

High pixel CMOS camera

# KP-FM400WCL

# KP-FMR400WCL

## 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 June, 2011.

# 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 to 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 fünftigen 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 Waschwassers, 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

Schlitze und Öffnungen im Gehäuse dienen der Ventilation. Sie sind für zuverlässigen Betrieb des Geräts 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 Einbauiinstallation 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 ein 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.

## 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 Netzspannungsschläge.

## 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. Entflammbare und explosive Substanzen

Vermeiden Sie Verwendung dieses Erzeugnisses an Orten mit Gasen bzw. entflammbaren 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 Vollendung 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 défectueuse 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 Denshi 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 applicable 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品的，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材料中的含量超出 SJ/T11363-2006 标准规定的限量要求。

# Declaration of Conformity

**Manufacturer's Name:** Hitachi Kokusai Electric, Inc.  
**Manufacturer's Address:** 4-14-1 Sotokanda, Chiyoda-ku,  
Tokyo 101-8980, Japan

**Representative(s) Address in the EU:** Hitachi Kokusai Electric Europe GmbH  
Siemens Strasse 9, D-63263 Neu- Isenburg,  
Germany

declares, that the product:

**Product Name:** Camera  
**Model Number(s):** KP-FM400WCL/KP-FMR400WCL

conforms to the following Standards:

**EMC:** EN 61000-6-3/2007  
EN 61000-6-1/2007

**Supplementary Information:**

"The product complies with the requirements of the Low Voltage  
Directive 2006/95/EC and the EMC Directive 2004/108/EC."

**Signature:**



K. Enomoto  
Senior Manager  
Quality Assurance Department II  
Hitachi Kokusai Electric Inc.



M. Momose  
Managing Director  
Hitachi Kokusai Electric Europe GmbH

Date: 6th Jun ,2011

# Operating considerations Notes to users

## **1. Important safety notes**

- Use this camera with a 12VDC 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. Contact a Hitachi Denshi service representative.

## **2. Handling**

- Do not attempt to remove cover.
- When installing or removing a lens, be sure to use care that water or dust dose not enter the inside of the camera.

## **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.
- 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.

## **7. Phenomena inherent to CMOS imaging device**

The following phenomena are inherent to a charge coupled device imaging element and do not indicate malfunction.

### **1) Fixed pattern noise**

High ambient temperature 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 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 become 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. It appears only when using it by the Full configuration.

### **7) Horizontal line noise when electronic shutter is used**

The horizontal line noise might appear by setting the exposure time when using it in a normal mode. It becomes easy to see by raising the camera sensitivity.

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## Overview

KP-FM400WCL are Camera Link output type black and white camera which utilized the 1-inch progressive scan CMOS image sensor with square pixel. KP-FMR400WCL are RAW data output type.

The high resolution image of two million pixels is output in no interlace by 150 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
Composition table .....	1

### Optional accessories

(1) 12 pin plug	HR10A-10P-12S(01)
(2) Junction box	JU-F30/JC-100
(3) Dummy glass (AR coated)	ARC1616
(4) IR cut filter	IRC1616
(5) Tripod adaptor	TA-FM200
(6) Mini-Camera Link cable	

### (7) 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 region, use the shield type and install clamp filter (ZCAT 2035-0930A: TDK) at both ends (camera and video processor ends).

## Features

### High resolution

The 1-inch 4,000,000 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 vertical sub sampling 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.

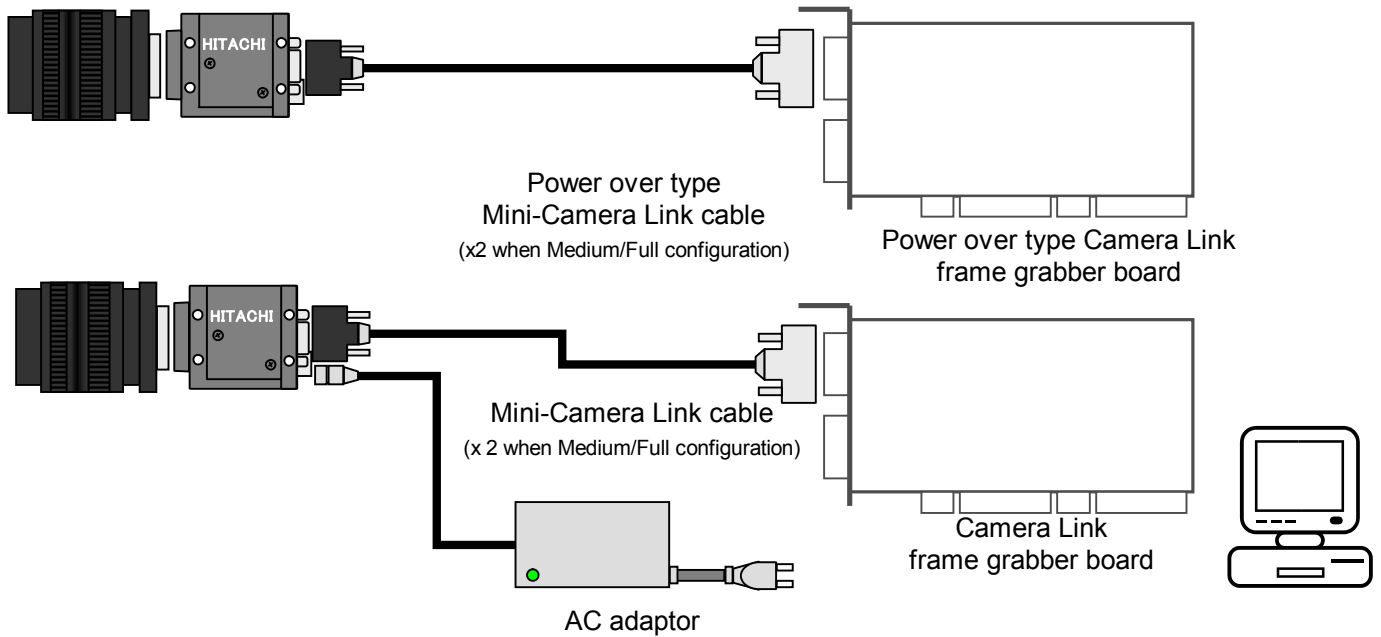
### Automatic power supply change

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

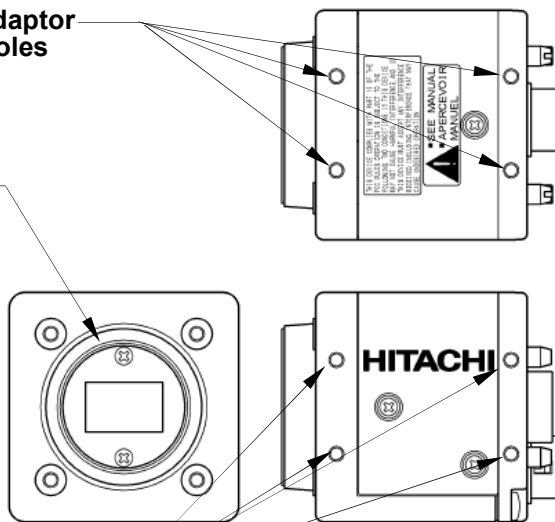
KP-FM400WCL and KP-FMR400WCL connect to frame grabber board using Camera Link cable.



## Section name and functions

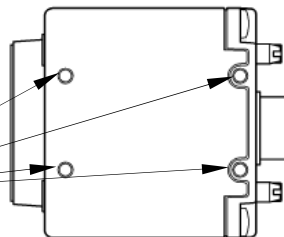
Camera / Tripod adaptor  
mounting screw holes

Lens mount  
(C mount)

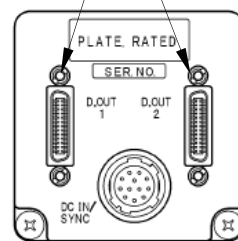


Camera / Tripod adaptor  
mounting screw holes

Camera / Tripod adaptor  
mounting screw holes



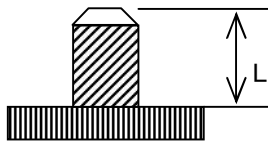
**Camera Link connectors**  
Use for digital video output  
and camera control signal  
input/output signal.  
The power supply from the  
board is also possible.



**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  $5.5\text{mm}$

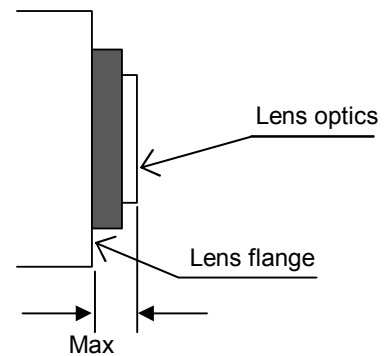
Screws longer than  $5.5\text{ mm}$  can cause internal damage, while less than  $4\text{ mm}$  prevents secure fastening and risks dropping to cause damage and injury.

## 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.

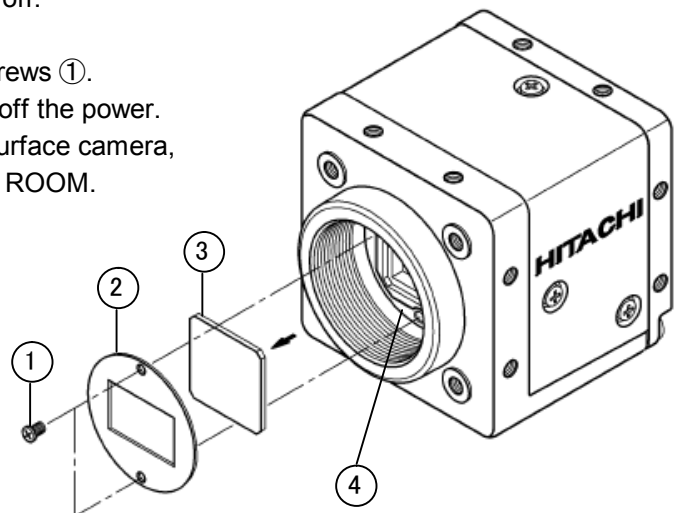
(1) Remove two screws ① and filter holder ② will come off.

(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 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.

## 2. DCIN/SYNC connector

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

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

Plug (matching cable plug) : HR10A-10P-12S(01) HIROSE or equivalent

# Functions and operations

Various mode setup and adjustment of KP-FM400WCL and KP-FMR400WCL 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 7 to 16) about communication method of each command.

## 1. Main functions

### (1) TRIGGER : Setting about external trigger

#### MODE : 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.
- BURST TRIGGER : Trigger mode set to Burst trigger.

#### POLARITY : Select of trigger polarity

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

#### SOURCE : 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.

#### BURST NUM : Setting of number of output frames at Burst trigger mode

- 1 to 65535 frames : The number of continuous output frames at the burst-trigger mode is set.  
(Factory setting : 1 frame).

\*Please refer to "Trigger operation and timing chart" from 28 page to 32 page for details concerning an external trigger mode.

### (2) SHUTTER : Setting of electronic shutter

- OFF (Factory setting) : Shutter operation set to OFF (NORMAL shutter).
- 1/38, 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).

#### VARIABLE VALUE- : Setting speed of VARIABLE shutter.

- 16.125μs to 211367μs : Electronic shutter can be set in the range of 16.125μs to 211367μs in 65535 steps.(Factory setting: 26454.7μs)  
Shutter speed setting value and exposure time can be derived as follows.

$$\text{Exposure time } (\mu\text{s}) = 16.125(\mu\text{s}) + \text{Shutter speed setting value} \times 3.225 (\mu\text{s})$$

#### MULTI SHUT NUM- : Setting of number of frames of multi shutter speed

- 1 to 255 frames : The number of frames of one cycle of multi shutter speeds is set.  
(Factory setting : 1 frame)

#### INC EXP STEP- : The increase amount setting of exposure time of multi shutter speed

- 0 to 211350μs : The exposure time of every one frame amount of an increase is set.  
(Factory setting : 0μs)

### (3) ACCEL : Setting of off between vertical lines

- x1(OFF) to x10 : The magnification of the off reading between vertical lines is set.  
(Factory setting : OFF)

**(4) DATA BIT : Setting of output bit depth**

8bit (Factory setting) : Image is outputted by 8 bit.  
10bit : Image is outputted by 10 bit.

**(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.

**(6) CLK : Setting of Camera Link clock frequency**

80MHz (Factory setting) : Camera Link clock frequency set to 80MHz.  
40MHz : Camera Link clock frequency set to 40MHz.

**(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 lamp image is output.  
V : The vertical lamp image is output.  
HV : The horizontal and vertical lamp image is output.

**(9) 12pinOUT : Setting of the tenth pin of 12 pin 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**

x1~x4 : x1 to x4 are set by 769 steps(0 to 768). (Factory setting : x1)  
 $GAIN = 1 + \text{Setting value} \times 0.00390625$

**(11) BLACK LEVEL : Adjustment of offset level**

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

**(12) PARTIAL SCAN : Setting of partial scanning**

OFF (Factory setting),  
1AREA to 8AREA : The number of areas of partial scan is set.  
**AREA START (1th to 8th) : Setting of starting position in scan area (1th to 8th).**  
1 to 1088 : Scan is started from the line set up in 1 to 2048.  
**AREA WIDTH (1th to 8th) : Setting of width of scan area (1th to 8th).**  
1 to 1088 : Scan is performed number of line set up in 1 to 2048.

**(13) FACTORY SETTING**

SET : Return to the factory settings.

# Remote control

## 1. Comms\* specifications

•Control system	: Start-stop synchronization system
•Transmission rate	: 9600 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.

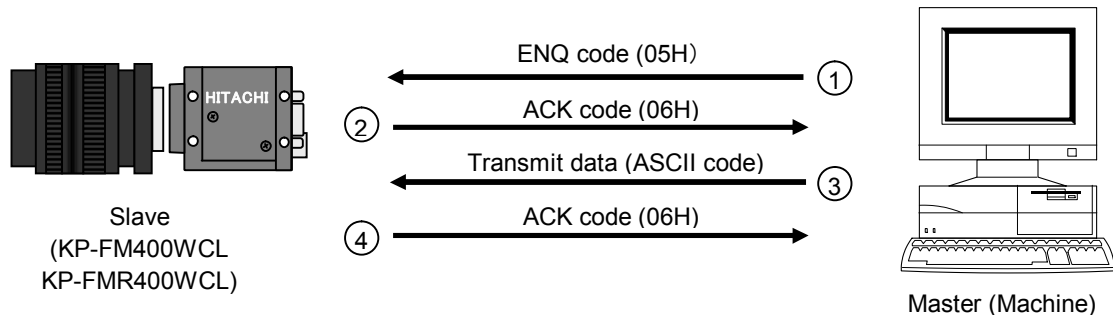
## 3. Comms procedure

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)

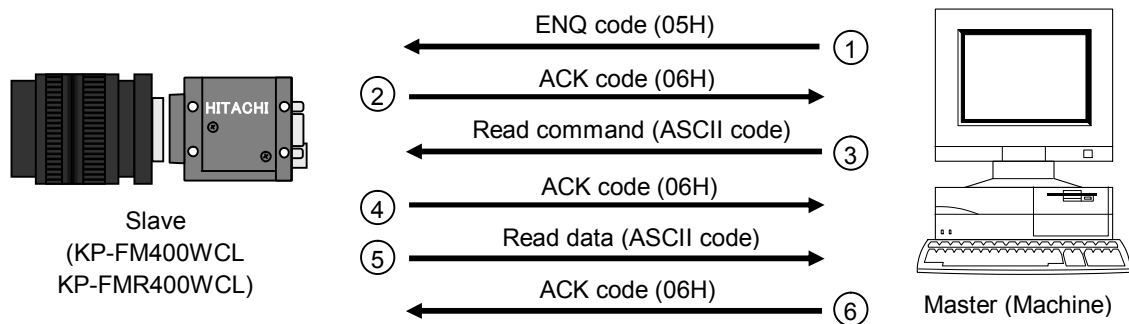
The receive protect timer for master and slave processes is 1 second. For example, if 1 block of TEXT data is being received, if the data interval exceeds 1 second, error is produced and the data are lost. An acknowledgment of data receipt is not produced.

### (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.

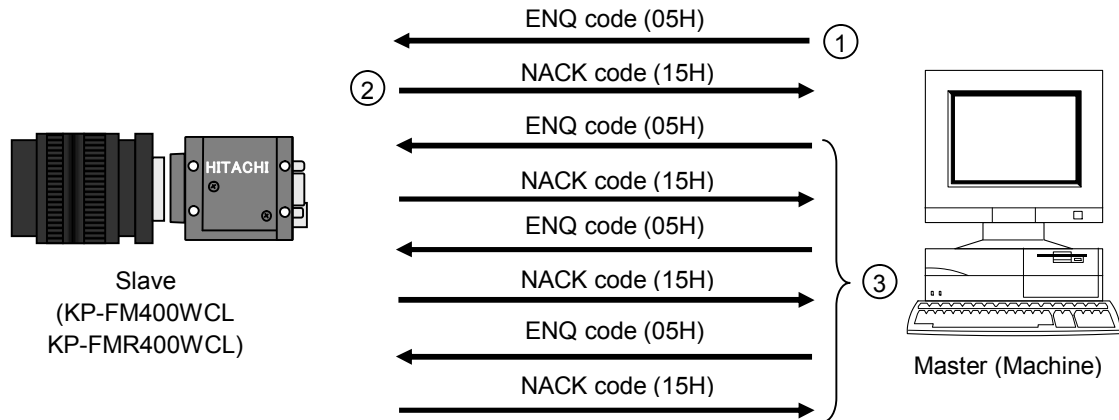
### (2) Master reads data (normal process)



- 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)



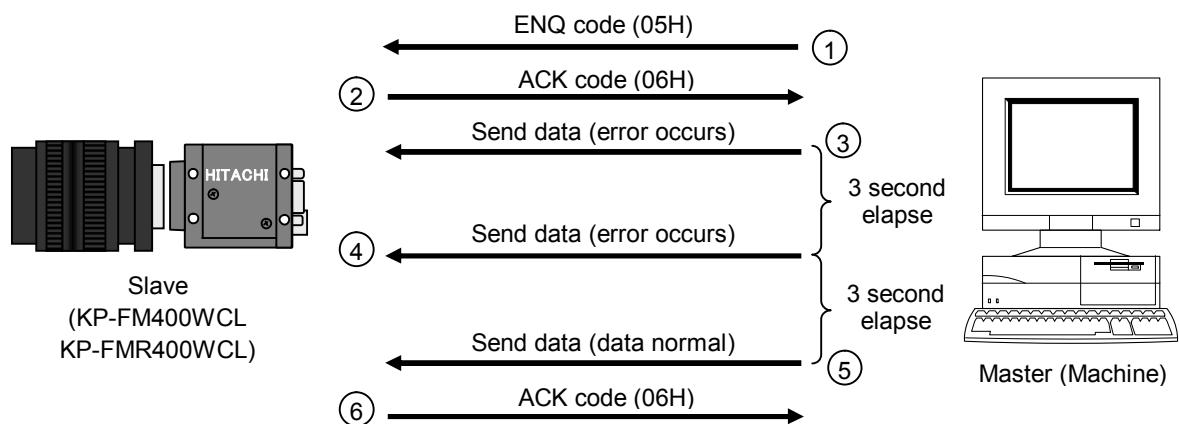
① Master sends ENQ code to slave.

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.

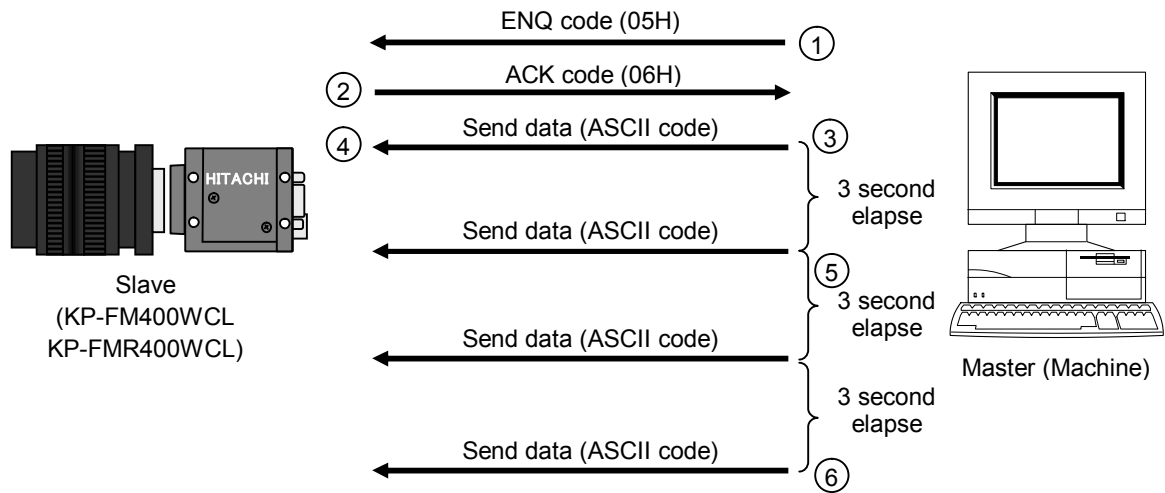
③ Master sends data, but slave detect error (framing, over-run error).

④ Slave detects error and does not accept data.

⑤ Sequence 3 and 4 repeats, then master transfers normal data.

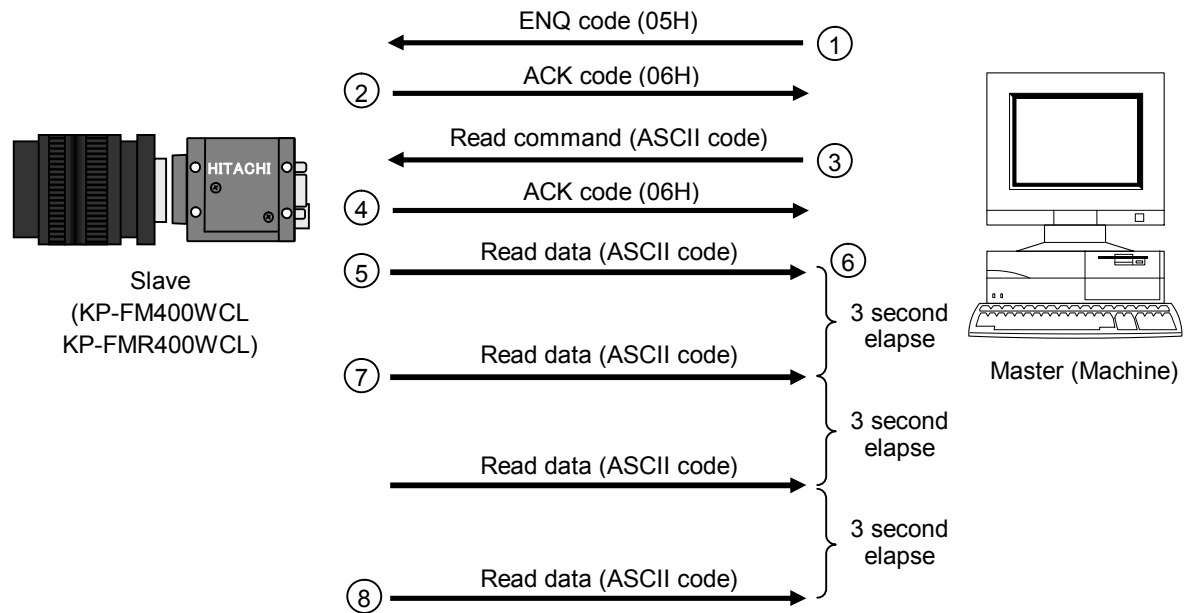
⑥ Slave detects normal data and returns ACK code to master to end the session.

## (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.

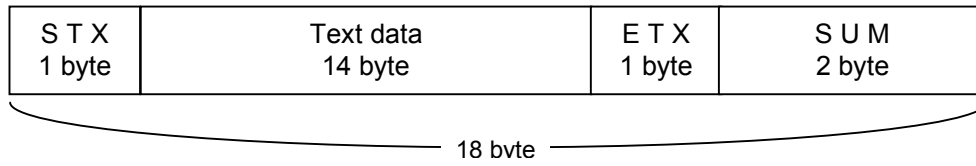
#### 4. Comms command data format

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

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

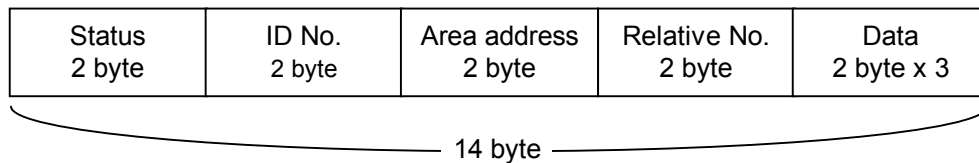
(b) Comms byte quantity is 18.

(c) Comms data format (transmission sequence).



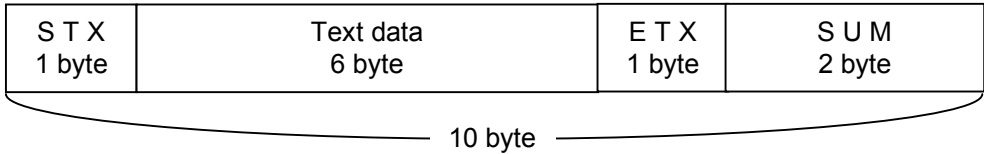
- STX (start code) : Code indicating start of text.  
1 byte (02H)
- Text data : Transmit / receive data.  
14 byte (ASCII code)
- ETX (end code) : Code indicating end of text.  
1 byte (03H)
- SUM : XOR result (FFH), of adding STX, Text data, and ETX.  
2 byte (ASCII code)

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



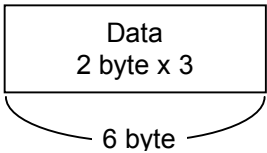
- Status : Transmission data status.  
2 byte (ASCII code)  
Used for EEPROM write (0: write absent, 1: write present).
- ID No. : Camera peculiar ID.  
KP-FM400WCL and KP-FMR400WCL have (FFH).  
2 byte (ASCII code)
- Area address : Classification of Send data (01H) and Read command (81H).  
2 byte (ASCII code)
- Relative No. : Sets number (0 to 255) 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	0x00	0x00
2	Upper	Lower	0x00
3	Upper	Mid	Lower

### 5. Calculation method of checksum

Example

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

- STAUTUS to DATA are transformed into hexadecimal number on the basis of the ASCII code.  
'0'→(30)<sub>16</sub>    '1'→(31)<sub>16</sub>    '4'→(34)<sub>16</sub>    'F'→(46)<sub>16</sub>    STX: (02)<sub>16</sub>    ETX: (03)<sub>16</sub>
- STX to ETX are added all.  

$$(02)_{16}+(30)_{16}+(31)_{16}+(46)_{16}+(46)_{16}+(30)_{16}+(31)_{16}+(30)_{16}+(34)_{16}+(30)_{16}+(30)_{16}+(30)_{16}+(30)_{16}+(30)_{16}+(03)_{16} = (2D7)_{16}$$

STX
STATUS
ID
AREA
RELATIVE
DATA
ETX
- The XOR (Exclusive OR) between the value obtained in 2 clause and (FF)<sub>16</sub> are taken, then two column under the answer become SUM  

$$(2D7)_{16} \text{ XOR } (FF)_{16} = (228)_{16}$$

# Command list

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	02	01	FF	01	04	00	00	00	03	28
		FIXED	02	01	FF	01	04	01	00	00	03	27
		1TRIG	02	01	FF	01	04	02	00	00	03	26
		BURST	02	01	FF	01	04	03	00	00	03	25
	POLARITY	POSITIVE	02	01	FF	01	0F	00	00	00	03	16
		NEGATIVE	02	01	FF	01	0F	01	00	00	03	15
	SOURCE	CL-CC1	02	01	FF	01	05	00	00	00	03	27
		12pin	02	01	FF	01	05	01	00	00	03	26
	BURST NUM (2Byte)	1 Frame	02	01	FF	01	07	00	01	00	03	24
		65535 Frame	02	01	FF	01	07	FF	FF	00	03	CD
SHUTTER SPEED (*2)	PRESET	OFF	02	01	FF	01	08	00	00	00	03	24
		1/38	02	01	FF	01	08	01	00	00	03	23
		1/100	02	01	FF	01	08	02	00	00	03	22
		1/250	02	01	FF	01	08	03	00	00	03	21
		1/500	02	01	FF	01	08	04	00	00	03	20
		1/1000	02	01	FF	01	08	05	00	00	03	1F
		1/2000	02	01	FF	01	08	06	00	00	03	1E
		1/10000	02	01	FF	01	08	07	00	00	03	1D
		1/50000	02	01	FF	01	08	08	00	00	03	1C
		VARIABLE	02	01	FF	01	08	FF	00	00	03	F8
	VARIABLE (*3) VALUE (2Byte)	MIN(16.125us)	02	01	FF	01	11	00	00	00	03	2A
		26454.7 us	02	01	FF	01	11	20	06	00	03	22
		MAX (211367us)	02	01	FF	01	11	FF	FF	00	03	D2
	MULTI SHUT NUM(*4)	1 Frame	02	01	FF	01	09	01	00	00	03	22
		255 Frame	02	01	FF	01	09	FF	00	00	03	F7
	INC EXP STEP (2Byte) (*5)	0us	02	01	FF	01	0A	00	00	00	03	1B
		211350us	02	01	FF	01	0A	FF	FF	00	03	C3
CONFIG	BASE		02	01	FF	01	12	00	00	00	03	29
	MEDIUM		02	01	FF	01	12	01	00	00	03	28
	FULL		02	01	FF	01	12	02	00	00	03	27
CLK	80MHz		02	01	FF	01	19	00	00	00	03	22
	40MHz		02	01	FF	01	19	01	00	00	03	21
ACCEL	OFF(x1)		02	01	FF	01	13	00	00	00	03	28
	x10		02	01	FF	01	13	09	00	00	03	1F
DATA BIT	8bit		02	01	FF	01	14	00	00	00	03	27
	10bit		02	01	FF	01	14	01	00	00	03	26
GAIN (2Byte) (*6)	x1 (0)		02	01	FF	01	0C	00	00	00	03	19
	x4 (768)		02	01	FF	01	0C	03	00	00	03	16
BLACK LEVEL (*7)	MIN (0/255)		02	01	FF	01	17	00	00	00	03	24
	MAX (127/255)		02	01	FF	01	17	7F	00	00	03	07
TEST PATTERN	OFF		02	01	FF	01	50	00	00	00	03	27
	H		02	01	FF	01	50	01	00	00	03	26
	V		02	01	FF	01	50	02	00	00	03	25
	HV		02	01	FF	01	50	03	00	00	03	24
FLIP	OFF		02	01	FF	01	51	00	00	00	03	26
	H		02	01	FF	01	51	01	00	00	03	25
	V		02	01	FF	01	51	02	00	00	03	24
	HV		02	01	FF	01	51	03	00	00	03	23

(\*1) BURST NUM becomes effective at the BURST trigger mode. It is selectable in the range from 0001<sub>16</sub> to FFFF<sub>16</sub>.

(\*2) The setting of SHUTTER SPEED becomes invalid at the ONE trigger mode.

(\*3) VARIABLE VALUE becomes effective only when VARIABLE is selected. It is selectable in the range from 0000<sub>16</sub> to FFFF<sub>16</sub>.

(\*4) MULTI SHUT NUM is selectable in the range from 00<sub>16</sub> to FF<sub>16</sub>.

(\*5) INC EXP STEP is selectable in the range from 0000<sub>16</sub> to FFFF<sub>16</sub>.

(\*6) GAIN is selectable in the range from 0000<sub>16</sub> to 0300<sub>16</sub>.

(\*7) BLACK LEVEL is selectable in the range from 00<sub>16</sub> to 7F<sub>16</sub>.

Item			STX	1	2	3	4	5	6	7	ETX	SUM
				STATUS	ID NO.	AREA ADDRESS	RELATIVE NO.	DATA				
PARTIAL SCAN (*8)	AREA	OFF	02	01	FF	01	1E	00	00	00	03	16
		1AREA	02	01	FF	01	1E	01	00	00	03	15
		8AREA	02	01	FF	01	1E	08	00	00	03	0E
	AREA1 START (2Byte)	1	02	01	FF	01	1F	00	01	00	03	14
		2048	02	01	FF	01	1F	08	00	00	03	0D
	AREA1 WIDTH (2Byte)	1	02	01	FF	01	20	00	01	00	03	29
		2048	02	01	FF	01	20	08	00	00	03	22
	AREA2 START (2Byte)	1	02	01	FF	01	21	00	01	00	03	28
		2048	02	01	FF	01	21	08	00	00	03	21
	AREA2 WIDTH (2Byte)	1	02	01	FF	01	22	00	01	00	03	27
		2048	02	01	FF	01	22	08	00	00	03	20
	AREA3 START (2Byte)	1	02	01	FF	01	23	00	01	00	03	26
		2048	02	01	FF	01	23	08	00	00	03	1F
	AREA3 WIDTH (2Byte)	1	02	01	FF	01	24	00	01	00	03	25
		2048	02	01	FF	01	24	08	00	00	03	1E
	AREA4 START (2Byte)	1	02	01	FF	01	25	00	01	00	03	24
		2048	02	01	FF	01	25	08	00	00	03	1D
	AREA4 WIDTH (2Byte)	1	02	01	FF	01	26	00	01	00	03	23
		2048	02	01	FF	01	26	08	00	00	03	1C
	AREA5 START (2Byte)	1	02	01	FF	01	27	00	01	00	03	22
		2048	02	01	FF	01	27	08	00	00	03	1B
	AREA5 WIDTH (2Byte)	1	02	01	FF	01	28	00	01	00	03	21
		2048	02	01	FF	01	28	08	00	00	03	1A
	AREA6 START (2Byte)	1	02	01	FF	01	29	00	01	00	03	20
		2048	02	01	FF	01	29	08	00	00	03	19
	AREA6 WIDTH (2Byte)	1	02	01	FF	01	2A	00	01	00	03	18
		2048	02	01	FF	01	2A	08	00	00	03	11
	AREA7 START (2Byte)	1	02	01	FF	01	2B	00	01	00	03	17
		2048	02	01	FF	01	2B	08	00	00	03	10
	AREA7 WIDTH (2Byte)	1	02	01	FF	01	2C	00	01	00	03	16
		2048	02	01	FF	01	2C	08	00	00	03	0F
	AREA8 START (2Byte)	1	02	01	FF	01	2D	00	01	00	03	15
		2048	02	01	FF	01	2D	08	00	00	03	0E
	AREA8 WIDTH (2Byte)	1	02	01	FF	01	2E	00	01	00	03	14
		2048	02	01	FF	01	2E	08	00	00	03	0D
FACTORY SETTING		SET	02	01	FF	01	45	01	00	00	03	22

(\*8) PARTIAL SCAN START/WIDTH are selectable in the range from 0001<sub>16</sub> to 0800<sub>16</sub> and the sum total of START and WIDTH is 2049 or less.

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	02	00	FF	81	04	00	00	00	03	21
	POLARITY	02	00	FF	81	0F	00	00	00	03	10
	SOURCE	02	00	FF	81	05	00	00	00	03	20
	BURST NUM	02	00	FF	81	07	00	00	00	03	1E
SHUTTER SPEED	PRESET	02	00	FF	81	08	00	00	00	03	1D
	VARIABLE VALUE	02	00	FF	81	11	00	00	00	03	23
	MULTI SHUT NUM	02	00	FF	81	09	00	00	00	03	1C
	INC EXP STEP	02	00	FF	81	0A	00	00	00	03	14
CONFIG		02	00	FF	81	12	00	00	00	03	22
CLK		02	00	FF	81	19	00	00	00	03	1B
ACCEL		02	00	FF	81	13	00	00	00	03	21
DATA BIT		02	00	FF	81	14	00	00	00	03	20
GAIN		02	00	FF	81	0D	00	00	00	03	11
BLACK LEVEL		02	00	FF	81	17	00	00	00	03	1D
TEST PATTERN		02	00	FF	81	50	00	00	00	03	20
FLIP		02	00	FF	81	51	00	00	00	03	1F
PARTIAL SCAN	AREA	02	00	FF	81	1E	00	00	00	03	0F
	AREA1 START	02	00	FF	81	1F	00	00	00	03	0E
	AREA1 WIDTH	02	00	FF	81	20	00	00	00	03	23
	AREA2 START	02	00	FF	81	21	00	00	00	03	22
	AREA2 WIDTH	02	00	FF	81	22	00	00	00	03	21
	AREA3 START	02	00	FF	81	23	00	00	00	03	20
	AREA3 WIDTH	02	00	FF	81	24	00	00	00	03	1F
	AREA4 START	02	00	FF	81	25	00	00	00	03	1E
	AREA4 WIDTH	02	00	FF	81	26	00	00	00	03	1D
	AREA5 START	02	00	FF	81	27	00	00	00	03	1C
	AREA5 WIDTH	02	00	FF	81	28	00	00	00	03	1B
	AREA6 START	02	00	FF	81	29	00	00	00	03	1A
	AREA6 WIDTH	02	00	FF	81	2A	00	00	00	03	12
	AREA7 START	02	00	FF	81	2B	00	00	00	03	11
	AREA7 WIDTH	02	00	FF	81	2C	00	00	00	03	10
	AREA8 START	02	00	FF	81	2D	00	00	00	03	0F
AREA8 WIDTH	02	00	FF	81	2E	00	00	00	03	0E	

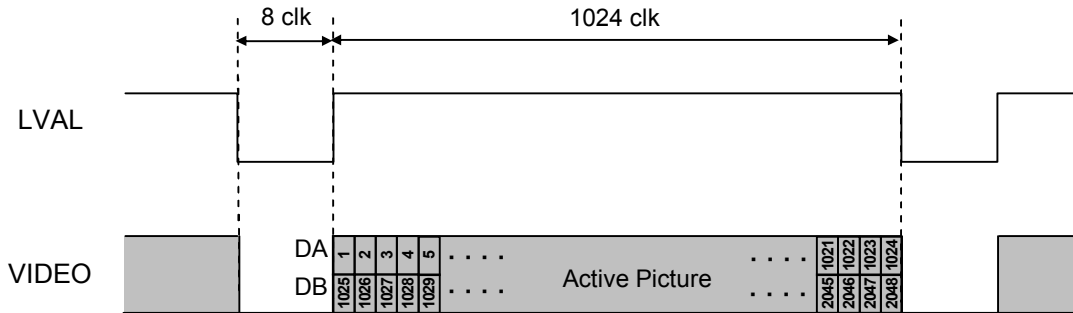
The reading data from the Slave is based on "4. Comms command data format(2)" of "Remote control" (page 13).



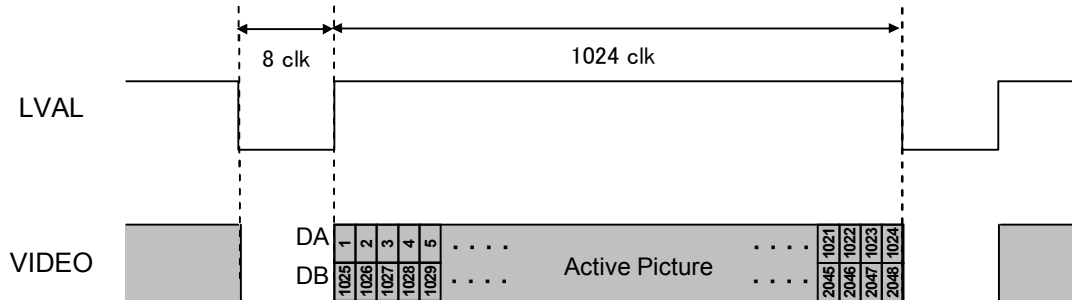
# Camera Link output timing chart

## 1. Horizontal timing

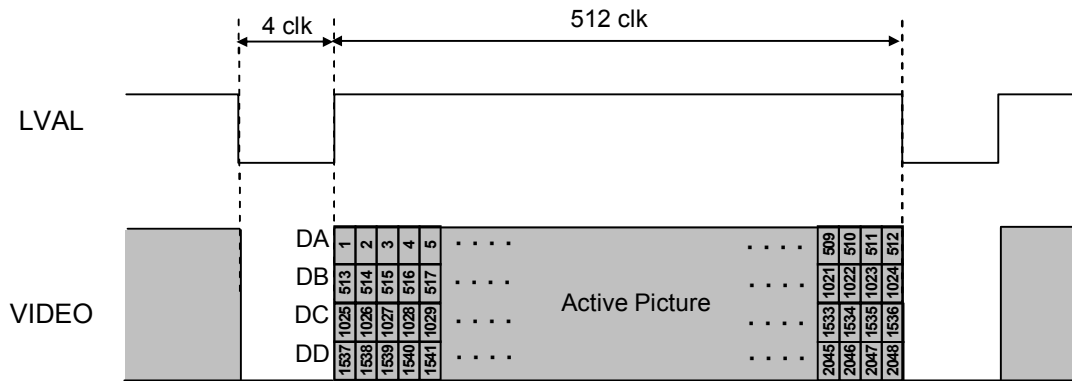
(1) 80MHz Base configuration (1 clk = 12.5 ns)



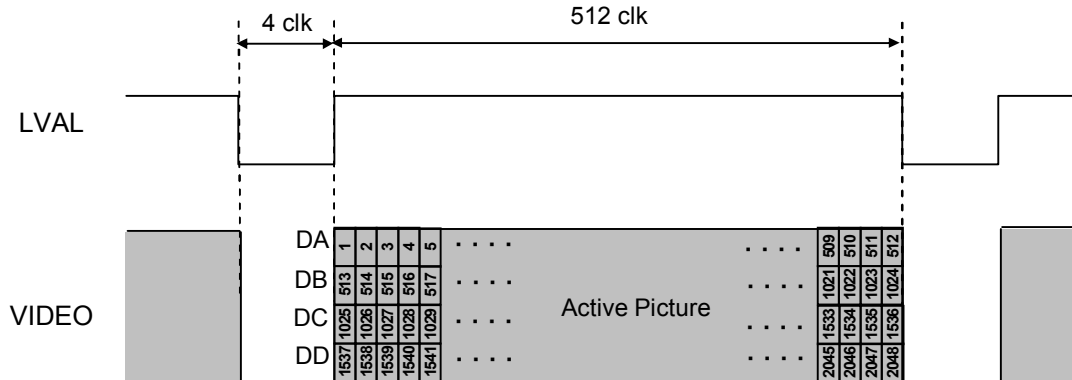
(2) 40MHz Base configuration (1 clk = 25 ns)



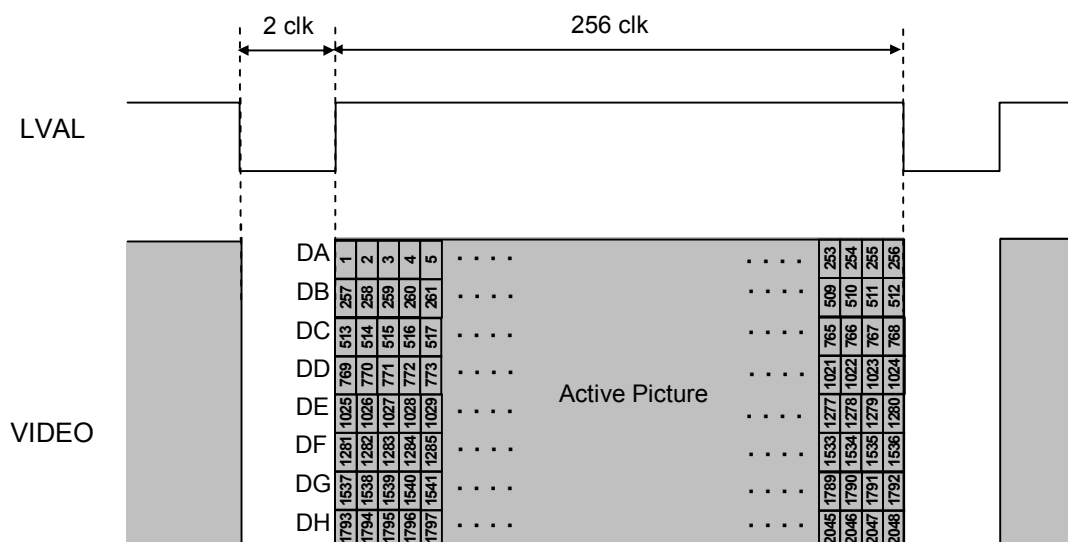
(3) 80MHz Medium configuration (1 clk = 12.5 ns)



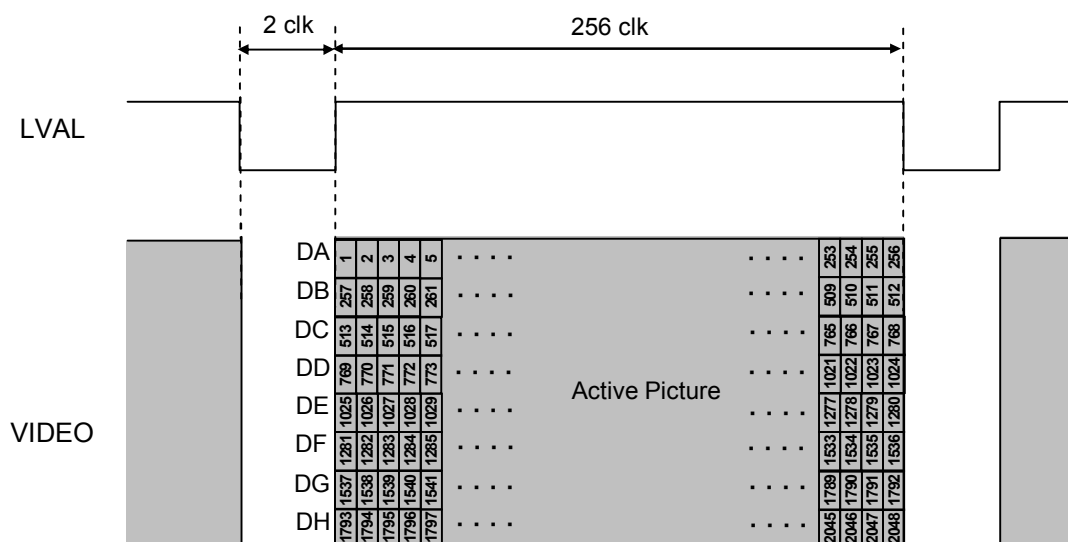
(4) 40MHz Medium configuration (1 clk = 25 ns)



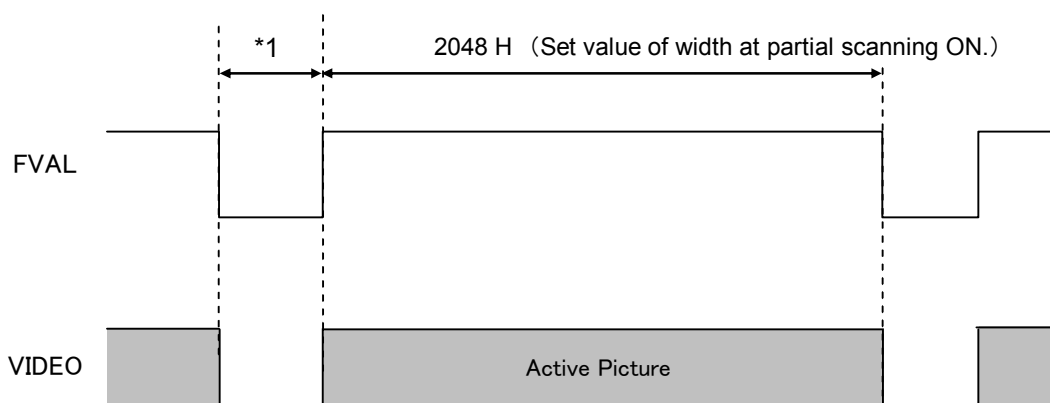
(5) 80MHz Full configuration (1 clk = 12.5 ns)



(6) 40MHz Full configuration (1 clk = 25 ns)



## 2. Vertical timing



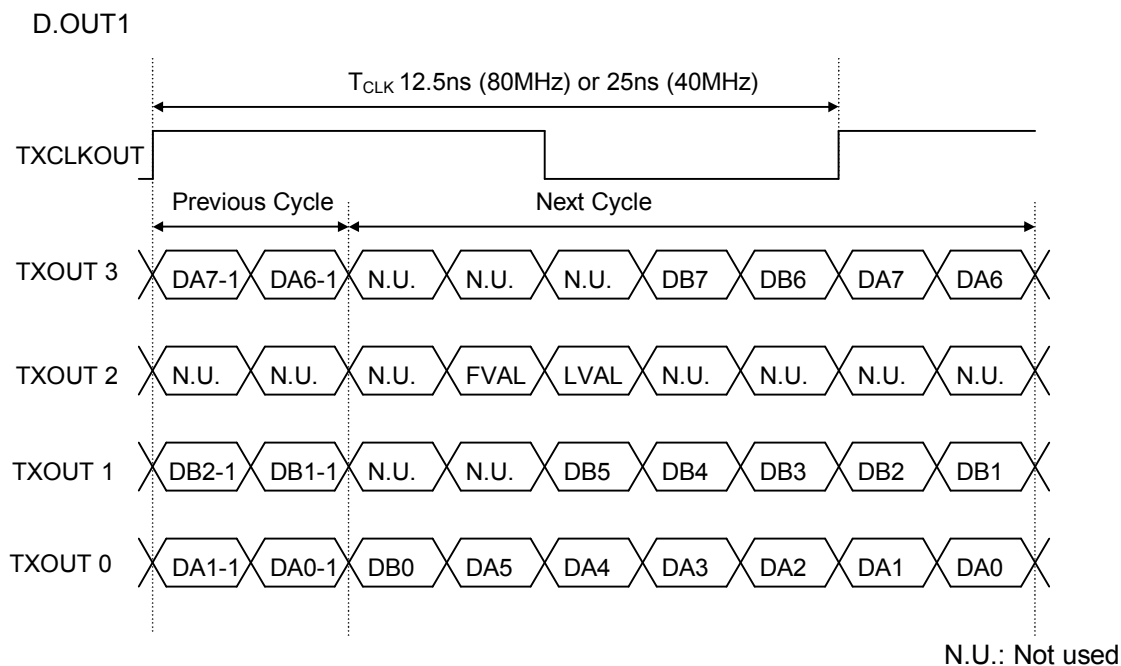
One horizontal period and blanking period (\*1) are different because of the setting of the configuration and the clock frequency.

Cameralink output setting	One horizontal period	Blanking period (*1)
Base configuration 40MHz	1H = 25.800μs	3.25H
Base configuration 80MHz	1H = 12.900μs	4.5H
Medium configuration 40MHz	1H = 12.900μs	4.5H
Medium configuration 80MHz	1H = 6.450μs	7H
Full configuration 40MHz	1H = 6.450μs	7H
Full configuration 80MHz	1H = 3.225μs	12H

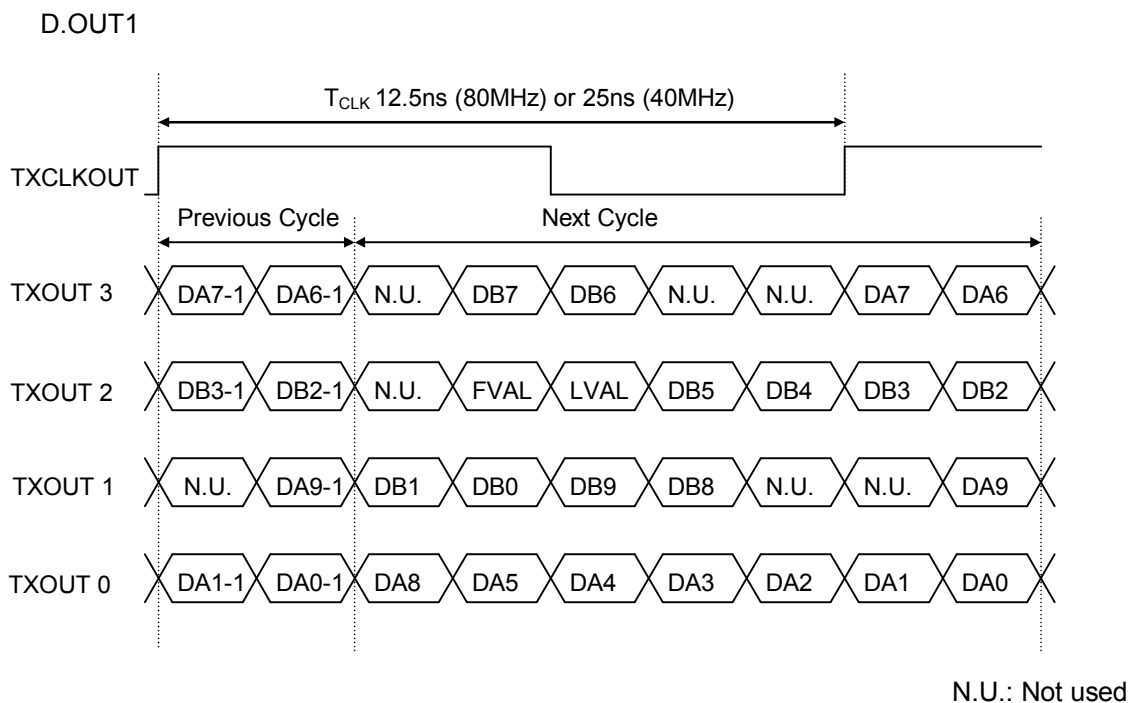
### 3. Transmitter LVDS output pulse position measurement

#### (1)Base configuration

##### (a)8bit



##### (b)10bit



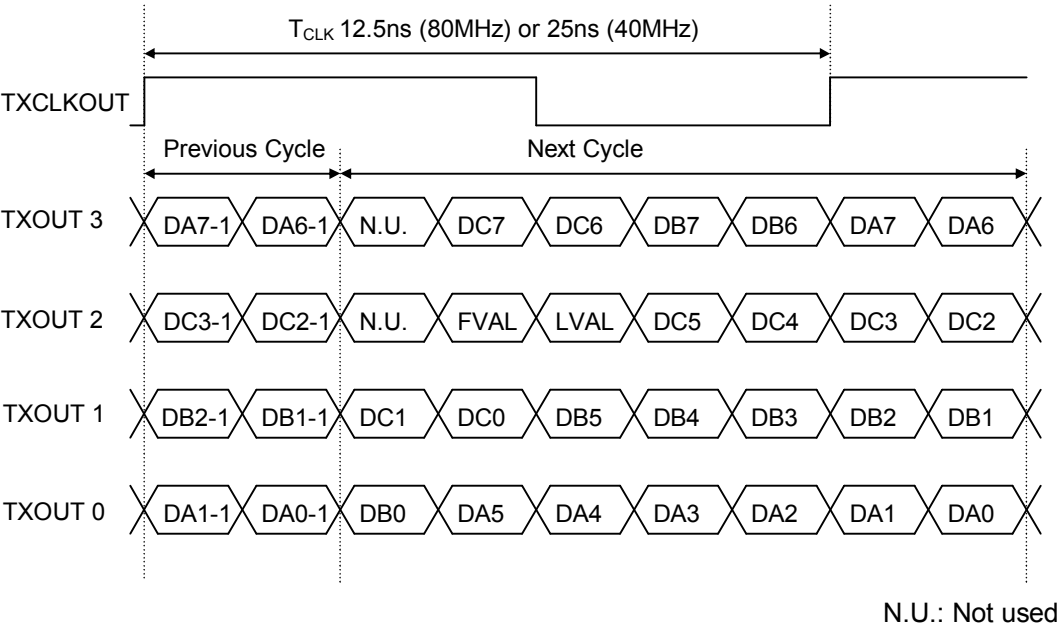
\* When using Base configuration, please be sure to connect to CameraLink cable to D.OUT1.

If the cable is connected to D.OUT2, the machine may break down.

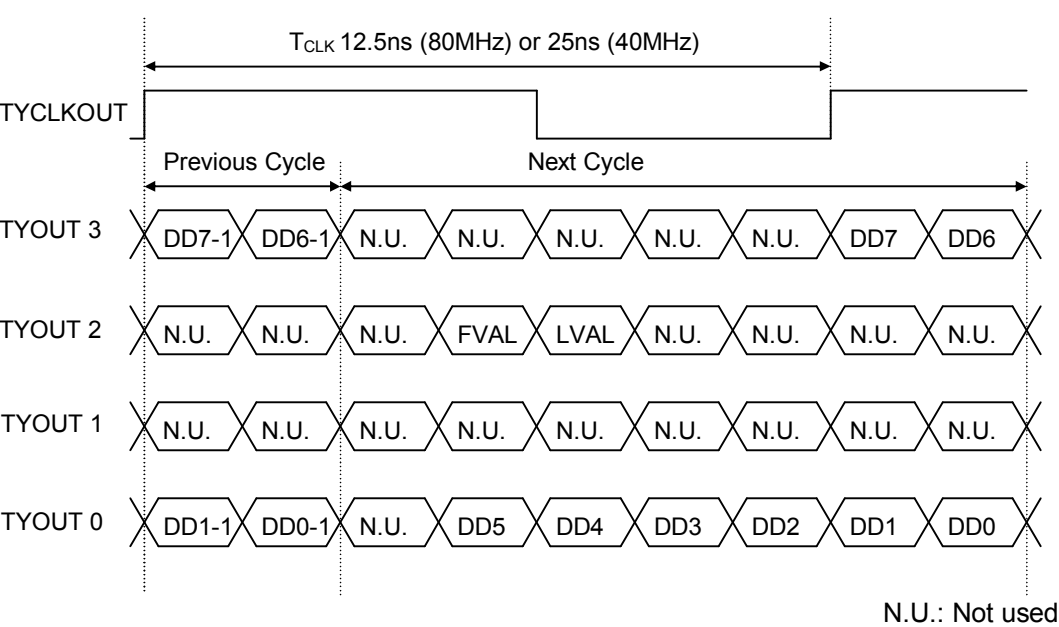
(2)Medium configuration

(a)8bit

D.OUT1

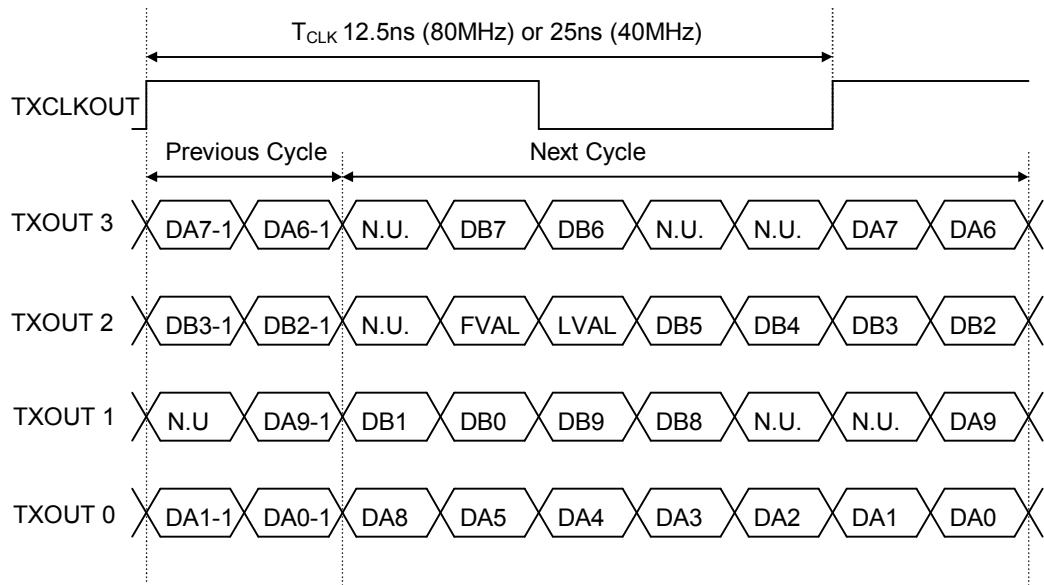


D.OUT2



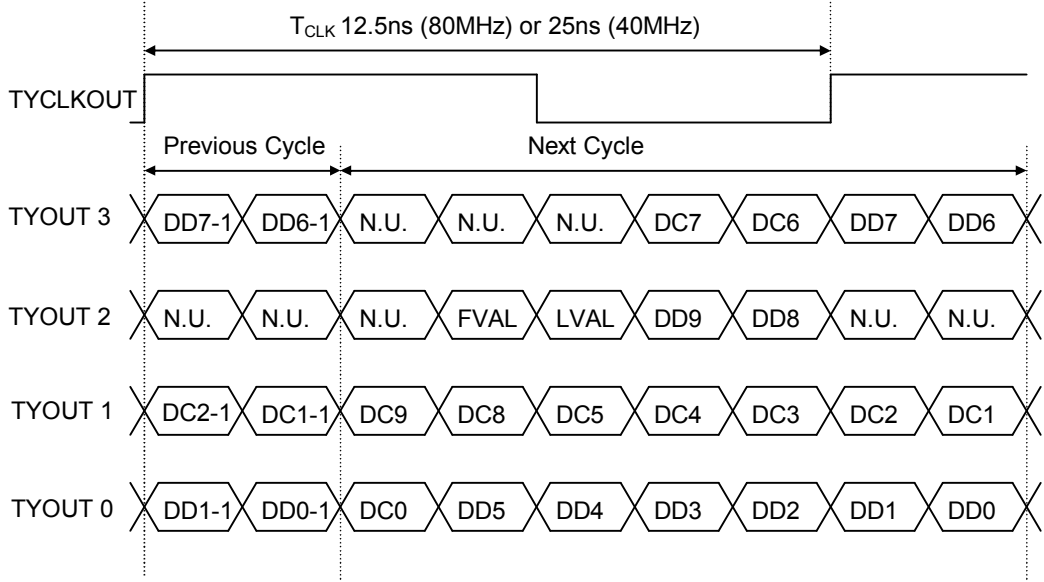
(b) 10bit

D.OUT1



N.U.: Not used

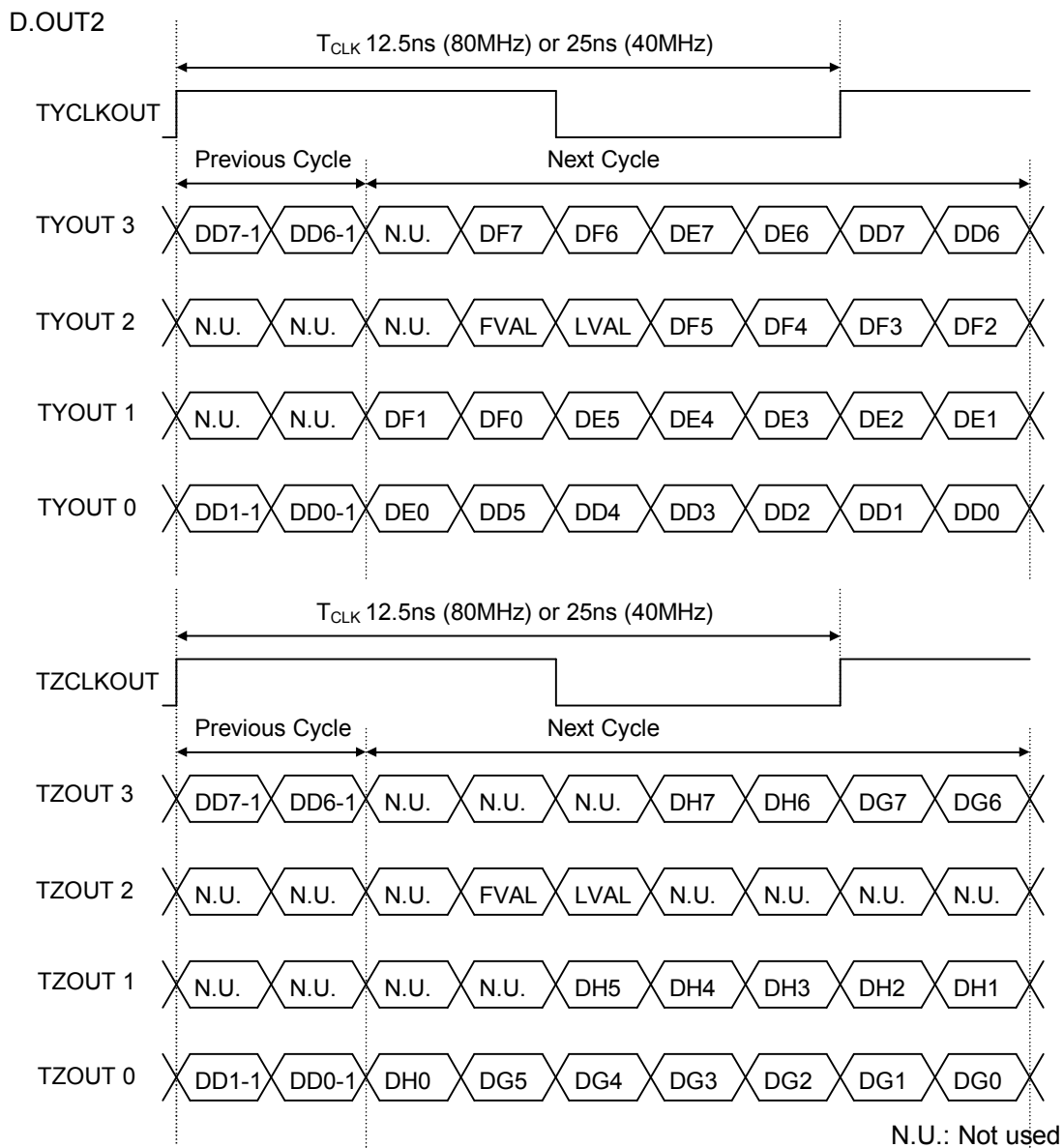
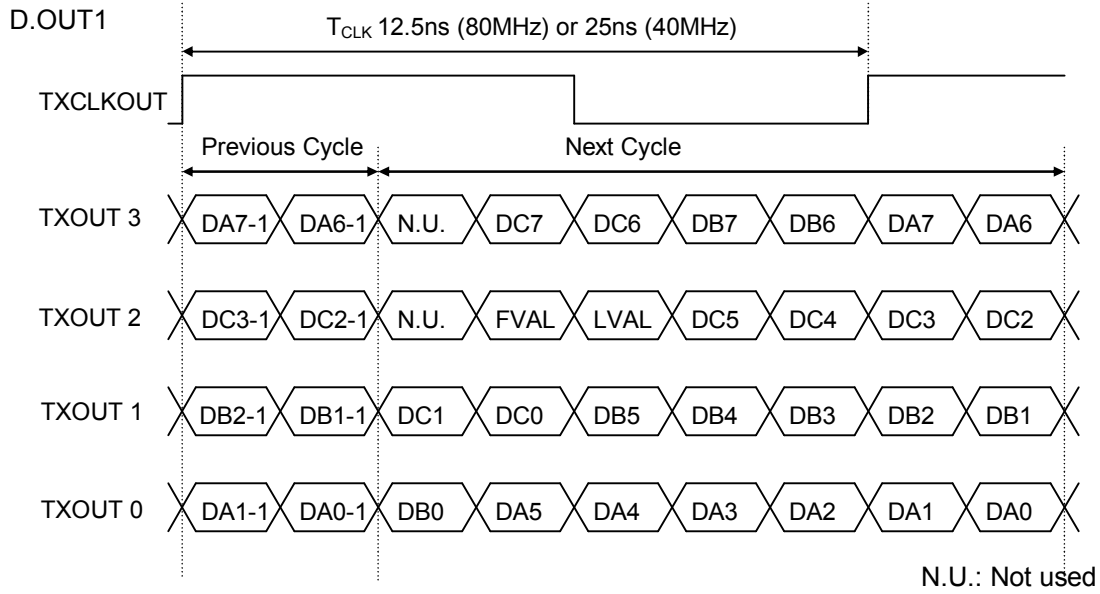
D.OUT2



N.U.: Not used

### (3) Full configuration

#### (a) 8bit

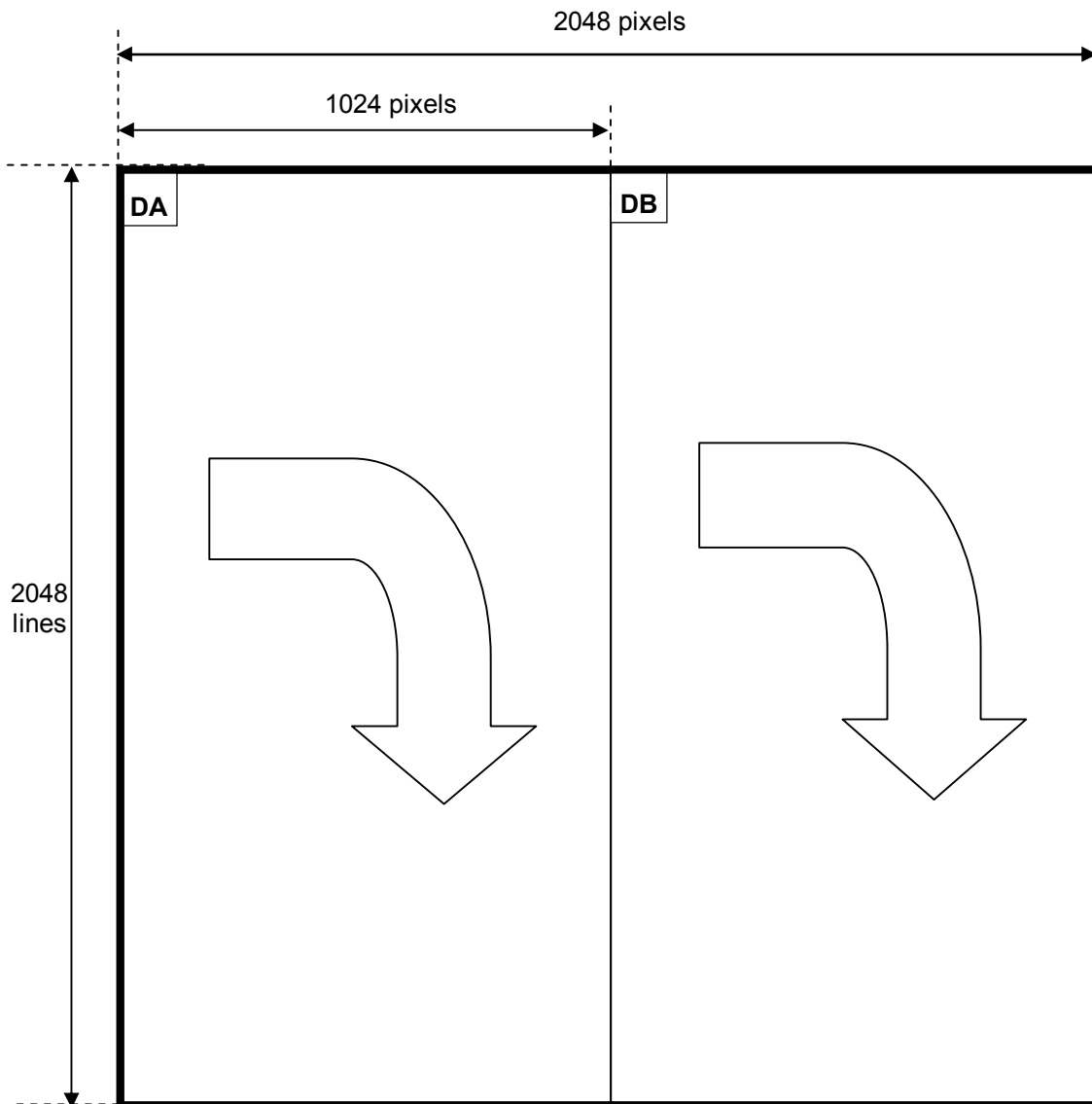


#### 4. Output sequence

DA, DB, DC, DD, DE, DF, DG and DH show output TAP of the cameralink.

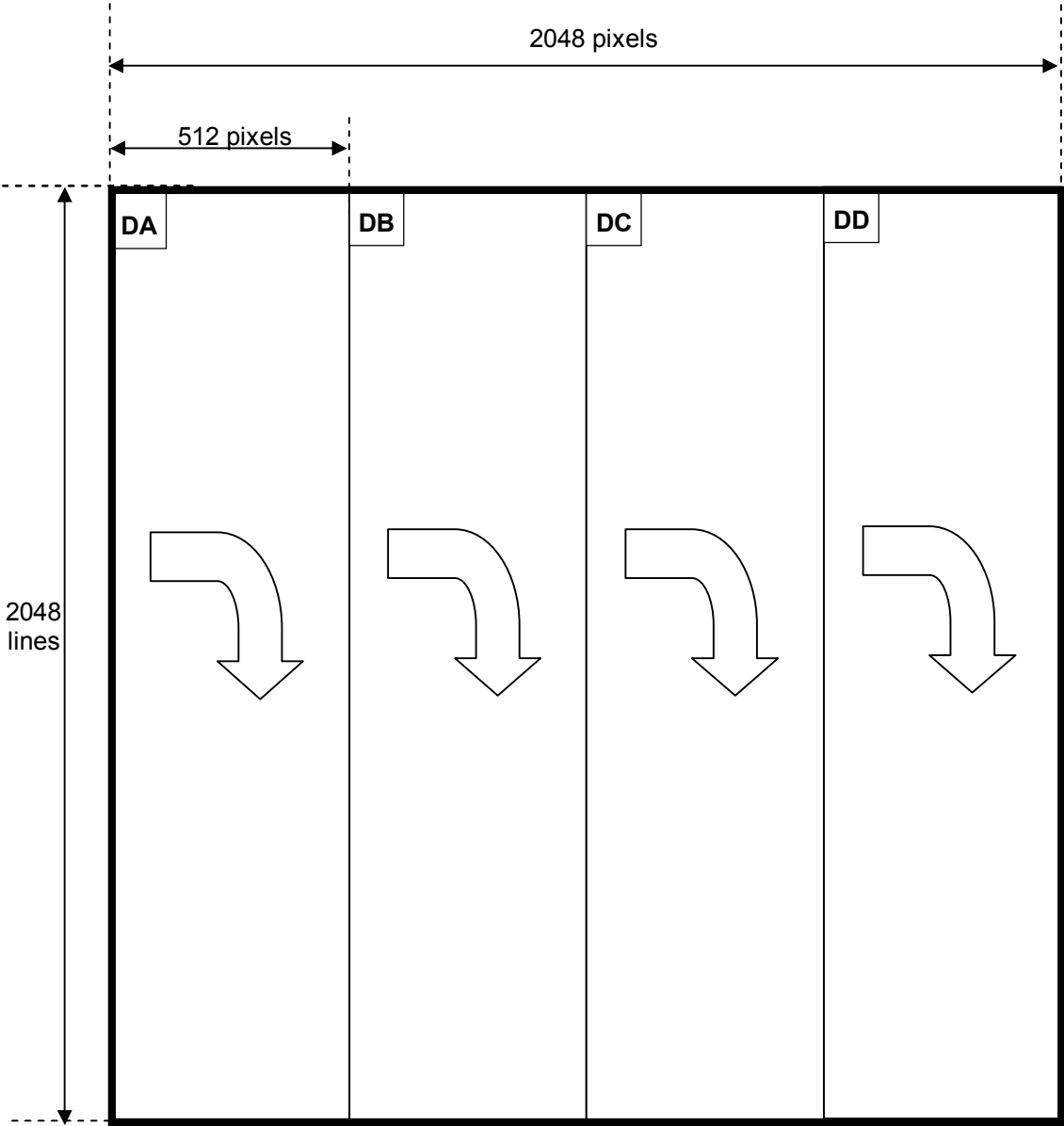
Refer to “Transmitter LVDS output pulse position measurement” for details.

##### (1) Base configuration

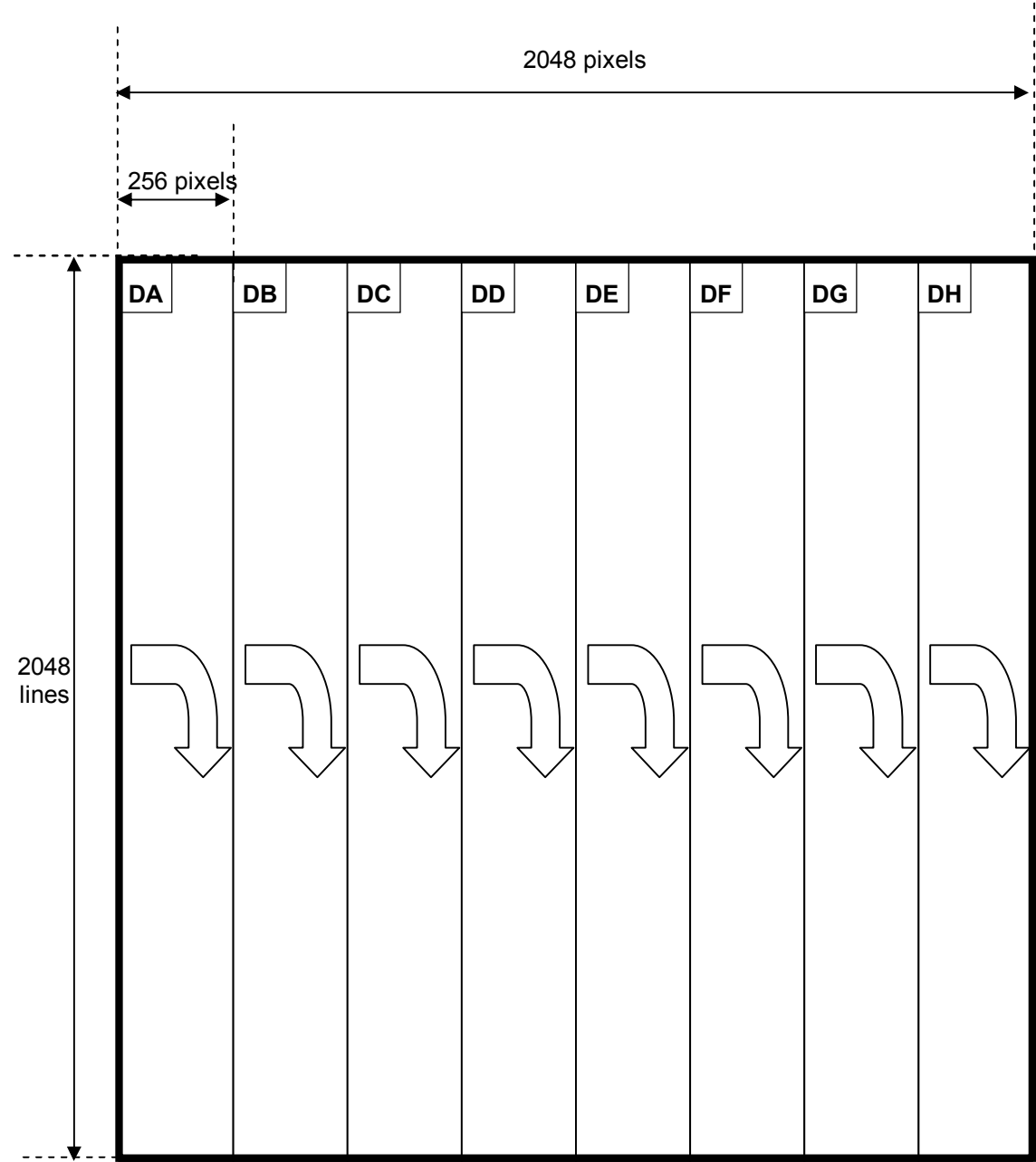




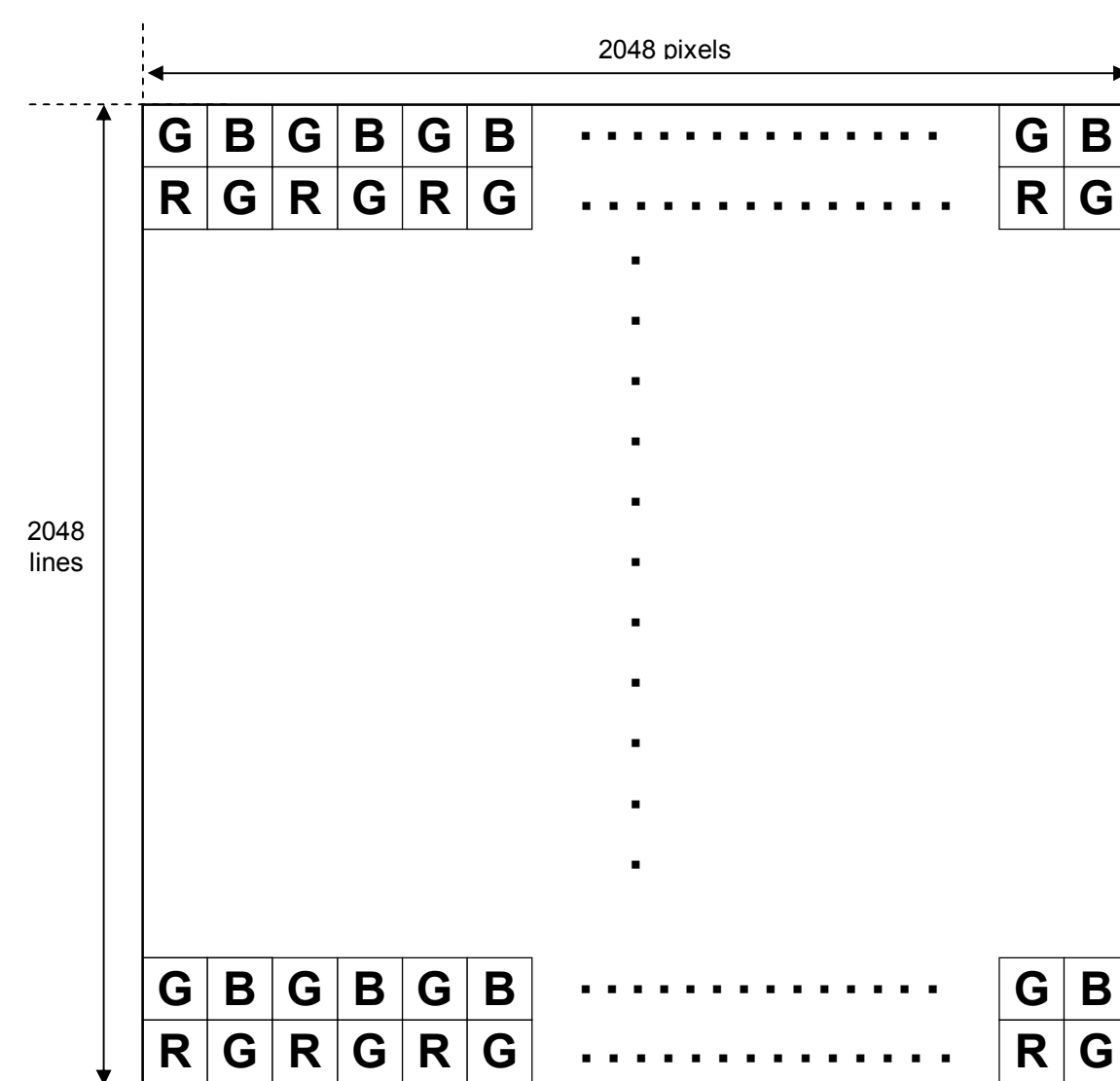
(2) Medium configuration



(3) Full configuration



### 5. Color Output sequence (KP-FMR400WCL)

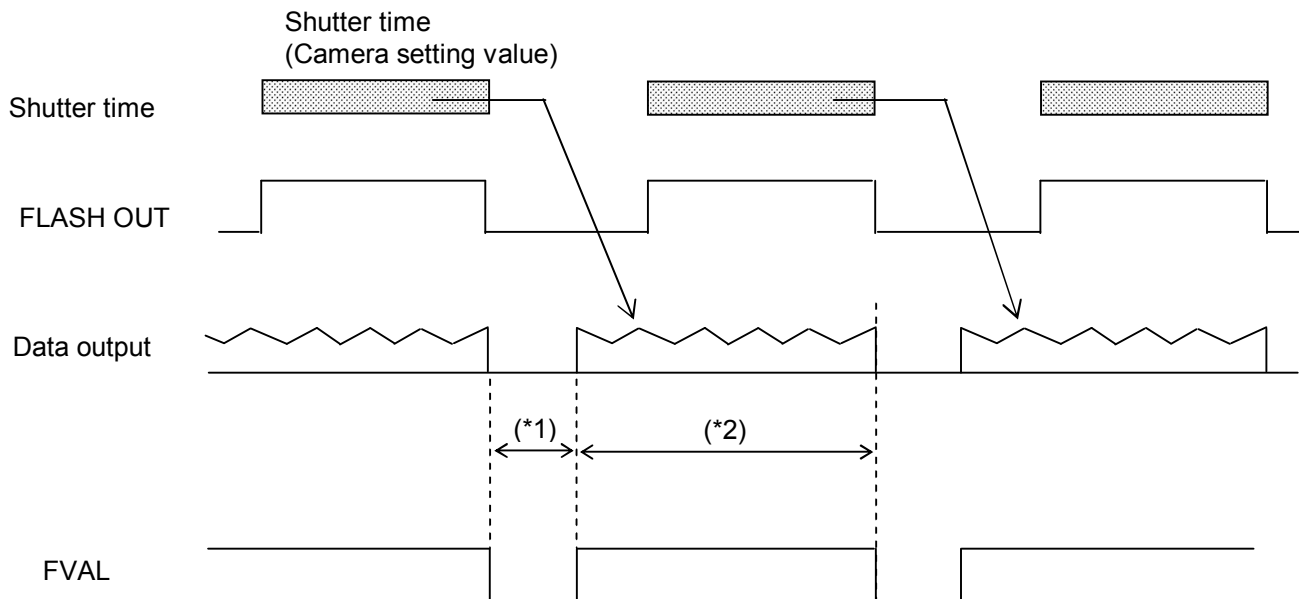


# Trigger operation and timing chart

## 1. Normal mode

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

When the multi shutter speed is set, exposure time (Shutter time) increases every one frame, and one cycle's worth of an image is output repeatedly.



One horizontal period and blanking period (\*1) are different because of the setting of the configuration and the clock frequency.

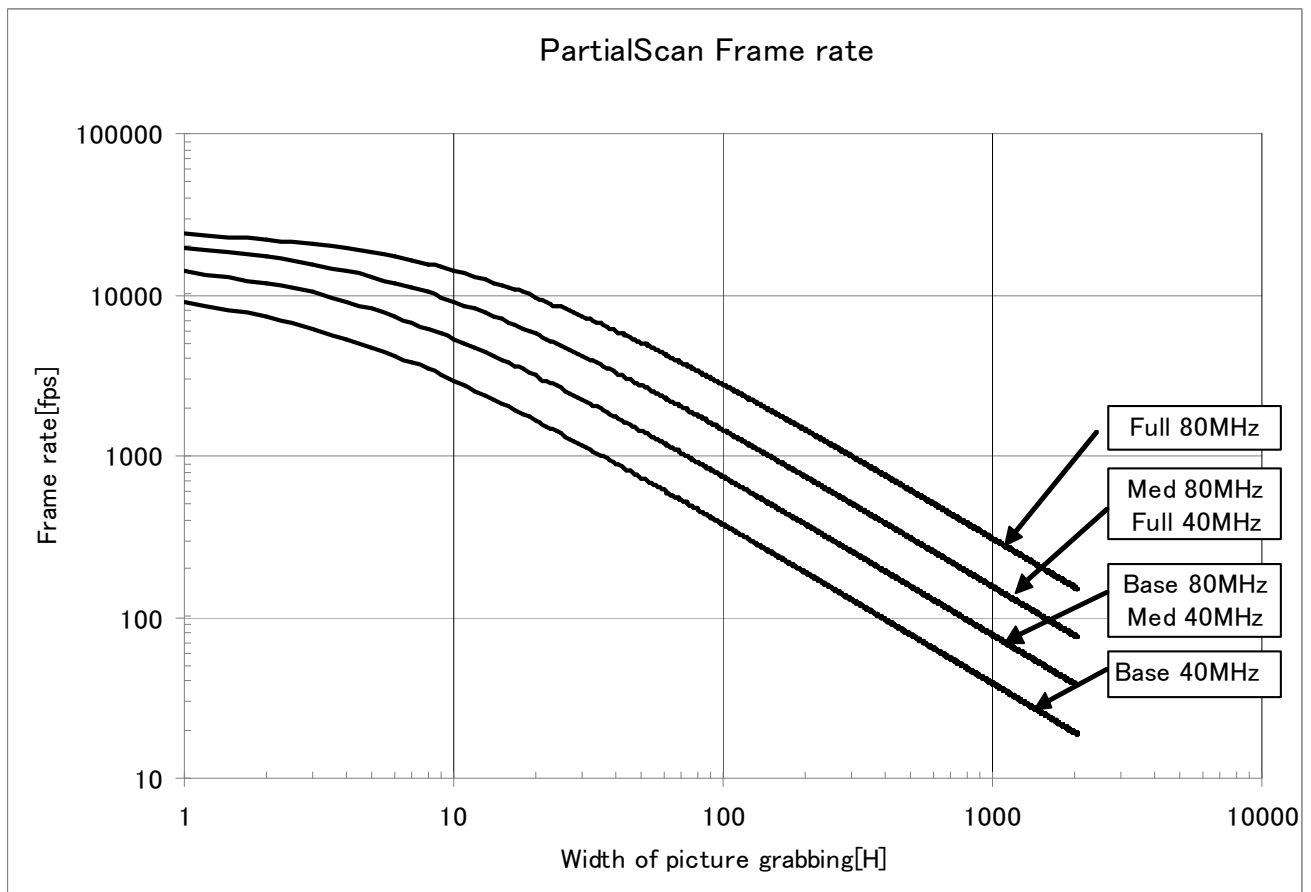
Cameralink output setting	One horizontal period	Blanking period (*1)
Base configuration 40MHz	1H = 25.800μs	3.25H
Base configuration 80MHz	1H = 12.900μs	4.5H
Medium configuration 40MHz	1H = 12.900μs	4.5H
Medium configuration 80MHz	1H = 6.450μs	7H
Full configuration 40MHz	1H = 6.450μs	7H
Full configuration 80MHz	1H = 3.225μs	12H

(\*2) is 2048H at partial scan OFF, and set value of width at partial scan ON.

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

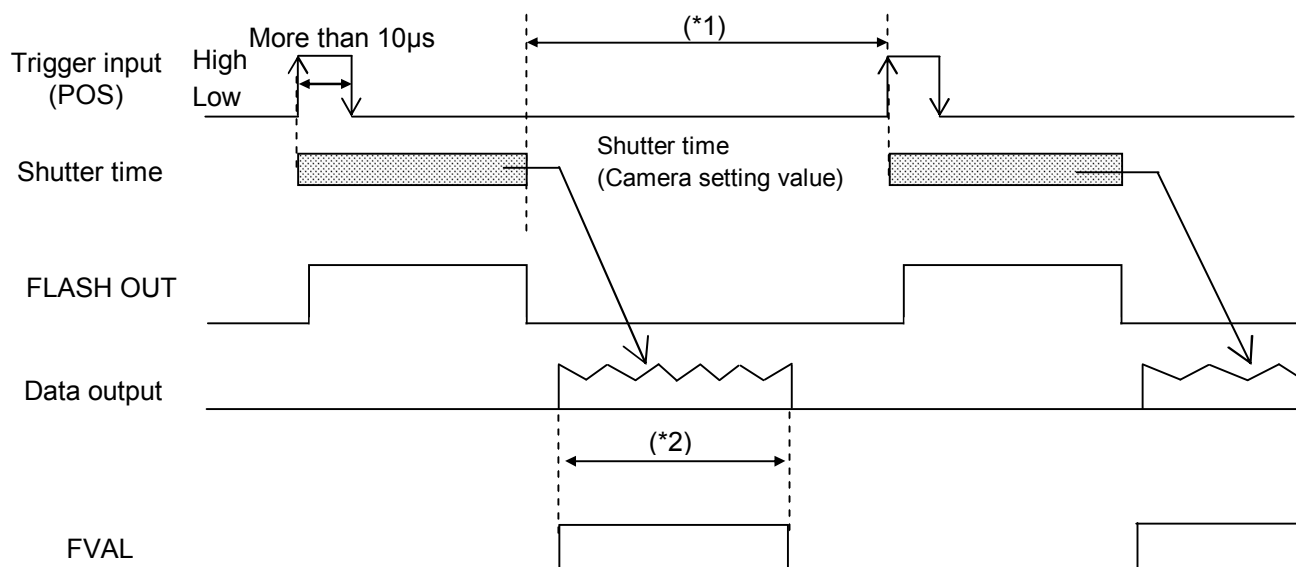
Cameralink output setting	Total lines	Frame rate(fps)
Base configuration 40MHz	$(\text{Width}+3.25)\text{H}$	$40000000/(\text{Width}+3.25)/1032$
Base configuration 80MHz	$(\text{Width}+4.5)\text{H}$	$40000000/(\text{Width}+4.5)/516$
Medium configuration 40MHz	$(\text{Width}+4.5)\text{H}$	$40000000/(\text{Width}+4.5)/516$
Medium configuration 80MHz	$(\text{Width}+7)\text{H}$	$40000000/(\text{Width}+7)/258$
Full configuration 40MHz	$(\text{Width}+7)\text{H}$	$40000000/(\text{Width}+7)/258$
Full configuration 80MHz	$(\text{Width}+12)\text{H}$	$40000000/(\text{Width}+12)/129$

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.



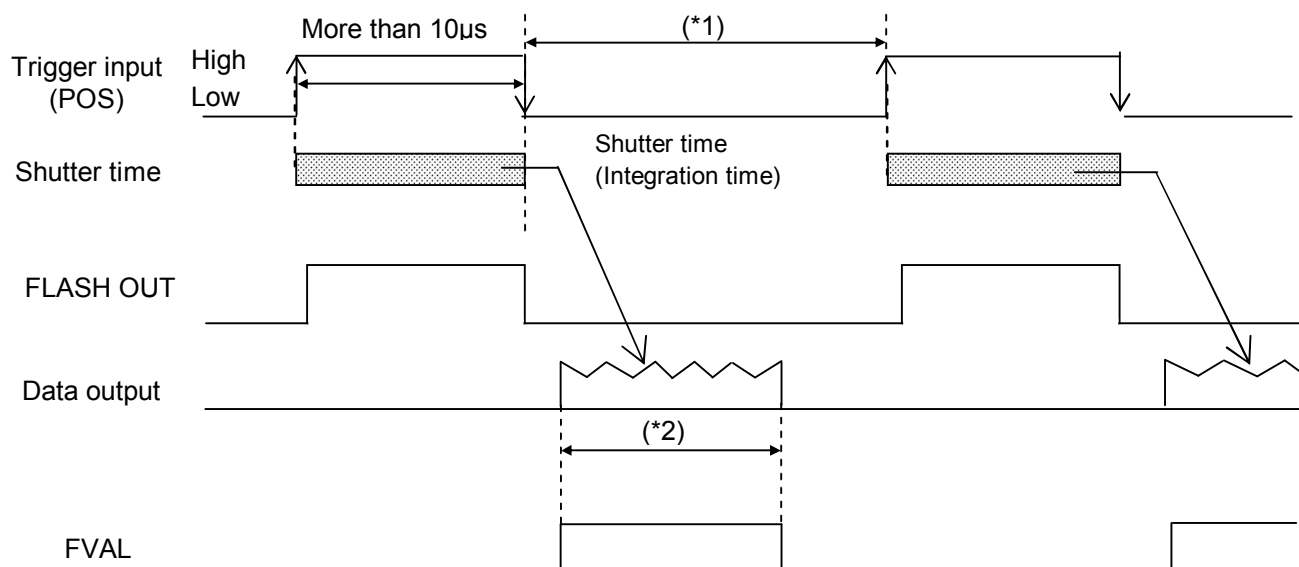
One horizontal period and Period from exposure end to the following trigger input (\*1) are different because of the setting of the configuration and the clock frequency.

Cameralink output setting	One horizontal period	(*1)
Base configuration 40MHz	1H = 25.800μs	More than (*2) + 3.25H
Base configuration 80MHz	1H = 12.900μs	More than (*2) + 4.5H
Medium configuration 40MHz	1H = 12.900μs	More than (*2) + 4.5H
Medium configuration 80MHz	1H = 6.450μs	More than (*2) + 7H
Full configuration 40MHz	1H = 6.450μs	More than (*2) + 7H
Full configuration 80MHz	1H = 3.225μs	More than (*2) + 12H

(\*2) is 2048H at partial scan OFF, and set value of width at partial scan ON.

### 3. ONE trigger mode

When trigger polarity setting is POSITIVE, after the trigger signal rise, exposure is start. At the trigger signal falling edge, the internal VD signal is reset and the video data are transmitted. The trigger signal width equals the exposure time.



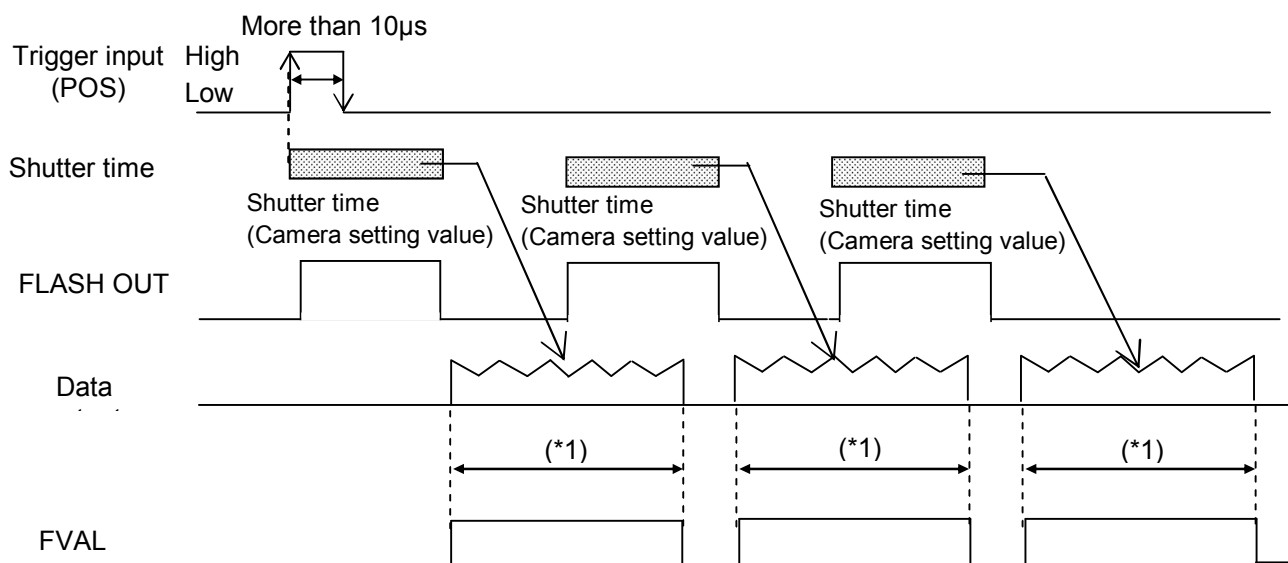
One horizontal period and Period from exposure end to the following trigger input (\*1) are different because of the setting of the configuration and the clock frequency.

Cameralink output setting	One horizontal period	(*1)
Base configuration 40MHz	1H = 25.800μs	More than (*2) + 3.25H
Base configuration 80MHz	1H = 12.900μs	More than (*2) + 4.5H
Medium configuration 40MHz	1H = 12.900μs	More than (*2) + 4.5H
Medium configuration 80MHz	1H = 6.450μs	More than (*2) + 7H
Full configuration 40MHz	1H = 6.450μs	More than (*2) + 7H
Full configuration 80MHz	1H = 3.225μs	More than (*2) + 12H

(\*2) is 2048H at partial scan OFF, and set value of width at partial scan ON.

#### 4. Burst trigger 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. Thereafter, images of the set number of burst-frame are continuously output. When the multi shutter speed is set, exposure time (Shutter time) increases every one frame, and one cycle's worth of an image is output repeatedly.



(\*1) is 2048H at partial scan OFF, and set value of width at partial scan ON.



## Input / Output signal

### 1. Input signal

The level of the trigger signal input to KP-FM400WCL and KP-FMR400WCL 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-FM400WCL and KP-FMR400WCL is as follows.

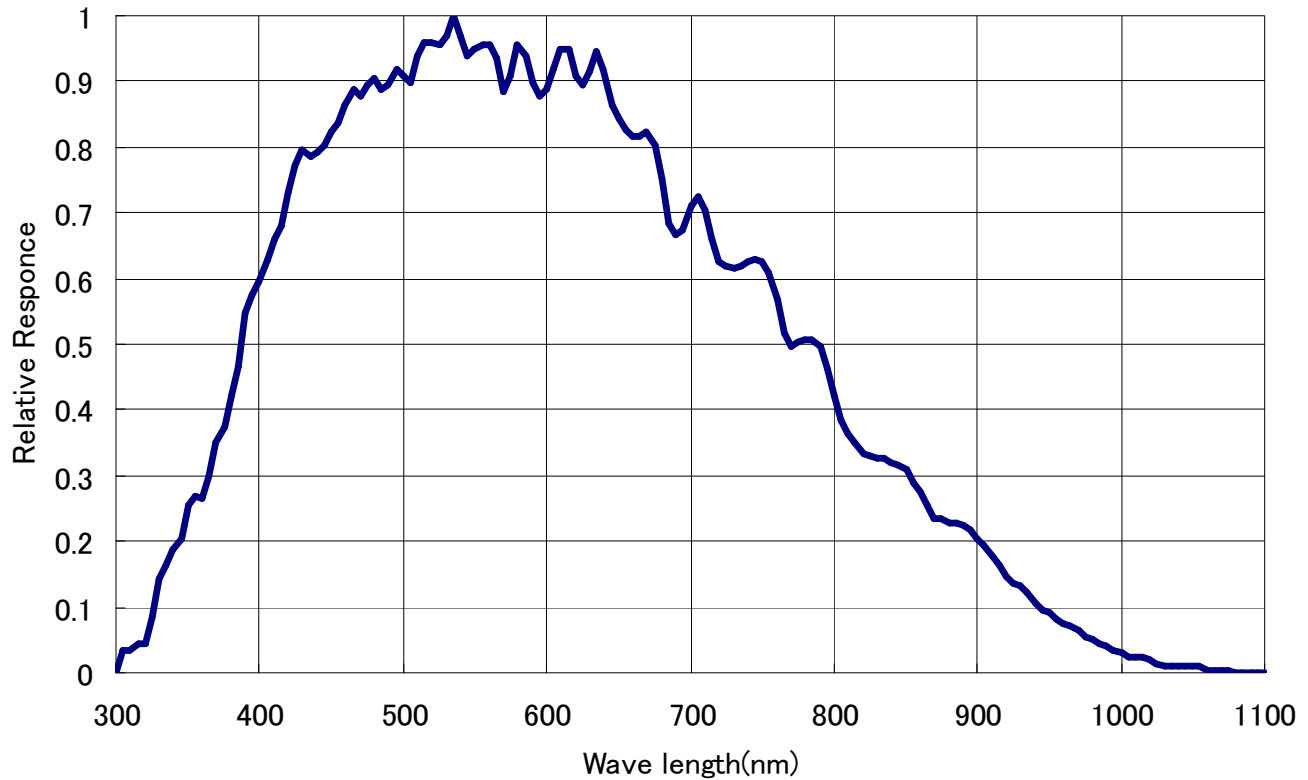
High level : +5.0V

Low level : 0V

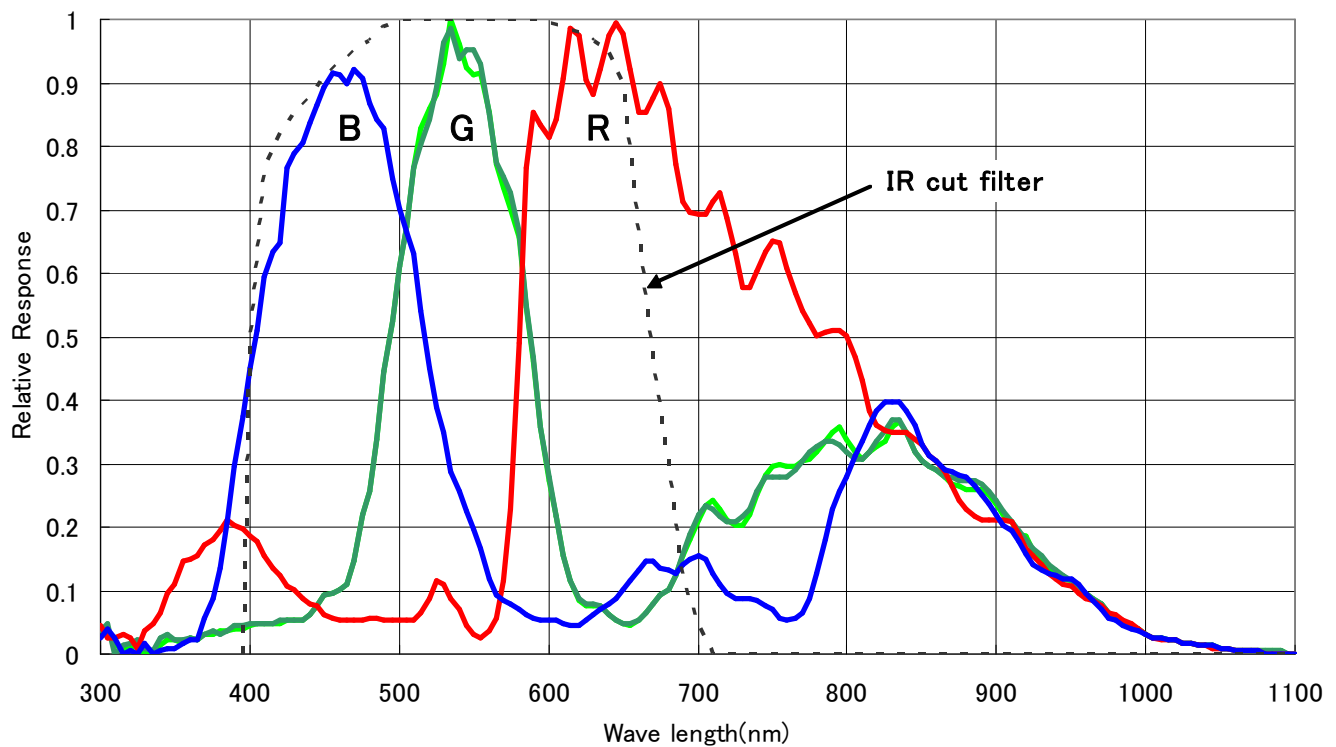
## Spectral response

Spectral response of KP-FM400WCL and KP-FMR400WCL are showing.

### 1. KP-FM400WCL



### 2. KP-FMR400WCL



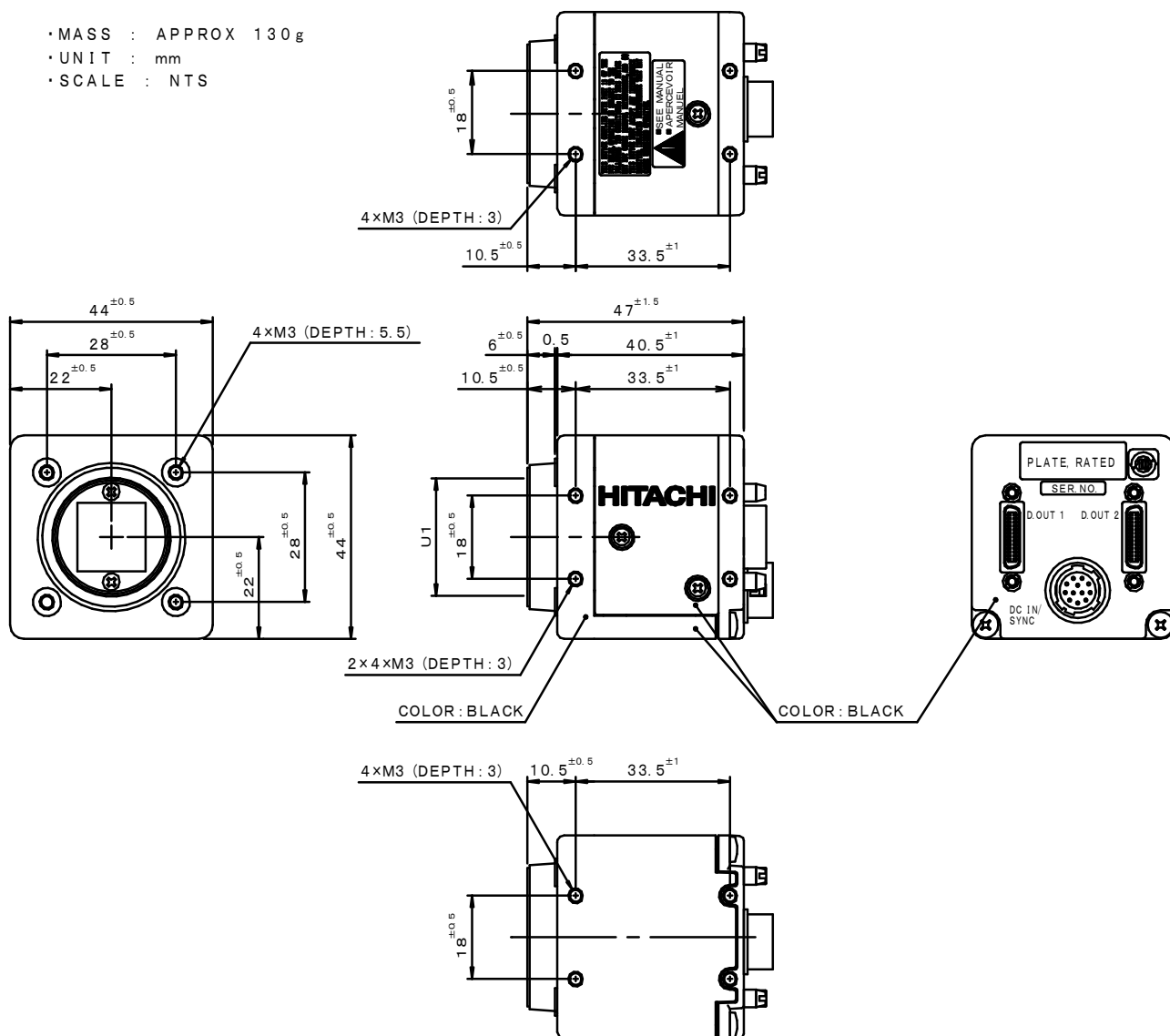
## Specifications

Specifications of KP-FM400WCL and KP-FMR400WCL are showing.

	KP-FM400WCL	KP-FMR400WCL
1) Imaging device	1-inch global shutter method CMOS	
Effective pixels	2048 (H) x 2048 (V)	
Pixel size	5.5μm (H) x 5.5μm (V)	
Color filter	None	RGB primary color mosaic filter
2) Image area	11.264mm (H) x 11.264mm (V)	
3) Scanning system	Progressive scan	
4) Frame rate	MAX.150 frame per second (full pixel readout)	
5) Pixel frequency	40.000MHz	
6) Horizontal scanning frequency	Full configuration(80MHz) : 310.078kHz Full configuration(40MHz) : 155.039kHz Medium configuration(80MHz) : 155.039kHz Medium configuration(40MHz) : 77.519kHz Base configuration(80MHz) : 77.519kHz Base configuration(40MHz) : 38.759kHz	
8) Vertical scanning (full pixel readout)	Full configuration(80MHz) : 150.523Hz Full configuration(40MHz) : 75.445Hz Medium configuration(80MHz) : 75.445Hz Medium configuration(40MHz) : 37.768Hz Base configuration(80MHz) : 37.768Hz Base configuration(40MHz) : 18.896Hz	
9) Synchronization	Internal	
10) Lens mount	C mount	
11) Flange back	17.526mm (no adjustment)	
12) Optical filter	Dummy glass (AR coated)	IR cut filter
13) Video output	Digital output (CameraLink) Base configuration 2TAP (80Hz or 40MHz) Medium configuration 4TAP (80Hz or 40MHz) Full configuration 8TAP (80Hz or 40MHz)	
Output image size	2048 (H) x 2048 (V) (full pixel readout)	
15) Resolution	Horizontal / Vertical : 2000TV lines	Horizontal / Vertical : 1400TV lines
16) Sensitivity	400 lx、F8、3200K	2000 lx、F16、3200K
18) S/N	48dB	
19) Electronic shutter		
Preset	OFF, 1/38, 1/100, 1/250, 1/500, 1/1000, 1/2000, 1/10000, 1/50000 second	
Variable	16.125μs ~ 211367μs	
20) Gamma	γ=1	
21) Frame on demand		
Mode	OFF (Normal mode), Fixed shutter mode, ONE trigger, Burst trigger	
Trigger input	From CameraLink (CC1) or DCIN/SYNC connector	
22) Partial scan	Selectable start position and width of picture grabbing in 1H step (max 8 areas)	
25) Remote control		
Control system	Start-stop synchronization system	
Control items	TRIGGER、SHUTTER、ACCEL、DATA BIT、CONFIG、CLK、FLIP、TEST 12pinOUT、GAIN、BLACK LEVEL、PARTIAL SCAN、FACTORY SETTING	
26) Power supply	DC12V±1V	
27) Power consumption	Approx. 230mA (Approx. 2.76W)	
28) 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 70%	
Storage	-20°C to +60°C (-4 to +140F) / less than RH 70% (without dew)	
29) Vibration endurance	10 to 55Hz (2.37 to 71.7 m/s <sup>2</sup> ), sweep: 1 minutes, XYZ, 30minutes	
30) Shock endurance	490.3m/ s <sup>2</sup> (vertical, horizontal, once each faze)	
31) Dimensions	44(W) x 44(H) x 41(D) mm	
32) Mass	Approx. 130g	
33) Standard compositions	Camera, Composition table	

# Dimensions

- MASS : APPROX 130 g
- UNIT : mm
- SCALE : NTS



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