



**TWO-WIRE ANALOGUE  
DIMMER MULTIPLEXING  
STANDARD D54**

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**TWO WIRE ANALOGUE DIMMER MULTIPLEXING STANDARD**

**1 SCOPE**

This standard describes the electrical and mechanical criteria to ensure signal compatibility between control system multiple outputs and dimmer inputs to ensure reliable interworking. A second signal is similarly described to allow the multiplexing of manual faders into the control system.

**2 DESCRIPTION**

**2.1 Outline**

The multiplex dimmer levels are transmitted down a screened cable using time-division multiplexing with timing information derived from superimposed sync and end-of-frame pulses for a normal capacity of up to 384 dimmers per cable. An expansion capacity of up to 768 dimmers per cable is described. For larger installations, two or more multiplex cables shall be used. A typical system block diagram is shown in Fig.1.

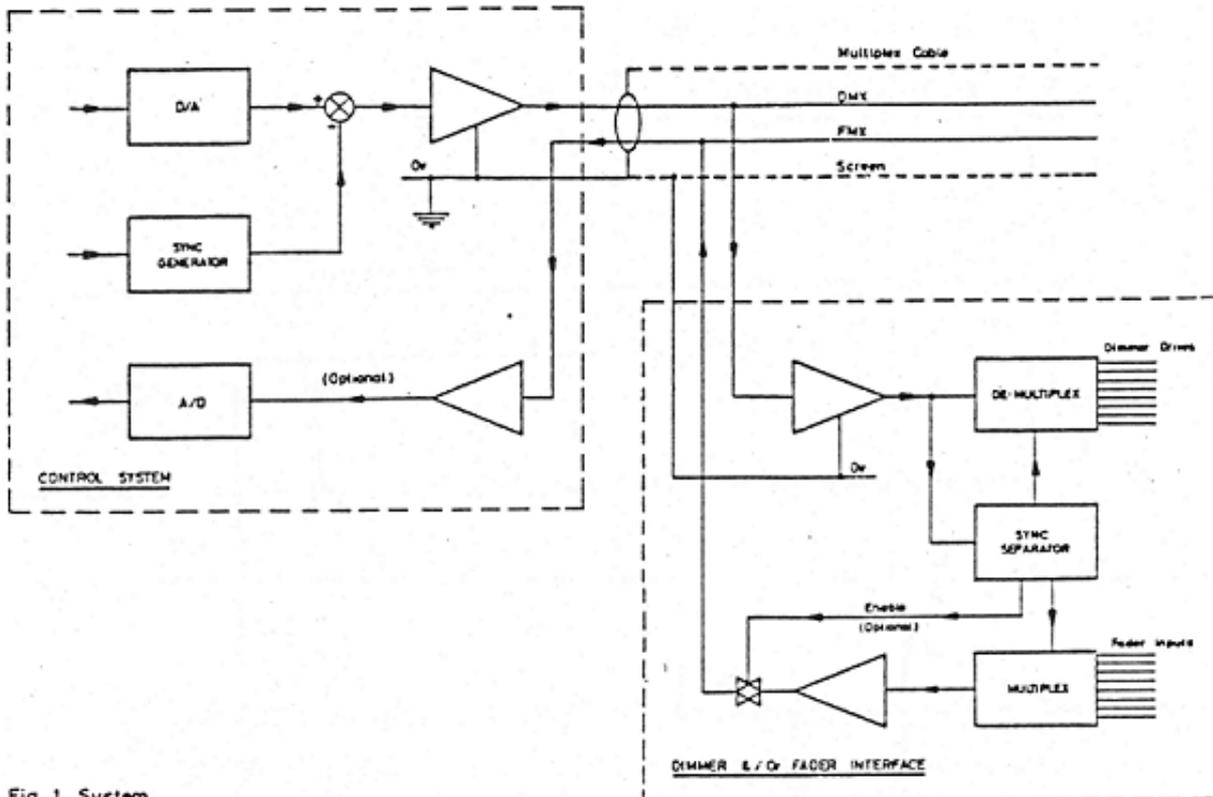


Fig. 1 System

In all cases the control system is the master and the dimmer and/or fader interfaces act as slaves. Each interface may just drive dimmers, multiplex faders or both as required. Each interface shall be coded to respond only to the dimmers of interest and means shall be provided to assure predictable response in the case of incomplete or absent multiplex drive.

One signal (and conductor) is used to multiplex the dimmer levels (DMX) and an optional second to multiplex faders (FMX).

## 2.2 Signal Specifications

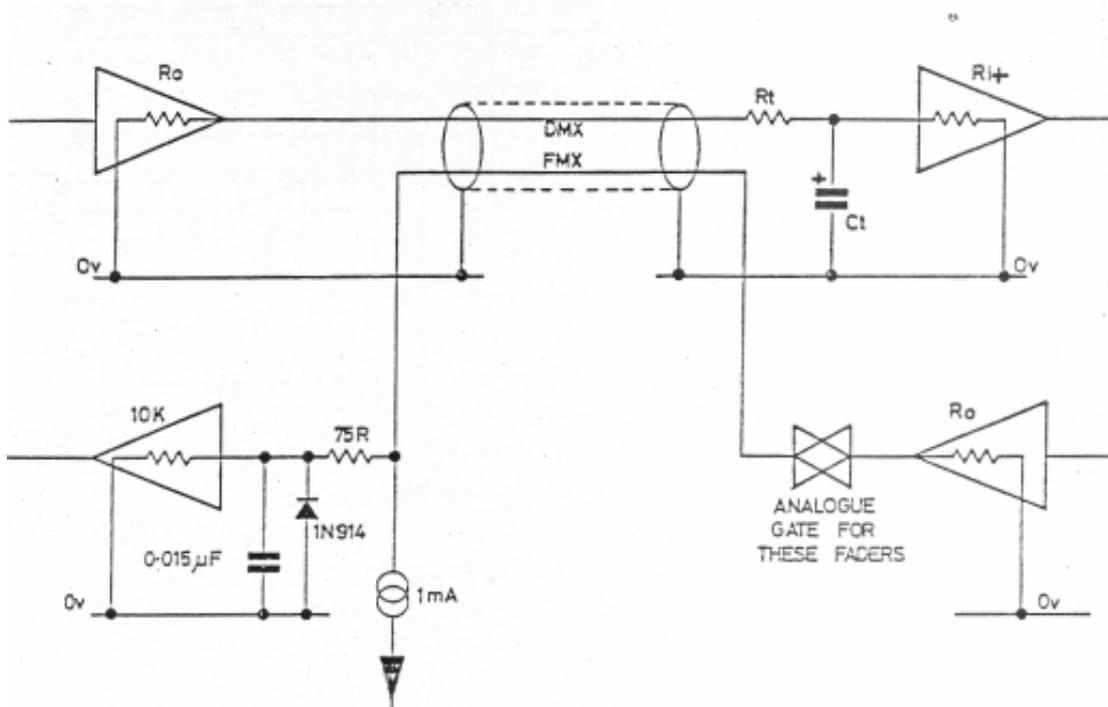
The transmitter and receiver are specified separately at their output and input terminals respectively to allow for tolerances and signal distortion in typical cables.

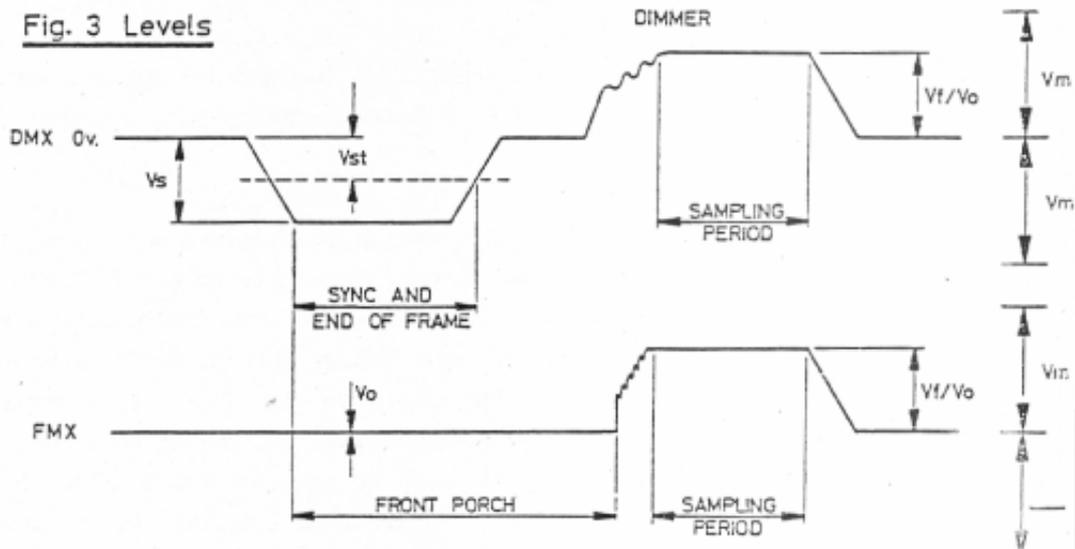
The DMX signal is terminated by a distributed A.C. termination configured to provide a noise immunity appropriate to the size of the system.

The FMX signal is fully terminated at its receiver and has a current sink to ensure that when not driven it settles to zero. Each driver for the FMX signal shall be gated onto the cable only for the duration of the fader numbers being multiplexed. Inadvertent connection of two fader multiplexes to the cable, both coded for the same faders, may give indeterminate results but shall not cause damage. A front porch is set to 0V to minimise bus conflict between fader multiplexes at change-over from one interface to the other.

### 2.2.1 Impedances and Levels

Fig. 2 Impedances





Note			TRANSMIT			RECEIVE		
			Max	Min	Norm	Max	Min	Norm
1	Transmitting Impedance	$R_o$	10R					
	Receiving Impedance	$R_i$	-	-	-	-	90k	100k
2	Termination per dimmer	$R_t$	-	-	-	30k	20k	24k
3	Termination capacitor	$C_t$	-	-	-	+25%	-25%	$\frac{10^{-6}}{R_t}$
	Sync Level	$V_s$	-6.0V	-4.0V	-5.0V			
	Sync Detector Threshold	$V_{st}$	-	-	-	-3.0V	-2.0V	-2.5V
4	Full Level	$V_f$	5.1V	4.9V	5.0V	5.1V	4.9V	5.0V
	Off Level	$V_o$	0.1V	0.1V	0.0V	0.1V	0.1V	0.0V
	Safe Input Levels	$V_m$	-	-	-	-	+/-10V	-

**Notes**

- 1) Outputs to be short-circuit proof to 0V to unlimited periods.
- 2) The termination resistor is paralleled for multiple dimmers received, e.g.24 dimmers use 1k.
- 3) The termination capacitor is set to give a 1µs time-constant, e.g. for  $R_t = 1k$ ,  $C_t = 1,000pF$ .
- 4) Full Level may be adjusted at the control system.

**INSERT FIG 4**

**2.3 Cable and Connections**

The cable used shall be a single (for DMX only) or twin screened cable generally of good microphone quality. Whilst cables may be chosen for the most economic performance in each particular installation, for optimum performance to achieve a maximum transmission distance of 1km a cable should be used as below:



Each conductor:	0.5mm <sup>2</sup> minimum
Screen:	Full copper braid
Capacitance:	300pF/m maximum
Nominal Impedance:	75R

Where input/output connectors are used, the following type and connections are to be preferred:

XLR 3 PIN (e.g. Cannon AXR-3-XX)

PIN	SIGNAL	PREFERRED WIRE COLOUR
1	0V	Screen
2	FMX	Red
3	DMX	Blue

### 3 EARTHING CONSIDERATIONS

Precautions shall be taken to ensure that no earth loop, leakage or external fault current flows down the cable screen. Particular attention should be taken to avoid multiple earth connections in situations where multiple Neutral-Earth connections are made (e.g. PME mains distribution systems), since these can cause neutral current to flow through the screen.

Connection, if required, between 0V and mains earth shall only be made at the main control system.

Note			TRANSMIT			RECEIVE		
			Max	Min	Norm	Max	Min	Norm
	End of Frame pulse	Te	0.5s	35µs	-	0.5s	30µs	-
	Inter-Frame period	Ti	15µs	0.5s	-	-	10µs	-
	Sync Pulse	Ts	10µs	6µs	8µs	15µs	3µs	-
	Analogue Valid Delay	Tv	15µs	-	-	20µs	-	-
	Analogue Hold period	Th	Td	50µs	-	Td	45µs	-
(2)	Total Dimmer period	Td	0.5s	70µs	-	0.5s	70µs	-
	Total Cycle period	Tc	0.5s	-	40ms	0.5s	-	40ms
	Analogue Gate Delay	Tg	20µs	0	-	-	-	-
(1)	FMX Front Porch	Tfp	Tf	20µs	-	-	-	-
(1)	FMX Valid Delay	Tf	35µs	-	-	70µs	-	-
(2)	Number of Dimmers	N	384	1	-	768	1	-
	Slew Rate	-	-	2V/µs	2.5V/µs	-	0	-

## Notes

- 1) FMX Delays start at leading edge of Sync local to the receiver..
- 2) Provision should be made at the receiver to accept an expanded capacity of 768 dimmers. This will not support FMX signals and  $T_d (\text{min}) = 50\mu\text{s}$

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