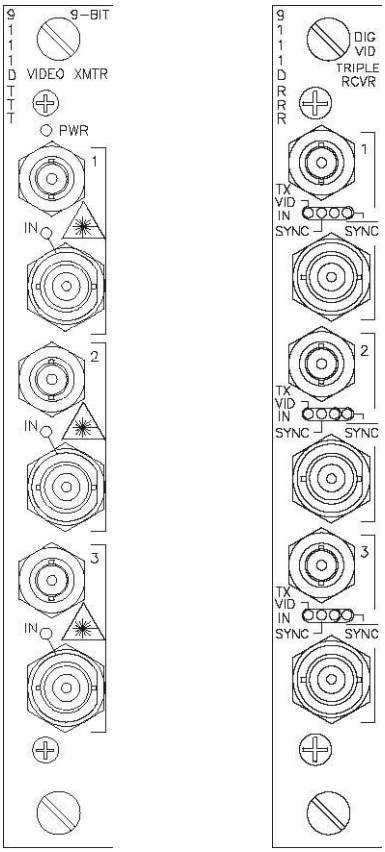
Optelecom 9000 Series
Installation and Operation Manual

Model 9111D



Rack-Mount Fiber Optic
Video Transmitter and Receiver Modules

For transport of up to three NTSC or PAL video signals in one direction, each over a separate optical fiber using 9-bit digital encoding and transmission techniques

UM50325, Manual 9111D, Rev. C

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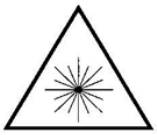
Safety Instructions

RM-1

The safety information contained in this section, and on other pages of this manual, must be observed whenever this unit is operated, serviced, or repaired. Failure to comply with any precaution, warning, or instruction noted in the manual is in violation of the standards of design, manufacture, and intended use of the unit. TKH Security Solutions USA assumes no liability for the customer's failure to comply with any of these safety requirements.

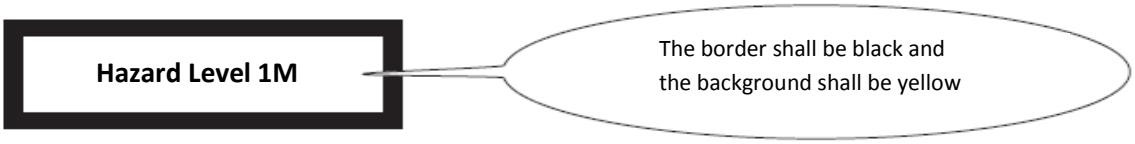


LASER RADIATION
DO NOT VIEW DIRECTLY WITH OPTICAL INSTRUMENTS (MAGNIFIERS)
CLASS 1M LASER PRODUCT

CAUTION:
DISCONNECTED OPTICAL CONNECTORS MAY EMIT OPTICAL ENERGY.
DO NOT VIEW BEAM WITH OPTICAL INSTRUMENTS (MAGNIFIERS)

This product contains Class 1M lasers or LEDs.
- Class 1M laser product according to IEC60825-1:1993+A1+A2
- **CAUTION: Use of controls or adjustments or procedures other than those specified herein may result in hazardous radiation exposure.**
- Precautions should be taken to prevent exposure to optical radiation when the unit is removed from its enclosure or when fiber is disconnected from the unit.
- Laser radiation may be present on a fiber connection to this unit even when the power has been removed from the unit.
- This unit is intended for installation in locations where only trained service personnel have access to the fiber connections.
- The locations of all optical connections are listed in the Connection Locations and Function section of this manual.
- Optical outputs and wavelengths are listed in the Specifications section of this manual.

The optical devices used in this equipment are Hazard Level 1M. As required by IEC60825-1, the installer is responsible for insuring that the label depicted below is present in the restricted locations where this equipment is installed.



This assembly contains parts sensitive to damage by electrostatic discharge (ESD). Use ESD precautionary procedures when touching, removing, or inserting parts or assemblies.

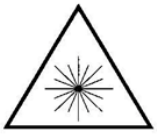
The chassis into which this unit is installed must be housed in a properly rated NEMA enclosure.

When this unit is operated in extremely elevated temperature conditions, it is possible for internal and external metal surfaces to become extremely hot. Care should be taken to insure this unit is installed in a restricted area where only properly trained service personnel have access to the unit.

Instrucciones de Seguridad

RM-1

Debe observarse la información de seguridad contenida en esta sección, y en otras páginas de este manual siempre que se opere, dé servicio o repare esta unidad. Si no se cumple con alguna precaución, advertencia o instrucción indicada en este manual se infringen los estándares de diseño, fabricación y el uso destinado a la unidad. TKH Security Solutions USA no asume ninguna responsabilidad si el cliente no cumple con alguno de estos reequisitos de seguridad.



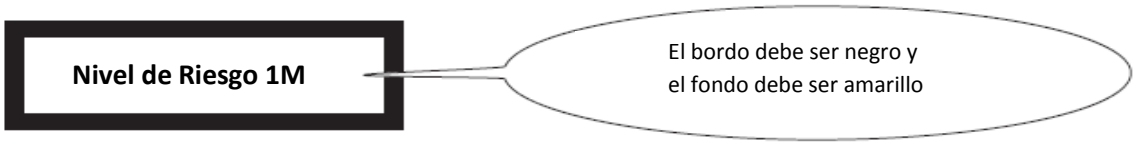
RADIACIÓN LÁSER
NO VER DIRECTAMENTE CON INSTRUMENTOS ÓPTICOS (DE AUMENTO)
PRODUCTO LÁSER CLASE 1M

PRECAUCIÓN:
LOS CONECTORES ÓPTICOS DESCONECTADOS PUEDEN AMITIR ENERGÍA ÓPTICA
NO VER EL HAZ CON INSTRUMENTOS ÓPTICOS (DE AUMENTO)

Este producto contiene rayos láser o diodos emisores de luz Clase 1M.

- Producto láser Clase 1M conforme a la norma IEC60825-1: 1993+A1+A2
- **PRECAUCIÓN: El uso de los controles, ajustes o procedimientos, aparte de los aquí especificados, pueden ocasionar exposición peligrosa a la radiación.**
- Deben tomarse precauciones para evitar la exposición a la radiación óptica cuando se saque la unidad de su alojamiento, o cuando se desconecte la fibra de la unidad
- Puede haber radiación laser en una conexión de fibra a esta unidad aun cuando se haya eliminado la corriente de la unidad.
- Este equipo está destinado a instalarse en lugares donde sólo el personal de servicio debidamente entrenado tenga acceso a las conexiones de fibra.
- La ubicación de todas las conexiones ópticas se enumeran en la sección Ubicación de los conectores y funciones de este manual.
- Las salidas ópticas y longitudes de onda aparecen en la sección Especificaciones de este manual.

Los dispositivos ópticos usados en este equipo son de Nivel de Riesgo 1M. Según lo exige la norma IEC60825-1, el instalador es responsable de asegurar que la etiqueta descrita a continuación esté presente en las áreas restringidas donde se instale este equipo.



Este ensamblaje contiene piezas sensibles al daño por descargas electrostáticas (ESD, por sus siglas en inglés). Use procedimientos para prevenir las descargas electrostáticas al tocar, desmontar o insertar piezas o ensamblajes.

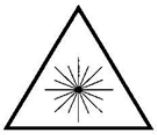
El chasis en el cual está instalada esta unidad debe estar dentro de un alojamiento debidamente calificado por NEMA.

Cuando se opera esta unidad en condiciones de temperatura sumamente elevada, es posible que las superficies internas y externas de metal se pongan extremadamente calientes. Debe tenerse cuidado para asegurar que esta unidad se instale en un área restringida donde sólo tenga acceso a la unidad el personal de servicio debidamente capacitado

Sicherheitsanleitungen

RM-1

Die in diesem abschnitt und auf anderen seiten dieses Handbuchs enthaltenen Sicherheitsinformationen müssen befolgt werden, wenn diese einheit betrieben, gewartet oder repariert wird. Falls Vorsichtsmassnahmen, Warnungen oder Anweisungen in diesem Handbuch nicht befolgt werden, verstösst dies gegen die Konstruktions, und Herstellungsstandards und erfolgt im gegensatz zum vorgesehenen Verwendungszweck dieser einheit. TKH Security Solutions USA übernimmt keine Haftung für das Verabsäumnis des Kunden, diese Sicherheitsanforderungen einzuhalten.



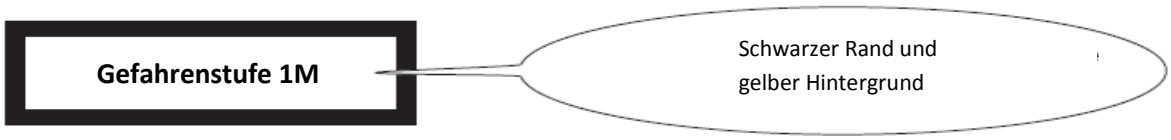
LASER-STRAHLUNG
NICHT DIREKT MIT OPTISCHEN INSTRUMENTEN (LUPEN) ANSEHEN
LASER-PRODUKT DER KLASSE 1M

VORSICHT:
ABGEKLEMMTE OPTISCHE STECKVERBINDER KÖNNEN OPTISCHE ENERGIE FREI SETZEN
NICHT MIT OPTISCHEN INSTRUMENTEN (LUPEN) IN DEN STRAHL BLICKEN.

Dieses Produkt enthält Laser oder LEDs der Klasse 1M.

- Laserprodukt der Klasse 1M gemäß IEC60825-1:1993+a1+A2
- **VORSICHT: Wenn die Bedienungselemente anders als hier beschrieben bzw. andere Einstellungen verwendet werden, kann es zu schädlicher Strahlenaussetzung kommen.**
- Es müssen Vorsichtsmaßnahmen getroffen werden, um Aussetzung an optischer Strahlung zu vermeiden, wenn die Einheit aus dem Gehäuse genommen oder die Faseroptik von der Einheit getrennt wird.
- In einer Faseroptik-Verbindung dieser Einheit kan auch dann Laserstrahlung vorhanden sein, wenn die Stromversorgung zur Einheit abgeschaltet wurde.
- Diese Einheit ist zum Einbau an Orten vorgesehen, an denen nur geschultes Personal Zugang zu den Faseroptik-Verbindungen hat.
- Die Lage aller optischen Verbindungen ist im Abschnitt über die Lage von Anschlüssen und Funktionsweise dieses Handbuchs zu finden.
- Optsiche Ausgänge und Wellenlängen sind im Abschnitt mit den technischen Daten dieses Handbuchs zu finden.

Die optischen Vorrichtungen in diesem Gerät haben Gefahrenstufe 1M. Wie vorgeschrieben durch IEC60825-1 ist der Installateur dafür verantwortlich, sicherzustellen, dass die unten abgebildeten Schilder an den Orten mit eingeschränktem Zugang, an denen dieses Gerät aufgestellt ist, vorhanden sind.



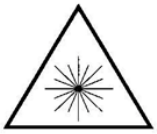
Diese Baugruppe enthält Teile, die durch elektrostatische Entladungen (ESD) beschädigt werden können. Vorsichtsmaßnahmen zum Schutz vor elektrostatischer Entladung treffen, wenn Teile oder Baugruppen berührt, ausgebaut oder eingefügt werden.

Das Gestell, in dem diese Einheit eingebaut ist, muss in einem entsprechend klassifizierten NEMA-Schutzgehäuse untergebracht sein.

Wenn diese Einheit bei besonders hohen Temperaturen betrieben wird, können interne und externe Metallflächen extrem heiß werden. Es muss darauf geachtet werden, dass diese Einheit in einem Bereich mit eingeschränktem Zugang aufgestellt wird, damit nur geschultes Wartungspersonal Zugang zur Einheit hat.

Consignes de Sécurité

Les consignes de sécurité contenues dans cette section et dans le reste de ce manuel doivent être respectées a chaque fois que cet appareil est utilisé ou fait l'objêt d'une maintenance ou d'une réparation. Le non-respect d'une précaution, d'un avertissement ou d'une instruction figurant dans ce manuel est une violation des normes de conception, fabrication et indication d'usage de l'appareil. TKH Security Solutions USA n'est pas responsable du non-respect de ces consignes de sécurite par le client.



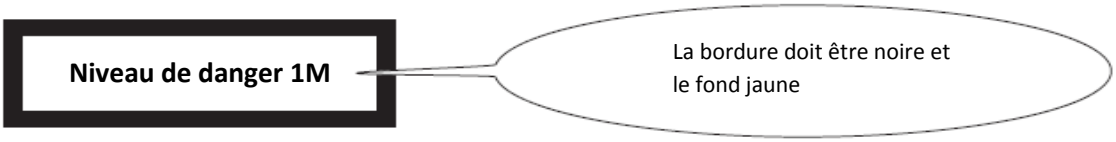
RAYONNEMENT LASER
NE PAS REGARDER DIRECTEMENT AVEC DES INSTRUMENTS OPTIQUES (LOUPES)
PRODUIT LASER DE CLASSE 1M

ATTENTION:
LES CONNECTEURS OPTIQUES DEBRANCHES PEUVENT EMETTRE UNE ENERGIE OPTIQUE.
NE PAS REGARDER LE FAISCEAU AVEC DES INSTRUMENTS OPTIQUES (LOUPES)

Ce produit contient des lasers ou diodes électroluminescentes de classe 1M.

- Produit laser de classe 1M conformément à IEC60825-1:1993+A1+A2
- **ATTENTION: L' utilisation de commandes ou réglages, ou de procedures différentes de celles indiquées ici risque de provoquer une exposition dangereuse au rayonnement.**
- Prendre des précautions pour empêcher une exposition au rayonnement optique lorsque l' appareil est retiré de son boîtier ou lorsque la câble optique fibre est débranché de l' appareil.
- Un rayonnement laser pourra être present dans un câble optique branché sur cet appareil, même une fois l'alimentation coupée.
- Cet appareil est prévu pour une installation à des endroits où seul un personnel de maintenance formé accès aux câbles optiques.
- Les points de branchement de tous les cables optiques sont indiqués à la section Points de branchement et function de ce manuel.
- Les sorties et longueurs d' onde optiques figurant à la section Caractéristiques techniques de ce manual.

Les appareils optiques utilisés dans cet équipement correspondent à un niveau de danger 1M. Comme exigé par la norme IEC60825-1, il incombe à l'installateur de s'assurer que l'étiquette ci-dessous est présente aux endroits d'accès limité où cet équipement est installé.



Cet ensemble contient des pièces sensibles aux décharges électrostatiques (ESD). Prendre les précautions relatives aux ESD avant de toucher, retirer ou insérer des pièces ou des ensembles.

Le châssis dans lequel est installé cet appareil doit être place dans une enceinte NEMA conforme aux spécifications nominales.

Lorsque cet appareil fonctionne à une température ambiante extrêmement élevée, il est possible que les surfaces métalliques internes et externes deviennent extrêmement chaudes. S'assurer que cet appareil est installé dans une zone dont l'accès est limité à un personnel de maintenance correctement formé.

Fiber Information

This unit was manufactured with attention to fiber cleanliness by TKH Security Solutions USA. Beyond the optical safety information contained in this manual, the following guidelines should be observed when working with optical fibers.

The biggest problem is **dirt**!

It takes very little contamination to cause problems with optical fiber connections; cleanliness is extremely important to proper operation of optical equipment.

1. Protect optical connectors by leaving the connector covers in place on unused fiber connections and on the fiber tips themselves.

2. Personnel who remove and replace fibers should be equipped with a fiber cleaning kit. These are inexpensive and can be obtained from any fiber equipment supply house. If you choose to, you can use propanol and lint-free tissue to clean fibers.

    a. Do not use isopropanol alcohol (typically called rubbing alcohol) mixed with water. This can cause additional spots. (**Caution: *Pure isopropanol is very flammable!***)

    b. Use lintless tissues to clean fibers.

    c. Clean the fiber with a folded tissue moistened with the propanol, pulling the connector tip across the tissue, then turn the connector 90 degrees and repeat in a different spot on the tissue.

    d. Don't pull the fiber across and then push it back. This will put the dirt that was cleaned off back on again.

    e. Repeat the process on a dry, folded tissue.

3. When removing fibers, ***always*** clean them when replacing them no matter how long you had them off.

4. When connecting fibers, pay attention to the bend radius of the fibers. A general rule is to have a 3-inch (8 cm) bend radius. A bend radius less than 3 inches is an attenuator and can cause optical signal loss.

5. Installers of fiber equipment should be equipped with the equipment manuals and an optical power meter to measure the optical inputs and outputs in a system. An optical power meter is an inexpensive tool that can save much time and effort in getting optical communications links up and running. Properly equipped and trained installers can quickly determine the source of any problems that occur.

External Wiring Information

Cable assemblies with lengths external to the unit not exceeding 3.05 meters, coiled or uncoiled, may be constructed of jacketed appliance wiring material suitable for the maximum voltage current and temperature, rated VW-1 or FT-1 or better. Cable assemblies with lengths external to the unit not exceeding 3.05 meters, coiled or uncoiled, and supplied by a limited power source or NEC Class 2 source of supply as defined in the National Electric Code, ANSI/NFPA 70, may be constructed of materials rated VW-1 or FT-1 or better with no additional requirements.

Functional Description

The 9111DT transmitters and 9111DR receivers are available in one, two, or three circuit versions with one, two, or three independent transmitters or receivers. In this manual, we will refer to all models as the 9111DT and 9111DR.

Each transmitter on a 9111DT card accepts one composite video signal in NTSC, PAL, or SECAM format via a BNC input connector. The baseband video signals are sampled at a 16 Mhz rate by an A-to-D converter operating with 9 bits of precision. The signal is serialized and converted to an optical signal for transmission over the fiber.

Each receiver on a 9111DR card accepts the optical signal and converts it to a serial bit stream. The stream is then deserialized, converted into a video signal, and output via a BNC connector.

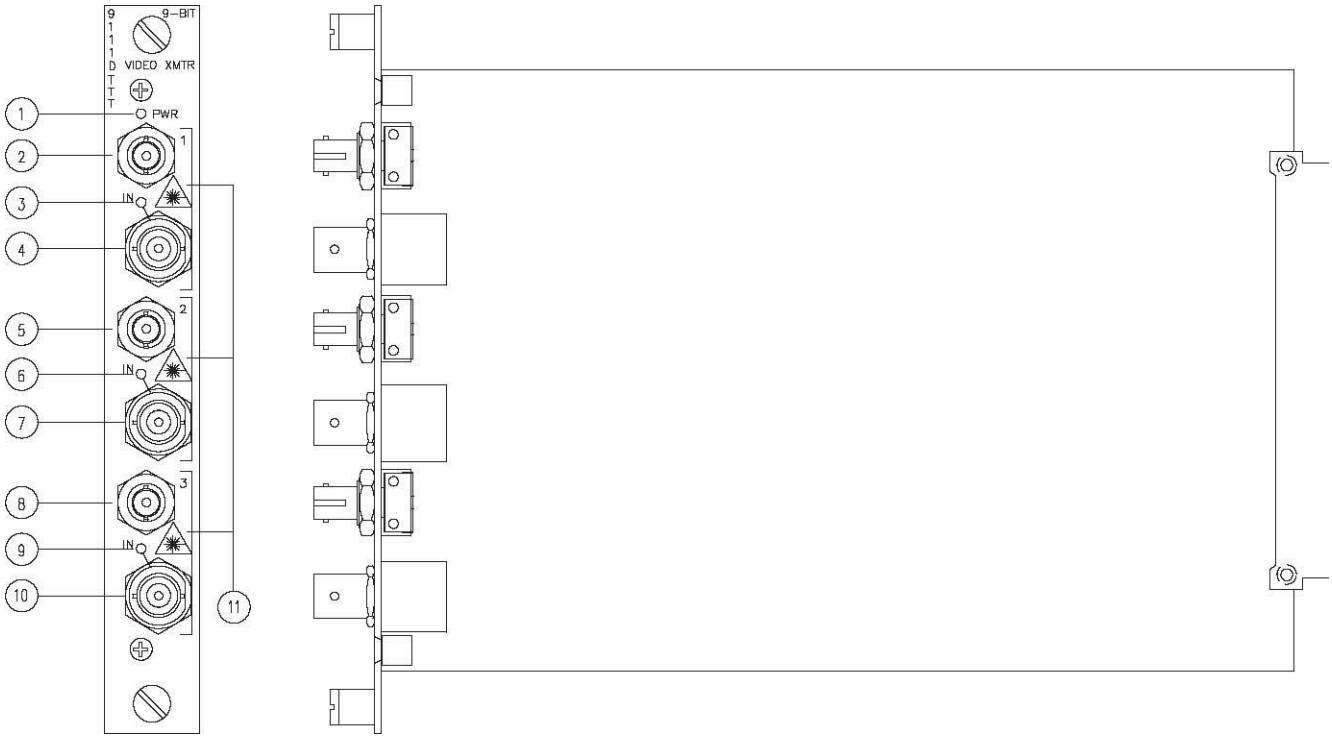
9111DT transmitters are optically compatible with the 9111DR rack-mount receivers and 9114DR standalone receivers.

9111DR receivers are optically compatible with the 9111DT rack-mount transmitters and 9113DT, 9114DT, and 9115DT standalone transmitters.

The cards operate on 6VDC as supplied by the chassis into which it is installed.

9111DT Indicator and Connector Locations

FIGURE 1



1. **POWER INDICATOR**
   This ***green*** LED illuminates when 6V power is applied to the card via the chassis backplane.

2. **OPTICAL OUTPUT PORT CONNECTOR FOR TRANSMITTER 1**
   The output optical connection for transmitter 1 is made here.

3. **VIDEO PRESENT INDICATOR FOR TRANSMITTER 1**
   This ***green*** LED, when illuminated, indicates the presence of a video signal on the BNC input connectors for transmitter 1.

4. **VIDEO INPUT CONNECTOR FOR TRANSMITTER 1**
   This BNC connector is for the video input to transmitter 1.

5. **OPTICAL OUTPUT CONNECTOR FOR TRANSMITTER 2**
   The output optical connection for transmitter 2 is made here.

6. **VIDEO PRESENT INDICATOR FOR TRANSMITTER 2**
   This ***green*** LED, when illuminated, indicates the presence of a video signal on the BNC input connector for transmitter 2.

7. **VIDEO INPUT CONNECTOR FOR TRANSMITTER 2**
   This BNC connector is for the video input to transmitter 2.

8. **OPTICAL OUTPUT CONNECTOR FOR TRANSMITTER 3**
   The output optical connection for transmitter 3 is made here.

9. VIDEO PRESENT INDICATOR FOR TRANSMITTER 3

This ***green*** LED, when illuminated, indicates the presence of a video signal on the BNC input connector for transmitter 3.

10. VIDEO INPUT CONNECTOR FOR TRANSMITTER 3

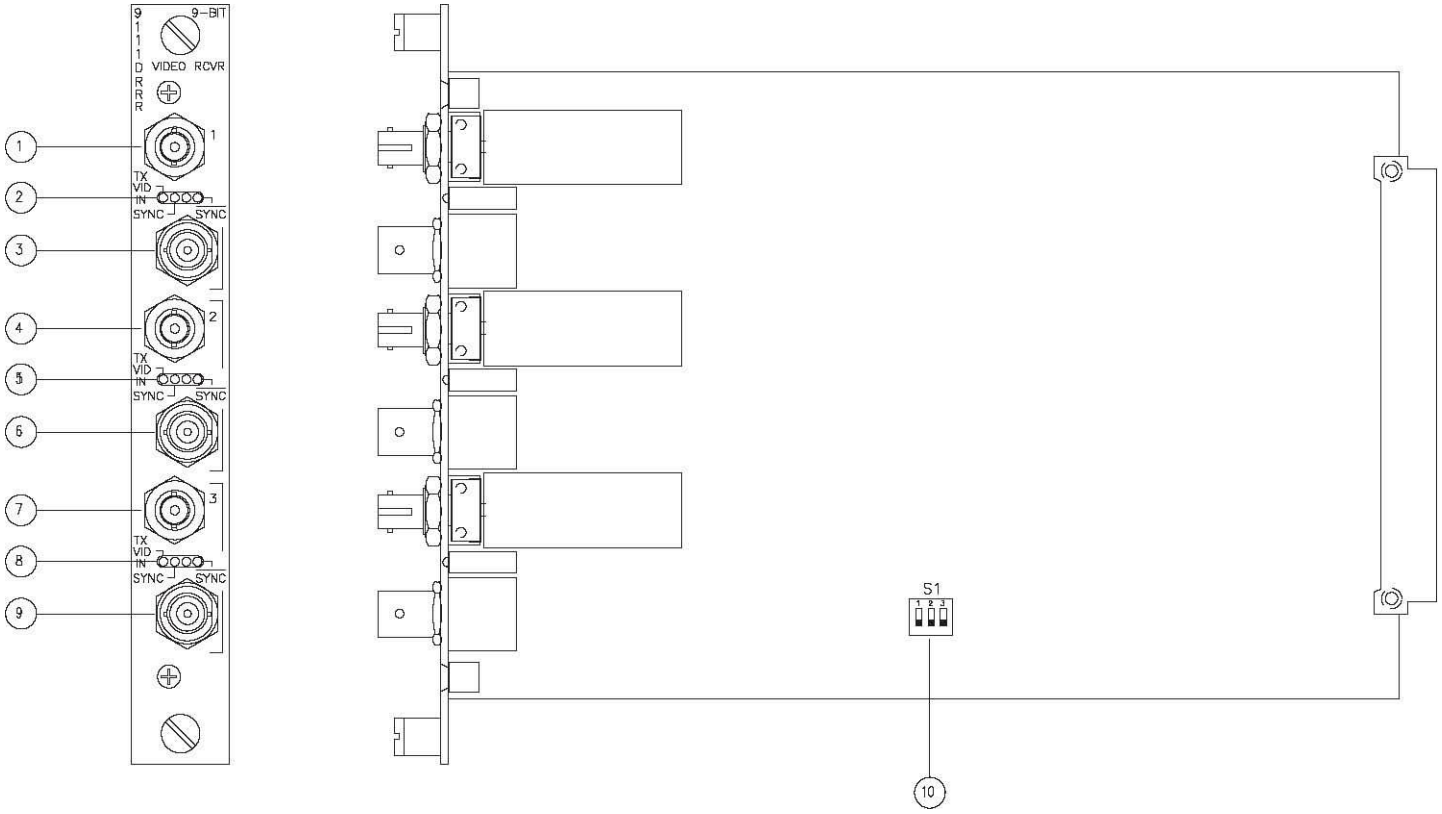
This BNC connector is for the video input to transmitter 3.

11. IEC LASER WARNING LABEL

Refer to the Safety Instructions at the beginning of this manual.

9111DR Indicator and Connector Locations

FIGURE 2



1. OPTICAL INPUT CONNECTOR

The input optical connection for receiver 1 is made here.

2. INDICATORS FOR RECEIVER 1

- The ***green*** Tx Video Input Present LED, when illuminated, indicates the presence of a video signal on the BNC input connector at the *transmitter* end of the link.
- The ***green*** SYNC LED indicates the optical signal and the resulting decoded electrical signal from the transmitter are correct.
- The ***red*** Not Sync LED indicates either the optical signal or the resulting decoded electrical signal from the transmitter is not correct.

3. VIDEO OUTPUT INDICATOR FOR RECEIVER 1

This BNC connector is the video output connector for receiver 1.

4. OPTICAL INPUT CONNECTOR FOR RECEIVER 2

The input optical connection for receiver 1 is made here.

5. INDICATORS FOR RECEIVER 2

- The ***green*** Tx Video Input Present LED, when illuminated, indicates the presence of a video signal on the BNC input connector at the *transmitter* end of the link.
- The ***green*** SYNC LED indicates the optical signal and the resulting decoded electrical signal from the transmitter are correct.
- The ***red*** Not Sync LED indicates either the optical signal or the resulting decoded electrical signal from the transmitter is not correct.

6. VIDEO OUTPUT CONNECTOR FOR RECEIVER 2

This BNC connector is the video output connector for receiver 2.

7. OPTICAL INPUT CONNECTOR FOR RECEIVER 3

The input optical connection for receiver 3 is made here.

8. INDICATORS FOR RECEIVER 3

- The ***green*** Tx Video Input Present LED, when illuminated, indicates the presence of a video signal on the BNC input connector at the *transmitter* end of the link.
- The ***green*** SYNC LED indicates the optical signal and the resulting decoded electrical signal from the transmitter are correct.
- The ***red*** Not Sync LED indicates either the optical signal or the resulting decoded electrical signal from the transmitter is not correct.

9. VIDEO OUTPUT CONNECTOR FOR RECEIVER 3

This BNC connector is the video output connector for receiver 3.

10. CHASSIS SYSTEM ALARM DISABLE SWITCH

This switch disables the chassis system alarm light for the sync signal alarm on each of the receivers on the board. Normally, the demux SYNC is not detected for any one of the three channels. It will close a solid state switch that causes the Model 9002 chassis system LED to go from *green* to *red*. This allows the user to disable the sync alarm outputs for channels that do not have fiber or transmitters connected.

Set Up and Operation of the 9111D

Set up and operation of the 9111DT and DR units consists of installing the unit into a Series 9000 chassis, connecting the optical cables, and the video input and output signals.

There is one switch setting for the 9111DR. Switch S1 allows the user to disable the chassis alarm that occurs when a receiver loses sync with its transmitter. Since there can be one, two, or three receivers on a card, and the possibility exists that one or more of the receivers may be spares and not connected by fiber or the transmitter may not be connected, the user can disable the sync alarm for that circuit by turning on the appropriate switch.

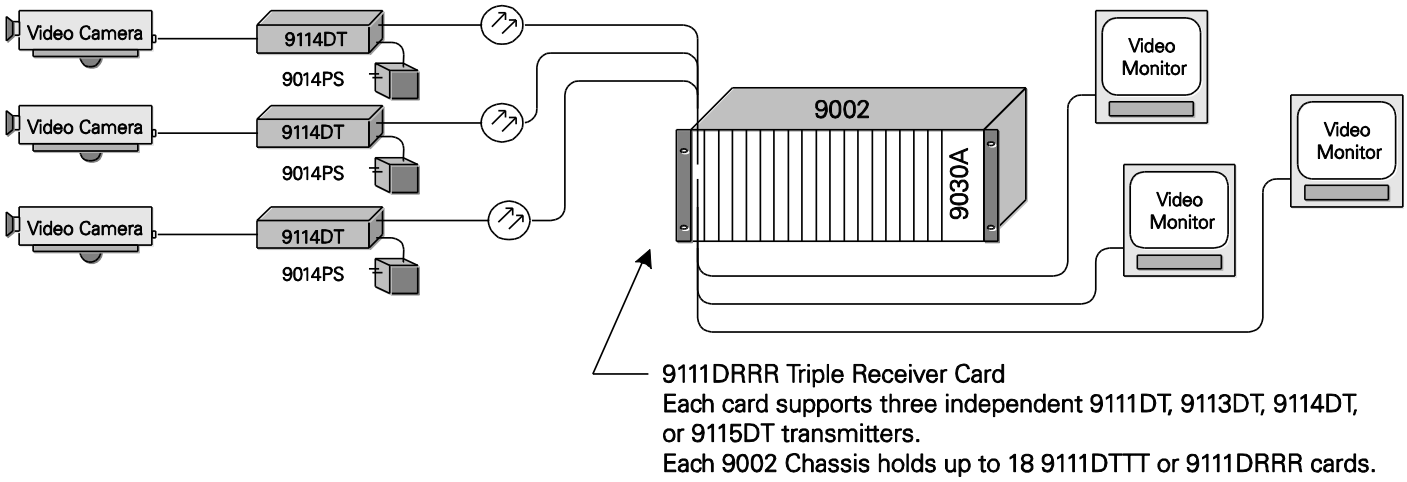
This switch has no effect on the operation of the link, nor does it affect the operation of the GUI alarms for loss of video. It only serves to disable the chassis indication of a failure for a circuit that may not be in use. GUI alarms are managed separately from the chassis alarm and may be enabled or disabled via software with no effect on the chassis alarms.

Refer to Table 1 for details on setting the switches.

TABLE 1 — 9111DR S1 SWITCH SETTINGS

Switch	Applies to	On	Off
S1-1	9111DR 9111DRR 9111DRRR	Sync alarm for receiver 1 is disabled	Sync alarm for receiver 1 is enabled
S1-2	9111DR 9111DRR	Sync alarm for receiver 2 is disabled	Sync alarm for receiver 2 is enabled
S1-3	9111DRRR	Sync alarm for receiver 3 is disabled	Sync alarm for receiver 3 is enabled

Typical Application diagram for the 9111D



Troubleshooting the 9111D

The indicator LEDs on the transmitter and receiver provide information as to the optical and electrical status of the units. Troubleshooting normally starts at the transmitting end.

On the 9111DT transmitter, the power indicator should be illuminated; if no indicators are illuminated, check the chassis power supply, power source, and connections.

When video is applied, the Video Present indicator should be illuminated ***green***. If the Video Present indicator is not green, then check the video source and connections.

On the 9111DR receiver, at least one of the indicators should be illuminated; if **no** indicators are illuminated, check the chassis power supply, power source, and connections.

When the SYNC indicator is illuminated ***green***, operation should be normal. The SYNC indicator is illuminated ***green*** and the TX Video Present indicator is not illuminated, the video source at the *transmitter* end should be checked.

If the NOT SYNC indicator is illuminated ***red,*** this is usually an indication of insufficient optical signal at the optical input. Check the fiber for poor connections or optical losses greater than the unit specifications.

Operation of the 9111D with the Network Management System

Operation of the 9111DT with the Network Management System consists of the following parameters:

1. Slot Number
2. Card Name (Model Number)
3. Serial Number
4. Time
5. Wavelength
6. Revision Number
7. Chronometer Value (Cumulative Hours of Operation)
8. Reset Cycles (Cumulative Number of Power Cycles)
9. Firmware Revision
10. Laser Drive Current (each channel)
11. Video Input Present (each channel)

Operation of the 9111DR with the Network Management System consists of the following parameters:

1. Card Location
2. Card Name (Model Number)
3. Serial Number
4. Time
5. Wavelength
6. Revision Number
7. Chronometer Value (Cumulative Hours of Operation)
8. Reset Cycles (Cumulative Number of Power Cycles)
9. Firmware Revision
10. Local Demux Sync Per Channel
11. Received Optical Power (each channel)
12. Transmit Video Input Present (each channel)

NMS users should set the Alarm Status and Alarm Limits for each parameter as required for the specific application when the NMS software is operated for the first time.

When the 9111D card is installed into an existing system already utilizing NMS system software, an upgrade of the software will be necessary to add the 9111D card to the software database in the NMS software.
Consult the factory for guidance on how to download the latest version of the software from the TKH Security USA FTP download site.

Specifications for the 9111D

OPTICAL

Transmitter Model	LDS	L	LD
Transmitter Optical Output Wavelength	850	1310	1310
Mating Receiver Model	S	L	L
Transmitter Optical Output Power (dBm) 50 µm	–10	–21	N/A
Transmitter Optical Output Power (dBm) 62.5 µm	–7	–17	N/A
Transmitter Optical Output Power (dBm) 09 µm	N/A	N/A	–7
Receiver Optical Input Sensitivity (dBm) 50 µm	–28	–29	N/A
Receiver Optical Input Sensitivity (dBm) 62.5 µm	–28	–29	N/A
Receiver Optical Input Sensitivity (dBm) 09 µm	N/A	N/A	–30
Maximum Receiver Optical Input (dBm)	–5	–5	–5
Link Budget (dB) 50 µm	18	8	N/A
Link Budget (dB) 62.5 µm	21	12	N/A
Link Budget (dB) 09 µm	N/A	N/A	23
Estimated Distance (km) 50 µm[1, 2]	5	5	N/A
Estimated Distance (km) 62.5 µm[1, 2]	5	6	N/A
Estimated Distance (km) 09 µm[1, 2]	N/A	N/A	57

[1] Range based on losses of 3.0 dB/km @ 850 nm or 1.0 dB/km @ 1310 nm for 62.5/125 multimode fiber, 0.35 dB/km @ 1310 nm or 0.25 dB/km @ 1550 nm for singlemode fiber, and includes a 3 dB safety factor.

[2] Range may be limited by modal and chromatic dispersion, fiber quality, and bandwidth. Range estimates for multimode are based on 500 Mhz/Km fiber.

VIDEO (PER CHANNEL)

Video Sampling Rate/Resolution 16Mhz, 9-bit
Video Input/Output Signal NTSC or PAL, 1V p-p, 75Ω
Video Input/Output Connector BNC
Video Bandwidth 6.5 Mhz (-3.0 dB)
SNR ≥63 dB
Differential Phase ≤1°
Differential Gain ≤2%

POWER

Requirements	6.0 VDC (Chassis power supply)
9111DT	200 mA
9111DTT	350 mA
9111DTTT	500 mA
9111DR	300 mA
9111DRR	500 mA
9111DRRR	800 mA

PHYSICAL

Dimensions (in inches)	6.1 H x 0.8 W x 8.6 D

ENVIRONMENTAL

Operating Temperature	-40° C to +74° C
Storage Temperature	-55° C to +85° C
Relative Humidity	0 to 95% noncondensing

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