TTV 1640

3-CCD lightweight broadcast camera

The Thomson Video Equipement TTV 1640 is an all-new 3-CCD camera that has been developed to maximise the benefits to be derived from modern solid-state sensors. CCD sensor technology has now reached the point where significant advantages are available to professionals working with lightweight cameras incorporating these devices, making them the number one choice in the fast, unforgiving environment of news reporting. Thomson Video Equipement has optimised the camera design to take maximum advantage of the capabilities of these CCD sensors.

THOMSON VIDEO EQUIPEMENT

Principal features of the TTV 1640

- Excellent Picture Quality.
- Compact and Lightweight.
- Extremely Rugged.
- High Sensitivity, Excellent Signal/noise ratio.
- No Lag — Excellent Dynamic Resolution.
- Very large Contrast Range; White Compression and Knee optimised to CCD characteristics.
- No Comet-tailing.
- No "Blooming" or Highlight Defocussing.
- Colorimetry matches existing tube cameras.
- No Tube/scan-related adjustments.
- Microprocessor control to give enhanced facilities and status indications.
- Highly Resistant to Strong Electric/-Magnetic Fields.
- No Microphony.
- Standard "Betacam®" Rear Adapter Interface for system adaptability.
- Optically compatible with Existing Lenses.
- No Sensor Deterioration over Lifetime of Camera.

Performance

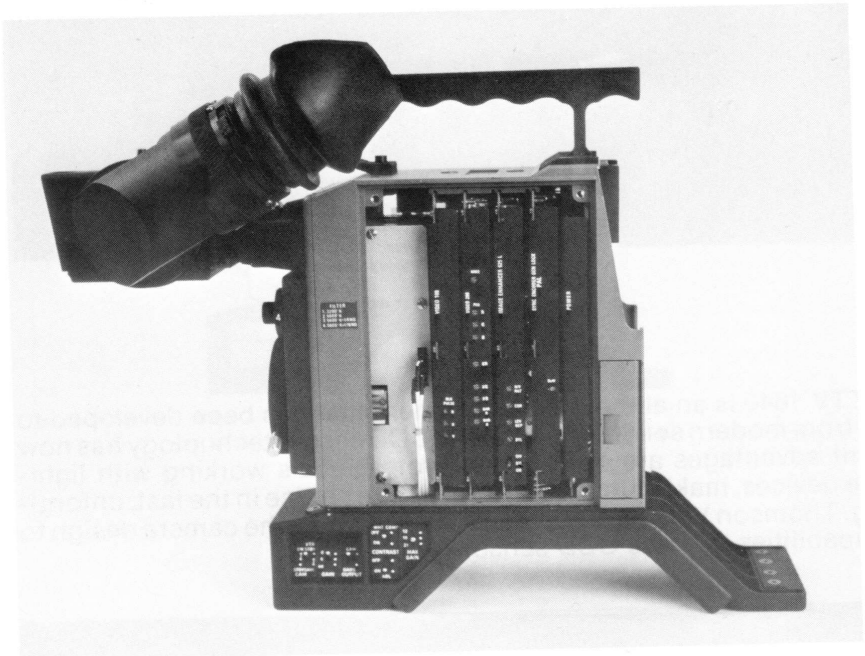
Considerable care has been taken during the development of the TTV 1640 to ensure that maximum advantage is taken of the CCD sensor capabilities, the objective being to ensure that the performance is optimised to achieve the best overall result. The TTV 1640 is a completely new design, which has allowed maximum freedom to achieve this objective.

CCD Advantages

The TTV 1640 pictures are remarkable for the absence of defects inherent in all tube cameras. Lag, comet-tailing, highlight defocussing, image retention and image burn-in are totally eliminated; this is of particular interest for ENG applications. Other characteristics are also improved, and these are discussed below.

Sensitivity and Signal/Noise

The total absence of CCD sensor lag and their immunity from image retention and comet-tail effects results in the fact that basic sensitivity and signal/noise ratio are the limiting factors for low-light performance of the camera. Superior sensitivity has been achieved in the TTV 1640 while maintaining a measured signal/noise ratio comparable with tube cameras. Electronic color temperature correction has been used in place of traditional yellow filters to minimise light loss in the optics path. This not only assists with improving sensitivity, but also eliminates the need for the cameraman to ensure that the correct color filter is selected under difficult lighting conditions. An illumination level of only 1100 Lux is required at 0 dB gain with the lens set to f:4, with a signal/noise ratio of 59 dB. The subjective noise level under normal operating conditions however is superior, and this, together with gain-dependent video processing techniques allows a maximum gain level of +21 dB to be used. Under these conditions, only 12 Lux will produce full video output (For 525/60 systems).



Resolution

The TTV 1640 uses both optical and electronic techniques to maximise resolution and minimise aliasing effects. The uniformity of resolution over the whole picture area gives the TTV 1640 excellent subjective resolution. The pixel structure of the sensor is the fundamental limitation of a CCD camera's resolution, but this cannot be considered in isolation since interaction of picture detail and sensor structure cause aliasing effects which if not minimised cause serious subjective impairment to the picture. Placement of the CCD sensors, optical low-pass filtering and contour correction are critical to the resolution performance, and special techniques are used in the design and manufacture of the TTV 1640 to assure optimum results.

Highlight handling

The absence of sensor lag and image retention ("burn" and "sticking") greatly improve the TTV 1640 performance compared to tube cameras in high-contrast conditions. However, excessive overloads will eventually cause smearing — an inherent characteristic of the interline transfer CCD sensor which has to be offset against it's many advantages. The TTV 1640 minimises this effect with both optical and electronic techniques. The result, in conjunction with sophisticated white compression, clipping and auto-knee circuits gives superb pictures even under the most difficult lighting situations.

Image Uniformity

In addition to uniform resolution over the whole active picture area, the TTV 1640 has no black or white shading effects resulting from the camera. The only shading errors result from the lens, and are thus symmetrical and easily corrected for in comparison to tube cameras. The picture uniformity of the TTV 1640 is excellent, the advantage being especially noticable at high gain settings.

Operational Features

The TTV 1640 takes full advantage of the CCD sensor characteristics to optimise operational as well as performance features.
The size and weight are significantly smaller than it's tube camera predecessors, which when combined with the more compact second generation VTR's gives substantial improvements for the cameraman. The reduction in overall length is of particular benefit in crowded situations. Switches have been located for easy operation and positive function identification to avoid errors resulting from accidental operation of adjacent switches. Cable connections have bee located to give minimum interference to normal operation.
The lower power consumption (15 W) is half that required by a tube camera of similar quality, and when used with the same VTR the saving is more than 30 %. This results in longer duration between battery changes, and more reliable battery operation.
Ruggedness is a key characteristic, especially in the ENG environment. The TTV 1640 main structure uses a magnesium casting for strength combined with light weight, and the camera has been designed with hard outdoor use and frequent transportation in mind. The TTV 1640 is very tolerant of it's operating environment. Mechanical shock and high sound pressure levels do not cause microphony, and the camera is highly resistant to strong external magnetic and electric fields.
All normal operational automatics are of course provided, except centering which is not required since registration accuracy is built-in for life at the factory during CCD sensor mounting. Of special note are two white balance memory positions for each filter position in addition to on-line auto white balance and the preset setting, and auto black level set as well as auto black balance.

The maximum gain of the TTV 1640 may be set to +12, +18 or +21 dB. This gives the user maximum flexibility in low light conditions, while the automatic knee circuit and white compression system optimise the results in high contrast situations. The absence of color correction filters eliminates the possibility of losing sensitivity unnecessarily in low light conditions as a result of incorrect choice of filter, and allows the provision of a greater range of ND filters for other applications.
The TTV 1640 is always ready for immediate use. There are no technical setup procedures to follow prior to operation, and warm-up is sensibly instantaneous.
The viewfinder is a new design featuring not only better brightness and resolution, but also alpha-numeric message displays in the viewfinder image to supplement the information traditionally displayed with LED's. These displays have a timeout feature to avoid unnecessary distraction. the viewfinder eyepiece may be adjusted to the diopter setting preferred by the individual cameraman.

Microprocessor Control

The TTV 1640 control system is microprocessor-based which has permitted the traditional operational automatic functions and the status indications of the camera to be enhanced. More color balance settings can be stored, and these settings automatically change with filter selection. Alpha-numeric messages are displayed in the viewfinder image to complement normal LED indications. The user can therefore operate with a higher level of confidence, safe in the knowledge that warning of abnormal camera status or performance will be given. The level of message detail is selectable, and a time-out feature built-in to accommodate individual preferances.

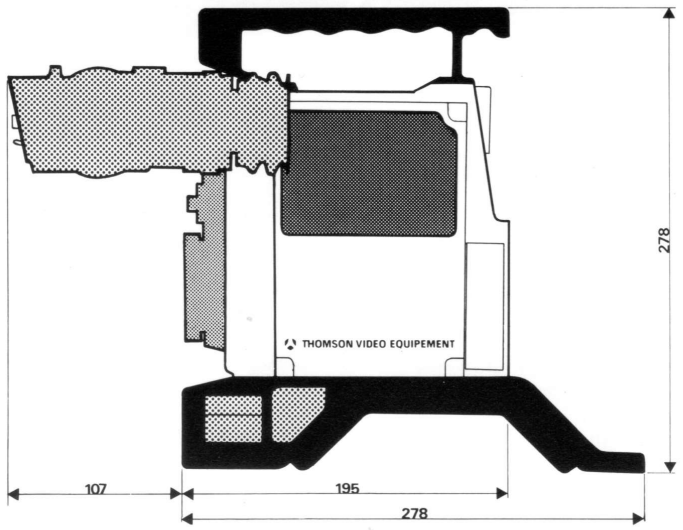
Production Capabilities

Although the currently available sensors are clearly best suited to the ENG environment, the design does not limit use of the TTV 1640 to ENG applications.
A Genlock input is provided to allow multiple camera operation; the BT 33 remote control panel may be connected to the camera to facilitate picture matching; and RGB video signals are available on an 8-pin connector.
The TTV 1640 uses the same lens optical, mechanical and electrical interface as is used on Thomson tube cameras. The same Betacam interface has also been retained at the rear of the camera. This means that existing camera lenses and rear

modules may be used with the TTV 1640 CCD camera. Cable connection to separate VTR's, microwave links and vision switchers is thus easily achieved with existing accessories. The CA 83 rear module, introduced to interface TTV 1623/1624 cameras by RGB triax link to the TTV 1530 studio/O.B. camera base station and full-facility control panel, is compatible with the TTV 1640 CCD camera. Whilst certain functions available from this panel are not necessary for the CCD camera (such as centering) it does allow the user to work in any production environment with the CCD camera head.

TYPICAL PRODUCT CHARACTERISTICS

Systems	625/50 PAL or SECAM 525/60 NTSC
Sensors	3 2/3-inch interline transfer CCD 500 x 582 pixels (625-line systems) 510 x 492 pixels (525-line systems)
Optical system	f: 1.4 RGB prism with 4 filters
Lens mount	Compatible with TTV 1623/1624 series
Sensitivity and signal/noise	1100 lux at f:4; 90% reflectance chart, 3200° K, 0 dB gain. 59 dB (525 lines) 1400 Lux at f:4; 90% reflectance chart, 3200° K, 0 dB gain. 57 dB (625 lines)
Minimum illumination	12 lux at + 21 dB (525-lines) 15 lux at + 21 dB (625-lines)
Horizontal resolution	550 TV lines
Registration	0.05% (Whole picture area)
Geometric distortion	Less than 0,1% (without lens)
Power consumption	15 W (approx. with high brightness viewfinder)
Weight	3.5 Kg approx. incl viewfinder
Environmental	— 20 C to + 45 C; RH 95% non-condensing (operating) — 20 C to + 55 C; RH 95% non-condensing (storage)



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