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TITLE : Galaxy Dual Change-over Circuit Description
NUMBER : 2X XXXXX
ISSUE : 00.1 Draft
DATE : 30 March, 2000
COPY: :
SERVER/PATH : amelia/home/projects/dualgal/docs
FILENAME : CIRCDESC.DOC
FORMAT : Microsoft Word for Windows 2.0

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ABSTRACT

This document describes the electronic circuit operation of Galaxy Dual Change-over Crate

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Galaxy Dual Change-over Circuit Description

1. INTRODUCTION

This document gives details of the electronic and electrical operation of the Galaxy Change-over Crate.

A Change-over Crate normally operates in conjunction with sections of a Power Distribution and Switching unit. As these units are usually designed to suit individual installations, it is beyond the scope of this document to provide a description. However, brief details are given of the sections which directly affect the operation of the Change-over Crate.

A Change-over Crate provides the interconnection between two Galaxy crate assemblies and a set of Galaxy peripherals and other devices, together with providing the facility to connect selectively between the crates and the peripherals.

Within the Change-over Crate Ref 1745 Relay Change-over Cards are used to switch the various crate - peripheral signals.

A Ref 1746 Communications Timeout Card provides an indication of the correct operation of each electronics crate.

2. CONVENTIONS

Within this document the following conventions are used :-

Signals (switched by relays) are classed as either: off - switched to 'open circuit', +V - switched to the +24V power supply, or, 0V - switched to power supply 0V.

Relays are referred to by PCB position number followed by relay letter (A, B, C, D) eg. Relay 4C is the third relay on the card in position 4 within the Crate.

3. CHANGE-OVER CRATE

3.1. System OK Indications

Card 1 is a Ref 1746 Communications Timeout card. This is connected in the Transmit lines from each Galaxy crate to 'Desk #1'. Should a crate cease normal transmissions to 'Desk #1', the appropriate output from the Ref 1746 will switch from off to 0V. Relay 10C and / or relay 10D will then energise, which will disconnect power from the appropriate indicator(s)

3.2. Mode and Device Select Switching

3.2.1. Normal / Split Mode Switching

When keyswitch SW9 is 'off', the system operates in 'normal' mode (as a single system with 'full backup') The signal SPLIT will be off, and relays 3A and 3B will not be energised. This enables Crate Bypass switching, and Disc 1 / 2 switching, and disables Printer 1 / 2 switching.

When keyswitch SW9 is 'on', the system operates in 'split' mode (as two independent systems) The signal SPLIT will be at +V, and relays 3A and 3B will be energised. This disables Crate Bypass switching, and Disc 1 / 2 switching, and enables Printer 1 / 2 switching. The SPLIT indicator is powered via relay 3B pin10c.

3.2.2. System 1 / 2 Switching

Relay 2A and relay 2B form a latch. When the SYSTEM 2 switch is pressed, relay 2B is energised. Once relay 2B is energised, power to its coil will be taken via relay 2A pin 5a. Relay 2B will thus latch in an energised state.

When the SYSTEM 1 switch is pressed, relay 2A will be energised, which will break the circuit to the coil of relay 2B, and will de-energise it.

Relay 2B switches the signals SYSTEM-1 and SYSTEM-2 respectively between off and +V when energised or de-energised. The relay also switches power between the SYSTEM 1 and SYSTEM 2 indicator lamps.

Two further signals are derived - SYSTEM-2&!SPLIT which switched from off to +V whenever SYSTEM-2 is at +V but SPLIT is off, and SYSTEM 2+SPLIT which switches from off to +V whenever either (or both) SYSTEM-2 or SPLIT are at +V.

3.2.3. Disc 1 / 2 Switching

When the system is in 'normal' mode, relay 2C and relay 2D form a latch in an identical manner to that used for SYSTEM 1 / 2 switching, operating from the DISC 1 and DISC 2 switches. Whenever relay 2D is energised the signal DISC-2 is switched from off to +V.

Relay 2d also switches power between the DISC 1 and DISC 2 indicators

When the system is in 'split' mode, relay 2C is continuously energised from relay 3B pin 10a. This prevents relay 2D from being energised and holds the signal DISC-2 off. Power to the DISC 1 and DISC 2 indicators is disconnected at relay 3B pin 12c.

3.2.4. Printer 1 / 2 Switching

In 'normal' mode, the coil of relay 3D is connected via relay 3B pin 11a to the SYSTEM-2 signal. Relay 3D thus switches the signal PRINTER_TO_2 from off to +V whenever SYSTEM-2 is at +V. Power to the PRINTER 1 and PRINTER 2 indicators is disconnected at relay 3B pin 10c.

In 'split' mode, relay 3C and relay 3D are connected as a latch, via relay 3B, operating from the PRINTER-1 and PRINTER-2 switches. The signal PRINTER_TO_2 switches according to the switch operations. Power is switched between the PRINTER 1 and PRINTER 2 indicators by relay 3D.

3.2.5. Crate Bypass Switching

In 'normal' mode, relay 4B is energised, via relay 3A, from the BYPASS 1 switch. [This is a latching action switch]. The signal CRATE-1_BYPASS is switched directly by the switch from off to +V.

Relay 4B applies power to the BYPASS 1 indicator, applies +V to relay 2B's coil (thus selecting SYSTEM 2 continuously), and disconnects +V from the BYPASS 2 switch. (Thus preventing manual selection of bypass for both crates simultaneously).

Relay 4D and the BYPASS 2 switch operate in a similar manner for crate 2.

Either Bypass relay may be energised, irrespective of manual bypass switching, from the Power Distribution unit. Figure 1 shows a typical circuit used in a Power Distribution Unit. Whenever power is removed from the Galaxy electronics crate, the contactor switches the crate into Bypass, which also causes a change over to the 'other' crate.

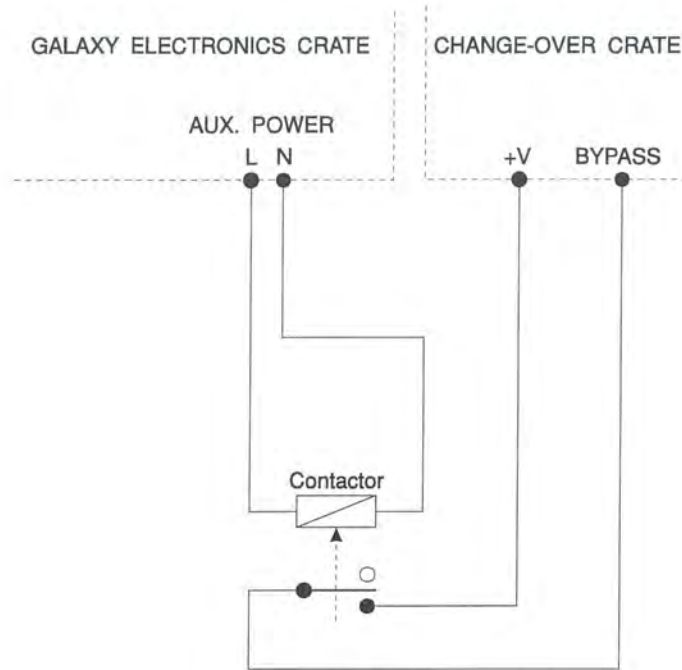


FIGURE 1 - BYPASS SWITCHING

In 'split' mode, relay 3A disables all Bypass switching.

3.3. Power and Crate Status Switching

3.3.1. Power Control Switching

The OFF / ON keyswitches in Desk #1 and Desk #2 energise relays 8D and 8C, respectively, when switched on. These relays switch power to the contactors in the Power Distribution Units of the two Galaxy Crates, and the main system Power Distribution Unit whenever either keyswitch is turned on.

3.3.2. Blackout and Crate Status Switching

In 'normal' mode, the 'Hardwired' Blackout signal from Desk #1 is routed via relay 8A which switches it to either Crate 1 or Crate 2, depending on the signal SYSTEM-2. Relay 8A also switches Crate Active status signals - when SYSTEM-2 is off, Desk #1 Blackout is routed to Crate 1 with the Crate 2 Blackout input connected to Blackout 0V and the Crate Active signal is switched on for Crate 1 - if SYSTEM-2 is switched to +V, Desk #1 Blackout is routed to Crate 2 with the Crate 1 Blackout input connected to Blackout 0V and the Crate Active signal is switched on for Crate 2

In 'Split' mode, relay 8B switches the Blackout signal from Desk #1 to Crate 1, and the Blackout signal from Desk #2 to Crate 2. (relay 8A than has no effect on the Blackout signal routing). Relay 8B also switches on the Split Active signal to Crate 2.

3.4. Control Desk and Geographic Mimic Switching

3.4.1. Transmit Lines to Desks

Figure 2 shows the circuit for switching the transmit lines to Desk #1.

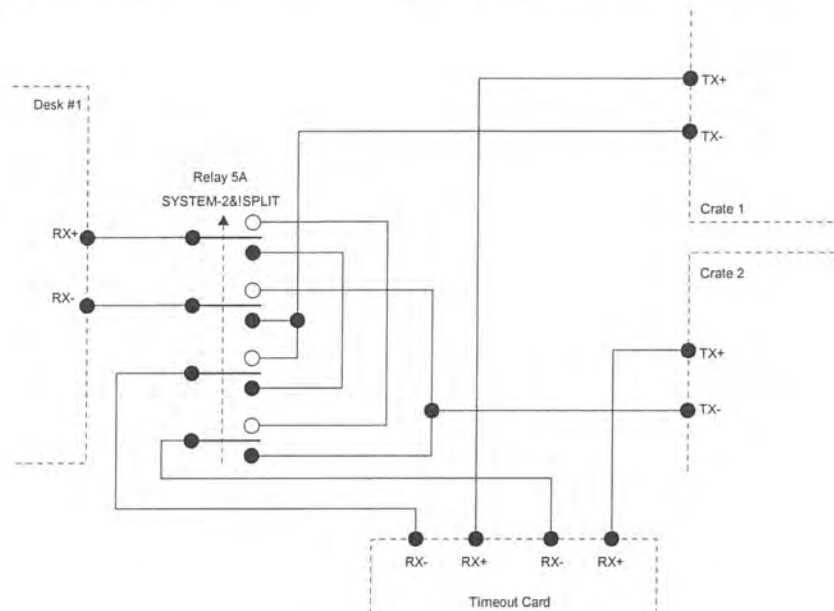


FIGURE 2 - DESK #1 PORT TRANSMIT LINE SWITCHING

The Desk #1 transmit TX+ lines from each crate are routed via the Ref 1746 Timeout Card. The outputs from the Timeout Card are off whenever communications activity exists on the TX+ lines. Otherwise relay 10C and / or relay 10D will be energised to switch off the SYSTEM 1 OK lamp or SYSTEM 2 OK lamp respectively.

When relay 5A is not energised, the TX+ and TX- lines from Crate 1 are routed to Desk #1; the TX+ and TX- lines from Crate 2 are routed only to the Timeout Card. When SYSTEM 2 is selected, in 'Normal' mode, relay 5A is energised. This routes the TX+ and TX- lines from Crate 2 to Desk #1; the TX+ and TX- lines from Crate 1 are routed only to the Timeout Card.

The transmit lines to Desk #2 are switched by relay 5C, which routes them to Crate 2 whenever System 2 or 'Split' mode are selected.

3.4.2. Receive Lines From Desks

Figure 2 shows the circuit for switching the receive lines from either desk.

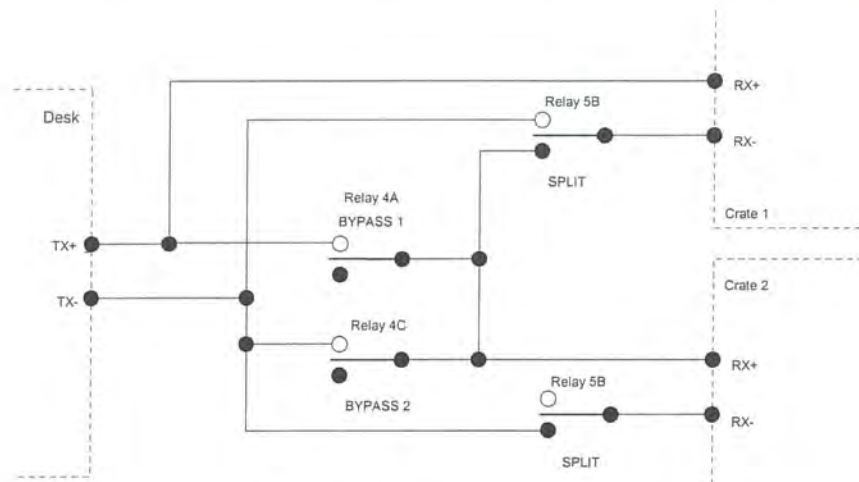


FIGURE 3 - DESK PORT RECEIVE LINE SWITCHING

In 'Normal' mode, the receive lines from each desk are connected in series to both crates, to allow system 'tracking' to operate.

If a Crate Bypass mode is enabled, relay 4A - Crate 1, or relay 4C - Crate 2, connects the receive lines to the 'bypassed' crate together - removing the crate from the series circuit.

If 'Split' mode is selected, relay 5B switches the receive lines so that those from Desk #1 are routed to Crate 1, and those from Desk #2 are routed to Crate 2.

3.5. Geographic Mimic Switching

This is similar to that for Desk #2, with the exception that, when 'Split' mode is selected - energising relay 6D - the receive lines as well as the transmit lines are routed, by relay 5D, to Crate 1 when System 1 is selected, and to Crate 2 when System 2 is selected.

3.6. Disc Switching

3.7. Printer Switching

3.8. Dimmer Output Switching

3.9. Video Output Switching

3.10. Riggers

4. COMMUNICATIONS TIMEOUT CARD

Ref 1746 Circuit Diagram 6B40xxx

4.1. Introduction

The card holds two identical circuits which are used to monitor operation of galaxy crate electronics, and operate external indication (and switching) should normal Galaxy crate operation cease. The card forms part of a Dual Galaxy Change-over Crate.

4.2. Functional Description

4.2.1. Theory of Operation

A Galaxy crate normally communicates (or attempts to communicate) with its Control pod at regular intervals - even if the Control pod is switched off, disconnected, or otherwise not responding.

The presence of Crate - Pod communications operates a timing circuit which, during normal Crate operation, holds the Ref 1746 output in an 'off' condition. Should Crate - Pod communication fail for longer than the time constant of the timing circuit, it is assumed that the Crate has failed and the Ref 1746 switches its output into an 'on' condition.

4.2.2. Circuit Description

The Ref 1746 holds two identical timing circuits. Only one is described in this document.

4.2.2.1. 20mA Current Loop Interface

The card is connected such that the connections DATA 1+ and DATA 1- are in series with the transmit current loop from the Crate to Pod #1.

For a transmit line 'on' condition (data 1), a current of 20mA flows via the LED in opto-coupler IC1. This switches on the photo-transistor in IC1, which turns on transistor TR1 and presents a high level to capacitor C10.

A transmit line 'off' condition (data 0) presents a low level to C10.

Resistor R1 absorbs energy from any interference 'spikes' which may be present on the data lines. Diode D1 short circuits any negative voltage 'spikes' which may be present on the data lines.

4.2.2.2. Timing Circuit

A high to low transition at the 'left' side of C10 will cause a low going pulse of approximately 500 μ s duration on the 'right' side of C10. While this pulse is present, transistor TR3 acts as a switch and discharges capacitor C1 to 0V.

At the high going edge following the pulse, IC3 (a '555' timer) is triggered.

IC3 is connected as a monostable, and the connection of TR3 converts the monostable operation to be 're-triggerable'.

While the monostable is triggered, IC3 pin 3 is high, TR2 is switched on, and TR4 is switched off. OUTPUT 1 is effectively open circuit.

Should the normal crate - pod communication cease for longer than the timeout period of the timer (approximately 1.2 seconds), the timer will time out, IC3 pin 3 will go low, TR2 will switch off, TR4 will switch on. OUTPUT 1 will be connected to 0V.

Switch SW1, which is normally in the 'closed' position, may be opened to disconnect the Ref 1746 output from external circuitry, thus simulating the condition of a correctly operating Galaxy crate.

4.2.2.3. Power up Hold Off

OUTPUT 1 and OUTPUT 2 are held in an 'off' condition for approximately 5 seconds following card power up. This prevents spurious indications (and switching) during the normal Galaxy power up routines.

The timing network C5 and R17 applies base drive to TR2 via D3 and R7, to hold TR2 on and TR4 off.

4.2.2.4. Power Supply

A 7805 three terminal regulator (REG 1) provides a stable power rail of +5V from the input voltage which may vary according to crate design.

5. RELAY CHANGE-OVER CARD

Ref 1745Circuit Diagram 6B40xxx

5.1. Introduction

This card holds four 4 pole change-over relays for use in a Galaxy Change-over crate.

5.2. Functional Description

RL A, RL B, RL C, and RL D are 4 pole change-over relays with 24V DC coils. Whenever a relay coil is energised, the relay switches over the signals that have been connected to its contacts (as determined by the design and wiring layout of the Change-over Crate).

A diode is connected across each relay coil to short circuit the back emf generated whenever a relay is switched off, and thus prevent damage being caused to the system power supply.