Model Electronic Railway Group
TECHNICAL BULLETIN G16/07
Issue 2
Gordon Hopkins [M328]

SRO4 Shift Register Output 4 Bytes

AUG 2002

Introduction

Many layout accessories can be driven by simple ON/OFF controls, either singly, such as a Semaphore signal, or in multiple, such as Multi-Aspect Colour Light Signals. In most cases like these, solid-state transistorised switching provides an extremely reliable and much cheaper alternative to the use of electro-mechanical relays.

The module shown here provides 32 independent open-collector outputs, which can be used for any desired function within the specification of the output devices. Further output buffering (Opto-Coupling for example) would allow virtually any device to be controlled. The module is designed to be Control Panel mounted, as part of an RPC system. This document revision (Issue 2) reflects the modified byte ordering scheme introduced with the new RPIC interface module (see TBs G16/4 & G16/5).

Interface Specifications

- Power Requirements — +5V DC Regulated Supply derived from RPC Stack
- Control Input — RPC Shift Register Compatible.
- Output Switching — 500mA per output (see Circuit Description)
- Connectors — RPC Stacking plus 'Molex' Connectors for external wiring
- Logic Polarity — 1 = Output Short Circuit to 0V, 0 = Output Open-Circuit

Circuit Description

The 32 bit output control signals are produced by IC's 1 to 4 (4094) using the standard RPC shift register stacking method. Within the module, the devices are cascaded together, using the pins provided for this purpose. The logic level output signals are buffered by IC's 5 to 8, which are Octal Darlington Drivers (ULN2803A) with built-in Back-EMF protection diodes. Each of these provides eight Open-Collector outputs, capable of sinking up to 500mA each, up to the device power dissipation limit of 2.25W. This limitation is due to the saturation voltage, typically ~1V, of the ULN2803A output transistors, which should be taken into account when allocating the output functions if higher currents are to be switched. The outputs are made available in groups of eight at connectors PL3 to PL6. Each of these connectors also provides a 0V pin, and a pin which is wire link selectable to give either +5V output or a connection to the Back-EMF diode protection pin on the associated ULN2803A. The +5V output option might be used for powering LEDs or similar, while the Back-EMF option allows the device to drive relays without additional protection. As these options relate to each separate group of eight outputs, they can be mixed and matched accordingly. Removable Jumper Links can be used if preferred.

The connector pin numbering on the Printed Circuit Board layout appears rather confused. This is caused by the unfortunate pinout of the 4094 shift register, which splits the eight bits into two lots of four, one on each side of the device. As a result, the bit numbers are interlaced giving the layout shown below.

Connector Bit Assignments

PIN	PL3	PL4	PL5	PL6
1	0V	0V	0V	0V
2	4	12	20	28
3	0	8	16	24
4	5	13	21	29
5	1	9	17	25
6	6	14	22	30
7	2	10	18	26
8	7	15	23	31
9	3	11	19	27
10	Link option	Link option	Link option	Link option

Note that Bits within the module are numbered from 0 to 31, not from 1 to 32 as you might expect. This follows the base zero numbering convention for this type of control system, and the RPC communication protocol works in this manner too. This module adds four to the number of Bytes allocated to the RPI or RPIC Interface Module when System Initialisation is performed, so for additional SRO4's, simply add multiples of 32 to these Bit numbers accordingly, e.g. a second SRI4 would comprise Bits 32 to 63, a third 64 to 95 and so on, counting away from the RPI or RPIC. The maximum number of SRO4's on any one stack (this includes RSE split stacks) is 8, equivalent to 32 Bytes, as this gives a Bit range of 0 to 255.

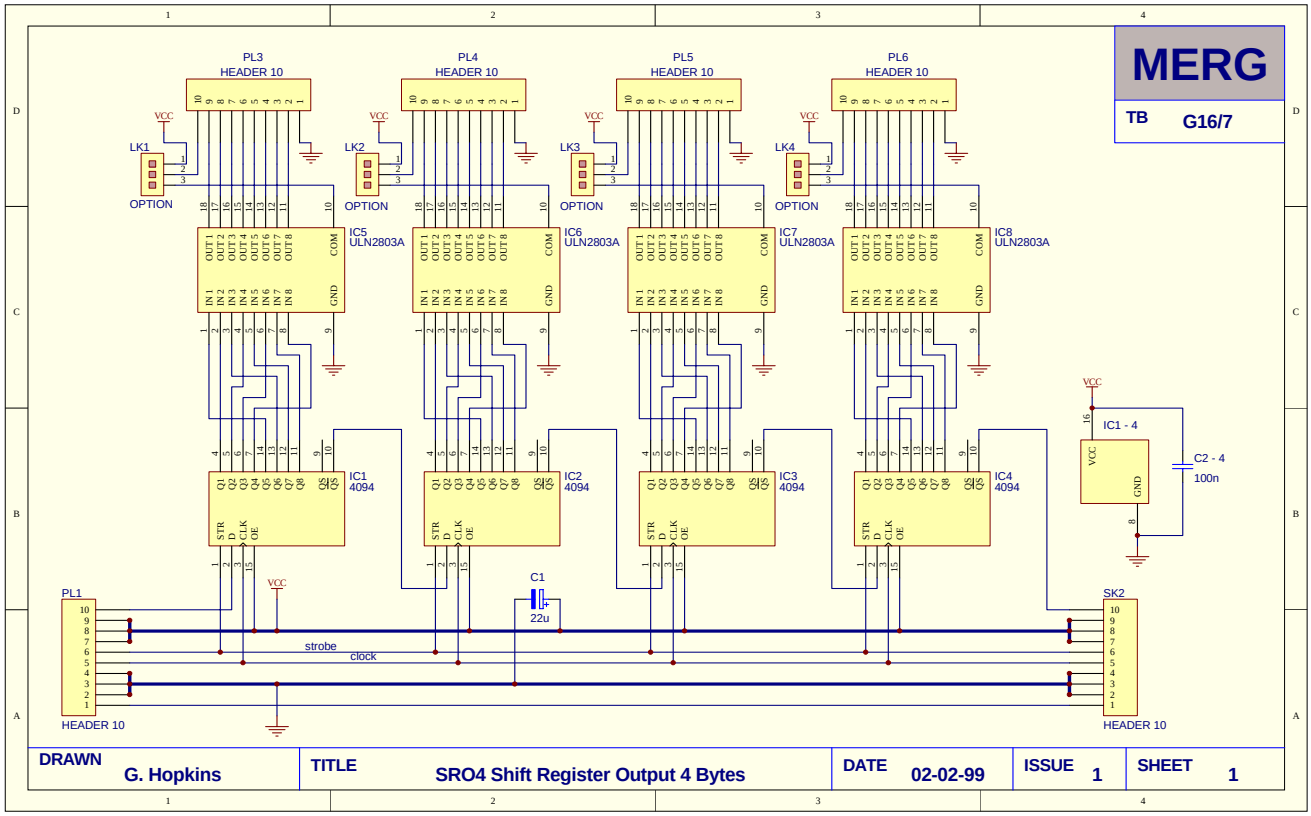
See Technical Bulletin G16/5 for more information on these aspects of System Setup.

[Cont. over >>>]

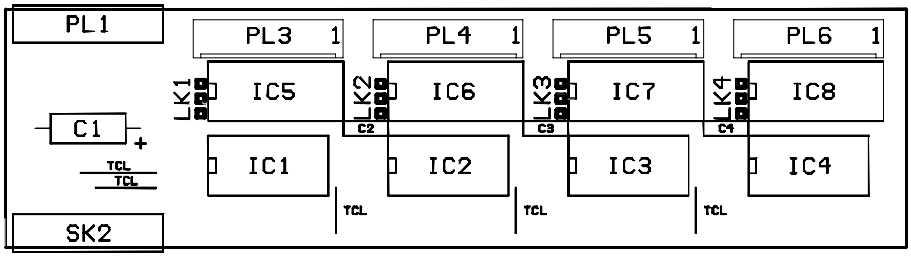
Parts List

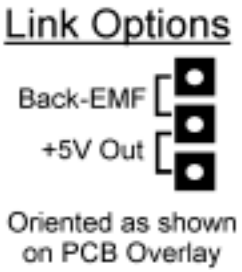
Capacitor	22µF 16V	1 off	C1
Capacitor	100nF	3 off	C2 to 4
IC	CD4094BE	4 off	IC1 to 4
IC	ULN2803A	4 off	IC5 to 8
Header Plug	10 pin R/A	1 off	PL1
Header Socket	10 pin R/A	1 off	SK2
Header Plug	10 pin Straight	4 off	PL3 to 6
Crimp Socket Housing	10 pin	4 off	for PL3 to 6
Crimp Terminals		40 off	External Wiring connections
Tinned Copper Wire		As reqd	Tinned Copper Links (TCL)
Spacers	M3 x 4mm	2 off	

Circuit Diagram

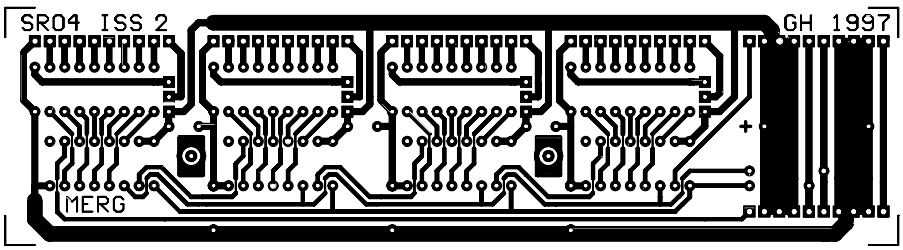


PCB Overlay (not to scale)





PCB Layout (not to scale)



G16_07_2.doc

