

High pixel CMOS camera

KP-FM500WCL

KP-FMD500WCL

Operation Manual



Thank you for purchase this fine Hitachi Kokusai Electric CMOS camera.
Before using the camera, please read this operation manual carefully.

Hitachi Kokusai Electric Inc.

RoHS Compliant

These products comply with the requirement of the RoHS (Restriction of the use of Certain Hazardous Substances in Electrical and electronic Equipment) Directive 2002/95/EC.

The first edition in August, 2018.

IMPORTANT SAFETY INSTRUCTIONS

1. Read Instructions

All the safety and operating instructions should be read before the product is operated.

2. Retain Instructions

The safety and operating instructions should be retained for future reference.

3. Heed Warnings

All warnings on the product and the operating instructions should be adhered to.

4. Follow Instructions

All operating and use instructions should be followed.

5. Cleaning

Unplug this product from the wall outlet before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.

6. Attachments

Do not use attachments not recommended by the product manufacturer as they may cause hazards.

7. Water and Moisture

Do not use this product near water - for example, near a bath tub, wash bowl, kitchen sink, or laundry tub; in a wet basement; or near a swimming pool; and the like.

8. Accessories

Do not place this product on an unstable cart, stand, tripod, bracket, or table. The product may fall, causing serious injury to a child or adult, and serious damage to the product. Use only with a cart, stand, tripod, bracket, or table recommended by the manufacturer, or sold with the product. Any mounting of the product should follow the manufacturer's instructions, and should use a mounting accessory recommended by the manufacturer.

9. Moving

A product and cart combination should be moved with care.

Quick stops, excessive force, and uneven surfaces may cause the product and cart combination to overturn.

10. Ventilation

Slots and openings in the cabinet are provided for ventilation and to ensure reliable operation of the product and to protect it from overheating, and these openings must not be blocked or covered.

The openings should never be blocked by placing the product on a bed, sofa, rug, or other similar surface. This product should not be placed in a built-in installation such as a bookcase or rack unless proper ventilation is provided or the manufacturer's instructions have been adhered to.

11. Power Sources

This product should be operated only from the type of power source indicated on the marking label. If you are not sure of the type of power supply to your home, consult your product dealer or local power company. For products intended to operate from battery power, or other sources, refer to the operating instructions.

12. Grounding or Polarization

This product is equipped with a three-wire grounding-type plug a plug having a third (grounding) pin. This plug will only fit into a grounding-type power outlet. This is a safety feature. If you are unable to insert the plug into the outlet, contact your electrician to replace your obsolete outlet. Do not defeat the safety purpose of the grounding-type plug.

13. Power-Cord Protection

Power-supply cords should be routed so that they are not likely to be walked on or pinched by items placed upon or against them, paying particular attention to cords at plug, convenience receptacles, and the point where they exit from the product.

14. Lightning

For added protection for this product during a lightning storm, or when it is left unattended and unused for long periods of time, unplug it from the wall outlet. This will prevent damage to the product due to lightning and power-line surges.

15. Overloading

Do not overload wall outlets, extension cords or integral convenience receptacles as this can result in a risk of fire or electric shock.

16. Object and Liquid Entry

Never push objects of any kind into this product through openings as they may touch dangerous voltage points or short-out parts that could result in a fire or electric shock. Never spill liquid of any kind on the product.

17. Inflammable and Explosive Substance

Avoid using this product where there are gases, and also where there are inflammable and explosive substances in the immediate vicinity.

18. Heavy Shock or Vibration

When carrying this product around, do not subject the product to heavy shock or vibration.

19. Servicing

Do not attempt to service this product yourself as opening or removing covers may expose you to dangerous voltage or other hazards. Refer all servicing to qualified service personnel.

20. Damage Requiring Service

Unplug this product from the wall outlet and refer servicing to qualified service personnel under the following conditions:

- When the power-supply cord or plug is damaged.
- If liquid has been spilled, or objects have fallen into the product.
- If the product has been exposed to rain or water.
- If the product does not operate normally by following the operating instructions. Adjust only those controls that are covered by the operating instructions as an improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to its normal operation.
- If the product has been dropped or damaged in any way.
- When the product exhibits a distinct change in performance-this indicates a need for service.

21. Replacement Parts

When replacement parts are required, be sure the service technician has used replacement parts specified by the manufacturer or have the same characteristics as the original part.

Unauthorized substitutions may result in fire, electric shock, or other hazards.

22. Safety Check

Upon completion of any service or repairs to this product, ask the service technician to perform safety checks to determine that the product is in proper operating condition.

23. Wall or Ceiling Mounting

The product should be mounted to a wall or ceiling only as recommended by the manufacturer.

24. Heat

The product should be situated away from heat sources such as radiators, heat registers, stoves, or other products (including amplifiers) that produce heat.

WICHTIGE SICHERHEITSANWEISUNGEN

1. Alle Anweisungen lesen

Vor Betrieb des Erzeugnisses sollten alle Sicherheits- und Bedienungsanleitungen gelesen werden.

2. Die Anweisungen aufbewahren

Die Sicherheits- und Bedienungsanleitungen sollten fünfjährigen Bezug aufbewahrt werden.

3. Warnungen beachten

Die Warnungen auf dem Erzeugnis und in den Bedienungsanleitungen sollten beachtet werden.

4. Anweisungen befolgen

Alle Bedienungsanleitung- und Verwendungsanweisungen sollten befolgt werden.

5. Reinigung

Den Stecker des Geräts vor Reinigung aus der Steckdose ziehen. Keine flüssigen Reinigungsmittel oder Aerosolreiniger verwenden. Zum Reinigen einen feuchten Lappen verwenden.

6. Zubehör

Nur vom Hersteller des Erzeugnisses empfohlenes Zubehör verwenden, da es sonst zu Störungen kommen kann.

7. Wasser und Feuchtigkeit

Dieses Erzeugnis nicht in der Nähe von Wasser verwenden - z.B. in der Nähe einer Badewanne, eines Waschbeckens, einer Küchenspüle, eines Waschzubehörs, in einem nassen Keller, in der Nähe eines Schwimmbeckens usw.

8. Aufstellung

Das Erzeugnis nicht auf einen instabilen Wagen, Stand, Dreifuß, Träger oder Tisch stellen. Das Erzeugnis kann sonst herunterfallen und ein Kind oder einen Erwachsenen schwer verletzen. Außerdem kann das Gerät schwer beschädigt werden. Nur mit einem Wagen, Stand, Dreifuß, Träger oder Tisch verwenden, der vom Hersteller empfohlen oder mit dem Erzeugnis verkauft worden ist. Für jegliche Anbringung sollten die Anweisungen des Herstellers befolgt werden, und das vom Hersteller empfohlene Anbringungszubehör sollte verwendet werden.

9. Eine Kombination von Erzeugnis und Wagen sollte vorsichtig bewegt werden

Schneller Halt, übermäßige Krafteinwirkung und unebene Oberflächen können Umkippen der Kombination von Erzeugnis und Wagen verursachen.

10. Ventilation

Schlitz und Öffnungen im Gehäuse dienen der Ventilation. Sie sind für zuverlässigen Betrieb des Gerätes und Schutz vor Überhitzung erforderlich und dürfen nicht blockiert oder abgedeckt werden. Die Öffnungen sollten niemals dadurch blockiert werden, daß das Gerät auf ein Bett, ein Sofa, einen Teppich oder eine ähnliche Oberfläche gestellt wird.

Das Gerät sollte nur dann in Einbauinstallation wie in einem Bücherschrank oder einem Gestell verwendet werden, wenn angemessene Ventilation vorgesehen ist bzw. Die Anweisungen des Herstellers befolgt worden sind.

11. Stromversorgung

Dieses Erzeugnis sollte nur an der auf dem Typenschild angegebenen Stromversorgungsart betrieben werden. Wenn Sie nicht sicher sind, was für eine Stromversorgung Sie haben, so wenden Sie sich bitte an Ihren Erzeugnishändler oder an das lokale Elektrizitätswerk. Beziehen Sie sich für Batteriebetrieb oder andere Stromquellen vorgesehene Erzeugnisse bitte auf die Bedienungsanleitungen.

12. Erdung oder Polarisierung

Dieses Erzeugnis ist mit einem Schutzkontaktstecker mit drei Leitern ausgerüstet, mit einem Erdungskontakt. Dieser Stecker paßt nur in eine schuko-Steckdose. Dies ist eine Sicherheitsmaßnahme. Wenn Sie den Stecker nicht in die Steckdose stecken können, so wenden Sie sich bitte an Ihren Elektriker, damit er die veraltete Schutz des Schutzkontaktsteckers unwirksam macht.

13. Netzkabelschutz

Netzkabel sollten so verlegt werden, daß möglichst nicht darauf getreten wird und daß sie nicht eingeklemmt werden, mit besonderer Beachtung der Kabel an Stackern, Verlängerungskabeln und dem Austritt des Kabels aus dem Erzeugnis.

14. Blitzschlag

Für zusätzlichen Schutz des Erzeugnisses während eines Gewitters oder bei Nichtverwendung für lange Zeit den Stecker aus der Steckdose ziehen. Dies verhindert Beschädigung durch Blitzschlag und Netzspannungsspitzen.

15. Überlastung

Wandsteckdosen, Verlängerungskabel und eingebaute Bequemlichkeitssteckdosen nicht überlasten, da dies Feuer oder elektrischen Schlag verursachen kann.

16. Eindringen von Fremdkörpern und Flüssigkeit

Niemals Objekte irgendwelcher Art durch die Öffnungen in das Gerät schieben, da diese unter hoher Spannung stehende Teile berühren oder kurzschließen können, wodurch es zu Feuer oder elektrischem Schlag kommen kann. Niemals Flüssigkeiten irgendwelcher Art auf das Erzeugnis verschütten.

17. Entflammare und explosive Substanzen

Vermeiden Sie Verwendung dieses Erzeugnisses an Orten mit Gasen bzw. entflammaren oder explosiven Substanzen in der direkten Umgebung.

18. Starke stöße oder Vibrationen

Setzen Sie das Erzeugnis beim Transport nicht starken Stößen oder Vibrationen aus.

19. Wartung

Versuchen Sie nicht, dieses Erzeugnis selbst zu warten, da Sie sich durch Öffnen bzw. Entfernen von Abdeckungen hohen Spannungen und sonstigen Gefährdungen aussetzen können. Beziehen Sie sich für jegliche Wartung auf qualifiziertes Wartungspersonal.

20. Beschädigung, die Wartung erfordert

Ziehen Sie den Stecker dieses Erzeugnisses aus der Steckdose und wenden Sie sich an qualifiziertes Wartungspersonal, wenn eine der folgenden Bedingungen vorliegt:

- Wenn das Netzkabel oder der Stecker beschädigt ist.
- Bei Eindringen von Flüssigkeit oder Fremdkörpern in das Gerät.
- Wenn das Erzeugnis Regen oder Wasser ausgesetzt worden ist.
- Wenn das Erzeugnis bei Befolgen der Bedienungsanleitungen nicht normal funktioniert. Nur die Regelemente verstellen, die in den Bedienungsanleitungen behandelt werden, da unangemessene Einstellung anderer Regelemente Beschädigung verursachen kann und oft beträchtliche Arbeit durch einen qualifizierten Techniker erfordert, um das Erzeugnis wieder, zu normalem Betrieb zurückzubringen.
- Wenn das Erzeugnis fallen gelassen oder beschädigt worden ist.
- Wenn das Erzeugnis eine klare Änderung in der Leistung zeigt - dies weist darauf hin, daß Wartung erforderlich ist.

21. Ersatzteile

Wenn Ersatzteile erforderlich sind, darauf achten, daß der Wartungstechniker nur die vom Hersteller festgelegten Ersatzteile oder Teile mit den gleichen Charakteristiken wie die ursprünglichen Teile verwendet. Unautorisierte Ersatzteile können Feuer, elektrischen Schlag oder sonstige Gefährdungen verursachen.

22. Sicherheitsprüfung

Bitten Sie den Wartungstechniker nach der Vervollendung von Wartung oder Reparaturarbeiten an diesem Erzeugnis um die Durchführung von Sicherheitsprüfungen, um zu bestimmen, daß das Erzeugnis im angemessenen Betriebszustand ist.

23. Anbringung an der Wand oder an der Decke

Das Erzeugnis sollte nur entsprechend den Empfehlungen des Herstellers an einer Wand oder an der Decke angebracht werden.

24. Wärme

Das Erzeugnis sollte fern von Wärmequellen wie Radiatoren, Heizwiderständen, Öfen und anderen Wärme erzeugenden Erzeugnissen (einschließlich Verstärkern) aufgestellt werden.

MISES EN GARDE IMPORTANTES

1. Lire les instructions

Lire toutes les instructions de sécurité et de fonctionnement avant de faire fonctionner l'appareil.

2. Conserver ces instructions

Conserver les instructions de sécurité et de fonctionnement à des fins de référence ultérieure.

3. Tenir compte des avertissements

Tous les avertissements qui figurent sur l'appareil et dans le mode d'emploi devront être respectés.

4. Observer les instructions

Observer toutes les instructions de fonctionnement et d'utilisation.

5. Nettoyage

Avant de procéder au nettoyage, débrancher l'appareil de la prise secteur. Ne pas utiliser de produits de nettoyage liquides ou en aérosol.

Nettoyer l'appareil avec un chiffon humide.

6. Fixations

Ne pas utiliser de fixations non recommandées par le fabricant de l'appareil car elles pourraient être source de danger.

7. Eau et humidité

Ne pas utiliser l'appareil à proximité d'eau - par exemple près d'une baignoire, d'un lavabo, d'un évier ou d'un bac à lessive, dans un sous-sol humide, ou près d'une piscine, etc.

8. Accessoires

Ne pas placer l'appareil sur un chariot, un socle, un pied, un support ou une table instables. L'appareil pourrait tomber, blessant grièvement des enfants ou des adultes, et étant sérieusement endommagé.

Utiliser exclusivement le chariot, le socle, le pied, le support ou la table recommandés par le fabricant, ou vendus avec l'appareil. Pour tout montage de l'appareil, respecter les instructions du fabricant, et utiliser à cette fin l'accessoire de montage recommandé par le fabricant.

9. L'appareil monté sur son chariot devra être déplacé avec précaution

Des arrêts brusques, une force excessive et des surfaces irrégulières pourraient provoquer le renversement de l'ensemble appareil-chariot.

10. Ventilation

Les fentes et les ouvertures du coffret sont prévues pour la ventilation ainsi que pour garantir un fonctionnement en toute sécurité de l'appareil et le protéger de toute surchauffe, et ces ouvertures ne devront donc être ni obstruées ni recouvertes. Ne jamais obstruer les ouvertures en plaçant l'appareil sur un lit, un sofa, un tapis ou toute surface similaire. Ne jamais placer l'appareil dans un support confiné, par exemple une bibliothèque ou une étagère, sans ventilation suffisante ou sans respecter les instructions du fabricant.

11. Sources d'alimentation

L'appareil devra être alimenté exclusivement sur le type d'alimentation indiqué sur l'étiquette signalétique. Si l'on n'est pas sûr du type d'alimentation du local, consulter le revendeur de l'appareil ou la compagnie d'électricité locale. Pour les appareils qui fonctionnent sur batterie ou sur d'autres sources, voir le mode d'emploi.

12. Mise à la terre ou polarisation

L'appareil est doté d'une fiche trifilaire avec mise à la terre, dont la troisième broche assure la mise à la terre. Cette fiche ne rentrera que dans les prises trifilaires de mise à la terre. Ceci est une mesure de sécurité. Si la fiche ne rentre pas dans la prise, faire remplacer la prise désuète par un électricien.

Ne pas rendre vaine la mesure de sécurité assurée par cette prise avec mise à la terre.

13. Protection du cordon d'alimentation

Acheminer les cordons d'alimentation de façon qu'on ne risque pas de marcher dessus ou de les coincer sous un objet placé dessus ou contre eux.

Faire particulièrement attention aux fiches des cordons, à la proximité des prises, et à l'endroit où ils ressortent de l'appareil.

14. Foudre

Pour renforcer la protection de l'appareil pendant un orage, ou si l'on s'en éloigne ou qu'on reste longtemps sans l'utiliser, le débrancher de la source d'alimentation. Ceci permettra d'éviter tout dommage de l'appareil dû à la foudre et aux surtensions de ligne.

15. Surcharge

Ne pas surcharger les prises, rallonges et prises multiples car cela pourrait entraîner un risque de feu ou de choc électrique.

16. Pénétration d'objets et de liquides

Ne jamais enfoncer d'objets d'aucune sorte dans les ouvertures de l'appareil car ils pourraient toucher des points de tension dangereuse ou court-circuiter des pièces, ce qui pourrait provoquer un feu ou un choc électrique. Ne jamais renverser de liquide d'aucune sorte sur l'appareil.

17. Substances inflammables et explosives

Éviter d'utiliser l'appareil en présence de gaz, ainsi qu'à proximité immédiate de substances inflammables et explosives.

18. Chocs ou vibrations violents

Lorsqu'on transporte l'appareil, ne pas le soumettre à des chocs ou des vibrations violents.

19. Réparations

Ne pas tenter de réparer l'appareil soi-même car le fait d'ouvrir ou de retirer les caches risque d'exposer l'utilisateur à des tensions dangereuses notamment. Confier toute réparation à un personnel qualifié.

20. Dommages nécessitant réparations

Débrancher l'appareil de la source d'alimentation et confier les réparations à un personnel qualifié dans les cas suivants:

- Lorsque le cordon d'alimentation ou sa fiche sont endommagés
- Si du liquide s'est renversé sur l'appareil ou que des objets sont tombés dedans
- Si l'appareil a été exposé à la pluie ou à l'eau.
- Si l'appareil ne fonctionne pas normalement lorsqu'on observe les instructions d'utilisation.
Ne régler que les commandes couvertes par le mode d'emploi ; en effet, un réglage incorrect des autres commandes pourrait entraîner des dommages et nécessiteront souvent des travaux de réparation coûteux par un technicien qualifié pour remettre l'appareil en état de marche.
- Si l'appareil est tombé ou qu'il a été endommagé.
- Si l'appareil affiche une nette modification de ses performances, cela signifie qu'il a besoin d'être réparé.

21. Pièces de rechange

Si l'on a besoin de pièces de rechange, veiller à ce que le technicien de réparation utilise exclusivement les pièces de rechange spécifiées par le fabricant ou des pièces ayant les mêmes caractéristiques que les pièces d'origine. Les pièces de rechange non autorisées risquent de provoquer un feu, un choc électrique et autres dangers.

22. Vérification de sécurité

Après tout travail d'entretien ou de réparation de l'appareil, demander au technicien de réparation d'effectuer les vérifications de sécurité pour s'assurer que l'appareil est en bon état de marche.

23. Montage au mur ou au plafond

L'appareil ne pourra être monté au mur ou au plafond que de la manière recommandée par le fabricant.

24. Chaleur

Éloigner l'appareil des sources de chaleur, telles que radiateurs, appareils de chauffage, cuisinières, et de tout produit engendrant de la chaleur (y compris les amplificateurs).

IMPORTANT NOTICE

For U.S.A.

These products have 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 product 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.

WARNING

Changes or modifications not expressly approved by Hitachi Kokusai responsible for compliance could void the user's authority to operate the equipment.

For Canada

This product does not exceed the class A/class B limits for radio noise emissions from digital apparatus as set out in the radio interference regulations.

Le présent appareil n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de classe A prescrites dans le règlement sur le brouillage radioélectrique édicté par le ministère des communications du Canada.

China RoHS

The following statement is related to the regulation on "Measures for the Administration of the control of Pollution by Electronic Information Products", known as "China RoHS".

The table shows contained Hazardous Substances in this camera.

说明书（环境方面：补充资料）

对象产品：CMOS 摄像机

1. 电子产品污染控制标志



此标志是根据 2006 年 2 月 28 日公布的《电子信息产品污染控制管理办法》以及 SJ/T11364-2006 《电子信息产品污染控制标识要求》而制定的，是用来表示适用于在中华人民共和国流通的电子信息产品的环保使用期限。

只要遵守此类产品的安全事项以及使用上应注意的问题，从制造日起到此年限内，不会发生产品中的有害物质外泄、突变等，不会对环境、人体以及财产产生严重影响。同时，此年限是除去必须定期交换的保守部件的，是其他产品的环保使用期限。

产品在正常情况下使用完毕要废弃时，请遵守各地区对电子信息产品的回收·再利用的相关各项法律、法规。

另外，从第三者处转买的情况下即使在本期限内也视为失去效力。

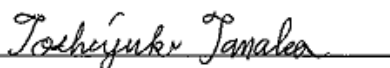
2. 产品中有毒有害物质或元素的名称及含量

	部件名称	有毒有害物质或元素					
		铅 (Pb)	水银 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
1	主机	×	○	○	○	○	○

○：表示该有毒有害物质在该部件所有均质材料中的含量均在 SJ/T11363-2006 标准规定的限量要求以下。

×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T11363-2006 标准规定的限量要求。

EU Declaration of Conformity (No. KV-0401A)

1	Apparatus model/Product (product, type, batch or serial number): KP-FM500WCL/KP-FMD500WCL / Sample 001	
2	Name and address of the manufacturer or his authorised representative:	Manufacturer: Hitachi Kokusai Electric Inc. 2-15-12 Nishi-shimbashi, Minato-ku, Tokyo 105-8039, Japan Authorised representative in Europe : Hitachi Kokusai Electric Europe GmbH Siemensstr.9 D-63263 Neu-Isenburg Germany
3	This declaration of conformity is issued under the sole responsibility of the manufacturer.	
4	Object of the declaration (identification of apparatus allowing traceability;)	CMOS Camera : Model KP-FM500WCL/KP-FMD500WCL
5	The object of the declaration described above is in conformity with the Union harmonization legislation listed in section 6 :	
6	Applied Union harmonized legislation and references to the relevant harmonization standards used, including the date of the standard, or references to the other technical specifications, including the date of the specification, in relation to which conformity is declared:	
	Documents No	Title
	Directive 2014/30/EU EU harmonized Standards	EU EMC Directive (March 2014) EN 61000-6-3:2007/A1:2011/AC:2012 EN 61000-6-1:2007
	Directive 2011/65/EU EU harmonized Standards	EU RoHS Directive (July 2011) EN50581 : 2012
7	Notified body involved ---	
8	Additional information: ---	
	Signed for and on behalf of: Hitachi Kokusai Electric Inc.	
	(place and date of issue):	2-15-12 Nishi-shimbashi, Minato-ku, Tokyo 105-8039, Japan 11 July, 2016
	(name,function) (signature):	 T.Tanaka Senior Manager Product Quality Assurance Department Quality Assurance Division Hitachi Kokusai Electric Inc.

Operating considerations Notes to users

1. Important safety notes

- Use this camera with a 12VDC (11VDC to 13VDC) power supply. Time will be needed for about four seconds by the time the camera works normally after turning on the power supply.
- Observe that flammable objects, water or metal do not enter the camera interior. These may lead to failure or accident.
- Do not modify the camera or use the camera with external covers removed. These may cause failure, void any warranties and pose a safety hazard.
- Stop using the camera at the approach of electrical storm (thunder audible). Protect the camera from rain if using it outdoors.
- In event the camera shows any abnormality, switch off the camera and disconnect the power cord. Contract a Hitachi Kokusai Electric service representative.
- Do not touch the optical filter on the front of the sensor. The image deteriorates due to dirt, scratches, etc.
- When using a heavy lens such as a zoom lens or when heavy vibration or shock is applied, fix the lens to the device.

2. Handling

- Do not attempt to remove cover.
- When installing or removing a lens, be sure to use care that water or dust does not enter the inside of the camera.
- Please do installation work of lens at a clean place to prevent dust adhesion.
- When installing the lens, please handle carefully so as not to incline. Also, in the screw part of the lens mount, please use those with no foreign matter adhesion, scratches or garbage etc.

3. Installing and storage

Avoid installing or storing the camera in the following environments.

- Environments exposed to direct sunlight, rain or snow.
- Environments where combustible or corrosive gas exists.
- Excessively warm or cold environment (Operating ambient temperature: -10 to 50°C).
- Humid or dusty environment.
- Place subjected to excessive vibration or shock.
- Environment exposed to strong electric or magnetic field.
- Do not aim the camera lens at the sun.
- Do not shoot strong light.
- When such a scene is shot, vertical trailing will appear. However, this is not due to failure. In case strong light enters camera through the lens, partial deterioration in picture quality will result.

4. To obtain stable performance for long time

When the camera is used continuously for long time under high ambient temperature, the inside electrical parts become deteriorated, resulting in shortening its life. To use the camera continuously for long time, the highest temperature must be below 40°C.

5. Connectors

Confirm the power is off before connecting or disconnecting a signal cable. Grasp connectors by the body, not the attached wires.

6. Cleaning

- Use a blower or a lens brush to remove dusts on the lens or the optical filter.
- Wipe dirt on the case off with dry soft cloth. If dirt is hardened, wipe them off with cloth moistened with neutral detergent liquid; wipe the cover with dry cloth. Please remove dust so as not to scratch lens or optical filter.
- Do not use benzene, thinner, alcohol, liquid cleaner or spray-type cleaner.
- In event dust or other debris is lodged between the CMOS and optical filter, consult dealer for cleaning by an optical technician.
- Even when you do not use this camera, please attach a lens or seal to protect the optical filter from dust and scratches.

7. Phenomena inherent to CMOS imaging device

The following phenomena are inherent to a CMOS device and do not indicate malfunction.

1) Fixed pattern noise

High ambient temperature or high camera sensitivity can cause fixed pattern noise to appear throughout the scene.

2) Moire

Interaction between patterns can produce an additional "phantom" pattern to appear. The CMOS picture elements (pixels) are arranged in a pattern, which can interact with a pattern in the scene (e.g., a performer wearing a finely striped necktie) to result in a Moire pattern. The effect should be considered when selecting costumes, props and other scene elements.

3) Ghosting

Strong direct or reflected light near an object of interest can cause ghosting of the object to appear in the picture. The effect is more obtrusive with certain iris settings and lens types. Select the scene layout and camera pointing direction carefully in order to avoid this effect.

4) Defective pixels

Imperceptible white spots may rarely come up on the screen due to cosmic rays and so on. It becomes easy to appear when the sensitivity of the camera is raised or in the operation at the high temperature.

5) Monochrome reversing

When taking picture of personally strong light, the part where white is saturated might become CMOS element with a black image. Please adjust quantities of light at such time.

6) Horizontal pull phenomenon of image

Subject might became bright when there is strong light (strong reflection of the light, the fluorescent lamp, and sunlight etc.) next to subject. It becomes easy to see by raising the camera sensitivity.

7) Horizontal line noise when electronic shutter is used

Depending on the exposure time setting, horizontal line noise may appear. The higher a camera sensitivity is, the easier it is to see it.

8. Attention about laser light

Laser light may do damage to CMOS image sensor. When you use laser light, be careful not to irradiate it on the CMOS image sensor surface. The CMOS image sensor breakage by laser light irradiation is out of warranty. (The repair is not free of charge.)

Table of Contents

1. Overview	1
2. Standard Composition	1
3. Features	1
4. System example	2
5. Section name and functions	2
6. Camera mounting	3
7. Lens	3
8. Optical filter	3
9. Connector	4
10. Functions and operations	6
11. Remote control	9
12. Command list	16
13. Camera Link output timing chart	19
14. Trigger operation and timing chart	34
15. Input / Output signal	38
16. Spectral response	39
17. Specifications	40
18. Dimensions	41

Overview

KP-FM500WCL are Camera Link output type black and white camera which utilized the 2/3 –inch progressive scan CMOS image sensor with square pixel. KP-FMD500WCL are RAW data output type.

The high resolution image of five million pixels is output in no interlace by 163 frames per second.

Because square pixel CMOS is adopted, the image that is appropriate for the picture processing is obtained.

Standard composition

Check when unpacking

Camera 1
Written guarantee 1

Optional accessories

(1) 12 pin plug HR10A-10P-12S
(2) Junction box JU-F30/JC-100
(3) Tripod adaptor TA-FM200
(4) Mini-Camera Link cable

(5) Camera cable

	Molded type	Shield type
2m	C-201KSM	C-201KSS
5m	C-501KSM	C-501KSS
10m	C-102KSM	C-102KSS

In the CE Marking or KCC region, use the shield type and install clamp filter (ZCAT 2035-0930A: TDK) at both ends (camera and video processor ends).

*If you do not use the specified optional item, malfunction may occur.

Features

High resolution

The 2/3-inch five million pixels square lattices CMOS achieve a high resolution.

Global shutter

The clear image is obtained even by subject with a fast movement by CMOS sensor adoption of the global shutter type.

Frame on demand

It is possible to import images according to arbitrary timing by the input of the trigger signal.

Change of frame rate

The frame rate can be changed by setting the camera link configuration and the camera link clock frequency. A further frame rate can improve if partial scan and binning function is used.

Small and lightweight

The small SDR connector for digital output allows the camera size and mass to be drastically reduced to 44(W) x 44(H) x 41(D) mm / approx. 130g.

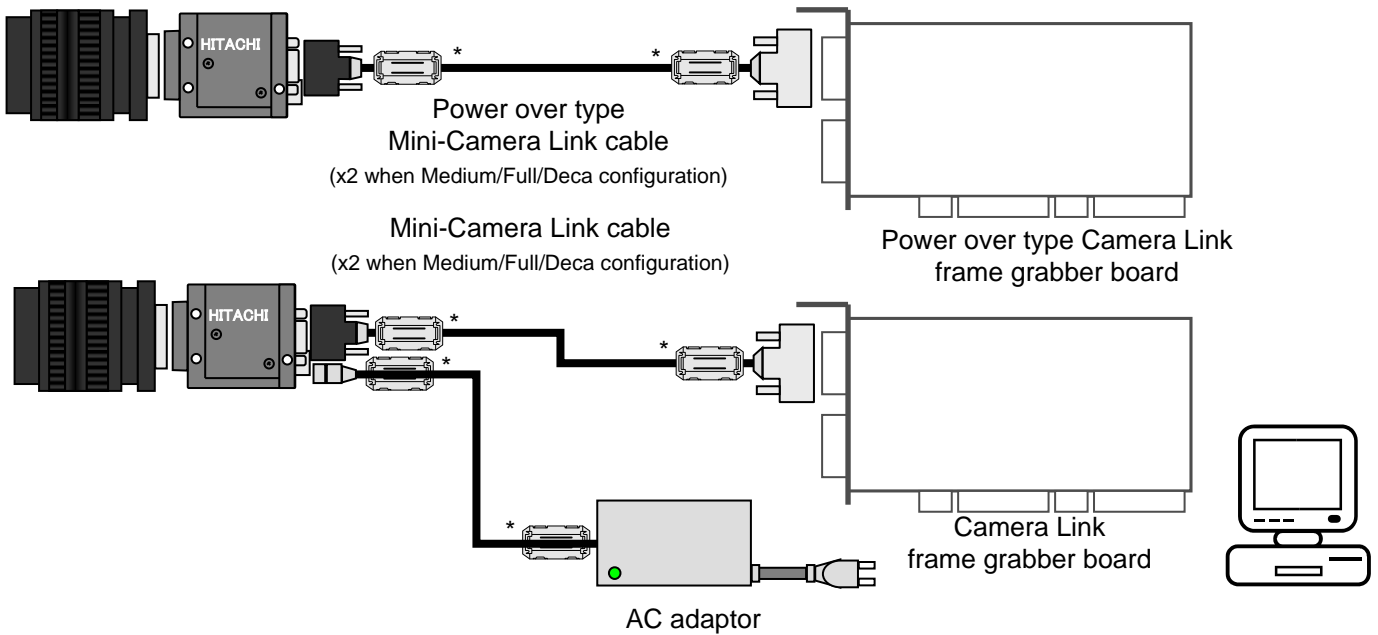
Automatic power supply change

The power supply through the Camera Link cable is possible from the PoCL frame grabber board. Because the power supply from the DCIN/SYNC connector is also possible, it is possible to make the camera work by using usual frame grabber board.

The power supply from the DCIN/SYNC connector is given to priority when the power supply is supplied from both.

System example

KP-FM500WCL and KP-FMD500WCL connect to frame grabber board using Camera Link cable.



*In the CE Marking or KCC region, use the shielded type and install clamp filter (ZCAT 2035-0930A: TDK) at both ends (camera and video processor ends).

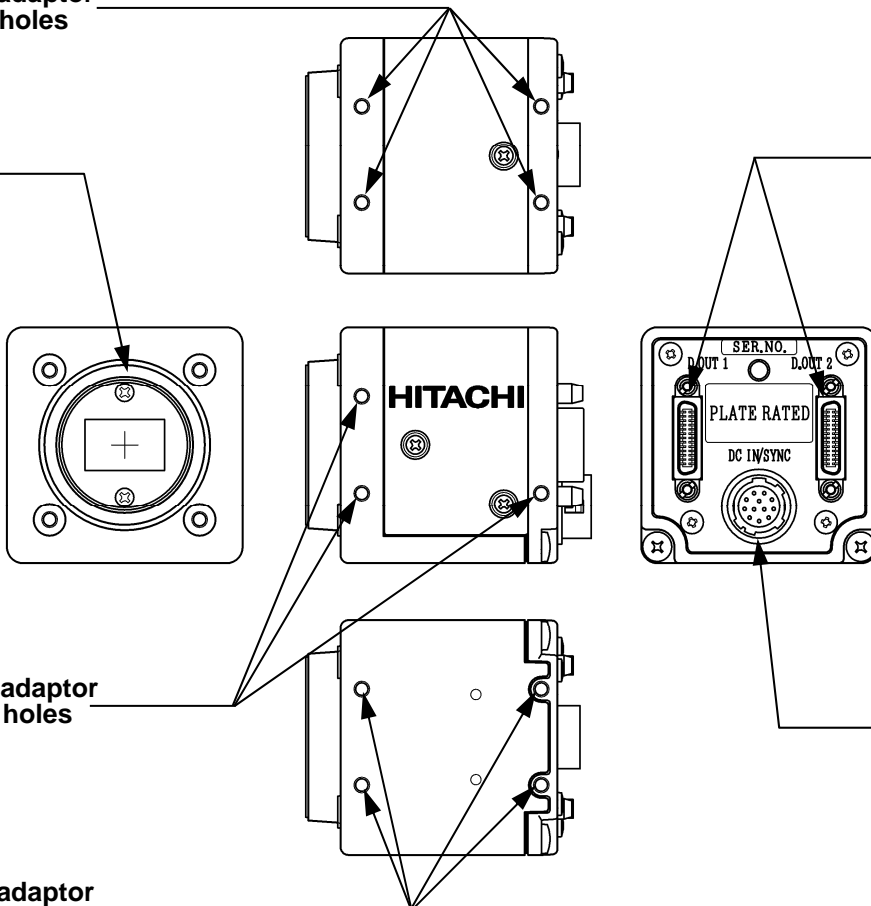
Section name and functions

Camera / Tripod adaptor mounting screw holes

Lens mount (C mount)

Camera / Tripod adaptor mounting screw holes

Camera / Tripod adaptor mounting screw holes

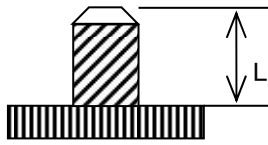


Camera Link connectors
Use for digital video output and camera control signal input/output signal. The power supply from the board is also possible.

DC IN/SYNC 12pin connector
Use for DC+12V power and external trigger input. When the board supplies the power supply by way of the Camera Link connector, the connection is unnecessary.

Camera mounting

Attached optional accessory the tripod adaptor "TA-FM200", mount the camera to a tripod or mounting bracket.

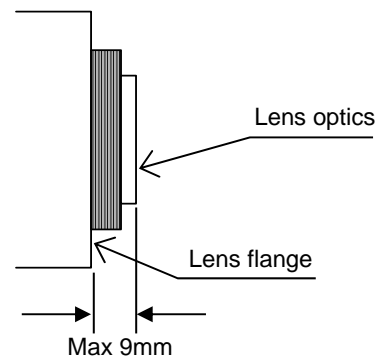


Screw type: U1/4-20
Length L = 4 to 5.5mm
Screws longer than 5.5 mm can cause internal damage, while less than 4 mm prevents secure fastening and risks dropping to cause damage and injury.

Lens

CAUTION

Observe the dimensions of the lens mounting selection as illustrated at the right.
If the dimensions are not observed, do not use such a lens, because the lens and the camera will be damaged.

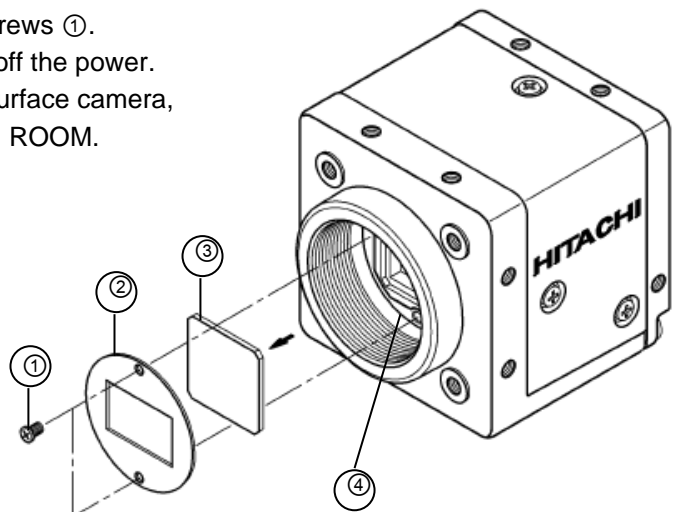


Optical filter

How to remove the optical filter.

- (1) Remove two screws ① and filter holder ② will come off.
- (2) Remove the optical filter ③ from filter frame ④.
- (3) Then, reinstall and secure filter holder ② with two screws ①.

Note: Prior to removing the optical filter, be sure to turn off the power.
Since garbage etc. invades into image reception surface camera, please work under the clean air, such as a CLEAN ROOM.



Connector

1. Camera Link connector

D.OUT1 (Connector 1)

Pin No.	Signal	Pin No.	Signal
1	+12V (PoCL)	14	GND
	GND (non-PoCL)		
2	TXOUT 0 (-)	15	TXOUT 0 (+)
3	TXOUT 1 (-)	16	TXOUT 1 (+)
4	TXOUT 2 (-)	17	TXOUT 2 (+)
5	TXCLKOUT (-)	18	TXCLKOUT (+)
6	TXOUT 3 (-)	19	TXOUT 3 (+)
7	RX (+) [SERTC (+)]	20	RX (-) [SERTC (-)]
8	TX (-) [SERTFG (-)]	21	TX (+) [SERTFG (+)]
9	TRIG(-) [CC1 (-)]	22	TRIG (+) [CC1 (+)]
10	N.U. [CC2 (+)]	23	N.U. [CC2 (-)]
11	N.U. [CC3 (-)]	24	N.U. [CC3 (+)]
12	N.U. [CC4 (+)]	25	N.U. [CC4 (-)]
13	GND	26	+12V (PoCL)
			GND (non-PoCL)

D.OUT2 (Connector 2: used for Medium/Full/Deca Configuration)

Pin No.	Signal	Pin No.	Signal
1	+12V (PoCL)	14	GND
	GND (non-PoCL)		
2	TYOUT 0 (-)	15	TYOUT 0 (+)
3	TYOUT 1 (-)	16	TYOUT 1 (+)
4	TYOUT 2 (-)	17	TYOUT 2 (+)
5	TYCLKOUT (-)	18	TYCLKOUT (+)
6	TYOUT 3 (-)	19	TYOUT 3 (+)
7	100Ω(+)	20	100Ω(-)
8	TZOUT 0 (-)	21	TZOUT 0 (+)
9	TZOUT 1 (-)	22	TZOUT 1 (+)
10	TZOUT 2 (-)	23	TZOUT 2 (+)
11	TZCLKOUT (-)	24	TZCLKOUT (+)
12	TZOUT 3 (-)	25	TZOUT 3 (+)
13	GND	26	+12V (PoCL)
			GND (non-PoCL)

SDR connector (3M) or equivalent

N.U.: Not Used

- The digital out cable should be comprised of a twisted pair of wires having 100Ω characteristic impedance and an outer heath shield type conductor.
- Connect the shield (ground) of the digital out cable to the ground terminal of the video equipment, frame grabber, etc.
- TX: Transmit data from camera to machine
- RX: Transmit data from machine to camera

(Note) Please do not unplug and insert cable (digital out cable) with a power supplied to a camera.

(Note) In the CE Marking or KCC region, use the shield type and install clamp filter (ZCAT2035-0930A: TDK) at both ends of the cable.

2. DCIN/SYNC connector

PIN NO.	Signal	PIN NO.	Signal
1	GND	7	Trigger INPUT
2	N.U. (PoCL)	8	GND
	+12V (non-PoCL)		
3	GND	9	N.U.
4	N.U.	10	FLASH OUT / VD OUT
5	GND	11	N.U.
6	N.U.	12	GND

N.U.: Not Used

Connector (camera side) : SNH-10-12(RPCB) SAMWOO or equivalent

Plug (matching cable plug) : HR10A-10P-12S HIROSE or equivalent

(Note) Please do not unplug and insert cable (digital out cable) with a power supplied to a camera.

(Note) In the CE Marking or KCC region, use the shield type and install clamp filter
(ZCAT2035-0930A: TDK) at both ends of the cable.

Functions and operations

Various mode setup and adjustment of KP-FM500WCL and KP-FMD500WCL are performed by the remote control via Camera Link. Operation and adjustment way of function utilized are described below.

See "Remote control" and "Command list" (page 9 to 18) about communication method of each command.

1. Main functions

(1) TRIGGER : Setting about external trigger

①MODE : Select of mode

OFF (Factory setting) : Trigger mode set to OFF (normal mode).

FIXED SHUTTER : Trigger mode set to Fixed shutter.

ONE TRIGGER : Trigger mode set to One trigger.

②POLARITY : Select of trigger polarity

POSITIVE (Factory setting) : Input polarity HIGH is made into trigger signal.

NEGATIVE : Input polarity LOW is made into trigger signal.

③SOURCE : Select of trigger source

CL-CC1 (Factory setting) : Input trigger signal from Camera Link signal CC1 (see page 4 "Connector").

12pin : Input trigger signal from 7 pin of 12 pin DCIN/SYNC connector.
(see page 5 "Connector").

*Please refer to "Trigger operation and timing chart" from 34 page to 37 page for details concerning an external trigger mode.

(2) SHUTTER : Setting of electronic shutter

①PRESET: Setting speed of PRESET shutter.

OFF (Factory setting) : Shutter operation set to OFF (NORMAL shutter).

1/60, 1/100, 1/250, 1/500,

1/1000, 1/2000, 1/10000,

1/50000 second

: Electronic shutter set to preset shutter speed (PRESET shutter).

VARIABLE

: Electronic shutter set to variable shutter speed (VARIABLE shutter).

②VARIABLE VALUE- : Setting speed of VARIABLE shutter.

20 μ s to 655370 μ s : Electronic shutter can be set in the range of 20 μ s to 655370 μ s
in 65535 steps. (Factory setting: 30110 μ s)

In 1 step, it is variable for 10 μ s.

(3) BINNING : Setting of off between vertical lines

OFF (Factory setting) : The magnification of the off reading between vertical lines is OFF.

ON : The magnification of the off reading between vertical lines is set.

*This function is only KP-FM500WCL.

(4) DATA BIT : Setting of output bit depth

8bit (Factory setting) : Image is outputted by 8 bit.

10bit : Image is outputted by 10 bit. (Except Deca Configuration (10TAP))

12bit : Image is outputted by 12 bit. (Only Base/Medium Configuration can be set)

(5) CONFIG : Setting of Camera Link configuration

- BASE (Factory setting) : Camera Link configuration is set to Base configuration.
MEDIUM : Camera Link configuration is set to Medium configuration.
FULL : Camera Link configuration is set to Full configuration.
DECA : Camera Link configuration is set to Deca(10TAP) configuration.
*Compared to Base/Medium/Full Configuration, the level of the video signal to be output is quadrupled.

(6) CLK : Setting of Camera Link clock frequency

- 85MHz (Factory setting) : Camera Link clock frequency set to 85MHz.
60MHz : Camera Link clock frequency set to 60MHz.

(7) FLIP : Setting of upper and lower, right and left reversing output

- OFF (Factory setting) : Image is usually output.
H : Image is reversed right and left.
V : Image is reversed up and down.
HV : Image is reversed right and left, up and down.

(8) TEST PATTERN : Setting of test pattern output

- OFF (Factory setting) : Image is usually output.
H : The horizontal ramp image is output.
V : The vertical ramp image is output.
HV : The horizontal and vertical ramp image is output.

(9) OUTPUT SIGNAL : Setting of the tenth pin of DCIN/SYNC connector

- OFF (Factory setting) : No output (LOW)
FLASH : The flash pulse (strobe) is output.
VD : The VD pulse of the camera is output.

(10) GAIN : Adjustment of digital gain

- 0dB(0/180) ~ 18dB(180/180) : Set 0 to 18dB in steps of 0.1dB. (Factory setting : 0dB(0/180))

(11) R-GAIN : Adjustment of Red gain

- 6.021dB(0/255) ~ 5.974dB(255/255) : Adjust Red gain in 256 steps. (Factory setting : 0dB(128/255))
*This function is only KP-FMD500WCL.

(12) B-GAIN : Adjustment of Blue gain

- 6.021dB(0/255) ~ 5.974dB(255/255) : Adjust Blue gain in 256 steps. (Factory setting : 0dB(128/255))
*This function is only KP-FMD500WCL.

(13) BLACK LEVEL : Adjustment of offset level

0/255 (Factory setting) ~ 127/255 : Offset level is set by 128 steps. (Factory setting : 0/255)

(14) PARTIAL SCAN : Setting of partial scanning

① **MODE** : **Setting of partial scan**

OFF (Factory setting) : partial scanning is OFF.

ON : partial scanning is set.

② **START** : **Set capture start position.**

1 (Factory setting) ~ 2045 line : Please set the acquisition start position as increments of 4 lines.

③ **WIDTH** : **Set capture width.**

4 ~ 2048 (Factory setting) line : Please set the acquisition width as increments of 4 lines.

[Note] Don't operate normally when it is not increments of 4 lines.

(15) TEMPERATURE : Acquire the temperature

-READ- : Acquire the temperature detected by the temperature sensor.

(16) NOISE CANCEL : Setting of noise cancel

0 (Factory setting) ~ 255 : Adjust trigger noise cancellation threshold in 256 steps. (Factory setting : 0)

In 1 step, it is variable for 20ns.

*A pulse with a width shorter than the set threshold is regarded as noise, and the trigger operation is not performed.

(17) FACTORY SETTING

SET : Return to the factory settings.

Remote control

1. Comms* specifications

- Control system : Start-stop synchronization system
- Transmission rate : 115200 bps
- Data length : 8 bit
- Star bit : 1 bit
- Stop bit : 1 bit
- Parity : None
- Bit transfer : LSB first

*Comms: Communications

2. Comms control

The remote control software controls all communications. Data send/receive (BSC handshake) is by transferring TEXT data to the camera controller chip.

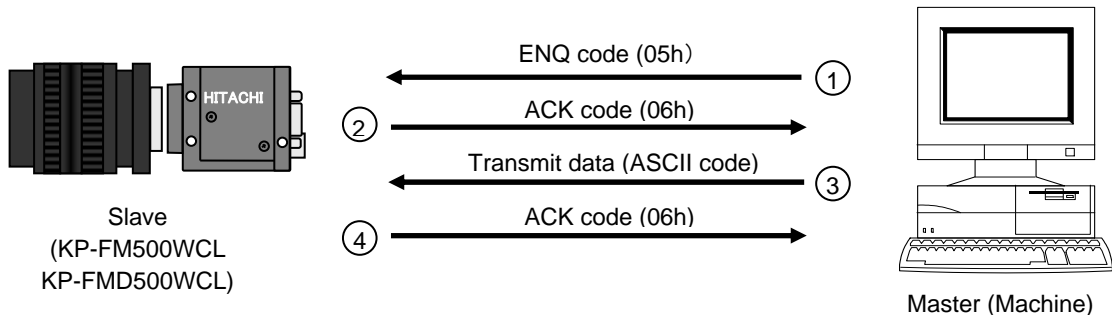
3. Comms procedure

The following pages indicate the camera controller chip and remote control software data protocol. In the description, the camera is designated as slave and the software as master.

- Receive protect timer (time out error)

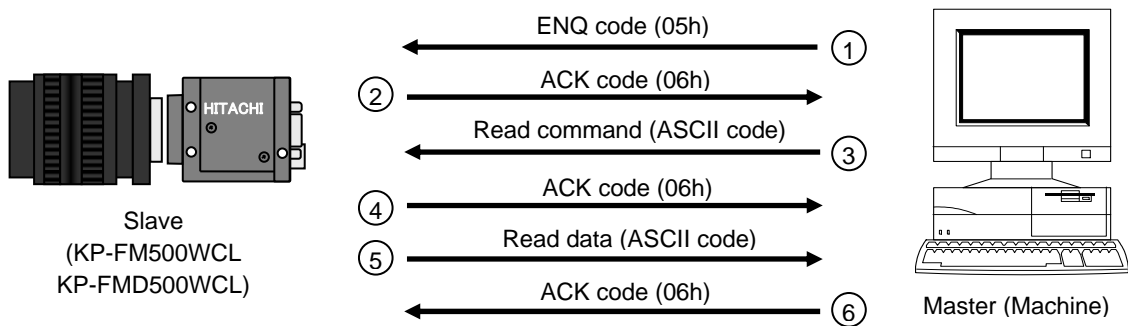
The receive protect timer for master and slave processes is 1 second. For example, if 1 block of TEXT data is being received, if the data interval exceeds 1 second, error is produced and the data are lost. An acknowledgment of data receipt is not produced.

(1) Transmission from master (normal process)



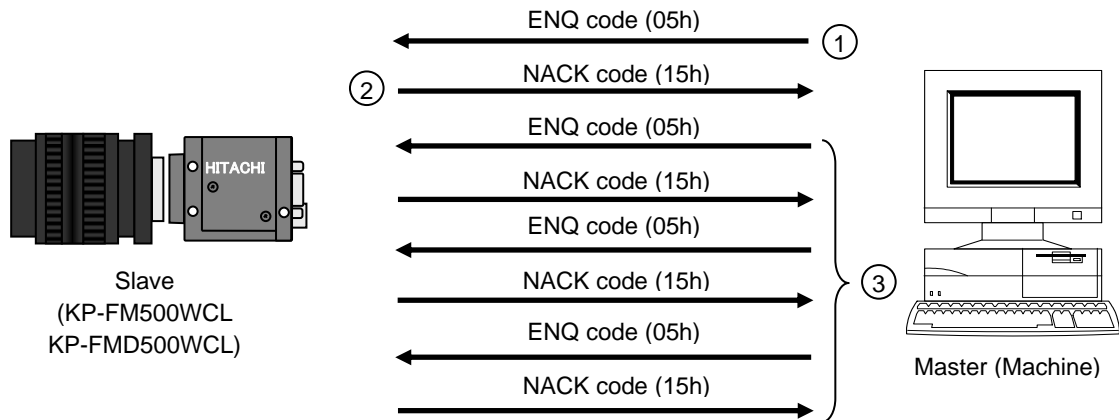
- ① Session starts when ENQ is sent from master to slave.
- ② Slave acknowledges by returning ACK to master.
- ③ Master sends data to slave.
- ④ Slave acknowledges receipt of data by again returning ACK to master and end the handshake.

(2) Master reads data (normal process)



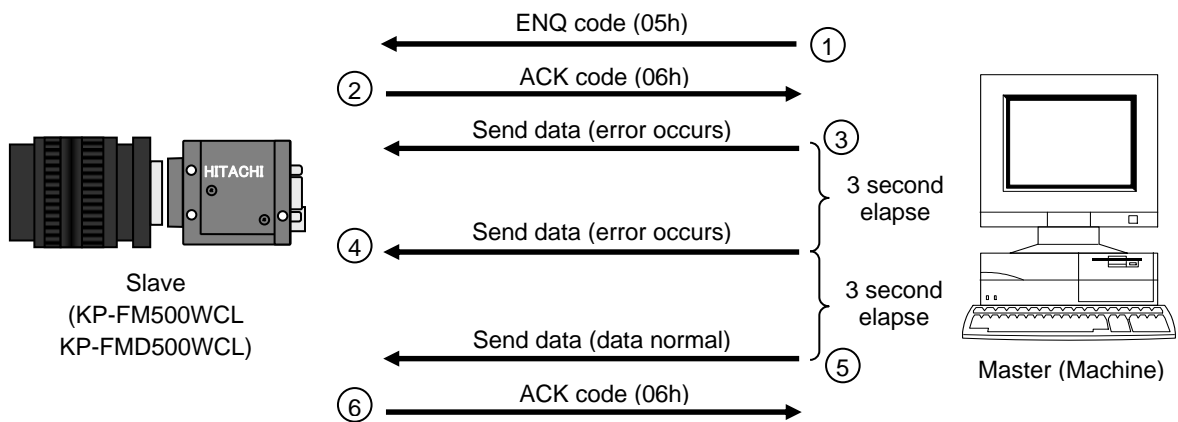
- ① Session starts when ENQ is sent from master to slave.
- ② Slave acknowledges by returning ACK to master.
- ③ Master sends read command to slave.
- ④ Slave receives read command, then acknowledges by returning ACK code to master.
- ⑤ Slave sends read data to master.
- ⑥ Master receives read data, then acknowledges by returning ACK code to slave.

(3) Data transmitted by master (control abort process)



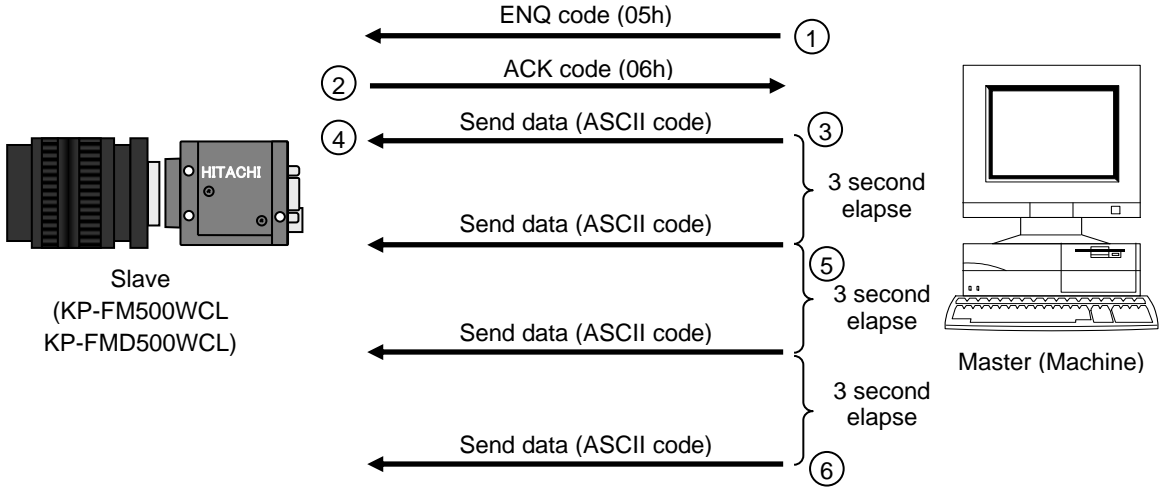
- ① Master sends ENQ code to slave.
 - ② Since ACK code cannot be sent, slave sent NACK code to master.
 - ③ Sequence is repeated 3 times in attempts to retransmit.
- After receiving the 3rd successive NACK code, communications control is aborted

(4) Data transmitted by master (data error process)



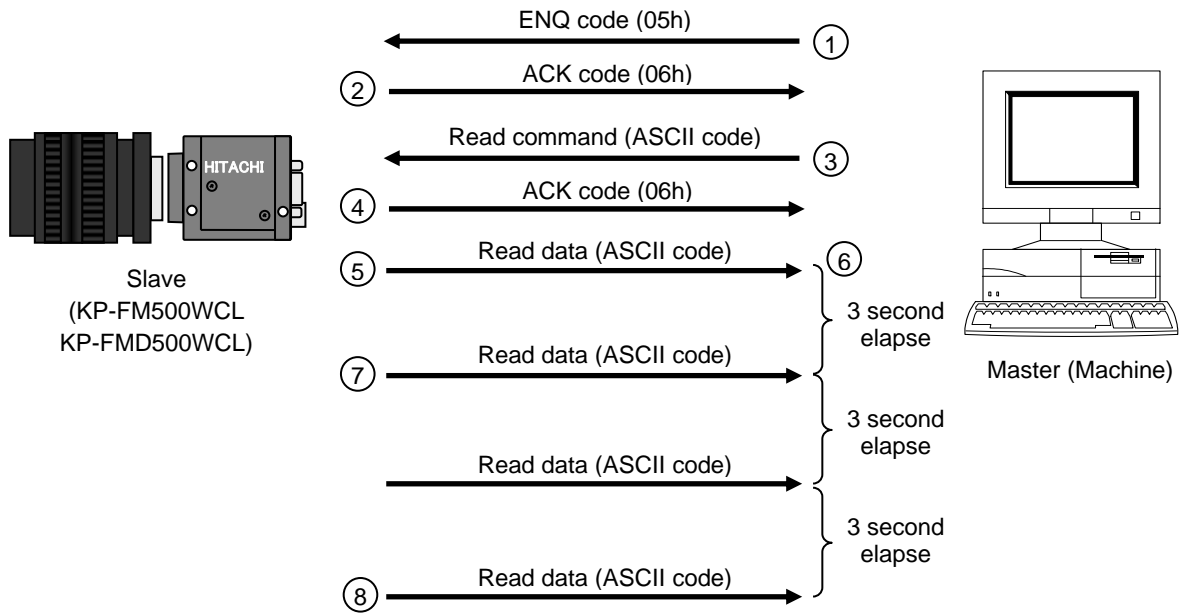
- ① Session starts when ENQ is sent from master to slave.
- ② Slave acknowledges by returning ACK to master.
- ③ Master sends data, but slave detect error (framing, over-run error).
- ④ Slave detects error and does not accept data.
- ⑤ Sequence 3 and 4 repeats, then master transfers normal data.
- ⑥ Slave detects normal data and returns ACK code to master to end the session.

(5) Data frame error (Master transmission)



- ① Session starts when ENQ is sent from master to slave.
- ② Slave acknowledges by returning ACK to master.
- ③ Master sends data.
- ④ For some reason, slave does not receive data.
- ⑤ Master does not receive acknowledgment to the send code and repeats the sequence every 3 seconds for 3 times.
- ⑥ If unsuccessful after 3 attempts, master aborts the sequence and ends communication.

(6) Transmission frame error (Master receive)



- ① Session starts when ENQ is sent from master to slave.
- ② Slave acknowledges by returning ACK to master.
- ③ Master sends read command.
- ④ Slave returns ACK code to acknowledge read command.
- ⑤ Slave sends read data to master.
- ⑥ For some reason, master fails to receive read data.
- ⑦ Slave fails to receive acknowledgment of read data and attempts to resend every 3 seconds for 3 times.
- ⑧ After the third failure, slave aborts the sequence and ends communication.

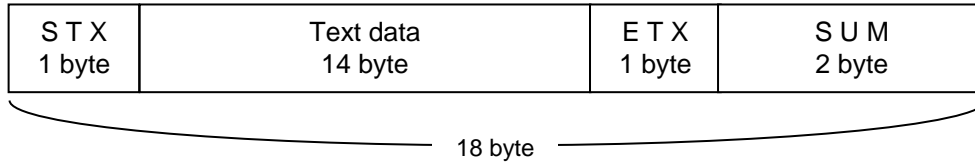
4. Comms command data format

(1) Send data and read command (master to slave)

(a) Command data are converted into ASCII code and transmitted.

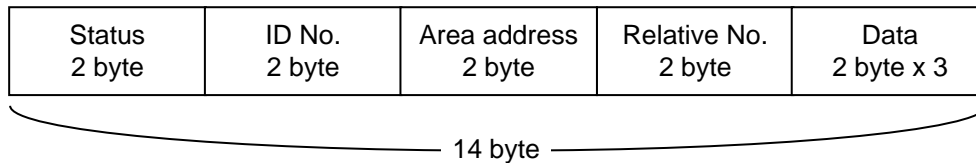
(b) Comms byte quantity is 18.

(c) Comms data format (transmission sequence).



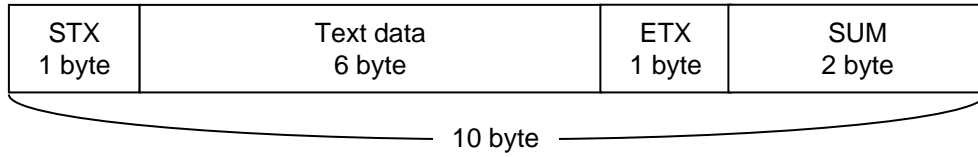
- STX (start code) : Code indicating start of text.
1 byte (02h)
- Text data : Transmit / receive data.
14 byte (ASCII code)
- ETX (end code) : Code indicating end of text.
1 byte (03h)
- SUM : XOR result (FFh), of adding STX, Text data, and ETX.
2 byte (ASCII code)

(d) Text data format details (transmission sequence).



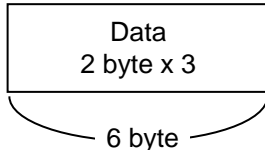
- Status : Transmission data status.
2 byte (ASCII code)
Used for EEPROM write ("00": write absent, "01": write present).
- ID No. : Camera peculiar ID.
KP-FM500WCL and KP-FMD500WCL have ("FF").
2 byte (ASCII code)
- Area address : Classification of Send data ("01") and Read command ("81").
2 byte (ASCII code)
- Relative No. : Sets number ("00" to "FF") for each adjustment item.
2 byte (ASCII code)
- Data (note) : Sets data to be transmitted.
2 byte x 3 (ASCII code)

- (2) Read (receive) data (slave to master)
- (a) Command data are converted into ASCII code and transmitted.
- (b) Comms byte quantity is 10.
- (c) Comms data format (transmission sequence)



- STX (start code) : Code indicating start of text.
1 byte (02h)
- Text data : Transmit / receive data.
6 byte (ASCII code)
- ETX (end code) : Code indicating end of text.
1 byte (03h)
- SUM : XOR result (FFh), of adding STX, Text data, and ETX.
2 byte (ASCII code)

(d) Text data details (transmission sequence)



- Data (note) : Sets Read data to be transmitted.
2 byte x 3 (ASCII code)

Note: Data transfer sequence

Data bytes	1st byte	2nd byte	3rd byte
1	Data	"00"	"00"
2	Upper	Lower	"00"
3	Upper	Mid	Lower

5. Calculation method of checksum

Example

STX	1	2	3	4	5	6	7	ETX	SUM
	STATUS	ID NO	AREA ADDRES S	RELATIVE NO	DATA				
02h	"01"	"FF"	"01"	"04"	"00"	"00"	"00"	03h	"28"

1. STATUS to DATA are transformed into hexadecimal number on the basis of the ASCII code.

'0'→30h '1'→31h '4'→34h 'F'→46h STX:02h ETX:03h

2. STX to ETX are added all.

$$02h + 30h + 31h + 46h + 46h + 30h + 31h + 30h + 34h + 30h + 30h + 30h + 30h + 30h + 30h + 03h = 2D7h$$



3. The XOR (Exclusive OR) between the value obtained in 2 clause and FFh are taken, then two column under the answer become SUM

Command list

02D7h XOR FFh = 228h

1. Send data (Setting command. Note: 1 to 7 and SUM need to be transformed into ASCII code)

Item			STX	1	2	3	4	5	6	7	ETX	SUM
				STATUS	ID NO.	AREA ADDRESS	RELATIVE NO.	DATA				
TRIGGER	MODE	OFF	02h	"01"	"FF"	"01"	"04"	"00"	"00"	"00"	03h	"28"
		FIXED	02h	"01"	"FF"	"01"	"04"	"01"	"00"	"00"	03h	"27"
		1TRIG	02h	"01"	"FF"	"01"	"04"	"02"	"00"	"00"	03h	"26"
	POLARITY	POSITIVE	02h	"01"	"FF"	"01"	"0F"	"00"	"00"	"00"	03h	"16"
		NEGATIVE	02h	"01"	"FF"	"01"	"0F"	"01"	"00"	"00"	03h	"15"
	SOURCE	CL-CC1	02h	"01"	"FF"	"01"	"05"	"00"	"00"	"00"	03h	"27"
		12pin	02h	"01"	"FF"	"01"	"05"	"01"	"00"	"00"	03h	"26"
	NOISE CANCEL	0clk	02h	"01"	"FF"	"01"	"63"	"00"	"00"	"00"	03h	"23"
255clk		02h	"01"	"FF"	"01"	"63"	"FF"	"00"	"00"	03h	"F7"	
OUTPUT SIGNAL		OFF	02h	"01"	"FF"	"01"	"06"	"00"	"00"	"00"	03h	"26"
		FLASH OUT	02h	"01"	"FF"	"01"	"06"	"01"	"00"	"00"	03h	"25"
		VD OUT	02h	"01"	"FF"	"01"	"06"	"02"	"00"	"00"	03h	"24"
SHUTTER SPEED (*1)	PRESET	OFF	02h	"01"	"FF"	"01"	"08"	"00"	"00"	"00"	03h	"24"
		1/60	02h	"01"	"FF"	"01"	"08"	"01"	"00"	"00"	03h	"23"
		1/100	02h	"01"	"FF"	"01"	"08"	"02"	"00"	"00"	03h	"22"
		1/250	02h	"01"	"FF"	"01"	"08"	"03"	"00"	"00"	03h	"21"
		1/500	02h	"01"	"FF"	"01"	"08"	"04"	"00"	"00"	03h	"20"
		1/1000	02h	"01"	"FF"	"01"	"08"	"05"	"00"	"00"	03h	"1F"
		1/2000	02h	"01"	"FF"	"01"	"08"	"06"	"00"	"00"	03h	"1E"
		1/10000	02h	"01"	"FF"	"01"	"08"	"07"	"00"	"00"	03h	"1D"
		1/50000	02h	"01"	"FF"	"01"	"08"	"08"	"00"	"00"	03h	"1C"
	VARIABLE	02h	"01"	"FF"	"01"	"08"	"FF"	"00"	"00"	03h	"F8"	
	VARIABLE(*2) VALUE (2Byte)	MIN(20us)	02h	"01"	"FF"	"01"	"11"	"00"	"00"	"00"	03h	"2A"
		30110us	02h	"01"	"FF"	"01"	"11"	"0B"	"C1"	"00"	03h	"04"
MAX		02h	"01"	"FF"	"01"	"11"	"FF"	"FF"	"00"	03h	"D2"	
CONFIG		BASE	02h	"01"	"FF"	"01"	"12"	"00"	"00"	"00"	03h	"29"
		MEDIUM	02h	"01"	"FF"	"01"	"12"	"01"	"00"	"00"	03h	"28"
		FULL	02h	"01"	"FF"	"01"	"12"	"02"	"00"	"00"	03h	"27"
		DECA	02h	"01"	"FF"	"01"	"12"	"03"	"00"	"00"	03h	"26"
CLK		85MHz	02h	"01"	"FF"	"01"	"19"	"00"	"00"	"00"	03h	"22"
		60MHz	02h	"01"	"FF"	"01"	"19"	"01"	"00"	"00"	03h	"21"
BINNING(*3)		OFF	02h	"01"	"FF"	"01"	"13"	"00"	"00"	"00"	03h	"28"
		ON	02h	"01"	"FF"	"01"	"13"	"01"	"00"	"00"	03h	"27"
DATA BIT		8bit	02h	"01"	"FF"	"01"	"14"	"00"	"00"	"00"	03h	"27"
		10bit	02h	"01"	"FF"	"01"	"14"	"01"	"00"	"00"	03h	"26"
		12bit	02h	"01"	"FF"	"01"	"14"	"02"	"00"	"00"	03h	"25"
GAIN (*4)		0dB (0)	02h	"01"	"FF"	"01"	"0C"	"00"	"00"	"00"	03h	"19"
		18dB (180)	02h	"01"	"FF"	"01"	"0C"	"B4"	"00"	"00"	03h	"03"
BLACK LEVEL (*5)		MIN (0/255)	02h	"01"	"FF"	"01"	"17"	"00"	"00"	"00"	03h	"24"
		MAX (127/255)	02h	"01"	"FF"	"01"	"17"	"7F"	"00"	"00"	03h	"07"
TEST PATTERN		OFF	02h	"01"	"FF"	"01"	"50"	"00"	"00"	"00"	03h	"27"
		H	02h	"01"	"FF"	"01"	"50"	"01"	"00"	"00"	03h	"26"
		V	02h	"01"	"FF"	"01"	"50"	"02"	"00"	"00"	03h	"25"
		HV	02h	"01"	"FF"	"01"	"50"	"03"	"00"	"00"	03h	"24"
FLIP		OFF	02h	"01"	"FF"	"01"	"51"	"00"	"00"	"00"	03h	"26"
		H	02h	"01"	"FF"	"01"	"51"	"01"	"00"	"00"	03h	"25"
		V	02h	"01"	"FF"	"01"	"51"	"02"	"00"	"00"	03h	"24"
		HV	02h	"01"	"FF"	"01"	"51"	"03"	"00"	"00"	03h	"23"

(*1) SHUTTER SPEED settings are effective only in the condition TRIGGER MODE is OFF or FIXED SHUTTER.

(*2) VARIABLE VALUE can be set only when VARIABLE is selected. It can be set within the range of 0000h to FFFFh.

(*3) Binning function is only KP-FM500WCL.

(*4) Gain can be set within the range of 00h to B4h.

(*5) BLACK LEVEL can be set within the range of 00h to 7Fh.

Item			STX	1	2	3	4	5	6	7	ETX	SUM
				STATUS	ID NO.	AREA ADDRESS	RELATIVE NO.	DATA				
PARTIAL SCAN (*6)	MODE	OFF	02h	"01"	"FF"	"01"	"1E"	"00"	"00"	"00"	03h	"16"
		ON	02h	"01"	"FF"	"01"	"1E"	"01"	"00"	"00"	03h	"15"
	START(2Byte)	1	02h	"01"	"FF"	"01"	"1F"	"00"	"01"	"00"	03h	"14"
		2045	02h	"01"	"FF"	"01"	"1F"	"07"	"FD"	"00"	03h	"E4"
	WIDTH(2Byte)	4	02h	"01"	"FF"	"01"	"20"	"00"	"04"	"00"	03h	"26"
		2048	02h	"01"	"FF"	"01"	"20"	"08"	"00"	"00"	03h	"22"
WHITE BALANCE (*7)	R-GAIN	0	02h	"01"	"FF"	"01"	"2A"	"00"	"00"	"00"	03h	"19"
		128	02h	"01"	"FF"	"01"	"2A"	"80"	"00"	"00"	03h	"11"
		255	02h	"01"	"FF"	"01"	"2A"	"FF"	"00"	"00"	03h	"ED"
	B-GAIN	0	02h	"01"	"FF"	"01"	"2B"	"00"	"00"	"00"	03h	"18"
		128	02h	"01"	"FF"	"01"	"2B"	"80"	"00"	"00"	03h	"10"
		255	02h	"01"	"FF"	"01"	"2B"	"FF"	"00"	"00"	03h	"EC"
FACTORY SETTING		SET	02h	"01"	"FF"	"01"	"45"	"01"	"00"	"00"	03h	"22"

(*6) START of partialscan can be set within the range of 0001h to 07FDh.

WIDTH of partialscan can be set within the range of 0004h to 0800h.

Please set the sum total of START and WIDTH is 0801h or less.

Please set the acquisition width as increments of 4 lines.

(*7) WHITE BALANCE function is only KP-FMD500WCL.

2. Read command (Note: 1 to 7 and SUM need to be transformed into ASCII code)

Item	STX	1	2	3	4	5	6	7	ETX	SUM	
		STATUS	ID NO.	AREA ADDRESS	RELATIVE NO.	DATA					
TRIGGER	MODE	02h	"00"	"FF"	"81"	"04"	"00"	"00"	"00"	03h	"21"
	POLARITY	02h	"00"	"FF"	"81"	"0F"	"00"	"00"	"00"	03h	"10"
	SOURCE	02h	"00"	"FF"	"81"	"05"	"00"	"00"	"00"	03h	"20"
	NOISE CANCEL	02h	"00"	"FF"	"81"	"63"	"00"	"00"	"00"	03h	"1C"
OUTPUT SIGNAL		02h	"00"	"FF"	"81"	"06"	"00"	"00"	"00"	03h	"1F"
SHUTTER SPEED	PRESET	02h	"00"	"FF"	"81"	"08"	"00"	"00"	"00"	03h	"1D"
	VARIABLE VALUE	02h	"00"	"FF"	"81"	"11"	"00"	"00"	"00"	03h	"23"
CONFIG		02h	"00"	"FF"	"81"	"12"	"00"	"00"	"00"	03h	"22"
CLK		02h	"00"	"FF"	"81"	"19"	"00"	"00"	"00"	03h	"1B"
BINNING(*1)		02h	"00"	"FF"	"81"	"13"	"00"	"00"	"00"	03h	"21"
DATA BIT		02h	"00"	"FF"	"81"	"14"	"00"	"00"	"00"	03h	"20"
GAIN		02h	"00"	"FF"	"81"	"0C"	"00"	"00"	"00"	03h	"12"
BLACK LEVEL		02h	"00"	"FF"	"81"	"17"	"00"	"00"	"00"	03h	"1D"
TEST PATTERN		02h	"00"	"FF"	"81"	"50"	"00"	"00"	"00"	03h	"20"
FLIP		02h	"00"	"FF"	"81"	"51"	"00"	"00"	"00"	03h	"1F"
PARTIAL SCAN	MODE	02h	"00"	"FF"	"81"	"1E"	"00"	"00"	"00"	03h	"0F"
	START	02h	"00"	"FF"	"81"	"1F"	"00"	"00"	"00"	03h	"0E"
	WIDTH	02h	"00"	"FF"	"81"	"20"	"00"	"00"	"00"	03h	"23"
WHITE BALANCE (*2)	R-GAIN	02h	"00"	"FF"	"81"	"2A"	"00"	"00"	"00"	03h	"12"
	B-GAIN	02h	"00"	"FF"	"81"	"2B"	"00"	"00"	"00"	03h	"11"
TEMPERATURE		02h	"00"	"FF"	"81"	"62"	"00"	"00"	"00"	03h	"1D"

(*1) Binning function is only KP-FM500WCL.

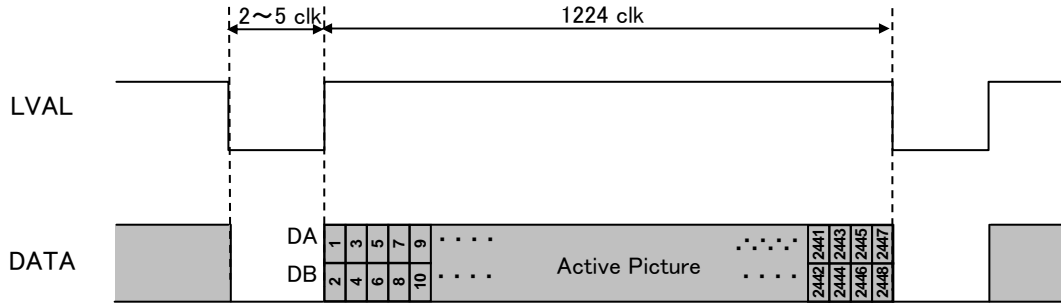
(*2) WHITE BALANCE function is only KP-FMD500WCL.

Read data from the slave follows "4. Comms command data format(2)"(page 15) of "Remote control".

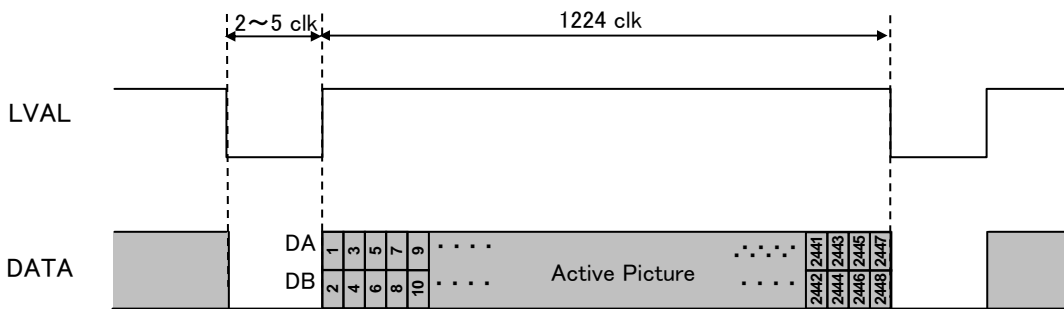
Camera Link output timing chart

1. Horizontal timing

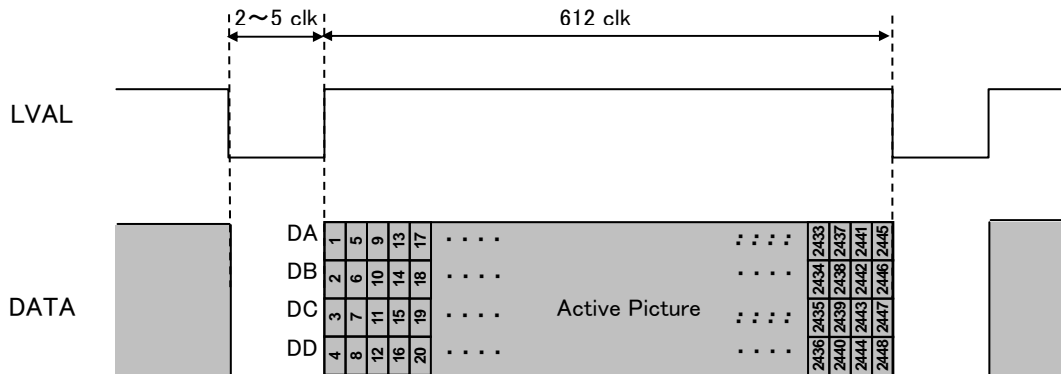
(1) 85MHz Base Configuration (1 clk = 11.765 ns)



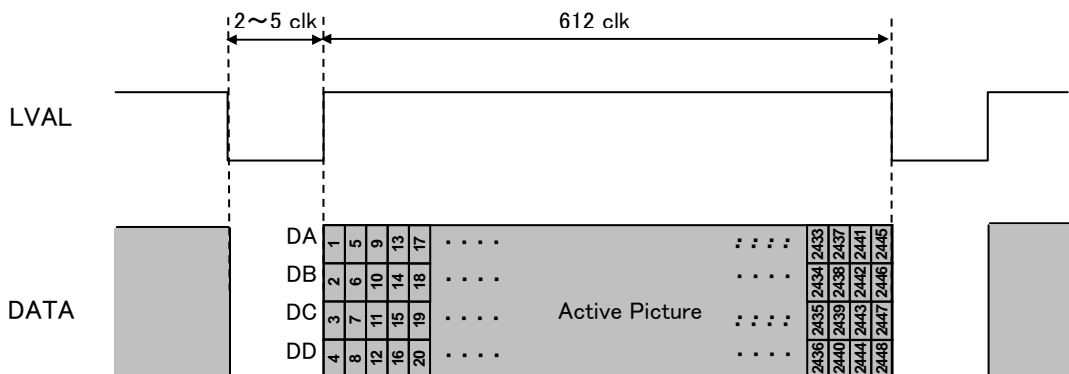
(2) 60MHz Base Configuration (1 clk = 16.667 ns)



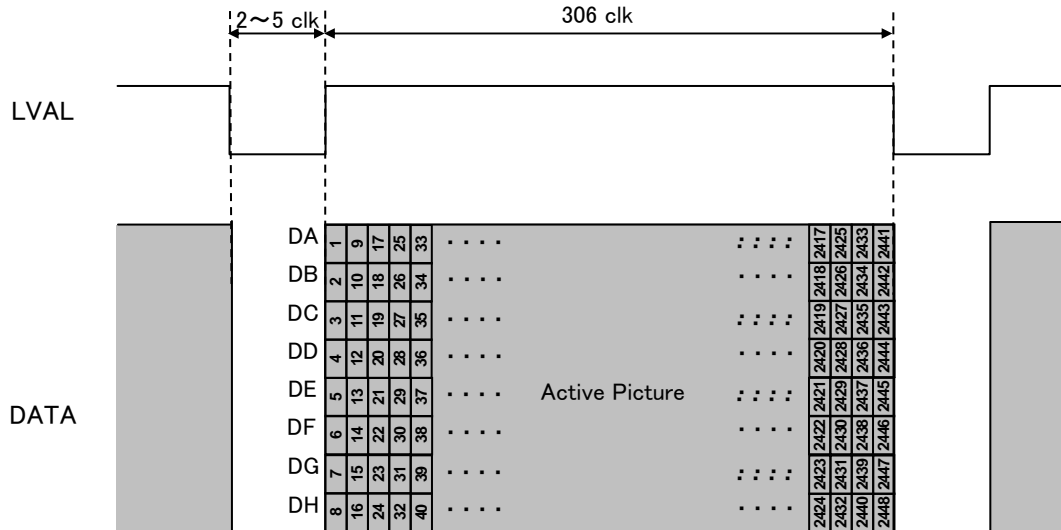
(3) 85MHz Medium Configuration (1 clk = 11.765 ns)



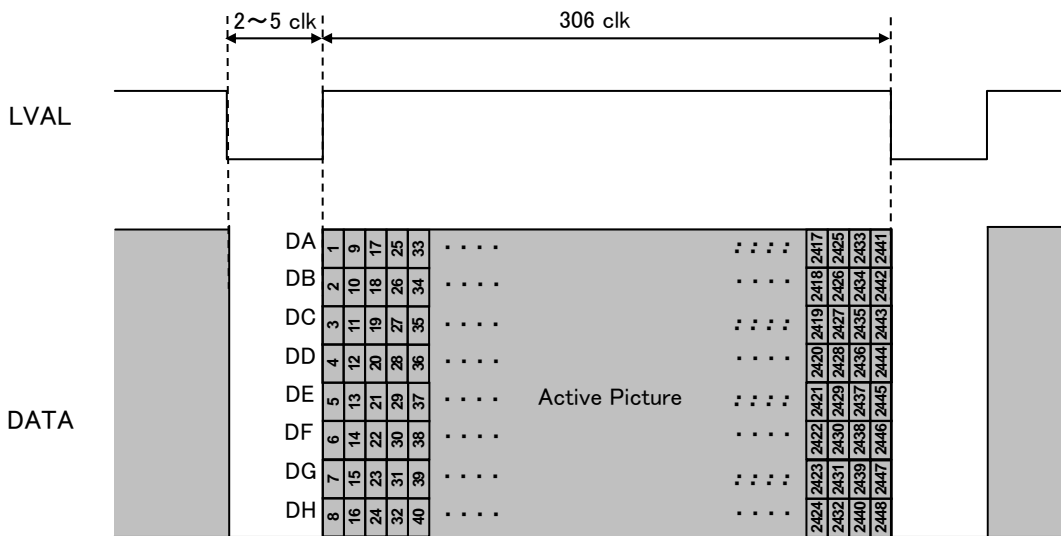
(4) 60MHz Medium Configuration (1 clk = 16.667 ns)



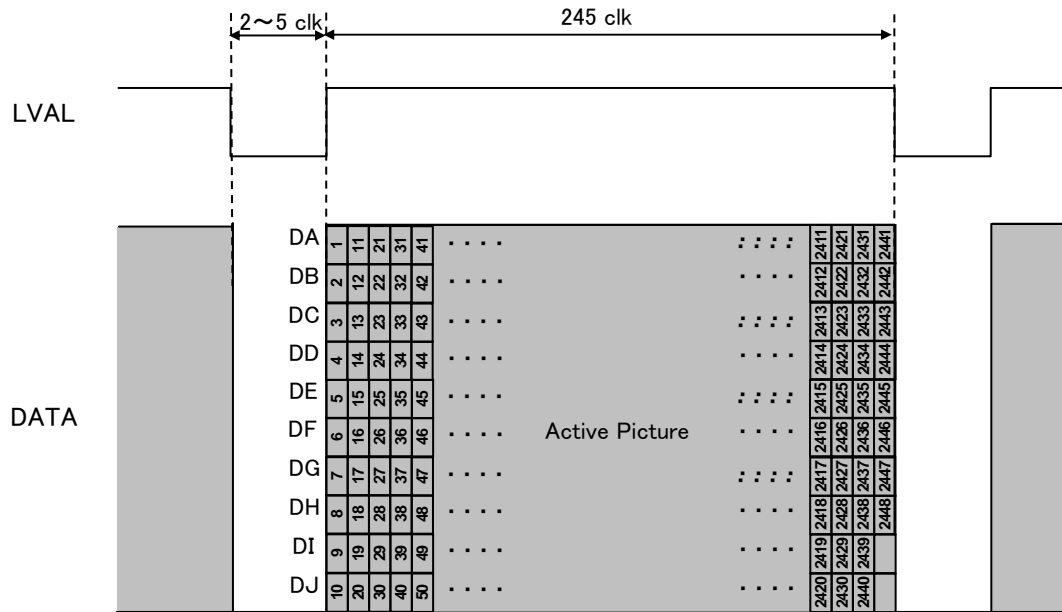
(5) 85MHz Full configuration (1 clk = 11.765 ns)



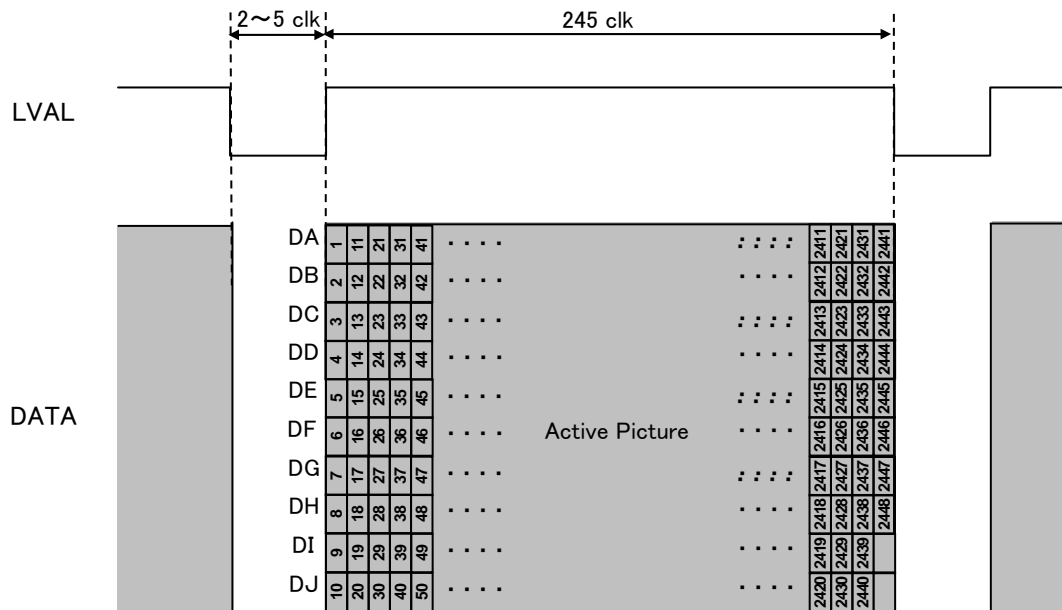
(6) 60MHz Full Configuration (1 clk = 16.667 ns)



(7) 85MHz Deca(10TAP) Configuration (1 clk = 11.765 ns)

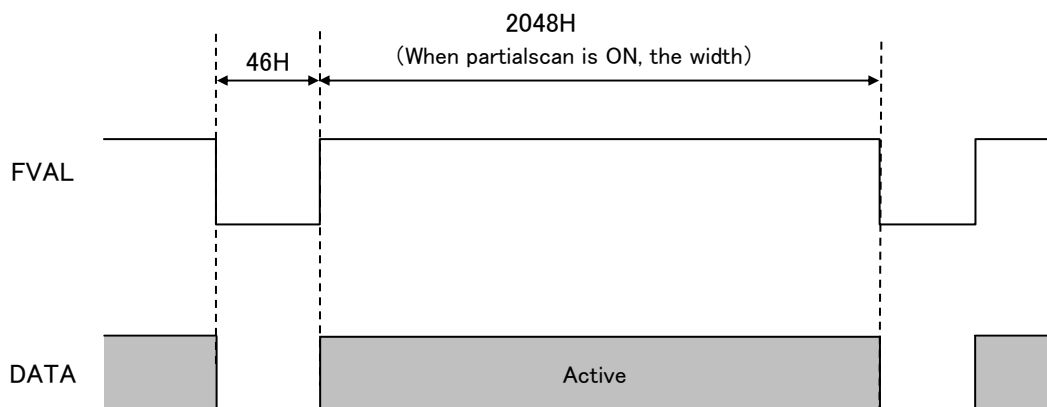


(8) 60MHz Deca(10TAP) Configuration (1 clk = 16.667 ns)

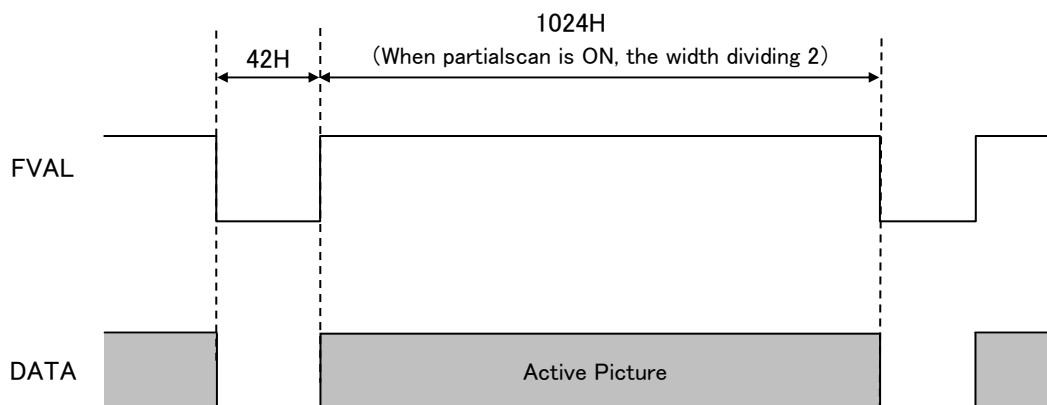


2. Vertical timing

(1) BINNING: OFF, KP-FMD500WCL



(2) BINNING: ON (*This function is only KP-FM500WCL.)



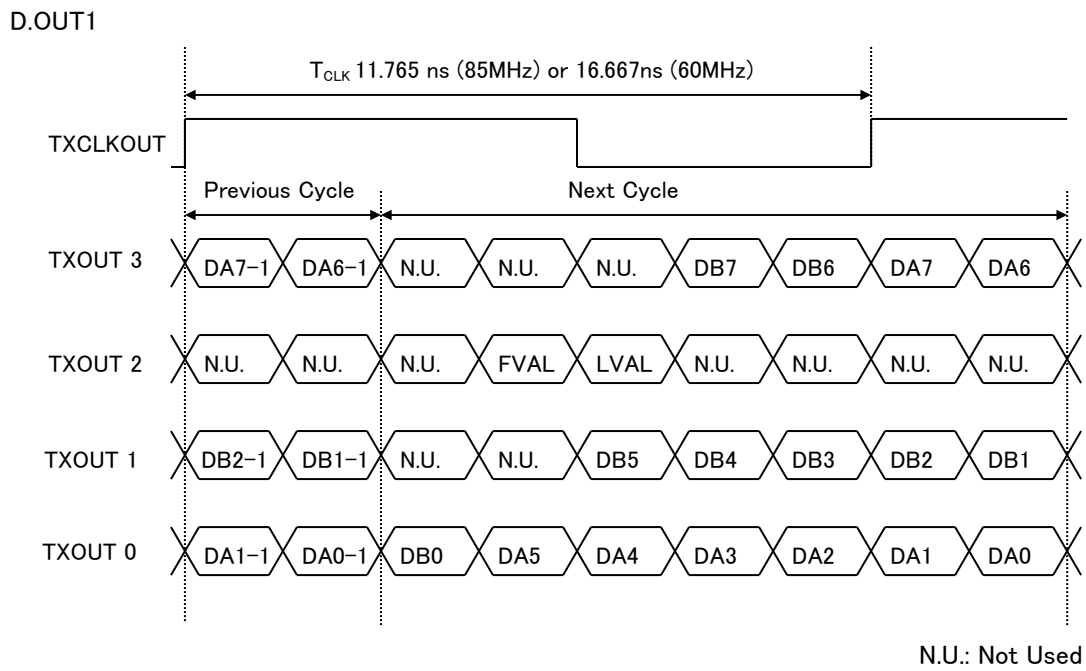
1 horizontal period differs depending on the configuration and clock frequency setting.

CameraLink output	1horizontal period
Base Configuration 85MHz	1H = 14.438us
Base Configuration 60MHz	1H = 20.458us
Medium Configuration 85MHz	1H = 7.246us
Medium Configuration 60MHz	1H = 10.163us
Full Configuration 85MHz	1H = 3.636us
Full Configuration 60MHz	1H = 5.158us
Deca(10TAP) Configuration 85MHz	1H = 2.923us
Deca(10TAP) Configuration 60MHz	1H = 4.148us

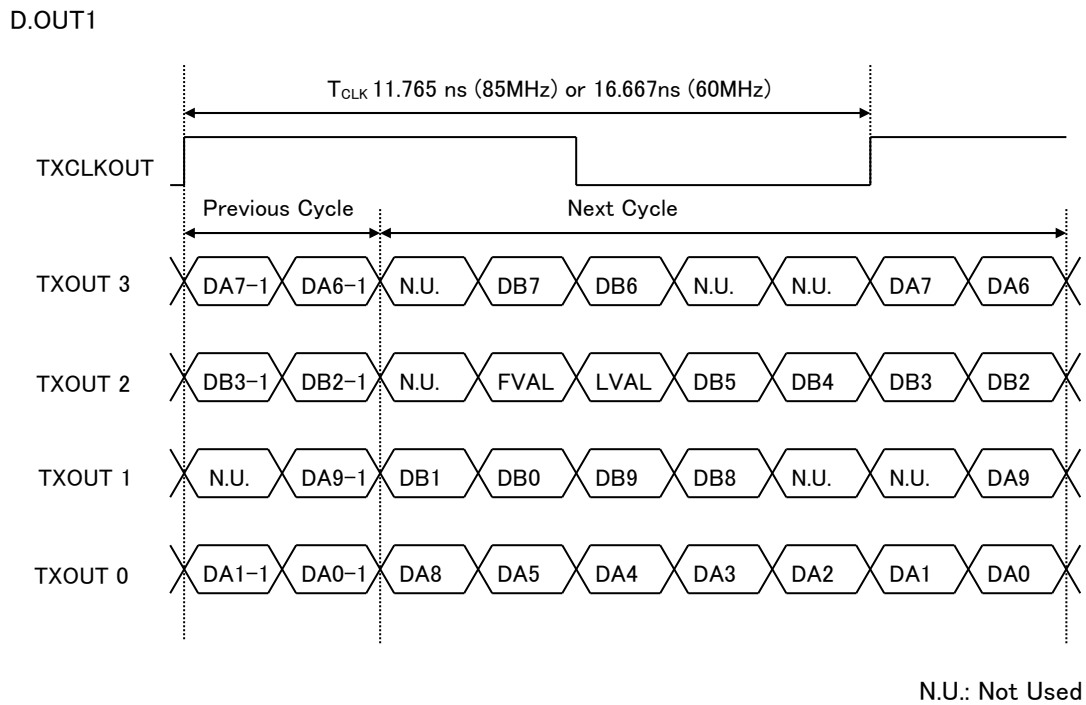
3. Transmitter LVDS output pulse position measurement

(1) Base Configuration

(a) 8bit



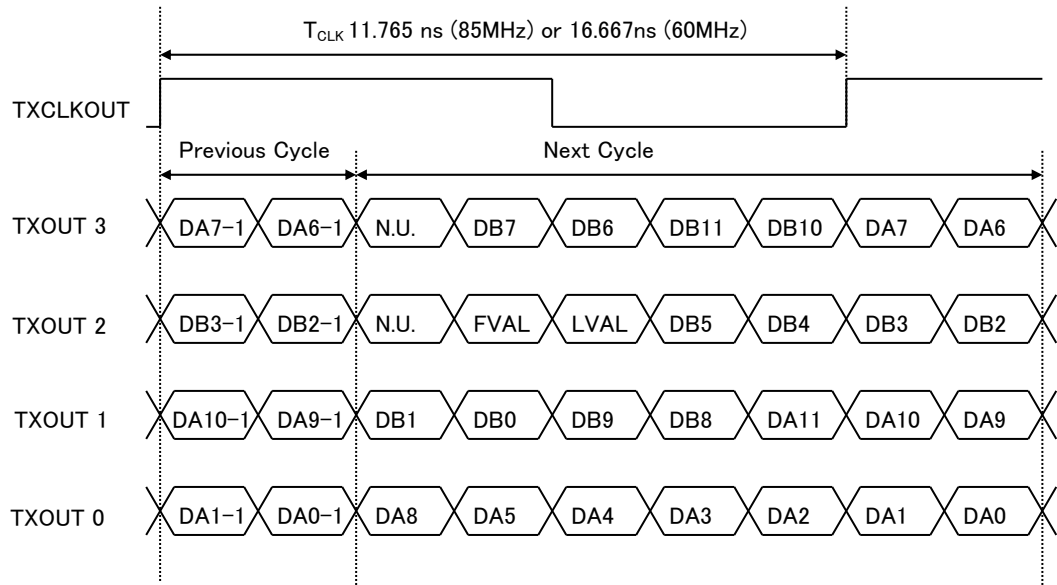
(b) 10bit



* When using Base configuration, please be sure to connect to CameraLink cable to D.OUT1. If the cable is connected to D.OUT2, the machine may break down.

(c) 12bit

D.OUT1



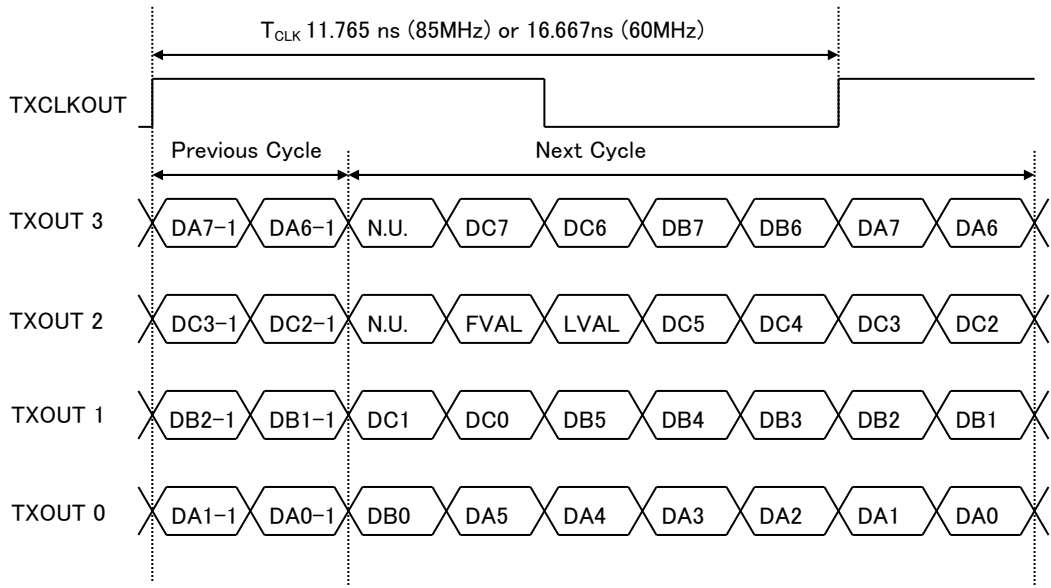
N.U.: Not Used

* When using Base configuration, please be sure to connect to CameraLink cable to D.OUT1.
If the cable is connected to D.OUT2, the machine may break down.

(2) Medium Configuration

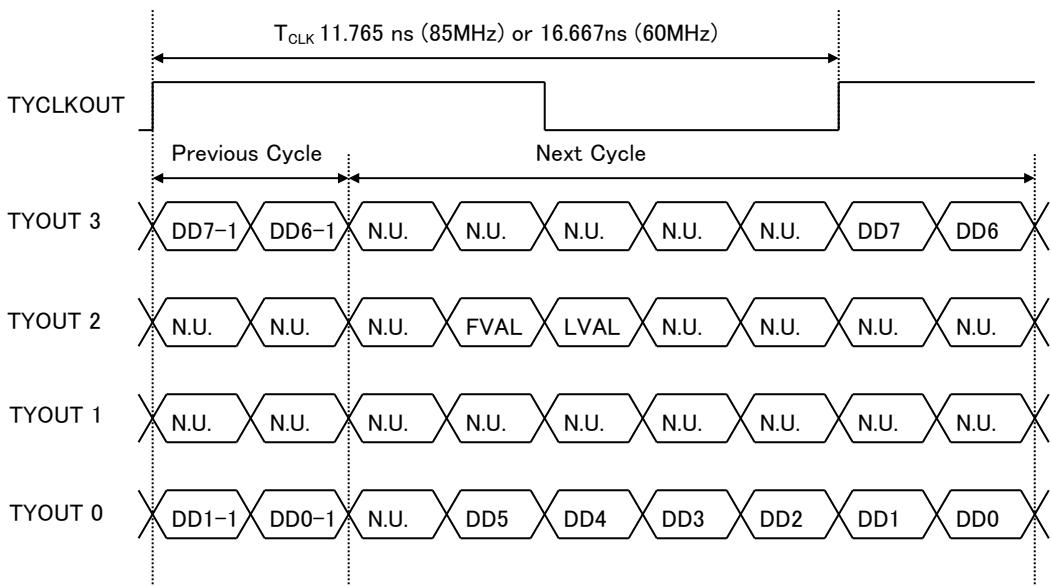
(a) 8bit

D.OUT1



N.U.: Not Used

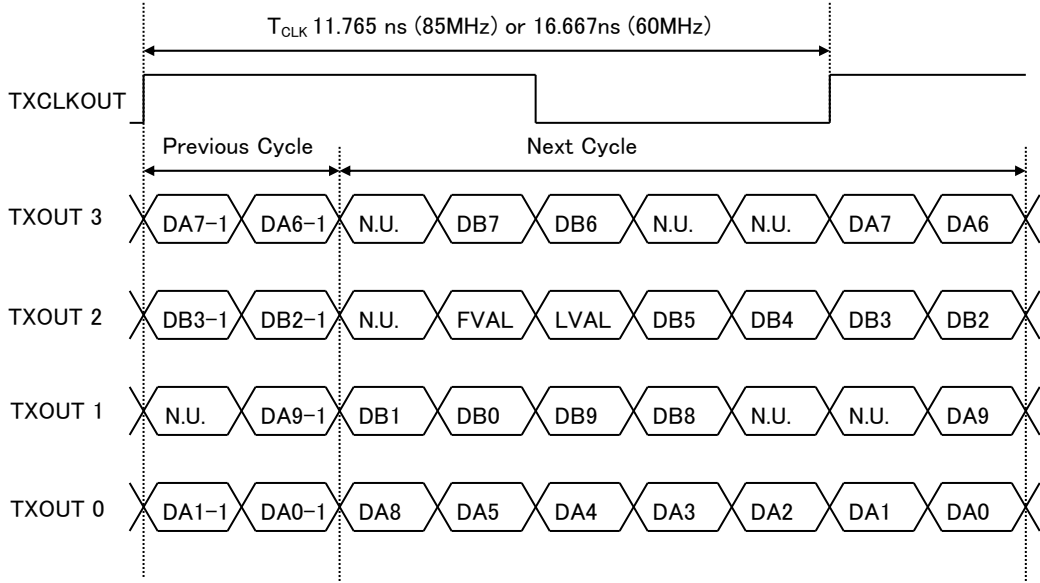
D.OUT2



N.U.: Not Used

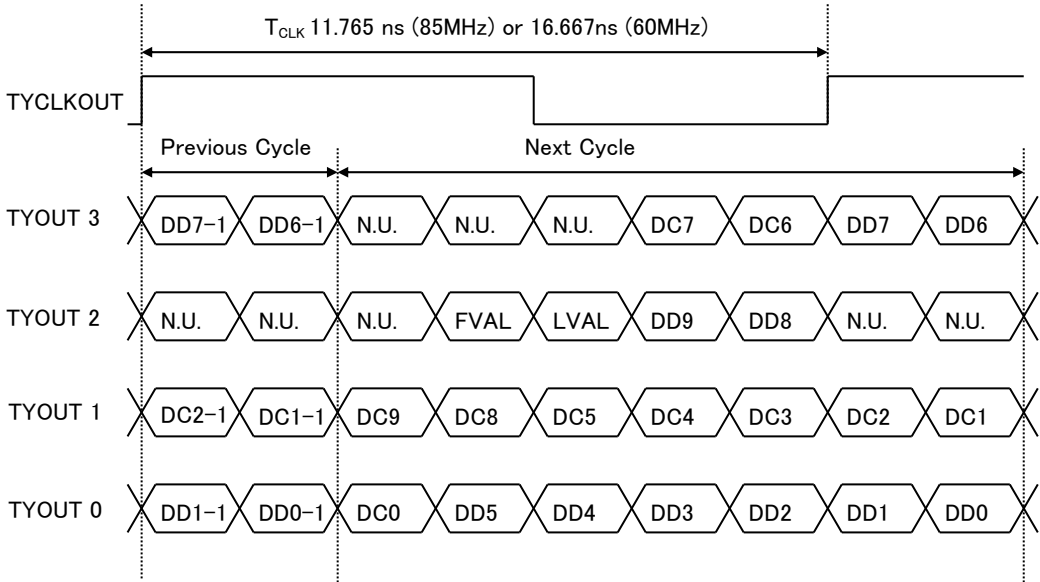
(b) 10bit

D.OUT1



N.U.: Not Used

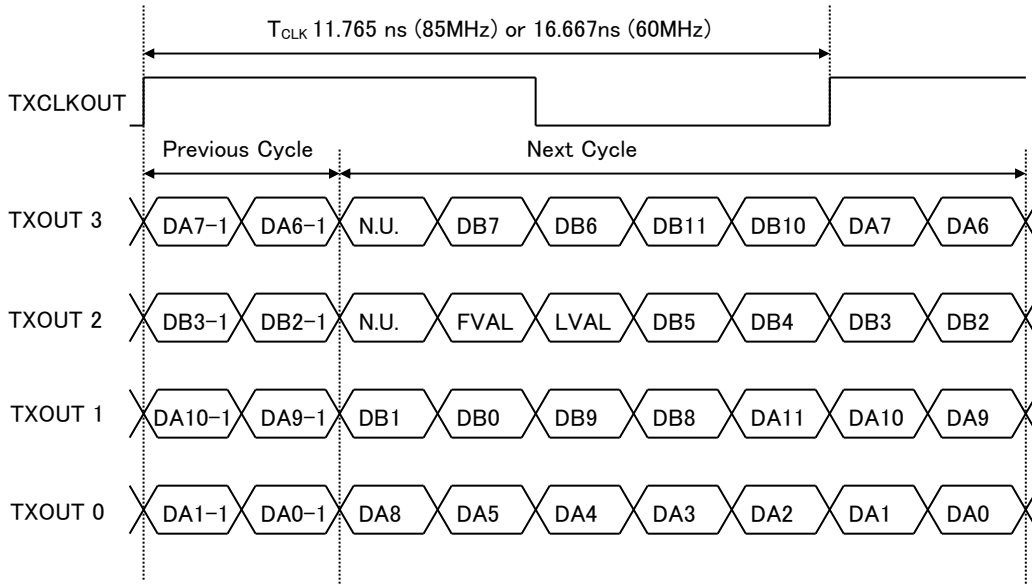
D.OUT2



N.U.: Not Used

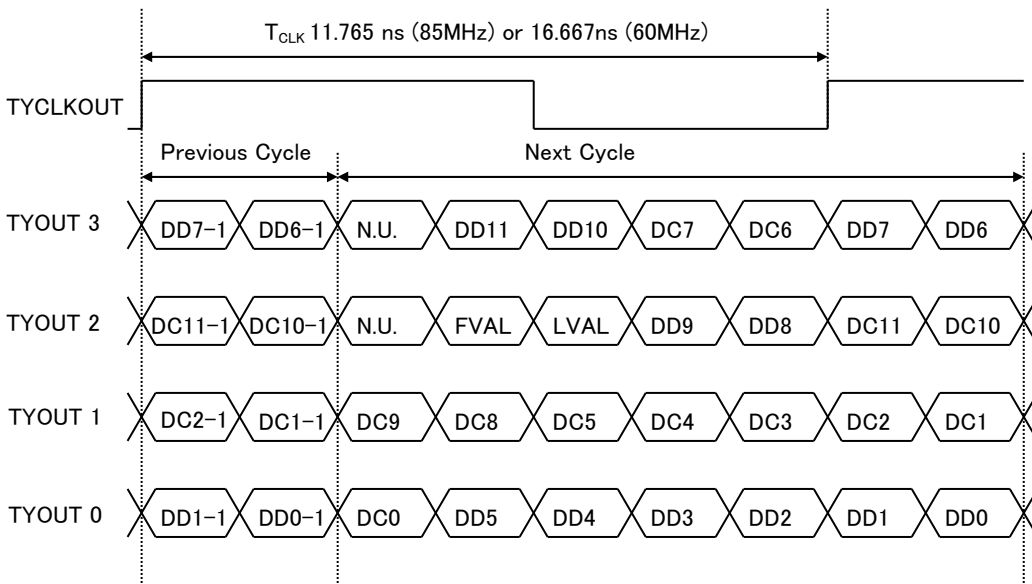
(c) 12bit

D.OUT1



N.U.: Not Used

D.OUT2

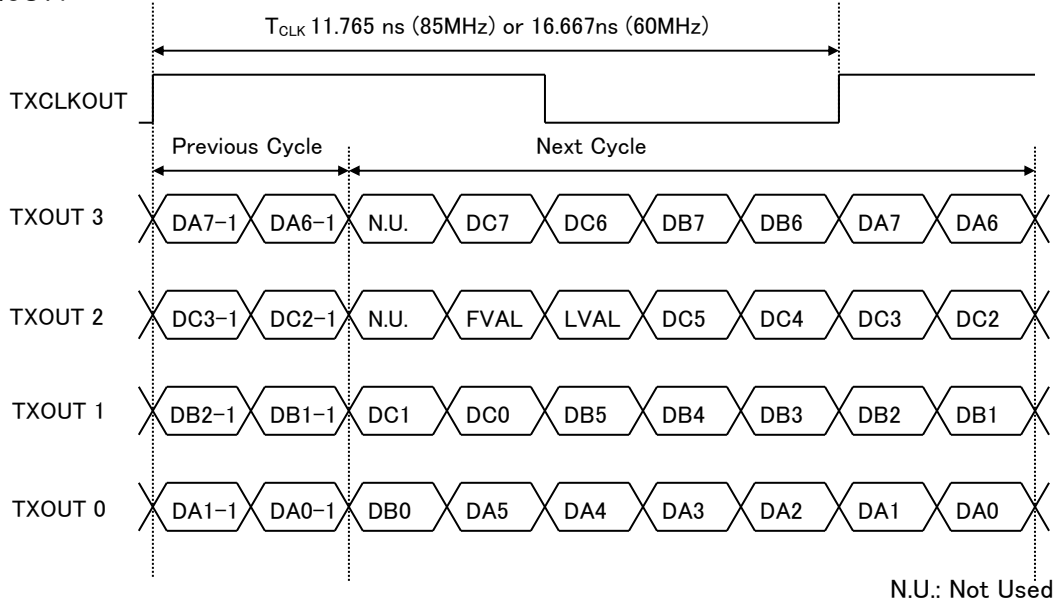


N.U.: Not Used

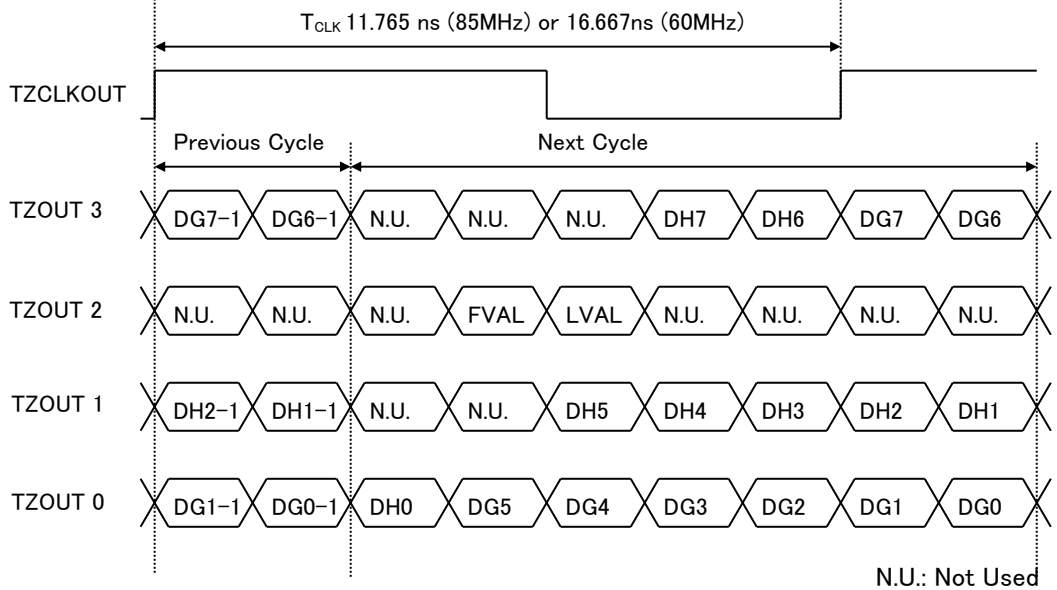
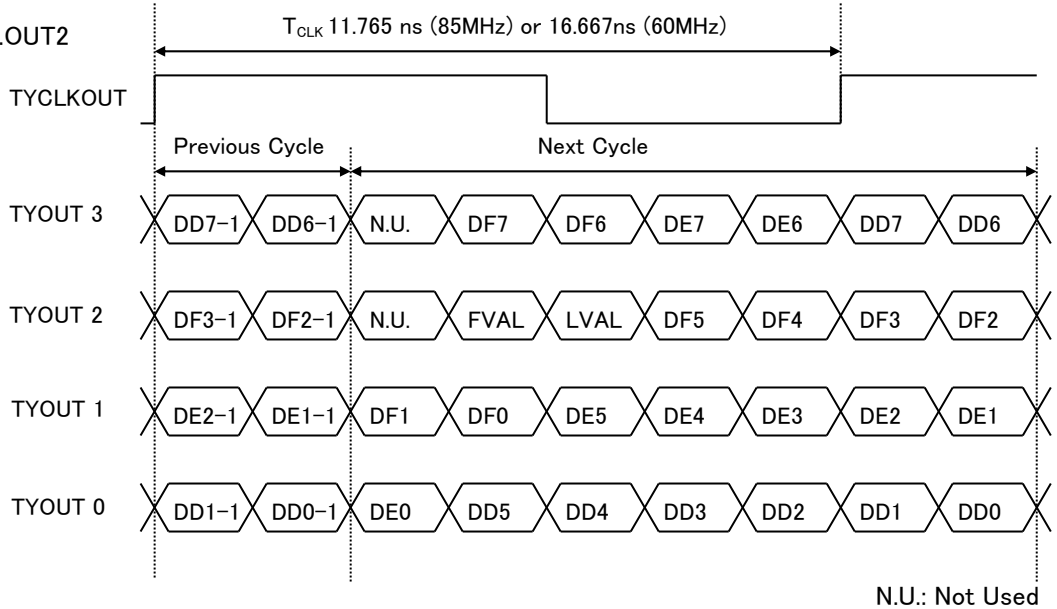
(3) Full Configuration

(a) 8bit

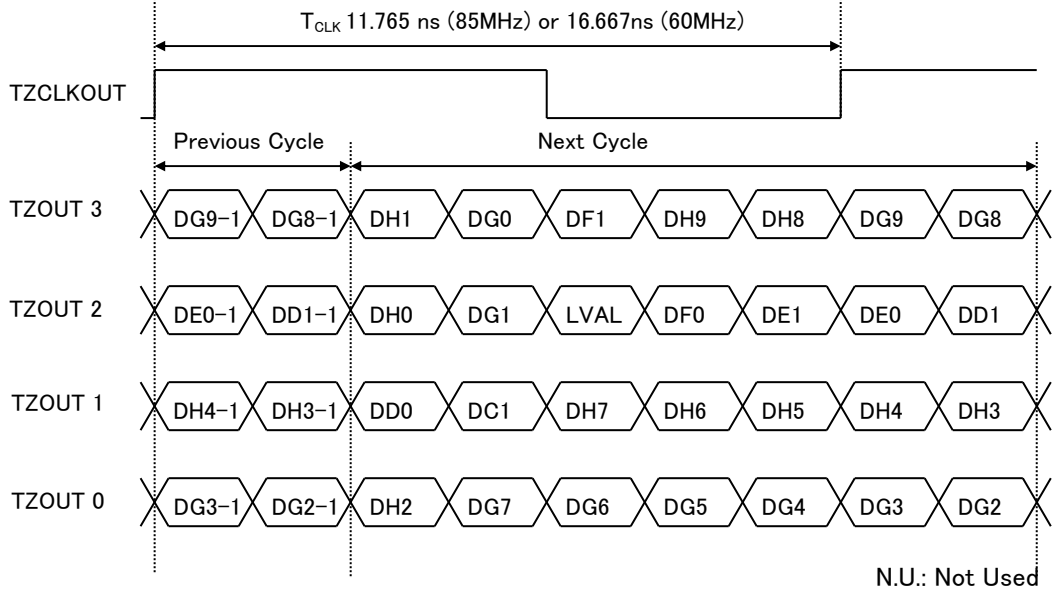
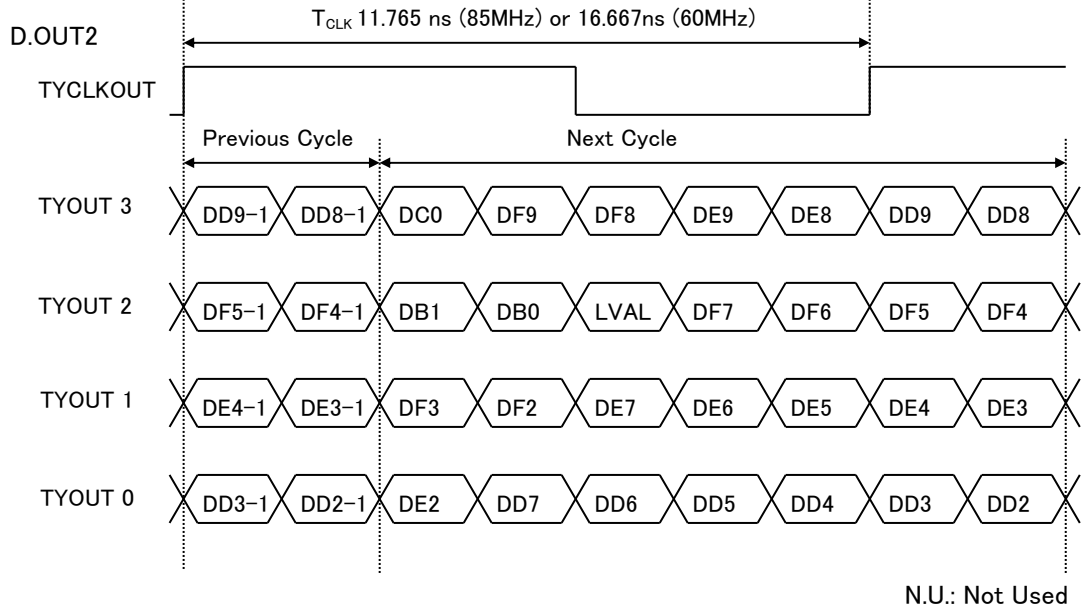
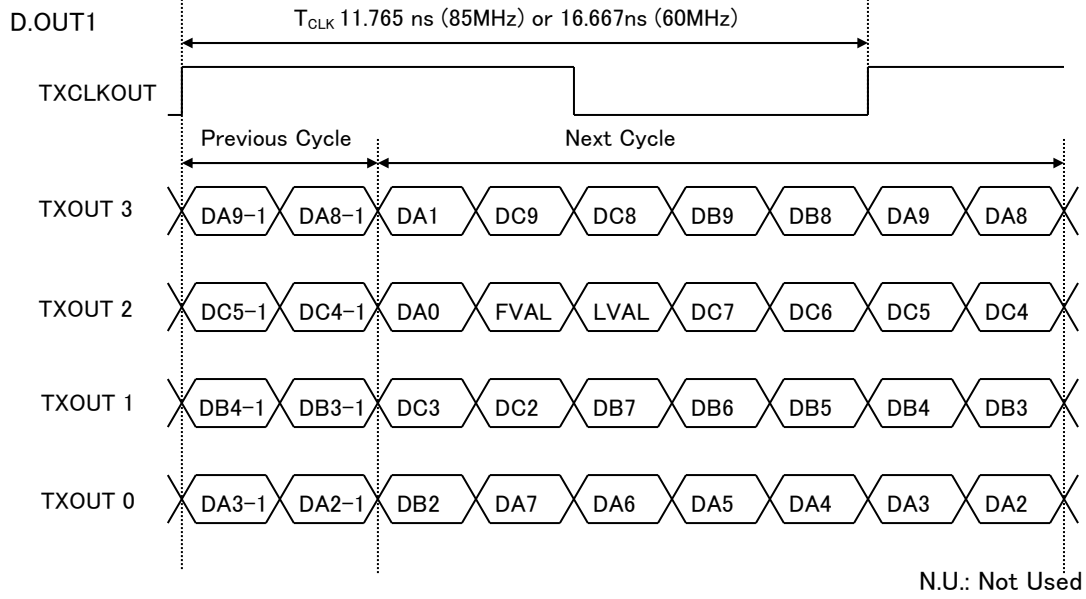
D.OUT1



D.OUT2

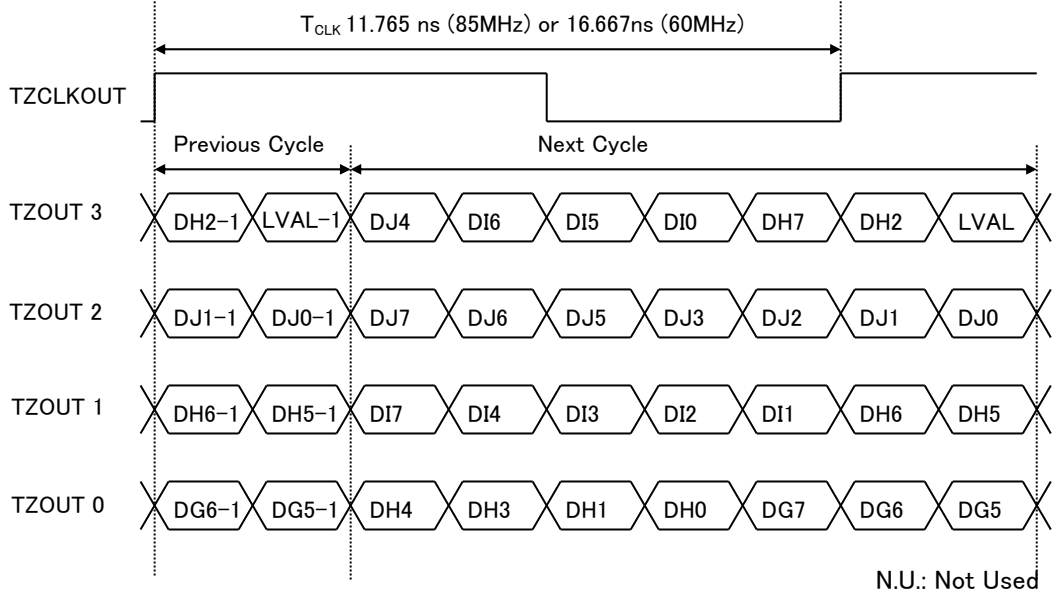
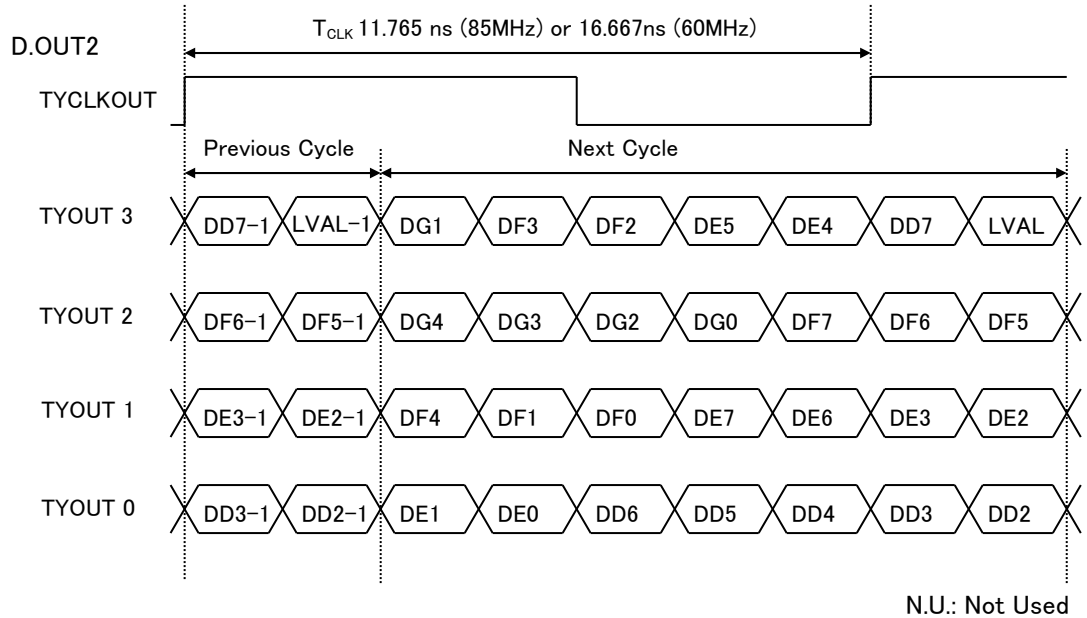
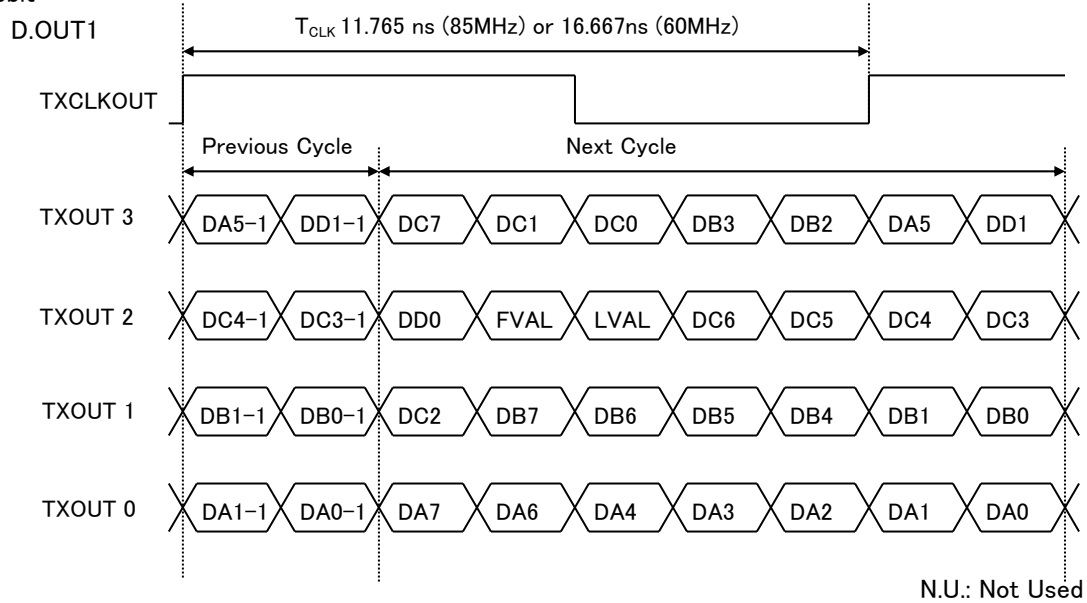


(b) 10bit



(4)Deca(10TAP) Configuration

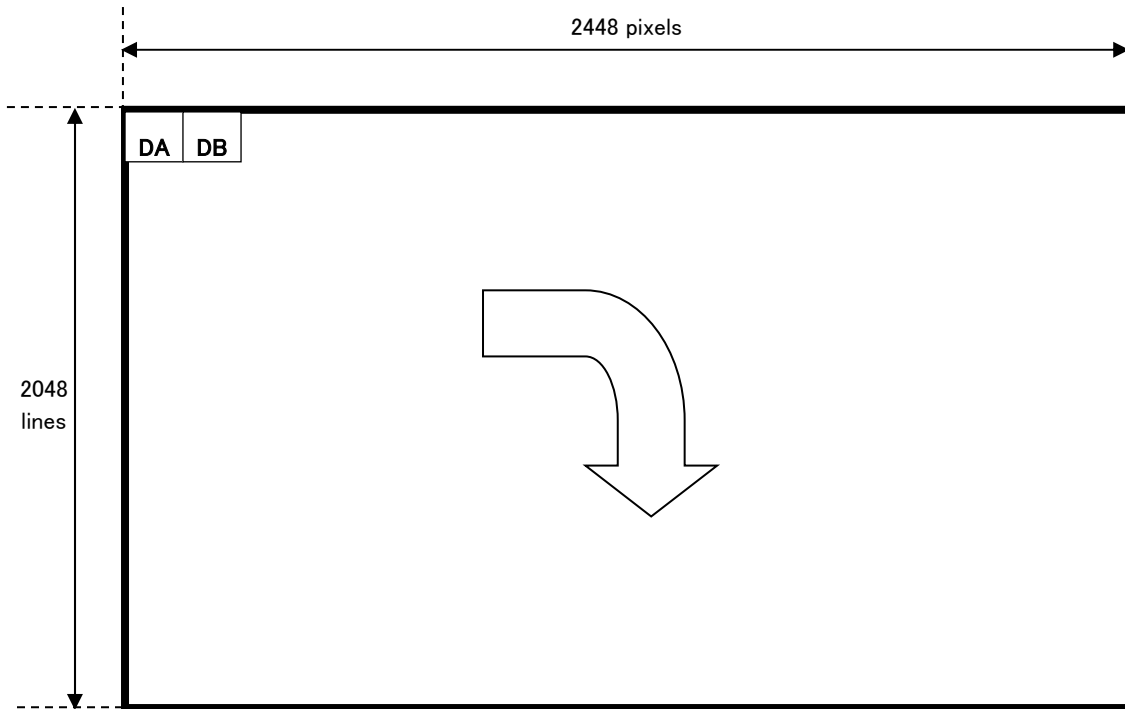
(a)8bit



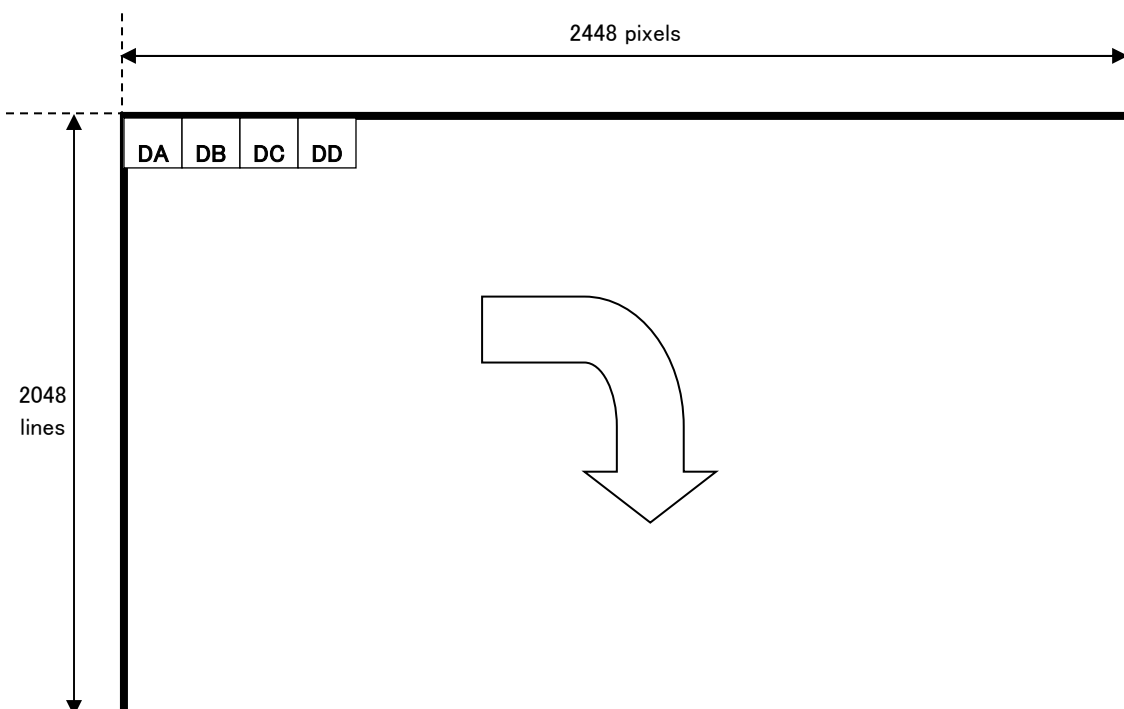
4. Output sequence

DA, DB, DC, DD, DE, DF, DG, DH, DI and DJ show output TAP of the cameralink.
Refer to "Transmitter LVDS output pulse position measurement" for details.

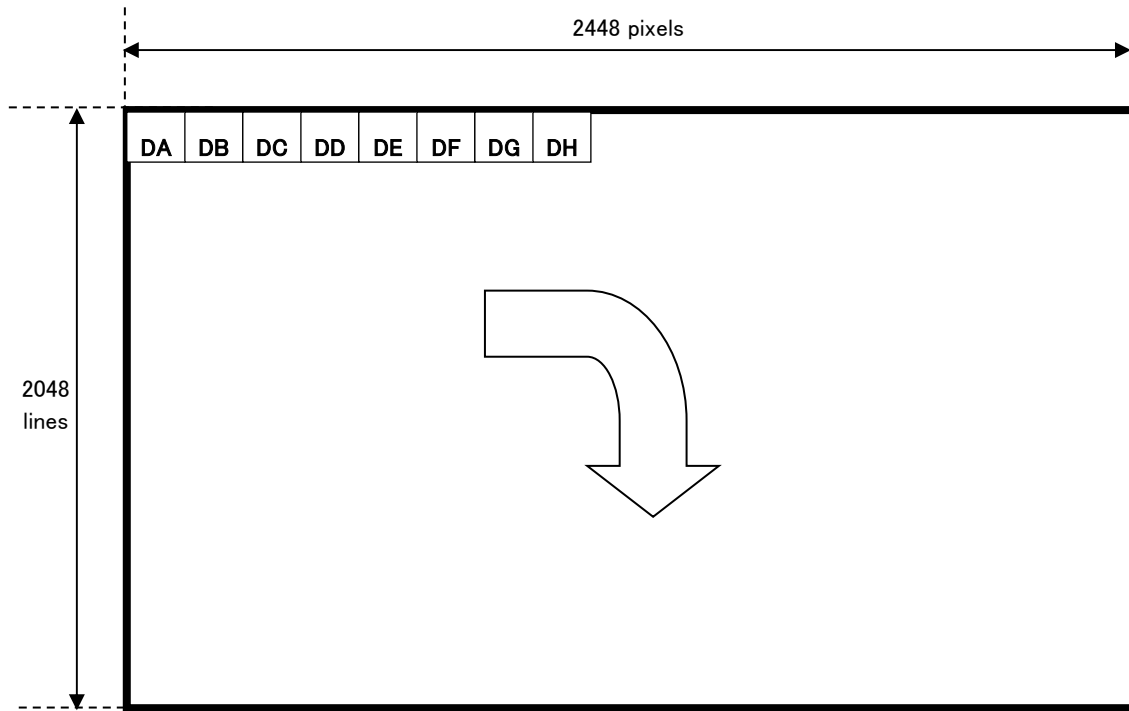
(1) Base Configuration



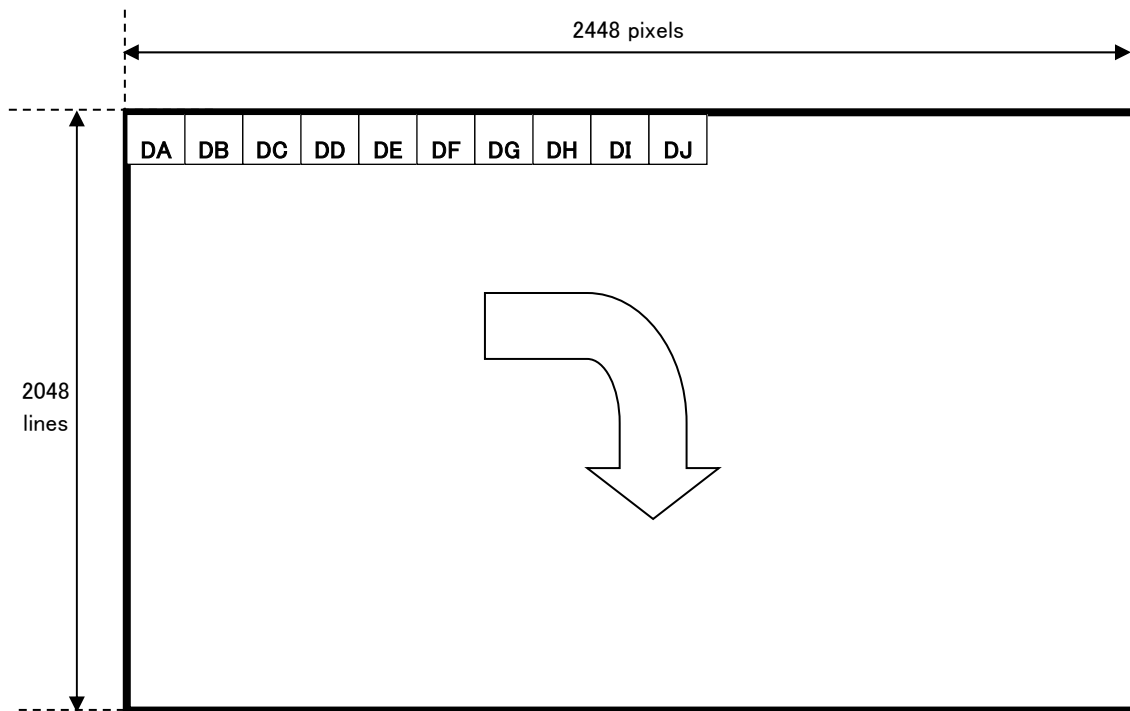
(2) Medium Configuration



(3) Full Configuration

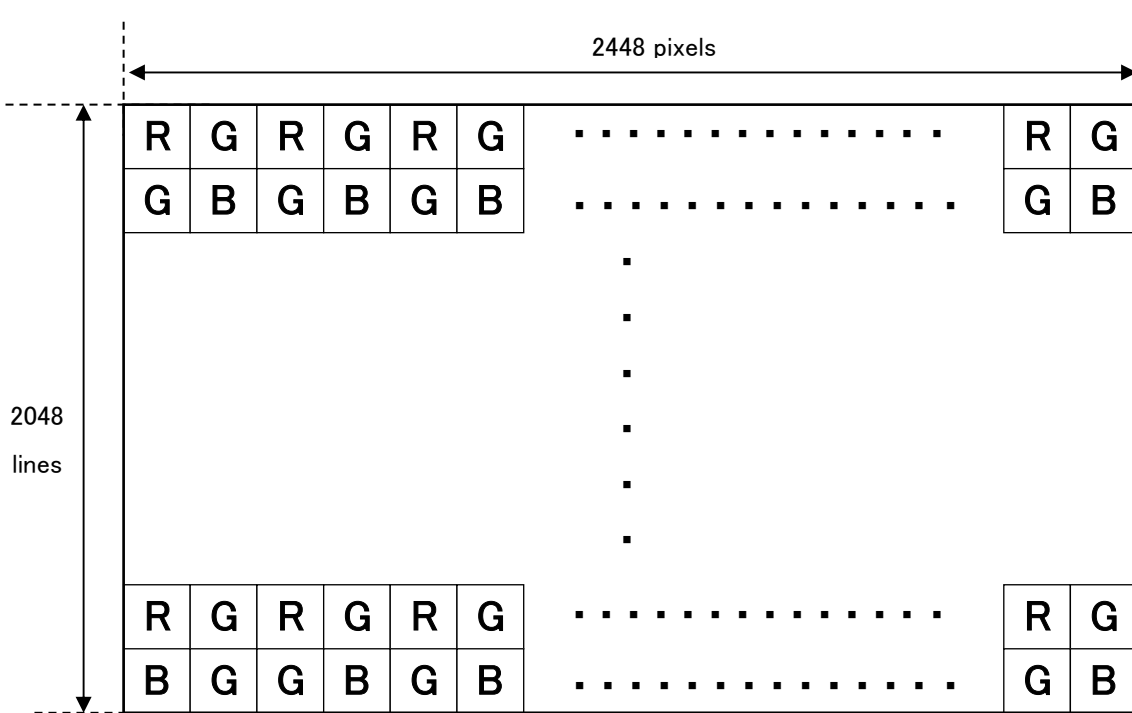


(4) Deca Configuration (10TAP)



(5). Color Output sequence (KP-FMD500WCL)

*FLIP: OFF



Trigger operation and timing chart

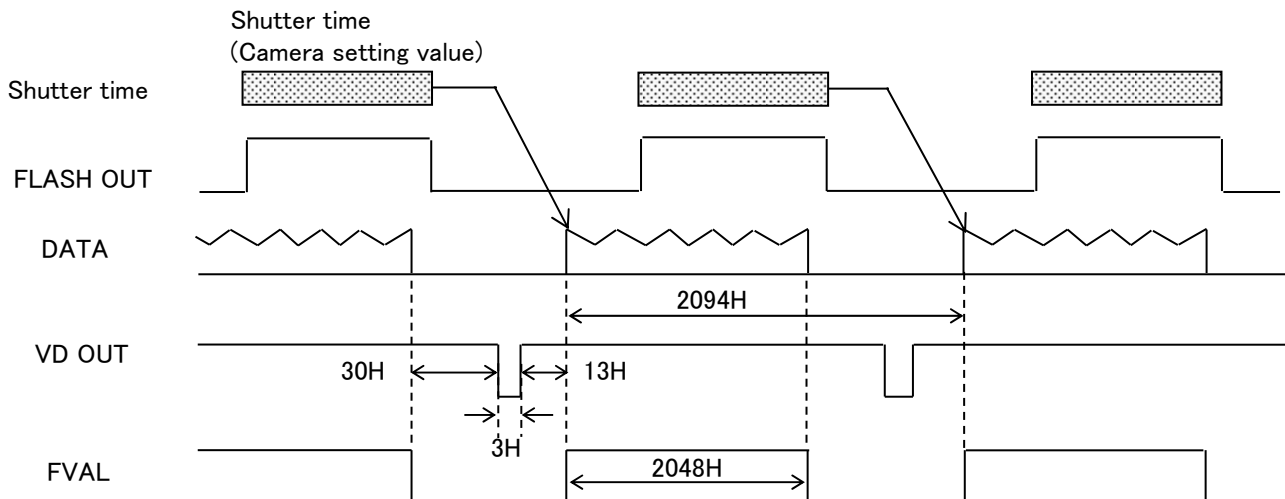
1 horizontal period differs depending on the configuration and clock frequency setting.

CameraLink output	1horizontal period
Base Configuration 85MHz	1H = 14.438us
Base Configuration 60MHz	1H = 20.458us
Medium Configuration 85MHz	1H = 7.246us
Medium Configuration 60MHz	1H = 10.163us
Full Configuration 85MHz	1H = 3.636us
Full Configuration 60MHz	1H = 5.158us
Deca(10TAP) Configuration 85MHz	1H = 2.923us
Deca(10TAP) Configuration 60MHz	1H = 4.148us

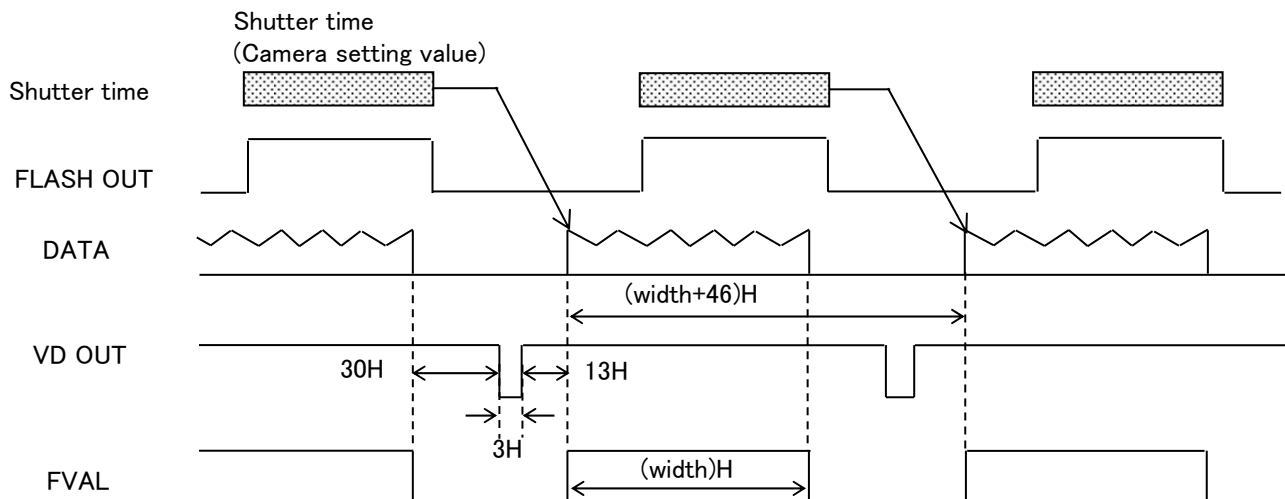
(1) Normal mode

The exposure and the image output are repeated at the set shutter speed.

(a) Partial scan: OFF



(b) Partial scan : ON

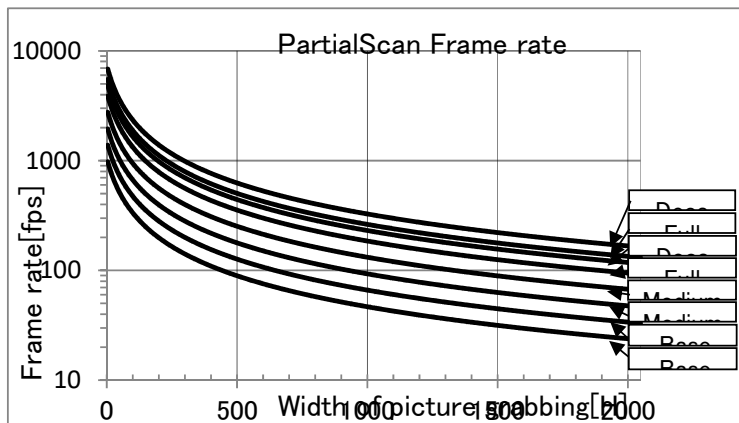


Frame rate can be calculated from following equations using width of picture grabbing.

Cameralink output setting	Frame rate(fps)
Base Configuration 85MHz	$74250000 / (\text{Width} + 46) / 1072$
Base Configuration 60MHz	$74250000 / (\text{Width} + 46) / 1519$
Medium Configuration 85MHz	$74250000 / (\text{Width} + 46) / 538$
Medium Configuration 60MHz	$74250000 / (\text{Width} + 46) / 762$
Full Configuration 85MHz	$74250000 / (\text{Width} + 46) / 270$
Full Configuration 60MHz	$74250000 / (\text{Width} + 46) / 383$
Deca (10TAP) Configuration 85MHz	$74250000 / (\text{Width} + 46) / 217$
Deca (10TAP) Configuration 60MHz	$74250000 / (\text{Width} + 46) / 307$

[Note] Please set the acquisition width as increments of 4 lines.

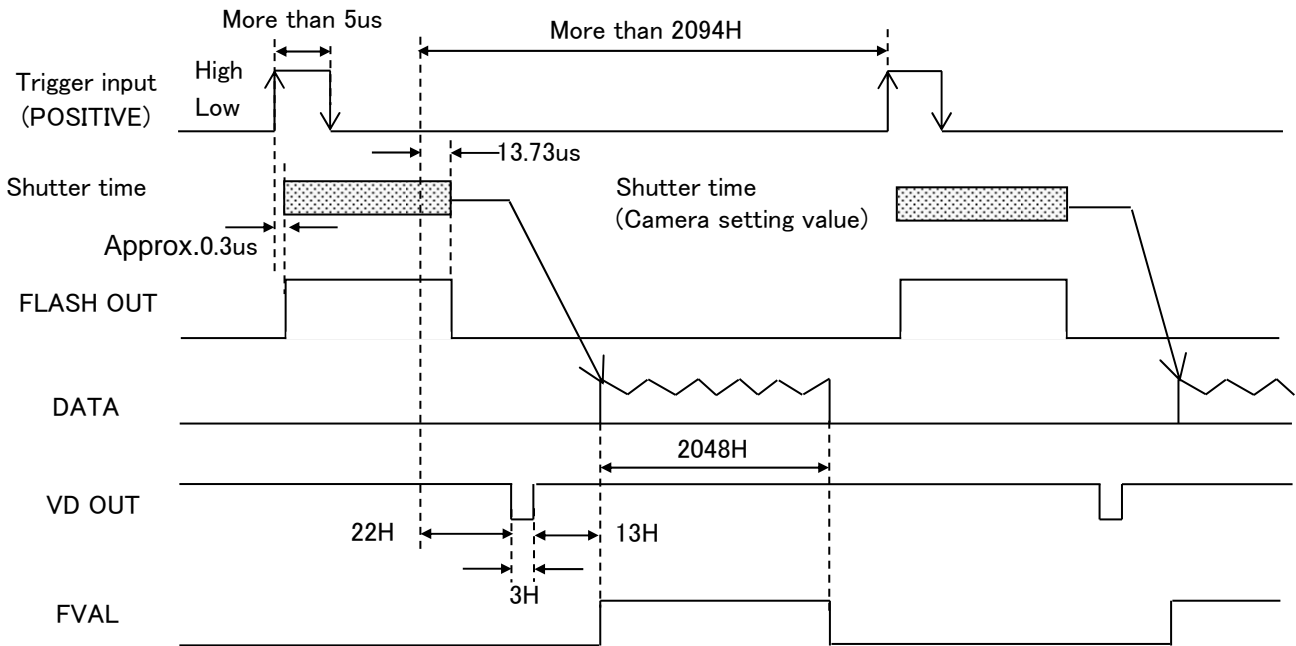
Graph following shows frame rate in each of picture grabbing in the partial scan mode.



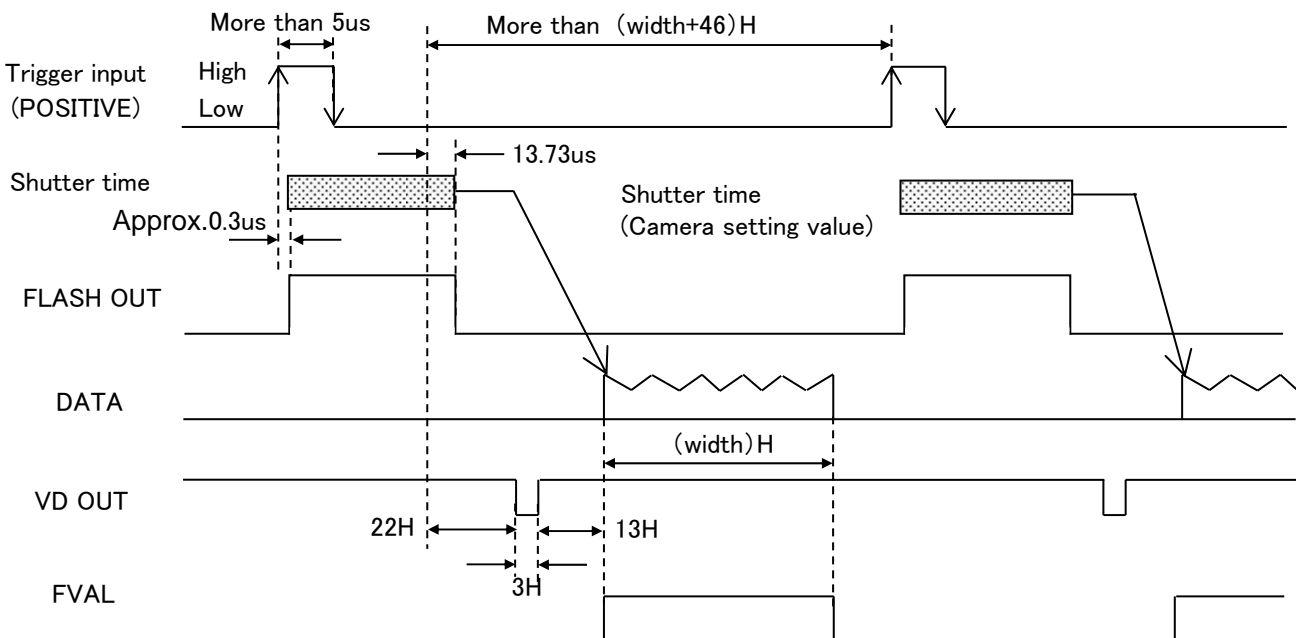
(2). Fixed shutter mode

When trigger polarity setting is POSITIVE, after the trigger signal rise, exposure is start. The exposure time is set by the camera electronic shutter speed. The video output is obtained immediately after the end of fixed exposure.

(a) Partial scan : OFF



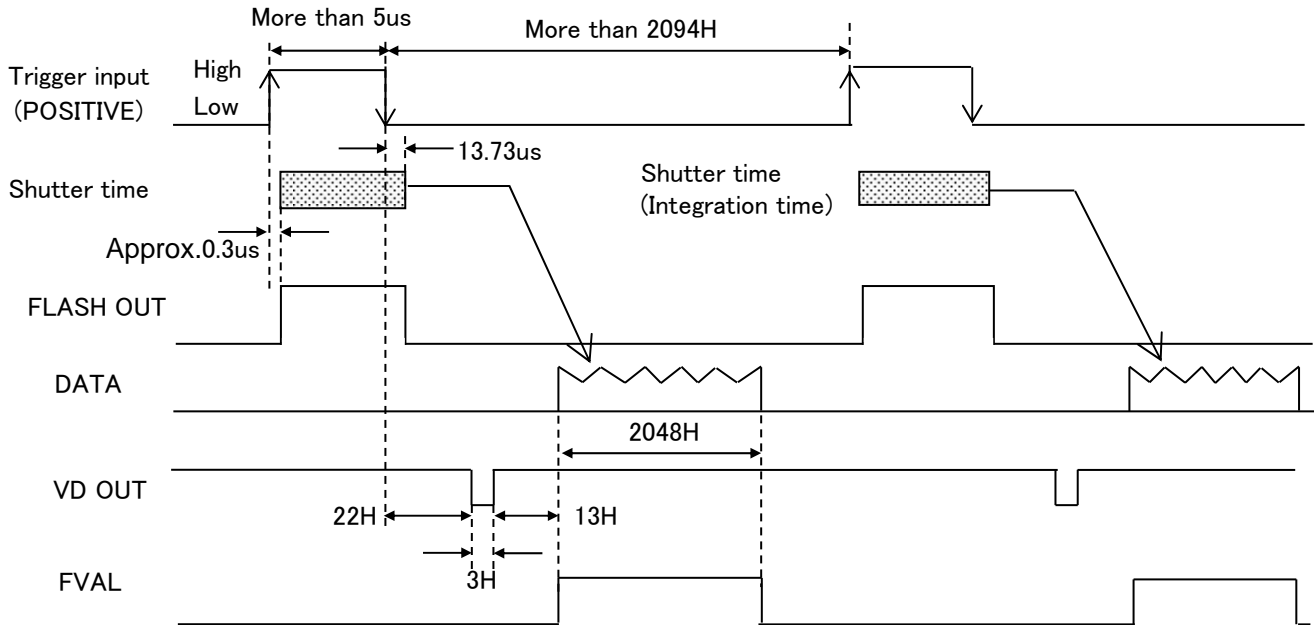
(b) Partial scan : ON



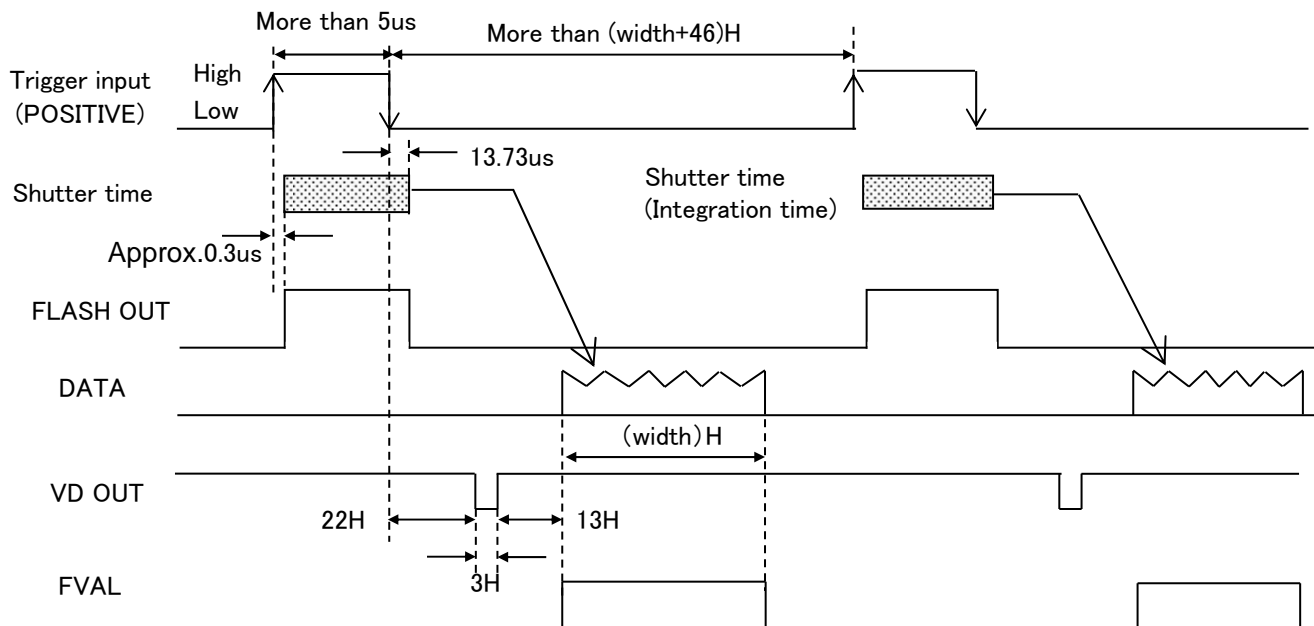
(3). ONE trigger mode

When trigger polarity setting is POSITIVE, after the trigger signal rise, exposure is start. Exposure is terminated at the falling edge of the trigger, and video data is output.

(a) Partial scan : OFF



(b) Partial scan : ON



Input / Output signal

1. Input signal

The level of the trigger signal input to KP-FM500WCL and KP-FMD500WCL is as follows.

(1) Input from CameraLink cable
LVDS level.

(2) Input from DCIN/SYNC connector
High level : +2.5 to +5.0 V
Low level : 0 to +0.3 V

2. Output signal

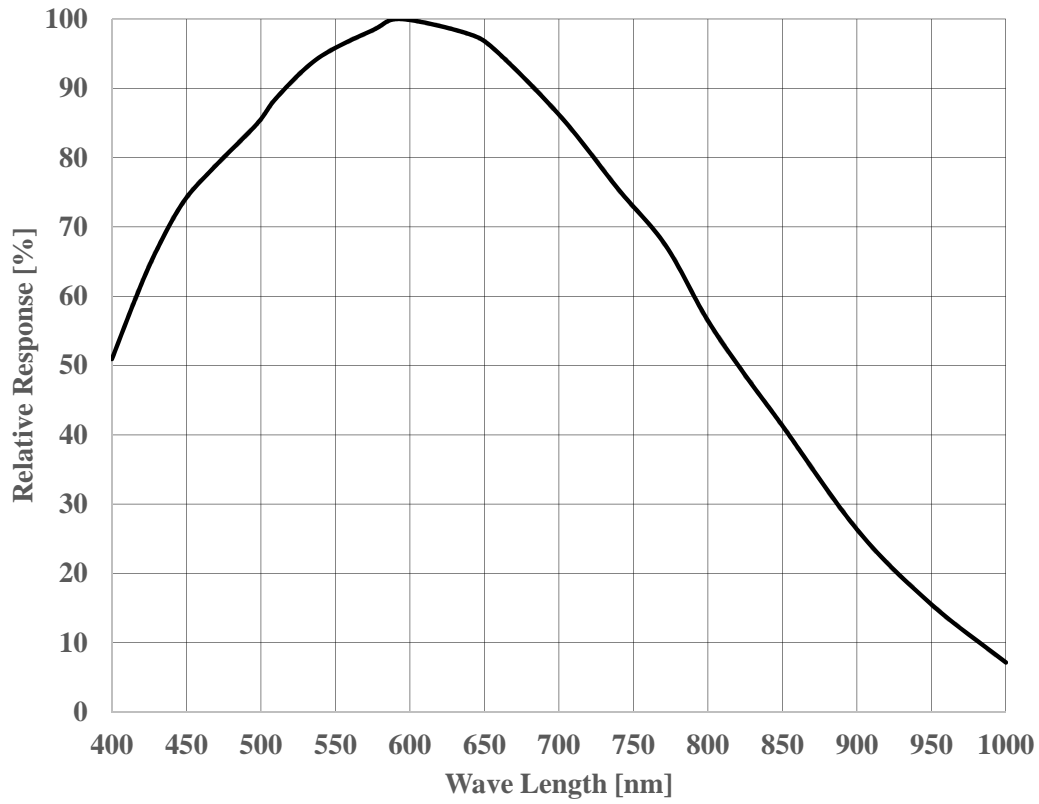
The level of the VD and FLASH output from KP-FM500WCL and KP-FMD500WCL is as follows.

High level : +5.0V
Low level : 0V

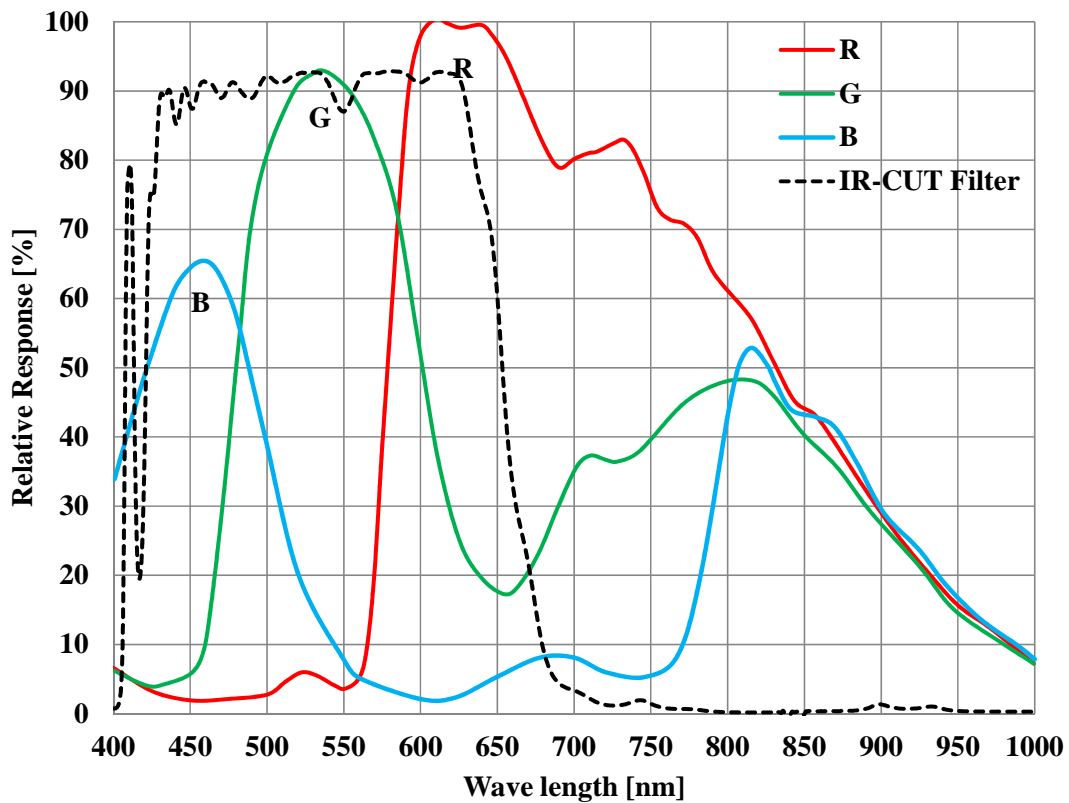
Spectral response

Spectral response of KP-FM500WCL and KP-FMD500WCL are showing.

1. KP-FM500WCL



2. KP-FMD500WCL

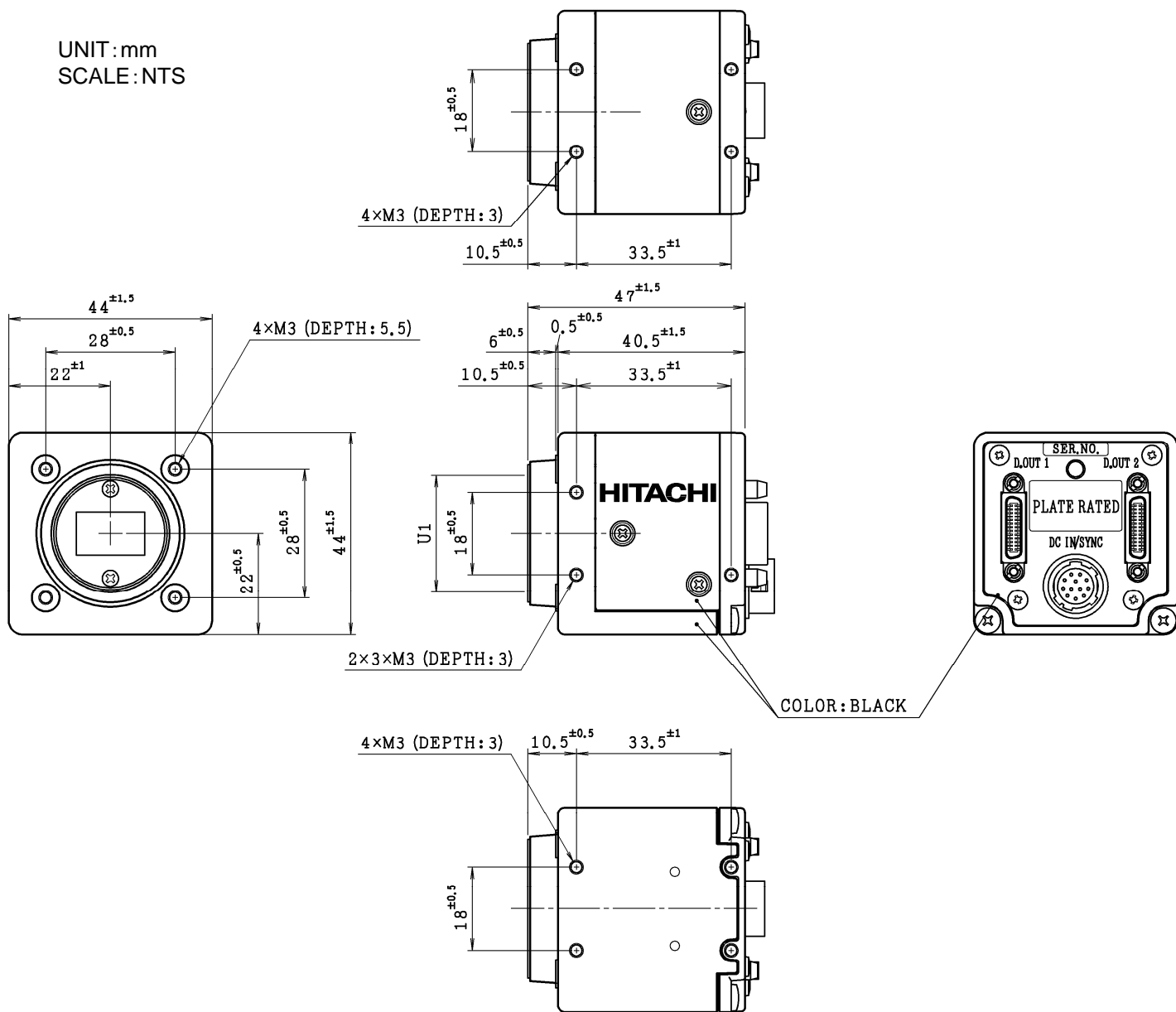


Specifications

	KP-FM500WCL	KP-FMD500WCL
1) Imaging device	2/3 inch global shutter method CMOS	
Effective pixels	2448 (H) x 2048 (V)	
Pixel size	3.45μm (H) x 3.45μm (V)	
Color filter	None	RGB primary color mosaic filter
2) Image area	8.45mm (H) x 7.07mm (V)	
3) Scanning system	Progressive scan	
4) Frame rate	MAX.163 frame per second (full pixel readout)	
5) Horizontal scanning frequency	Deca Configuration(85MHz) : 342.166kHz Deca Configuration(60MHz) : 241.071kHz Full Configuration(85MHz) : 275.000kHz Full Configuration(60MHz) : 193.864kHz Medium Configuration (85MHz) : 138.011kHz Medium Configuration (60MHz) : 97.441kHz Base Configuration (85MHz) : 69.263kHz Base Configuration (60MHz) : 48.881kHz	
6) Vertical scanning (full pixel readout)	Deca Configuration(85MHz) : 163.403Hz Deca Configuration(60MHz) : 115.5Hz Full Configuration(85MHz) : 131.328Hz Full Configuration(60MHz) : 92.58Hz Medium Configuration(85MHz) : 65.908Hz Medium Configuration(60MHz) : 46.533Hz Base Configuration(85MHz) : 33.077Hz Base Configuration(60MHz) : 23.343Hz	
7) Synchronization	Internal	
8) Lens mount	C mount	
9) Flange back	17.526mm(no adjustment)	
10) Optical filter	Dummy glass (AR coated)	IR cut filter
11) Video output	Digital output (CameraLink) Base Configuration 2TAP (85MHz or 60MHz) Medium Configuration 4TAP (85MHz or 60MHz) Full Configuration 8TAP (85MHz or 60MHz) Deca Configuration 10TAP (85MHz or 60MHz)	
Output image size	2048 (H) x 2048 (V) (full pixel readout)	
12) Resolution	Horizontal / Vertical: 2000TV lines	Horizontal / Vertical: 1400TV lines
13) Sensitivity	500 lux, F8, 3200 K	1600 lux, F8, 3200 K
14) S/N	50 dB	
15) Electronic shutter		
Preset	OFF, 1/60, 1/100, 1/250, 1/500, 1/1000, 1/2000, 1/10000, 1/50000 second	
Variable	20μs ~ 655370μs	
16) Gamma	γ = 1	
17) Frame on demand	OFF (Normal mode), Fixed shutter mode, ONE trigger mode	
18) Partial scan	Selectable start position and width of picture grabbing in 4line step	
19) Remote control Control items	TRIGGER, SHUTTER, BINNING, DATA BIT, CONFIG, CLK, FLIP, TEST 12pinOUT, GAIN, BLACK LEVEL, PARTIAL SCAN, FACTORY SETTING	
20) Power supply	DC12V±1V	
21) Power consumption	Approx. 300mA (Approx. 3.6W)	
22) Ambient temperature		
Performance	0°C to +40°C (+32 to +104F) / less than RH 90%	
Operating	-10°C to +50°C (+14 to +122F) / less than RH 90%	
Storage	-20°C to +60°C (-4 to +140F) / less than RH 70% (without dew)	
23) Vibration endurance	15~200Hz(98m/s ²), sweep: 10 minutes x 3 (Total 30min), XYZ(Total 90min)	
24) Shock endurance	686m/ s ² (once each front, back, top, bottom, left and right)	
25) Dimensions	44(W) x 44(H) x 41(D) mm (Not including protrusions)	
26) Mass	Approx. 130g	
27) Standard compositions	Camera, Composition table	

Dimensions

UNIT : mm
SCALE : NTS



Hitachi Kokusai Electric Inc.

32, Miyuki-cho, Kodaira-shi, Tokyo 187-8511, Japan
Phone: +81-50-3383-3432, Fax: +81-42-322-3270
URL: <http://www.hitachi-kokusai.co.jp/global/en/index.html>

Hitachi Kokusai Electric Asia (Singapore) Pte. Ltd.

Office : 7 Tampines Grande, #02-04 Hitachi Square, Singapore 528736
Phone: +65-6212-1945, Fax: +65-6231-2429
URL: <http://www.hitachi-kokusai.com.sg/>

Hitachi Kokusai Electric America, Ltd.

Head Quarter : 150 Crossways Park Drive, Woodbury, NY 11797, U.S.A.
Northeast Office : Phone: 1-516-921-7200
Facsimile: 1-516-496-3718
West Office : 11258 Monarch street Unit H, Garden Grove, CA 92841, U.S.A
Phone: 1-310-328-6116
Facsimile: 1-310-328-6252
Midwest Office : 2531 Technology Drive, Suite 310 Elgin, IL 60124, U.S.A
Phone: 1-847-428-5793
Facsimile: 1-847-428-5785
Midwest Sales : Phone: 1-714-895-6116
Facsimile: 1-714-895-6252
Southeast Sales : Phone: 1-850-934-1234
Facsimile: 1-516-496-3718
Central Sales : Phone: 1-817-490-5124
Facsimile: 1-516-496-3718
URL: <http://www.hitachikokusai.us/>

Hitachi Kokusai Electric Europe GmbH

Frankfurt Head Office : Siemensstrasse 9, D-63263 Neu-Isenburg, Germany
Phone: +49(0)6102-8332-0, Fax: +49(0)6102-202616
London Office : Windsor House, Queensgate, Britannia Road, Waltham Cross,
Hertfordshire, EN8 7NX, United Kingdom
Phone: +44(0)845-1212177, Fax: +44(0)845-1212180
URL: <http://www.hitachi-keu.com/>

Hitachi Kokusai Linear Equipamentos Eletrônicos S/A

Head Office : Rodovia BR 459, No121-A, Km 121 - Bairro Corrego Raso,
Santa Rita do Sapucaí, 37540-000, MG -Brazil
Phone: +55(35)3473-3473, Fax: +55(35)3473-3474
Sales Office : Alameda Santos, 745 -9 Andar- Conj. 91B, Cerqueira Cesar,
São Paulo, 01419-001, SP -Brazil
Phone: +55(11)3541-3244, Fax: +55(11)3541-2425
URL: <http://www.hitachi-linear.com.br/>

Hitachi Kokusai Electric Turkey Elektronik Ürünleri Sanayi ve Ticaret A.Ş.

Head Office : Istanbul Deri OSB VIII-5 Parsel No.1, 34953 Tuzla Istanbul, Turkey
Tuzla Branch: Istanbul Endüstri ve Ticaret Serbest Bölgesi, Akif Kopuz Cad.
No:3 34957 Tuzla Istanbul, Turkey
Phone: 90-216-394-2908
Facsimile: 90-216-394-2909
URL: <http://www.hitachi-kokusai.com.tr/>