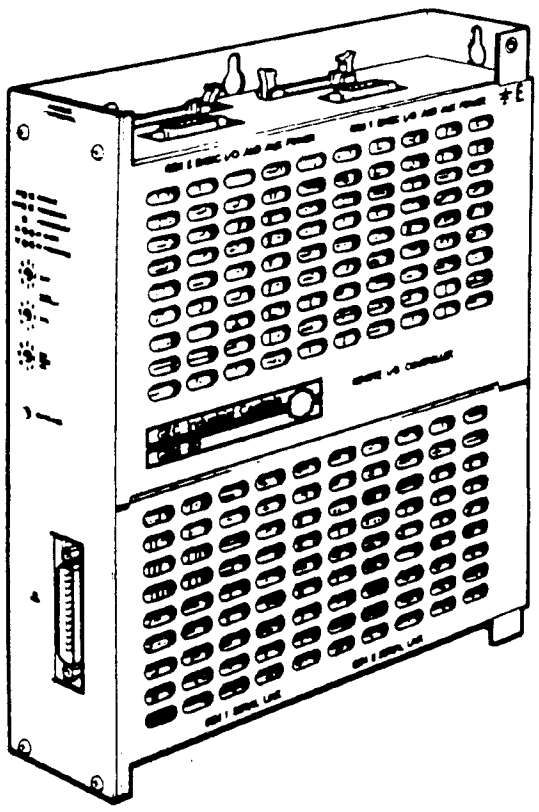
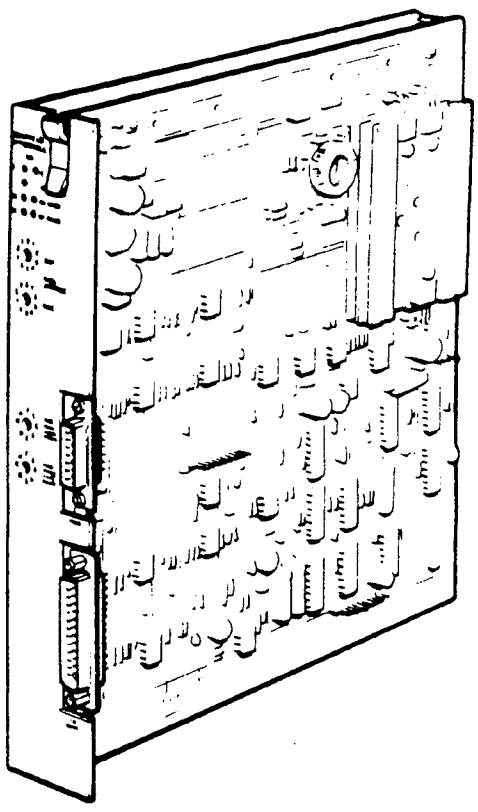
ALSTOM

REMOTE I/O VERIFICATION SYSTEM

9006 and 8863



9006



8174

GEM80 USER INFORMATION

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1. INTRODUCTION

The Remote Verification I/O Controller module (9006) provides an interface to the Verification I/O highway, enabling GEM80 Programmable Controllers to read and write to Verification I/O and Basic I/O units over long distances.

The Remote Verification I/O Controller converts the parallel data normally transmitted along the Verification highway into a high speed serial link. This data is received by one or more Remote I/O Interface modules (8174) that are housed in subracks (8863) sited at locations up to 3km away, and converted into Verification and/or Basic Highways set by the user.

A single 9006 controller can exchange information with 32 Remote Interfaces (8174) linked by a daisy-chained serial link.

A maximum of 4096 bits can be handled by each Remote Verification I/O Controller. You can connect up to 32 Remote Verification I/O Controllers to provide 64K total of Verification/Basic I/O points, subject to the capacity of the host controller.

Each Remote I/O Interface module can provide a minimum of:

- 64 bits of Verification with 0 bits Basic, or
- 64 bits Basic with 0 bits Verification

up to a maximum of:

- 256 bits Basic with 1792 bits Verification, or
- 2048 bits all Verification I/O.

All remote I/O Interfaces are compatible with Remote Verification I/O and can be set up in the normal way.

A Remote Verification I/O Controller is housed in a metal box, to which you must connect Verification ribbons, serial link cable and (if necessary) additional power input connections.

The 9006 Controller incorporates facilities that allow two GEM80 Programmable Controllers to read the same I/O data, thus making it easy to connect into hot standby systems. All 9006 Controllers allow port 1 of the Programmable Controller(s) to be converted to RS485 signal levels, so that signals from this port may be received at the Remote Interface Stations, enabling you to perform Remote Programming.

As a safety feature, the Programmable Controller's Watchdog relay is used to inhibit the output of data at all remote stations, independent of the operation of the 9006 unit and 8174 module units.

2. HARDWARE LAYOUT

Figure 2.1 shows a typical configuration where 3 Remote Verification I/O controllers are each connected to GEM80 Controllers through a 26-way ribbon cable. The ribbon cable output from the GEM80 Controllers can be "daisy chained" to each Remote Verification I/O Controller in turn. The illustration shows the system connected for changeover operation. The I/O data link cable from the Remote Verification Controller is then routed to the Remote Verification I/o Interfaces through a series of terminal rails (see Figure 2.2).

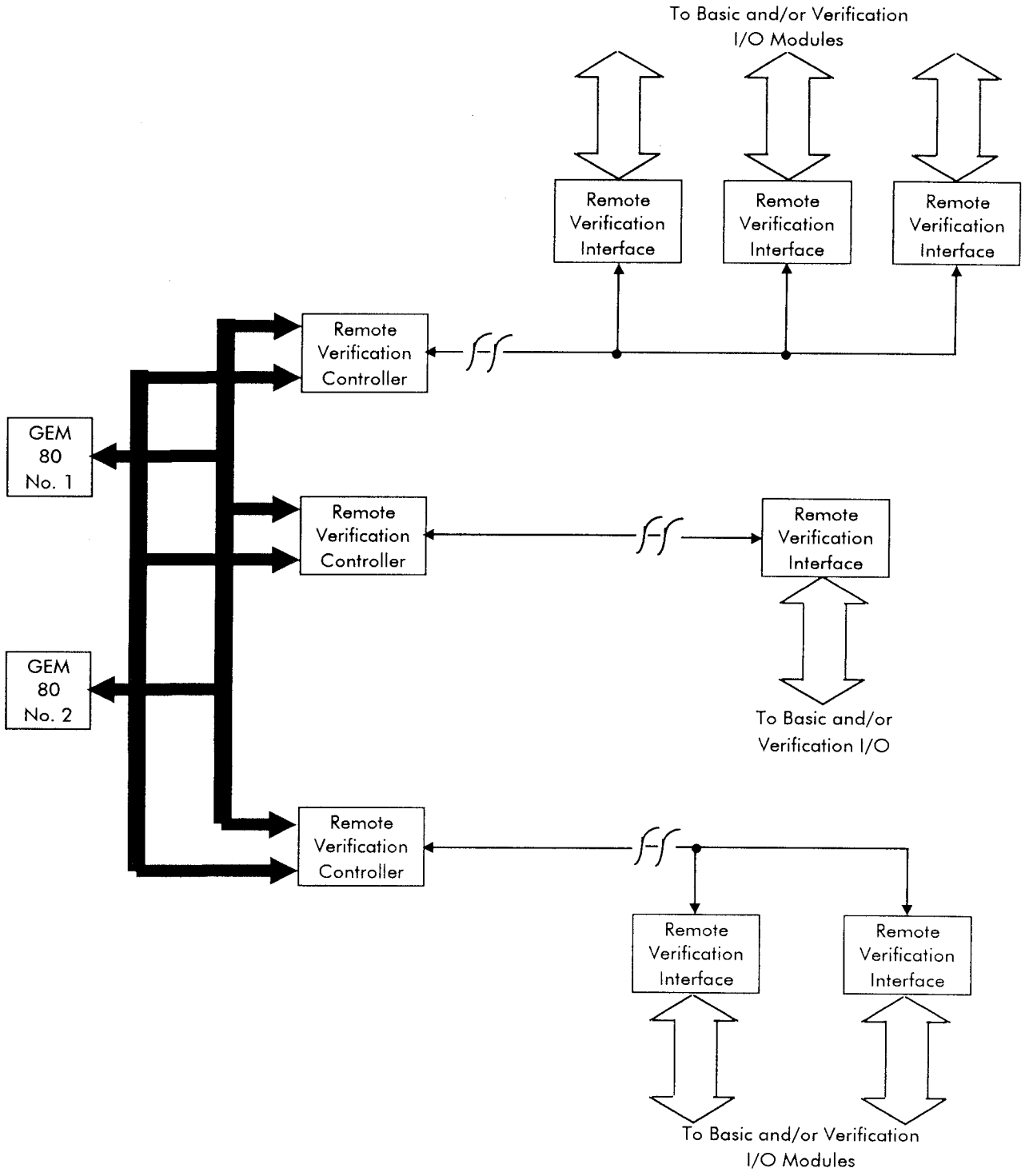
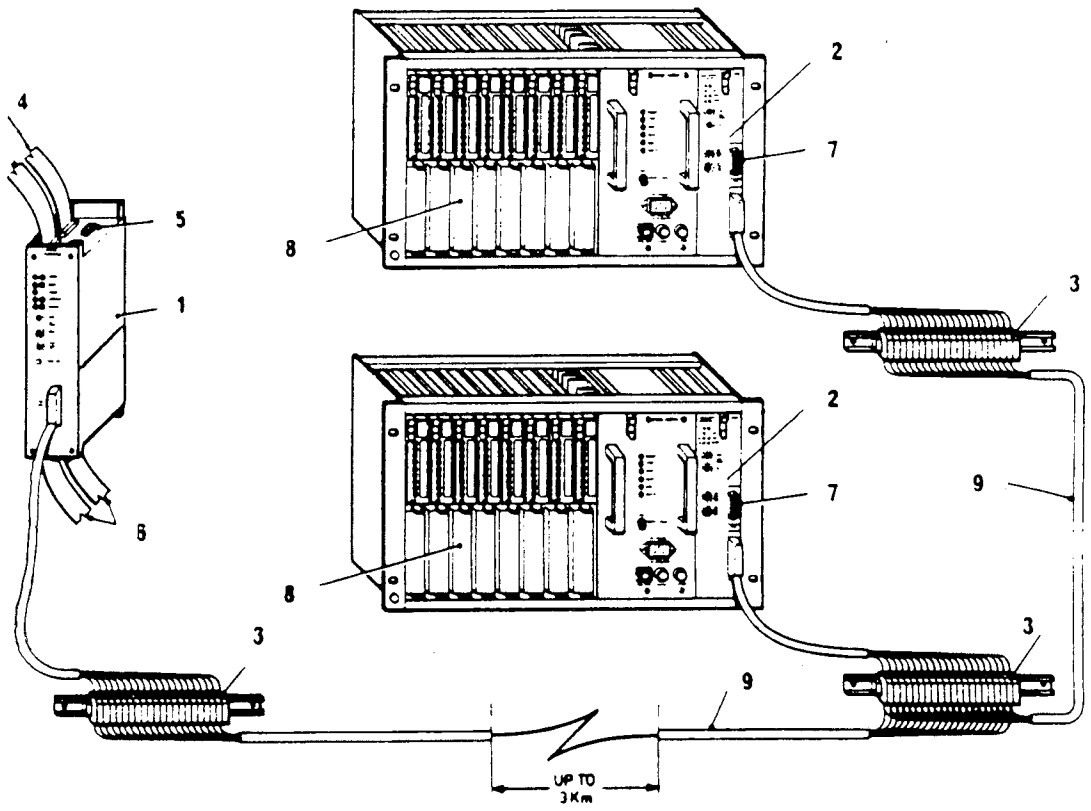


Figure 2.1 - Typical Configuration

Figure 2.2 illustrates in more detail the method of connection between the Remote Verification I/O Controller and the associated Remote Verification I/O interfaces. Each unit is supplied with a cable harness terminated at one end by a 25-way 'D' type connector. The free end of this cable harness is then connected into a terminal rail and the I/O data link cable (screened, twin-twisted pairs with overall screen) "daisy chained" to each terminal rail. Section 5 - Connections - provides detailed information on pin and terminal numbers.



1. Remote Verification I/O Controller
2. Remote Verification I/O Interface Module
3. Termination Rails
4. Verification Highway Ribbons
5. Auxiliary Power Supply Input
6. Serial Link Cables
7. Remote Programming Port
8. Basic Compact I/O Modules
9. I/O Data Link Cable

Figure 2.2 - Hardware Layout

3. OPERATION

3.1 Remote Verification I/O Controller (9006)

3.1.1 Introduction

The 9006 performs the function of extending the Verification Highway up to 3km by converting it from the Verification Highway format to a high speed serial link. An 8174 series Remote I/O Interface module converts this serial data into Basic or Basic and Verification I/O.

The 9006 is sited locally with a GEM80 Programmable Controller. The Verification ribbon cable is brought from the Controller's I/O Processor and is fitted into a 26 way ribbon cable socket mounted on the top of the unit.

3.1.2 Remote I/O Controller Operation

Start up	: performs comprehensive self test
	: starts operating cycle
	: decides whether GEM80 Controller No. 1 or GEM80 Controller No. 2 is active
Operating cycle	: as the controller sets output data, the Remote Controller writes it to memory
	: transmits output data in memory to each Remote unit in turn
	: instructs each Remote unit to transmit input data in turn
	: reads inputs of Remote units into memory
	: outputs input information from memory to controller when the address location is next scanned
Cycle time	: as GEM80 Controller
	: serial input data read/write time is 1ms per 64 I/O allocated
Repetition time	: free running

3.1.3 Self Test and Watchdog

WARNING: IF THE REMOTE VERIFICATION I/O CONTROLLER TRIPS DUE TO A SELF TEST FAILURE, IT DOES NOT AUTOMATICALLY CAUSE THE GEM80 HOST CONTROLLER TO TRIP. THE USER IS ADVISED TO USE THE FAULT TABLES SET BY THE GEM80 CONTROLLER TO DECIDE THE APPROPRIATE CAUSE OF ACTION

The Remote Verification I/O Controller performs self tests at switch on and also tests all the data received from Remote Interface units. Any self test fault is indicated as a highway failure.

A fault occurs immediately if there is a failure to service the internal watchdog circuits at 100ms intervals.

3.1.4 Changeover

The 9006 Remote Verification I/O Controller can be used in a dual GEM80 Programmable Controller configuration:

The Changeover unit receives a Verification I/O ribbon from each of the Programmable Controllers. One of these ribbons is considered to be active and the other on standby.

Active Ribbon	: all output data written to Remote I/O Controller
	: all input data received
Standby Ribbon	: all output data ignored by Remote I/O Controller
	: all input data received

On first application of power, the Remote I/O Controller will try to run on Verification ribbon 1. If the watchdog for GEM80 Programmable Controller 1 fails to come up, the Remote I/O Controller will switch to Verification Ribbon 2 from Programmable Controller 2 but only if Programmable Controller 2 watchdog is healthy. If neither GEM80 watchdogs are healthy, then the Remote I/O Controller will monitor both watchdogs and wait for the first of either to become active.

Whichever watchdog comes up first (with preference to GEM80 Programmable Controller 1) the Remote I/O Controller will select that GEM80 as the active equipment.

The Remote I/O Controller will continue to regard this GEM80 as active, even if the other controller becomes healthy.

A changeover will only occur if the active controller's watchdog trips and the watchdog of the standby controller is healthy.

3.2 Remote Verification I/O Interface Module

3.2.1 Introduction

The Remote Verification I/O Interface module mounts in the processor slot of an 8-slot Remote I/O subrack connected only by the serial link cable and the GEM80 Systems Programmer. The Remote Verification I/O Interface will produce two highways, Basic and Verification. The quantity and boundaries of the two highways will be set by four switches accessible through the front panel.

The two highways are available to the user via socket 1 and 5 on the backplane. The Verification highway is brought out on socket 5 and on the backplane I/O module connectors. A second Basic I/O ribbon is not available.

No address setting of the backplane is required for any Verification modules fitted.

The Basic I/O highway, address range A0-A7, is available on socket 1 and on the I/O backplane connectors.

The backplane must be configured in the usual way for any Basic I/O modules.

In this way, both Verification and Basic I/O modules can be mixed in the same subrack.

3.2.2 Remote I/O Interface Operation

The 8174-4001 Remote I/O Interface module performs a repetitive cycle; it scans its inputs and sets its outputs. Its input data is transmitted to the remote I/O Controller and its outputs are set according to data received from the Remote I/O Controller.

Start up	: performs comprehensive self-test : starts operating cycle : closes watchdog interlock
Operating cycle	: scans inputs into data tables : scans outputs from data tables : services watchdog at regular intervals
Repetition interval	: free running
Fault shutdown	: opens watchdog contact and ceases scanning
Restart after shutdown	: initiated power off/on externally or by operating power module switchshutdown/run : I/O data tables cleared to zero on power up

3.2.3 Self-test and Watchdog

The Remote I/O Interface performs self-tests when power is switched on and also on data received from the Remote I/O Controller.

The watchdog relays are automatically picked up on satisfactory completion of start up tests. Any failure indication related to gross maloperation of the equipment results in automatic watchdog trip.

Faults which immediately trip watchdog	: power supply break : power module failure : remote I/O interface module failure : fault interfacing with data transfer on basic I/O highway
Faults which trip watchdog when detected by running tests	: failure to store or recall data : host GEM80 Programmable Controller fault which causes its watchdog to trip
Faults from which recovery is automatic	: power supply re-applied after break : host GEM80 Programmable Controller watchdog reset
Watchdog Contacts (for plant):	
Circuit for user	: volt free contact : closed when controller healthy and status running with normal inputs
Resistive rating	: a.c. 200VA 1A 259V make/break : d.c. 100W 1A 250V make/break
Connections power module for access)	: 6.3mm (¼") push-on tabs on the backplane (remove

3.2.4 Input/Output

Type	: GEM80 Basic I/O Highway
Capacity	: up to 256 bits of Basic and 1792 bits of Verification I/O : up to 2048 bits of Verification I/O : logic I/O up to 2048 ON/OFF states)or : numeric I/O up to 128 values in the range +32767)any)mixture
Module space	: space for up to 8 I/O modules in the controller subrack : gives up to 2048 I/O points
Cycle time	: 2.0ms +4.0ms per I/O word allocated (Basic I/O) : 0.2ms per I/O word allocated (Verification I/O) : serial I/O data read/write time is 1ms per 64 I/O allocated

3.3 Use With Verification I/O Expanders

Not all the I/O on a system need be remote from the host GEM80 Programmable Controller. If you need Verification I/O local to the Controller, then you can connect this I/O to the Verification ribbon via the appropriate I/O subrack. The address location of the local I/O modules will of course be situated out of the Remote I/O Controller's address range. If you need standard Basic I/O locally, then you must connect it via an 8191-4001 Verification I/O Expander unit.

The Verification I/O ribbon cable can be freely daisy chained between a mixture of Remote Controllers, Verification I/O Expanders and Verification I/O modules.

3.4 Multidropping Remote I/O Expanders

It is important that all Remote I/O Controllers select the same GEM80 Programmable Controller after testing the watchdogs of the prospective, active and standby Controllers. To ensure this at all times, the Remote I/O Controllers are daisy chained with the R1 to W1 + AND R2 to W2+ signals (see Figure 6.3).

3.5 Operating Times

The overall time for the transmission of data to a Remote I/O Interface is built up as follows:

time = Host Controller scan time + I/O data link time (worst case) + Remote I/O Interface scan time

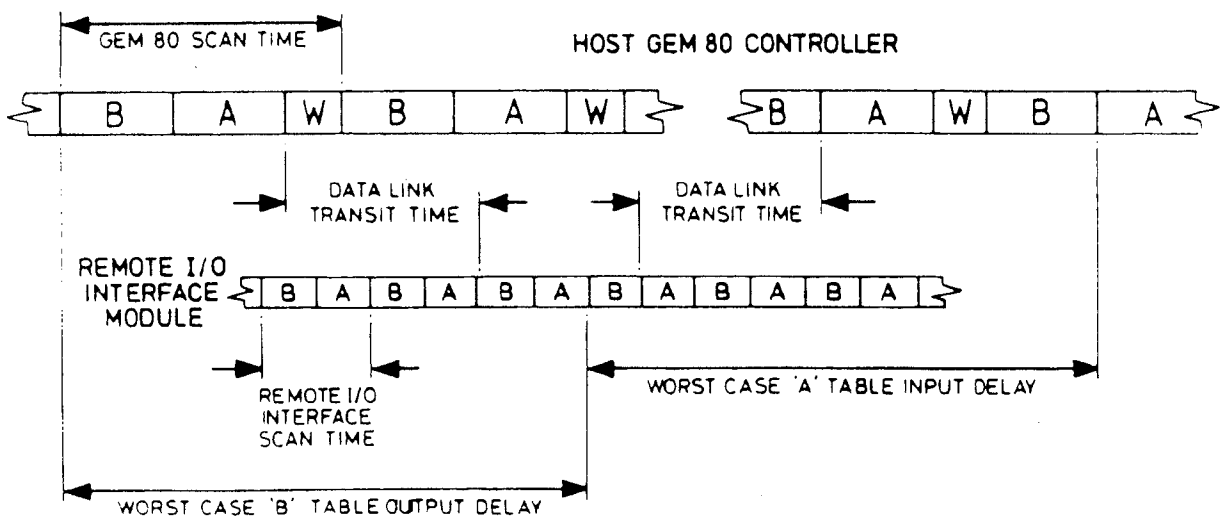
The host controller scan time is fixed by the program size and the total of I/O connected.

The Remote I/O Interface scan time is fixed by the quantity of I/O connected to it.

This leaves the I/O data link time as the only possible variable in the scan time.

For applications where the overall scan time is critical, it is possible to optimise this time by using more than one Remote I/O Controller and distributing the Remote I/O Interfaces between them. Each I/O data link in such a configuration can be considered as being in parallel with all other I/O data links.

Figure 3.1 shows the relationship between the respective input and output scans of the GEM80 Controller itself and each remote I/O Interface Module.



KEY A = A-tables being scanned
B = B-tables being scanned
W = Wait time at end of the I/O scan for the Ladder Processor (usually zero)

Figure 3.1 - Scan Relationship

3.6 Addressing

3.6.1 Addresses for Remote Verification I/O Controllers

As you can connect more than one Remote Verification I/O Controller to the Verification Highway, you must tell the GEM80 Controller which set of addresses you need. You must allocate the base address and then an address width. This will establish an address "window" for a particular Remote Verification I/O Controller. Switches 1, 2 and 3 on the front panel of the Remote I/O Controller are used for this purpose.

SW1 and SW2 in combination set the base address. SW3 sets the address width in 16-bit words.

The switches must be set up before power up. If the switch positions are changed, the unit must be powered down and back up again for re-initialisation.

The base address is set in blocks of 256 bits (16 A/B table addresses). The maximum base address permitted is up to 256 bits less than the maximum amount of Verification I/O bits available on the particular GEM80 system.

Table 3.1 - SW1 and SW2 Base Addresses

SW1	SW2	BASE ADDRESS
0	0	0
1	0	16
2	0	32
3	0	48
4	0	64
5	0	80
6	0	96
7	0	112
8	0	128
9	0	144
A	0	160
B	0	176
C	0	192
D	0	208
E	0	224
F	0	240
0	1	256
1	1	272
2	1	288
3	1	304
4	1	320
5	1	336
6	1	352
7	1	368
8	1	384
9	1	400
A	1	416
B	1	432
C	1	448
D	1	464
E	1	480
F	1	496

Table 3.2 - SW3 Address Width

SW3	ADDRESS WIDTH	NUMBER OF I/O ADDRESSED
0	ZERO	NONE
1	16	256
2	32	512
3	64	1024
4	80	1280
5	96	1536
6	112	1792
7	128	2048
8	144	2304
9	160	2560
A	176	2816
B	192	3072
C	208	3328
D	224	3584
E	240	3840
F	256	4096

3.6.2 Remote I/O Interface - Address Switch Setting

Before being able to set up the "address window" on the Remote Verification I/o Controller, you will have to determine the number of addresses needed by each remote location. On the Remote Verification I/O Interface, four rotary switches are provided to set the base address and the mix of Basic and Verification I/O required. Accessible from the front panel of the unit, the four switches SW1 - SW4 are set as follows:

1. SW1 and SW2 in combination set the base address. See table 3.3 for the switch settings corresponding to the base addresses.

2. SW3 sets the Verification Address Boundary. Taking the number of Basic I/O bits configured and adding the number of Verification I/O bits configured will give the total mix of I/O bits for that unit. See Table 3.4 for SW3 settings

3. SW4 determines the number of Basic I/O bits to be configured for the unit. See Table 3.5 for SW4 settings.

Table 3.3 - SW1 and SW2 Base Addresses

SW1 SETTING	SW2	BASE ADDRESS	SW1 SETTING	SW2	BASE ADDRESS
0	0	0	2	3	128
1	0	4	3	3	132
2	0	8	4	3	136
3	0	12	5	3	140
4	0	16	6	3	144
5	0	20	7	3	148
6	0	24	8	3	152
7	0	28	9	3	156
8	0	32	0	4	160
9	0	36	1	4	164
0	1	40	2	4	168
1	1	44	3	4	172
2	1	48	4	4	176
3	1	52	5	4	180
4	1	56	6	4	184
5	1	60	7	4	188
6	1	64	8	4	192
7	1	68	9	4	196
8	1	72	0	5	200
9	1	76	1	5	204
0	2	80	2	5	208
1	2	84	3	5	212
2	2	88	4	5	216
3	2	92	5	5	220
4	2	96	6	5	224
5	2	100	7	5	228
6	2	104	8	5	232
7	2	108	9	5	236
8	2	112	0	6	240
9	2	116	1	6	244
0	3	120	2	6	248
1	3	124	3	6	252

3.6.3 Basic and Verification Address Boundaries

Each Remote Verification I/O Interface provides a maximum of 2048 Verification I/O bits. Of this total, a maximum of 256 Basic I/O bits can be configured leaving the balance (1792 bits) as Verification I/O. If you do have to allocate Basic I/o, it must be located immediately after the base address set for the unit.

Table 3.4 - Verification Addresses Used

SW3 SETTING	QUANTITY OF BITS	ADDRESSES USED FROM BASE ADDRESS
0	0	0
1	64	4
2	128	8
3	256	16
4	512	32
5	768	48
6	1024	64
7	1280	80
8	1536	96
9	1792	112
A	2048	128

Table 3.5 - Basic Addresses Used

SW4 SETTING	QUANTITY OF BITS	ADDRESSES USED FROM BASE ADDRESS
0	0	0
1	64	4
2	128	8
3	256	16

3.6.4 Example of Address Allocation

Figure 3.2 Shows a Remote I/O System comprising:

1. A GEM80 Controller
2. Remote Verification I/O Controller
3. Remote Location No. 1 consisting of:
   1 - 8174-4004 module
   11 - 8158-4001 modules
   8 - 8163-4001 modules
4. Remote Location No. 2 consisting of:
   1 - 8174-4004 module
   6 - 8158-4001 modules
   3 - 8163-4001 modules

3.6.4.1 Remote Location No. 1

1. Remote Location No. 1 will occupy addresses starting at A/B table location 0. SW1 and SW2 on the 8174-4004 Remote Verification Interface Module must both be set 0 (See Table 3.3)

2. Both Basic and Verification I/O modules are used at this location and the Basic I/O modules must occupy the first set of A/B addresses. In this example, eight 8163-4001, 32-channel input modules are called up. Total Basic I/O allocation is therefore 256 bits. SW4 on 8174-4004 Remote Verification I/O Module is set to 3. (See Table 3.5)

3. The other two racks of I/O at Remote Location No. 1 contain eleven 8158-4001 Verification I/O modules. Each 8158 module occupies 8 A/B table locations (128 I/O bits) therefore 11 x 128 = 1408 bits of Verification I/O need to be addressed. SW3 must be set to the next highest address range, which in this case is 8 (1536 bits).

   Switch settings for the 8174-4004 Remote Verification I/O Interface Module for Remote Location No. 1 are therefore:

   SW1 = 0, SW2 = 0, SW3 = 8 and SW4 = 3.

3.6.4.2 Remote Location No. 2

1. Since Remote Location No. 1 has occupied 256 bits of Basic I/O and 1536 bits of Verification I/O, a total of 1792 I/o bits or 112 A/B table locations (0-111). The next Remote Location (No. 2) must therefore start from base address A/B 112. Set SW1 to 8 and SW2 to 2. (See Table 3.3).

   Remember that the Basic I/O modules must occupy the first set of A/B addresses at this location also.

2. Remote Location No. 2 also has eight 8163-4001, 32-channel input modules. SW4 is therefore set to 3. (See Table 3.5)

3. Six 8158-4001 modules occupy 6 x 128 bits of Verification I/O = 768 I/O bits. SW3 must be set to 5 to give this figure.

   Switch settings for the 8174-4004 Remote Verification I/O Interface Module for Remote Location No. 2 are therefore:

   SW1 = 8, SW2 = 2, SW3 = 5 and SW4 = 3

   Note that in the example Remote Location No. 1 has not taken up the full Verification I/O addressed. There are 8 A/B locations (128 I/O bits) spare. In Remote Location No. 2, all addressed Verification I/o has been taken up.

4. If a third Remote location was to be installed, it could start at base address:

   (256 + 1536) = Remote Location No. 1

   Plus:

   (256 + 768) = Remote Location No. 2

   Equals:

   2816/16 = 176 words

   Switch settings for SW1 and SW2 on the Remote Verification I/O Interface Module for a possible Remote Location 3 would be 4 and 4 respectively.

3.6.4.3 Remote Verification I/O Controller

The Remote Verification I/O Controller must have switches SW1 and SW2 set to 0 because it is working with addresses starting from A/B table location 0. The total I/O used at Remote Stations No. 1 and 2 calculated in 4 above is 2816 bits . SW3 should therefore be set to A. However, if no other Remote I/O Controllers, Expanders or I/O modules are connected to the Verification I/O Ribbon, SW3 can be set to any setting of A or greater (B, C, D, E or F) without penalty, because the Remote Verification I/O Controller will operate only on those addresses requested by the Ladder Program.

To address all I/O bits in Remote Locations 1 and 2, the Remote Verification I/O Controller should be set as follows:

SW1 = 0, SW2 = 0 and SW3 = A

As an aid to calculating the number of addresses and the settings of each switch, table 3.6 has been compiled with the locations and modules shown in Figure 3.2. Table 3.7 (a blank form) is included which may be photocopied to provide a basis for your own calculations.

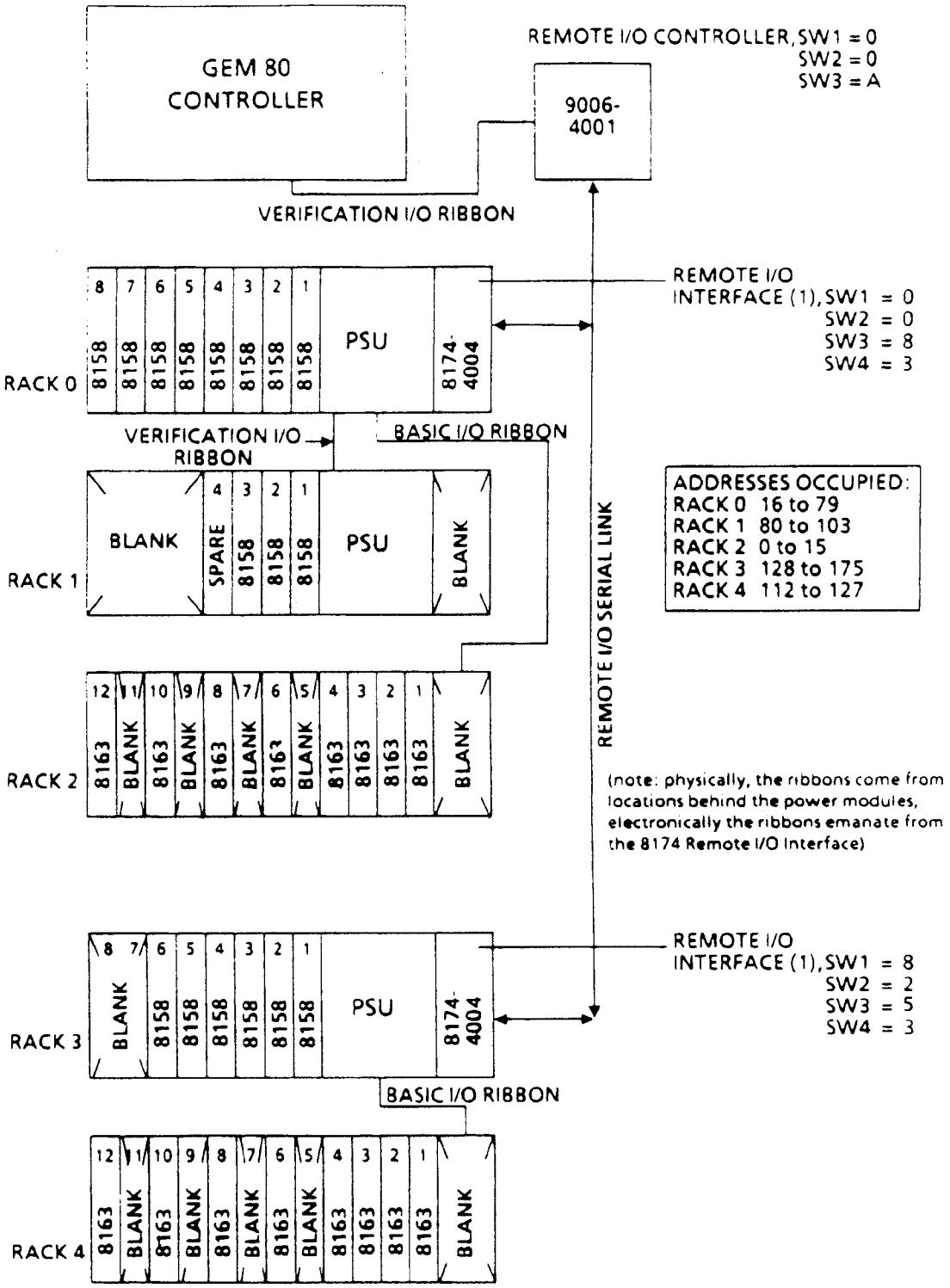


Figure 3.2 - Remote I/O System (Example)

Table 3.6 - Worked Example from Figure 3.2

A/B TABLE ADDRESS	REMOTE I/O BASE ADDRESS SW 1	REMOTE I/O BASE ADDRESS SW 2	BASIC/VERIFICATION (B/V)	SUBRACK NUMBER	SLOT NUMBER	MODULE NUMBER
0	0	0	B	2	1	
1	0	0				
2	0	0		2	2	
3	0	0				
4	1	0		2	3	
5	1	0				
6	1	0		2	4	
7	1	0				
8	2	0		2	6	
9	2	0				
10	2	0		2	8	
11	2	0				
12	3	0		2	10	
13	3	0				
14	3	0		2	12	
15	3	0				
16	4	0	V			
17	4	0				
18	4	0				
19	4	0		0	1	
20	5	0				
21	5	0				
22	5	0				
23	5	0				
24	6	0				
25	6	0				
26	6	0				
27	6	0		0	2	
28	7	0				
29	7	0				
30	7	0				
31	7	0				
32	8	0				
33	8	0				
34	8	0				
35	8	0		0	3	
36	9	0				
37	9	0				
38	9	0				
39	9	0				
40	0	1				
41	0	1				
42	0	1				
43	0	1		0	4	
44	1	1				
45	1	1				
46	1	1				
47	1	1				
48	2	1				
49	2	1				
50	2	1				
51	2	1		0	5	
52	3	1				
53	3	1				
54	3	1				
55	3	1				
56	4	1				
57	4	1				
58	4	1				
59	4	1		0	6	
60	5	1				
61	5	1				
62	5	1				
63	5	1				
64	6	1	V			
65	6	1				
66	6	1				
67	6	1		0	7	
68	7	1				
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97	4	2				
98	4	2				
99	4	2		1	3	
100	5	2				
101	5	2				
102	5	2				
103	5	2				
104	6	2				
106	6	2		SPARE		
106	6	2				
107	6	2				
108	7	2				
109	7	2		SPARE		
110	7	2				
111	7	2				
112	0	3	B	4	1	
113	8	2				
114	8	2		4	2	
115	8	2				
116	9	2		4	3	
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153	8	3				
154	8	3				
155	8	3		3	4	
156	9	3				
157	9	3				
158	9	3				
159	9	3				
160	0	4				
161	0	4				
162	0	4				
163	0	4		3	5	
164	1	4				
165	1	4				
166	1	4				
167	1	4				
168	2	4				
169	2	4				
170	2	4				
171	2	4		3	6	
172	3	4				
173	3	4				
174	3	4				
175	3	4				
176	4	4				
177	4	4				
178	4	4				
179	4	4				
180	5	4				
181	5	4				
182	5	4				
183	5	4				
184	6	4				
185	6	4				
186	0	4				
187	6	4				
188	7	4				
189	7	4				
190	7	4				
191	7	4				
192	8	4				
193	8	4				
194	8	4				
195	8	4				
196	9	4				
197	9	4				
198	9	4				
199	9	4				
200	0	5				
201	0	5				
202	0	5				
203	0	5				
204	1	5				
205	1	5				
206	1	5				
207	1	5				
208	2	5				
209	2	5				
210	2	5				
211	2	5				
212	3	5				
213	3	5				
214	3	5				
215	3	5				
216	4	5				
217	4	5				
218	4	5				
219	4	5				
220	5	5				
221	5	5				
222	5	5				
223	5	5				
224	6	5				
225	6	5				
226	6	5				
227	6	5				
228	7	5				
229	7	5				
230	7	5				
231	7	5				
232	8	5				
233	8	5				
234	8	5				
235	8	5				
236	9	5				
237	9	5				
238	9	5				
239	9	5				
240	0	6				
241	0	6				
242	0	6				
243	0	6				
244	1	6				
245	1	6				
246	1	6				
247	1	6				
248	2	6				
249	2	6				
250	2	6				
251	2	6				
252	3	6				
253	3	6				
254	3	6				
255	3	6				

Table 3.7 - Blank Form for Location History

A/B TABLE ADDRESS	REMOTE I/O BASE ADDRESS SW 1 2	BASIC/VERIFICATION (B/V)	SUBRACK NUMBER	SLOT NUMBER	MODULE NUMBER
0	0 0				
1	0 0				
2	0 0				
3	0 0				
4	1 0				
5	1 0				
6	1 0				
7	1 0				
8	2 0				
9	2 0				
10	2 0				
11	2 0				
12	3 0				
13	3 0				
14	3 0				
15	3 0				
16	4 0				
17	4 0				
18	4 0				
19	4 0				
20	5 0				
21	5 0				
22	5 0				
23	5 0				
24	6 0				
25	6 0				
26	6 0				
27	6 0				
28	7 0				
29	7 0				
30	7 0				
31	7 0				
32	8 0				
33	8 0				
34	8 0				
35	8 0				
36	9 0				
37	9 0				
38	9 0				
39	9 0				
40	0 1				
41	0 1				
42	0 1				
43	0 1				
44	1 1				
45	1 1				
46	1 1				
47	1 1				
48	2 1				
49	2 1				
50	2 1				
51	2 1				
52	3 1				
53	3 1				
54	3 1				
55	3 1				
56	4 1				
57	4 1				
58	4 1				
59	4 1				
60	5 1				
61	5 1				
62	5 1				
63	5 1				

A/B TABLE ADDRESS	REMOTE I/O BASE ADDRESS SW 1 2	BASIC/VERIFICATION (B/V)	SUBRACK NUMBER	SLOT NUMBER	MODULE NUMBER
64	6 1				
65	6 1				
66	6 1				
67	6 1				
68	7 1				
69	7 1				
70	7 1				
71	7 1				
72	8 1				
73	8 1				
74	8 1				
75	8 1				
76	9 1				
77	9 1				
78	9 1				
79	9 1				
80	0 2				
81	0 2				
82	0 2				
83	0 2				
84	1 2				
85	1 2				
86	1 2				
87	1 2				
88	2 2				
89	2 2				
90	2 2				
91	2 2				
92	3 2				
93	3 2				
94	3 2				
95	3 2				
96	4 2				
97	4 2				
98	4 2				
99	4 2				
100	5 2				
101	5 2				
102	5 2				
103	5 2				
104	6 2				
105	6 2				
106	6 2				
107	6 2				
108	7 2				
109	7 2				
110	7 2				
111	7 2				
112	8 2				
113	8 2				
114	8 2				
116	8 2				
116	9 2				
117	9 2				
118	9 2				
119	9 2				
120	0 3				
121	0 3				
122	0 3				
123	0 3				
124	1 3				
125	1 3				
126	1 3				
127	1 3				

A/B TABLE ADDRESS	REMOTE I/O BASE ADDRESS SW 1 2	BASIC/VERIFICATION (B/V)	SUBRACK NUMBER	SLOT NUMBER	MODULE NUMBER
128	2 3				
129	2 3				
130	2 3				
131	2 3				
132	3 3				
133	3 3				
134	3 3				
135	3 3				
136	4 3				
137	4 3				
138	4 3				
139	4 3				
140	5 3				
141	5 3				
142	5 3				
143	5 3				
144	6 3				
145	6 3				
146	6 3				
147	6 3				
148	7 3				
149	7 3				
150	7 3				
151	7 3				
152	8 3				
153	8 3				
154	8 3				
155	8 3				
156	9 3				
157	9 3				
158	9 3				
159	9 3				
160	0 4				
161	0 4				
162	0 4				
163	0 4				
164	1 4				
165	1 4				
166	1 4				
167	1 4				
168	2 4				
169	2 4				
170	2 4				
171	2 4				
172	3 4				
173	3 4				
174	3 4				
175	3 4				
176	4 4				
177	4 4				
178	4 4				
179	4 4				
180	5 4				
181	5 4				
182	5 4				
183	5 4				
184	6 4				
185	6 4				
186	0 4				
187	6 4				
188	7 4				
189	7 4				
190	7 4				
191	7 4				

A/B TABLE ADDRESS	REMOTE I/O BASE ADDRESS SW 1 2	BASIC/VERIFICATION (B/V)	SUBRACK NUMBER	SLOT NUMBER	MODULE NUMBER
192	8 4				
193	8 4				
194	8 4				
195	8 4				
196	9 4				
197	9 4				
198	9 4				
199	9 4				
200	0 5				
201	0 5				
202	0 5				
203	0 5				
204	1 5				
205	1 5				
206	1 5				
207	1 5				
208	2 5				
209	2 5				
210	2 5				
211	2 5				
212	3 5				
213	3 5				
214	3 5				
215	3 5				
216	4 5				
217	4 5				
218	4 5				
219	4 5				
220	5 5				
221	5 5				
222	5 5				
223	5 5				
224	6 5				
225	6 5				
226	6 5				
227	6 5				
228	7 5				
229	7 5				
230	7 5				
231	7 5				
232	8 5				
233	8 5				
234	8 5				
235	8 5				
236	9 5				
237	9 5				
238	9 5				
239	9 5				
240	0 6				
241	0 6				
242	0 6				
243	0 6				
244	1 6				
245	1 6				
246	1 6				
247	1 6				
248	2 6				
249	2 6				
250	2 6				
251	2 6				
252	3 6				
253	3 6				
254	3 6				
255	3 6				

3.7 User Program

The Remote I/O Interface module is not programmable; the user program is held in the host GEM80 Programmable Controller.

A programming port is available on the Remote I/O Interface module to enable the user to examine the user program at a point remote from the host controller. To enable Remote Programming, the serial link ribbon cable of the host controller must be connected to the Remote I/O controller unit, to PL6 for the first GEM80 controller or to PL5 for the second. The connection of a programming lead to a Remote I/O Interface module inhibits all other programming ports on the other Remote I/O Interface modules within that system. The programming port supports GEM80 System Programmer types 8922, 8940 and 9022.

When using the remote programming facility, the programmer unit can only edit/monitor the GEM80 Programmable Controller on line from the Remote Station. To edit/monitor the standby GEM80 controller, you must connect the programmer to the front port (port 0) of the standby controller.

The remote programming facility will use Port 1 of the host GEM80 controller while Port 2 of the host controller can still be used in the normal way.

3.7.1 Programming Considerations

After switch-on of the host controller, all input data (A-tables) will be read as -1 (FFFF) on the first and second program scans. Thereafter, the A-table values will reflect the input signals. If this proves to be a problem, the user should enclose his program (or specific parts of his program) in an OBEY BLOCK routine which is activated on the third and all successive scans of the program.

The Remote I/O system has the Remote I/O Interface modules scanning their I/O independently of the host GEM80 controller. It is therefore possible for the interface module to read its I/O twice before the host GEM80 requests the data. This causes a problem only on counter modules which are normally cleared each scan (the user measures the number of counts received between scans).

3.8 Fault Tables

A fault table (F-table) location exists in the host GEM80 Programmable Controller for each group of 8 addresses, i.e. two fault bits per I/O word. This can be used for detecting a failure at any of the remote stations. Any failures on the serial link will be reflected as a fault in the appropriate table. The F-tables assigned to this function are shown in Table 3.8, where n = 45 for all controllers except GEM80/400 and GEM80/400VME, where n = 200.

The first of the two bits gives a warning for the corresponding module, and the second indicates a fault. If both bits are set, then the module is either not present in the subrack or damaged.

Table 3.8 - Fault Locations

MASTER I/O PROCESSOR					
FAULT TABLE	I/O ADDRESS	FAULT TABLE	I/O ADDRESS	FAULT TABLE	I/O ADDRESS
Fn	0-7	Fn + 44	352-359	Fn + 88	704-711
Fn + 1	8-15	Fn + 45	360-367	Fn + 89	712-719
Fn + 2	16-23	Fn + 46	368-375	Fn + 90	720-727
Fn + 3	24-31	Fn + 47	376-383	Fn + 91	728-735
Fn + 4	32-39	Fn + 48	384-391	Fn + 92	736-743
Fn + 5	40-47	Fn + 49	392-399	Fn + 93	744-751
Fn + 6	48-55	Fn + 50	400-407	Fn + 94	752-759
Fn + 7	56-63	Fn + 51	408-415	Fn + 95	760-767
Fn + 8	64-71	Fn + 52	416-423	Fn + 96	768-775
Fn + 9	72-79	Fn + 53	424-431	Fn + 97	776-783
Fn + 10	80-87	Fn + 54	432-439	Fn + 98	784-791
Fn + 11	88-95	Fn + 55	440-447	Fn + 99	792-799
Fn + 12	96-103	Fn + 56	448-455	Fn + 100	800-807
Fn + 13	104-111	Fn + 57	456-463	Fn + 101	808-815
Fn + 14	112-119	Fn + 58	464-471	Fn + 102	816-823
Fn + 15	120-127	Fn + 59	472-479	Fn + 103	824-831
Fn + 16	128-135	Fn + 60	480-487	Fn + 104	832-839
Fn + 17	136-143	Fn + 61	488-495	Fn + 105	840-847
Fn + 18	144-151	Fn + 62	496-503	Fn + 106	848-855
Fn + 19	152-159	Fn + 63	504-511	Fn + 107	856-863
Fn + 20	160-167	Fn + 64	512-519	Fn + 108	864-871
Fn + 21	168-175	Fn + 65	520-527	Fn + 109	872-879
Fn + 22	176-183	Fn + 66	528-543	Fn + 110	880-887
Fn + 23	184-191	Fn + 67	544-551	Fn + 111	888-895
Fn + 24	192-199	Fn + 68	544-551	Fn + 112	896-903
Fn + 25	200-207	Fn + 69	552-559	Fn + 113	904-911
Fn + 26	208-215	Fn + 70	560-567	Fn + 114	912-919
Fn + 27	216-223	Fn + 71	568-575	Fn + 115	920-927
Fn + 28	224-231	Fn + 72	576-583	Fn + 116	928-935
Fn + 29	232-239	Fn + 73	584-591	Fn + 117	936-943
Fn + 30	240-247	Fn + 74	592-599	Fn + 118	944-951
Fn + 31	248-255	Fn + 75	600-607	Fn + 119	952-959
Fn + 32	256-263	Fn + 76	608-615	Fn + 120	960-967
Fn + 33	264-271	Fn + 77	616-623	Fn + 121	968-975
Fn + 34	272-279	Fn + 78	624-631	Fn + 122	976-983
Fn + 35	280-287	Fn + 79	632-639	Fn + 123	984-991
Fn + 36	288-295	Fn + 80	640-647	Fn + 124	992-999
Fn + 37	296-303	Fn + 81	648-655	Fn + 125	1000-1007
Fn + 38	304-311	Fn + 82	656-663	Fn + 126	1008-1015
Fn + 39	312-319	Fn + 83	664-671	Fn + 127	1016-1023
Fn + 40	320-327	Fn + 84	672-679	Fn + 128	1024-1031
Fn + 41	328-335	Fn + 85	680-687	Fn + 129	1032-1039
Fn + 42	336-343	Fn + 86	688-695		
Fn + 43	344-351	Fn + 87	696-703		

4. POWER SUPPLIES

4.1 Remote Verification I/O Controller

Power for the Remote I/O controller is derived from the 15 Volts on the Verification Ribbon Highway. The consumption is 1.75 Amps @ 15V d.c. ±2%.

In case the GEM80 Programmable Controller configuration does not have enough power available, provision is made for connection to an auxiliary 15V power source.

Two links, Link 1 and Link 2, are provided to route the power either from the auxiliary power source or from the Verification Ribbon Highway.

The links are set to position A for power from the Verification Ribbon Highway and position B for power from the auxiliary source. Link 1 corresponds to the inputs from GEM80 Controller No. 1 (PL1/PL3) while Link 2 corresponds to the inputs from GEM80 Controller No. 2 (PL2/PL4).

The links are visible through the lower top cover and can be accessed by removing the cover.

4.2 Remote Verification I/O Interface

The power supply module can be a.c. mains powered or d.c. battery powered. There is an internal "OR" which allows a.c. or d.c. supplies to be present at the same time. Typically, for 24V d.c. no power is drawn from the d.c. input, but above 40V d.c., some load may be drawn depending on the a.c. voltage.

AC mains powered

Power input	: 88 to 132V or 176 to 264V a.c., this covers 110/120/220/240V nominal each with +10%, –20% tolerance : 45 to 63Hz
Consumption	: 40 to 100W, depending on I/O configuration
Inrush	: at 240V 25A peak decays exponentially with 4ms time constant : at 110V 50A peak decays exponentially with 4ms time constant
Input supply interruption	: shuts down after ride through period
Connections	: male socket on front panel : female connector supplied for user wiring
Isolation	: transformer

DC Battery Powered

Power input	: 22 to 85V
Consumption	: 40 to 100W depending on I/O configuration
Inrush	: peak current 1.8A per volt, e.g. 86A at 48V, decays exponentially with 4ms time constant
Input supply interruption	: shuts down after ride through period
Connections	: male socket on front panel : female plug optional extra for user wiring
Isolation	: none (d.c. input negative solidly linked to GEM80 0V)

5. INSTALLATION

5.1 Remote Verification I/O Controller

Two printed circuit boards are contained within a metal case. Designed for stand-alone fitting, the case measures 272mm (height), 238.5mm (width) and 67mm (depth). Fixing holes are provided to allow mounting in any position convenient to the user.

Figure 5.1 shows the outline dimensions of the unit with the connections marked. Ensure that the unit is mounted to allow screwdriver access to the 3 address switches on the front panel.

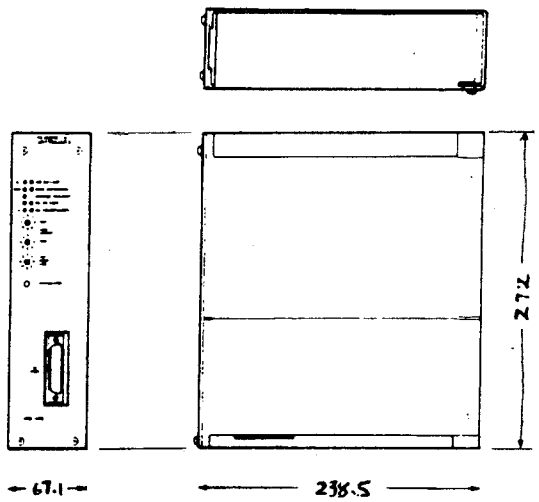


Figure 5.1 - Outline Dimensions (Remote I/O Controller)

5.2 Remote Verification I/O Interface

The module is mounted in a 19" (483mm) subrack containing an 8132 Power Module and up to 8 Compact or Verification I/O modules.

Figure 5.2 shows the outline dimensions of the subrack with details of size and position of mounting holes.

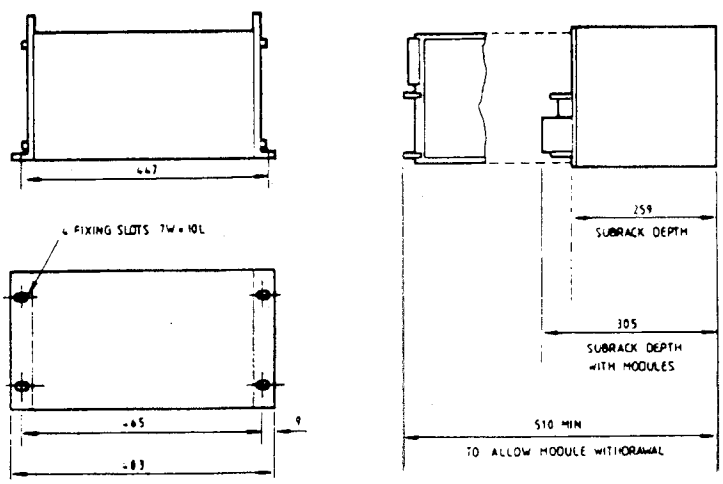


Figure 5.2 - Outline Dimensions of Subrack

6. CONNECTIONS

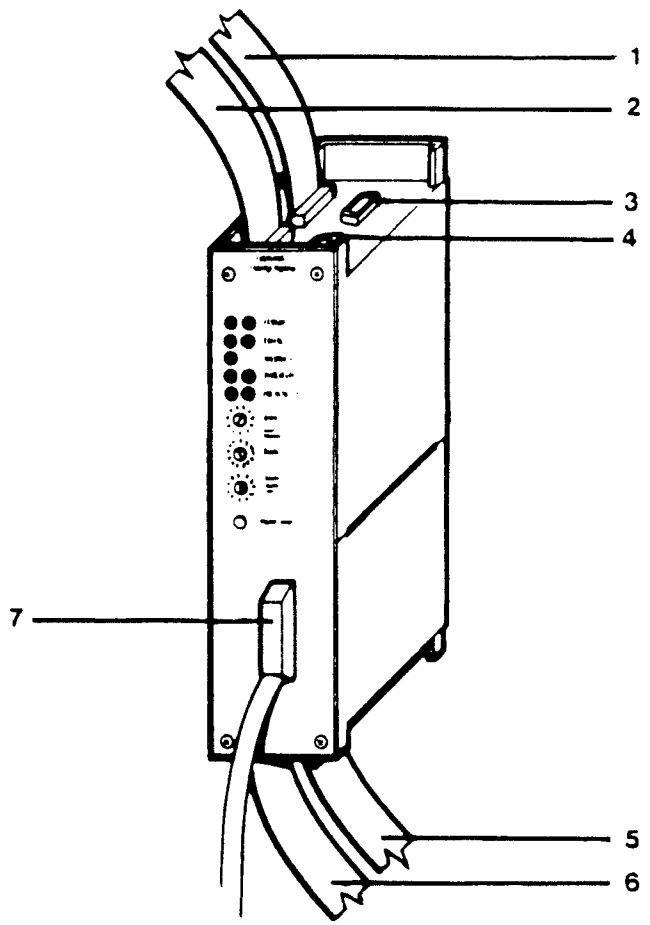
6.1 Remote Verification I/O Controller

Figure 6.1 shows a Remote Verification I/O Controller with the connector types and usages indicated. PL1 and PL2 are 26-way ribbon connectors to GEM80 Controllers 1 and 2 respectively.

PL3 and PL4 provide an input for an auxiliary power source should this be necessary. See Section 4.1 for more detail.

PL5 and PL6 are 26-way ribbon connectors for serial link connection to GEM80 Controllers 2 and 1 respectively.

SK2 on the front panel of the unit is the 25-way 'D' type outlet for the I/O data link to the Terminal Rail.



1.	PL1	26-way ribbon	Verification I/O highway Ribbon 1
2.	PL2	26-way ribbon	Verification I/O highway Ribbon 2
3.	PL3	15-way D-type	Auxiliary power supply, Controller 1
4.	PL4	15-way D-type	Auxiliary power supply, Controller 2
5.	PL5	26-way ribbon	Serial link ribbon, Controller 2
6.	PL6	26-way ribbon	Serial link ribbon, Controller 1
7.	SK2	25-way D-type	I/O data link to Terminal Rail

Figure 6.1 - Remote Verification I/O Connectors

6.2 Remote Verification I/O Controller - Terminal Rail

Using the Cable Harness 8891-4094, SK2 on the front panel is wired to terminal rail type 8891-4032.

Table 6.1 shows the pin numbers and colour coding for the connecting cable with details of the Terminal Rail numbers and function of each wire.

Table 6.1 - 9006 Terminal Rail Connections

'D'-type Pin No.	Colour	Terminal Rail No.	Mnemonic	Function
13	Mech. coding			
2	Green	1	RR+	Not used
15	Yellow	2	RR-	Not used
14	Blue	3	RPS	Not used
		4	SCN	Not used
4	Brown	5	TR+	Not used
17	Violet	6	TR-	Not used
1	Red	7	TPS	Not used
3	White	9	RL+	RX+ Programming Port
16	Black	10	RL-	RX- Programming Port
		11	SCN	Screen
5	Orange	12	TL+	Tx+ Programming Port
18	Pink	13	TL-	TX- Programming Port
		14	SCN	Screen
6	Turquoise	15	R1	R1 Output
19	Grey	16	R2	R2 Output
		17	SCN	Screen
7	Red/Blue	18	RD+	Rx+ I/O Data
20	Green/Red	19	RD-	Rx- I/O Data
8	Yellow/Red	20	RDS	Not Used
		21	SCN	Screen
9	Red/Black	22	TD+	Tx+ I/O Data
22	Red/Brown	23	TD-	Tx- I/O Data
21	White/Red	24	TDS	Not Used
		25	SCN	Screen
12	Yellow/Green	26	WD+	Watchdog +ve
25	White/Green	27	WD-	Watchdog -ve
		28	SCN	Screen overall Screen
		29	SCN	Earth Connection
10	Yellow/Blue	30	W1+	GEM80 1 Watchdog +ve
23	White/Blue	31	W1-	GEM80 1 Watchdog -ve
11	Blue/Black	32	W2+	GEM80 2 Watchdog +ve
24	Orange/Blue	33	W2-	GEM80 2 Watchdog -ve

6.3 I/O Data Link

The interconnections between Remote I/O Interfaces and their Remote I/O Controller are via a 12 core cable.

Cable: 6 pairs screened plus overall screen.

The cable can be considered as having three functions:

a) connections for I/O data - 4 cores

b) connections for Programming Port - 4 cores

c) connections for host GEM80 controller, watchdog and 0V - 4 cores

Examples of interconnections are shown in Figure 6.2

At the last Remote I/O Interface on a cable run, it is essential that the cable is terminated via resistors to stop the cable being charged up by the voltage source. This is achieved by linking in the terminals RPS, TPS, RDS and TDS as shown. The necessary resistors being part of the Remote I/O Interface Module.

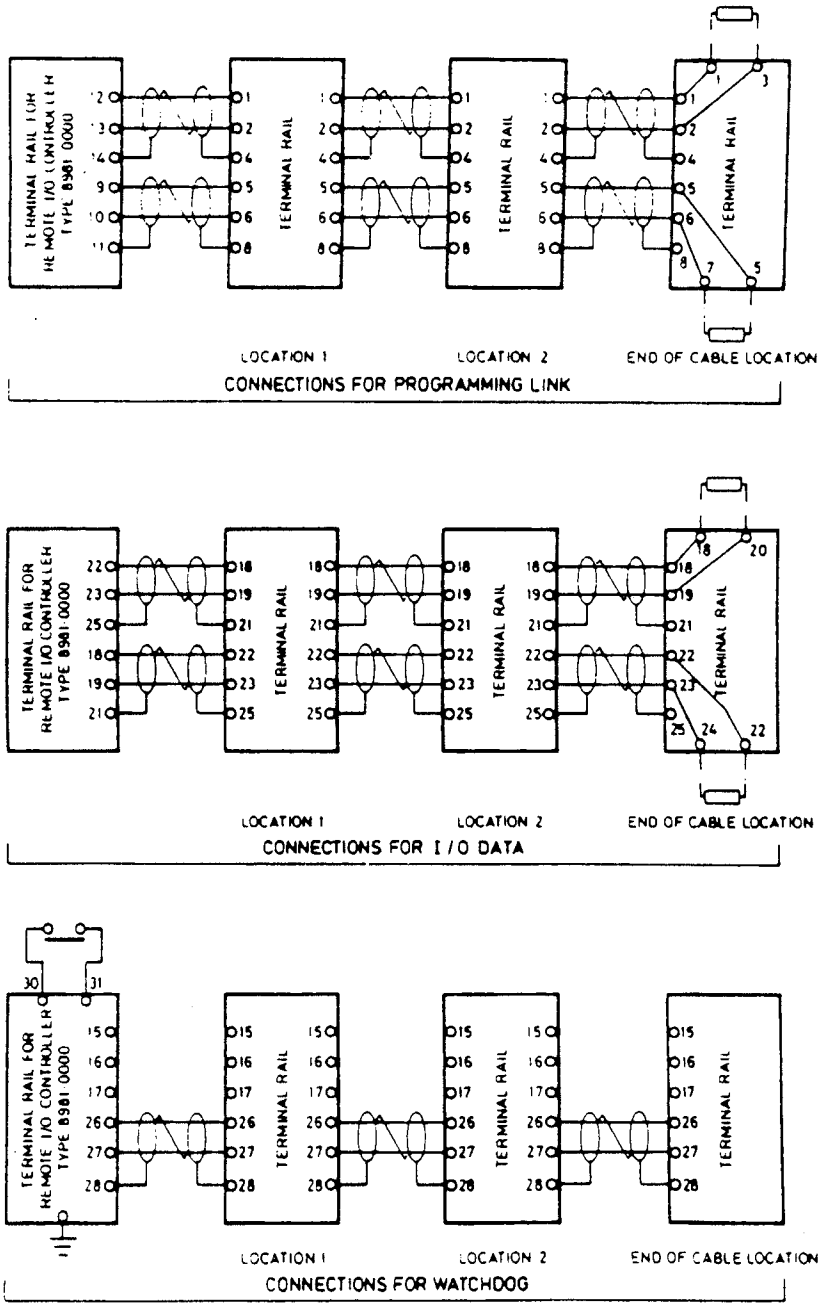


Figure 6.2 - I/O Data Link Connections

6.4 Remote Verification I/O Interface - Terminal Rail

A cable harness 8891-4094 links the terminal rail at each location to SK2, a 25-way 'D' type connector on the front of the interface module, see Table 6.2 for pin numbers and function details.

Table 6.2 - Terminal Rail - 8174 Connections

Terminal Rail No.	Mnemonic	Function
1	RR+	RX+ Programming port
2	RR-	RX- Programming port
3	RPS	Termination resistor
4	SCN	Screen
5	TR+	Tx+ Programming port
6	TR-	Tx- Programming port
7	TPS	Termination Resistor
8	SCN	Screen
9	RL+	Not used
10	RL-	Not used
11	SCN	Not used
12	TL+	Not used
13	TL-	Not used
14	SCN	Not used
15		Not used
16		Not used
17	SCN	Screen
18	RD+	Rx+ I/O Data
19	RD-	Rx- I/O Data
20	RDS	Termination Resistor
21	SCN	Screen
22	TD+	Tx+ I/O Data
23	TD-	Tx- I/O Data
24	TDS	Termination Resistor
25	SCN	Screen
26	WD+	GEM80 watchdog +ve
27	WD-	GEM80 watchdog -ve
28	SCN	Screen
29	SCN	Earth connection
30	W1+	Not used
31	W1-	Not used
32	W2+	Not used
33	W2-	Not used

6.5 Watchdog Connections

The Remote Verification I/O Controller has six inputs for watchdog indications. W1+, W1-, W2+, W2-, WD+ and WD-.

W1+ and W1- are used to indicate the health of the watchdog circuitry in GEM80 Controller No.1. Similarly, W2+ and W2- are used for GEM80 Controller No. 2. These inputs must be volt free.

WD+ and WD- should be a d.c. signal between 18 and 30 volts and hard-wired through the terminal rail to all Remote Verification I/O Interface modules. See Figures 6.3 and 6.4 for details of these connections. Note that the watchdog signals described above are derived from user supplied equipment driven by the watchdogs in the GEM80 controllers.

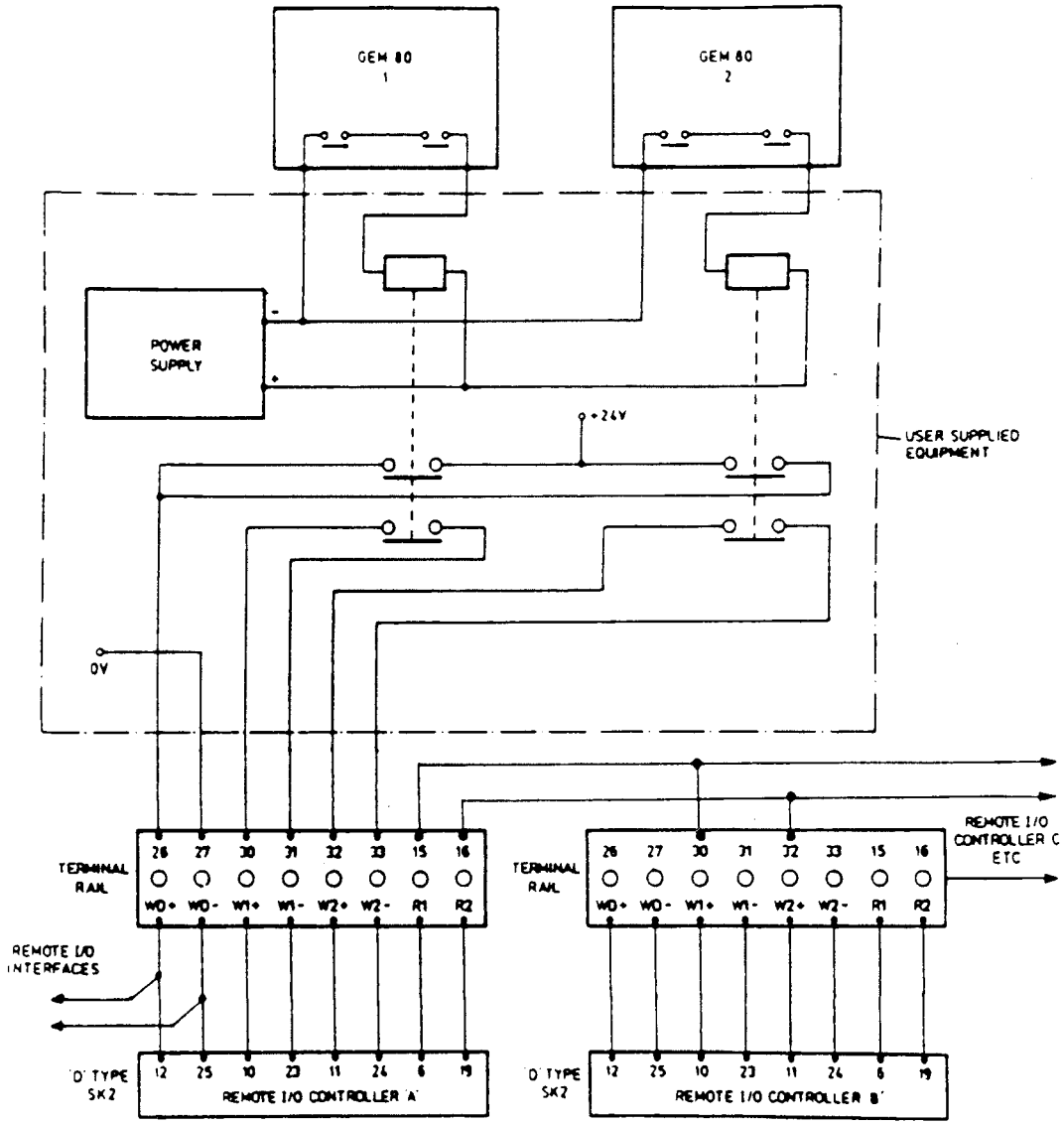


Figure 6.3 - Interconnection Between Remote Verification I/O Controllers

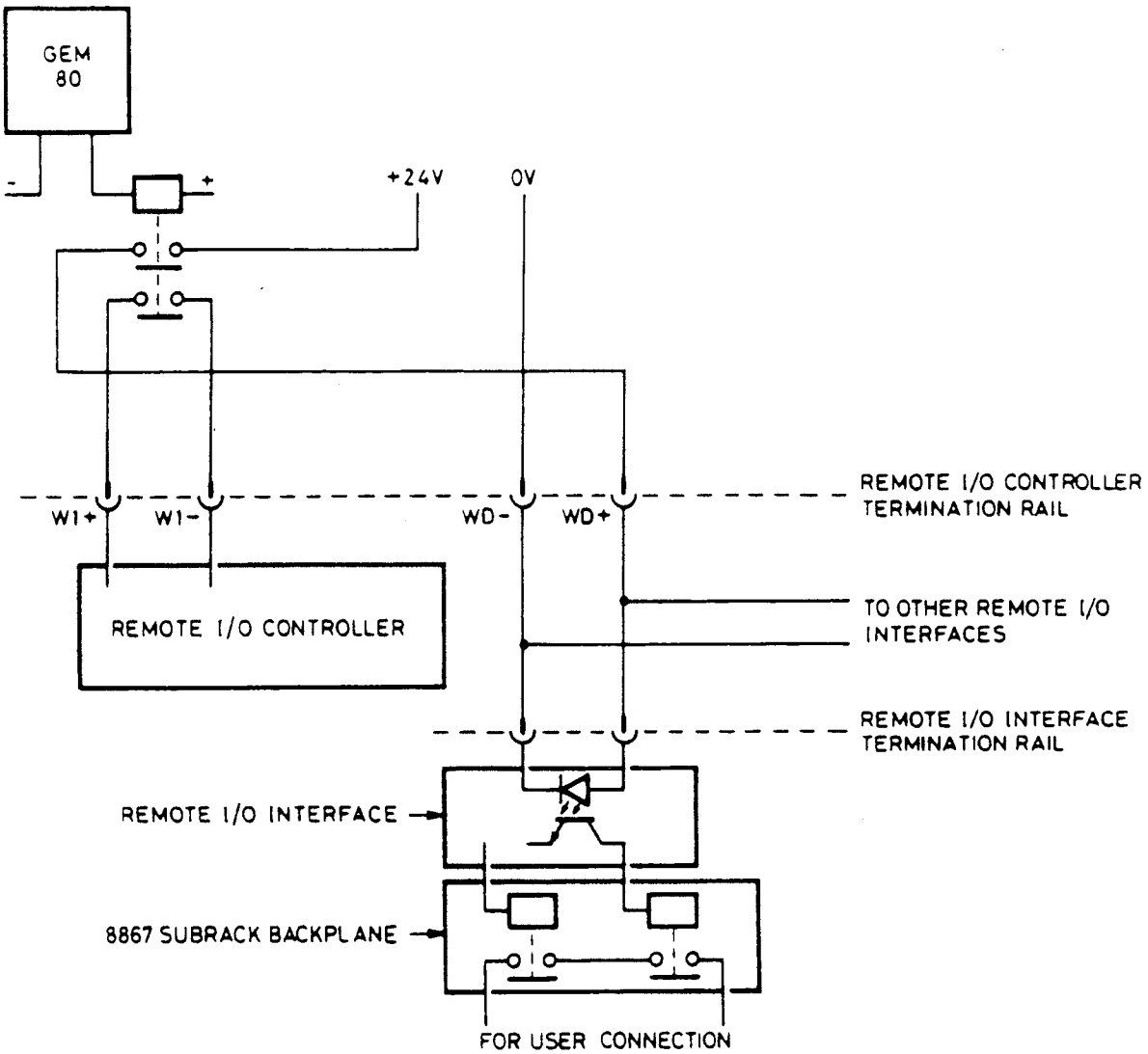


Figure 6.4 - Watchdog Connections

7. ORDERING CODES

7.1 Main Equipment

Remote Verification I/O Controller (change-over) consisting of:	9006-4001
Remote Verification I/O Controller	9006-4002
Cable Harness	8891-4094
Terminal Rail	8891-4032
Remote Verification I/O Interface Subrack consisting of:	8863-4003
Subrack	8857-4005
Power Module	8132-4005
Remote Verification I/O Interface Module	8174-4004
Cable Harness	8891-4094
Terminal Rail	8891-4032

7.2 Spares

Remote Verification I/O Interface Module	8174-4004
Power Module	8132-4005
Fuse FS1 (DC Input) Size 0, Glass Standard 7.5A	82020/114
Fuse FS2 (AC Input) Size 0, Glass A.S 2.0A	82021/210
Female Plug for AC Input	80720/131

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