

IRT Eurocard

Type AVS-3170

5 x 1 High Frequency Relay Switcher

Designed and manufactured in Australia

IRT can be found on the Internet at: http://www.irtelectronics.com

IRT Eurocard

Type AVS-3170

Description

Instruction Book

Table of Contents

Page

Section

General description	3
Technical specifications	4
Technical description	5
Power supplies	5
Switching logic	6
Sync path	6
Signal path	7
Internal adjustments	7
Configuration	7
Interconnecting modules	8
Switch pulses - internal & external sync.	8
Power on reset	8
Link settings	9
Wire per crosspoint operation	10
Location of links & user settings	11
Installation	12
CPS-3050 Local control	13
TPS-3010 Local tally panel	13
Signal connections	13
Front & rear panel connector diagrams	14
Maintenance & storage	15
Warranty & service	15
Equipment return	15
Drawing index	16

This instruction book applies to units later than S/N 9700000.

General description

The AVS-3170 5 x 1 relay switcher for video and RF is a passive unbalanced circuit relay switcher.

The relays used are low capacitance reed relays wired to minimise crosstalk from the unused inputs and thus allow the switcher to be used with RF or video signals in excess of 140 MHz.

This also allows the switcher to be used for high-speed digital signals with minimal effect on the pulse risetime.

When used at very high data rates the small amount of high frequency attenuation may be corrected by following the switcher with a data distribution amplifier. This not only provides automatic equalisation, but also source isolation and multiple outputs.

Termination resistors for 75 Ω signals are fitted as standard. These may be easily changed to 50 Ω for RF signals or removed for switching TTL or other signals.

When the switcher is not powered, relay 1 circuit switches input 1 to the output thus providing a secure path during power failures.

The AVS-3170 5 x 1 relay switcher is designed to interface with other IRT Eurocard 3000 series switchers or with the VG-737 video and AG-738 audio program fail detectors.

The switcher may be fitted with a local control panel, type CPS-3050, or with a tally panel, type TPS-3010, for local path indication when the switcher is operated remotely.

The AVS-3170 is built to the IRT Eurocard format and may be mounted in any of IRT's standard Eurocard frames together with other Eurocard modules.

Standard features:

- Suitable for video, RF, ACS or high speed digital signals.
- May be used for G.703 MPEG transport streams.
- Economical switcher for 2, 8, 34 & 45 Mb/s data signals.
- Termination impedance may be easily changed from 75 Ω to 50 Ω or open circuit.
- Default path from source 1 on power fail.
- Compatible with 3000 series switchers or wire per crosspoint control.

Accessories available: -

FRU-3000 Eurocard module mounting frame Mounts up to 12 Eurocard modules and one PSU-3000 Dual AC power supply side by side in 134 mm of standard rack space (3 Rack Units). FRU-1030 1 RU chassis conversion/PSU Converts Eurocards to a 1 rack unit format. The FRU-1030 can be fitted with either one or two Eurocards in a horizontal side by side format. A single AC power supply is included to power the cards.

TME-6 Eurocard extender board.

Instruction Book.

AVS-3170 Technical Specifications

Video inputs:		
Number		5.
Impedance		75 Ω terminated when not selected.
Video outputs:		
Tvpe		Relay switched.
Number		1.
Impedance		Designed for use with 75 or 50 Ω signals. Output impedance will be that of selected input.
Control inputs/	outputs:	
Type		5 bit BCD coded parallel TTL level
Type		or
		or individual grounding contacts
Number		Lipput & Loutput
INUIIIDEI		1 mput & 1 output.
Performance:		
Video crosstalk		< -60 dB to 10 MHz.
Relay contact rating		24 Vdc - 100 mA, 100 Vac - 0.3 A.
Power Requirement	S	28 Vac CT (14-0-14) or \pm 16 Vdc.
Power consumption		<95 mA.
Connectors:	Video	BNC.
	Control	Plug in HE14 10 pin dual IDC.
Other:		
Temperature range		$0 - 50^\circ$ C ambient
Mechanical		Suitable for mounting in IRT 19" rack chassis types FR-700 & FR-722
Weenaniear		with input output and power connections on the rear panel
Finish Front	nanel	Grev enamel silk-screened black lettering & red IRT logo
Rear a	ssembly	Detachable silk-screened PCB with direct mount connectors to Eurocard
Real t	issembly	and external signals
Dimensions		6 HP x 3 U x 220 mm IRT Eurocard
Dimensions		
Supplied accessories		Rear connector assembly including matching connectors for control
		inputs & outputs.
Optional accessories		CPS-3050 local control panel.
		TPS-3010 local tally panel
		CPS-9000 remote control panel
		TME-6 module extender card

Due to our policy of continuing development, these specifications are subject to change without notice.

Technical description

The 3000 series of switchers and controllers share a common logic control system. For detailed information regarding compatible switcher modules and control panels refer to the *3000 Series Switcher* manual.

Power supplies: (See diagram 803142 sheet 2.)

Input power may be fed by a number of means.

- 1. One or two 14 0 14 Vac supplies via connections on the 64 pin DIN rear connector of the module. (Used when module is mounted in FR-700 chassis or FR-748A chassis fitted with one or two PT-701 PSU's.)
- 2. Two ±16 Vdc supplies via connections on the 64 pin DIN rear connector of the module. (Used when module is mounted in FR-748A chassis fitted with one or two PT-748A PSU's.)
- One 14 0 14 Vac supply and one ±16 Vdc supply via connections on the 64 pin DIN rear connector of the module. (Used when module is mounted in a FR-748A chassis fitted with 1 x PT-701 PSU and 1 x PT-748A PSU.)
- 4. A single 14 0 14 Vac supply connected to the 3 pin male connector on the module side of the rear assembly. (Used when module is mounted in FR-722 chassis.)

The input power is isolated by fusible resistors F 1 to F 4. Should these fail they should be only replaced by a similar type of the same value or protection of the common power supply will be compromised.

If an AC supply is provided, the isolated AC is full wave rectified by diodes D 10 to D 13 and D 14 to D 17 to provide a raw DC voltage of approximately 20 V at filter capacitors C 1 and C 13. The actual voltage will vary depending on the type of frame, loading of PSU by other modules and the local mains supply voltage.

If a DC supply is provided, the isolated DC passes through the diodes D 10 to D 13 and D 14 to D 17, which provide protection against accidental reverse polarity connection of the DC supply. Where a DC supply is used, the input voltage must be at least ± 15 Vdc under all conditions to ensure sufficient margin for the proper operation of the following voltage regulators and losses in the input fusible resistors and diodes.

The raw DC power is fed to three terminal regulator IC's that provide ± 12 Vdc rails for the video circuits. The ± 12 Vdc is also supplied to the remote logic connector PL 4 pin 1A via a current limiting resistor R 24 for use by control panels.

The +12 Vdc rail is further connected to another three terminal regulator to provide the +5 Vdc required by the logic control circuits.

A number of 10 μ F tantalum tag capacitors are located at key points in the circuit to suppress interference on the DC rails. Should any of these fail they should be replaced by high quality tantalum tag capacitors of at least 16 Vdc rating.

A green LED on the front panel indicates presence of DC power in the module. This LED is supplied from the +5 Vdc regulated supply rail via R 23.

If the module is fitted with local control buttons (CPS-3050) or a local tally panel (TPS-3010) then LD 1 the DC power indicator LED is omitted.

Switching Logic:

Control logic for each switcher module is performed by a Programmable Logic Array (PLA) which has been programmed for the required operations. This component will only function correctly when loaded with the correct program and is therefore only available through IRT.

Each module of the switcher group has two control connectors on its rear assembly.

They are labelled PL 4 and PL 5. For descriptive purposes, PL 4 is called the "input" connector and PL 5 the "output" connector.

The pins on these connectors have the following functions:

	PL 4	PL 5
1A	+12 Vdc	NC
1B	Ground	Ground
2A	Data 4	Data 4
2B	Data 3	Data 3
3A	Data 2	Data 2
3B	Data 1	Data 1
4A	Data 0	Data 0
4B	Switch pulse in	Switch pulse out
5A	Busy out	Busy in
5B	Unlatch in	Unlatch out



The 5 bit codes on Pins 2A to 4A represent the input selected. This code is in BCD (Binary Coded Decimal) where the Data 0 to 3 represent the binary numbers 0 to 9 (Inputs 1 to 10 if Data 4 is 0 or Inputs 11 to 20 if Data 4 is 1).

The *unlatch out* signal is asserted by a switcher if any of its front panel switches is operated or if its *unlatch in* signal is asserted. The presence of an *unlatch in* signal causes any switcher to release control of the data lines (if it had control of them).

A switcher signals that it has control of the data lines by asserting busy out. Busy out also ripples busy in.

The operation of a push-button ripples unlatch to modules farther down the chain, causing any of them with control of the bus to release it, and in so doing clear the *busy* line.

As soon as the requesting module sees its *busy in* line clear, it takes control of the bus and asserts its *busy out*. The *busy out* signal then ripples up the chain causing any other modules release control (if they had it).

Sync path:

The switchers may be operated in either a local or remote sync mode in order to allow simultaneous switching of different signals in multilevel applications.

This implies that the matrix will not switch until a sync pulse is received. When this is not provided externally, a local sync needs to be provided.

The AVS-3170 generates a local sync by means of a free running oscillator followed by a (U 2). This provides pulses approximately every 25 ms.

The "localsync" signal is passed to the PLA via link LK 4, which allows a choice of internal or external sync to the switcher logic. The chosen sync is echoed to "vertout" which is available on the PL 5 remote connector for slaving other switchers. See *Configuration* section for details.

Signal path:

Video path: (See diagrams 803142 sheet 1.)

The incoming video signal on each of inputs 1 - 5 is connected to a BNC connector on the rear assembly. These terminals are terminated either via a termination resistor (R 1 to R 4) or via other equipment connected to the output. The switching arrangement of the relay contacts ensures that one input is always connected to the output and so only four termination resistors are required.

It should be noted that during relay switching a discontinuity in termination will occur, which can cause a "glitch" in the output signal.

It should also be noted that the signal is directly coupled through the relays and so will pass any DC content present. Care should be taken to ensure that any DC present on the signal does not exceed the contact rating of the relays.

In the event of power loss all relays revert to the power off status shown on the schematic, with input 1 connected to the output.

The circuit arrangement for the relays provides a changeover function from one input to the next. This results in only four relays and relay drivers being required.

The relay drivers consist of an NPN transistor pull down switch connected to the +12 Vdc rail (Q 2, 4, 6 & 8) operating a PNP transistor pull-up of the relay coil to the +12 Vdc rail. The other side of the relay is connected to the -12 Vdc rail to equalise loading of the +ve and -ve supply rails.

Internal adjustments

The AVS-3170 contains no user adjustable controls other than link settings described in the *Configuration* section of this manual.

Configuration

The AVS-3170 may be used in a stand-alone mode (with a CPS-3050 local control panel) or may be connected to external control.

The control system is the same as is used on IRT's other 3000 series switchers and the AVS-3170 may be incorporated into complex switching systems using a combination of these modules.

These switchers include:

AVS-3011	5 x 1 analogue video
AAS-3021	5 x 1 analogue audio
DDS-3031	5 x 1 RS422
DVS-3041	5 x 1 SDI or ASI digital

In addition the following control panels may be used:

1	5
CPS-3050	local 5 button control panel (fits to front of switcher)
CPS-9001	remote 5 button control panel
CPS-1050	10 button 1 RU remote control panel
CPS-1052	20 button 1 RU remote control panel

And the following logic controllers:

CDC-3060	microprocessor programmed controller and RS232 interface
CDC-3061	3 way priority controller
CDC-3062	4 way priority controller

Some of the above switchers and controllers are normally configured for greater than $5 \ge 1$ operation. For details on extended operation see *Switcher set-ups larger than* $5 \ge 1$ following.

Interconnecting modules:

From the description given under *circuit description -- control circuit* the following rules for daisy chaining the modules can be deduced:

- I. Modules are looped by joining PL 5 (data out) on one module to PL 4 (data in) on the next.
- II. A CPS-9000 or CPS-9001 remote control panel must be powered by either:
 - (a) Connecting its PL 5 to PL 4 on a powered module (i.e. one of the switcher group or a CDC-3060 logic control module).
 - or
 - (b) Connecting its PL 5 to PL 4 on another CPS-9000 that is configured as in (a).
- III. If a CDC-3060 logic control module is used it must be the last link in the chain. I.e., PL 4 of the CDC-3060 connects to PL 5 of the last switcher.

Switch pulses - internal & external sync.:

Each 3000 series switcher has a free running switch pulse generator for executing a crosspoint change. The period is approximately 25 ms. Uniquely, the AVS- $3010/3011 5 \times 1$ video switcher can synchronise its switch pulse generator so that transitions will occur in the vertical interval of the video signal that is currently selected.

When a switcher group module is configured as *Inputs 1-5* (using LK's 1 & 2), it uses its own switch pulses. If configured for any other input range (e.g. *Inputs 6-10*), it defaults to using the switch pulses incoming on its PL 4 connector -- *switch pulse in*, and also passes these on to *switch pulse out* on its PL 5.

By changing LK 4 the switcher can be forced to use the incoming switch pulses from an external AVS-3010/3011 switcher if the switching is required to be synchronised to a related video signal.

As the switch pulse signal is sent from the AVS-3010/3011 1 - 5 switcher only on its PL 5 connector, this must be the first switcher connected to the chain.

Power on reset:

Power on reset is needed so that at power on only one switcher or control panel drives the buss. LK 3 on each of the *Switcher Group* or the CPS-9000 / 9001 remote control panel is used to select which unit is in control at power on.

If LK 3B is **not** installed and the switcher/control panel is configured to be for *Inputs 1-5* then at power on that unit will take control of the buss and select input 1.

In the case of a multi-level set up, such as a 5×1 video with a 5×1 audio as a slave, all the slaves should have LK 3B installed.

LK 3 has another function. If LK 3A is **not** installed then any CPS-3050 switcher panel installed on the front of the module will act as tally only -- the operation of any of its buttons will have no effect.

Switcher set ups larger than 5 x 1

The AVS-3170 has the addressing capability to be set as 1 to 5, 6 to 10, 11 to 15 or 16 to 20. However, the switching arrangement does not permit AVS-3170's to be linked for 10×1 (or more) operation.

This does not prevent the AVS-3170 form being used as part of a larger system, but care must be taken to ensure that the envisaged design is realisable in practice.

For example: If two AVS-3170 switchers are connected to a CPS-1050 control panel, with one switcher set to addresses 1 - 5 and the other to 6 - 10, then pressing button 7 on the control panel will result in the first switcher output reverting to input 1 and the second selecting input 2 (7).

The control panel would only show input 7 as selected. If the switchers were fitted with TPS-3010 tally panels, these would show no selection on switcher 1 - 5 and input 2 (7) on switcher 6 - 10.

Signal side:

Because the first switcher is not open circuit at its output, it may not be bridged to the second switcher to form a 10 x 1 matrix. To achieve this result a third switcher is required to switch between the two. Another AVS_{3170} may be used for this purpose or an AMS_{3170} changeover switch may be used

Another AVS-3170 may be used for this purpose or an AMS-3170 changeover switch may be used. (See AMS-3170 manual for details.)

Control side:

The control signal for the third switcher may be obtained by wiring a discrete diode OR gate from the tally out connector on the CPS-1050. (See CPS-1050 manual for details.)

LK 1 and LK 2 on the switchers are used to assign the group of inputs that a module will switch.

NOTE: Always have one at least one switcher configured as '*Inputs 1-5*' otherwise there will be no switch pulses and consequently no switching action at all.

Connector PL 5 (data out) on switcher 1 - 5 connects to PL 4 (data in) on switcher 6 - 10 and so on.

Cables may be wired using the connectors provided or may be ordered from IRT using the following part numbers: GDW-3010 150 mm cable for joining adjacent modules in 3 RU frame. GDW-3011 300 mm cable for joining modules in 1 RU frames.

Link Settings:

Links LK 1 & LK 2: These set the crosspoint range of the switcher or control panel as follows:

Inputs	LK 1	LK 2
1 - 5		
6 - 10	IN	
11 - 15		IN
16 - 20	IN	IN

- Link LK 3: Local / remote control selection. If the switchers on the front of this unit are to be active, then install LK 3A, otherwise install LK 3B.
- Link LK 4: LK 4A: Always use incoming switch pulses. LK 4B: Normal selection of switch pulses.

Wire per crosspoint operation

In most cases, the BCD encoded remote control system offers the most satisfactory way of controlling one or more switchers. There are however, situations where it is necessary to provide a wire per crosspoint access for control and / or a line per crosspoint tally system.

Both of these facilities may be made available on the 3000 series in a number of ways.

3011 Series compatible:

The AVS-3170 provides an on board patching area for changing the switcher from BCD to WPX input using the PL 4 & PL 5 connectors.

To change to WPX mode the WPX links should be installed on the PCB where indicated on the PCB overlay and all of the "Universal" links should be removed or cut.

A momentary contact closure to ground on the relevant control input will now cause the switcher to operate in the same way as it would had the switch on the local control panel type CPS-3050 been depressed.

No complicated logic is required of a remote control to the switcher in this configuration. The CP-700 passive fivebutton remote control may be used to operate the switcher or a custom switch panel may be fabricated. If the CP-700 is used to operate the switcher the LED's for tally will be inoperative and the + Volts connection on the CP-700 should not be connected.

The primary disadvantage of this method is that no tally is available on the switch lines. It is however the most simple implementation for remote control and is ideally suited to external latching switches or external relay contact closure.

Connections are as follows:

	PL 4 & 5
1A	N/C.
1B	Ground.
2A	Switch 5 contact
2B	Switch 4 contact
3A	Switch 3 contact
3B	Switch 2 contact
4A	Switch 1 contact
4B	N/C.
5A	N/C.
5B	N/C.



Location of links & user settings

The following location diagram is not to scale and is intended only to assist in finding the location of links, which may need to be changed by the user during *Configuration*.



Installation

Operational Safety:

WARNING

Operation of electronic equipment involves the use of voltages and currents that may be dangerous to human life. Note that under certain conditions dangerous potentials may exist in some circuits when power controls are in the **OFF** position. Maintenance personnel should observe all safety regulations.

Do not make any adjustments inside equipment with power **ON** unless proper precautions are observed. All internal adjustments should only be made by suitably qualified personnel. All operational adjustments are available externally without the need for removing covers or use of extender cards.

Pre-installation:

Handling:

This equipment may contain or be connected to static sensitive devices and proper static free handling precautions should be observed.

Where individual circuit cards are stored, they should be placed in antistatic bags. Proper antistatic procedures should be followed when inserting or removing cards from these bags.

Power:

AC mains supply:	Ensure that operating voltage of unit and local supply voltage match and that correct rating fuse is installed for local supply.
DC supply:	Ensure that the correct polarity is observed and that DC supply voltage is maintained within the operating range specified.

Earthing:

The earth path is dependent on the type of frame selected. In every case particular care should be taken to ensure that the frame is connected to earth for safety reasons. See frame manual for details.

Signal earth: For safety reasons a connection is made between signal earth and chassis earth. No attempt should be made to break this connection.

Installation in frame or chassis:

See details in separate manual for selected frame type.

Before installing in frame, make any required link changes as detailed in the Configuration section.

CPS-3050 -- Local control:

All switchers are sold with a plain front panel with DC power LED and printed with the switcher type number and IRT logo. The CPS-3050 provides the necessary components to add control buttons and tally to the front panel.

Before fitting the CPS-3050, the original front panel and LD 1, LED DC indicator, must be removed.

The CPS-3050 PCB should then be pressed carefully into place making sure that the pins on the CPS-3050 plug mate correctly with the socket on the main module PCB. The front plate is then fitted using the screws and spacers provided.

For local switching, to take effect link LK 3 must be placed in the "A" position. See Configuration for details.

TPS-3010 -- Local tally panel:

All switchers are sold with a plain front panel with DC power LED and printed with the switcher type number and IRT logo.

The TPS-3010 provides the necessary components to add tally LED indicators to the front panel. This is desirable when switchers are controlled only by remote connections that are distant from the switcher. This panel is especially useful when switchers are controlled via the CDC-3060 controller from a remote location using RS232 connections. The TPS-3010 provides confidence that a slave switcher has responded to the master command and can therefore greatly assist in finding faults in inter-module wiring.

Before fitting the TPS-3010, the original front panel and LD 1, LED DC indicator, must be removed.

The TPS-3010 PCB should then be pressed carefully into place making sure that the pins on the TPS-3010 plug mate correctly with the socket on the main module PCB.

The front plate is then fitted using the screws and spacers provided.

Connections:

Video:

The incoming video signal on each of inputs 1 - 5 is connected to a BNC connector on the rear assembly. These terminals are terminated either via a termination resistor (R 1 to R 4) or via other equipment connected to the output.

The switching arrangement of the relay contacts ensures that one input is always connected to the output and so only four termination resistors are required. The fifth termination is the output load.

For 50 Ohm sources these resistors should be changed to 50 Ohms and the connected output load should also be 50 Ohms.

For other signals the termination impedance may be change to suit in a similar fashion. It is recommended that the input terminations not be open circuited. For high impedance circuits the resistors should be changed to no greater than 10 K Ω to prevent excessive noise.

It should be noted that during relay switching a discontinuity in termination will occur, which can cause a "glitch" in the output signal.

It should also be noted that the signal is directly coupled through the relays and so will pass any DC content present. Care should be taken to ensure that any DC present on the signal does not exceed the contact rating of the relays.

In the event of power loss all relays revert to the power off status shown on the schematic, with input 1 connected to the output.

Front & rear panel connector diagrams

The following front panel and rear assembly drawings are not to scale and are intended to show relative positions of connectors, indicators and controls only.



Maintenance:

No regular maintenance is required.

Care however should be taken to ensure that all connectors are kept clean and free from contamination of any kind. This is especially important in fibre optic equipment where cleanliness of optical connections is critical to performance.

Storage:

If the equipment is not to be used for an extended period, it is recommended the whole unit be placed in a sealed plastic bag to prevent dust contamination. In areas of high humidity a suitably sized bag of silica gel should be included to deter corrosion.

Where individual circuit cards are stored, they should be placed in antistatic bags. Proper antistatic procedures should be followed when inserting or removing cards from these bags.

Warranty & Service

Equipment is covered by a limited warranty period of three years from date of first delivery unless contrary conditions apply under a particular contract of supply. For situations when "**No Fault Found**" for repairs, a minimum charge of 1 hour's labour, at IRT's current labour charge rate, will apply, whether the equipment is within the warranty period or not.

Equipment warranty is limited to faults attributable to defects in original design or manufacture. Warranty on components shall be extended by IRT only to the extent obtainable from the component supplier.

Equipment return:

Before arranging service, ensure that the fault is in the unit to be serviced and not in associated equipment. If possible, confirm this by substitution.

Before returning equipment contact should be made with IRT or your local agent to determine whether the equipment can be serviced in the field or should be returned for repair.

The equipment should be properly packed for return observing antistatic procedures.

The following information should accompany the unit to be returned:

- 1. A fault report should be included indicating the nature of the fault
- 2. The operating conditions under which the fault initially occurred.
- 3. Any additional information, which may be of assistance in fault location and remedy.
- 4. A contact name and telephone and fax numbers.
- 5. Details of payment method for items not covered by warranty.
- 6. Full return address.
- 7. For situations when "**No Fault Found**" for repairs, a minimum charge of 1 hour's labour will apply, whether the equipment is within the warranty period or not. Contact IRT for current hourly rate.

Please note that all freight charges are the responsibility of the customer.

The equipment should be returned to the agent who originally supplied the equipment or, where this is not possible, to IRT direct as follows.

Equipment Service IRT Electronics Pty Ltd 26 Hotham Parade ARTARMON N.S.W. 2064 AUSTRALIA

 Phone:
 61 2 9439 3744
 Fax:
 61 2 9439 7439

 Email:
 service@irtelectronics.com
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 61 2 9439 7439

Drawing index

Drawing #	Sheet #	Description
804132	1	AVS-3170 control circuit schematic
804132	2	AVS-3170 signal circuit schematic







