A Description of the Strand Riggers Control

Dr. David Bertenshaw, Rev 4 20th August 2021

1. The idea of a memory system riggers control is quite old. There was a 1972 picture of a "MSR Focus Remote" in Bob Hartley's MSR literature on Backstage Heritage Collection. This is mislabelled. In the Strand Slide Library at the V&A, there is slide C232 of "MSR Operator on stage with remote cue box". I thus assume this was a special that remotely operated the desk +1/-1 buttons and a Load button, with feedback of the three digit 7-segment Cue number display to allow remote stepping through cues. The cable looks quite heavy, probably 25 core.

https://www.theatrecrafts.com/archive/documtents/photo_bobhartley_msr_15.jpg

2. The Riggers Control itself was designed late 1978, as per its schematic drawing 6A21628 from the last MMS maintenance manual, and signed off in 1979. I guess it thus saw first service in early 1979.

3. It was designed as an accessory for MMS, via its Stalls Module, then used on DUET2 by 1981-2 and Galaxy 2.

be sited to avoid obstructing a direct view of the lighting controlled.

To the DUET 2 console can be added, initially or on-site, a variety of peripheral units to meet the particular needs and preferences of different users. These add-on options extend, not alter, the fundamental layout, philosophy and facilities of the console.

If submastering is required a free standing desk is available with 10 submaster stores, each with a group fader with 50% overrun capability. The DUET 2 memory can be used to record and recall the allocation of channels to particular submaster groups.

The Rigger's Control is a one-hand held remote channel control for on/off, raise/dim control for setting and focusing luminaires.

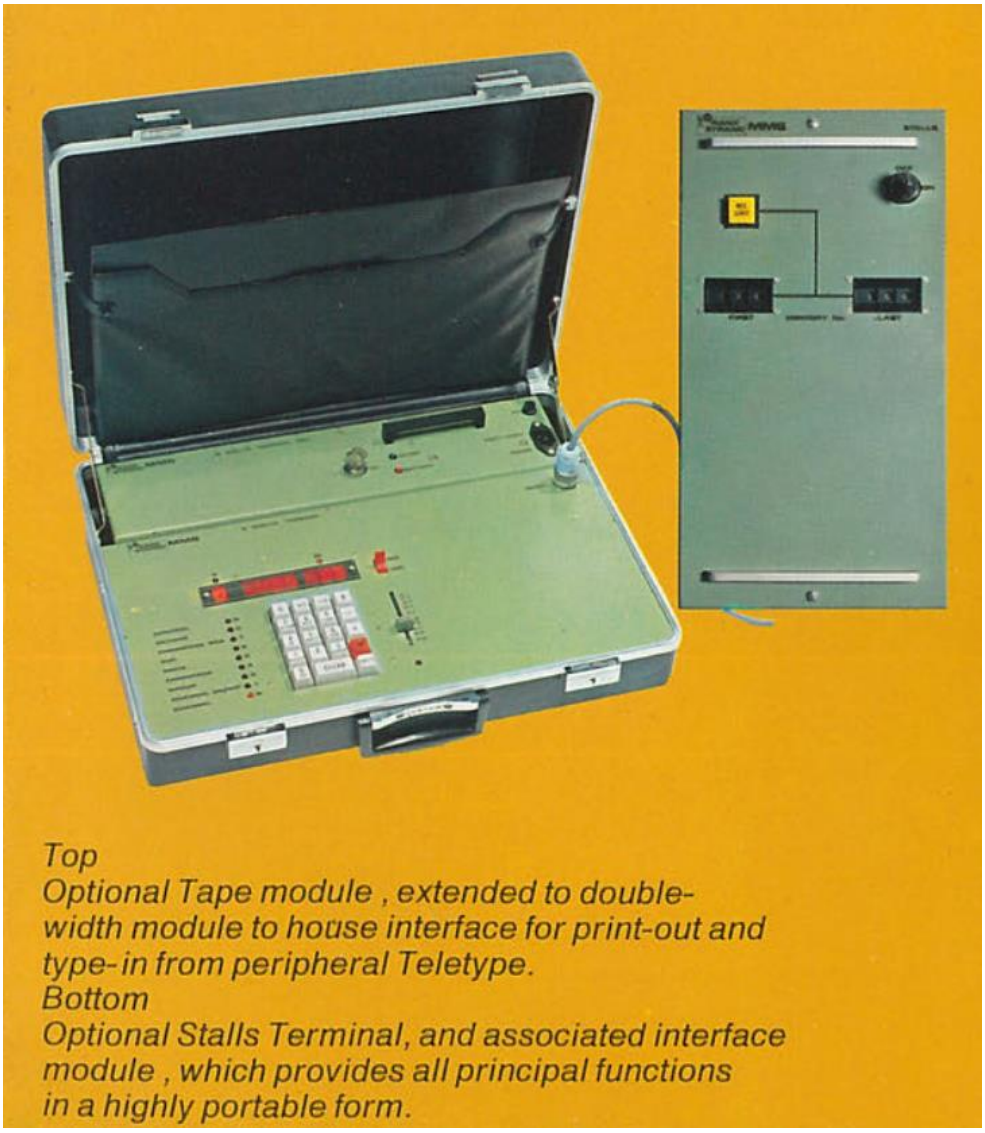
The DUET 2 console, VDU and optional peripherals are described in more detail in the following pages, but already it should be evident that DUET 2 is the definitive memory control for all small to medium sized stage and studio needs.

https://www.theatrecrafts.com/archive/documents/duet2brochure_1980.pdf

4. The mechanical design was constrained by the lack of tooling money for something not expected to sell in any volume. This prevented plastic enclosure moulding tooling, nor could any decent standard plastic box could be found. So the casing top and base were precision sand-cast from wooden patterns. I don't recall who did the styling, but Michael Cawte was then employed as Industrial Designer, so it was probably him.

5. The Channel numbers 000-999 were selected by three BCD 0-9 lever selector switches, with two control switches for slow fade up/down or instant full/out. The small red LED indicated flashed if the control was connected and transmitting successfully.

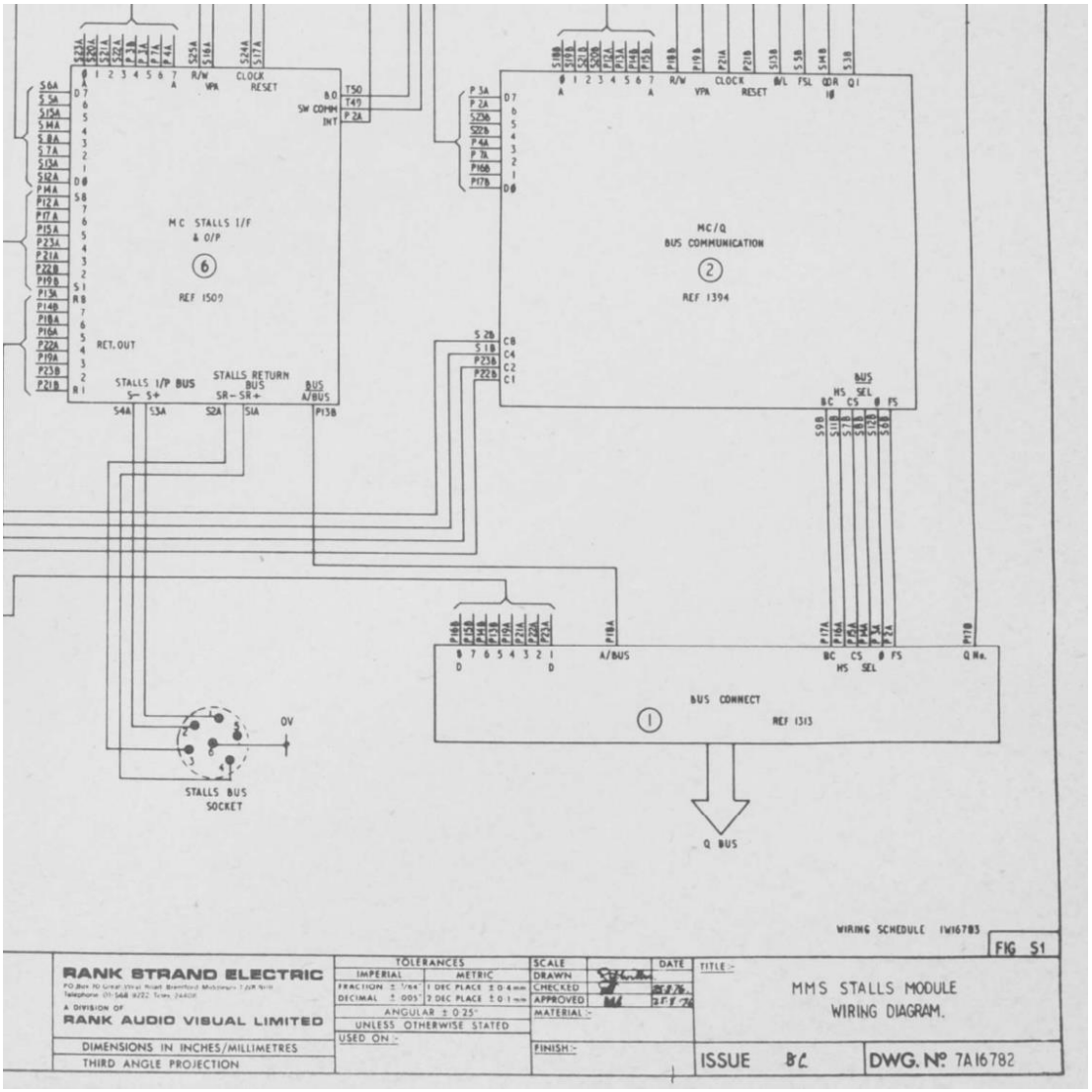
6. The concept of the Riggers derived from the MMS Stalls module. This complex module which incorporated a microprocessor (MC6800) driven channel and playback module communicated with the Stalls Briefcase control. It was designed and released in 1976. The ubiquitous Riggers blue 6-way Hypertac connector is on the Briefcase!



Top
Optional Tape module , extended to double-width module to house interface for print-out and type-in from peripheral Teletype.
Bottom
Optional Stalls Terminal, and associated interface module , which provides all principal functions in a highly portable form.

https://www.theatrecrafts.com/archive/documents/mms_brochure_1976.pdf

7. The MMS Stalls module had two data buses to the briefcase, a 2-wire serial I/P Bus and also a 2-wire serial “Stalls Return Bus” in the same connector.

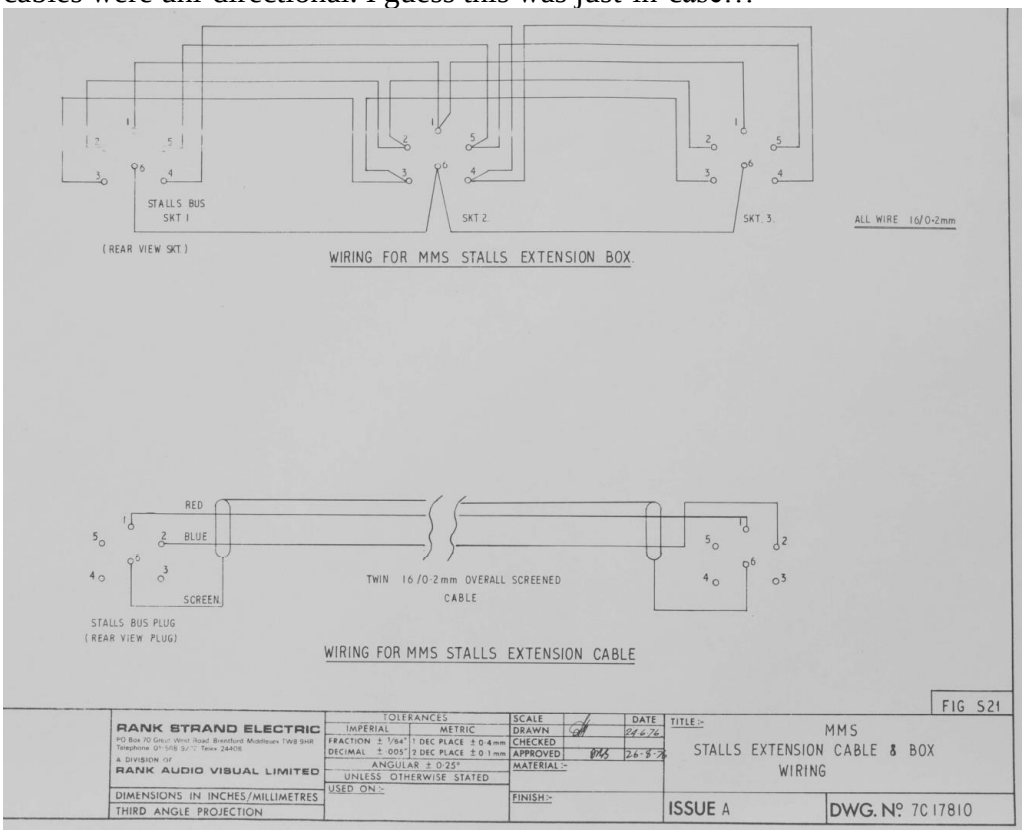


8. The I/P bus had the identical properties as the Riggers bus and was wired the same. Operation expected was the I/P Bus received commands at the Console from the Briefcase and Return Bus sent display information back to the Briefcase.

   However it seems that didn't all happen. The wiring diagram of the Briefcase shows that the actual Briefcase only sent commands and didn't receive the Return Bus. It did however monitor the I/P bus and check that the data it sent did not get corrupted on the bus due to any other user (which the Riggers control only partially did).

   Despite this, Strand still specified that remote wiring for the Stalls extension outlet boxes should be bi-directional, whereas the actual Stalls (and thus Riggers) extension

cables were uni-directional. I guess this was just-in-case…



9. The Briefcase, even though battery powered for a few hours, was by no means portable enough to go up ladders etc. So a Riggers control was devised that could just send the basic channel commands on a fire-and-forget basis. The feedback would simply be if the selected spotlight lit up or went out.

10. In an ideal world it would have been designed around a little microcontroller, but in that era all such chip sets were large and power hungry – think back to the embryonic mobile phones from 1978!

Mobira Talkman, NMT450 portable car phone, 1984 (Photo: Nokia)

However since the signalling was a simple asynchronous serial format, this could be

generated by very low power CMOS logic. Further the bus was powered, and since signalling was by shorting the bus, no transmit power was used. It was thus possible to design a simple system that would run for days off a rechargeable 9V PP3 NiCad cell. A separate small power supply was provided to trickle charge the unit.

To conserve power further, the electronics was only powered when the control switches were pressed up/down. When off it presented a high impedance to the bus, so did not interfere.

11. Electrical Signalling
    The bus was powered from the console at 5 V between lines, with 100 R total impedance, 50 R per leg. This roughly equated to the characteristic impedance od twin core microphone cable. The Riggers signalled by shorting the bus, and at the receiver this was detected if the bus <3 V, i.e. =>20 mA.
    Logic 1 (idle) = 5 V, logic 0 = <3 V.

    Assuming 16/0.2 mm twin cable at 0.5 mm^2 this gave a maximum cable length, with tolerances, of ~1,200 m, so long enough for a reasonable rig. I have not found any Riggers Handbook, which would have set out the specified limits. Thicker cable would give longer runs. The far ends of the cable were not terminated.

    Since the signalling was fire-and-forget there is the risk of collisions and errors from multiple users. At power-up, the bus was sensed to see if there is signalling active from others, and if so, this unit holds off until the bus is idle. Not perfect, but something. It is strange that parity was not implemented which would have improved error protection, but the requirements were simple and feedback of an error obvious.

12. Digital Signalling.
    The system ran at 2,400 baud for wired connection, with an option for 600 baud (phase encoded) for a radio connection. I am not aware that any radio systems were ever used, since it would have needed modems both ends as well as bought-in radio links with international licensing nightmares. Later designs used infra-red for Galaxy Designers.

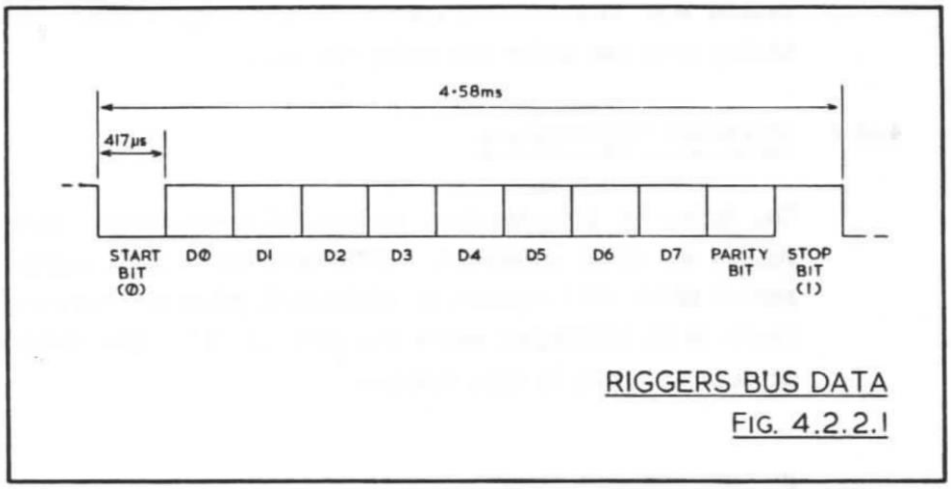
    The three byte packet was transmitted in 14 ms, so essentially instantaneous. If the switches were held down, the packet was retransmitted again (if the bus was clear) after a 13 byte delay to allow other users to use the bus as well.

    Three 11 bit bytes were transmitted, start bit (0), 8 data bits, parity=1 and stop bit (1).
    Byte 1 was 100's switch,
    Byte 2 was 10s and 1s switch,
    Byte 3 was control codes.
    The control codes had first 2 bits encoding the slow-up/slow-down/fast-up/fast-down switches. The second 2 bits were a "User Code" settable by a DIL switch internally. This identified 1 of 4 users. I am not aware of any actual use of this.

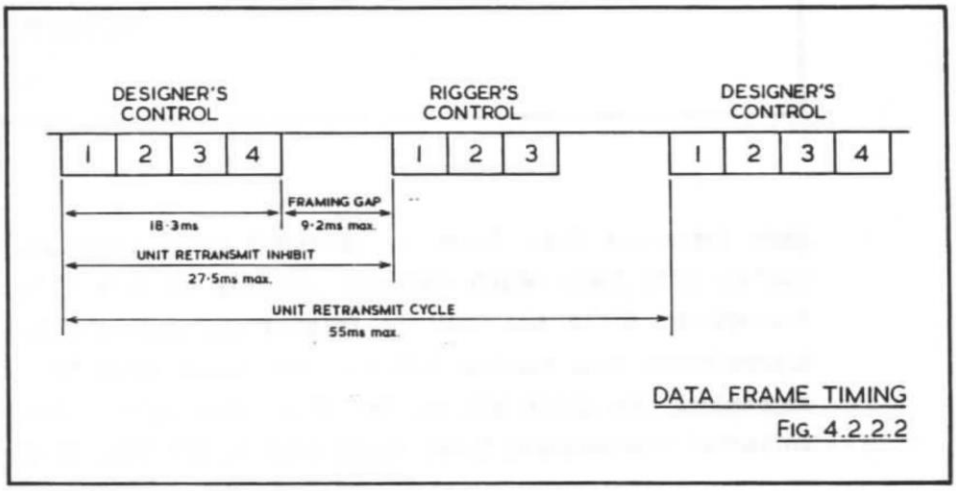
    The four last Control bits were "Function codes" and not wired. However they could be changed to force playback of Cue numbers rather than fade Channel numbers, i.e.

whatever was possible on the Briefcase. Duet probably only supported basic Channel control.

Galaxy 2 provided support for the Riggers Control and also the new Designers control with full level setting and memory access. The Designers also added a 4th byte to the transmission sequence and odd parity error checking.



RIGGERS BUS DATA
FIG. 4.2.2.1



DATA FRAME TIMING
FIG. 4.2.2.2

13. The Strand Designers Control carried the concept further on Galaxy 2, and its handbook should be accessible on the Backstage Heritage website shortly.

14. Finally one must not forget that Strand Riggers control had a lanyard long enough that one could clip it on your belt and operate the unit with one hand without needing to unclip. Unfortunately this meant a length of lanyard that allowed the unit to swing about somewhat, potentially bringing tears to the eyes of a running male electrician!