

CCD Camera TV Modulator

Update

XU55K Issue 4



Please note that the CCD Camera and housing are not included in the kit.

1
PROJECT
RATING

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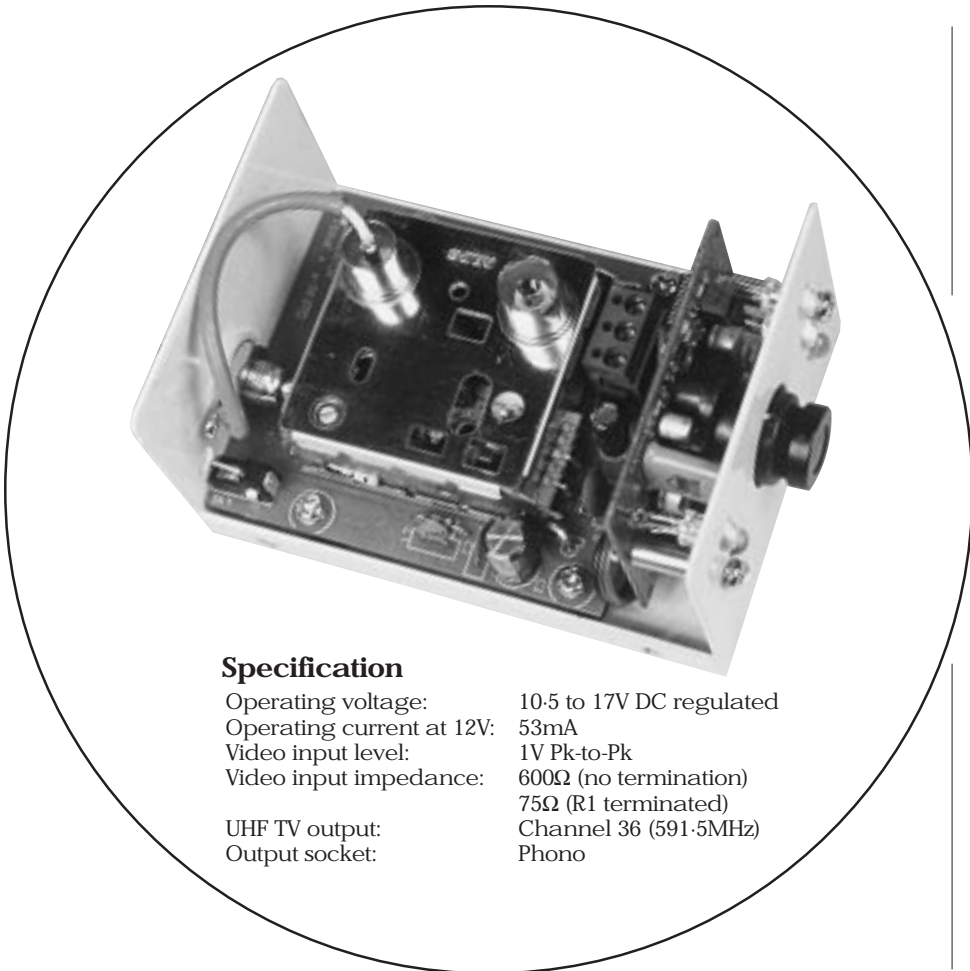
APPLICATIONS

- ★ Run colour and monochrome CCD cameras on domestic TV sets
- ★ Interface video only devices to TV sets
- ★ CCTV Security systems

FEATURES

- ★ Amplification of upper video frequencies
- ★ Low cost
- ★ Built-in supply regulation
- ★ Reverse polarity protection
- ★ Simple construction





Specification

Operating voltage:	10.5 to 17V DC regulated
Operating current at 12V:	53mA
Video input level:	1V Pk-to-Pk
Video input impedance:	600Ω (no termination) 75Ω (R1 terminated)
UHF TV output:	Channel 36 (591.5MHz)
Output socket:	Phono

is required, which superimposes (modulates) the video signals from the CCD camera, or a wide range of other units giving a composite video output, onto a high-frequency (UHF) carrier wave. To simplify the construction and alignment of the project, a pretuned modulator module has been employed in the design. The RF output from this modulator is suitable for connection to the aerial input of UK UHF TV sets via a standard coaxial aerial lead.

Circuit Description

Refer to the Modulator block and circuit diagrams, shown in Figures 1 and 2, respectively. These should assist you when following the circuit description or during fault-finding of the completed unit, should this be necessary. The regulated DC power is applied to the Modulator via the jack socket SK1. This supply must be within the range of 10.5 to 17V DC (regulated), since this also feeds the CCD camera module itself, which is an expensive item to replace should excessive voltage be applied – so do not exceed the maximum voltage! To prevent reverse polarity damage, diode D1 is included.

The main supply rail decoupling is provided by C3 with additional high-frequency decoupling provided by 100nF ceramic capacitors C1 and C2.

THE CCD Camera TV Modulator has now been redesigned to fit into the purpose-built Security Camera Housing (AG00A), and also to enable a reduction in the wiring necessary to create a security camera system. As such, a new PCB is used, along with a rearranged layout and the use of a power socket and terminal block in place of the PCB pins used previously. The video output from the Maplin monochrome and colour CCD camera modules (AY16S and AR59P, respectively) cannot be connected directly to the majority of domestic TV sets, since their output signal is in composite video form. Some TVs do have a direct video input socket (Peritel), also known as a SCART socket, to which the camera can be directly connected, but most only have a UHF aerial input socket for the reception of TV stations. To solve this problem, a low-cost UHF modulator

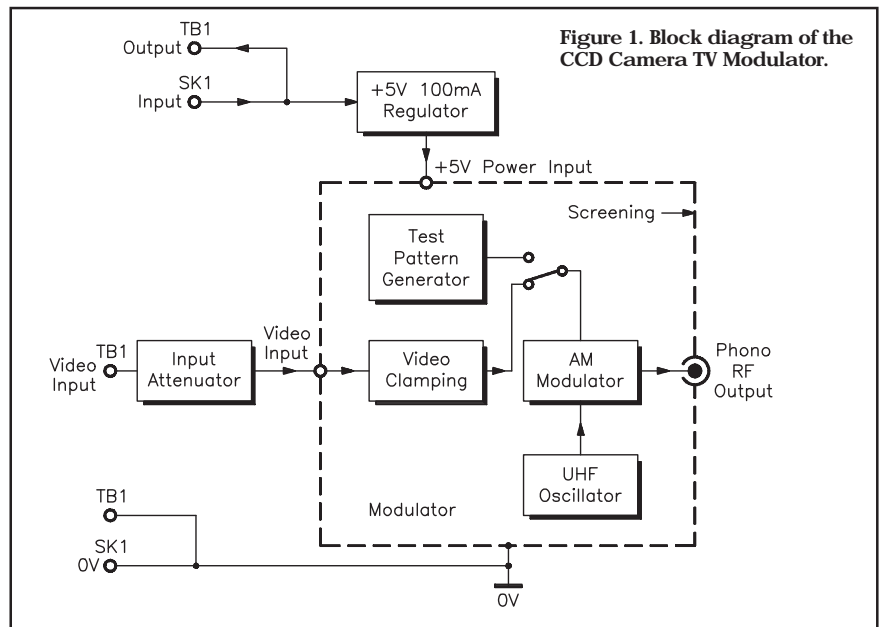


Figure 1. Block diagram of the CCD Camera TV Modulator.

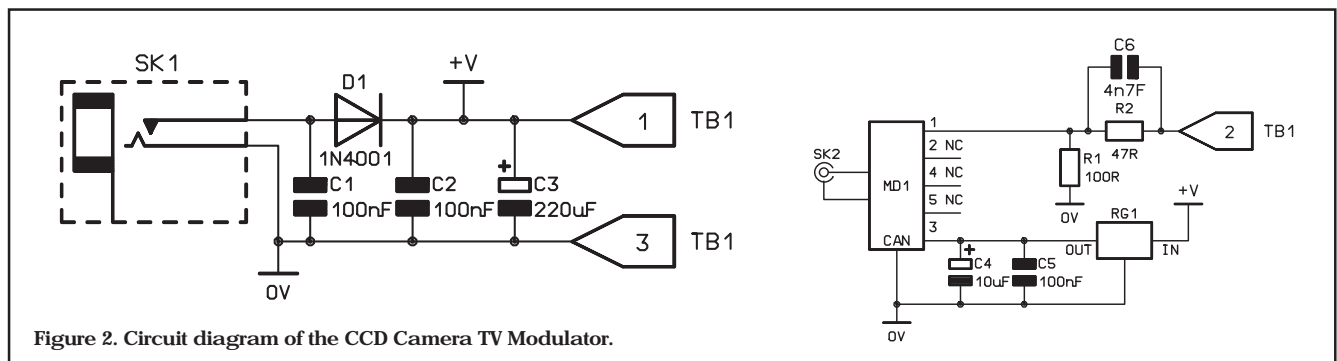


Figure 2. Circuit diagram of the CCD Camera TV Modulator.

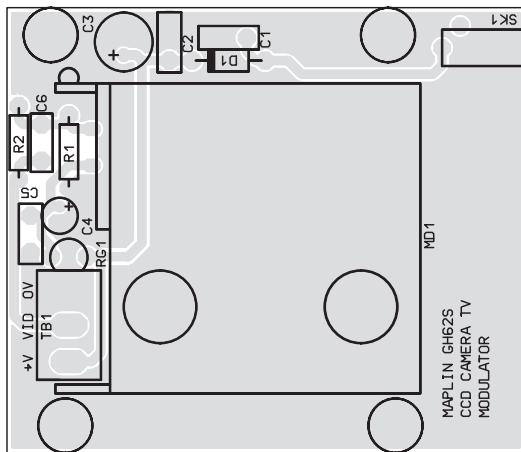


Figure 3. PCB legend and track.

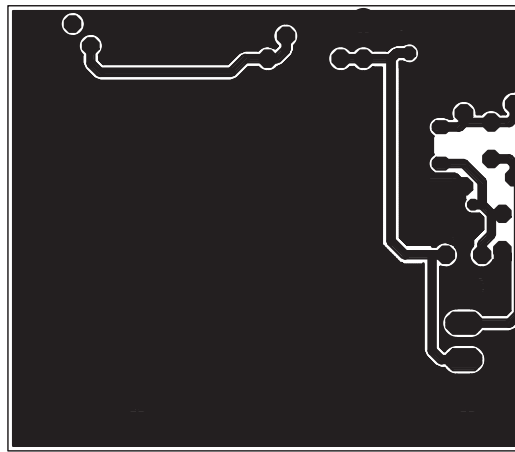


Figure 4. Exploded assembly diagram.

The modulator, MD1, requires a +5V stabilised supply. This voltage is obtained by using a small 100mA regulator, RG1, with capacitors C4 and C5 providing the final decoupling to the power input of MD1.

The video signal from the CCD camera is applied to pin 2 of the three-way terminal block TB1, and the ground connection is made to pin 3. The input impedance of the modulator, MD1, is significantly higher than the 75Ω termination resistance required by the CCD camera modules. This termination load is corrected by placing across the video input a 100Ω resistor, R1. However, this resistor can be omitted if the CCD camera is already terminated by some other video device, i.e. a VCR or monitor. The terminated video signal is attenuated by resistors R2 and R1 (if fitted) to drive the video input of MD1 at the correct level. The video attenuator stage is bypassed at high frequencies by a low value (4.7nF) ceramic capacitor, C6. This has the effect of boosting the upper frequencies by a small amount, producing a slightly sharper picture. If this enhanced image is not required, C6 may be omitted.

As can be seen from the block diagram of Figure 1, all the main signal processing circuits are contained within the UHF modulator block MD1. All the stages are powered from a common +5V supply, RG1, with the 0V ground connection made to its metal screening can. The incoming video information is first passed through a signal clamping circuit. This is to ensure that if overdriven, the RF output of the modulator will not completely break up. The video information is then applied to an amplitude modulator (AM) stage, which receives the output from a RF oscillator running at a frequency of approximately 591.5MHz (TV channel 36). Now that the video signal has been superimposed onto the RF carrier, it can be outputted, via

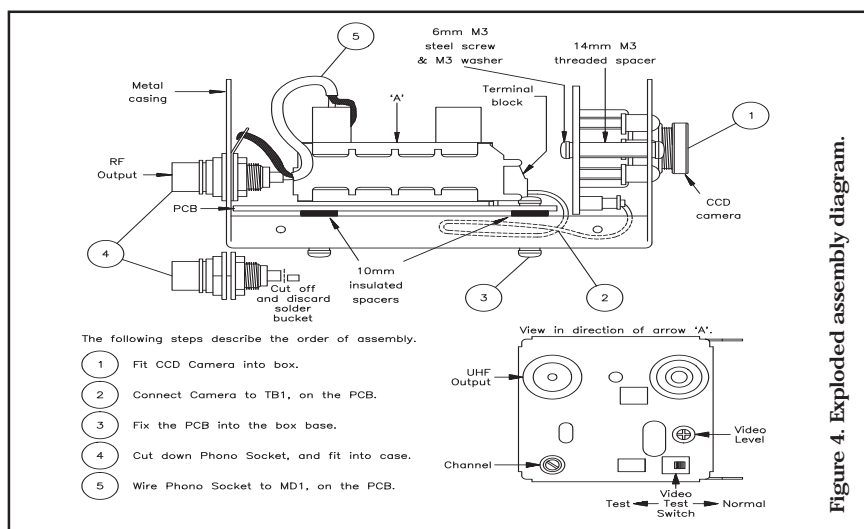


Figure 4. Exploded assembly diagram.

the phono connector, to a standard colour or monochrome (black and white) UHF television receiver.

PCB Assembly

Refer to Figure 3, showing the PCB legend and track while assembling the board. Removing a misplaced component can be tricky and may damage the component(s), so always double-check the type, value and polarity before soldering!

The sequence in which the components are placed is not critical. However, the following sequence is advised. Commence with the smaller components and progress through to the largest. Install resistors R1 and R2, followed by diode D1; this has a band at one end to identify the cathode (K) lead. The legend shows the diode position with a symbol like a resistor, but with the prefix 'D1', and this symbol also has a bar across one end, which is where the cathode is placed. Next, fit the ceramic capacitors (C1, C2, C5 and C16) and electrolytic capacitors (C3 and C4). The polarity for the electrolytic capacitors is indicated by a plus sign (+) on the PCB legend. However, the majority of electrolytic capacitors

have the polarity designated by a negative symbol (-), in which case, the lead nearest this symbol goes in the hole *opposite* to the positively designated hole.

Next, install the voltage regulator RG1, making sure that its flat surface conforms to the package outline on the legend, followed by the power socket SK1 and terminal block TB1, with the access holes facing outward. The next stage is to mount the modulator MD1, making certain that the two wire connections are in their correct positions to align with the holes in the PCB. To secure MD1 to the board, simply fix in place using a Quickstick pad, and solder the two wires and screening can to veropins inserted through the PCB at the appropriate positions.

This completes the assembly of the PCB. Carefully check your assembly work, making sure that there are no misplaced components, solder bridges, whiskers or dry joints. It is also very important that the solder side of the circuit board does not have any trimmed component leads standing proud by more than 3mm, as this may result in a short circuit against the metal camera housing. Finally, remove excess flux from the board using a suitable solvent.

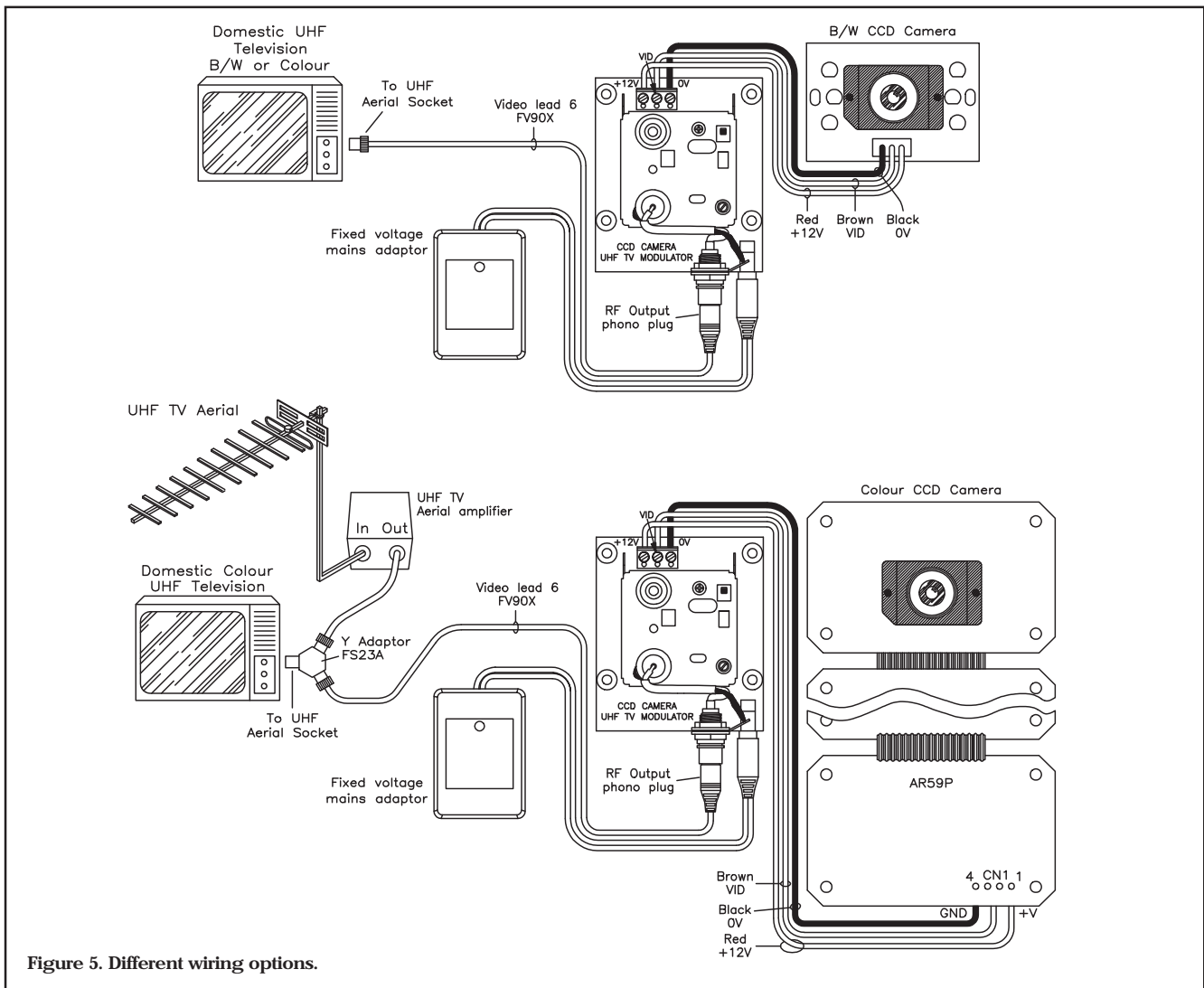


Figure 5. Different wiring options.

Security Camera Housing Assembly

The specified CCD Camera Housing (AG00A) is supplied predrilled to accept the camera module, and the Modulator board has been designed to fit the other existing holes in the housing. All that remains is for the boards to be fixed into place by means of screws, washers and spacers, some of which are provided with the housing. However, additional spacers and screws will be required – refer to the Optional Parts List and to the assembly layout diagram shown in Figure 4 for details.

Note that some items of hardware supplied with the housing are not used, in particular, the hexagonal plastic spacers and some of the self-tapping screws, since not all of these are needed. Take care not to overtighten the screws, so as to avoid damaging the PCBs. The infra-red LEDs' legs may need to be manipulated slightly to allocate all six LEDs to their respective holes in the housing.

Wiring

As can be seen from Figure 4, the total amount of wiring has been kept

to a minimum – just three wires and a screened cable. The connections between the Modulator and CCD camera module are made using the three-way length of ribbon cable supplied with the camera module. The red lead is connected to pin 1 of the terminal block TB1 (marked +12V on the PCB legend), the brown lead goes to the central pin 2 of TB1 (marked 'VID'), and the black lead connects to pin 3 of TB1, marked 0V – see Figure 5.

There are two basic methods of using the modulator with your TV set, these being shown in Figure 5. The first and most simple is to just plug the RF output from the modulator lead into the UHF aerial socket on your TV and tune to channel 36. The only drawback to this is that since you no longer have your TV aerial connected to the set, no UHF TV stations can be received. In the second method, a coaxial Y-adaptor is used to combine the UHF signals from the modulator and TV aerial, thus allowing both to be tuned in. However, to prevent any stray signals from the modulator reaching your TV aerial and being possibly picked up by the next door neighbour, you should use an indoor aerial amplifier. This will have two beneficial effects, blocking the signal from the modulator to the aerial and

compensating for the insertion loss of the Y-adaptor. Remember that you may have to retune the modulator to a clear channel if it clashes with any TV stations or a VCR/satellite receiver (especially with the launch of channel 5).

The 12V regulated AC-DC adaptor (JC92A) is supplied with a generous length of power cable and several universal plugs, one of which fits the socket SK1. Take care to ensure the correct polarity – the centre pin must be positive. The RF output from the Phono connector on the modulator is fed to the UHF aerial socket of your television via a ready-made Phono Plug to Coax Plug Video Lead, such as FV90X (1.2m long), or JW40T (10m long), as required.

Testing and Alignment

Referring to the wiring diagram of Figure 5, connect an appropriate 12V regulated adaptor (such as JC92A) or power supply via the socket SK1, and connect the RF from the modulator MD1 to a colour or monochrome (B/W) TV set tuned to UHF channel 36, and the TV should display the image seen by the CCD camera. If no picture is visible, try adjusting the channel tuning control on the television.

The frequency output of the

video modulator MD1 is factory set to channel 36 (591.5MHz), which should be suitable for most applications. If necessary (and having rechecked your assembly work/connections/TV settings beforehand), it can be returned by adjusting the ferrite core of its oscillator stage.

Using the Modulator

When wiring up and installing a video camera system, it is recommended that the connections between the power supply, modulator and CCD camera are kept to the minimum length possible, to minimise the possibility of interference. If the camera system is to be used at any greater distance from the television, then the RF output lead from the modulator should be extended by using a coaxial line socket (YW09K), low-loss coaxial cable (XR29G/XR87U) and a coaxial plug (HH07H).

Figure 6 shows a typical installation of a security camera system (to monitor callers at your door). The camera should be mounted high up and preferably out of sight, to protect it from vandalism or theft, and it must be suitably protected from the elements, as the specified housing is not waterproof. Note also that the housing is really only suitable for the monochrome CCD camera (which is the ideal choice for a security camera, since it can 'see' in the

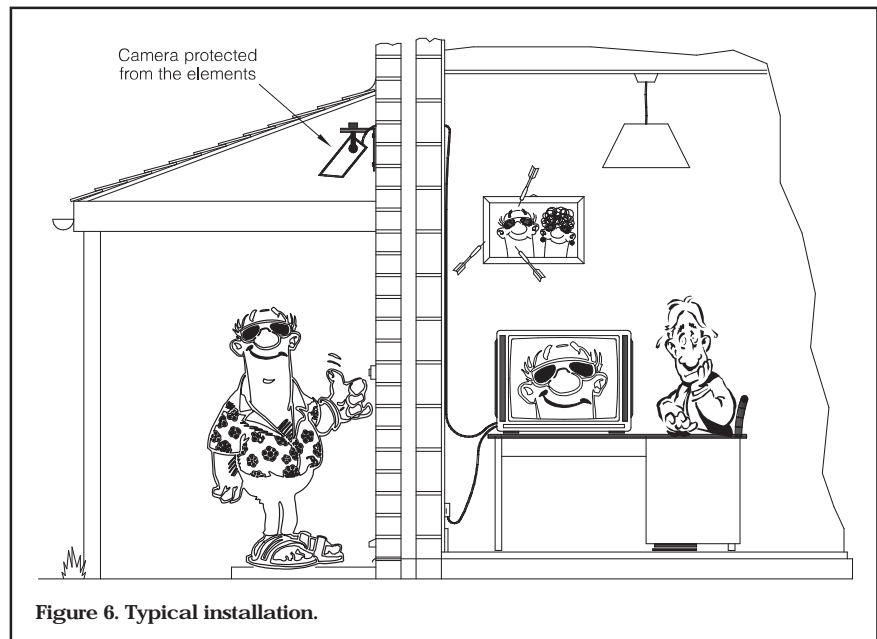


Figure 6. Typical installation.

dark). This is due to the extra holes drilled for the infra-red LEDs, and because this housing is not large enough to contain both a colour CCD camera (which is larger than the monochrome version) and the modulator.

Ensure that all cables are protected where they pass through holes in walls, using strain relief sleeving/grommets (e.g., JX64U-JX66W, or JX71N), to prevent the risk of short-

circuiting due to cable damage. Plastic cable clips, such as BH21X/RT63T (5mm diameter) or 'P' clips (e.g., LR44X) can be used to neatly secure lengths of coaxial cable to walls, door frames, etc.

Obviously, when setting up the security camera system, ensure that the cables are well hidden from view or made inaccessible, to avoid them being 'got at' by unscrupulous individuals!

CCD CAMERA TV MODULATOR PARTS LIST

RESISTORS: All 0.6W 1% Metal Film

R1	100Ω	1	(M100R)
R2	47Ω	1	(M47R)

CAPACITORS

C1,2,5	100nF 16V Ceramic Disc	3	(YR75S)
C3	220µF 16V Radial Electrolytic	1	(AT41U)
C4	10µF 16V Radial Electrolytic	1	(AT77J)
C6	4n7F Ceramic Disc	1	(WX76H)

SEMICONDUCTORS

D1	1N4001	1	(QL73Q)
RG1	LM78L05ACZ	1	(QL26D)

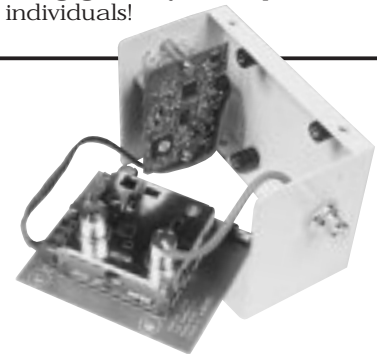
MISCELLANEOUS

MD1	UHF Modulator	1	(WC20G)
	1mm Single-ended PCB Pins	3	(FL24B)*
	Miniature PCB-mounted DC Power Socket	1	(FK07H)
	3-way 5mm PCB-mounted Terminal Block Type 300	1	(JY94C)
	PCB	1	(GH62S)
	Instruction Leaflet	1	(XU55K)
	Constructors' Guide	1	(XH79L)

OPTIONAL (Not in Kit)

	Regulated 12V Mains Adaptor	1	(JC92A)
	Monochrome CCD Video Camera	1	(AY16S)
	Colour CCD Camera (see text)	1	(AR59P)
	Phono Plug to Coax Plug Video Lead	1	(FV90X)
	Chassis-mounted Phono Socket	1	(JZ06G)
	M3 10mm Insulated Spacer	1 Pkt	(FS36P)
	M3 Threaded Spacer	1 Pkt	(FG38R)
	M3 Washer	1 Pkt	(BF62S)

M3 6mm Steel Screw	1 Pkt	(JY21X)
2-to-1 Coax Adaptor Type Y	1	(FS23A)
10m Coaxial Flylead	1	(JW40T)
Miniature Coaxial Cable	1	(XR88V)
Coaxial Connector	1	(HH11M)
Security Camera Case	1	(AG00A)



The Maplin 'Get-You-Working' Service is available for this project, see Constructors' Guide or current Maplin Catalogue for details.

The above items (excluding Optional) are available as a kit.

Order As LT37S (CCD Camera TV Modulator)

Please Note: Items in the parts list marked with a * are supplied in 'package' quantities (e.g. packet, strips, reel, etc.), see current Maplin Catalogue for full ordering information.

The following new item (which is included in the kit) is also available separately

CCD Camera TV Modulator PCB Order As GH62S

The following Optional items are *not* included in the kit, but are available separately.

Monochrome CCD Video Camera **Order As AY16S**
 Colour CCD Camera **Order As AR59P**
 Security Camera Housing **Order As AG00A**



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