

IRT Eurocard

Type DAF-3420

AES / EBU Digital Audio Delay

Designed and manufactured in Australia

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

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Instruction Book

Table of Contents

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Section	rage
Operational Safety	2
General description	3
Technical specifications	4
Circuit description	5
Configuration	6
Operation	7
Installation	8
Front and rear layouts	9
Maintenance & storage	10
Warranty & service	10
Equipment return	10
Drawing list index	11

This instruction book applies to units later than S/N 0011001.

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.

IRT Eurocard Type DAF-3420 AES / EBU Digital Audio Delay

GENERAL DESCRIPTION



The DAF-3420 is designed to provide a programmable delay to AES/EBU digital audio signals to match delays in video paths so that lip synchronisation may be maintained.

The module is particularly suited to FM radio stations providing simulcasts and in sports broadcasts, video editing and special effects environments where multiple frame stores and digital video effects units delay the picture whilst the sound follows a separate direct path.

Any input signal conforming with the AES/EBU structure may be used, including digitally compressed multichannel audio such as AC-3. The input audio sample rate may range between 25 kHz and 55 kHz.

Channel, User and Validity bits are preserved, no audio data is changed - output = delayed input.

The delay is adjustable in audio frame periods (4 ms at 48 kHz)

A front panel rotary switch allows a delay of 1 to 9 video frames to be selected (1 video frame = 40 ms for 48 kHz AES). It also allows the serial remote control to be selected.

A second front panel toggle switch allows the delay to be switched in or out.

Sub-video frame delays are selectable via DIP switches on the board. An optional delay extension of up to 1.5 seconds (total at 48 kHz) is available.

The DAF-3420 is designed to fit IRT's standard Eurocard frames and may be used alongside any other of IRT's analogue or digital Eurocards.

Standard features:

- Delay adjustable in steps to match video delays.
- Maximum delay of 280 ms expandable to 1.5 sec with optional memory module.¹
- Suitable for AES/EBU signals including AC3.
- Local or remote control.
- 75 or 110 Ohm inputs and outputs.
- All inputs and outputs transformer coupled.
- Digital circuit re-shapes output and restores level.

¹ At 48 KHz AES/EBU sample rate.

TECHNICAL SPECIFICATIONS

IRT Eurocard module Type DAF-3420

Inputs:

inputs:		
Number Type		1. 110 Ω balanced or 75 Ω unbelowed
		75Ω unbalanced selected by links on PCB.
Format Input level		AES3-1992 standard.
Cable length		>500 m 75 Ω (Belden 8281). >200 m 110 Ω (AES digital high quality shielded pair).
Outputs:		
Number		1.
Туре		110 Ω balanced > 3 Vp-p. or
Format		AES3-1992 standard.
Remote:		
Control RS485	Туре	Loop through connection.
	Addressing	8 possible addresses
Alarm	Data rate	Changeover relay contacts.
Performanc	e:	
Frequency range		25 to 54 kHz continuous.
Rise & fall times		<20 ns.
Delay range		0 to 360 ms with 1 Mb memory (standard) in steps of 40 ms at 48 kHz sample rate. 0 to 1.56 sec's with 4 Mb memory (optional) in steps of 20 ms at 48 kHz sample rate.
Delay increment		192/(sample rate in fiz) ins.
Connectors	Balanced Unbalanced	Phoenix 3 terminal plug-in blocks. BNC.
Other:		
Power requireme	ents	28 Vac CT (14-0-14) or ± 16 Vdc.
Power consumpt	ion	<4 VA.
Temperature ran	ge	0 - 50° C ambient.
Mechanical		Suitable for mounting in IRT 19" rack chassis with input, output and power connections
Finish:	Front panel Rear assembly	Grey enamel, silk-screened black lettering & red IRT logo. Detachable silk-screened PCB with direct mount connectors to Eurocard and external
Dimensions		signals. 6 HP x 3 U x 220 mm IRT Eurocard.
Supplied accesso	ories	Rear connector assembly including matching connectors for 110 Ohm and controls.
Optional accesso	ries	DAC-3410 AES to analogue converter AAC-3390 analogue to AES converter DAA-3400 AES DA 8 outputs DDS-3031 5 x 1 AES/RS-422 switcher. TME-6 module extender card

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

CIRCUIT DESCRIPTION

The DAF-3420 accepts either 75 Ω unbalanced BNC or 110 Ω balanced Phoenix style screw terminal block AES/EBU signals on both the input and output ports via its rear assembly.

Links LK1 and LK2 set the input impedance by connecting the input transformer, T1, to either the 75 Ω (Position B) unbalanced BNC or to the 110 Ω (Position A) balanced phoenix input port. This transformer coupled input signal is fed to IC5, which is an AES/EBU receiver chip. This chip recovers the AES audio data, user validity & channel data bits, as well as frame rate, sample rate, bit rate & 4 x bit rate clocks for synchronisation. These signals are fed to the FPGA, IC4, for processing.

IC4 feeds the AES data into a plug in memory chip IC10, which is 1 Mbit chip that comes as standard with the DAF-3420 unit. A 4 Mbit chip, IC11, is available as an option instead of IC10 for allowing greater delays up to 1.5 seconds via the remote control feature of the card. Data is then read out of IC10 (optionally IC11) after a delay period. IC4 converts the data back into a form suitable for output to IC7, an AES transmitter. The audio delay is set by the front panel rotary switch, SW2, and is read by IC4 through the parallel to serial interface IC1. IC3 provides the configuration data for IC4 upon powering up.

AES Output from IC7 is fed to the output via output transformer T2, which connects to either the 75 Ω unbalanced BNC connector via links LK3 and LK4 (Position B) or to the 110 Ω balanced Phoenix style screw terminal block via links LK3 and LK4 (Position A). AES output being the delayed AES input.

RS-485 remote interfacing is performed by IC8. Should RS-232 remote interfacing be desired instead of RS-485, IC8 and its associated componentry should be replaced by IC9 and its associated componentry. Note that modifications made to the board by non IRT Electronics' staff voids all warranty on the unit.

LED 3 is provided as an alignment LED for the front panel rotary switch, SW2. In REM position LED 3 is on. SW1 acts as a delay bypass switch. It is inoperable when running the unit in the remote state.

All chips operate from a +5 Vdc power supply and is generated by IC2, which is a switch mode power supply. The card operates from either 14-0-14 Vac centre tapped supply or by ± 16 Vdc.

CONFIGURATION

Audio Link settings:

The DAF-3420 accepts either 75 Ω unbalanced BNC or 110 Ω balanced Phoenix style screw terminal block AES/EBU signals on both the input and output ports. On board links set the relevant port's impedance path. Both ports and their associated link settings are independent of each other allowing a combination of 75 Ω unbalanced or 110 Ω balanced connections.

Input	75 Ω	Links	1B 2B	Output	75 Ω	Links	3B 4B
	110 Ω	Links	1A 2A		110 Ω	Links	3A 4A

Audio Delay settings:

A front panel rotary switch allows a delay of 1 to 9 delay units (X). A delay unit X = 40 ms for an AES sample rate of 48 kHz, which is equivalent to 1 video frame. For other sample rates X = (1920/Sample Rate) ms where sample rate is measured in kHz.

For example, an AES signal sampled at 44.1 kHz would have a delay rate X = (1920/44.1) = 43.5 ms.

Jumpers on board, J4 and J5, also allow:

J4 Out - A further 1/2 video frame delay (X/2 = 20 ms @ 48 kHz) to be switched in. **J5 Out** - A further 1/5 video frame delay (X/5 = 8 ms @ 48 kHz) to be switched in.

If both J4 and J5 are out, extra video frame delay is additive (X/2 + X/5 = 28 ms @ 48 kHz)

Remote Control Interface:

When the front panel rotary switch is in the remote (REM) position, a simple 4 byte serial protocol allows remote control of the selected delay via an RS-485 interface. With an optional memory extension, delays in excess of 1.5 seconds may be selected. Jumpers allow selection of 8 possible addresses for the module, as well as 4 possible baud rates - 4800, 9600, 19200 and 38400.

For jumper settings J1 - J7:

Jumper In = 0; Jumper Out = 1.

Jumpers J1, J2 and J3 control the serial address:

J3	J2	J1	Address
In (0)	In (0)	In (0)	0
In (0)	In (0)	Out (1)	1
In (0)	Out (1)	In (0)	2
In (0)	Out (1)	Out (1)	3
Out (1)	In (0)	In (0)	4
Out (1)	In (0)	Out (1)	5
Out (1)	Out (1)	In (0)	6
Out (1)	Out (1)	Out (1)	7

Jumpers J6 and J7 control the baud rate:

J6	J7	Baud rate (bps)
In (0)	In (0)	38400
In (0)	Out (1)	19200
Out (1)	In (0)	9600
Out (1)	Out (1)	4800

Jumper **J8 In** terminates the RS-485 line driver with 220 Ω for RS-485 systems requiring a termination load.

OPERATION

With the AES audio input and output set for the correct loading impedance, as explained in the configuration section, any input signal conforming to the AES/EBU structure with a sample rate between 25 kHz and 55 kHz may be used, including digitally compressed multi-channel audio such as AC-3. Channel, User and Validity bits are preserved.

A front panel rotary switch allows a delay of 1 to 9 delay units (X). For broadcast standard sample rates of 48 kHz, each delay unit is equivalent to 1 video frame (40 ms). For other sample rates X = (1920/Sample Rate) ms where sample rate is measured in kHz. Each number of the switch position corresponds to the number of delay units, or video frames in the case of a 48 kHz sample rated signal.

Removing either, or both, of jumpers J4 and J5 allows further delays of X/2 and X/5, respectively, or X/2 + X/5 for both jumpers removed.

A second front panel toggle switch allows the delay to be switched in or out. This switch is ignored in the remote control mode.

Remote Interface:

When the front panel rotary switch is in the remote position, a simple 4 byte serial protocol allows remote control of the selected delay via an RS-485 interface. With an optional memory extension, delays in excess of 1.5 seconds may be selected. Jumper selections allow selection of 8 possible memory addresses for the module, as well as 4 possible baud rates - 4800, 9600, 19200 and 38400, see configuration section.

The serial format required is 1 Start bit, 8 Data bits and 1 Stop bit. The LSB is sent first.

The 4 byte sequence is:

	1	2	3	4
Break	Address	Count	Delay	Checksum

A Break is a transmission of all 1's, ie no start bits. This should have a duration greater than the period required for several bytes to be transmitted. It initialises the receiver.

Address:

The address should be of the form:

Bit No.	7 (MSB)	6	5	4	3	2	1	0 (LSB)
Value	0	0	0	0	0	A2	A1	A0

A2, A1 and A0 should match the value set by J3, J2 and J1 or else transmission will be ignored. This allows multiple units to share the control interface.

Count:

The count should always be set to 3. It indicates the number of bytes in the transmission following the address byte.

Delay:

The Delay value can be any number from 0 to 255. Unless the 4 Mbit memory module is connected to the board, the 2 MSBs are ignored.

Bit No.	7 (MSB)	6	5	4	3	2	1	0 (LSB)
Delay	+ 32X	+ 16X	+ 8X	+ 4X	+ 2X	+ X	+ X/2	+ X/5

For example, at a sample rate of 48 kHz, X = 40 ms. For a 200 ms delay with a sample rate of 48 kHz requires a value of 00010100, which is equivalent to 14H in hexadecimal or 20 in decimal. A value of 01100011 (63H) means a delay of (16X + 8X + X/2 + X/5) = 24.7X = 988 ms.

For any other sample rates the value of X = 1920/Sample rate, where sample rate is in kHz.

For example, with a sample rate of 44.1 kHz, X = 43.5 ms. Thus a value of 63H means a delay of 1074.45 ms.

Checksum:

The checksum is an 8 bit number such that the sum of the 4 bytes of the transmission add to 0 modulo 256. That is, the lower 8 bits of Address byte + Count byte + Delay byte + Checksum = 0.

For example, Address = 3, Count = 3, Delay = 14H (200 ms) would have a checksum of E6H. If the checksum is errored then the transmission is ignored.

INSTALLATION

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.

Audio connections:

The DAF-3420 accepts either 75 Ω unbalanced BNC or 110 Ω balanced Phoenix style screw terminal block AES/EBU signals on both the input and output ports. On board links set the relevant port's impedance path. Both ports and their associated link settings are independent of each other allowing a combination of 75 Ω unbalanced or 110 Ω balanced connections.

Audio Link settings:

Input	75 Ω	Links	1B 2B	Output	75 Ω	Links	3B 4B
	110 Ω	Links	1A 2A		110 Ω	Links	3A 4A

Remote Interface Connections:

SK5 and SK6 are paralleled together allowing multiple DAF-3420's (up to 8) to be connected together on an RS-485 line. When connecting between units, wire pin for pin from SK6 of one card to SK5 of the next.

Connect to the RS-485 (or RS-232) line as follows:

Front & rear panel connector diagrams

The following front panel and rear assembly drawings are not to scale and are intended to show connection order and approximate layout only.



Maintenance & storage

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.

Phone:

Email:

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

61 2 9439 3744 Fax: 61 2 9439 7439 service@irtelectronics.com

Drawing List Index

Drawing #	Sheet #	Description
804358 804358 804358 804358	1 2 3 4	DAF-3420 circuit diagram - main circuit. DAF-3420 circuit diagram - 1 Mbit memory. DAF-3420 circuit diagram - 4 Mbit memory. DAF-3420 circuit diagram - rear assembly.



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