series of stages, or gates to determine if they are the intended target code. If any gate fails, the Decode Tool will continue to run and supply more candidates until it runs out of Captures to process.

If a code Qualifies (passes all gates) the Decode Tool is set to Pass and X-Mode processing ceases. It will not continue to run even if there are Captures left that have not been processed.

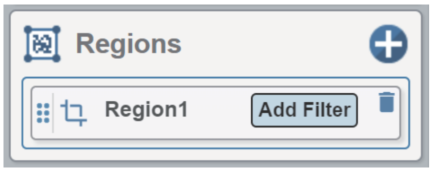
The Decode Tool will only pass if all Gates have passed (with the exception of Grading). Pass/Fail for the Decode Tool is set into an output result. An individual Pass/Fail result for each gate is stored as well that can be used for process control or other tracking purposes.

● Gate 1 – Code is Present

Once a code is read by X-Mode that is one of the target symbology types and is in one of set ROIs, it is marked as found and sent on to the Read Qualification gate.

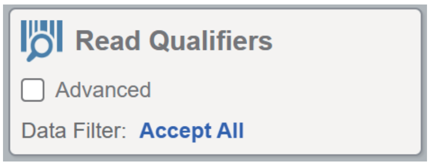


and



● Gate 2 – Code is Read (Read Qualification)

Default – By default the Read Qualification stage is set to accept any code of the correct type that is “found” and declares it as read. Once read, the code is passed on to the final Matching and Verification qualification stages.

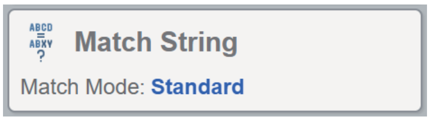


Advanced – A secondary very powerful use of the Read Qualification stage is as a pre-filter. The Read Qualification section can be setup with a series of pre-filters to only pass on codes with a definedvcombination of Symbology type and data content. Multiple sets of these pre-filters can be set at one time and operate in an OR fashion. This gate qualifies any of the pre-filter combinations are found, and then the code is passed on to the Code Matching stage.

For example: Read Qualification can be set to accept a *Data Matrix that starts with ABC*, **or**a *Code 128 that starts with XYZ*. The algorithm ignores all other codes that it finds and only passes on the code that meets one of these very specific qualifications to the next stage. Once a code that satisfies one of these pre-filters, the code is marked as read. If no code is read that satisfies this gate, the Decode Tool will continue to run in all Captures until it does read, or until there are no more Captures to run in. In that case, the tool is marked as a No Read and fails.

- **Gate 3 – Code Matches**

The user can further define the required string content within the Match String stage using full or partial flexible string matching functions. This stage acts not only as a traditional Match String routine, but can also be used to perform a final test on the code that goes beyond Read Qualification or Match String alone.



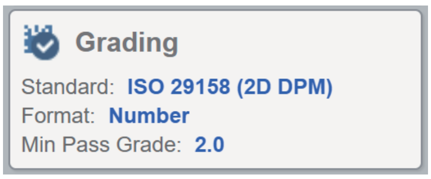
For Example: Gate 2 allows codes to be read that start with ABC or XYX indicating that the parts found are the correct type of parts. Match string however can be set to accept “only” ABC123, ABC234, or XYZ222, indicating that not only is the part the correct type, but is the correct exact model as well.

Individual Code Read Pass/Fail and Code Match Pass/Fail results can be sent to the controlling system informing it if the exact correct part is present, or if other similar parts of that type are mistakenly getting into the parts stream.

In summary, the decode tool performs standard read and match, and it allows for a two-stage matching process that allows the user to apply deeper logic, and communicate a richer output that would normally require scripting.

- **Gate 4 – Code is Good Quality (ISO Verification/Validation)**

When enabled, as a last step, the Decode Tool will check the quality of the code that has passed all of the previous qualification gates. It does this using standard ISO Verification algorithms. The user is able to set a Pass/Fail limit for Code Quality. Note however that this result will not affect the overall Decode Tool pass fail result. Instead, the pass/fail result, score, or detailed verification report can simply be sent as data.



7-8-2 Decode Tool Settings

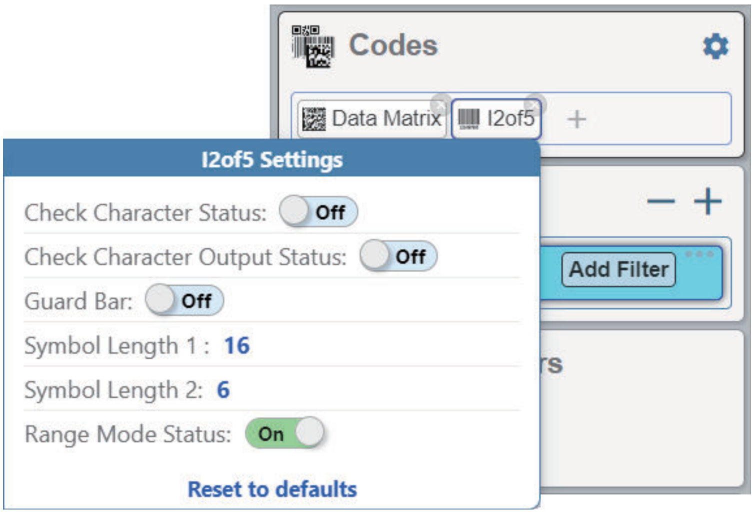
Item	Setting value [Job Default]	Description
Codes Setting Sprocket	Brings up code selection list.	Brings up dialog box for Advanced Decoding Parameters.

Item	Setting value [Job Default]	Description
Codes selector (+)	**[Data Matrix, QR Code, Code 128, Code 39],** All major types	Adds symbology types to the list the Decode Tool is set to read. User the X in upper corner of code to delete a type from the list. **Note:** Pharmacode And DotCode are special symbology types. Only Pharmacode or only DotCode can be on in the tool.
Regions 	**[OneDefault Region]** -N Regions	Add or delete ROIs for the Decode Tool. Add with the + icon. Delete with the trash can icon next to the region.
Add Filter	**[No Filters],** Variable Filter Chain	See Creation of Image Preprocessing Filter Chain below.
Read Qualifiers – Advanced	Unchecked, **[Checked]**	Read Qualification will Pass on any code that is found when this setting is unchecked. Read Qualification will Pass on only those codes that have are the correct symbology type and have the correct partial or full string content.
Read Qualifiers – Data Filter	**[Accept All]**, Individualized Data Filter	(See Read Qualification below)
Match String – Match Mode	**[Disabled]**,Standard	Turns on String Matching for the code that is both found and read by this Decode Tool. The Match or Mismatch output will affect the overall Pass/Fail status of this Decode Tool. (See Matching Function Below)
Grading Standard	**[Off]**,ISO 15416, ISO 15415, ISO 29158	Turns on applicable ISO Verification standard to perform Validation grading for the code found by this Decode Tool. The numeric score (default) or letter grade will not be used to define whether or not the Decode Tool Passes or Fails. It is used to display the grades, or to output the grading report as data.
Output	**<Decode Data>,** Decode Tool Results	This section allows the user to completely format the string that is passed back to the Read Cycle for eventual output. The formatting tool described below allows the user to add a rich set of data into the output beyond just the decode string. For example the X, Y and Angle of the code can be added.

7-8-3 Setting Standard Decode Tool Parameters

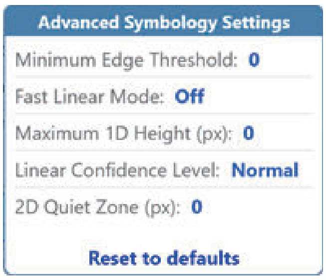
Each Symbology Tool has a set of parameters that control how it operates. Default settings are normally adequate and do not require user attention. If the Symbology is not working, or any of these parameters need to be set, the user should click on that Symbology in the Codes list. The Symbology Settings Dialog will appear, allowing the user to make changes.

See the **Symbologies** section for a full explanation of all settings for all code types.



7-8-4 Setting Advanced Decode Tool Parameters

When the user clicks on the Gear Icon, the following Advanced Parameters are available to be set individually for each Decode Tool. They apply to all Symbologies of that type that are enabled within the tool.



Advanced Parameter	Definition
Minimum Edge Threshold (0 to 128)	This setting is used to improve search speed in images with an excessive amount of edges that have a lower contrast than the symbology. This setting will filter out edges with magnitude less than what is specified and only consider edges with sufficient contrast like those of the code. The range is from 0 to 128. The default setting is 0. 0 allows X-Mode to use internal threshold limit which is able to find codes with as little as 5% contrast. 1 corresponds to virtually no contrast. 128 corresponds to a pure white background and pure black code. The user can experimentally set this to a much higher value. (64 is a good maximum for black and white labels) Care must be taken with this setting, since setting threshold too high can keep the decoder from finding and reading codes. **KEY POINT:** The **Optimize** routine sets this value to 60% of the gradient for the code that was optimized. If after Optimization, codes are failing, this value should be reduced as a first step.

Advanced Parameter	Definition
Fast Linear Mode	**Off** – Advanced parameter is disabled This feature prioritizes and improves the search and decode time for 1D symbols with a fixed orientation. **Fast Horizontal -** This enables the horizontal Fast Linear Mode. This will not decode vertical barcodes, nor 2D. **Fast Vertical -** This enables the vertical Fast Linear Mode. This will not decode horizontal barcodes, nor 2D.
Maximum 1D Height (pixels)	This feature is used to eliminate invalid 1D Code candidates that may be found in very busy images such as those with lines of text surrounding the barcode. The user should measure the real barcode height in pixels and then round up by 10%. Any other feature in the scene such single or multiple lines of text, and even taller barcodes will be ignored. There is no limit on this height setting.
Linear Confidence Level	Linear Confidence Level is intended to prevent misreads. When it is set to a higher level, it requires more scan lines to decode the same result, making the read more certain. The default state is **Normal**. The most secure state is **High**.
2D Quiet Zone (pixels)	Applies to the Quiet Zone Size for 2D symbols. The user sets the size to the smallest quiet zone of the four sides in pixels. This allows X-Mode to eliminate some of the invalid code candidates that cause slow processing. There is no limit on this setting, and it should be set approximately to the distance from the code edge to the nearest non-code edge.

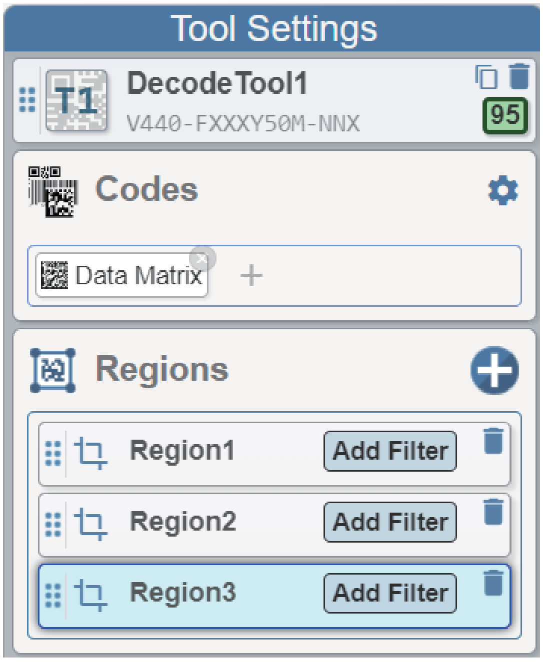
7-8-5 Decode Tool Dialog Regions (Regions of Interest)

Regions of Interest (ROIs)

Decode Tools can be set to run on the full image, or within a limited ROI (Region of Interest) in the image. ROIs reduce the amount of processing time required to run, and can be used to exclude non-target codes from consideration.

A single decode tool can also be set to run in multiple ROIs. For example, if the target code is printed at one corner of the part, and the part can be presented at any of four orientations, 4 separate ROIs can be added to cover each corner, again limiting the number of pixels the system has to process.

The example below shows the scenario with two ROIs in the lower left and upper right to account for two orientations the part can be presented in.



7-8-6 Working with Regions of Interest (ROIs)

As stated earlier, ROIs are mainly used to target and limit the image area in which the Decode Tool runs. Normally, a Decode Tool is configured with just one ROI, but it can be configured with multiple ROIs to target different areas of the image. The decoder will look for the target code in all of the ROIs. ROIs are also used to perform Image Preprocessing on the image prior to running the decoder. See section 7-7-5 – ROI Image Preprocessing Filters.

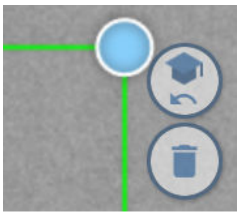
Regions of Interest are added to a Decode Tool using the **+** icon in the Regions area. They are deleted using the trash can icon.

ROIs appear on the screen as green boxes. The are labeled in the upper left hand corner showing the Decode Tool number and the Region number. The example below is T1-Region 1, signifying the first Decode Tool and the first Region.

When the user clicks on the Decode Tool in the Tool list, or clicks on the green box on the screen, the ROI becomes active with handles so the user can move it, resize it, delete it, and run Optimize. Optimize is explained in section 6-6-3.

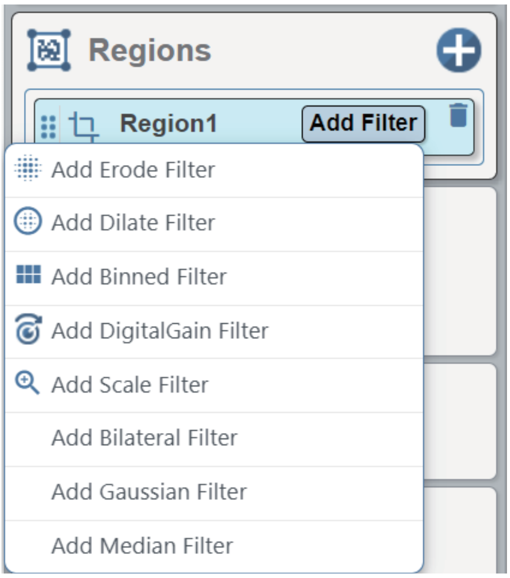
ROI Control

- **Move –** The ROI is moved by clicking anywhere inside the box and dragging it.
- **Resize –** The ROI is resized by clicking on any of the blue circle corner handles and dragging them.
- **Delete –** The trash can icon will delete the ROI.
- **Optimize –** The Train (hat) icon activates the Optimize function. Once Optimized (or once Minimum Edge Strength is set) the Train icon turns to the icon shown below.
- **Un-Optimize –** Clicking on the Train icon with the back arrow turns off Optimization for that ROI and/or sets Minimum Edge Strength back to default.



7-8-7 ROI Image Preprocessing Filters

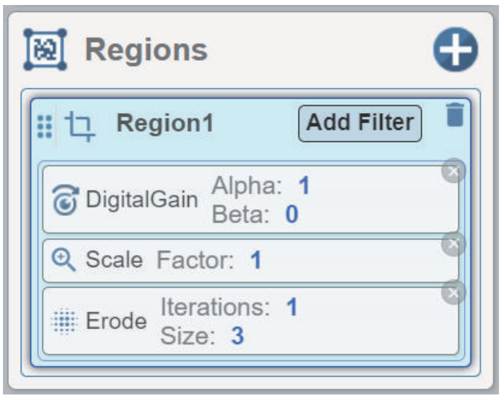
Each ROI can be set to run image preprocessing prior to executing X-Mode within that ROI. Image preprocessing is used to improve the image making it easier to X-Mode to find and read the code within it. The Add Filter button allows the user to a variety of filters into the ROI.



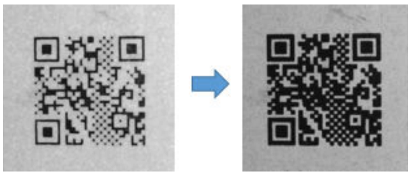
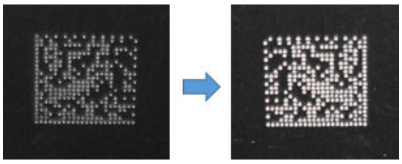
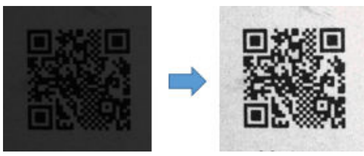
Multiple filters can be combined into filter chain as well. In the example below we use a normal ROI to first try to read the code, and if that does not work, the Decode Tool will try to decode using the ROI with the following filter chain to improve the image:

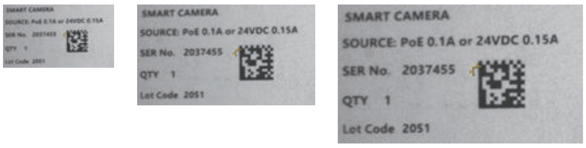
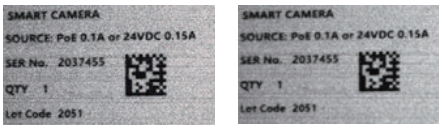
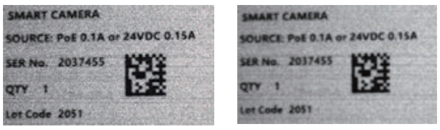
- Digital Gain is added to increase contrast
- Next the image is scaled up to improve the PPE of the code
- Finally the light cells are eroded (thinned out) to make them more closer to square cells

This chain turns the smaller original image in the center into the pre-processed image on the right.



7-8-8 Region Image Preprocessing Filter Settings

Item	Description/Content
Erode Filter	Erode Light (Dilate Dark) – Thins the light pixels and grows the dark pixels. This is useful for increasing the size of dark cells for a dark-on-light printed symbol. • Iterations – Number of times to run the kernel. • Size – Size of the kernel (3 x 3, 5 x 5, 7 x 7). 
Dilate Filter	Dilate Light (Erode Dark) – Grows the light pixels and thins the dark pixels. This is useful for increasing the size of the light cells for a light-on-dark direct part mark symbol. • Iterations – Number of times to run the kernel. • Size – Size of the kernel (3 x 3, 5 x 5, 7 x 7). 
Binned Filter	Binning is a very fast operation that decimates the image in half for each iteration by averaging a 2x2 pixel area into 1 pixel for each iteration. This feature is useful when the PPE for codes is large causing unnecessary processing time. For example if a QR code PPE is 14 pixels, Binning with 2 iterations will bring the PPE down to 3.5. It will also reduce the number of pixels is the search region by the same amount.  Bin performs the operation once. If the user adds a second Bin filter, the image will be cut in half again.
Digital Gain Filter	Gain multiples the signal strength, to increase both the brightness of the image, as well as the contrast in the image. Example: For image with dark cells at 50 grey levels and light cells at 75, the contrast difference between them is 25. If gain is two, the contrast increases to 50 grey levels.  Gain < 1 decreases the signal strength and contrast. Gain > 1 increases. Gain has no upper limit and should be set empirically.

Item	Description/Content
Scale Filter	Scales the input image up or down. Scale down reduces the number of pixels and may give a faster decode. Scale up increases the number of pixels in a code and may increase the chances that the code cells can be correctly determined and the code decoded.  Scale < 1.0 decreases size. Scale > 1.0 increases. Scale has no upper limit. However, if the PPE ends up greater than 10 pixels, the user should check to see if there are other issues with the code that go beyond the fact that it might be too small.
Median Filter	The median filter is a low impact smoothing filter used to remove noise and edge artifacts. 
Gaussian Filter	The Gaussian smoothing operator is a 2-D convolution operator that is used to `blur' images and remove detail and noise. In this sense it is similar to the median filter, but it uses a different kernel that represents the shape of a Gaussian ("bell-shaped") hump. Wider smoothing than Median Filter. 
Bilateral Filter	A bilateral filter is a much like the Gaussian filter, but does a better job at removing noise while preserving edge definition.

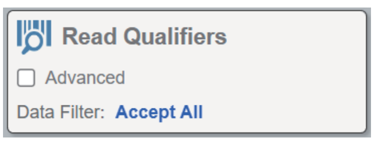
7-8-9 Decode Tool Dialog Read Qualification

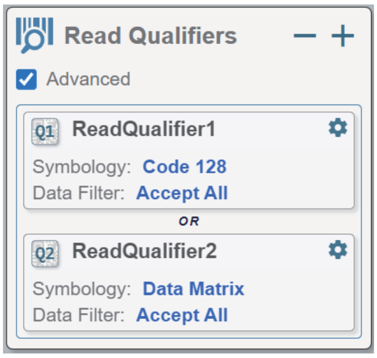
The function of Read Qualification was described above. This section deals with the specific settings of this section of the Decode Tool Dialog.

The Default operation for Read Qualification is to accept any code that is “found” and qualify it as Read.

If the user clicks on the Advanced, they will see there are actually sub-qualifiers in place that specify this behavior, one for each code type that has been selected in the Decode Tool. The Data Filter is set to Accept All strings in each of them.

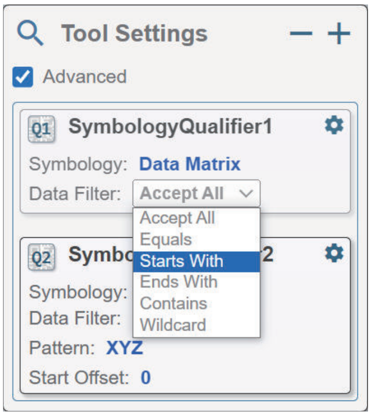
Each of the sub-qualifiers are logically ORed together, meaning if any one of them is true, the Read Qualification passes.





Advanced

When Advanced is checked, Qualification cases can be added or deleted with the +/- controls. For each case, the user can choose a specific Symbology for it to apply to and they can choose a specific Data Filter that matches some expected portion of the code string data content. The string functions are the following and are self-documenting by virtue of their names, Equals, Starts With, Contains, etc.



Starts With

Starts With is used to check the exact location of a substring within the decoded string.

Starts With is used in combination with an additional parameter called **Start Offset**. Start Offset is the exact character location within the string where the pattern is expected to start.

Starts With Example 1: For the string 123ABC456, if the user wants to check that the pattern 123 is exactly at the beginning of the string, they should say Starts With 123 at Start Offset 0. If the decoded string started with something other than 123, then the algorithm would conclude that this was not the code that the user was looking for, and continue to test other codes.

```
String: 123ABC456
Offset: 012345678
        ^
        123
```

Starts With Example 2: For the string 123ABC456, if the user wanted instead to check that the pattern ABC is there and in the correct location in the string, they should say Starts With ABC at Start Offset 3.

```
String: 123ABC456
Offset: 012345678
        ---^
        ---ABC
```

Ends With

Ends With is similar to **Starts With** and used to check the exact location of a substring within the decoded string. In this case, however, it uses **End Offset**. This tells the match function to back up a certain number of spaces to do the string match.

Ends With Example 1: For the string 12ABC456, if the user wants to check for 456 using Ends With, they would say Ends With 456 with End Offset set to 0. The search has to back up 0 spaces to match the 456 pattern to the end of the string.

```
String: 123ABC456
Offset: 876543210
                ^
              456
```

Ends With Example 2: For the string 12ABC456, if the user wants to check for ABC using Ends With, they would say Ends With ABC with End Offset set to 3. This shifts the pattern back to the left to that offset and does a compare.

```
String: 123ABC456
Offset: 876543210
             ^---
          ABC---
```

Contains

Contains is more flexible and is used to check that the substring exists somewhere within the decoded string. In this case Start Offset is used simply to narrow down an area of the string to check for the expected pattern.
Contains Example 1: For the string 123ABC456, if the user wants to check for ABC using Contains, they could say Contains ABC with Start Offset set to either 0, 1, 2, or 3. Contains starts searching at the Start Offset location and searches from there forward to the end of the string for ABC.

```
String: 123ABC456
Offset: 012345678
```

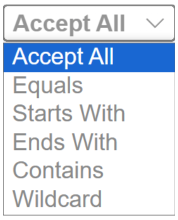
Wildcard

Wildcard uses a **Wildcard Character (*)** and a **Placeholder Character (?)** for flexible matching where part of the match should be fixed, and where other characters are allowed to vary. The Wildcard character is a stand-in for any length of string. The Placeholder character is a stand-in for a single character.

Wild Card Example 1: For the string 12ABC456, if the user wants to check for ABC and be sure that it is preceeded by three characters and followed by three characters, the user could set **???ABC???**.

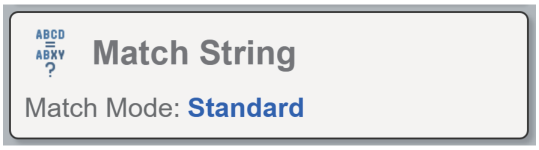
If the length of the string before or after ABC is unknown, or the user does not care, the user could set ***ABC***.
If one end is known, such as the leading characters, and the other end is unknown, the user could set **???ABC***.

7-8-10 Read Qualification Settings

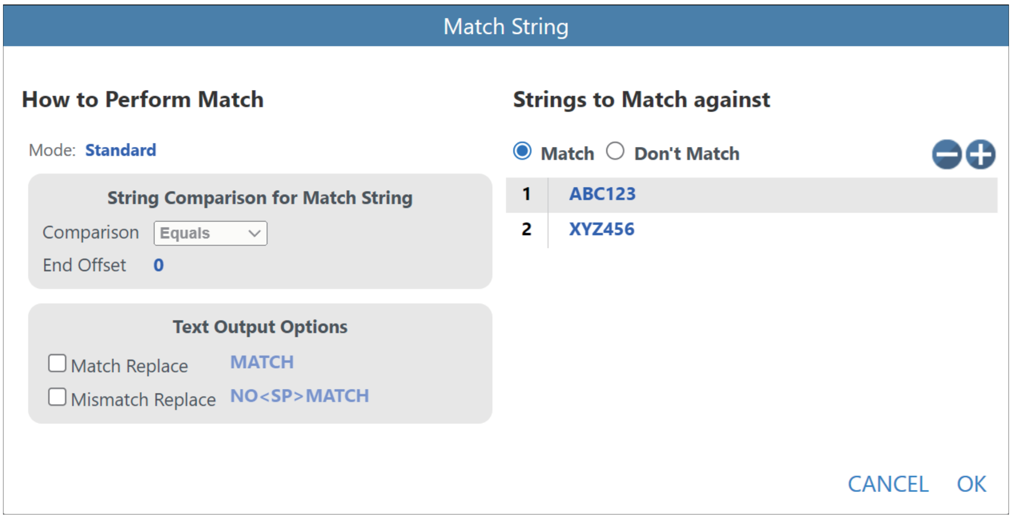
Item	Setting value [Job Default]	Description
Advanced	**[Unchecked],** Checked	Unchecked means that there are no special Read Qualification rules. The Decode Tool will **Accept-All** of the codes types that it has been set up to find and are the in ROIs.
+ / -	Addition and subtraction controls for rules.	Add or Delete a Qualifier Rule.
Symbology	**[All codes currently selected for this Decode Tool to read];** A subset of those codes	This setting allows the user to select a subset of all the codes. For example: The user can set it so that if it is a Data Matrix, the qualification logic will follow one path, and if a QR Code, the logic will follow a different path.
Data Filter	**[Accept All]**, See list below. 	Full set of common string comparison functions. Used to qualify on a code with specific string or substring content. See examples above.
Pattern	**[EMPTY_STRING]**, User Text	Examples: Starts with 123, 0 offset Ends with 456, 0 offset Contains ABC, 0 Offset Wildcard ???ABC*
Start Offset	**[0]** – String Length	0 means user is looking for this pattern starting at first character in the string
End Offset	**[0]** – String Length	0 means user is looking for this pattern starting at last character in the string minus the length of the comparison string
Wildcard Character	**[*]**	Allows matching to a pattern with unknown amount of characters somewhere in the string
Placeholder Character	**[?]**	Allows matching to a pattern with known set of characters at known location in the string. A **?** would be entered for each expected character.

7-8-11 Decode Tool Match String Dialog

If the code has passed Read Qualification, it is passed to Match String for partial for full string Match testing as the final qualification gate. The Match String function can be either Disabled or Standard. If the user clicks on Standard, the Match String Dialog opens up.



Match String Dialog



The left side of the dialog is used to set up **“How to Perform Match”**.

The **String Comparison for Match String** sections use the same exact String functions described above for Read Qualification.

The **Text Output Options** defines if the code string should replace by a MATCH of NO MATCH string. The user can substitute their own text in place of MATCH and NO MATCH.

The right side of the dialog is a list of the **Strings to Match Against**. The comparison is normally done as a Match, but the user can set it so that Don’t Match is the result that should pass (i.e. the string should “not” be one of these).

Note 1: There may be multiple strings with very different content that are sent down from the Read Qualification stage. That is ok. All possible strings should be listed in this table and the Match Function will consider all of them.
Note 2: Match / No Match counts will appear in the Read Cycle Counts report if Matching is enabled for one of the Decode Tools. If Match is not enabled, only Read / No Read will appear.

Read Cycle Counts	
Cycles	100
Reads / No Reads	96 / 4
Matches / No Matches	96 / 4
Stalls / Timeouts	0 / 0
Overrun - Trig/Proc	0 / 0
Pass Rate %	96.00%

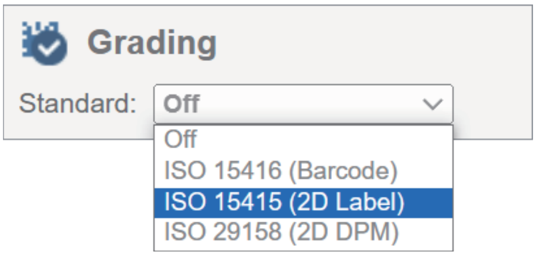
7-8-12 Match String Settings

Item	Setting value [Job Default]	Description
Mode	**[Disabled**], Standard	Off by default Standard is the only current option.
Comparison	**[Accept All]** Accept All Accept All Equals Starts With Ends With Contains Wildcard	Full set of common string comparison functions. See examples above
Start Offset	**[0]** – String Length	0 means user is looking for this pattern starting at first character in the string
End Offset	**[0]** – String Length	0 means user is looking for this pattern starting at last character in the string minus the length of the comparison string
Wildcard Character	**[*]**	Allows matching to a pattern with unknown amount of characters somewhere in the string
Placeholder Character	**[?]**	Allows matching to a pattern with known set of characters at known location in the string
Match Replace	**[MATCH],** Any user text	If option is selected, the actual code string will be replaced by the Match Replace string in the output
Mismatch Replace	**[NO MATCH],** Any user text	If option is selected, the actual code string will be replaced by the Mismatch Replace string in the output
Match Option	**[Match],** Don’t Match	Allows user to set Matching to pass on either Match or Mismatch
	Function	Add and Delete Sting from Match List
Match String List	User Input String List	List of all strings to Match (or Don’t Match) against

7-8-13 Decode Tool Quality Score Grading

Overview

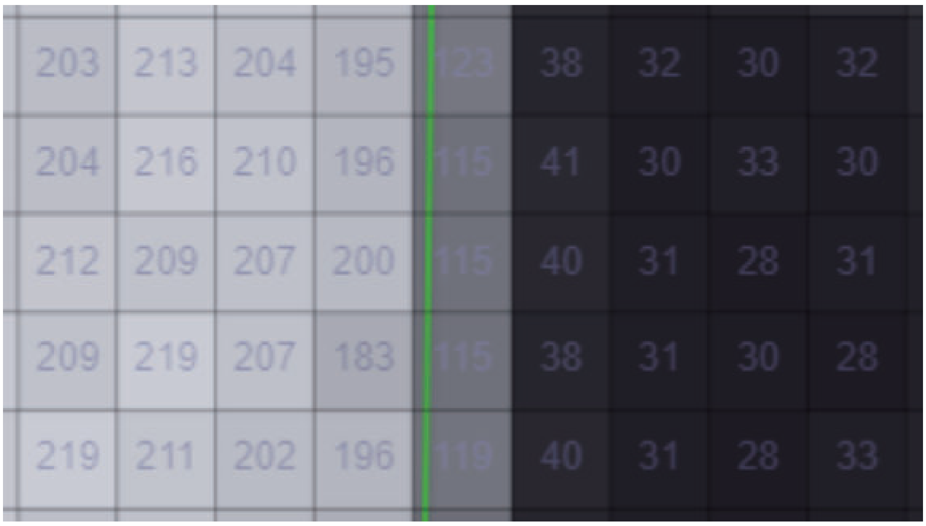
The Decode Tool provides an option to grade the final qualified target code against the three main ISO standards: 15416, 15415, and 29158. Only a code that makes it past all qualification gates will be graded.



Key Point: Calibration is not currently supported, so this tool can only be used for “print or process” validation rather than full ISO Verification.

To achieve the best results for “validation” purposes, the user can approximate calibration for 15416 and 15415 by setting the Capture up on a black and white printed label on paper.

Adjust the Capture Exposure and Gain so that the dark cells are approximately 10-20 grey levels and the light background is approximately 210 grey levels. Note that you can zoom all the way in on an image and see the grey values for each pixel. The same is true for DPM. Set the Capture near these values.



Operation

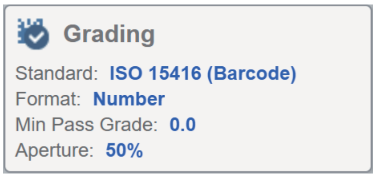
Within the verification dialog, the user is able to select the ISO grading standard. The user can also set a Pass/Fail threshold for grading. If the grade, or code quality, is below this value, the Decode Tool will fail, which in turn will cause the Read Cycle to fail.

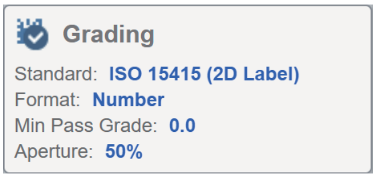
Normal use in reading applications is to set the Pass/Fail threshold to 0.0 so that Verification will not cause a read cycle failure, and instead, include the Verification Report in the output string allowing the host to monitor print quality while reading.

There are three options for grading selectable using the Grading dropdown list.

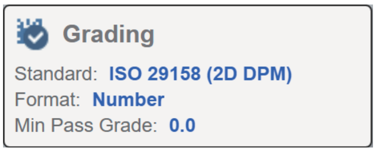
- **ISO 15416 –** is used for 1D Barcodes. Only UPC/EAN, Code 128, and Code 39 can be graded.
- **ISO 15415 –** is used for 2D Labels where strict grading is required. Only Data Matrix and QR Codes can be graded.

- **ISO 29158** is used for Direct Part Marks. It is also the best method for obtaining realistic grades from labels that reflect the actual reading capabilities of a normal code reader. Only Data Matrix and QR Codes can be graded.
- **ISO 15416, 15415 Grade Format –** ISO 15416 and 15415 provide a letter grade A - F, by default. The user can choose number format as an alternative. The numeric grade will vary from 4.0 – 0.0 but only displays in whole numbers.
- **ISO 15416, 15415 Aperture –** ISO 15416 and 15415 allow the user to set the Aperture as well. The aperture value range is 0-100% and is a percentage of the symbol cell size. 50% is the default.





- **ISO 29158 Grade Format –** Per the final standard, ISO 29158 provides a number grade by default. The numeric grade will vary from 4.0 – 0.0 and reporting down to the 1/10 place. The user can select Letter format as well. The system will output A-F, but does not show precision provided by the number format.
- **ISO 29158 Aperture –** There is no user setting for Aperture. ISO 29158 uses both a 50% and 80% aperture internally when it runs. The result it returns is the higher of the two scores.



7-8-14 Grading Settings

Item	Setting value [Job Default]	Description
Standard	**[Disabled]**, ISO15416, 15415, 29158	ISO 15416 is used for UPC/EAN, Code 128, and Code 39 barcodes. ISO 15415 is used for Data Matrix and QR Code Labels where strict grading is required. ISO 29158 is used for Data Matrix and QR Code DPM codes and is also the best method to obtain realistic grades from Labels that match the reading capabilities of a normal code reader.
Format	**[Numeric]**, Letter	Numeric is default grading output for ISO 15415 ISO 15416, and ISO 29158. 4.0 - 0.0.
Aperture (0 to 100% of the smallest code element)	0 - 100 **[50]**	15415 and 15416 use 50% as default. 29158 uses 50% and 80% internally
Min. Pass Grade	**[0.0] –** 4.0	Pass/Fail Threshold set by the user. The user is able to set a Pass/Fail threshold for grading. If the grade is below this value, the Decode Tool will fail, causing the Read Cycle to fail. Normal use in reading applications is to set the Pass/Fail threshold to 0.0 so that Verification will not cause a read cycle failure, and instead, include the Verification Report in the output string, allowing the host to monitor print quality while reading.

Grading Results Summary Display

When running in Setup Mode, the UI displays the Overall Grade for each Decode Tool within the step on the left side of the screen. The display will show either a Letter grade or a numeric depending on the setting.

If the user clicks on the overall grade, the detailed grading results are displayed. The set of tests performed by the three standards vary.

Reference Decode, which each have to pass to move on to the detailed tests, is shown at the top of the display. This is followed by the detailed test scores, and then the Overall Score at the bottom. The Overall score is set as the minimum value of all the detailed tests.

Note: The current implementation of Verification on the VHV5-F is not calibrated. This means that the Contrast and Reflectance scores for ISO 15416 and 15415 depend on the user setting up a high-contrast black and white image to begin with as described in the Overview above. For ISO 29158, which requires both Target calibration and Part calibration, Minimum Reflectance is currently left out of the overall score calculation.

Grading Results Detail Display

ISO 15416

Verification Grades	
Reference Decode	4.0
Decodability	2.7
Defects	4.0
Edge Determination	4.0
Minimum Edge Contrast	4.0
Minimum Reflectance	4.0
Modulation	4.0
Quiet Zone	4.0
Symbol Contrast	4.0
Overall	2.7

ISO 15415

Verification Grades	
Reference Decode	4.0
Axial Non-Uniformity	4.0
Contrast	2.0
Fixed Pattern Damage	4.0
Grid Non-Uniformity	4.0
Modulation	4.0
Reflectance Margin	4.0
Unused ECC	4.0
Overall	2.0

ISO 29158

Verification Grades	
Reference Decode	4.0
Axial Non-Uniformity	3.5
Cell Contrast	4.0
Cell Modulation	4.0
Fixed Pattern Damage	4.0
Grid Non-Uniformity	4.0
Minimum Reflectance	0.0
Unused ECC	4.0
Overall	3.5

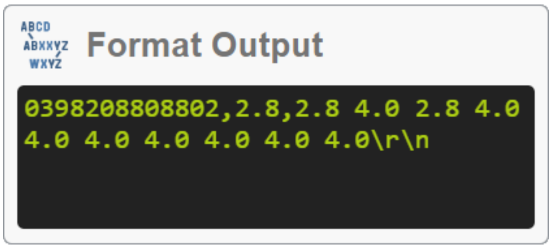
Grading Results Output

The summary Verification Grade and the full Verification Report can be added to the Output string that is created by each Decode Tool. This is done by clicking on the following items from the Output picker.

<Verification Grade>
<Verification Report>

The output string format will resemble the following.

The actual output string will look like the following.



Verification Report

Following is the content and order of the output from each ISO report. The Overall Grade is the first piece of data in the report. Each result in the report is separated by a SPACE.

Order of Data in Report		
ISO 15416	**ISO 15415**	**ISO 29158**
Overall Grade	Overall Grade	Overall Grade
Reference Decode	Reference Decode	Reference Decode
Decodability	Axial Non-Uniformity	Axial Non-Uniformity
Defects	Contrast	Cell Contrast
Edge Determination	Fixed Pattern Damage	Cell Modulation
Minimum Edge Contrast	Grid Non-Uniformity	Fixed Pattern Damage
Min Reflectance	Modulation	Grid Non-Uniformity
Modulation	Reflectance Margin	Minimum Reflectance
Quiet Zone	Unused ECC	Unused ECC
Symbol Contrast		

ISO 15416 Tests (1D Barcodes)

- Overall Grade – Lowest of any of the subsequent tests
- Reference Decode – Test if the barcode decodes with ISO reference decoding algorithm
- Decodability - The proportion of the available margin before improperly decoding characters within the symbol. This measurement is based off the individual bar and space elements within a character and their deviations from thresholds used to identify characters.
- Defects (score) - Irregularities found within elements and the quiet zones measured in terms of element reflectance non-uniformity
- Edge Determination — Percentage value of minimum edge contrast. Edge Contrast is the difference between the bar reflectance and space reflectance of two adjacent elements.
- Min Edge Contrast — Percentage value of minimum edge contrast. Edge Contrast is the difference between the bar reflectance and space reflectance of two adjacent elements.
- Min Reflectance — Percentage value of reflectance of darkest bar.
- Modulation — The ratio of the minimum edge contrast to symbol contrast.

- Quiet Zone — Fails if there is a violation in the quiet zone region before the leading or trailing bar. The required quiet zones are symbology dependent and can be found in the symbology specifications.
- Symbol Contrast — Is the difference between the highest and the lowest reflectance values in a scan reflectance profile

ISO 15415 Tests (2D Labels)

- Overall Grade - Lowest of any of the subsequent tests
- Reference Decode - Test if the 2D codes decodes with ISO reference decoding algorithm
- Axial Non-Uniformity - A measurement of the difference between the printed size of the rows and columns in a matrix.
- Contrast - The difference in percent of the maximum and minimum reflectivity in the inspection area.
- Fixed Pattern Damage - Measurement of non-uniformity in the quiet zone and in the locator and clock tracks
- Grid Non-Uniformity - This measurement is a delta of the difference of the measured grid in relation to the ideal grid formed from the four sides of the Data Matrix.
- Modulation - A measurement of the uniformity of the contrast of the dark areas and the light areas of the Data Matrix
- Reflectance Margin - Degree to which the cells are correctly distinguishable as black or white in comparison to the threshold.
- Unused Error Correction — The amount of error correction remaining after applying the reed Solomon error correcting algorithm and successfully decoding the symbol expressed as a percentage of the error correction contained within the symbol.

ISO 29158 Tests (2D DPM and General Labels)

- Overall Grade - Lowest of any of the subsequent tests
- Reference Decode - Test if the 2D codes decodes with ISO reference decoding algorithm
- Axial Non-Uniformity - A measurement of the difference between the printed size of the rows and columns in a matrix.
- Cell Contrast - The difference in percent of the center of the distribution of the light cells of the 2D Code versus the center of the distribution of the dark cells.
- Cell Modulation - A measurement of the uniformity of the contrast of the dark areas and the light areas of the Data Matrix
- Fixed Pattern Damage - Measurement of non-uniformity in the quiet zone and in the locator and clock tracks
- Grid Non-Uniformity - This measurement is a delta of the difference of the measured grid in relation to the ideal grid formed from the four sides of the Data Matrix.
- Minimum Reflectance – This measurement describes the brightness difference between the bright modules and the determined brightness of the bright modules in the calibration template.
- Unused Error Correction — The amount of error correction remaining after applying the reed Solomon error correcting algorithm and successfully decoding the symbol expressed as a percentage of the error correction contained within the symbol.

7-8-15 Decode Tool Output Formatting

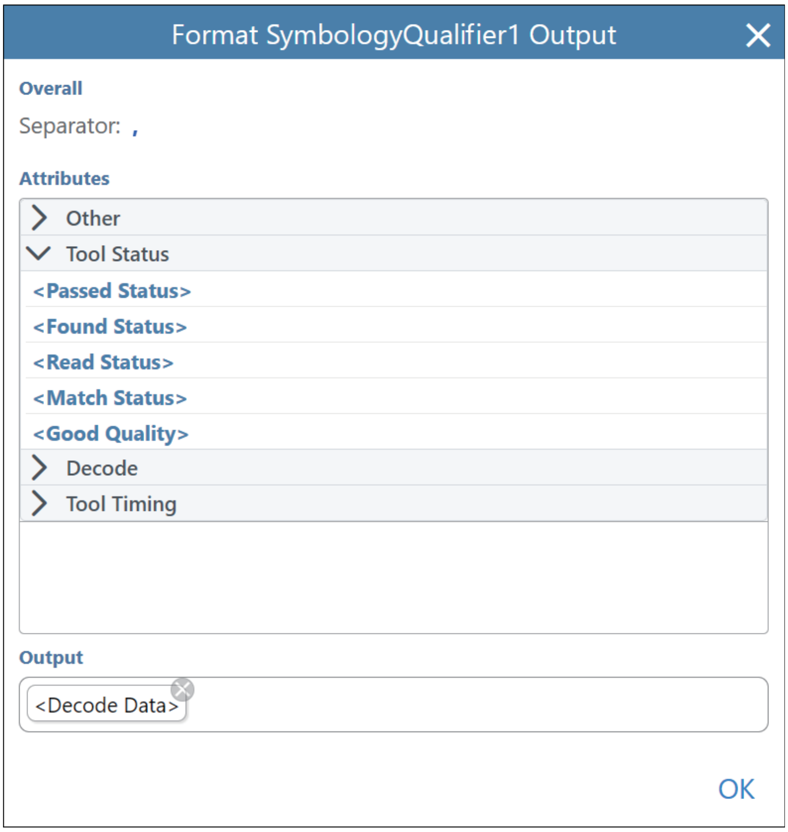
Constructing the Decode Tool Output String

The last function in the Decode Tool is Output. Output is used to compose the data string that is sent out from the Decode Tool to the Read Sequence. Data strings from all Decode Tools are appended into the overall output string result that will be sent at the end of the Read Cycle to the host.

By default, the Output for each Decode Tool contains the <Decode Data> field. <Decode Data> is the string contents of the code that has just been read.

The Formatting Tool described below allows the user to further customize the decode tool output string by adding user text, additional attributes of the code itself such as its X,Y, and Angle, and performance metrics for the Decode Tool such as decode time.

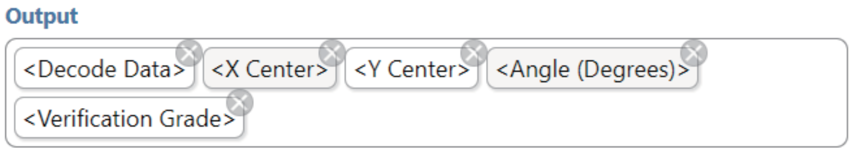
1. Click on <Decode Data> to open up the output string editor. The current content fields of the string are listed in the Output area.



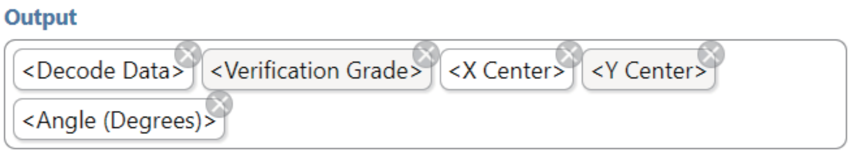
2. Append additional data to the string by clicking the desired attribute in the Other, Tool Status, Decode, or Tool Timing categories. That field will automatically appear at the end of the string in the Output area.

3. A user-defined separator is automatically inserted between each field as it is added.
   Note: There are three exceptions to this. No separator is inserted before or after <User Defined Text>, <SP>, or <TAB>. This allows the user the most control over creating a custom string.
4. The order of the fields in the string can be changed by dragging them to new locations in the field list.
5. Finally,any data field, including <Decode Data>, can be deleted from the Decode Tool Output string by clicking on the X for that field.

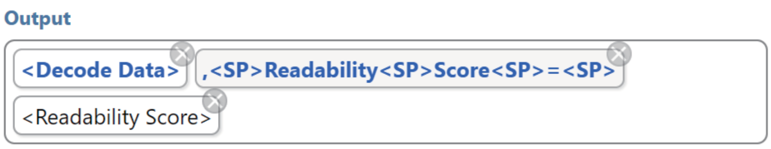
Example 1: This example shows what Output would contain if the user chose **Decode Data, X, Y, Angle, and Verification Grade** from the attributes lists.



Example 2: If the user wanted the Verification Grade second in the list instead, they would just click, drag, and drop it between <Decode Data> and <X Center>, producing the following:



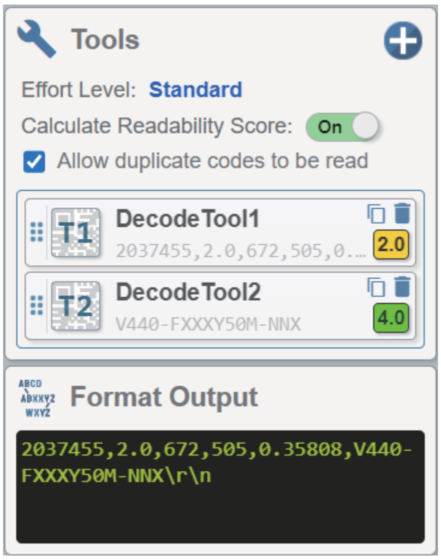
Example 3: This example shows how the <User Defined Text> field is used. Clicking on that field allows the user to change the text. It was changed to “Readability Score" as shown below.



The output from the Decode Tool is now:

```
2037455, Readability Score = 83\r
\n
```

Key Point: All Decode Tool Data Strings are sent up to the Read Sequence where they are automatically appended into the final Read Cycle Output String. The custom string from each Decode Tool can be seen both in the Decode Tool in the Tools Step section, and as part of the final string in the Format Output section.



See the table below for all the data/attributes that can be added into the Decode Tool output string, including User-Defined Text.

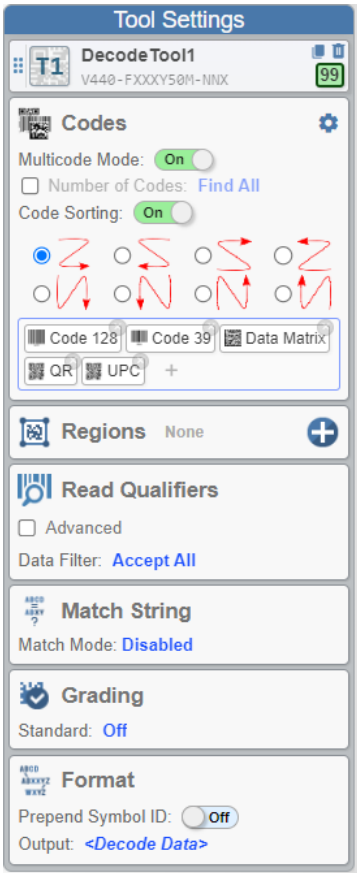
Decode Tool Format Output Result Options

Item	Description/Content
Other (User Text and General Text Formatting)	
User Defined Text	String to be inserted by the user
<SP>	Space is inserted
<TAB>	Tab is inserted
Tool Status – Pass fail status of the Decode Tool	
Passed Status	Decode Tool Status. Code was found, read, and matched (if enabled). Passed = **TRUE**. Failed = **FALSE**
Found Status	Found means that a code was found that was one of the target symbology types selected by the user, and it was in one of the ROIs set up by the user. Passed = **TRUE**. Failed = **FALSE**
Read Status	Read means that a code was found, and then it passed the Read Qualification step. Passed = **TRUE**. Failed = **FALSE**
Match Status	Matched means that a code was found, passed the Read Qualification step, and finally that the full string content matched user set match string. Passed = **TRUE**. Failed = **FALSE**
Good Quality	Good Quality means that code qualified completely and passed verification.
Decode Data – Data generated by X-Mode specific to the code that was read.	
Symbology Type	Symbology Type. Data Matrix, Code 93, etc.
Decoded Data String	Actual string date contained in the code
Polarity	Dark on Light = **TRUE**. Light on Dark = **FALSE**

Item	Description/Content
X1, Y1, X2, Y2, X3, Y3, X4, Y4 (pixels)	XY pixel coordinates of the four corners of the code corresponding the green rectangle drawn on the code. 1= Bottom Right, 2 = Bottom Left, 3 = Top Left, 4 = Top Right. Note that relationship stays relative to the angle of the code, not the code on the screen. Coordinate system reference: The upper left corner of the screen is considered 0,0 in pixel coordinates.
Readability Score	Outputs readability score 1-99 using quick test for code quality.
X Center Y Center (pixels)	X, Y coordinates of center of code. Corresponds to green rectangle drawn on the code. Coordinate system reference: The upper left corner of the screen is considered 0,0 in pixel coordinates.
Width, Height (pixels)	Width and Height of Code
Angle (Radians)	Angle of Code in Radians
Angle (Degrees)	Angle of Code in Degrees
Verification Grade	Letter or Number Grade depending on Format Setting A-F or 4.0 – 0.0
Verification Report	Output String with Letter or Number Grades for all verification tests. Overall Grade comes first, Reference Decode Second, and then all other tests as shown in the Verification Grade Display.
Tool Timing	
Time Localize (msec)	Time spent searching for possible locations of the target code in the ROI or Field of View
X-Mode Decode Time (msec)	Time spent evaluating all possible locations to determine if they are in fact a code, and then additional time spent to do the decode.

7-8-16 MultiCode Mode

Multicode Mode



Multicode Mode is a special mode of the Decode Tool that allows a single decode tool to read more than one code. It is an advanced feature designed to handle scenarios where multiple barcodes are present within a single field of view, and their positions or types are not consistent. This mode is particularly useful in applications such as bin picking or scanning packages on a conveyor belt.

When set to Multicode Mode, the Decode Tool will continue to run until the predetermined number of barcodes have been found, or until the Decode Tool quits, or times out.

For a barcode to be considered successfully decoded in Multicode Mode, it will still need to pass all the normal Qualification Gates:

- It must be one of the predefined barcode types.
- It must fall within the designated Regions of Interest (ROI), if specified.
- It must satisfy the conditions set by the Read Qualifier.
- It must correspond with an entry in the Match String Database.

If grading is enabled, it will be applied to all barcodes that meet these qualifications.

The format for outputting data is uniform across all decoded strings. For instance, if the user has chosen to output <Decode Data>, <X>, <Y>, and <Angle>, each decoded barcode will be reported in this format.

Additionally, users can specify the order in which barcode data is sorted in the output. The default setting arranges the data from the top left to the bottom right of the field of view.

7-9 Read Sequence End

7-9-1 Overview

As described in the Read Cycle section, the Read Cycle completes differently for each type of Job.

Continuous Mode/Presentation Mode – Read Cycle Processing ends only when the Decode Tools all Qualify. Processing will continue indefinitely waiting for parts to appear in front of the camera and this occurs.

Start/Stop Mode – Read Cycle Processing ends only when the the Stop Command is received.

Triggered Mode – Ends once all Decode Tools have Qualified, or have been set to NOREAD after searching in all available Captures in the Capture List. Here, if all Decode tools have succeeded, all pending Captures will be cancelled.. If any of the Decode Tools have not yet succeeded, the read cycle will continue until those Decode Tools have processed all available images have either read or failed to read.

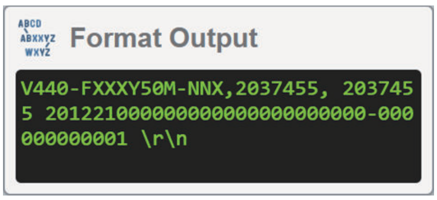
Once Read Cycle Processing ends the Read Sequence will move to the final two steps which are to format the output data, and then send the results through RS-232, TCP/IP and the Protocol Assembly. Finally, it will update the Digital outputs.

7-9-2 Read Sequence Data Format Output

Overview

In the next to last step in the Read Cycle, the formatted output string from each Decode Tool is passed to the Read Cycle Format Output step. Here, the final output string is constructed prior to being transmitted out as the final Read Cycle result.

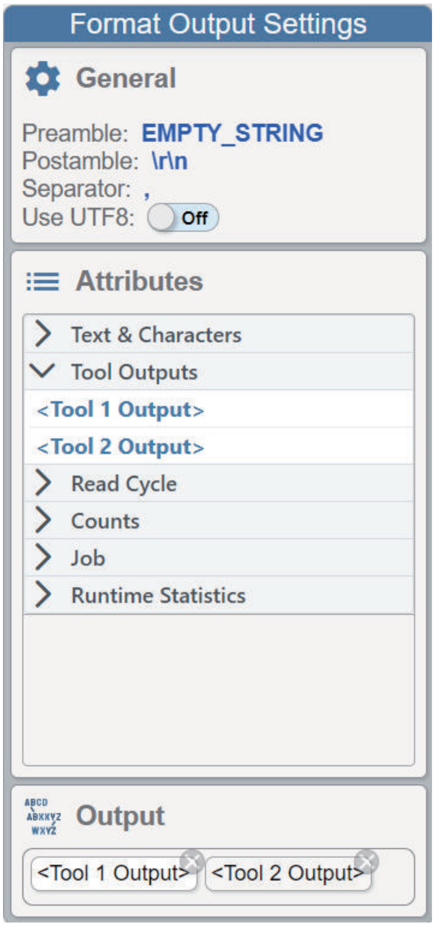
By default, each Decode Tool's string, <Tool Output> is appended into the final result string. The user also has the capability to add user defined text as well as Read Cycle specific data such as Read Time into the final string.



The Format Output Dialog described below allows the user to further customize the final result output string by adding User Text, detailed Pass/Fail data, Counts, Timing and performance metrics for the Read Cycle. Trigger and Result Time Stamps can be added as well.

Read Cycle Format Output Dialog

The user appends additional data to the string by clicking the desired attribute in the Text&Character, Tool Outputs, Read Cycle, Counts, Job and , Runtime Statistics categories. That field will automatically appear at the end of the string in the Output area.

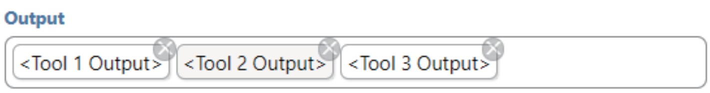


The user can set a predefined Preamble, Postamble and separator which will automatically inserted in the final result string.

The order of the fields in the string can be changed by dragging them to new locations in the field list.

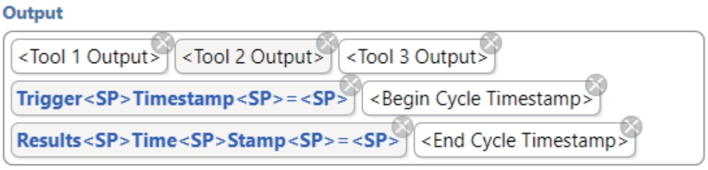
Finally, any piece of data, including <Tool Output>, can be deleted from the Output string by clicking the X for that field.

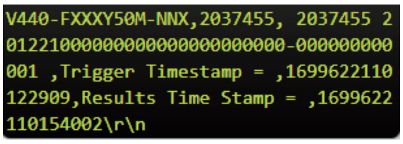
Example 1: This example shows what final Read Cycle Output would contain by default if the Job contained three Decode Tools.




```
V440-FXXXY50M-NNX,2037455, 2037455 2
01221000000000000000000000-000000000
001 \r\n
```

Example 2: This formatting example shows custom text strings and timestamp data added for that read cycle.





7-9-3 Read Cycle Format Output Settings

Item	Description/Content
General string formatting and user-insertable text	
Preamble	String placed at beginning of result
Postamble	String placed at beginning of result
Separator	Separator placed between elements
Use UTF8:	Symbols such as those encoded with Japanese characters are in a Unicode format. The standard code reader specification states, however, that the reader has to output ANSI strings. The problem is that the ANSI format does not show the UNICODE characters in a recognizable form. This setting allows the user to switch between sending and displaying strings as either ANSI when off, or UTF8 when on, which allows the user to see Unicode character strings in their native form.
User Defined Text	String to be inserted by the user
<SP>	Space is inserted
<TAB>	Tab is inserted
Tool Outputs	
Tool 1 Output	Final Formatted Output string from Decode Tool1
...	
Tool N Output	Final Formatted Output string from Decode ToolN, last in list
Read Cycle	
Passed	Read Cycle Passed = **True** Read Cycle Passed = **False**
All Present (Found)	All Codes Present = **True** Not All Codes Present = **False**
All Read	All Codes Read = **True** Not All Codes Read = **False**
All Match	All Codes Match = **True** Not All Codes Match = **False**
All Good Quality	All Codes Good Quality = **True** Not All Codes Good Quality = **False**
Cycle ID	Number of Cycles since Camera Power Up/Reboot
Begin Cycle Timestamp (μs)	Timestamp of when Trigger was received by the reader. The value is microseconds since Jan. 1, 1970.
End Cycle Timestamp (μs)	Timestamp of when the Result is sent by the reader. The value is microseconds since Jan. 1, 1970.

Item	Description/Content
Trigger Overrun	Trigger Overrun has Occurred = **True** No Trigger Overrun Issues = **False**
Process Overrun	Process Overrun has Occurred = **True** No Process Overrun Issues = **False**
Duration (msec)	Entire time of the current read cycle
Capture Time (msec)	Time spent on all Captures required in the current read cycle
Preprocess Time (msec)	Time spent on all Image Preprocessing in the current read cycle
Read Time (msec)	Time spent on all Decode Tool X-Mode processing in the current read cycle
Overhead Time (msec)	Time spent on other processing in the cycle such as reporting
Counts – Summary Counts (Batch Counts)	
Total Read Cycles	Total number of Read Cycles run since counts last cleared
# Cycles Failed	Total number of Failed Read Cycles since counts last cleared
# Cycles Passed	Total number of Passed Read Cycles since counts last cleared
# Reads	Total number of Reads Cycles since counts last cleared
# No Reads	Total number of Failed No Read Cycles since counts last cleared
# Matches	Total number of Matches since counts last cleared
# No Matches	Total number of No Matches since counts last cleared
# Good Quality	Total number of Good Quality counts since last cleared
# Bad Quality	Total number of Bad Quality counts since last cleared
Pass Rate (%)	Pass Rate % = # Passed/Total Read Cycles
Job	
Job Name	Name of the current loaded Job
Job Slot	Slot where the currently loaded Job is stored
Time Since Job Load (usec)	Elapsed Time since the Job was loaded. Displayed at the bottom of the UI
Runtime Statistics	
Part Per Minute (PPM)	Running average expressed in Parts Per Minute
Cycle Timeout (msec)	
Min, Current, Max Capture Time Duration (msec)	Statistics showing Minimum, Current, and Maximum Capture Times since counts last cleared. (Time spent acquiring images. If multiple captures were required, it would include the total time for all captures.)
Min, Current, Max Capture Time Count	Statistics showing Minimum, Current, and Maximum Capture Counts since counts last cleared. (Shows how many actual captures were required for decode.)
Min, Avg., Max, Current Processing Time (msec)	Statistics showing Minimum, Average, Maximum, and Current Processing Time since counts last cleared. (Time spent performing actual Read/Decode during the Read Cycle.)
Min, Avg., Max, Current Overall Cycle Duration (msec)	Statistics showing Minimum, Average, Maximum, and Current Cycle Durations since counts last cleared. (Time from Read Cycle Trigger to Read Cycle End.)
Min, Avg., Max, Current Overhead Time (msec)	Statistics showing Minimum, Average, Maximum, and Current Overhead Time since counts last cleared. (Time spent during Read Cycle on all other tasks other than Capture, Image Preprocessing, and Decoding. This includes setting IO, reporting, etc.)
Min, Current, Max, Avg. Time Between Cycles (msec)	Statistics showing Minimum, Current, Maximum, and Average Time Between Cycles since counts last cleared. (Time spent between end of processing previous cycle and processing current. Shows efficiency of the read cycle. This will go to near 0 when fully pipelined.)

Item	Description/Content
Min, Current, Max, Avg. Trigger Rate (msec)	Statistics showing Minimum, Current, Maximum, and Average Trigger Rate since counts last cleared. (Time from Read Cycle Trigger to next Read Cycle Trigger.)
Min, Current, Max, Avg. Total Cycle Time (msec)	Statistics showing Minimum, Current, Maximum, and Average Total Cycle Time since counts last cleared. (Time from Read Cycle Trigger to Read Cycle End.)
Min, Current, Max, Avg. Idle Time (msec)	Statistics showing Minimum, Current, Maximum, and Average Idle Time since counts last cleared. (Time spent not processing, waiting for next trigger.)

7-9-4 Read Sequence Data Transmit

The read cycle ends with reporting, where the final formatted output string is sent to the WebLink results screen, and out all active data channels (RS-232, TCP/IP, Ethernet/IP, PROFINET, etc.).

Digital Output signals indicating read cycle status such as Cycle Complete, Cycle Passed, Cycle Failed, Error are set at this exact time as well.

Key Point: If Digital Outputs are set to pulse mode, that processing for the next cycle will not be able begin until the output has been held on and then off for the set pulse time. Attention must be paid not to set these times excessively long.

7-10 The Output Step

7-10-1 Overview

The last step executed in the Read Cycle is the Output Step.

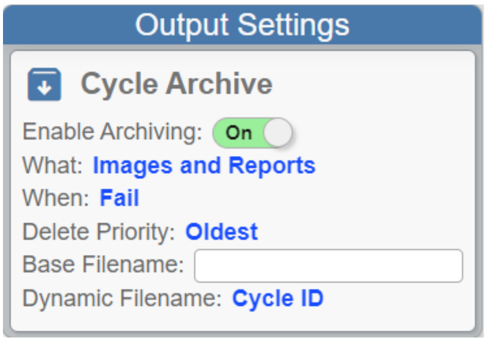
The Output Step allows the operator to configure the system to save Images and/or Cycle Reports during Runtime for archiving or debugging purposes.

Image and Report data is saved to RAM, It can be retrieved using the DDU which will copy it out of RAM and save it to an organized set of folders on the PC.

7-10-2 Output Dialog

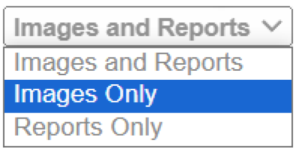
Archiving must be enabled. It is off by default.

When Enabled, the user can configure the following parameters to configure what gets saved, under what condition it gets saved, and how the files are named.



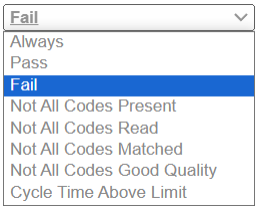
What to Save

What defines what to save. By default, both the Image and Cycle Report from a Read Cycle will be saved. The user can select Images or Cycle Reports only. The most common situation will be Images Only for the user to review problem decodes.



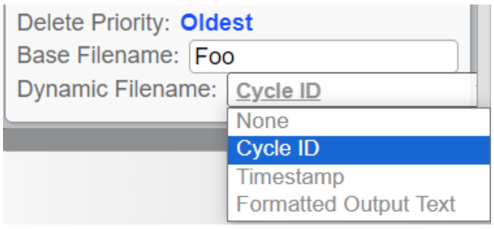
When, or under What Conditions, to Save

When defines what Read Cycle condition will cause the reader to save the Image and/or Cycle Report to RAM. By default, the condition to cause the save is a Read Cycle failure. The dropdown list gives the user much wide control over the condition for saving. The list is the same as what the operator is able to set for conditions to turn on the Digital Output.



File Control

The last three entries deal with file naming, as well as file management on the RAM.



● Delete Priority

Delete Priority deals with RAM File Management. The camera RAM is used to save Images and Reports until the user requests the data to be uploaded to the PC. The size of the RAM allocated for storage is 500 MB. This will hold approximately 100 Read Cycles of data for the 5 MP camera, and more for the 2.3 MP. Once the RAM is full, newer reports will begin to overwrite the older ones. Delete Priority allows the operator to overwrite the newest entries, or the oldest first. The default is for the system to overwrite the Oldest Files first.

● Base and Dynamic File Name

The complete report file name consist of two strings concatenated together. The first is an optional static string called the **Base Filename**. This is defined by the operator and will remain fixed from cycle to cycle.

The second is a variable string called **Dynamic Filename**. The operator uses this field to select what will constitute the dynamic portion of the file name which will change from read cycle to read cycle thus creating a unique name for each cycle.

By default **Dynamic Filename** is set to the **Cycle ID**. The **Cycle ID** is a unique number. It is reset on camera power up and will continue to incre-ment until the camera is shut down again. Any file saved with **Cycle ID** as part of the name will be different than all others for that interval.

The Dynamic portion can be set to the **Trigger Time Stamp**. The time stamp will always be unique if the camera is synced to a time server. If not, like Cycle ID, the time will be reset to factory time at power up.

Finally, it can be set to the actual **Decoded Output String**. Note that if the same code is being read over and over. This will not create a new unique file. The file will have the same name, and will be overwritten each time. In the same way, if the code fails to read and outputs “NOREAD”, this will not be unique either. Each file will be named NOREAD and overwrite the previous.

7-10-3 Output Step Settings

Item	Setting Value [Job Default]	Description
Enable Archiving	**[Off]**, On	Saving of Images and/or cycle reports.
What	**[Images and Reports]** Images Only Reports Only	Defines what should be saved for each Read Cycle.
When	Always Pass **[Fail]** Not All Codes Present Not All Codes Read Not All Codes Matched Not All Codes Good Quality Cycle Time Above Limit	Read Cycle result that prompts a report to be saved to RAM.
Delete Priority	**[Oldest],** Newest	Determines if system should overwrite the Oldest or Newest files in RAM when RAM becomes full.
Base Filename	**[empty string]**, user text	User text which defines the first part of string representing the file name.
Dynamic Filename	None Cycle ID Time Stamp **[Formatted Output]**	Variable part of the string representing the file name. Note: The Time Stamp is based on the Time and Data inserted in the camera at time of manufacture, unless the Time is set in Device Page using Time Sync Dialog.

7-10-4 Image and Report Retrieval

Images and Reports are saved in RAM on the reader. The Omron Device Discovery Utility (DDU) is the tool to upload files for review on the PC.

Saved Cycle Storage

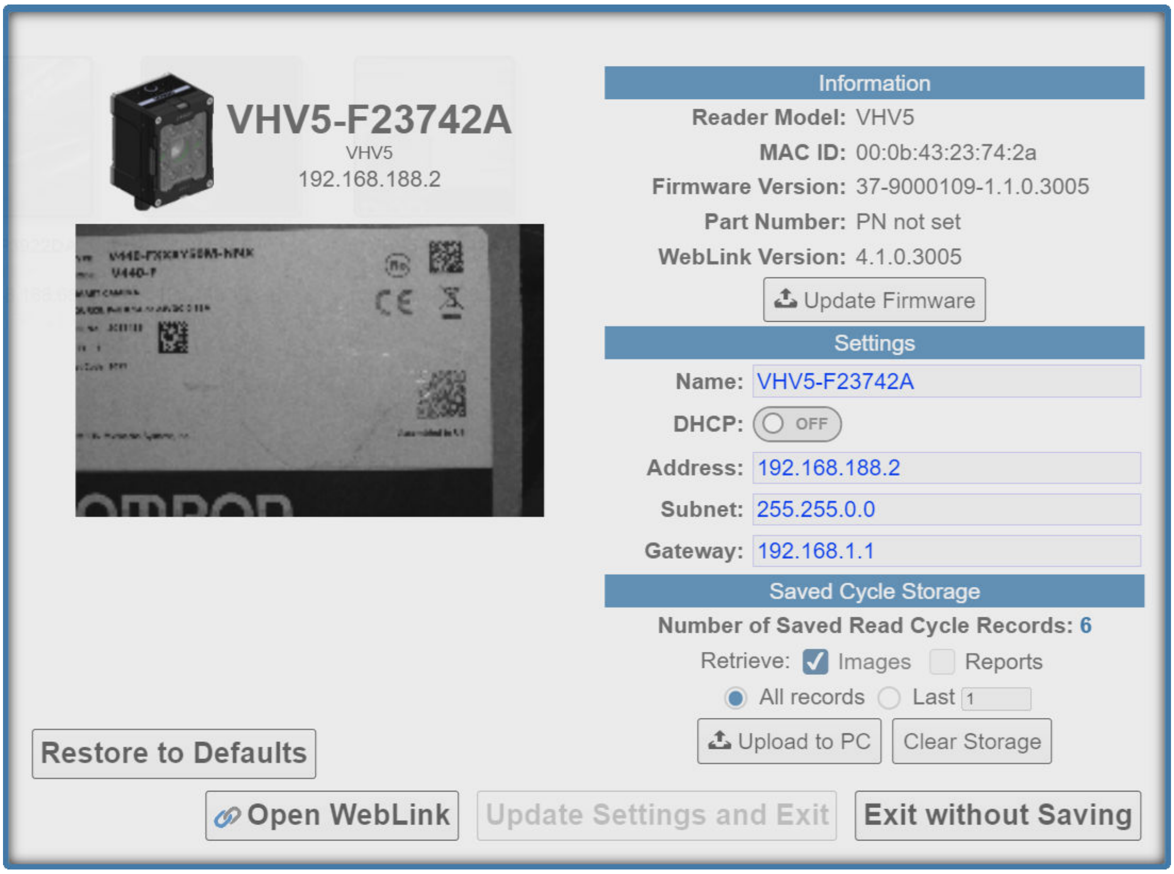
● Uploading Read Cycle Records to the PC

The DDU regularly checks the reader to determine if there are any Saved Read Cycle Records available for download from the camera to the PC. If records are present, their quantity is displayed.

Users should select whether they want to retrieve **Images**, **Reports**, or **both**.

Upon clicking the **Upload to PC** button, the records are compiled into a .zip file, transferred, and then saved in the PC's Downloads directory. After the transfer is complete, the records are automatically removed from the camera's RAM.

Additional controls allow the user to clear RAM storage. Users can also select how many of the records they would like to upload.



● File Naming Standard

■ Downloaded .zip Files

Downloaded files are .zip files containing all the data. The .zip file names have a fixed name format: **YearMonthDay_HourMinuteSecond_Camera- Name.zip**. See the example below.

Note: The Time and the Date for the .zip file are the based on the local time of the PC when the files were retrieved. This is the common convention. The same date and time stamp is seen under the Date Modified column.

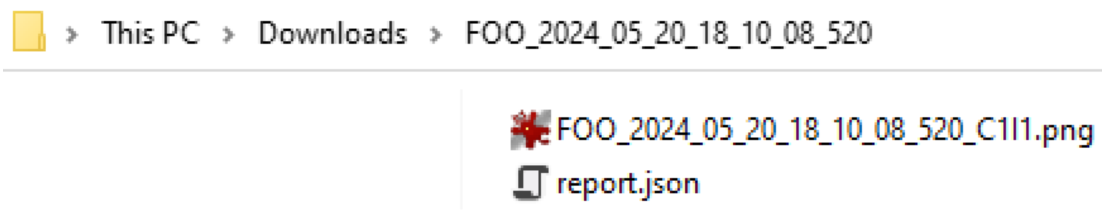
Name	Date modified	Type	Size
20240520_141015_VHV5-F23742A.zip	5/20/2024 2:10 PM	WinRAR ZIP archive	314 KB
20240520_140912_VHV5-F23742A.zip	5/20/2024 2:09 PM	WinRAR ZIP archive	1,708 KB
20240520_140738_VHV5-F23742A.zip	5/20/2024 2:07 PM	WinRAR ZIP archive	3,377 KB
20240520_140400_VHV5-F23742A.zip	5/20/2024 2:04 PM	WinRAR ZIP archive	569 KB

■ Contents of the .zip File

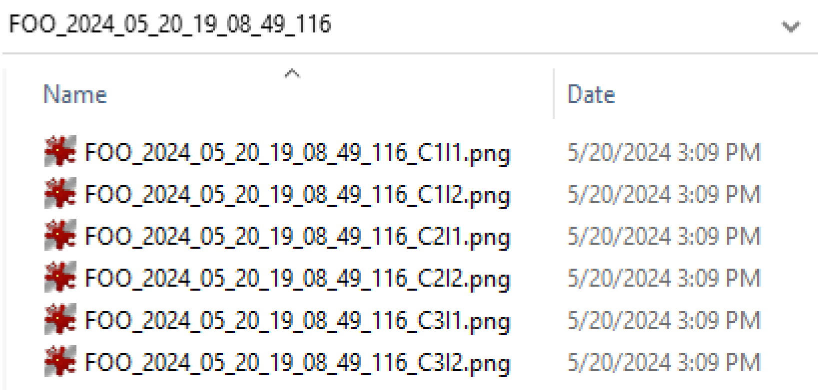
The.zip file includes one subfolder per cycle record. Each subfolder contains the image and/or report for that cycle. The folder and image and report names are generated by the camera reflecting the name defined by the user in the Output step.

Note: When the Timestamp is used as part of the file name, the Time and the Date are based on the UTC time of the camera when the read cycle was triggered.

The image name has an additional component that indicates which specific Capture is being referenced. The example below shows **C1|1**, which refers to Capture 1, Iteration 1.



An example with three Captures and 2 Iterations would look like the example below.



8

Serial Commands

The VHV5-F supports the serial commands described in this section.

8-1 Serial Command Syntax

Serial Command and Control

The reader TCP/IP, UDP, and RS-232 channels are normally used to output result data to a host. These same channels can be used to control the reader as well. This section lists the Serial Command set that can be used to control the reader.

The command set allows the host to Trigger the reader, to change the Mode of the reader, to set Key Job Parameters such as focus, lighting, and match string, and to call Quickset functions such as Quick Photometry and Quick Focus that actively set up imaging.

Serial Command Syntax

1. All Serial Commands start with an ! followed by the command name. All commands must be followed by a carriage return (CR).

   Example: !TRIGGER<CR>

2. Commands with arguments require a comma between each field.
   Example: !SETMATCHSTR,2,123456<CR>

Serial Command Response

1. All serial commands return an error code when complete. 0 = Success. All error codes are listed in the tables below. Note that some commands such as Quick Photometry and Quick Focus may take up to 5 seconds to complete.

   Example:
   !TRIGGER<CR>
   Expected Response: !TRIGGER=0

8-1-1 !TRIGGER

Description	Sends a soft trigger to the reader.	
Parameters	None	
Return Err Codes	0	Success

Operation: Triggers a Read Cycle if system is in Run or Setup mode.
Mode: System needs to be in Run mode or Setup mode to act on this command.

Example:
!TRIGGER<CR> – Triggers a Read Cycle.
Expected Response 1: !TRIGGER=0<CR><LF>
Expected Response 2: [Format Output]

8-1-2 !RUN

Description	Puts the reader into Run mode.
Parameters	None

Return Err Codes	0	Success

Operation: Puts the reader into Run mode and changes user interface to Run view.

Run Mode: Job Change is allowed in Run mode. Job Parameter changes are not allowed.

Example:

!RUN <CR> – Changes reader to Run mode.

Expected Response: !RUN=0<CR><LF>

8-1-3 !SETUP

Description	Puts the reader into Setup mode.	
Parameters	None	
Return Err Codes	0	Success

Operation: Puts the reader into Setup mode and changes user interface to Setup view.

Setup Mode: Job Change is not allowed in Setup mode. Job Parameter changes are allowed.

Example:

!SETUP<CR> – Changes reader to Setup mode.

Expected Response: !SETUP=0<CR><LF>

8-1-4 !OFFLINE

Description	Puts the reader into Offline mode. No triggers are accepted when offline.	
Parameters	None	
Return Err Codes	0	Success

Operation: Puts the reader in Offline mode and changes the user interface to Device view.

Offline Mode: Job is stopped and does not respond to triggers. Job Change is allowed in Offline mode. Job Parameter changes are not allowed.

Example:

!OFFLINE<CR> – Puts the reader in Offline mode.

Expected Response: !OFFLINE=0<CR><LF>

8-1-5 !SETEXPOSURE,<capture index>,<exposure value>

Description	Sets the specified capture to the specified exposure value.	
Parameters	<capture index>	1 based index of the capture you wish to modify.
	<exposure value>	Exposure setting you wish to set into the capture.
Return Err Codes	0	Success
	1	Error: No job is loaded.
	2	Error: Invalid capture index.
	3	Error: Exposure value was out of the valid range.
	101	Invalid command format. Must have at least 2 parameters.

Operation: Directly sets the Exposure Value of the selected Capture in the loaded job.

Example:

!SETEXPOSURE,1,64<CR> – Sets capture 1's exposure setting to 64.
Expected Response: !SETEXPOSURE=0<CR><LF>

8-1-6 !SETGAIN,<capture index>,<gain value>

Description	Sets the specified capture to the specified gain value.	
Parameters	<capture index>	1 based index of the capture you wish to modify.
	<gain value>	Gain value you wish to set into the capture.
Return Err Codes	0	Success
	1	Error: No job is loaded.
	2	Error: Invalid capture index.
	3	Error: Gain value was out of the valid range.
	101	Invalid command format. Must have at least 2 parameters.

Operation: Directly sets the Gain value of the selected Capture in the loaded job.

Examples:

!SETGAIN,1,50<CR> – Sets capture 1's gain setting to 50.
Expected Response: !SETGAIN=0<CR><LF>

!SETGAIN,1,101<CR> – Tries to set capture 1's gain setting to 101, but this is out of the valid range.
Expected Response: !SETGAIN=3<CR><LF>

8-1-7 !SETFOCUS,<capture index>,<focus value>

Description	Sets the specified Capture to the specified Focus value	
Parameters	<capture index>	1 based index of the capture you wish to modify.
	<focus value>	Focus value you wish to set into the capture.
Return Err Codes	0	Success
	1	Error: No job is loaded.
	2	Error: Invalid capture index.
	3	Error: Focus value was out of the valid range.
	101	Invalid command format. Must have at least 2 parameters.

Operation: Directly sets the Focus value of the selected Capture in the loaded job.

Example:
!SETFOCUS,1,150<CR> – Sets capture 1's Focus setting to 150.
Expected Response: !SETFOCUS=0<CR><LF>

8-1-8 !QUICKSET,<capture index>,<do focus>,<do photometry>,<roi left><roi top><roi width><roi height>

Description	Commands the reader to run either a Quick Focus, a Quick Photometry, or both. Optionally allows you to specify a region of interest (ROI) within the image in which to run the operations.

Parameters	<capture index>	1 based index of the capture on which you wish to run Quick Focus or Quick Photometry.
	<do focus>	Set to 1 if you wish to run the Quick Focus operation, 0 if not.
	<do photometry>	Set to 1 if you wish to run the Quick Photometry operation, 0 if not.
	<roi left>	Optional: Left-most pixel location of a region within the image in which you want to run the operation.
	<roi top>	Optional: Top-most pixel location of a region within the image in which you want to run the operation.
	<roi width>	Optional: Width of the region in which you want to run the operation.
	<roi height>	Optional: Height of the region in which you want to run the operation.
Return Err Codes	0	Success
	1	Error: No job is loaded.
	2	Error: Invalid capture index.
	3	Error: Invalid ROI parameters.
	99	Error: Unexpected error.
	101	Invalid command format. Must have at least 3 parameters.

Operation: Puts the system Offline. Runs Quick Photometry or Quick Focus on the selected Capture. Performs this operation within the specified region of interest (ROI). When done, the system is put back into the previous mode.

Note: This operation can take up to 5 seconds to complete and generate a response.

Examples:
!QUICKSET,1,1,0<CR> – Runs a Quick Focus operation on capture 1.
Expected Response: !QUICKSET=0<CR><LF>

!QUICKSET,2,0,1<CR> – Runs a Quick-Photometry operation on capture 2.
Expected Response: !QUICKSET=0<CR><LF>

!QUICKSET,1,1,1,400,500,400,200<CR> – Runs both a Quick Focus and Quick-Photometry operation on capture 1. These operations will be run within a region of the image starting at pixel 400,500, 400 pixels wide and 200 pixels tall.
Expected Response: !QUICKSET=0<CR><LF>

8-1-9 !JOBCHANGE,<job slot index>

Description	Changes the active job to the job in the specified slot.	
Parameters	<job slot index>	0 based index of the job slot to switch to.

Return Err Codes	0	Success
	2	Error: Unexpected Error
	3	Error: Job does not exist.
	8	Error: Invalid job file. Job could not be loaded because it is corrupt.
	12	Error: Invalid Job Slot specified. Slot was outside the valid range.
	101	Invalid command format. Must have at least 1 parameter.

Operation: Puts the system Offline if it is not already. Changes the Job to the one in the selected slot. When done, the system is put back into the previous mode.

Examples:
!JOBCHANGE,1<CR> – Change jobs to the job in slot 1.
Expected Response if there is a job in slot 1: !JOBCHANGE=0<CR><LF>
Expected Response if there is NO job in slot 1: !JOBCHANGE=3<CR><LF>

!JOBCHANGE,33<CR> – Trying to change to job slot 33, but there are only 32 slots on the VHV5-F.
Expected Response: !JOBCHANGE=12<CR><LF>

8-1-10 !SETMATCHSTR,<tool index>,<match string>

Description	Sets the match string of the specified tool to the specified match string value.	
Parameters	<tool index>	1 based index of the tool with the match string you wish to modify. Set this to -1 if you wish to apply the match string to all tools.
	<match string>	The match string value to set into the specified tool. If the match string contains a comma, it must be escaped. Otherwise it will be treated as a parameter separator.
Return Err Codes	0	Success
	1	Error: tool index is not valid.
	101	Invalid command format. Must have at least 2 parameters.

Operation: Sets the Match String for a specific Decode Tool.

Examples:
!SETMATCHSTR,2,123456<CR> – Sets tool 2's match string to "123456".
Expected Result if tool 2 exists: !SETMATCHSTR=0<CR><LF>
Expected Result if tool 2 does NOT exist: !SETMATCHSTR=1<CR><LF>

!SETMATCHSTR,1,123\,456<CR> – Sets tool 1's match string to "123,456". Comma is escaped.
Expected Result: !SETMATCHSTR=0<CR><LF>

8-1-11 !GETMATCHSTR,<tool index>

Description	Returns the match string(s) for the specified tool. Defaults to tool 0 if no index is specified.	
Parameters	<tool index>	Optional: 1 based index of the tool with the match string you wish to retrieve. If you leave off this parameter, then you will get the match string for tool 1.

Return Err Codes	0	Success
	1	Error: tool index is not valid.
	2	Error: specified tool is NOT a symbology tool and so has no match string.
	101	Invalid command format. Must have at least 2 parameters.

Operation: Returns the Match String for a specific Decode Tool.

Note: Command not applicable to EtherNet/IP or PROFINET.

Examples:

!GETMATCHSTR<CR> – Gets the match string from tool 1.

Expected Response (match string=123456): !GETMATCHSTR=0,123456

!GETMATCHSTR,2<CR> – Gets the match string from tool 2.

Expected Response if there is a tool 2: !GETMATCHSTR=0,123456

Expected Response if there is NOT a tool 2: !GETMATCHSTR=1

9

Symbologies

This main purpose of this section is to describe all of these low level parameter settings for each of the Code or Symbology Types so the user can set them intelligently.

9-1 Overview

Each Decode Tool is configured by the user to find and read one particular code in the image. The first thing the user must do is add all of the possible Code or Symbology Types it can be to the Codes list.

The second thing the user should do is set the specific parameters for that symbology type if required. As an example, for Code 39, the user may need to set "Fixed Symbol Length", so it is able to read the user's particular code.

The default settings for all code types are normally adequate to be able to read most codes with no change. However, there are cases when this is not true and alternate settings must be entered.

The main purpose of this chapter is to describe all of these low level parameter settings for each of the Code or Symbology Types so the user can set them intelligently.

9-1-1 Adding and Removing Codes from the List

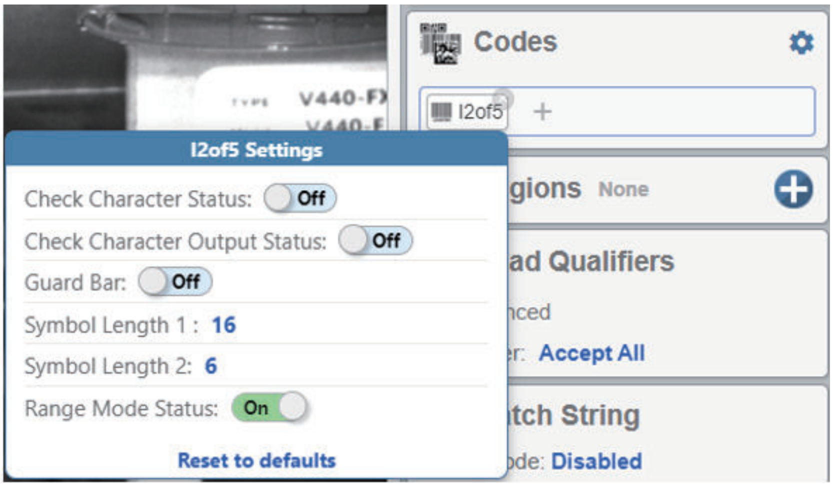
Data Matrix, **QR Code**, **Code 128** and **Code 39** are enabled as default code types of the decoder algorithm will search for in any new job.

The user may add or remove Symbology types from the list of codes to be found. Code Types are added using the **+**. Code types are deleted from the list by clicking on the x in the top right corner of the code type. Adding the Code Type to the list automatically enables it. Removing it from the list automatically disables it.

9-1-2 Changing Symbology Parameters

To change the parameters for a particular Symbology Type, the user should click on that Code Type in the list. This brings up a dialog box showing current settings. The user can now modify the settings individually or restore the settings to back to default.

Note: The new settings only affect how this one Decode Tool will work. They are not global settings that affect all tools in the job.


V440-F
Codes
I2of5
I2of5 Settings
Check Character Status: Off
Check Character Output Status: Off
Guard Bar: Off
Symbol Length 1 : 16
Symbol Length 2: 6
Range Mode Status: On
Reset to defaults
gions None
ad Qualifiers
nced
er: Accept All
tch String
ode: Disabled

9-2 Composite

When set to **Enabled** or **Required**, will decode the 2D composite component of a linear symbol. The linear symbol can be DataBar-14, DataBar Expanded, DataBar Limited, EAN-128, UPC-A, EAN-13, EAN-8, and UPC-E.

Usage:	Allows reading by both linear and 2D readers.
Default:	**Disabled**
Options:	**Disabled - when removed from the list** Enabled Required - when added to the list

9-2-1 Enabled

If **Composite** is set to **Enabled**, the reader will decode both the 2D composite and linear components. However, if the 2D composite component is not decoded, the linear data will be sent by itself at the end of the read cycle.

9-2-2 Required

If set to **Required**, the reader must decode both components, or a No-Read will occur.

9-2-3 Separator Status (Composite)

Usage:	Allows the user to distinguish between the main and **Supplemental** symbols.	
Definition:	Separates the linear and the composite component.	
Default:	**Disabled**	
Options:	Off = Disabled	On = Enabled

9-2-4 Separator Character (Composite)

Note: The Separator Character will be the same as the character defined in the **Multisymbol Separator** field.

Usage:	As required by the application.
Definition:	Allows the user to change the separator character from a comma to a new character.
Default:	**,** (comma)
Options:	Any ASCII character.

9-3 Aztec

Usage:	Used in document imaging, railway ticket validation, and some postal applications.
Definition:	A 2D matrix symbology built on a square grid with a square "bull’s-eye" pattern at the center. **Aztec** can encode up to 3,832 numeric or 3,067 alphabetical characters, or 1,914 bytes of data. The level of Reed-Solomon error correction used with Aztec is configurable, from 5% to 95% of the total data region. The recommended error correction level is 23% of symbol capacity plus codewords.
Default:	**Disabled**
Options:	**Disabled - when removed from the list** Enabled - when added to the list There are no other settings for Aztec other than the automatic Enable/Disable.

9-4 Postal Symbologies

Important: Postal Symbologies must have a minimum pixels-per-element value of **4** to be decoded reliably by the reader.
The reader must be configured to specific read range, field of view, and camera parameters before decoding Postal Symbologies.
For optimal decode results, position the symbol as close to the center of the reader's field of view as possible.

9-4-1 Postal Symbology Type

Usage:	The following 1D **Postal Symbologies** are used in mail sortation, auditing, certified mail, registered mail, metered mail, and point-of-sale (POS) applications.
Definition:	Determines the postal symbology that will be decoded by the reader.
Default:	**Disabled**
Options:	**0 = Disabled** 1 = U.S. Post (POSTNET, PLANET, Intelligent Mail (USPS4CB)) 2 = Australia Post 3 = Japan Post 4 = Royal Mail 5 = Dutch Post (KIX) 6 = UPU

U.S. Post (POSTNET, PLANET, Intelligent Mail (USPS4CB))

When **U.S. Post** is enabled, the reader will only decode **POSTNET**, **PLANET**, and **Intelligent Mail (USPS4CB)** symbols.
Important: POSTNET Status, **PLANET Status**, and **Intelligent Mail (USPS4CB) Status** are enabled by default. However, if any of the three U.S. Post symbologies is set to **disabled** individually, symbols of that type will not be decoded by the reader even when U.S. Post is enabled.
For example, if **U.S. Post** is enabled but **POSTNET Status** is disabled, **POSTNET** symbols will not be decoded by the reader.
See **POSTNET Status**, **PLANET Status**, and **GS1 DataBar** for more detail about U.S. Post symbologies.

Australian Post

When **Australia Post** is enabled, the reader will only decode Australia Post symbols.

Japan Post

When **Japan Post** is enabled, the reader will only decode Japan Post symbols.

Royal Mail

When **Royal Mail** is enabled, the reader will only decode Royal Mail symbols.

Dutch Post (KIX)

When **Dutch Post (KIX)** is enabled, the reader will only decode Dutch Post (KIX) symbols.

UPU

When **UPU** is enabled, the reader will decode UPU symbols.
For example, if **Postal Symbology Type** is set to **UPU** and **POSTNET Status** is enabled, the reader will attempt to decode both UPU and POSTNET symbols.

9-4-2 POSTNET Status

Usage: **POSTNET** is used by the United States Postal Service to direct mail. The ZIP Code or ZIP+4 Code is encoded in the symbol. Data is encoded in half-height and full-height bars, making POSTNET a "2-state" symbology.
The delivery point (usually the last two digits of the address or post office box number) is also typically encoded in POSTNET symbols.

Definition: If **U.S. Post** and **POSTNET Status** are both enabled, the reader will decode POSTNET symbols.

Default: **Enabled**

Options: Off = Disabled
On = Enabled

9-4-3 PLANET Status

Usage: **PLANET (Postal Alphanumeric Encoding Technique)** is a symbology used by the United States Postal Service to track and identify items during delivery. Each PLANET symbol is either 12 or 14 digits long, and encodes data in half-height and full-height bars, making PLANET a "2-state" symbology. The symbol always starts and ends with a full-height bar, or "guard rail", and each individual digit is represented by a set of five bars in which two of the bars are always short.

Definition: If **U.S. Post** and **PLANET Status** are both enabled, the reader will decode PLANET symbols.

Default: **Enabled**

Options: Off = Disabled
On = Enabled

9-4-4 USPS4CB Status

Usage: **USPS4CB**, also called **Intelligent Mail**, is used by the United States Postal Service to sort and track individual items as well as flats of mail. USPS4CB combines the capabilities of POSTNET and PLANET, and can encode 31 digits (65 bars). USPS4CB symbols are slightly longer than POSTNET symbols, and offer additional flexibility in choosing symbol height and width.

Data is encoded in four types of bars ("states"), each of which is identified by a name and a value. This type of postal symbol is known as "4-state". Each bar has a "tracker", or middle section, to which an "ascender" (top section) or "descender" (bottom section) may be added. The 4-state format allows the symbol to contain more information, and makes it easier to decode. 4-state symbols can also be printed easily in a variety of media, including dot matrix, inkjet, and laser.

Definition: If **U.S. Post** and **USPS4CB Status** are both enabled, the reader will decode USPS4CB symbols.

Default: **Enabled**

Options: Off = Disabled
On = Enabled

9-5 Code 39

Usage: **Code 39** is considered the standard for non-retail 1D symbology.

Definition: An alphanumeric symbology with unique start/stop code patterns, composed of 9 black and white elements per character, of which 3 are wide.

Default: **Enabled**

Options: Disabled - when removed from the list
Enabled - when added to the list

9-5-1 Check Character Status (Code 39)

Default: **Disabled**

Options: **Off = Disabled** On = Enabled

9-5-2 Check Character Output Status (Code 39)

Usage: **Check Character Output Status**, added to the symbol, provides additional data security.

Definition: When enabled, the check character is read and compared along with the symbol data. When disabled, symbol data is sent without the check character.
Note: With **Check Character Output Status** and an **External** or **Serial** trigger option enabled, an invalid check character calculation will cause a No-Read message to be transmitted at the end of the read cycle.

Default: **Disabled**

Options: **Off = Disabled** On = Enabled

9-5-3 Large Intercharacter Gap (Code 39)

Usage: **Large Intercharacter Gap** is helpful for reading symbols that are printed out of specification.

Definition: When enabled, the reader can read symbols with gaps between symbol characters that exceed three times (3x) the narrow element width.

Default: **Disabled**

Options: **Off = Disabled** On = Enabled

9-5-4 Fixed Symbol Length Status (Code 39)

Definition: When enabled, the reader will check the symbol length against the symbol length field. If disabled, any length will be considered valid.

Default: **Disabled**

Options: **Off = Disabled** On = Enabled

9-5-5 Fixed Symbol Length (Code 39)

Usage: **Fixed Symbol Length** helps prevent truncations and increases data integrity by ensuring that only one symbol length will be accepted.

Definition: Specifies the exact number of characters that the reader will recognize (this does not include start and stop and check characters). The reader ignores any symbology that does not match the specified length.

Default: **10**

Options: 1 to 64

9-5-6 Full ASCII Set (Code 39)

Usage: Must be enabled when reading characters outside the standard character set (0-9, A-Z, etc.)
The user must know in advance whether or not to use the **Full ASCII Set** option. Since **Full ASCII Set** requires two code words to encode one character, it is less efficient.

Definition: Standard Code 39 encodes 43 characters; zero through nine, capital "A" through capital "Z", minus symbol, plus symbol, forward slash, space, decimal point, dollar sign, and percent symbol. When **Full ASCII Set** is enabled, the reader can read the full ASCII character set, from 0 to 255.

Default: **Disabled**

Options: **Off = Disabled** On = Enabled

9-6 Codabar

Usage: Used in photo-finishing and library applications. Previously used in medical applications, but not typically used in newer medical applications.

Definition: Codabar is a 16-bit character set (0 through 9, and the characters **$**, **:**, /, **.**, **+**, and **–**) with start/stop codes and at least two distinctly different bar widths.

Default: **Disabled**

Options: **Disabled - when removed from the list**
Enabled - when added to the list

9-6-1 Start/Stop Match (Codabar)

Definition: When disabled, the reader will decode Codabar symbols whether or not the start and stop characters are the same.
When enabled, the reader will not decode Codabar symbols unless the start and stop characters are the same.

Default: **Enabled**

Options: Off = Disabled **On = Enabled**

9-6-2 Start/Stop Output (Codabar)

Definition: When disabled, the start and stop characters will not be present in the data output of the decoded symbol.
When enabled, the start and stop characters will be present in the data output of the decoded symbol.
Note: Because the start and stop characters are included as part of the data, the characters must be included as part of the length in a fixed length mode of operation.

Default: **Enabled**

Options: Off = Disabled **On = Enabled**

9-6-3 Large Intercharacter Gap (Codabar)

Definition: When disabled, the spaces between characters, or the "intercharacter gap", are ignored during the decode process.
Note: If the intercharacter space is large enough to be considered a margin, the symbol will not decode, regardless of this parameter’s setting.

Default: **Disabled**

Options: **Off = Disabled** On = Enabled

9-6-4 Fixed Symbol Length Status (Codabar)

Definition: When disabled, the reader will accept any Codabar symbol provided it doesn’t exceed the system’s maximum capabilities.
When enabled, the reader will reject any Codabar symbol that doesn’t match the fixed length.

Default: **Disabled**

Options: **Off = Disabled** On = Enabled

9-6-5 Fixed Symbol Length (Codabar)

Definition:	This is the value against which all Codabar symbol lengths will be compared.
Default:	**10**
Options:	1 to 64

9-6-6 Check Character Type (Codabar)

Definition:

When disabled, the reader will not perform any character checking calculations on decoded Codabar symbols.
When set to **Mod 16**, the reader will perform a modulus 16 check character calculation on the symbol. If the symbol does not pass this calculation, it will not be decoded.
When set to **NW7**, The reader will perform an NW7 modulus 11 check character calculation on the symbol. If the symbol does not pass this calculation, it will not be decoded.
When set to **Both**, the reader will perform both the Mod 16 and NW7 modulus 11 check character calculations on the symbol. If the symbol does not pass either calculation, it will not be decoded.

Default: **NoCheck**

Options: **NoCheck** Mod 16 NW7 (Mod 11) Mod 16 and NW7

9-6-7 Check Character Output (Codabar)

Definition:

When this field is disabled and a check character calculation is enabled, the reader will strip the verified check character from the symbol data output. This condition must be accounted for if a fixed length is also being used.
When enabled, the reader will output the check character as part of the symbol data. This condition must be accounted for if a fixed length is also being used.

Default: **Disabled**

Options: **Off = Disabled** On = Enabled

9-7 Interleaved 2 of 5

Usage: I-2/5 has been popular because it is the most dense symbology for printing numeric characters less than 10 characters in length; however, Omron Microscan does not recommend this symbology for any new applications because of inherent problems such as truncation.

Definition: A dense, continuous, self-checking, numeric symbology. Characters are paired together so that each character has five elements, two wide and three narrow, representing numbers 0 through 9, with the bars representing the first character and the interleaved spaces representing the second character. (A check character is highly recommended).

Important: You must set Symbol Length in order to decode I-2/5 symbols, unless **Range Mode** is enabled.

Default: **Disabled**

Options: **Disabled - when removed from the list**
Enabled - when added to the list

9-7-1 Check Character Status (Interleaved 2 of 5)

Usage: This option is not typically used, but it can be enabled for additional security in applications where the host requires redundant check character verification.

Definition: An error correcting routine in which the check character is added.

Default: **Disabled**

Options: **Off = Disabled** On = Enabled

9-7-2 Check Output Status (Interleaved 2 of 5)

Definition: When enabled, a check character is sent along with the symbol data for added data security.

Default: **Disabled**

Options: **Off = Disabled** On = Enabled

9-7-3 Symbol Length #1 (Interleaved 2 of 5)

Usage: Useful in applications where I-2/5 symbols of a specific length are required.

Definition: The **Symbol Length # 1** field is one of two fields against which the decoded symbol is compared before accepting it as valid or rejecting it.

Default: **16**

Options: 0 to 64, even only (will be truncated to next lower even number if odd number is inserted)

Important: If **Range Mode** is disabled, the length of the symbol must match either **Symbol Length # 1** *or* **Symbol Length # 2** to be considered a valid symbol.
If **Range Mode** is enabled, **Symbol Length # 1** and **Symbol Length # 2** form a range into which the length of the symbol must fall to be considered valid.

9-7-4 Symbol Length #2 (Interleaved 2 of 5)

Usage:	Useful in applications where I-2/5 symbols of a specific length are required.
Definition:	The **Symbol Length # 2** field is one of two fields against which the decoded symbol is compared before accepting it as valid or rejecting it.
Default:	**6**
Options:	0 to 64, even only (will be truncated to next lower even number if odd number is inserted) **Important:** If **Range Mode** is disabled, the length of the symbol must match either **Symbol Length # 2** or **Symbol Length # 1** to be considered a valid symbol. If **Range Mode** is enabled, **Symbol Length # 2** and **Symbol Length # 1** form a range into which the length of the symbol must fall to be considered valid.

9-7-5 Guard Bar Status (Interleaved 2 of 5)

- **Note:** Whenever **Guard Bar** is enabled, the presence of guard bars (also called "bearer bars") is required for decoding to take place.

Usage:	Useful when I-2/5 multisymbols are enabled to prevent false data output. This typically occurs with highly tilted or skewed symbols.	
Definition:	A guard bar is a heavy bar, at least twice the width of the wide bar, surrounding the printed I-2/5 symbol and helping to prevent false reads.	
Default:	**Disabled**	
Options:	**Off = Disabled**	On = Enabled

9-7-6 Range Mode Status (Interleaved 2 of 5)

Usage:	Useful in applications where I-2/5 symbols of a specific length are required.	
Definition:	When **Range Mode** is disabled, the reader checks the value of the symbol length against the values set in **Symbol Length # 1** and **Symbol Length # 2**. If the symbol length does not match either of the preset values, then it is rejected as invalid. When **Range Mode** is enabled, **Symbol Length # 1** and **Symbol Length # 2** are combined to form a range of valid symbol lengths. Any symbol length that does not fall into this range is rejected as an invalid symbol. Either of the preset symbol length values in the **Symbol Length # 1** and **Symbol Length # 2** fields can form the start or end of the range.	
Default:	**Enabled**	
Options:	Off = Disabled	**On = Enabled**

9-8 UPC/EAN

Usage:	Used primarily in point-of-sale applications in the retail industry. It is commonly used with the readers in applications in combination with **Matchcode** when there is a need to verify that the right product is being placed in the right packaging.
Definition:	**UPC** (Universal Product Code) is a fixed length, numeric, continuous symbology. UPC can have two- or five-digit supplemental bar code data following the normal code. The UPC Version A (UPC, A) symbol is used to encode a 12 digit number. The first digit is the number system character, the next five are the manufacturer number, the next five are the product number, and the last digit is the checksum character. When enabled, the reader will read UPC Version A and UPC Version E only.
Default:	**Disabled**
Options:	**Disabled - when removed from the list** Enabled - when added to the list

9-8-1 EAN Status

Usage:	**EAN** is the European version of the UPC symbology and is used in European market applications. **Note: UPC** must be enabled for **EAN** to take effect.		
Definition:	EAN is a subset of UPC. Disabled – No EAN output Enabled - When enabled, the reader will read UPC Version A, UPC Version E, EAN 13, and EAN 8. It also appends a leading zero to UPC Version A symbol information and transmits 13 digits. If transmitting 13 digits when reading UPC Version A symbols is not desired, disable EAN. Enabled Suppress Leading 0 - Same as above. It will read the UPCs as EANs but will not add the leading 0. **Note:** The extra character identifies the country of origin.		
Default:	**Enabled**		
Options:	Disabled	**Enabled**	Enabled Suppress Leading 0

9-8-2 Supplemental Status (UPC/EAN)

Usage:	Reads **Supplementals** typically used in publications and documentation.		
Definition:	A supplemental is a 2 to 5 digit symbol appended to the main symbol. When set to **Enabled** or **Required**, the reader reads supplemental code data that has been appended to the standard UPC or EAN codes.		
Default:	**Disabled**		
Options:	**Disabled**	Enabled	Required

Disabled

UPC **Supplementals** will not be decoded.

Enabled

When enabled, the reader will try to decode a main and a supplemental.

Required

When set to **Required**, both the main and the supplemental symbols must be read.
For example, if **Supplementals** is set to **Required**, **Separator** is enabled, and an asterisk is defined as the UPC separator character. Then the data is displayed as:
MAIN * SUPPLEMENTAL.

- **Note:** Under no circumstances will the supplemental symbol data be sent without a main symbol.
- **Note:** If additional symbols—other than the main or supplemental—will be read in the same read cycle, **Number of Symbols** should be set accordingly.

9-8-3 Separator Status (UPC/EAN)

Usage:	Allows users to distinguish between the main and Action at Storage Full symbols.	
Definition:	A character can be inserted between the standard UPC or EAN symbology and the supplemental symbology when **Supplementals** is set to **Enabled** or **Required.**	
Default:	**Disabled**	
Options:	**Off = Disabled**	On = Enabled

9-8-4 Separator Character (UPC/EAN)

Usage:	As required by the application.
Definition:	Allows the user to change the separator character from a comma to a new character.
Default:	**,** (**comma**)
Options:	Any ASCII character.

9-8-5 Supplemental Type (UPC/EAN)

Usage:	As required by symbology used in application.		
Definition:	Allows the user to select 2 character or 5 character supplements, or both.		
Default:	**Both**		
Options:	**Both**	2 characters only	5 characters only

Both

Either 2 character or 5 character supplementals will be considered valid.

2 Characters Only

Only two character supplementals will be considered valid.

5 Characters Only

Only five character supplementals will be considered valid.

9-8-6 Format UPC-E as UPC-A (UPC/EAN)

Definition:	When disabled, the reader will output the version E symbols in their encoded 6-character format. When enabled, the reader will format the symbol as either a 12-character UPC-A symbol or an EAN-13 symbol, depending on the state of the EAN status parameter. This formatting reverses the zero suppression that is used to generate the symbol in the UPC specification.	
Default:	**Disabled**	
Options:	**Off = Disabled**	On = Enabled

9-9 Code 128/EAN 128

Usage:	**Code 128** is a smaller symbology useful in applications with tight spots and high security needs.
Definition:	A very dense alphanumeric symbology. It encodes all 128 ASCII characters, it is continuous, has variable length, and uses multiple element widths measured edge to edge.
Default:	**Enabled**
Options:	Disabled - when removed from the list **Enabled - when added to the list**

9-9-1 Fixed Symbol Length Status (Code 128/EAN 128)

Definition:	When enabled, the reader will check the symbol length against the symbol length field. If disabled, any length will be considered a valid symbol.	
Default:	**Disabled**	
Options:	**Off = Disabled**	On = Enabled

9-9-2 Fixed Symbol Length (Code 128/EAN 128)

Usage:	**Fixed Symbol Length** helps prevent truncations and increases data integrity by ensuring that only one symbol length will be accepted.
Definition:	This specifies the exact number of characters that the reader will recognize (this does not include start, stop, and check characters). The reader ignores any symbol not having the specified length.
Default:	**10**
Options:	1 to 64

9-9-3 EAN 128 Status (Code 128/EAN 128)

Definition:	When this field is disabled, the reader will not check any Code 128 labels for conformance to EAN requirements, or perform any special formatting. When enabled, the reader can read symbols with or without a function 1 character in the first position. If a symbol has a function 1 character in the first position, it must conform to EAN format. Symbols that conform to EAN format will also be subject to the special output formatting options available in this command. If EAN status is required, the reader will only decode symbols that have a function 1 character in the first position and that conform to EAN format. All symbols read will be subject to the special output formatting options available in this command. **Note:** Code 128 status must be enabled for EAN status to be active.		
Default:	**Disabled**		
Options:	**Disabled**	Enabled	Required

9-9-4 Output Format (Code 128/EAN 128)

Definition:	In **Standard**, the reader will not apply special EAN output formatting options. In **Application**, the reader will apply the special EAN output formatting options to decoded EAN-conforming symbols.	
Default:	**Standard**	
Options:	**Standard**	Application

9-9-5 Application Record Separator Status (Code 128/EAN 128)

Definition:	When enabled, an EAN separator will be inserted into the output between fields whenever an EAN-conforming symbol is decoded and EAN output formatting applies.	
Default:	**Disabled**	
Options:	**Off = Disabled**	On = Enabled

9-9-6 Application Record Separator Character (Code 128/EAN 128)

Definition:	This is an ASCII character that serves as an EAN separator in formatted EAN output.
Default:	**, (Comma)**
Options:	Any ASCII character (7 bit)

9-9-7 Application Record Brackets (Code 128/EAN 128)

Definition:	If an EAN-conforming symbol is decoded and EAN formatting applies, this feature places bracket characters around the application identifiers in the formatted output.	
Default:	**Disabled**	
Options:	**Off = Disabled**	On = Enabled

9-9-8 Application Record Padding (Code 128/EAN 128)

Definition:	This feature causes the reader to pad variable-length application fields with leading zeroes. This is not done for the last field of a symbol.	
Default:	**Disabled**	
Options:	**Off = Disabled**	On = Enabled

9-10 Code 93

Usage: Sometimes used in clinical applications.

Definition: Code 93 is a variable-length, continuous symbology employing four element widths. Each Code 93 character has nine modules that may be either black or white. Each character contains three bars and three spaces.

Default: **Disabled**

Options: **Disabled - when removed from the list**
Enabled - when added to the list

9-10-1 Fixed Symbol Length Status (Code 93)

Definition: When disabled, the reader will accept any Code 93 symbol provided is doesn't exceed the system's maximum capabilities.
When enabled, the reader will reject any Code 93 symbol that doesn't match the fixed symbol length.

Default: **Disabled**

Options: **Off = Disabled** On = Enabled

9-10-2 Fixed Symbol Length (Code 93)

Definition: This is the symbol length value against which all Code 93 symbols will be compared.

Default: **10**

Options: 1 to 64

9-11 PDF417

Usage:	Used in applications where a large amount of information (over 32 characters) needs to be encoded within a symbol, typically where the symbol is transported from one facility to another. For example, an automobile assembly line might use a single symbol with multiple fields of information that will be read at several stations along the way, without reference to a database.
Definition:	A two-dimensional, multi-row (3 to 90), continuous, variable length symbology that has high data capacity for storing up to 2,700 numeric characters, 1,800 printable ASCII characters, or 1,100 binary characters per symbol. Each symbol character consists of 4 bars and 4 spaces in a 17-module structure.
Default:	**Disabled**
Options:	**Disabled - when removed from the list** Enabled - when added to the list

Note: Sending **<a1>** will cause PDF417 data to be prefaced with information consisting of error correction level (ECC Level ***n***), number of rows (***n*** Rows), number of columns (***n*** Columns), number of informative code words (***n*** Info Code Words) and the number of data characters (***n*** Data Characters). This feature can be disabled by re-sending **<a1>.**

9-11-1 Fixed Symbol Length Status (PDF417)

Default:	**Disabled**	
Options:	**Off = Disabled**	On = Enabled

9-11-2 Fixed Symbol Length (PDF417)

Usage:	Used to increase data integrity by ensuring that only one symbol length will be accepted.
Definition:	When enabled, the PDF symbol must contain the same number of characters as the symbol length setting before it can be considered a good read. The reader will ignore any symbol not having the specified length.
Default:	**10**
Options:	1 to 2710

Note: Fixed Symbol Length Status must be enabled for **Fixed Symbol Length** to take effect.

9-12 Pharmacode

Warning: Pharmacode has no start/stop patterns and is not bi-directional. If you scan it from left-to-right, you get a different sequence of data than if you scan it right-to-left. It is also possible for Pharmacode to interpret other edges on the part (such as text) as a barcode. When deploying Pharmacode, the reader must be set up to see the code in the correct orientation, as well as with a tight region of interest so the reader only sees the actual Pharmacode symbol.

Usage:	Used mostly with packaging for the pharmaceuticals industry.
Definition:	Encodes up to five different numbers, each with its own color, which may be entered in decimal or "binary" format with a 1 represented by a thick bar and a 0 represented by a thin bar. Bar width is independent of height. In decimal format, each part can be up to 999,999. In binary format, each input can have up to 19 ones and zeros. **Important:** When Pharmacode is enabled, other linear symbologies will not decode properly. Disable Pharmacode before reading other linear symbologies.
Default:	**Disabled**
Options:	**Disabled - when removed from the list** Enabled - when added to the list

9-12-1 Fixed Symbol Length Status (Pharmacode)

Definition:	When enabled, the reader will check the symbol length against the symbol length field. If disabled, any length will be considered valid.	
Default:	**Disabled**	
Options:	**Off = Disabled**	On = Enabled

9-12-2 Fixed Symbol Length (Pharmacode)

Definition:	Specifies the exact number of bars that must be present for the reader to recognize and decode the Pharmacode symbol.
Default:	**5**
Options:	1 to 16

9-12-3 Minimum Number of Bars (Pharmacode)

Definition:	Sets the minimum number of bars that a Pharmacode symbol must have to be considered valid.
Default:	**2**
Options:	1 to 16

9-12-4 Bar Width Status (Pharmacode)

Definition: If set to **Mixed Narrow and Wide**, the reader will autodiscriminate between narrow bars and wide bars. If set to **All Narrow**, all bars will be considered as narrow bars. If set to **All Wide**, all bars will be considered as wide bars. If set to **Fixed Threshold**, it will use the fixed threshold value to determine whether the bars are narrow or wide. The **Bar Width Status** setting will be ignored when the reader is able to tell the difference between the narrow and the wide bars.

Default:	**Mixed Narrow and Wide**	
Options:	**Mixed Narrow and Wide** All Narrow All Wide Fixed Threshold	

9-12-5 Direction (Pharmacode)

Definition:	Specifies the direction in which a symbol can be read.	
Default:	**Forward**	
Options:	**Forward**	Reverse

9-12-6 Fixed Threshold Value (Pharmacode)

Definition:	Used when **Bar Width Status** is set to **Fixed Threshold**. Defines the minimum difference in pixels that will distinguish a narrow bar from a wide bar.
Default:	**10**
Options:	1 to 65535

9-12-7 Background Color (Pharmacode)

Definition:	Used when the color of bars is reversed. Sets the background color that a Pharmacode symbol must have to be considered valid.	
Default:	**White**	
Options:	Black	**White**

9-13 Data Matrix

Usage: Very useful where information needs to be packed into a small area, and/or where symbols need to be applied directly to the substrate with laser etching, chemical etching, dot peen, or other methods.

Definition: Data Matrix is a type of Matrix symbology and has historically had subsets ECC 000 - ECC 200. Each higher level refers to increased error correction capabilities culminating with ECC 200 which uses Reed Solomon error correction. ECC 000 – ECC 140 are considered defunct and are not supported by this product.

ECC 200 symbols have an even number of rows and an even number of columns. Most of the symbols are square with sizes from 10x10 to 144x144. All ECC 200 symbols can be recognized by the upper right corner module being light (binary 0) instead of dark. Some standard Data Matrix symbols are rectangular, with sizes from 8x18 to 16x48.

The recent DMRE (Data Matrix Rectangular Extension) change added a large number of alternate Rectangular code sizes. If the Data Matrix is a DMRE, the DMRE option should be enabled.

Default: **Enabled**

Options: Disabled - when removed from the list
Enabled - when added to the list

9-13-1 DMRE Status

Usage: The Code type is Useful where information needs to be packed into a narrow region, and/or where symbols need to be applied directly to the substrate with laser etching, chemical etching, dot peen, or other methods.

Definition: DMREis a new ISO standard (ISO/IEC 21471) for Data Matrix codes with additional rectangular formats (aspect ratios) beyond what is supported by the standard Data Matrix standard (ISO16022). Status Enables or disables the DMRE symbology.

Default: **Disabled**

Options: **0 = Disabled** 1 = Enabled

9-14 QR Code and Micro QR Code

Usage: QR Codes are widely implemented in the automotive industry in Japan and throughout their worldwide supply chain.

Definition: QR Code is capable of handling numeric, alphanumeric, and byte data as well as kanji and kana characters. Up to 7,089 characters (numeric data) can be encoded using this symbol. Therefore, less space is required to encode the same amount of data in a QR Code symbol than in a conventional symbol, lowering the cost of labelling.
Three Position Detection Patterns in the symbol make omnidirectional, ultra-fast reading possible.
QR Code has error protection capability. Data can often be restored even if a part of the symbol has become dirty or damaged.

Default: **Enabled**

Options: Disabled - when removed from the list
Enabled - when added to the list

9-14-1 QR Model 1 Status

Definition: The original QR Code, a code capable of coding 1,167 numerals with its maximum version being 14 (73 x 73 modules).

Default: **Enabled**

Options: Off = Disabled **On = Enabled**

9-14-2 QR Model 2 Status

Definition: QR Code created by improving Model 1 so that this code can be read smoothly even if it is distorted in some way. QR Codes that are printed on a curved surface or whose reading images are distorted due to the reading angle can be read efficiently by referring to an alignment pattern embedded in them. This code can encode up to 7,089 numerals with its maximum version being 40 (177 x 177 modules).

Default: **Enabled**

Options: Off = Disabled **On = Enabled**

9-14-3 Micro QR Status

Usage: Used in various applications that require higher data density than that provided by standard QR Code. Some application examples are automotive inventory, vehicle ID, and mobile phone URL encoding.

Definition: **MicroQR Code** is a 2D matrix symbology that comes in 4 different symbol sizes, the largest capable of encoding 35 numeric characters.

Default: **Enabled**

Options: Off = Disabled **On = Enabled**

9-15 BC412

Usage:	Widely used in semiconductor manufacturing. Particularly useful where speed, accuracy, and ease of printing are required.
Definition:	BC412 (Binary Code 412), a proprietary IBM symbology since 1988, is an alphanumeric symbol with a set of 35 characters, each encoded by a set of 4 bars in 12 module positions. All bars have a single width; it is the presence (1) or absence (0) of bars in each of the twelve module positions that make BC412 binary. This symbology is also bi-directional and self-clocking, with a start character and a stop character.
Default:	**Disabled**
Options:	**Disabled - when removed from the list** Enabled - when added to the list

9-15-1 Check Character Output (BC412)

Usage:	**Check Character Output**, added to the symbol, provides additional security.	
Definition:	When enabled, the check character is read and compared along with the symbol data. When disabled, symbol data is sent without the check character.	
Default:	**Disabled**	
Options:	**Off = Disabled**	On = Enabled

9-15-2 Fixed Symbol Length Status (BC412)

Definition:	When enabled, the reader will check the symbol length against the symbol length field. If disabled, any length will be considered valid.	
Default:	**Disabled**	
Options:	**Off = Disabled**	On = Enabled

9-15-3 Fixed Symbol Length (BC412)

Definition:	When enabled, the check character is read and compared along with the symbol data. When disabled, symbol data is sent without the check character.
Default:	**10**
Options:	1 to 64

9-16 DataBar Expanded

Usage:	Used to encode primary and supplementary data in retail point-of-sale and other applications.
Definition:	DataBar Expanded is a variable length symbology that can encode supplementary information in addition to the 14-digit EAN item identification number and is capable of encoding up to 74 numeric or 41 alphabetic characters.
Default:	**Disabled**
Options:	**Disabled - when removed from the list** Enabled - when added to the list

9-16-1 Fixed Symbol Length Status (DataBar Expanded)

Definition:	When enabled, the reader will check the symbol length against the symbol length field, minus the embedded check character. If disabled, any length would be considered valid.
Default:	**Disabled**
Options:	**Off = Disabled** On = Enabled

9-16-2 Fixed Symbol Length (DataBar Expanded)

Usage:	**Fixed Symbol Length** helps prevent truncations and increases data integrity by ensuring that only one symbol length will be accepted.
Definition:	Specifies the exact number of characters that the reader will recognize (this does not include start, stop, and check character characters). The reader ignores any symbol not having the specified length.
Default:	**14**
Options:	1 to 74

9-17 DataBar Limited

Usage:	DataBar Limited is designed to be read by laser and CCD readers. It is not recommended for omnidirectional slot scanners.
Definition:	Encodes a smaller 14-digit symbol (74 modules wide) that is not omnidirectional.
Default:	**Enabled** **Disabled**
Options:	**Disabled - when removed from the list** Enabled - when added to the list

9-18 DataBar-14

Usage:	Used in the grocery, retail, and prescription drug industries where 14-digit EAN item identification may be needed.
Definition:	DataBar-14 is a fixed symbol length symbology that encodes 14 digits, including a 1-digit indicator. DataBar-14 is 96 modules wide. It can be stacked in two rows, it can read omnidirectionally if printed in full height, or horizontally if height-truncated for small marking.
Default:	**Disabled**
Options:	**Disabled - when removed from the list** Enabled - when added to the list

9-19 Micro PDF (MicroPDF417)

Usage:	Used for labelling small items that need large data capacity.
Definition:	A variant of PDF417, a very efficient and compact stacked symbology that can encode up to 250 alphanumeric characters or 366 numeric characters per symbol.
Default:	**Disabled**
Options:	**Disabled - when removed from the list** Enabled - when added to the list

9-19-1 Fixed Symbol Length Status (MicroPDF417)

Default:	**Disabled**	
Options:	**Off = Disabled**	On = Enabled

9-19-2 Fixed Symbol Length (MicroPDF417)

Usage:	Used to increase data integrity by ensuring that only one symbol length will be accepted.
Definition:	When enabled, the MicroPDF417 symbol must contain the same number of characters as the symbol length setting before it can be considered a good read. The reader will ignore any symbol not having the specified length.
Default:	**10**
Options:	1 to 366

Note: Fixed Symbol Length Status must be enabled for **Fixed Symbol Length** to take effect.

9-20 DotCode

Important: When DotCode is enabled, no other symbologies will be decodable. You must disable DotCode to decode symbols of any other type.

Usage:	Used for labelling in packaging industry.
Default:	**Disabled**
Options:	**Disabled - when removed from the list** Enabled - when added to the list

9-20-1 Expected Rows and Expected Columns

Usage:	Advanced parameter that helps decode damaged Dot Codes. It benefits from knowing the number of rows and columns. If left set at 0, the DotCode algorithm will decode any size.
Default:	**0 (will decode any number of rows and any number of columns)**
Options:	0 to 124

9-20-2 Rotation Mode

Default:	**0 = No Rotation**
Options:	**0 = No Rotation** 1 = Low Rotation 2 = Omnidirectional

No Rotation

The reader will decode horizontal and vertical symbols (**+/–** approximately **3 degrees**).

Low Rotation

The reader will decode **+/–** approximately **10 degrees** from the horizontal or vertical symbols. It is slightly slower than the No Rotation option.

Omnidirectional

The reader supports **360 degree** decoding. It is significantly slower than the other two options.

10

Specifications

10-1 Code Reader Specifications

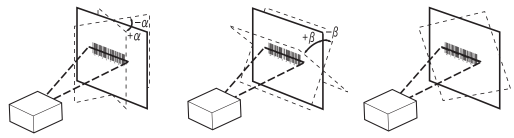
Item		VHV5-F□□□□023M-□□□	VHV5-F□□□□050M-□□□
Image Sensor	Resolution	2.3 MP - 1920 (H) x 1200 (V)	5.0 MP - 2472 (H) x 2048 (V)
	Pixel Size	3 µm	2.74 µm
	Color / Monochrome	Monochrome CMOS	
	Shutter	Global Shutter	
	Frames per Second	80 FPS	40 FPS
	Exposure	16 µs to 300,000 µs	50 µs to 300,000 µs (16 µs to 300,000 µs with strobe duration)
	Lens Selections	Focal Length: Medium = 8.5 mm, Narrow = 12.5 mm, Long = 20 mm	
	Focus	Liquid Lens Autofocus or Fixed Focus	
Symbologies*1	1D Symbologies	Code 39, Code 128, BC412, Interleaved 2 of 5, UPC/EAN, Codabar, Code 93, Pharmacode, PLANET, POSTNET, Japanese Post, Australian Post, Royal Mail, Intelligent Mail, KIX	
	2D Symbologies	Data Matrix (ECC 0-200), QR Code, Micro QR Code, Aztec Code, DotCode	
	Stacked Symbologies	PDF417, MicroPDF417, GS1 Databar (Composite and Stacked)	
ISO Code Validation	Data Matrix, QR Codes, 1D Symbologies	Validation only using ISO 15416, ISO 15415, and ISO 29158:2020	
Reading Performance*2	Number of Reading Digits	No upper limit (depends on bar width and reading distance)	
	Targeting Optics	Two green parallel LED spots	
	Illumination	8 high-power LEDs: White (6,500K) or Red (Wavelength: 625 nm)	
	Reading Distance / Field of View	Refer to Read Ranges section for details based on Lens and Sensor Type.	
	Pitch Angle (α)*3	±30°	
	Skew Angle (β)*3	±30°	
	Tilt Angle (γ)*3	±180°	
Trigger		External Trigger (Edge or Level), Serial Trigger (Ethernet, RS-232C), PLC	
Digital I/O Specifications	Input Signals	3 Fully Configurable Inputs: IN1 (Trigger by Default), IN2, IN3. Bi-directional, Optoisolated, 4.5-28V-rated (10 mA @ 28 VDC).	
	Output Signals	3 Fully Configurable Outputs: OUT1, OUT2, OUT3 (Strobe Optional). Bi-directional, Optoisolated, 3-28V rated, (I_{CE} < 100 mA at 24 VDC, current limited by user).	
	External Strobe	24V, GND, Strobe+ (> 1.5kΩ, user-implemented), Strobe– (> 1.5kΩ, user implemented), Analog Intensity Control (0-10V). (Strobe Trigger can operate as NPN or PNP).	
Communication	Connectivity	RS-232C, Ethernet TCP/IP, EtherNet/IP™, PROFINET	
	Ethernet Specifications	1000BASE-T	
Image Logging	Image Logging Type	To RAM	
Indicator LEDs	Membrane Switch	PWR (Green), LINK (Amber), MODE/STATUS (Amber), TRIGGER (Amber), PASS (Green), FAIL (Red)	
	360° Indicators	PASS (Green), FAIL (Red)	
Power Supply Voltage		Power over Ethernet (IEEE 802.3at) / 24 VDC +/– 10%	
Current Consumption		PoE+: 44-57 VDC @ 0.6 A (Max.); Direct: 24 VDC @ 2.1 A (Max.); External Light Port Connector: 24 VDC @ 1.5 A (Max) (Internally Current-Limited)	
Environmental / Immunity	Ambient Temperature Range	Operating: 0 to 45° C; Storage: –25 to 65° C (with no icing or condensation)	
	Ambient Humidity Range	Operating and Storage: 25% to 85%	
	Ambient Atmosphere	No Corrosive Gases	
	Vibration Resistance (Destructive)	Oscillation Frequency: 10 to 150 Hz; Half Amplitude: 0.35 mm; Vibration Direction: X/Y/Z; Sweep Time: 8 Minutes/Count; Sweep Count: 10 Times	
	Shock Resistance (Destructive)	Impact Force: 150 m/s2, Test Direction: 6 Directions, 3 Times Each (Up / Down, Front / Behind, Left / Right)	
	Degree of Protection	IEC 60529 IP69K	
Weight	Main Body Only	Approx. 372 g	
	Packaged Weight	Approx. 505 g	

Item		VHV5-F□□□□023M-□□□	VHV5-F□□□□050M-□□□
Dimensions	**Main Body Dimensions**	57.5 mm (W) × 50.5 mm (D) × 75 mm (H) (89 mm height with connectors)	
	Packaging Dimensions	170 mm (W) × 117 mm (D) × 86 mm (H)	
Accessories		ReadMeFirst, CE Compliance Sheet	
Safety Standards		IEC/EN 62368-1, 2nd and 3rd Ed UL 60950-1, 2nd Edition, 2019-05-09 (Information Technology Equipment - Safety - Part 1: General Requirements) CAN/CSA C22.2 No. 60950-1-07, 2nd Edition, 2014-10 (Information Technology Equipment - Safety - Part 1: General Requirements)*4	
Materials	**Case**	Aluminum, black anodized	
	Reading Window	Acrylic	
Software		WebLink	

*1. Symbologies are supported based on Omron’s read capability validation standard. Omron recommends that validation be performed for each application.

*2. Unless otherwise specified, reading performance is defined with center of field of view, angle R = ∞.

*3. Pitch angle Skew angle Tilt angle



*4. FCC = United States
UL = United States
CE = European Union
UKCA = Great Britain (England / Wales / Scotland)
RCM = Australia / New Zealand
KC = South Korea

10-2 Cable Specifications

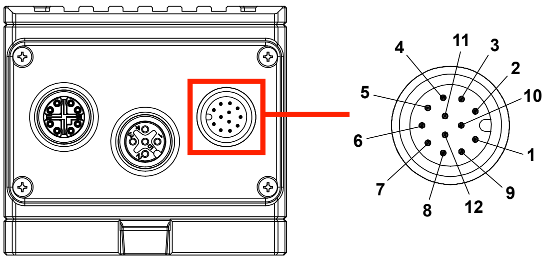
Item			V430-W8□□-_M	V430-WQ-_M	V430-WR-_M
Cable Type		Robot cable			
Connector Type		Straight LD: Right Angle Down LU: Right Angle Up		Straight	
Category		Ethernet	I/O		I/O and RS-232
Size		AWG24			
Outer Diameter		7.37 mm	7.11 mm		
Min. Bending Radius		73.7 mm	53 mm		
Usage Environment	**Ambient Temperature Range**	Operating: 0 to 45°C Storage: -25 to 65°C (No Icing or Condensation)			
	Ambient Humidity Range	25 to 85% (Non-Condensing)			
	Ambient Atmosphere	No Corrosive Gases			
	Vibration Tolerance	Oscillation Frequency: 10 to 150Hz, Half Amplitude: 0.35 mm, Vibration Direction: X/Y/Z, Sweep Time: 8 minute/count, Sweep Count: 10 times			
	Shock Resistance	Impact Force: 150 m/s^2, Test Direction: 6 directions, three times each (up/down, front/back, left/right)			
Material		Connector Overmold: Thermoplastic Polyamide, Cable Jacket: Polyurethane			
Weight			V430-W8-3M: 259g V430-W8-5M: 422g V430-W8-10M: 829g V430-W8LD-3M: 253g V430-W8LU-3M: 253g	V430-WQ-1M: 109g V430-WQ-3M: 272g V430-WQ-5M: 351g	V430-WR-1M: 107g V430-WR-3M: 276g

Item		61-000184-01	61-000185-01
Cable Type		Static use cable	
Connector Type		Straight	
Category		Lighting	
Size		AWG22	
Outer Diameter		7.2 mm	6.6 mm
Min. Bending Radius		72 mm	66 mm
Usage Environment	**Ambient Temperature Range**	Operating: 0 to 45°C Storage: -25 to 65°C (No Icing or Condensation)	
	Ambient Humidity Range	25 to 85% (Non-Condensing)	
	Ambient Atmosphere	No Corrosive Gases	
	Vibration Tolerance	Oscillation Frequency: 10 to 150Hz, Half Amplitude: 0.35 mm, Vibration Direction: X/Y/Z, Sweep Time: 8 minute/count, Sweep Count: 10 times	
	Shock Resistance	Impact Force: 150 m/s^2, Test Direction: 6 directions, three times each (up/down, front/back, left/right)	
Material		Connector Overmold: Thermoplastic Polyurethane, Cable Jacket: PVC	
Weight		95 g	227 g

10-3 Electrical Specifications

10-3-1 DIO (Parallel IO) Port

The Parallel IO Port connector is used for Digital Inputs (Trigger), Digital Outputs, RS-232, and Power. M12 12-Pin Male.



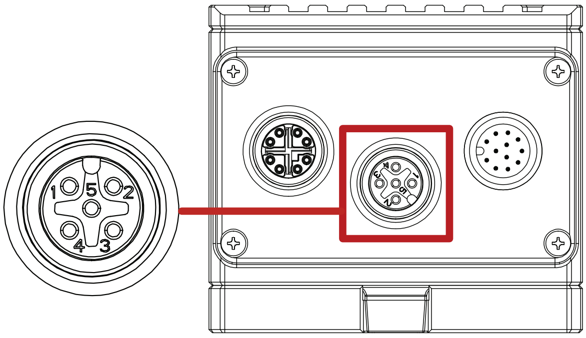
Pin	Name	Function	Flying Lead Color
1	Trigger (Input 1)	Trigger	WHITE
2	Power (+VIN)	24 Volts	BROWN
3	Input 3	General Purpose Input	GREEN
4	Input 2	General Purpose Input	YELLOW
5	Output 1	General Purpose Output	GRAY
6	Output 3	General Purpose Output	PINK
7	Ground (-VIN)	24V Reference (GND)	BLUE
8	Input Common	NPN or PNP Common for Input	RED
9	RS-232 (Host) RxD	Serial Command Input	BLACK
10	RS-232 (Host) TxD	Serial Data Output	VIOLET
11	Output 2	General Purpose Output	GRAY STRIPED
12	Output Common	NPN or PNP Common for Output	RED STRIPED

10-3-2 External Light Port

The third connector on the VHV5-F is used to drive an external light. The 5-pin female M12 provides 24V power, a Strobe Trigger output signal, and an optional Analog Intensity Control output signal. This five-pin assignment is compatible with many common machine vision light vendor's input connector requirements.

Precautions for Correct Use

The user must check the power and wiring specifications for their choice of external light and only connect the relevant signals. For example, pins 4 and 3 would be used to provide just a 24V strobe trigger signal output to an external strobe controller.



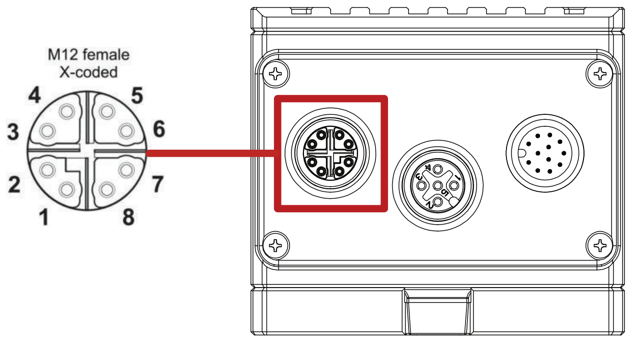
Pin	Signal	Description
1	+24 VDC	Provides up to 1.5 amps of current to light at 24V
2	Strobe Trig –	Strobe Trigger – (NPN referenced to DC Ground)
3	DC Ground	Ground
4	Strobe Trig +	Strobe Trigger + (PNP referenced to 24VDC Ground)
5	Analog Out	Selectable 0-10V analog output for intensity control

Examples:

- NERLITE Smart Series light with built-in strobe controller.
- Smart Vision lights with NanoDrive™ or Multi-Drive™ light control.

10-3-3 X-Code Ethernet Port

1000BASE-T X-Code Ethernet port. Female M12.



Pin	Description	Name
1	Bidirectional Data DA+	DA+
2	Bidirectional Data DA-	DA-
3	Bidirectional Data DB+	DB+
4	Bidirectional Data DB-	DB-
5	Bidirectional Data DD+	DD+
6	Bidirectional Data DD-	DD-
7	Bidirectional Data DC-	DC-
8	Bidirectional Data DC+	DC+

11

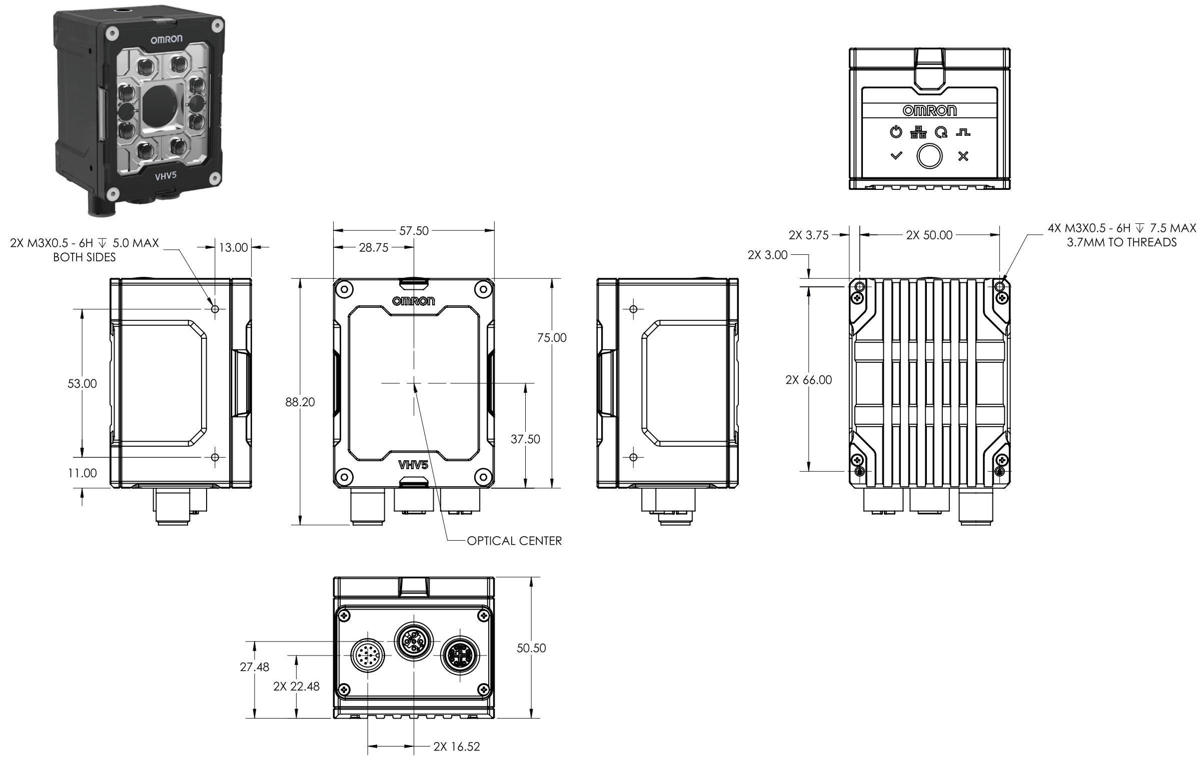
Code Reader and Accessory Drawings

This section provides the code reader's physical dimensions and information about the cables and accessories that are currently available for the code reader.

11-1 Dimensions

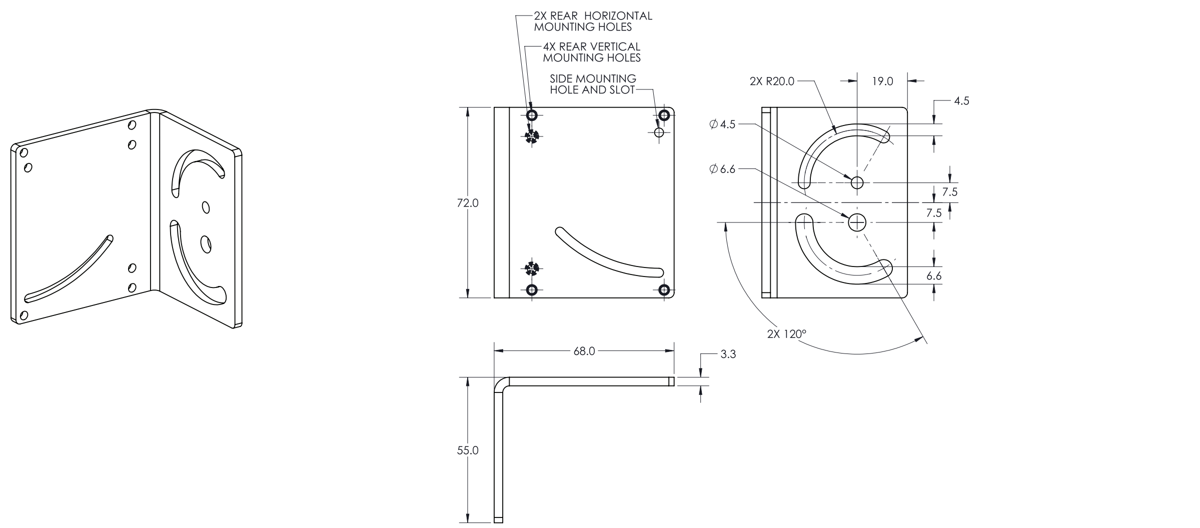
VHV5-F Autofocus Multicode Reader

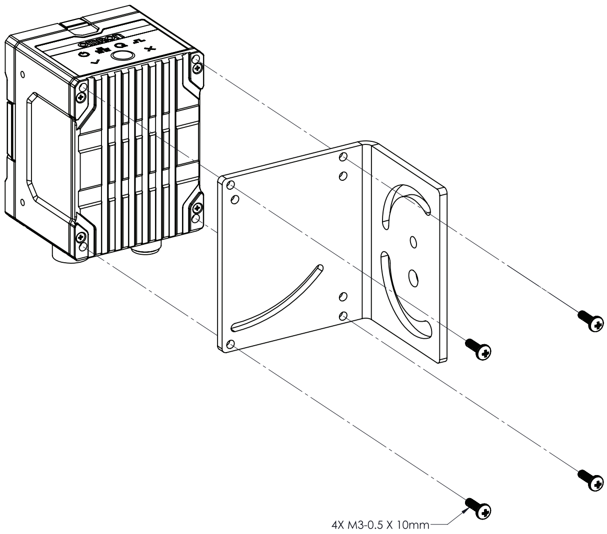
(Unit: mm)

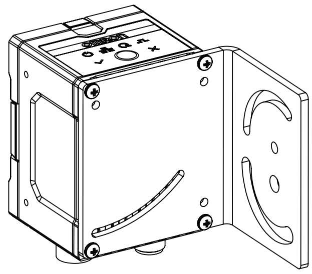


VHV5-F L-Bracket Adjustable Angle Mounting Kit

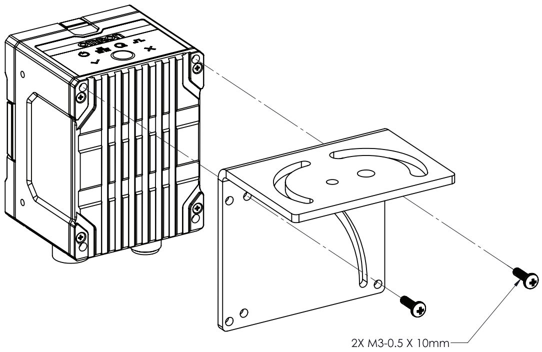
VHV5-AM0

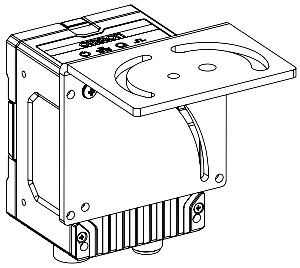






Assembled





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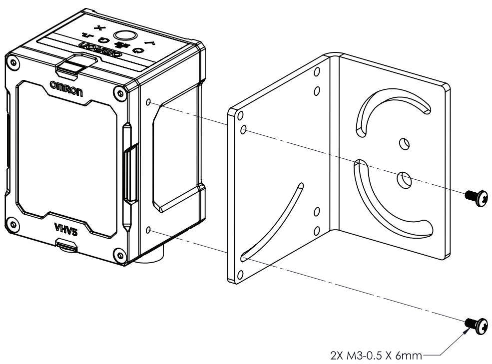
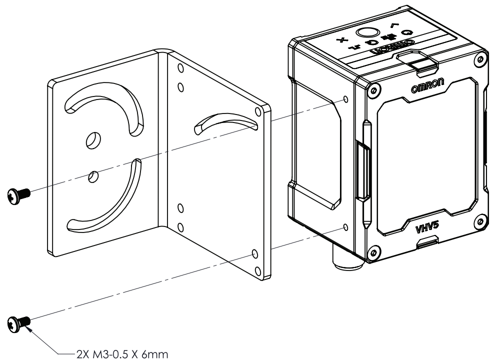
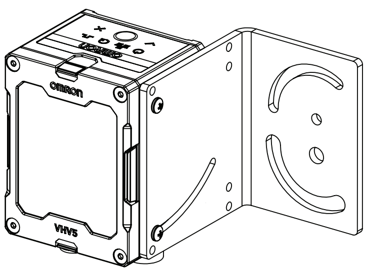
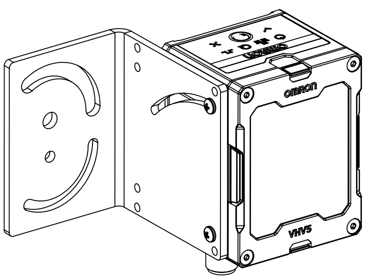






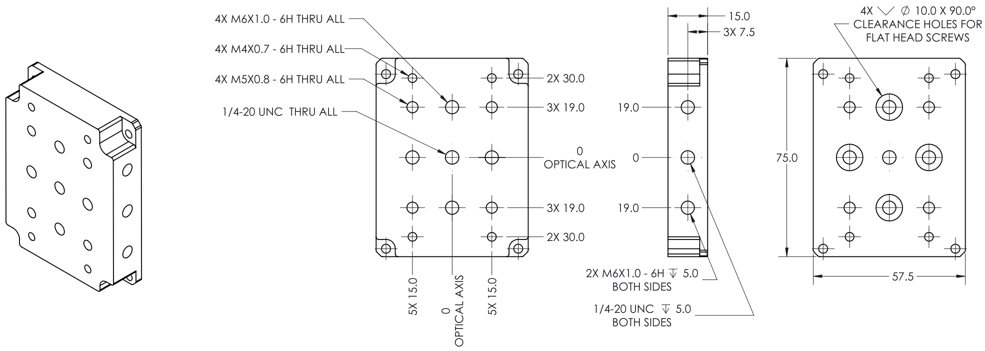


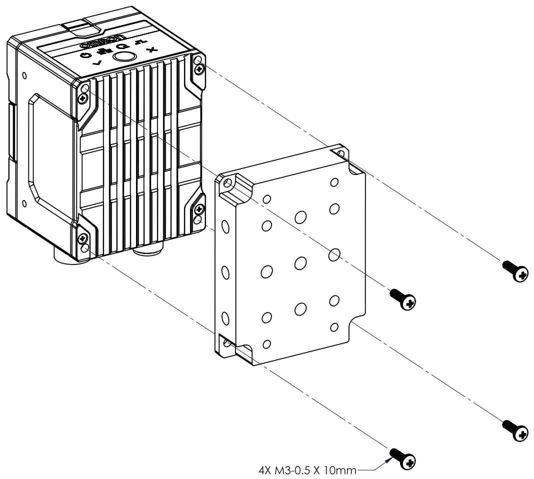
Assembled

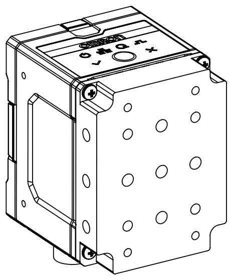
Assembled

VHV5-F Universal Mounting Block and Heatsink

VHV5-AM1



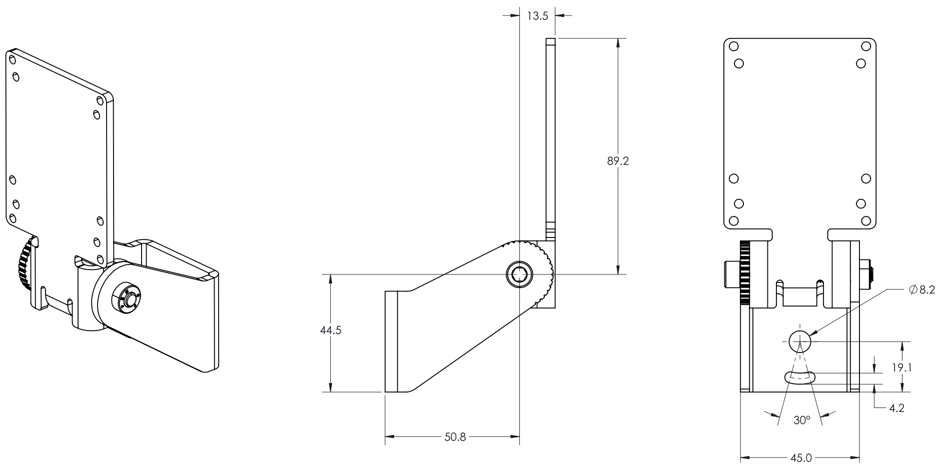


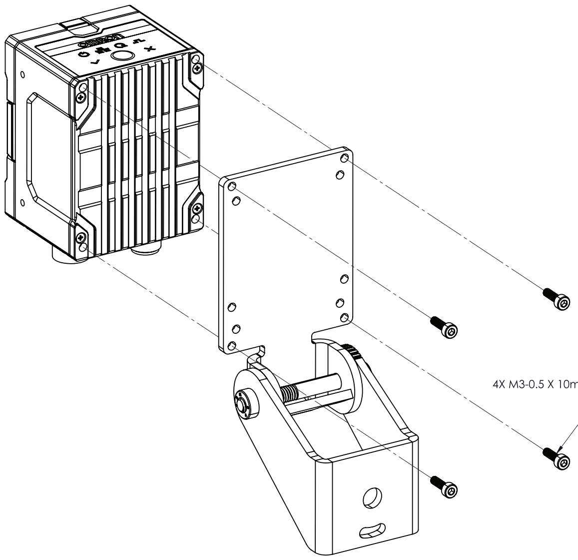


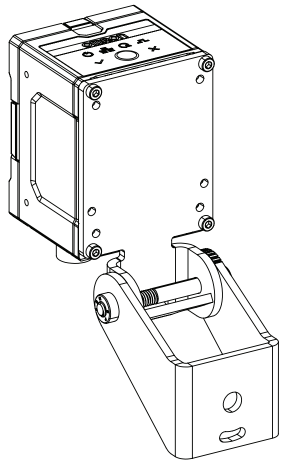
Assembled

VHV5-F APG Pan and Tilt Camera Mount

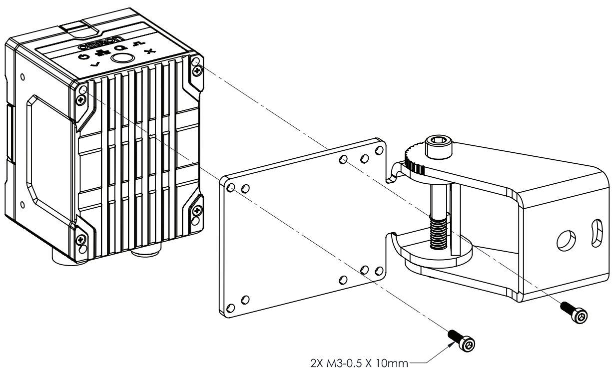
VHV5-AM2

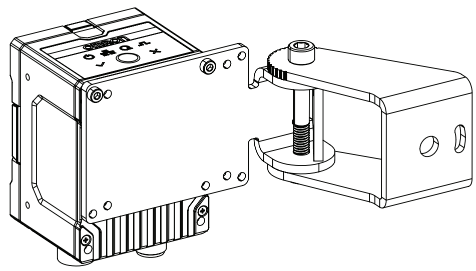




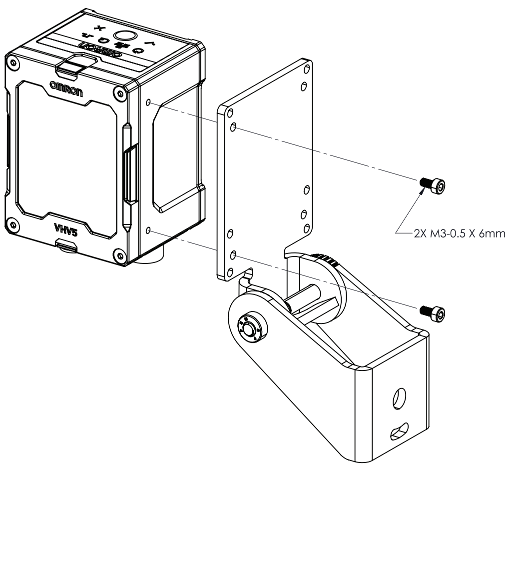


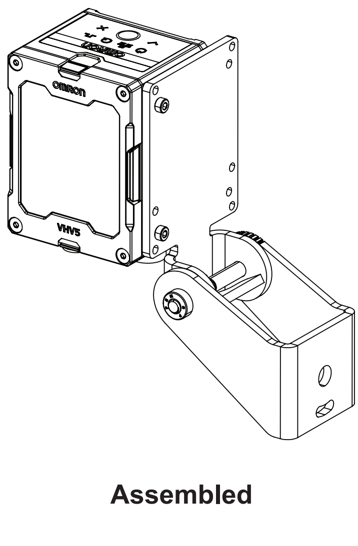
Assembled





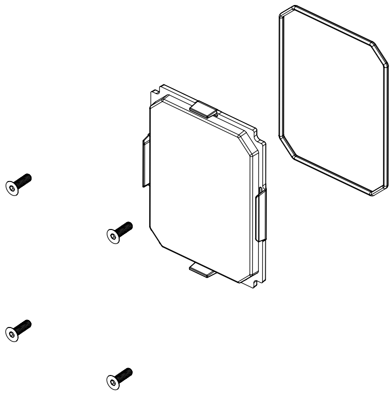
Assembled





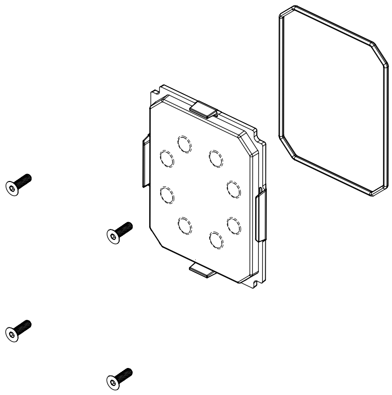
Assembled

VHV5-F Standard Window (for Medium Lens Models)
VHV5-AF0



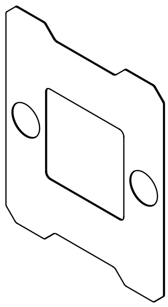
Torque: 4.8 in./lbs. (0.54 nm max.)

VHV5-F Lensed Window (for Narrow and Long Lens Models)
VHV5-AF1

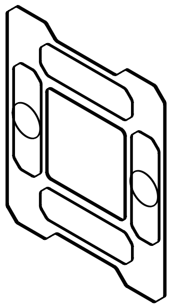


Torque: 4.8 in./lbs. (0.54 nm max.)

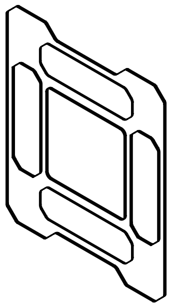
VHV5-F Diffuser Accessory
VHV5-AF2



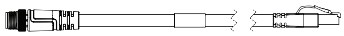
VHV5-F Polarizer Accessory
VHV5-AF3

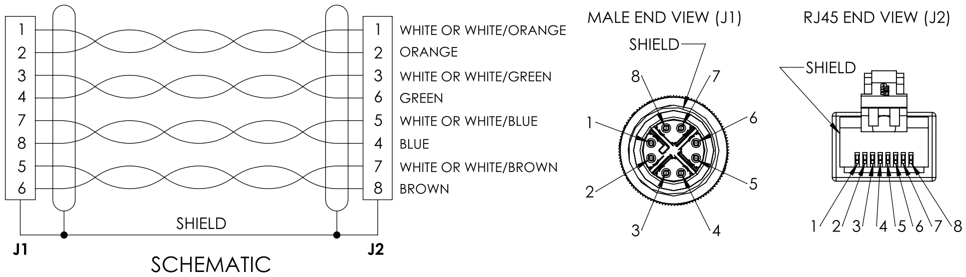


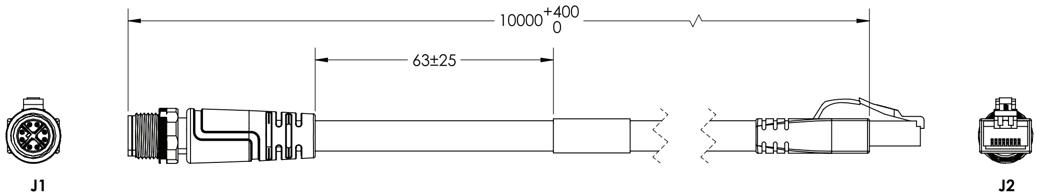
VHV5-F Half Polarizer Accessory
VHV5-AF4



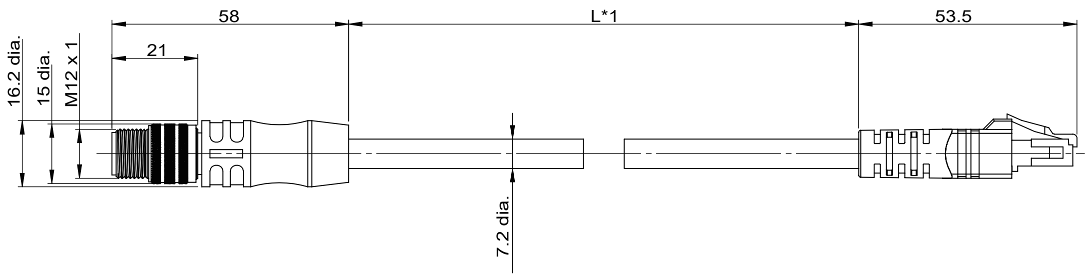
X-Code to RJ45 Ethernet Cable (High Flex, Straight, Black Jacket) – 1 Meter, 2 Meters, 5 Meters, 10 Meters
61-9000134-01
61-9000134-02
61-9000134-03
61-9000134-04

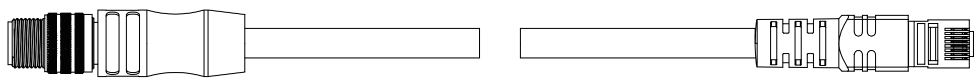






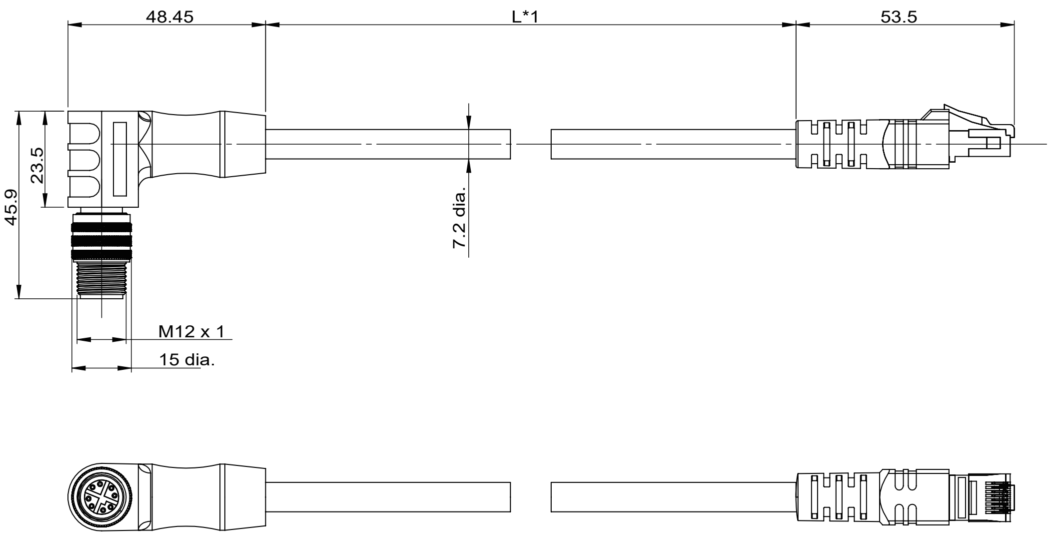
X-Code to RJ45 Ethernet Cable (High Flex, Straight, Green Jacket) – 2 M, 3 M, 5 M, 10 M, 20 M
FHV-VNB2 2M
FHV-VNB2 3M
FHV-VNB2 5M
FHV-VNB2 10M
FHV-VNB2 20M





*1 – Overall cable length varies based on model number. Example: FHV-VNB2 2M is a 2 meter cable.

X-Code to RJ45 Ethernet Cable (High Flex, Right- Angle, Green Jacket) – 2 M, 3 M, 5 M, 10 M, 20 M
FHV-VNLB 2M
FHV-VNLB 3M
FHV-VNLB 5M
FHV-VNLB 10M
FHV-VNLB 20M



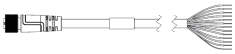
*1 – Overall cable length varies based on model number. Example: FHV-VNLB 2M is a 2 meter cable.

M12 to Flying Leads Cable – Parallel IO (Power, DIO, RS-232) – 3 Meters, 5 Meters, 10 Meters

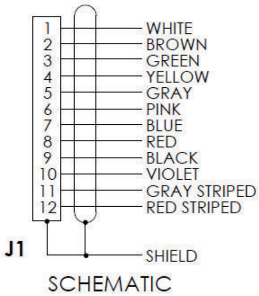
V430-W8-3M

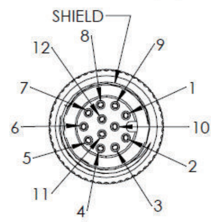
V430-W8-5M

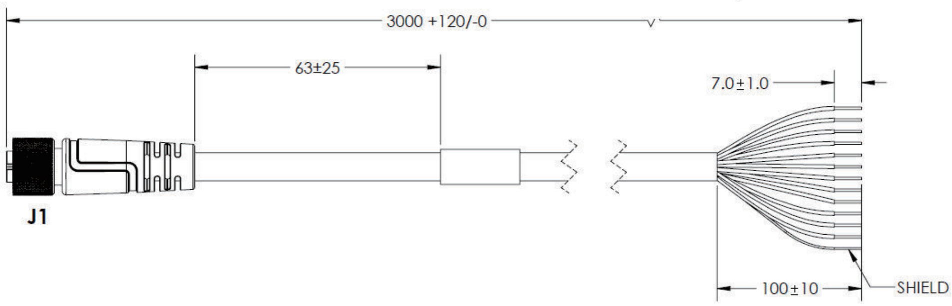
V430-W8-10M



Pin	Name	Use
1	Trigger (Input 1)	Trigger
2	Power (+VIN)	24 Volts
3	Input 3	General Purpose Input
4	Input 2	General Purpose Input
5	Output 1	General Purpose Output
6	Output 3	General Purpose Output, Optional Light Control
7	Ground (-VIN)	24V Reference (GND)
8	Input Common	NPN or PNP Common for Input
9	RS-232 (Host) RxD	Serial Command Input
10	RS-232 (Host) TxD	Serial Output Data
11	Output 2	General Purpose Output
12	Output Common	NPN or PNP Common for Output

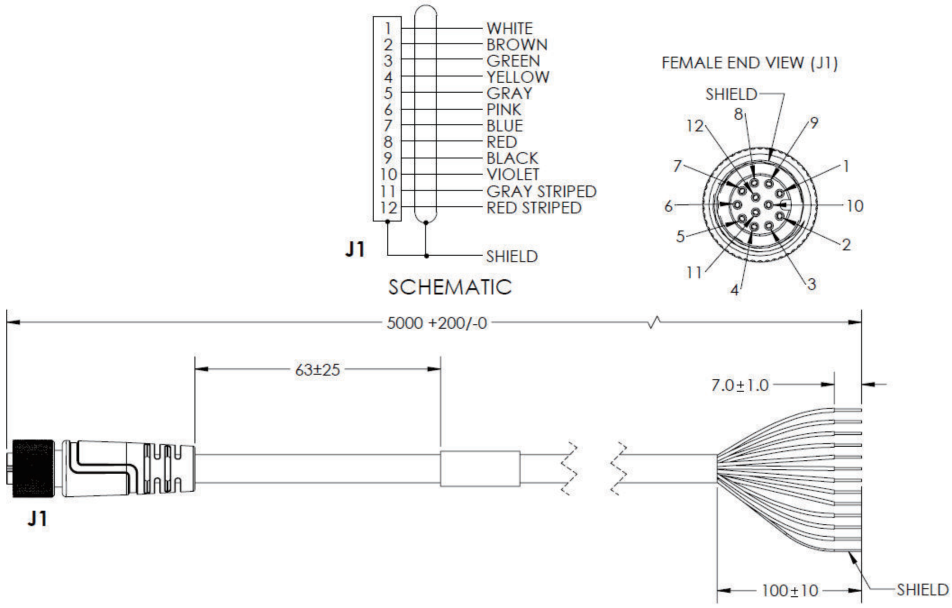




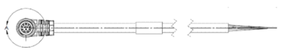


Pin	Name	Use
1	Trigger (Input 1)	Trigger
2	Power (+VIN)	24 Volts
3	Input 3	General Purpose Input
4	Input 2	General Purpose Input
5	Output 1	General Purpose Output
6	Output 3	General Purpose Output, Optional Light Control
7	Ground (-VIN)	24V Reference (GND)
8	Input Common	NPN or PNP Common for Input

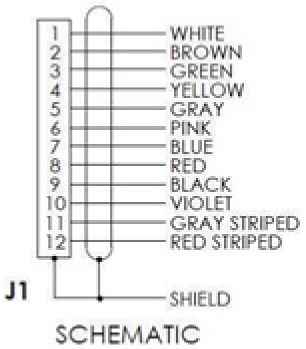
Pin	Name	Use
9	RS-232 (Host) RxD	Serial Command Input
10	RS-232 (Host) TxD	Serial Output Data
11	Output 2	General Purpose Output
12	Output Common	NPN or PNP Common for Output

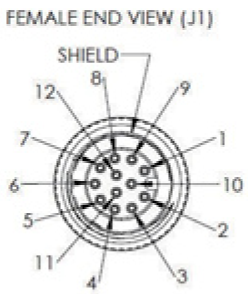


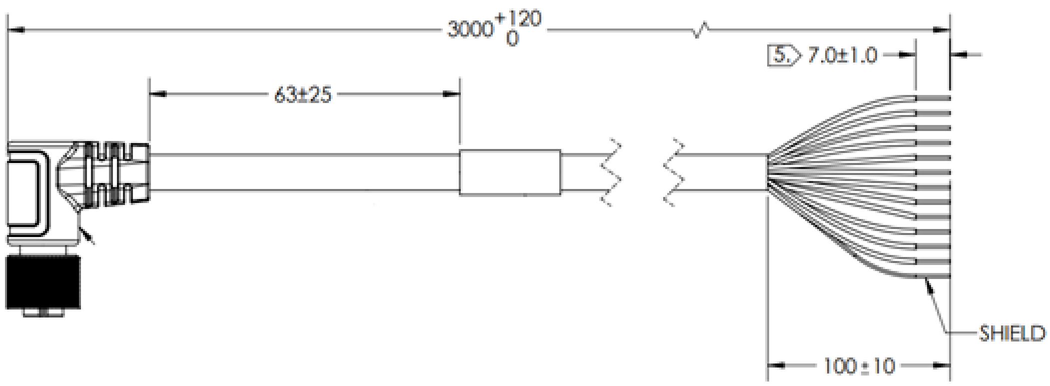
M12 to Flying Leads Cable – Parallel IO (Power, DIO, RS-232), Right Angle Back – 3 Meters V430-W8LD-3M

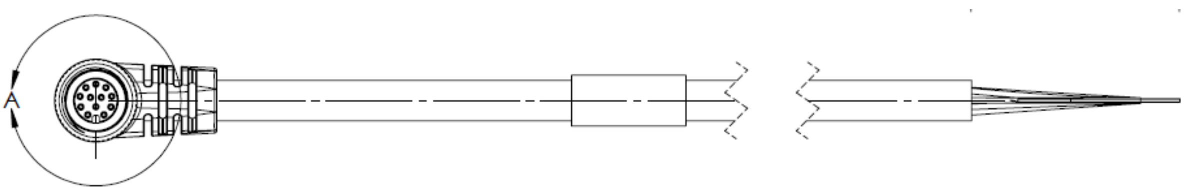


Pin	Name	Use
1	Trigger (Input 1)	Trigger
2	Power (+VIN)	24 Volts
3	Input 3	General Purpose Input
4	Input 2	General Purpose Input
5	Output 1	General Purpose Output
6	Output 3	General Purpose Output, Optional Light Control
7	Ground (-VIN)	24V Reference (GND)
8	Input Common	NPN or PNP Common for Input
9	RS-232 (Host) RxD	Serial Command Input
10	RS-232 (Host) TxD	Serial Output Data
11	Output 2	General Purpose Output
12	Output Common	NPN or PNP Common for Output



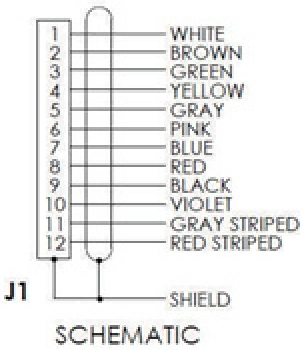


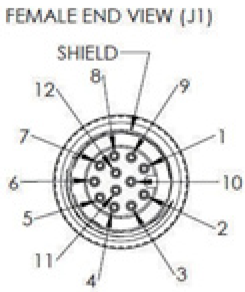


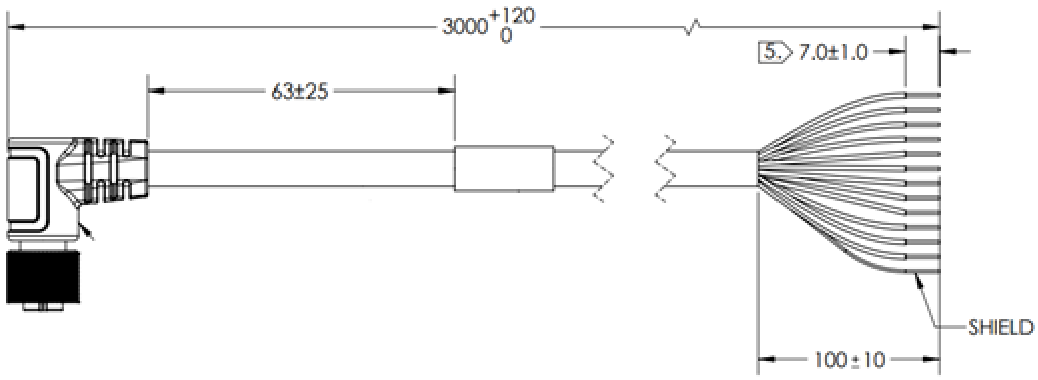


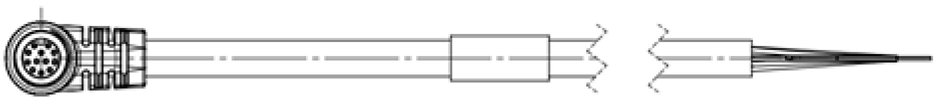
M12 to Flying Leads Cable – Parallel IO (Power, DIO, RS-232), Right Angle Front – 3 Meters
V430-W8LU-3M

Pin	Name	Use
1	Trigger (Input 1)	Trigger
2	Power (+VIN)	24 Volts
3	Input 3	General Purpose Input
4	Input 2	General Purpose Input
5	Output 1	General Purpose Output
6	Output 3	General Purpose Output, Optional Light Control
7	Ground (-VIN)	24V Reference (GND)
8	Input Common	NPN or PNP Common for Input
9	RS-232 (Host) RxD	Serial Command Input
10	RS-232 (Host) TxD	Serial Output Data
11	Output 2	General Purpose Output
12	Output Common	NPN or PNP Common for Output





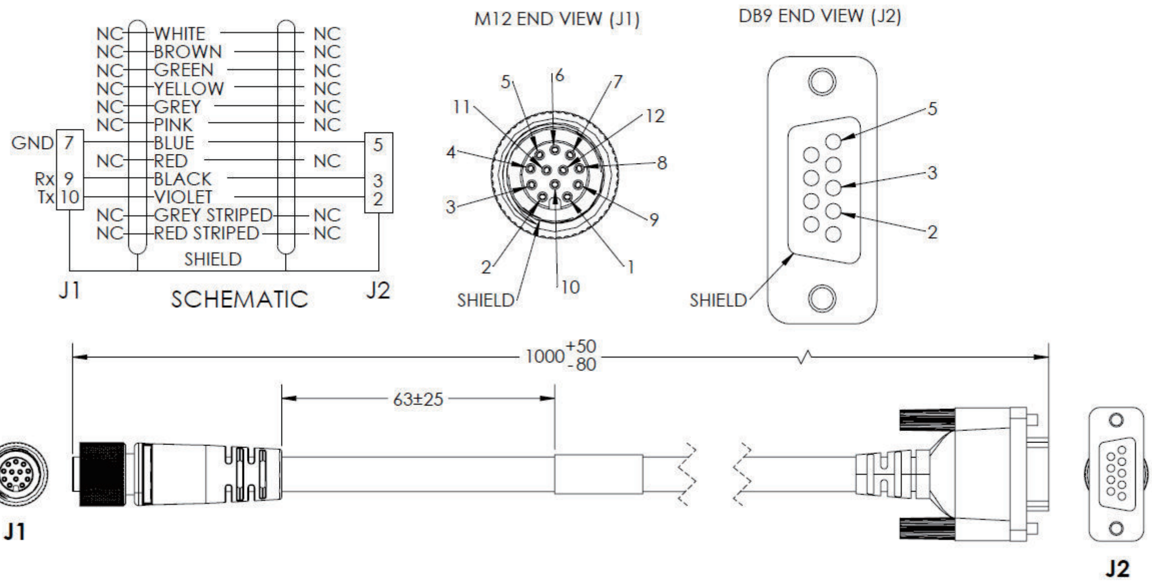


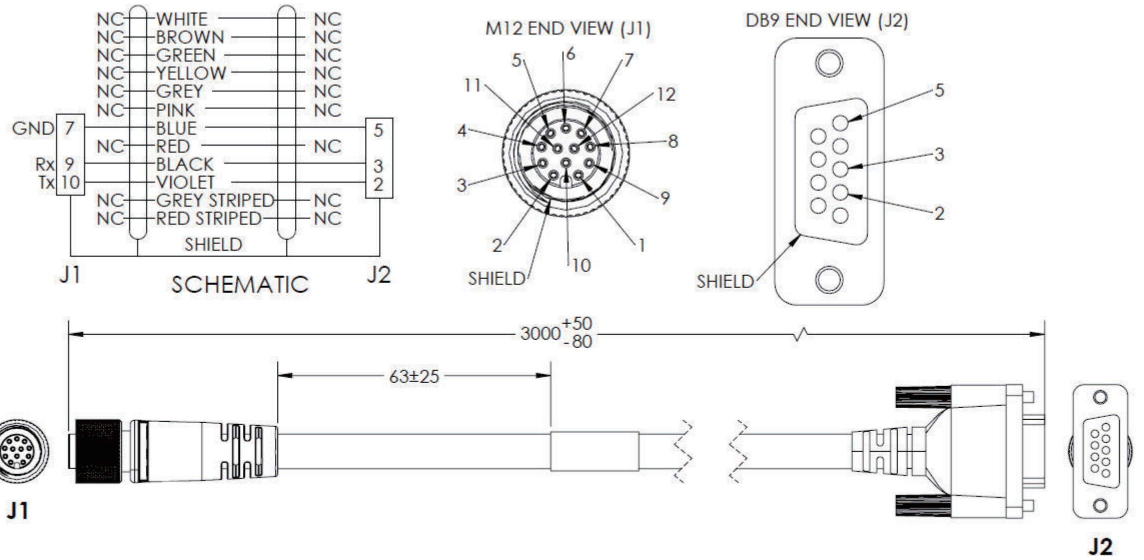


Reader M12 to RS-232 Breakout Cable – 1 Meter, 3 Meters

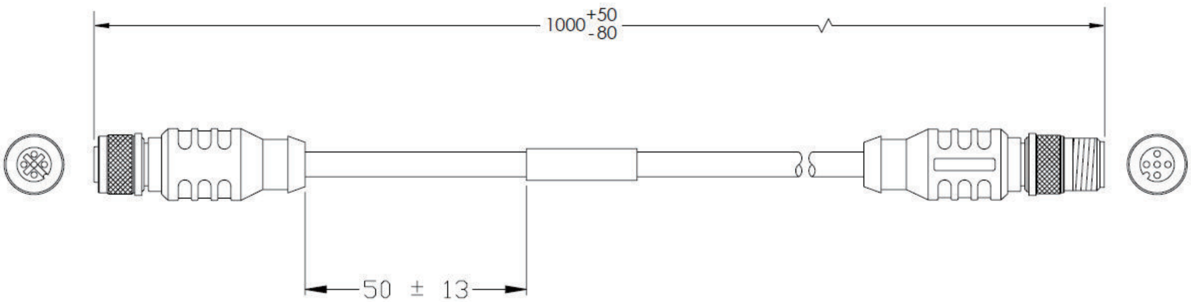
V430-WR-1M

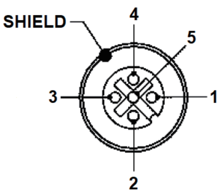
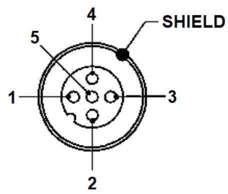
V430-WR-3M



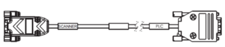


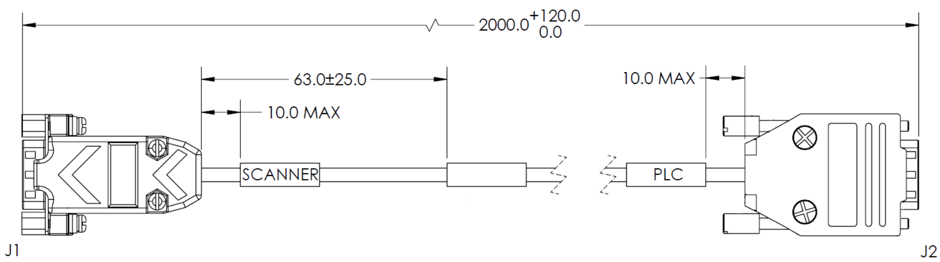
VHV5-F to External Light – 5 Pin M12 Plug to 5 Pin M12 Socket – 1 Meter
61-000184-01

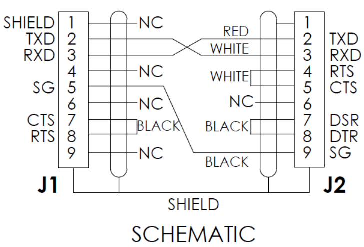


FEMALE END VIEW	MALE END VIEW
 1 = BROWN 2 = WHITE 3 = BLUE 4 = BLACK 5 = GRAY	 1 = BROWN 2 = WHITE 3 = BLUE 4 = BLACK 5 = GRAY

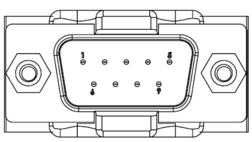
Cable, Adapter, Omron PLC – 2 Meters
V430-WPLC-2M



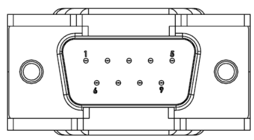




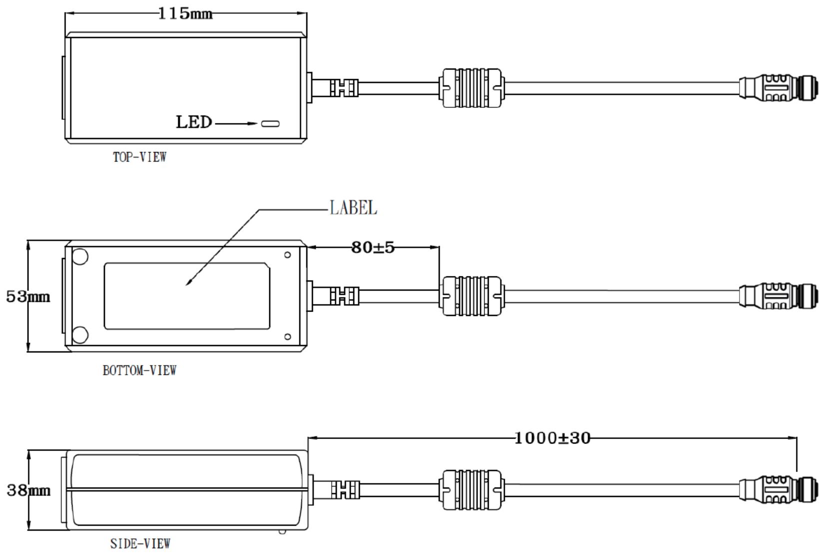
9 POS D-SUB PLUG (J1)

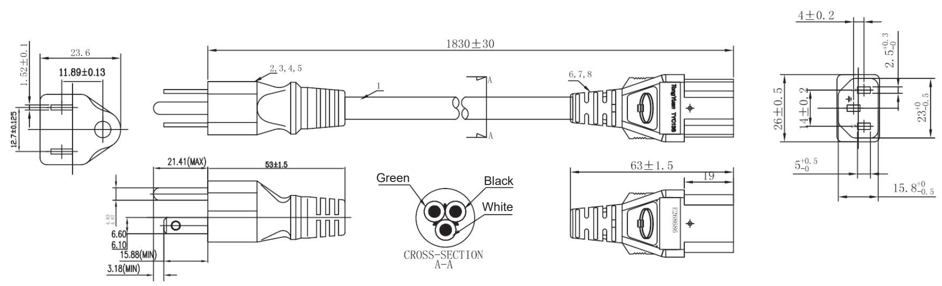


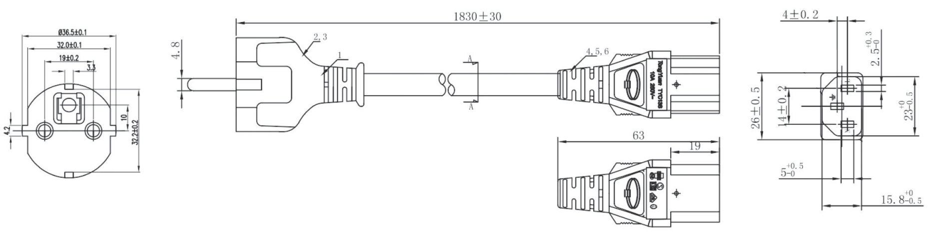
9 POS D-SUB PLUG (J2)



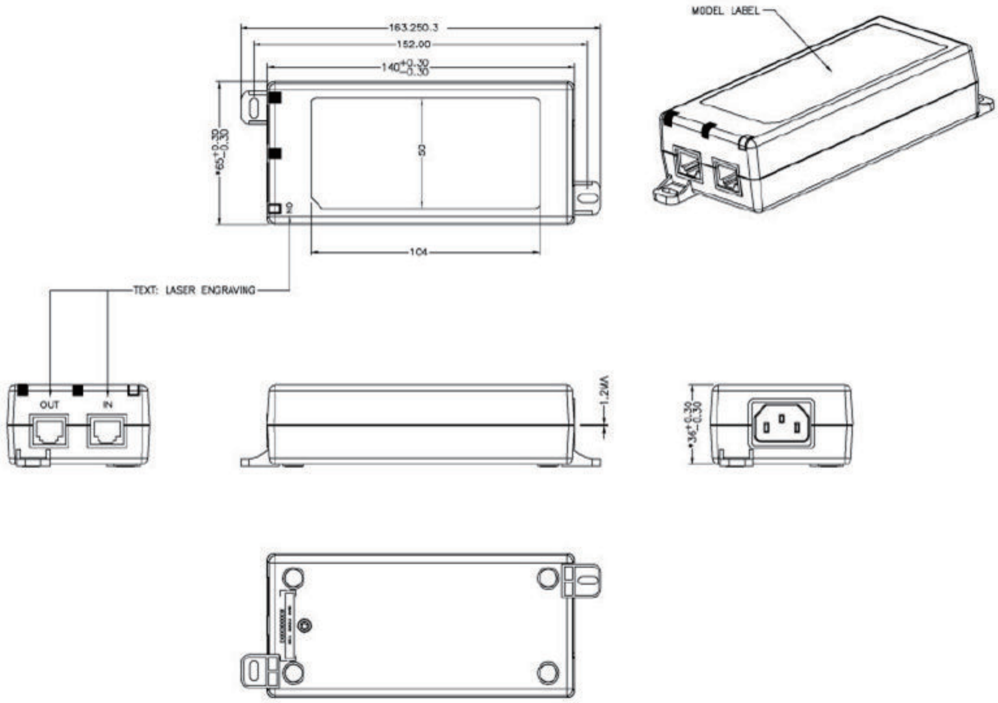
Power Supply, 100-240VAC, +24VDC, M12 12-Pin Socket – 1 Meter – U.S. / Euro Plug
97-000012-01



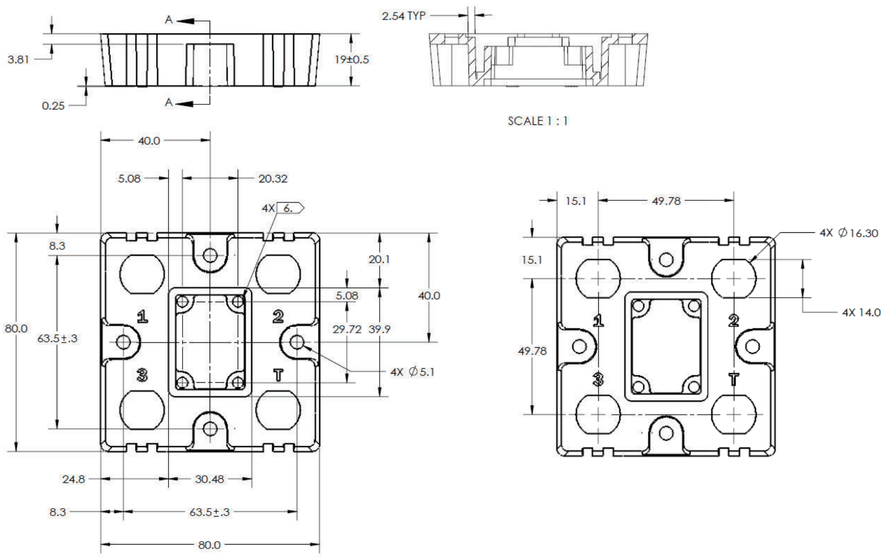




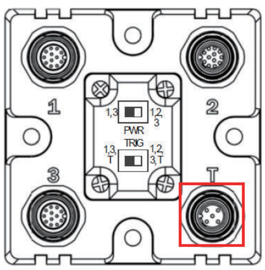
Single Port PoE Injector, 30W, IEEE802.3at Compliant, 2 x RJ45 Connector, 90 to 264VAC
98-9000311-01



QX-1 Interconnect Module – Power, Trigger, Daisy Chain, Smart Light Control Breakout
98-000103-02

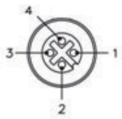


The QX-1's receptacles do not have explicit pin assignments. The QX-1 allows users to bus power and communications as required by the application.
Connectors 1 and 3 are 12-pin plugs, and connector 2 is a 12-pin socket. All three connectors can be assigned to bus power and data as required by the application.
The two switches at the center of the device allow the user to route signals as needed.

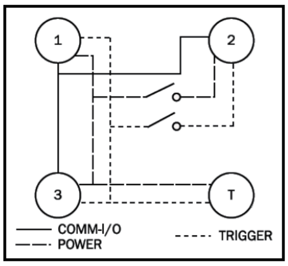


QX-1 Interface Device

Pin	Function
1	+24V
2	Trig/NM/Input 1 Common
3	Ground
4	Trigger



The diagram below (also shown on the base of the QX-1) illustrates how power, communications, I/O, and trigger signal can be routed through the QX-1 device depending on the needs of the application. The switches greatly increase signal routing flexibility.



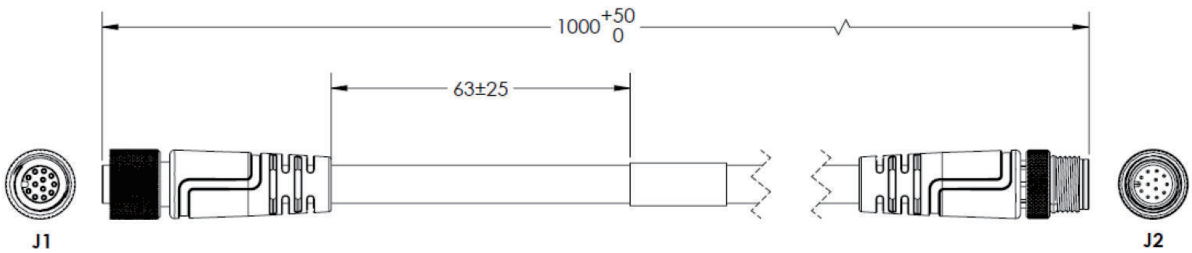
QX-1 Communications - I/O - Power - Trigger

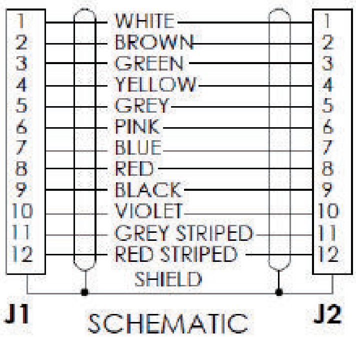
Reader to QX-1 Interconnect Cable – M12 Socket toM12 Plug. 1 Meter, 3 Meter, 5 Meter

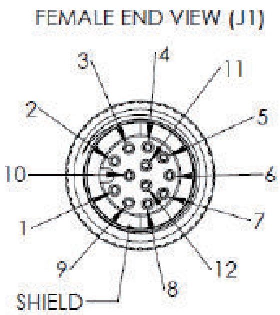
V430-WQ-1M

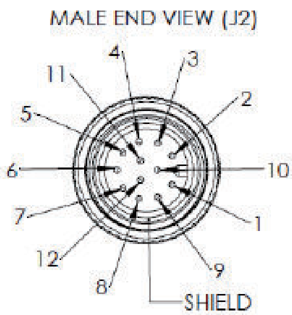
V430-WQ-3M

V430-WQ-5M

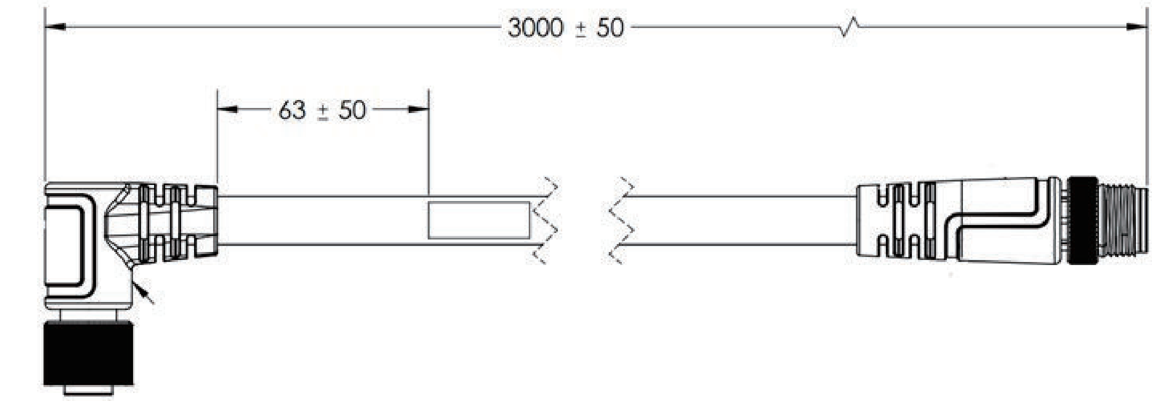


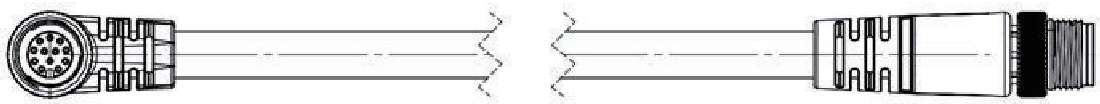


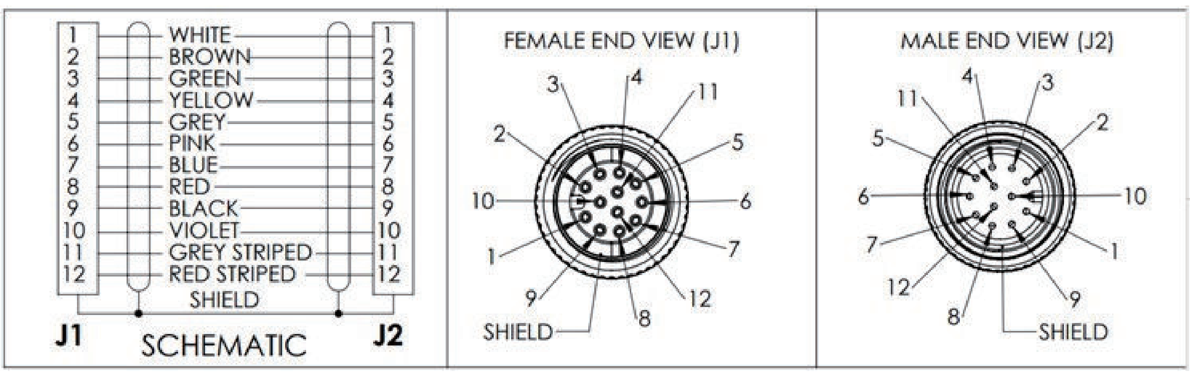




Reader to QX-1 Interconnect Cable – M12 Socket toM12 Plug – 1 Meter, 3 Meter (Right Angle to Back of Camera)
61-000162-03
61-000148-03



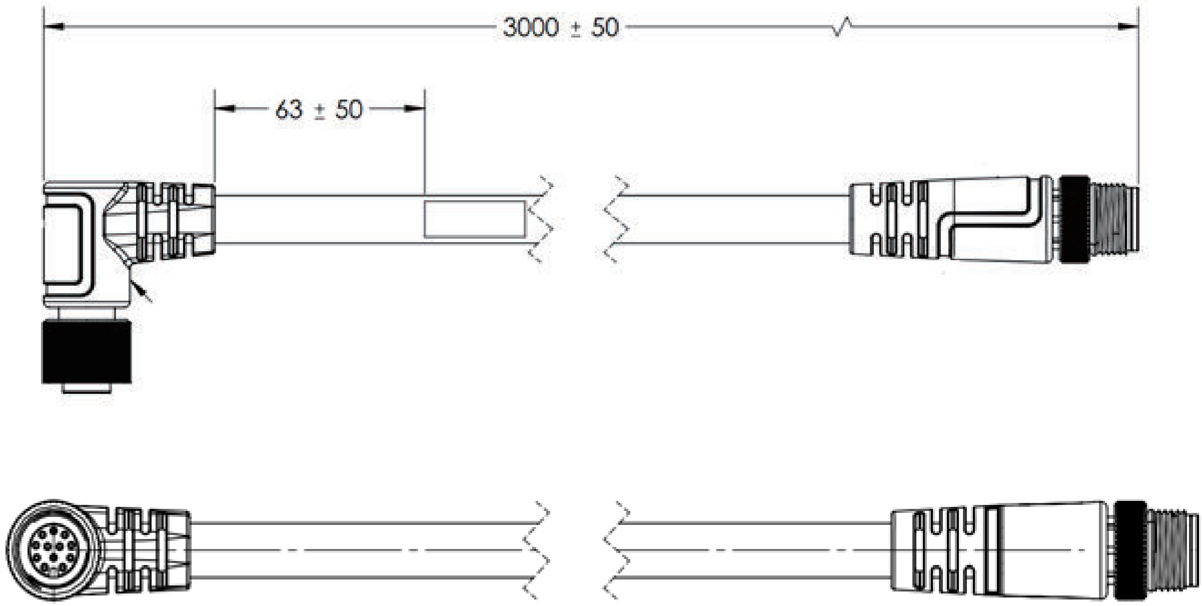


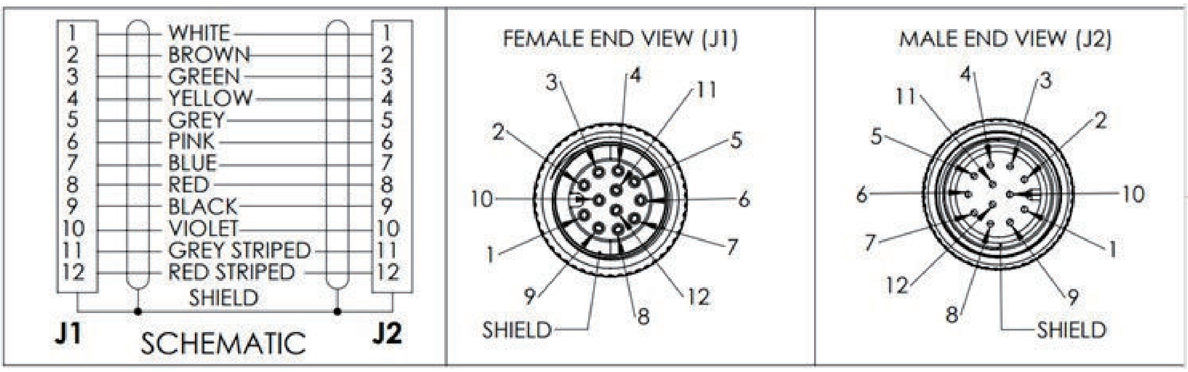


Right Angle Reader to QX-1 Interconnect Cable – M12 Socket toM12 Plug – 1 Meter, 3 Meter (Right Angle to Front of Camera

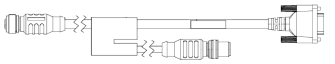
61-000162-04

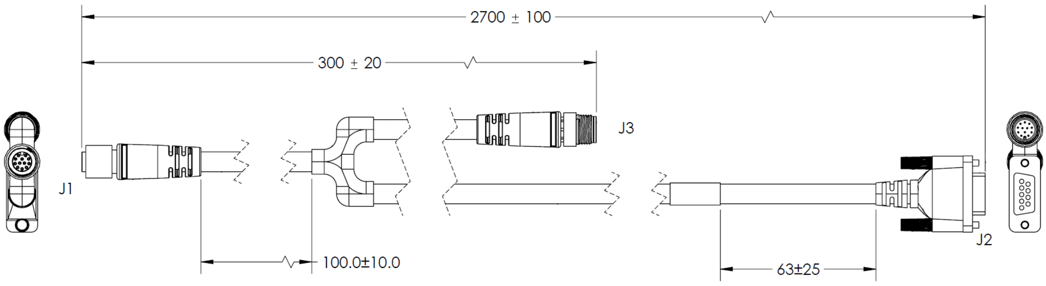
61-000148-04

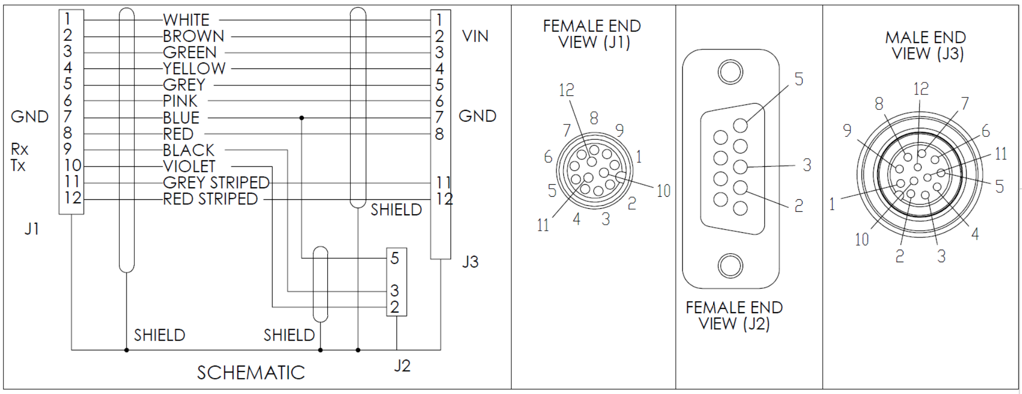




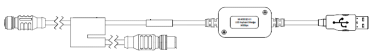
VHV5-F to QX-1 Interconnect Cables with RS-232 Breakout – 3 M, 5 M
V430-WQR-3M
V430-WQR-5M

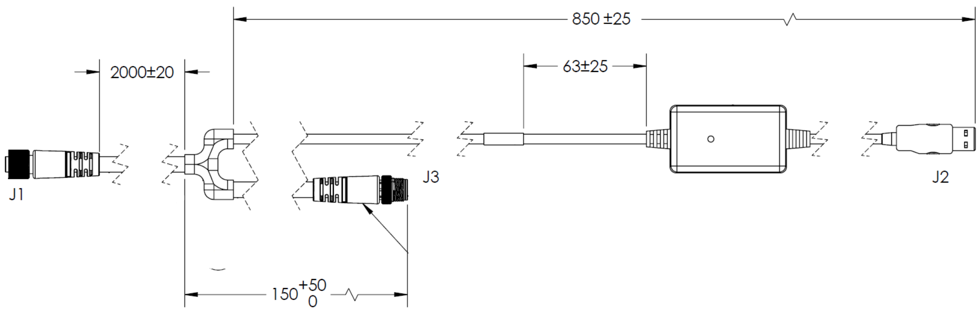


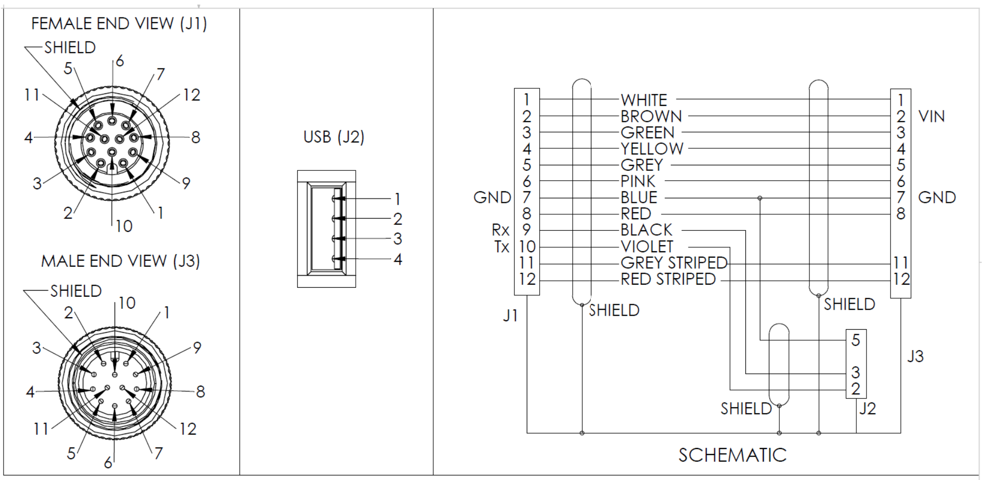




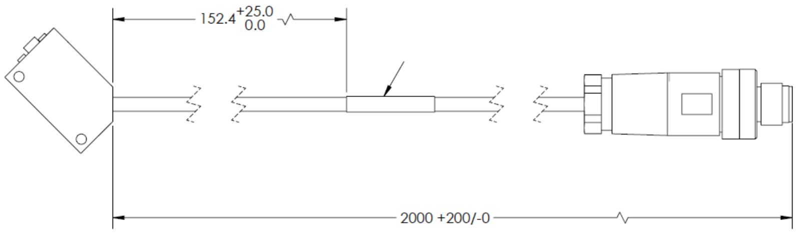
VHV5-F to QX-1 Interconnect Cables with USB Keyboard Wedge Breakout – 3 Meters V430-WQK-3M



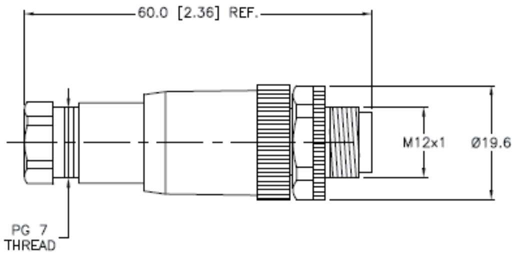




QX-1 Photo Sensor, M12 4-Pin Plug, NPN, Light ON / Dark ON – 2 Meters
99-9000016-01



QX-1 Field-Wireable M12 4-Pin Plug for Any Trigger Source or Photo Sensor – Screw Terminal Connector
98-9000239-01



11-2 Front Window Accessory Installation Guide

11-2-1 VHV5-AF0 Window Kit Removal and Installation

Removal:

Step 1: Disconnect power from the camera.

Step 2: Remove the four screws from the front bezel of the camera.

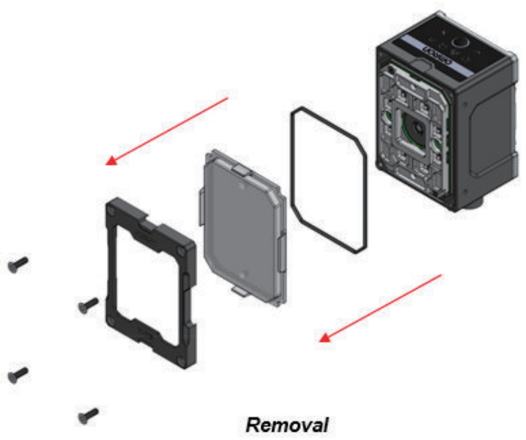
Step 3: Remove the front bezel, window and gasket.

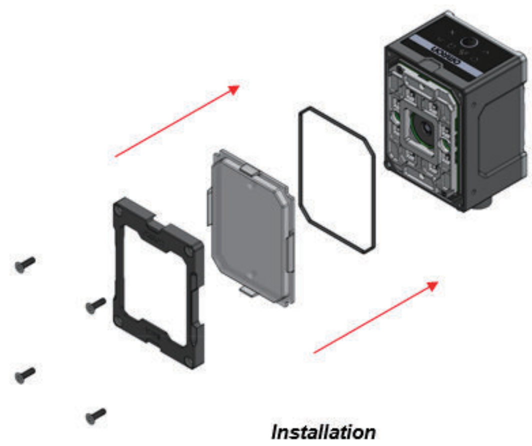
Installation:

Step 1: Install the gasket onto the camera. Ensure that the gasket is properly seated in place.

Step 2: Install the window and bezel onto the camera.

Step 3: Secure the window in place using the screws provided. Do not over-tighten the screws. (4.8 in./lbs. (0.54 nm max.)





11-2-2 VHV5-AF1 Window with Optics Kit Removal and Installation

Removal:

Step 1: Disconnect power from the camera.

Step 2: Remove the four screws from the front bezel of the camera.

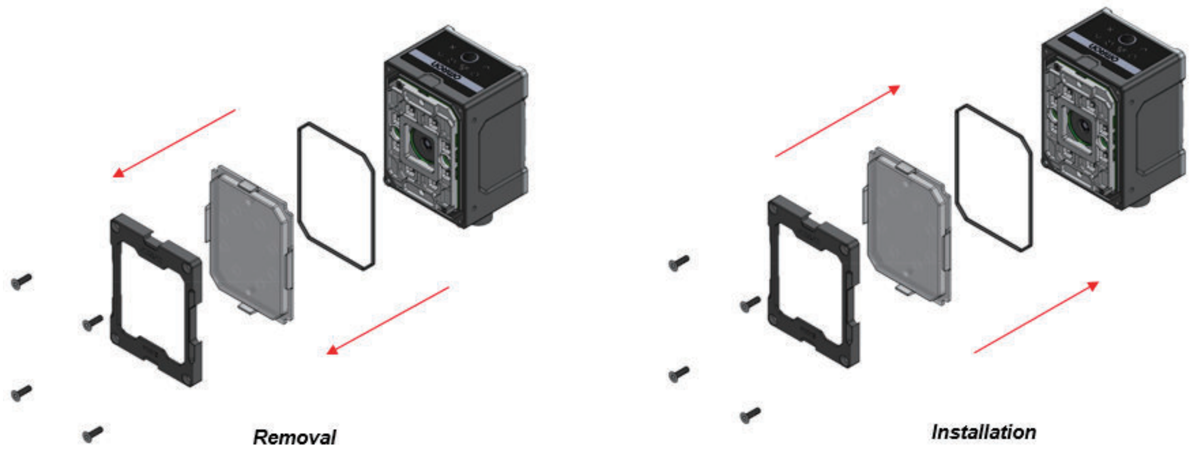
Step 3: Remove the front bezel, window and gasket.

Installation:

Step 1: Install the gasket onto the camera. Ensure that the gasket is properly seated in place.

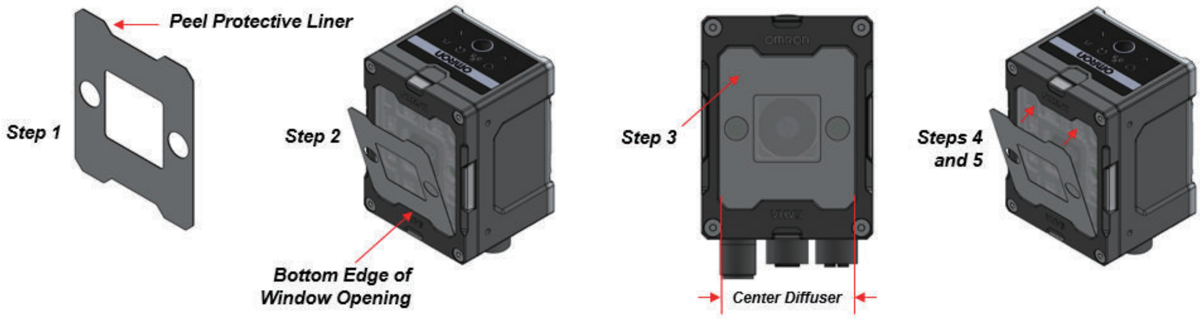
Step 2: Install the window and bezel onto the camera.

Step 3: Secure the window in place using the screws provided. Do not over-tighten the screws. (4.8 in./lbs. (0.54 nm max.)



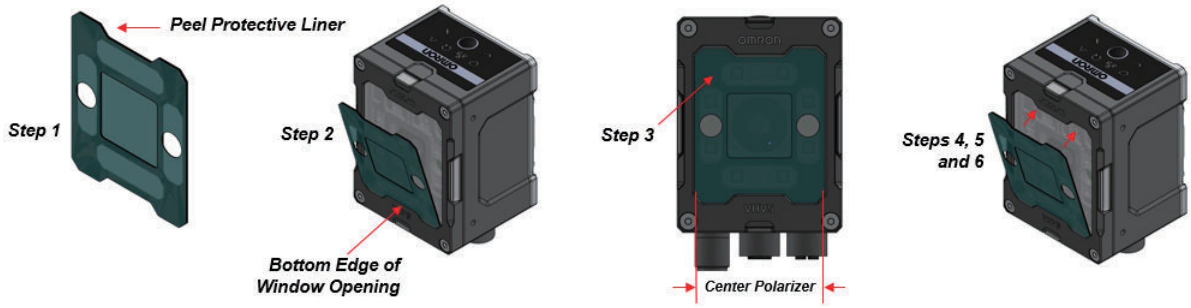
11-2-3 VHV5-AF2 Diffuser Kit Installation

Step 1: Peel the protective liner from the adhesive on the diffuser.
Step 2: Rest the narrow edge of the diffuser on the bottom edge of the window opening at an angle as shown below.
Step 3: Center the diffuser left-to-right in the window opening.
Step 4: Affix the diffuser to the window.
Step 5: Run your finger over the surface of the diffuser using light pressure to complete the bond.



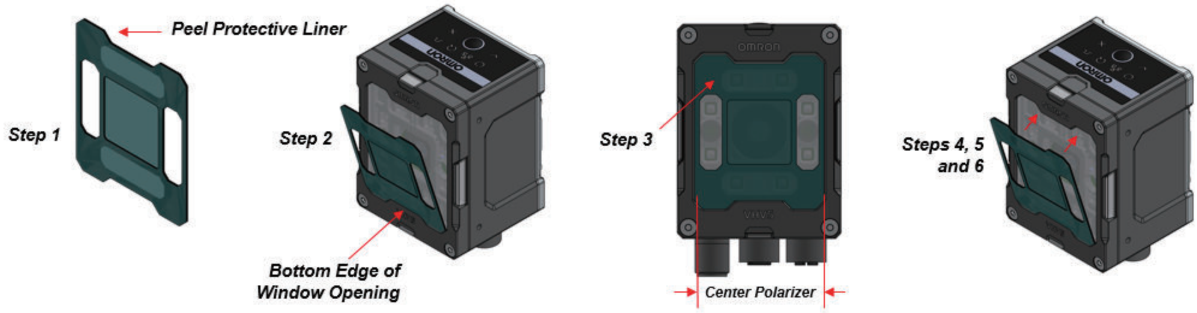
11-2-4 VHV5-AF3 Polarizer Kit Installation

Step 1: Peel the protective liner from the adhesive on the polarizer.
Step 2: Rest the narrow edge of the polarizer on the bottom edge of the window opening at an angle as shown below.
Step 3: Center the polarizer left-to-right in the window opening.
Step 4: Affix the polarizer to the window.
Step 5: Run your finger over the surface of the polarizer using light pressure to complete the bond.
Step 6: Peel the outer protective liner from the polarizer.



11-2-5 VHV5-AF4 Half-Polarizer Kit Installation

Step 1: Peel the protective liner from the adhesive on the polarizer.
Step 2: Rest the narrow edge of the polarizer on the bottom edge of the window opening at an angle as shown below.
Step 3: Center the polarizer left-to-right in the window opening.
Step 4: Affix the polarizer to the window.
Step 5: Run your finger over the surface of the polarizer using light pressure to complete the bond.
Step 6: Peel the outer protective liner from the polarizer.



12

Troubleshooting

This section provides troubleshooting information, including suggestions about how to solve various code reader issues. It also answers some common questions about VHV5-F functionality.

12-1 Troubleshooting

Problem	Possible Causes	Possible Solutions
The code reader decodes the symbol, but does not transmit the symbol data to the host.	The code reader is not configured for the correct host type.	Use WebLink to set the appropriate host type.
	The PoE injector-to-host (device) cable is disconnected or loose.	Re-connect the cable.
The host displays decoded data incorrectly.	The code reader is not configured to work with the specific host.	Program the correct data output conditions (e.g., UPC-E to UPC-A conversion).

13

Service and Maintenance

13-1 Service

If you have difficulty using the equipment, contact your facility's technical or systems support. If there is a problem with the equipment, you can contact customer service at your regional Omron website.

When contacting support, please have the following information available:

- Serial number of the unit
- Model number or product name
- Software type and version number

Omron Microscan responds to calls by e-mail, telephone, or fax within the time limits set forth in service agreements.

If your problem cannot be solved by support, you may need to return your equipment for servicing and will be given specific directions. Omron Microscan is not responsible for any damages incurred during shipment if the approved shipping container is not used. Shipping the units improperly can possibly void the warranty.

If you purchased your product from an Omron Microscan business partner, please contact that partner for support.

13-2 Maintenance

13-2-1 Known Harmful Ingredients

The following chemicals are known to damage the plastics on Omron Microscan products and should not come in contact with the device:

- Acetone
- Ammonia solutions
- Aqueous or alcoholic alkaline solutions
- Aromatic and chlorinated hydrocarbons
- Benzene
- Undiluted Bleach
- Carbolic acid
- Compounds of amines or ammonia
- Ethanolamine
- Ethers
- Ketones
- TB-lysoform
- Toluene
- Trichloroethylene

13-2-2 Tolerable Industrial Fluids and Chemicals

Not all fluid variants and brands have been tested.
The industrial fluids and chemicals listed below were evaluated and deemed tolerable for the housing of the VHV5-F. These industrial fluids and chemicals should not come in contact with the VHV5-F code reader window, which uses technology much like a digital camera. Marks, oil, or debris on the window will interfere with image captures. Leaving the following industrial fluids on the window will result in suboptimal decode performance. See *13-2-4 Cleaning the Code Reader* on page 13-4 for detailed cleaning instructions.

- Motor/Engine Oil
- Automatic Transmission Fluid (ATF)
- Continuously Variable Transmission (CVT) Fluid
- Industrial De-Greaser (Engine Brite Heavy Duty)
- Brake Fluid (DOT4)

If the code reader comes in frequent contact with the fluids and chemicals listed above, Omron Microscan recommends that you clean the outside of the code reader daily with the approved cleaning agent listed below.

13-2-3 Approved General Cleaning Agents

The following cleaning agents are approved for general cleaning of Omron Microscan products, including the VHV5-F.

- Isopropyl alcohol 70%

13-2-4 Cleaning the Code Reader

Routinely cleaning the exit window is required. A dirty window may affect scanning accuracy. Do not allow any abrasive material to touch the window.
To clean the code reader:

1. Dampen a soft cloth with one of the approved cleaning agents listed above or use pre-moistened wipes.

2. Gently wipe all surfaces, including the front, back, sides, top and bottom. Never apply liquid directly to the code reader. Be careful not to let liquid pool around the code reader window, trigger, cable connector or any other area on the device.

3. Be sure to clean the trigger and in between the trigger and the housing (use a cotton-tipped applicator to reach tight or inaccessible areas).

4. Do not spray water or other cleaning liquids directly into the exit window.

5. Wipe the code reader exit window with a lens tissue or other material suitable for cleaning optical material such as eyeglasses.

6. Immediately dry the code reader window after cleaning with a soft non-abrasive cloth to prevent streaking.

7. Allow the code reader to air dry before use.

8. Code reader connectors:
   1) Dip the cotton portion of a cotton-tipped applicator in isopropyl alcohol.
   2) Rub the cotton portion of the cotton-tipped applicator back-and-forth across the connector on the code reader at least 3 times. Do not leave any cotton residue on the connector.
   3) Use the cotton-tipped applicator dipped in alcohol to remove any grease and dirt near the connector area.
   4) Use a dry cotton tipped applicator and rub the cotton portion of the cotton-tipped applicator back-and-forth across the connectors at least 3 times. Do not leave any cotton residue on the connectors.

A

Appendices

A-1 ASCII Table

A-1-1 ASCII Table

Dec	Hex	Mne	Ctrl
00	00	NUL	^@
01	01	SOH	^A
02	02	STX	^B
03	03	ETX	^C
04	04	EOT	^D
05	05	ENQ	^E
06	06	ACK	^F
07	07	BEL	^G
08	08	BS	^H
09	09	HT	^I
10	0A	LF	^J
11	0B	VT	^K
12	0C	FF	^L
13	0D	CR	^M
14	0E	SO	^N
15	0F	SI	^O
16	10	DLE	^P
17	11	DC1	^Q
18	12	DC2	^R
19	13	DC3	^S
20	14	DC4	^T
21	15	NAK	^U
22	16	SYN	^V
23	17	ETB	^W
24	18	CAN	^X
25	19	EM	^Y
26	1A	SUB	^Z
27	1B	ESC	^[
28	1C	FS	^\
29	1D	GS	^]
30	1E	RS	^^
31	1F	US	^_

Dec	Hex	Ch
32	20	SP
33	21	!
34	22	“
35	23	#
36	24	$
37	25	%
38	26	&
39	27	'
40	28	(
41	29	)
42	2A	*
43	2B	+
44	2C	,
45	2D	-
46	2E	.
47	2F	/
48	30	0
49	31	1
50	32	2
51	33	3
52	34	4
53	35	5
54	36	6
55	37	7
56	38	8
57	39	9
58	3A	:
59	3B	;
60	3C	<
61	3D	=
62	3E	>
63	3F	?

Dec	Hex	Ch
64	40	@
65	41	A
66	42	B
67	43	C
68	44	D
69	45	E
70	46	F
71	47	G
72	48	H
73	49	I
74	4A	J
75	4B	K
76	4C	L
77	4D	M
78	4E	N
79	4F	O
80	50	P
81	51	Q
82	52	R
83	53	S
84	54	T
85	55	U
86	56	V
87	57	W
88	58	X
89	59	Y
90	5A	Z
91	5B	[
92	5C	\
93	5D	]
94	5E	^
95	5F	_

Dec	Hex	Ch
96	60	`
97	61	a
98	62	b
99	63	c
100	64	d
101	65	e
102	66	f
103	67	g
104	68	h
105	69	i
106	6A	j
107	6B	k
108	6C	l
109	6D	m
110	6E	n
111	6F	o
112	70	p
113	71	q
114	72	r
115	73	s
116	74	t
117	75	u
118	76	v
119	77	w
120	78	x
121	79	y
122	7A	z
123	7B	{
124	7C	|
125	7D	}
126	7E	~
127	7F	D

A-2 Glossary of Terms

A-2-1 Glossary of Terms

Aberration — The failure of an optical lens to produce an exact point-to-point correspondence between the object and its resulting image. Various types are chromatic, spherical, coma, astigmatism and distortion.

Absorption — The loss of light of certain wavelengths as it passes through a material and is converted to heat or other forms of energy. (–)

Active Illumination — Lighting an area with a light source coordinated with the acquisition of an image. Strobed flash tubes and pulsed lasers are examples.

Ambient Light — Light which is present in the environment of the imaging front end of a vision system and generated from outside sources. This light, unless used for actual illumination, will be treated as background noise by the vision system.

Analog — A smooth, continuous voltage or current signal or function whose magnitude (value) is the information.

Analog-to-Digital Converter (A/D Converter or ADC) — A device that converts an analog voltage or current signal to a discrete series of digitally encoded numbers (signal) for computer processing.

Application-Specific Integrated Circuit (ASIC) — An integrated circuit that is customized for a particular kind of use, rather than general use. All vision system elements including firmware can be integrated into one ASIC.

Architecture — The hardware organization of a vision system designed for high speed image analysis.

Aspect Ratio — The ratio between the height and width of a sensor or display. Found by dividing the vertical number of pixels (height) by the horizontal number of pixels (width) leaving it in fractional format.

Automatic Gain Control (AGC) — Adjustment to signal strength that seeks to maintain a constant level regardless of the distance between a reader and symbol.

Auxiliary Port — RS-232 connection to an auxiliary terminal or device for remote viewing.

Blooming — A situation in which too many photons are being produced to be received by a pixel. The pixel overflows and causes the photons to go to adjacent pixels. Blooming is similar to overexposure in film photography, except that in digital imaging, the result is a number of vertical and/or horizontal streaks appearing from the light source in the picture.

Baud Rate — The number of discrete signal events per second; bits per second.

Capture — The act of acquiring and storing video images in an imager or host computer. Also, the image captured.

Charge-Coupled Device (CCD) — A semiconductor device with an array of light-sensitive elements that converts light images into electrical signals.

Check Character — A Modulus 43 or Modulus 10 character that is added to encoded symbol data for additional data integrity.

Complementary Metal Oxide Semiconductor (CMOS) — Like CCDs, CMOS imagers include an array of photo-sensitive diodes, one diode within each pixel. Unlike CCDs, however, each pixel in a CMOS imager has its own individual amplifier integrated inside.

Connector — A plug or socket on a device or cable providing in/out connectivity for various circuits and pins.

Concentrator — Intermediary device that relays data from imagers to a host and commands from the host to the imagers or other devices.
Counter — Memory space allocated to keep track of imager events.
Daisy Chain — Linkage of primary and secondary imagers allowing data to be relayed up to the host via auxiliary port connections.
Decode — A Good Read. The successful interpretation and output of the information encoded in a symbol.
Default — Restores ROM or flash settings, initializes serial commands and resets all counters.
Delimited — A delimited command or field is bracketed by predefined characters.
Decode Rate — The number of good reads per second ahieved by an imager.
Dark Field Illumination — Lighting of objects, surfaces, or particles at very shallow or low angles, so that light does not directly enter a reader's optical hardware.
Depth-of-Field — The in-focus range of an imaging system. Measured from the distance behind an object to the distance in front of the object with all objects appearing in focus.
Diffused Lighting — Scattered soft lighting from a wide variety of angles used to eliminate shadows and specular glints from profiled, highly reflective surfaces.
Digital-to-Analog Converter (DAC) — A VLSI circuit used to convert digitally processed images to analog for display on a monitor.
Digital Imaging — Conversion of an image into pixels by means of an Analog-to-Digital Converter where the level of each pixel can be stored digitally.
Digital Signal Processor (DSP) — A VLSI chip designed for ultra-high-speed arithmetic processing. Often embedded in a vision engine.
Discrete I/O — Inputs and outputs characterized by discrete signal transitions from one voltage level to another so that digital switching can occur.
Direct Memory Access (DMA) — A capability provided by some computer bus architectures that allows data to be sent directly to memory from an attached device.
Dynamic Range — The difference between the minimum and maximum thresholds of discernible images; the amount of usable signal.
Edge Enhancement — Image processing method to strengthen high-spatial frequencies in the image.
Embedded Memory — Onboard memory device such as EPROM or flash.
End of Read Cycle — The time or condition at which the imager stops expecting symbol information to decode.
Erasable Programmable Read-Only Memory (EPROM) — A memory chip that retains data when its power supply is turned off; "non-volatile memory".
External Edge — Allows a read cycle to be initiated by a trigger signal from an object detector when it detects the appearance of an object (rising edge). The read cycle ends with a good read, a timeout, or a new trigger.
External Level — Allows a read cycle to be initiated by a trigger signal from an object detector. The read cycle ends when the object moves out of the detector's range.
Falling Edge — A change of state (to inactive) associated with a level trigger.
Field-Programmable Gate Array (FPGA) — A semiconductor device containing programmable interconnects and logic components.
Fill Factor — Percentage of pixel area used for light collection.
Firmware — Software hard-coded in non-volatile memory (ROM), and closely tied to specific pieces of hardware.
Fixed Symbol Length — Increases data integrity by ensuring that only one symbol length will be accepted.

Focal Distance — In camera-based vision, the distance from the front of the camera to the object being viewed. (In optics, the distance from the lens to the focal plane.)
Focal Plane — Usually found at the image sensor, it is a plane perpendicular to the lens axis at the point of focus (–).
Focus — Any given point in an image at which light converges; the focal point.
Frame — The total area captured in an image sensor while the video signal is not blanked.
Frame Grabber — A device that interfaces with a camera and, on command, samples the video, converts the sample to a digital value and stores that in a computer's memory.
Front End System — The object, illumination, optics and imager blocks of a vision system. Includes all components useful to acquire a good image for subsequent processing.
Full Duplex — A communications system in which signals can travel simultaneously between devices.
Gain — The amount of energy applied to pixel gray scale values prior to output, expressed in dB; optimal signal strength.
Good Read — A decode. The successful scanning and decoding of the information encoded in a bar code symbol.
Gradient — The rate of change of pixel intensity (first derivative).
Gray Scale — Variations of values from white, through shades of gray, to black in a digitized image with black assigned the value of zero and white the value of one.
Half Duplex — A communications system in which signals can travel between devices in both directions, but not simultaneously.
Histogram — A graphical representation of the frequency of occurrence of each intensity or range of intensities (gray levels) of pixels in an image. The height represents the number of observations occurring in each interval.
Host — A computer, PLC, or other device that is used to execute commands and process data and discrete signals.
Image — Projection of an object or scene onto a plane (i.e. screen or image sensor).
Image Processing (IP) — Transformation of an input image into an output image with desired properties.
Image Resolution — The number of rows and columns of pixels in an image. A higher resolution means that more pixels are available per element of the symbol being read. Examples: 640 x 480 (VGA); 854 x 480 (WVGA); 1280 x 1024 (SXGA); 2048 x 1536 (QXGA).
Image Sensor — A device that converts a visual image to an electrical signal; a CCD or CMOS array.
Initialize — Implement serial configuration commands into the imager’s active memory.
Input — A channel or communications line. Decoded data or a discrete signal that is received by a device.
Integration — Exposure of pixels on a CMOS sensor.
Ladder Orientation — A linear symbol orientation in which the bars are parallel to the symbol’s direction of travel.
Light-Emitting Diode (LED) — A semiconductor device that emits light when conducting current.
Lens — A transparent piece of material with curved surfaces which either converge or diverge light rays.
Machine Vision — The automatic acquisition and analysis of images to obtain desired data for controlling a specific activity.
Multidrop — A communications protocol for networking two or more imagers or other devices with a concentrator (or controller) and characterized by the use of individual device addresses and the RS-485 standard.

Noise — The same as static in a phone line or “snow” in a television picture, noise is any unwanted electrical signal that interferes with the image being read and transferred by the imager.
Normally Closed — A discrete output state that is only active when open.
Normally Open — A discrete output state that is only active when closed.
Object Plane — An imaginary plane in the field of view, focused by an imager’s optical system at the corresponding image plane on the sensor.
Output — A channel or communications line. Data or discrete signals that are transmitted or displayed by a device.
Parity — An error detection routine in which one data bit in each character is set to 1 or 0 so that the total number of 1 bits in the data field is even or odd.
Picket Fence Orientation — A linear symbol orientation in which the bars are perpendicular to the symbol’s direction of travel.
Pitch — Rotation of a linear or 2D symbol around an axis parallel to the symbol length on the Substrate.
Pixel — An individual element in a digitized image array; “picture element”.
Port — Logical circuit for data entry and exit. (One or more ports may be included within a single connector.)
Processing Time — The time used by a vision system to receive, analyze and interpret image information. Often expressed in “parts per minute”.
Programmable Logic Controller (PLC) — An electronic device used in industrial automation environments such as factory assembly lines and automotive manufacturing facilities.
Progressive Scan — A non-interlaced scan that doubles the number of visible picture lines per field by displaying all picture lines at once.
Protocol — The rules for communication between devices, providing a means to control the orderly flow of information between linked devices.
Random Access Memory (RAM) — A data storage system used in computers, composed of integrated circuits that allow access to stored data in any sequence without movement of physical parts.
Read Cycle — A programmed period of time or condition during which a reader will accept symbol input.
Read-Only Memory (ROM) — A data storage medium used in computers and other electronics, primarily used to distribute Firmware.
Real-Time Processing — In machine vision, the ability of a system to perform a complete analysis and take action on one part before the next one arrives for inspection.
Region — Area of an image. Also called a region of interest for image processing operations.
Saturation — The degree to which a color is free of white. One of the three properties of color perception, along with hue and value.
Scattering — Redirection of light reflecting off a surface or through an object.
Skew — Rotation of a linear or 2D symbol around an axis parallel to the symbol height on the substrate.
Substrate — The surface upon which a linear or 2D symbol is printed, stamped, or etched.
Symbol Transitions — The transition of bars and spaces on a symbol, used to detect the presence of a symbol on an object.
Symbology — A symbol type, such as Code 39 or Code 128, with special rules to define the widths and positions of bars and spaces to represent specific numeric or alphanumeric information.
Tilt — Rotation of a linear or 2D symbol around an axis perpendicular to the substrate.
Trigger — A signal, transition, or character string that initiates a read cycle.

Very Large-Scale Integration (VLSI) — The creation of integrated circuits by combining thousands of transistor-based circuits on a single chip.
Watchdog Timer — A security device that detects system crashes and attempts to reset the imager.

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