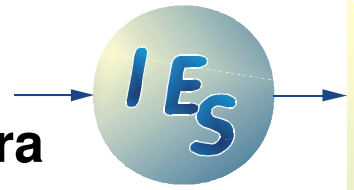# IES 0087
# TSA- Distribution for PCO DiMax-Camera

## SYSTEM DESCRIPTION

System for distribution of Trigger-, Sync-, and Arm-Signals for high-speed cameras PCO DiMax, including Sync-Generator, All-Armed-Logic and GigE junction boxes with 6 camera ports.

# Table of Contents

# 1. Overview

The TSA (**T**rigger, **S**ync, **A**rm) distribution system incorporates one or more IES 4732 TSA Camera Interface(s), one or more IES 0087 GigE Camera Junction Box(es) and the appropriate wiring between these components.

The IES 4732 Camera Interface provides these functions

- sync frequency generator
- master/slave sync frequency distribution
- isolated trigger interface
- arm logic
- status display

and offers up to 12 TSA-IO ports for connection of camera junction boxes. Not all of the 12 ports per device are installed in a typical user application. Unused port connectors are marked as "unused".

The IES 0087 GigE Camera Junction Box provides these functions

- up to six camera ports
- single connector camera attach
- status LED´s for power, trigger, sync, arm
- GigE connection breakout to RJ-45 connectors

All communication between the IES 4732 TSA Camera Interface and the GigE Camera Junction Boxes is carried out with differential signalling according to the RS-422 standard. The wiring used is a highest quality, flexible, superseeding Cat 7 SFTP cable with more than 100 dB shielding.

# 2. IES 4732 TSA Camera Interface

The IES 4732 TSA Camera Interface constitutes the upper end of the TSA distribution chain.

It contains a sync generator with user selectable frequencies, or accepts an external input. In the latter case, the device functions as a sync slave. The device switches automatically to slave mode, if an external signal is detected, and it switches automatically to master mode, if the external signal is absent.

It also contains an isolated trigger input, which can be wired together with other devices to a tape switch or other trigger source. The raw trigger input may be glitch filtered, if required (internal solder pads are provided).

It finally contains arm logic to build an "all armed" result status. The status is displayed in the front side LCD and there is also a solid state relay for additional user benefit.

## 2.1 Status Display

The front panel of the IES 4732 TSA Camera Interface is equipped with a 3 lines text LC display and two buttons. On power up the display shows the firmware revision code. After power up the display lines are used as follows:

| Line 1 | outgoing sync frequency at TSA IO connectors (rear side) |
| Line 2 | trigger slope |
| Line 3 | status information |

The sync frequency is user selectable, see below. The trigger slope is user selectable *only as an option* (normally "falling" to enable the use of tape switches).

The status line shows the characters "**TRG**", while an active trigger is present, for example as long as an attached tape switch is pressed. This enables easy checking of the trigger wiring.

The status line displays the string "**ALL ARMED**", if all attached cameras signal their armed state.

## 2.2 Selection of Sync-Frequency

Press the upper button for a long time (20 seconds) to enter menu mode. In line 3 the text "Edit..." is displayed. Release the upper button. The sync frequency value is blinking now. Press the upper button several times shortly to scroll through the possible built in sync frequencies. To select a frequency either press the upper button long again, or simply wait a long time. The new setting is stored in non volatile memory and will not be lost after power off. These sync frequencies are implemented:

| 100 | 250 | 500 | 1000 | 2000 |
| 2500 | 4000 | 5000 | 8000 | 10000 |

## 2.3 Arm logic

The ARM logic of the IES4732 Camera Interface performs a logical AND function for all installed TSA IO´s. Depending on user´s individual ordering, not all 12 TSA-IO ports are installed. Unused (or uninstalled) ports are marked as "unused" and are not taken into account for the AND function.

Used ports MUST all be in armed state in order to give an "all armed" result. This means, if an IO connector is not plugged in, or a wire connection to a junction box is broken the result status is "not armed", as desired.

Installed TSA-IO ports that are *intentionally* not connected to a junction box must be terminated with an "ARM simulator" connector, otherwise the "all armed" state can not be reached. Therefore a small number of ARM simulator connectors are provided to give the user flexibility in handling the system in case of temporary system changes, or repair or other irregular situations.

## 2.4 All armed output

The IES4732 TSA Camera Interface has a so called "all armed" output. This is a solid state relay, which may be used by the user to switch a lamp, a beeper, or to include the cameras into an existing all armed signal daisy chain.  When "all armed" is shown in the display, the solid state relay output is closed. Refer to connector SUP/AUX.

## 2.5 Connectors and Pinout

**TSA-IO**
**D-Sub 9F**

| Pin | Signal | Color |
|------|------------|--------|
| 1 | +TRG | orange |
| 2 | -TRG | red |
| 3 | +SYNC | yellow |
| 4 | -SYNC | brown |
| 5 | +ARMED | green |
| 6 | -ARMED | black |
| 7 | +5V pullup | |
| 8 | GNDREF | white |
| 9 | GNDREF | blue |
| Case | Screen | |

**SUP/AUX**
**Lemo EGG.1B.308**

| Pin | Signal | Color |
|------|------------------|--------|
| 1 | +Sup in (8 -16 V) | red |
| 2 | GND | black |
| 3 | Arm Switch a | yellow |
| 4 | Arm Switch b | blue |
| 5 | reserved | |
| 6 | reserved | |
| 7 | reserved | |
| 8 | reserved | |
| Case | screen | |

# 3. IES 0087 GigE Camera Junction Box

The IES 0087 GigE Camera Junction Box receives trigger and sync signals from a top level device such as the IES 4732, and sends an arm status for this field node upwards. It offers up to six camera ports with all required signals in one connector: power, trigger, sync, arm status and GigE.

### 3.1 Status LED´s
There are four status LED´s in the front panel.

A green LED "SUP" is on, if a supply voltage is present. The supply voltage is used for the box, and also for the attached cameras.

A yellow LED "SNC" is on, if the junction box receives a sync signal from the WTSA wire connection (D-type connector) to the top level sync generator.

A red LED is on, if a trigger is signalled. This enables easy testing of trigger wiring.

An orange LED is on, if the result status for the junction box is "armed". Read below for more information on the arm logic.

### 3.2 Arm logic
The arm status for the junction box is an AND function for all up to six camera ports. The arm status for a single camera port is shown in the table below:

| | |
|---|---|
| No camera connected, connector left open | armed |
| Camera connected, but switched off | not armed |
| Camera connected, but power fail | not armed |
| Camera connected, but not ready | not armed |
| Camera connected and recording | armed |

### 3.3 Connectors and Pinout

**TSA-IO**
**D-Sub 9M**

| Pin | Signal | Color |
|---|---|---|
| 1 | +TRG | orange |
| 2 | -TRG | red |
| 3 | +SYNC | yellow |

| 4 | -SYNC | brown |
|---|---|---|
| 5 | +ARMED | green |
| 6 | -ARMED | black |
| 7 | reserved | |
| 8 | GND | white |
| 9 | GND | blue |
| Case | Screen | |

**CAMx**
**Lemo FGG.2B.318.CYZD92.ZN**

| Pin | Signal | Color |
|---|---|---|
| 1 | Ethernet A- | or |
| 2 | Ethernet D- | Br |
| 3 | Ethernet B- | Gn |
| 4 | Ethernet B+ | wht (gn) |
| 5 | Ethernet C+ | Bl |
| 6 | ARM + | Red |
| 7 | +SUP | Orange |
| 8 | +SUP | Red |
| 9 | SYNC+ | Yel |
| 10 | SYNC- | Gn |
| 11 | -SUP | Gray |
| 12 | -SUP | Black |
| 13 | Ethernet A+ | Wht (or) |
| 14 | Ethernet D+ | Wht (br) |
| 15 | Ethernet C- | Wht (bl) |
| 16 | ARM-/CamPresent/GNDREF | Blue |
| 17 | TRG+ | Wht |
| 18 | TRG- | Br |
| Case | | Ethernet Screen<br>TRG shield<br>SYNC shield |

The RJ-45 ethernet connectors are assigned from left to right to the CAMx ports.

## 4. Specifications IES 4732 TSA Camera Interface

| Metrics | |
|---|---|
| Dimensions | 19" rack mount with 1 HU and 220 mm depth |
| Weight | 2 kg |
| | |

| Environment | |
|---|---|
| Temperature range | 0 … 50°C |
| Humidity | non condensing |

| Electrical Interface | |
|---|---|
| Power supply | 12 V (8 ... 16 V), max. 6 W |
| | |

| Trigger Input (GND contact or active low voltage) | |
|---|---|
| Isolation barrier | 1500 V |
| Maximum input voltage range | -12 ... +42 V |
| Typical trigger threshold | 2.5 V |
| Typical trigger current | 5 mA |

| Sync Input BNC | |
|---|---|
| Input type | Opto isolated, Rv internal = 390 Ohms |
| Typical drive level | 5...15 mA (compatible to Sync Output BNC) |

| Sync Output BNC | |
|---|---|
| Signal level | 5 V, max. 50 mA (compatible to Sync Input BNC) |
| Frequency tolerance | 10 ppm (1 µs in 100 ms) |

| ARM relay | |
|---|---|
| Maximum voltage | 60 V |
| Maximum current | 500 mA |

# 5. Specifications IES 0087 Camera Junction Box

| Metrics | |
|---|---|
| Dimensions | 164 x 105 x 40 mm³ |
| Weight | 0.5 kg |
| | |

| Environment | |
|---|---|
| Temperature range | 0 … 50 °C |
| Humidity | non condensing |

| Electrical Interface | |
|---|---|
| Power supply | 8...35 V, max. 6 W (plus Camera supply current) |
| | |

| Trigger Output | |
|---|---|
| Signal level | RS-422 differential |
| | |

| Sync Output | |
|---|---|
| Signal level | RS-422 differential |
| | |

| ARM Input | |
|---|---|
| Threshold level | 2.3 V (above signals armed) |
| | |