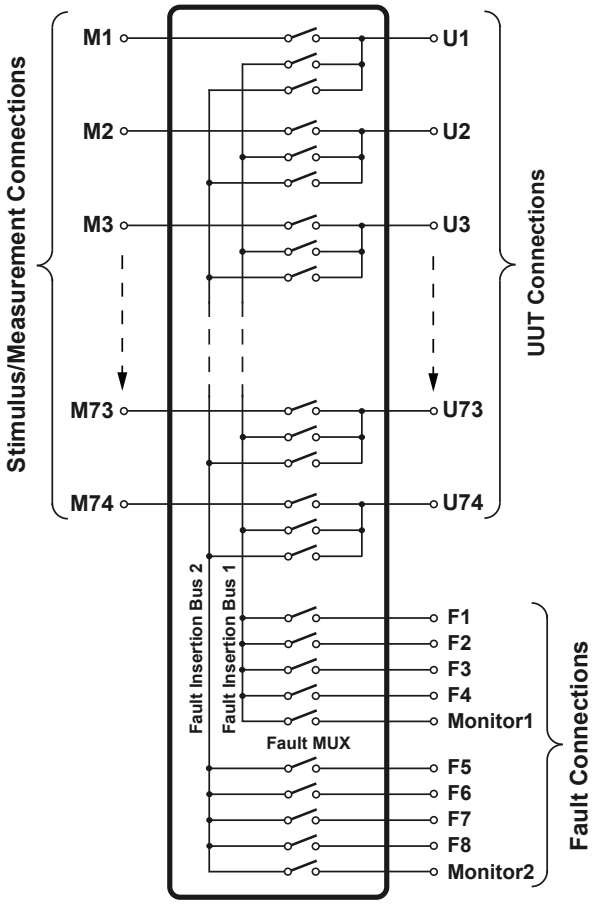
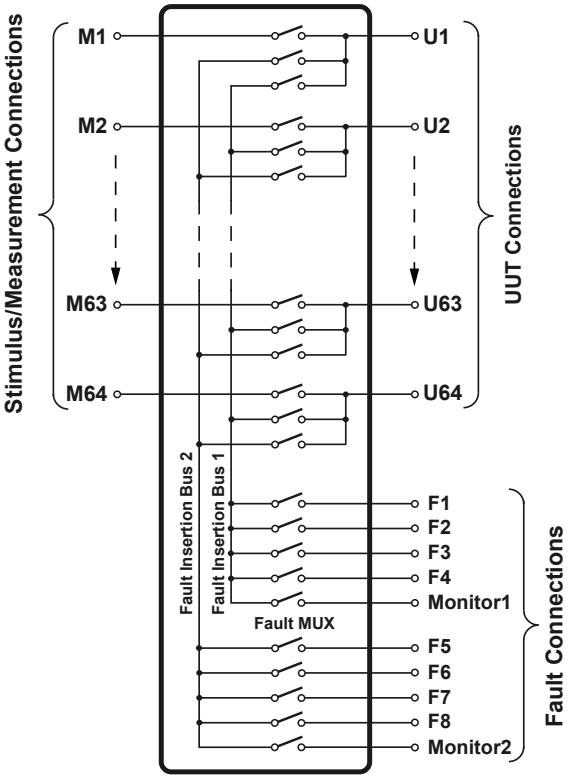
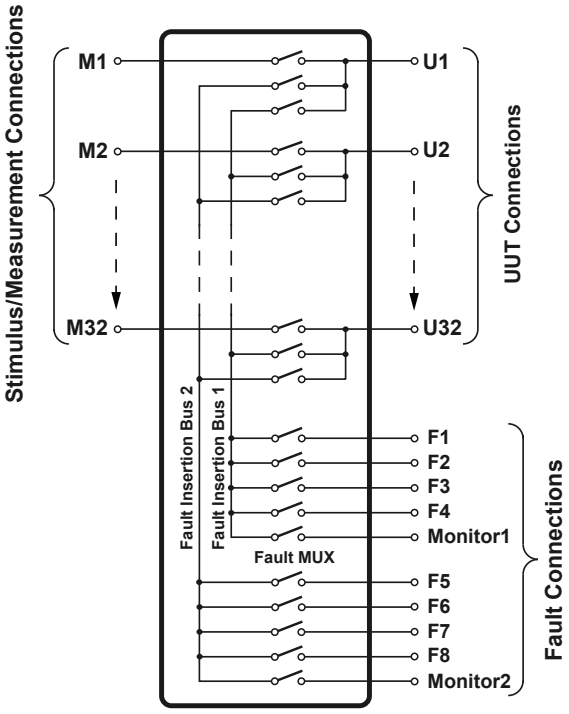
Versions With Normally Open Through Relays



40-190B-302 Dual Bus, 74-Channel Fault Insertion Switch Schematic (40-190B-301 Has 1 Fault Bus)



40-190B-402 Dual Bus, 64-Channel Fault Insertion Switch Schematic (40-190B-401 Has 1 Fault Bus)



40-190B-502 Dual Bus, 32-Channel Fault Insertion Switch Schematic (40-190B-501 Has 1 Fault Bus)

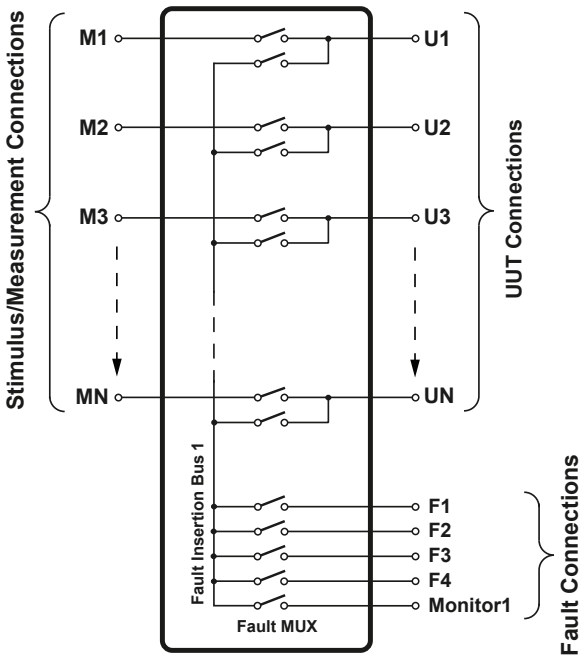


Figure 4.3 - Fault Insertion Switch with one fault bus and normally open through relays. The maximum channel count "N" is 74 (40-190B-301), 64 (40-190B-401) or 32 (40-190B-501).

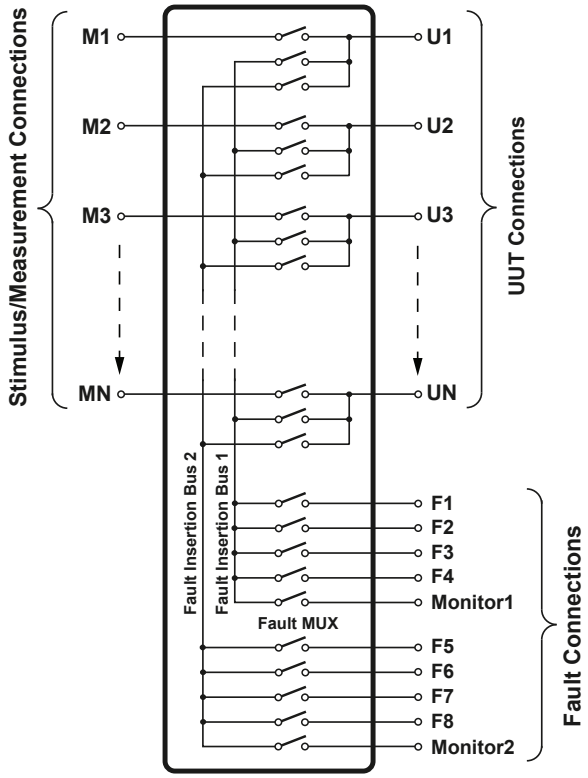


Figure 4.4 - Fault Insertion Switch with two fault buses and normally open through relays. The maximum channel count "N" is 74 (40-190B-302), 64 (40-190B-402) or 32 (40-190B-502).

The 40-190B modules contain multiple sub-units and two different ways to control the UUT connection switches for each channel and the fault line conditions. However, the first Sub-unit comprises all the channels, fault buses and MUX connections.

Please Note: The tables below apply to the first Sub-Unit only.

UUT Connections

Use the table below to determine the address (bit offset) of each channel's UUT connection switches for sub-models -001, -101 and -201:

Connections	Bit Offset	Function
Mn/Un (n = channel)	(n – 1) * 2 + 1	Break
	(n – 1) * 2 + 2	Fault1

Use the table below to determine the address (bit offset) of each channel's UUT connection switches for sub-models -002, -102 and -202:

Connections	Bit Offset	Function
Mn/Un (n = channel)	(n – 1) * 3 + 1	Break
	(n – 1) * 3 + 2	Fault1
	(n – 1) * 3 + 3	Fault2

Fault MUX/Line Connections

Use the table below to determine the address (bit offset) of each fault condition switch for sub-models -001, -101 and -201:

Connections	Bit Offset	Function
Fault and monitor (N = number of channels) (m = Fault connection)	(N * 2) + m	Fault Connection m
	(N * 2) + 5	Monitor 1

Use the table below to determine the address (bit offset) of each fault condition switch for sub-models -002, -102 and -202:

Connections	Bit Offset	Function
Fault and monitor (N = number of channels) (m = Fault connection)	(N * 3) + m	Fault Connection m
	(N * 3) + 9	Monitor 1
	(N * 3) + 10	Monitor 2

Example - the address of the Monitor 1 on a 40-190B-102 will be (64 * 3) + 9 or 201

40-190B-201 Sub-Unit Allocation

The 40-190B is available with single or dual fault insertion buses and is controlled with 5 sub-units or 7 sub-units respectively. There are 2 modes of operation embedded within the card. Mode A allows the user to control all switches within one sub-unit and Mode B partitions the switches into different sub-units with respect to their function.

Mode A comprises Sub-Unit 1 which enables the user to control all the switches within one sub-unit resulting in switching with less commands but it's up to the user to locate the switch functions within the sub-unit.

SUB-UNIT 1: consists of Break relays and Fault buses for each channel, plus (tagged on the end) the fault MUX and monitor connection.

WARNING: Fault and monitor MUX connection switches should not have multiple connections. Multiple connections can short the MUX circuitry resulting in possible card failure. It is recommended to customers to use Mode B as it ensures that the Fault MUX has only a single connection operating at any one time.

Mode B (Single Fault Bus Versions) comprises sub-units with a separate switch function. For all single fault bus versions (-001, -101 and -201), Sub-units 2, 3, 4 and 5 partition the card according to switch functionality.

SUB-UNIT 2: consists of Break Relays for each channel.

SUB-UNIT 3: consists of Fault insertion Bus 1 for each channel.

SUB-UNIT 4: consists of the Fault MUX connection.

SUB-UNIT 5: consists of the Monitor connection.

Please Note: Only one Mode can be operated at a time.

Mode B (Dual Fault Bus Versions) comprises sub-units with a separate switch function. For all dual fault bus versions (-002, -102 and -202), Sub-units 2, 3, 4, 5, 6 and 7 partition the card according to switch functionality.

SUB-UNIT 2: consists of Break Relays for each channel.

SUB-UNIT 3: consists of Fault insertion Bus 1 for each channel.

SUB-UNIT 4: consists of Fault insertion Bus 2 for each channel.

SUB-UNIT 5: consists of the Fault MUX 1 connection.

SUB-UNIT 6: consists of the Fault MUX 2 connection.

SUB-UNIT 7: consists of the Monitor connections 1 and 2.

Please Note: Only one Mode can be operated at a time.

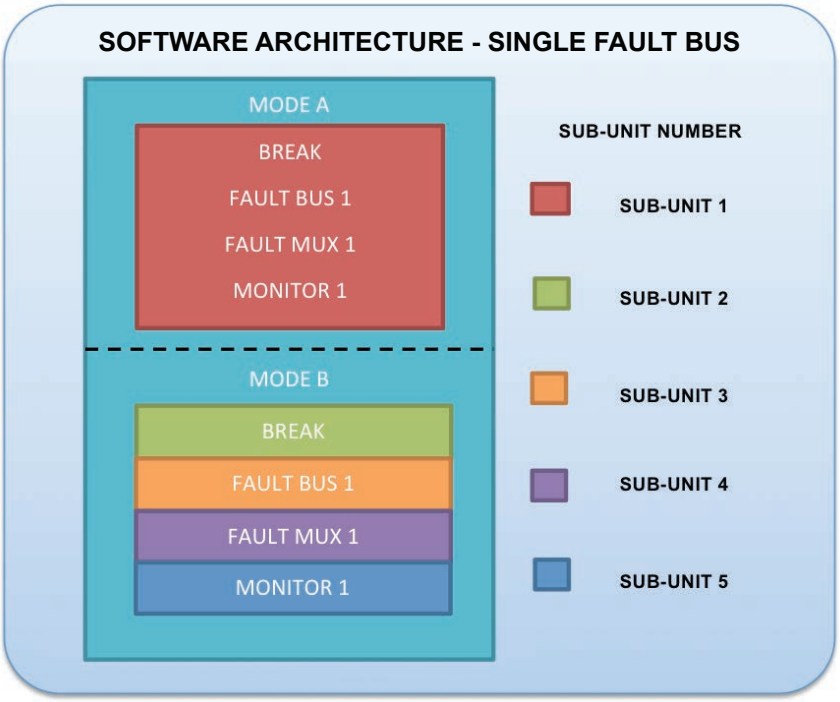


Figure 4.5 - Fault Insertion Switch 40-190B Sub-Unit Allocation - Single Fault Bus

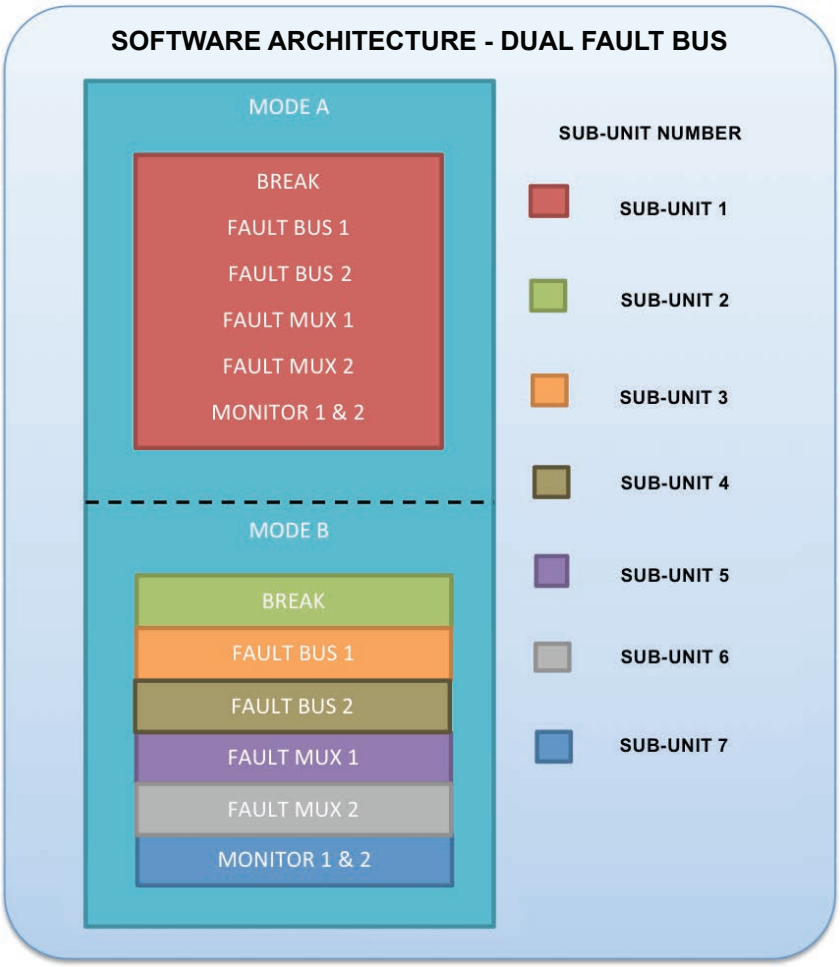


Figure 4.6 - Fault Insertion Switch 40-190B Sub-Unit Allocation - Dual Fault Bus

PROGRAMMING THE MODULE

Programming The 40-190B Single and Dual Fault Bus Versions Using a Single Sub-Unit (Mode A)

Here are examples of using drivers with the 40-190B using sub-unit 1. The examples shown are for the 40-190B-002 (74-channel, dual bus), other versions operate in the same way but with different numbers of bits in the sub-unit. Refer to Tables 4.1 to 4.6 for the bit usage within the sub-unit.

Using PILPXI

To operate a relay the user could use the simple OpBit command or the WriteSub commands

OpBit

```
DWORD sub_unit = 1;
PIL_OpBit( card_num, sub_unit, 1, 1);   // Operates the channel 1 Break relay
PIL_OpBit( card_num, sub_unit, 1, 0);   // Releases the channel 1 Break relay
PIL_OpBit( card_num, sub_unit, 6, 1);   // Operates the channel 2, Fault Bus 2 relay
PIL_OpBit( card_num, sub_unit, 228, 1); // Connects input F6 to Fault Bus 2
PIL_OpBit( card_num, sub_unit, 232, 1); // Connects Monitor 2 to Fault Bus 2
```

WriteSub

```
// Sub-unit is 232 bits wide, so 8 DWORDS are needed to hold the entire pattern
DWORD data[8];
data[0] = 1;            // Sets lowest bit to 1, channel 1 Break relay
data[1] = 0;
data[2] = 0;
data[3] = 0;
data[4] = 0;
data[5] = 0;
data[6] = 0;            // Disconnect all fault and monitor connections
data[7] = 0;            // from the fault buses
PIL_WriteSub( card_num, sub_unit, data);
data[0] = 0x20;         // Sets 6th bit, channel 2, Fault Bus 2 relay
data[1] = 0;
data[2] = 0;
data[3] = 0;
data[4] = 0;
data[5] = 0;
data[6] = 0;
data[7] = 0x88;         // Connect F6 and Monitor 2 to Fault Bus 2
PIL_WriteSub( card_num, sub_unit, data);
```

Programming The 40-190B Dual Fault Bus Versions Using Multiple Sub-Units (Mode B)

Here are examples of using drivers with the dual fault bus versions of the 40-190B using sub-units 2-7. The examples shown are for the 40-190B-002 (74-channel, dual bus), other dual bus versions operate in the same way but with different numbers of bits in the sub-units. Refer to Tables 4.10, 4.11 and 4.12 for the bit usage within each sub-unit.

Using PILPXI

To operate a relay the user could use the simple OpBit command or the WriteSub commands

OpBit

```
DWORD sub_unit = 2; // Break Relays
PIL_OpBit( card_num, sub_unit, 1, 1); // Operates the channel 1 Break relay
PIL_OpBit( card_num, sub_unit, 1, 0); // Releases the channel 1 Break relay


sub_unit = 4;       // Fault Bus 2
PIL_OpBit( card_num, sub_unit, 2, 1); // Operates the channel 2, Fault Bus 2 relay


sub_unit = 6;       // Fault MUX 2
PIL_OpBit( card_num, sub_unit, 1, 1); // Connects input F5 to Fault Bus 2


sub_unit = 7;       // Fault Monitor 1 & 2
PIL_OpBit( card_num, sub_unit, 2, 1); // Connects Monitor 2 to Fault Bus 2
```

WriteSub

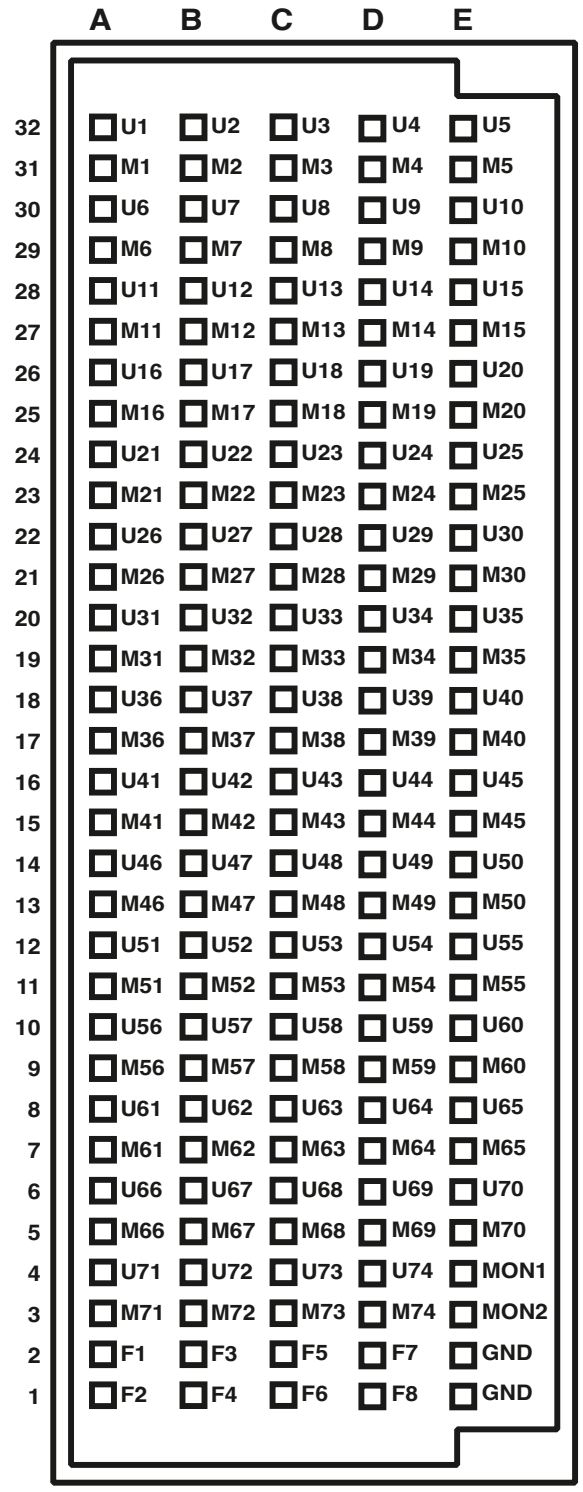
```
// Sub-unit 2, 3 & 4 are each 74 bits wide and therefore require 3 DWORDs for each
sub-unit to hold the entire pattern whereas sub units 5, 6 and 7 require 1 DWORD
each to hold the pattern
DWORD data[0];
DWORD sub_unit;
sub_unit = 2;   // Break Relays
data[0] = 1;    // Connects channel 1 break relay
data[0] = 0;    // Resets Break Relay Sub-unit
PIL_WriteSub( card_num, sub_unit, data);

sub_unit = 4;   // Fault Bus 2
data[0] = 2;    // Operates the channel 2, Fault Bus 2 relay
data[0] = 0;    // Disconnects Fault Bus 2
PIL_WriteSub( card_num, sub_unit, data);

sub_unit = 6;   // Fault MUX 2
data[0] = 1;    // Connects input F5 to Fault Bus 2
data[0] = 0;    // Disconnects Fault MUX 2
PIL_WriteSub( card_num, sub_unit, data);

sub_unit = 7;   // Fault Monitor 1 & 2
data[0] = 2;    // Connects Monitor 2 to Fault Bus 2
data[0] = 0;    // Disconnects Monitor 2 from Fault Bus 2
PIL_WriteSub( card_num, sub_unit, data);
```

Table 4.4 - Relay/Bit Table for 40-190B-002 & 40-190B-302 (74-channel, dual bus versions) for Sub-Unit 1 Including IVI Channel Names

BIT TO RELAY FUNCTION CROSS REFERENCE TABLE (40-190B-002/302)									
Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names	
1	1	CH1 Break	comA1	chA1	1	59	CH20 Fault1	comA59	chA59
1	2	CH1 Fault1	comA2	chA2	1	60	CH20 Fault2	comA60	chA60
1	3	CH1 Fault2	comA3	chA3	1	61	CH21 Break	comA61	chA61
1	4	CH2 Break	comA4	chA4	1	62	CH21 Fault1	comA62	chA62
1	5	CH2 Fault1	comA5	chA5	1	63	CH21 Fault2	comA63	chA63
1	6	CH2 Fault2	comA6	chA6	1	64	CH22 Break	comA64	chA64
1	7	CH3 Break	comA7	chA7	1	65	CH22 Fault1	comA65	chA65
1	8	CH3 Fault1	comA8	chA8	1	66	CH22 Fault2	comA66	chA66
1	9	CH3 Fault2	comA9	chA9	1	67	CH23 Break	comA67	chA67
1	10	CH4 Break	comA10	chA10	1	68	CH23 Fault1	comA68	chA68
1	11	CH4 Fault1	comA11	chA11	1	69	CH23 Fault2	comA69	chA69
1	12	CH4 Fault2	comA12	chA12	1	70	CH24 Break	comA70	chA70
1	13	CH5 Break	comA13	chA13	1	71	CH24 Fault1	comA71	chA71
1	14	CH5 Fault1	comA14	chA14	1	72	CH24 Fault2	comA72	chA72
1	15	CH5 Fault2	comA15	chA15	1	73	CH25 Break	comA73	chA73
1	16	CH6 Break	comA16	chA16	1	74	CH25 Fault1	comA74	chA74
1	17	CH6 Fault1	comA17	chA17	1	75	CH25 Fault2	comA75	chA75
1	18	CH6 Fault2	comA18	chA18	1	76	CH26 Break	comA76	chA76
1	19	CH7 Break	comA19	chA19	1	77	CH26 Fault1	comA77	chA77
1	20	CH7 Fault1	comA20	chA20	1	78	CH26 Fault2	comA78	chA78
1	21	CH7 Fault2	comA21	chA21	1	79	CH27 Break	comA79	chA79
1	22	CH8 Break	comA22	chA22	1	80	CH27 Fault1	comA80	chA80
1	23	CH8 Fault1	comA23	chA23	1	81	CH27 Fault2	comA81	chA81
1	24	CH8 Fault2	comA24	chA24	1	82	CH28 Break	comA82	chA82
1	25	CH9 Break	comA25	chA25	1	83	CH28 Fault1	comA83	chA83
1	26	CH9 Fault1	comA26	chA26	1	84	CH28 Fault2	comA84	chA84
1	27	CH9 Fault2	comA27	chA27	1	85	CH29 Break	comA85	chA85
1	28	CH10 Break	comA28	chA28	1	86	CH29 Fault1	comA86	chA86
1	29	CH10 Fault1	comA29	chA29	1	87	CH29 Fault2	comA87	chA87
1	30	CH10 Fault2	comA30	chA30	1	88	CH30 Break	comA88	chA88
1	31	CH11 Break	comA31	chA31	1	89	CH30 Fault1	comA89	chA89
1	32	CH11 Fault1	comA32	chA32	1	90	CH30 Fault2	comA90	chA90
1	33	CH11 Fault2	comA33	chA33	1	91	CH31 Break	comA91	chA91
1	34	CH12 Break	comA34	chA34	1	92	CH31 Fault1	comA92	chA92
1	35	CH12 Fault1	comA35	chA35	1	93	CH31 Fault2	comA93	chA93
1	36	CH12 Fault2	comA36	chA36	1	94	CH32 Break	comA94	chA94
1	37	CH13 Break	comA37	chA37	1	95	CH32 Fault1	comA95	chA95
1	38	CH13 Fault1	comA38	chA38	1	96	CH32 Fault2	comA96	chA96
1	39	CH13 Fault2	comA39	chA39	1	97	CH33 Break	comA97	chA97
1	40	CH14 Break	comA40	chA40	1	98	CH33 Fault1	comA98	chA98
1	41	CH14 Fault1	comA41	chA41	1	99	CH33 Fault2	comA99	chA99
1	42	CH14 Fault2	comA42	chA42	1	100	CH34 Break	comA100	chA100
1	43	CH15 Break	comA43	chA43	1	101	CH34 Fault1	comA101	chA101
1	44	CH15 Fault1	comA44	chA44	1	102	CH34 Fault2	comA102	chA102
1	45	CH15 Fault2	comA45	chA45	1	103	CH35 Break	comA103	chA103
1	46	CH16 Break	comA46	chA46	1	104	CH35 Fault1	comA104	chA104
1	47	CH16 Fault1	comA47	chA47	1	105	CH35 Fault2	comA105	chA105
1	48	CH16 Fault2	comA48	chA48	1	106	CH36 Break	comA106	chA106
1	49	CH17 Break	comA49	chA49	1	107	CH36 Fault1	comA107	chA107
1	50	CH17 Fault1	comA50	chA50	1	108	CH36 Fault2	comA108	chA108
1	51	CH17 Fault2	comA51	chA51	1	109	CH37 Break	comA109	chA109
1	52	CH18 Break	comA52	chA52	1	110	CH37 Fault1	comA110	chA110
1	53	CH18 Fault1	comA53	chA53	1	111	CH37 Fault2	comA111	chA111
1	54	CH18 Fault2	comA54	chA54	1	112	CH38 Break	comA112	chA112
1	55	CH19 Break	comA55	chA55	1	113	CH38 Fault1	comA113	chA113
1	56	CH19 Fault1	comA56	chA56	1	114	CH38 Fault2	comA114	chA114
1	57	CH19 Fault2	comA57	chA57	1	115	CH39 Break	comA115	chA115
1	58	CH20 Break	comA58	chA58	1	116	CH39 Fault1	comA116	chA116

Table 4.4 Continued - Relay/Bit Table for 40-190B-002 & 40-190B-302 (74-channel, dual bus versions) for Sub-Unit 1 Including IVI Channel Names

BIT TO RELAY FUNCTION CROSS REFERENCE TABLE (40-190B-002/302)										
Sub-Unit	Bit	Function	IVI Channel Names		Sub-Unit	Bit	Function	IVI Channel Names	
1	117	CH39 Fault2	comA117	chA117	1	175	CH59 Break	comA175	chA175
1	118	CH40 Break	comA118	chA118	1	176	CH59 Fault1	comA176	chA176
1	119	CH40 Fault1	comA119	chA119	1	177	CH59 Fault2	comA177	chA177
1	120	CH40 Fault2	comA120	chA120	1	178	CH60 Break	comA178	chA178
1	121	CH41 Break	comA121	chA121	1	179	CH60 Fault1	comA179	chA179
1	122	CH41 Fault1	comA122	chA122	1	180	CH60 Fault2	comA180	chA180
1	123	CH41 Fault2	comA123	chA123	1	181	CH61 Break	comA181	chA181
1	124	CH42 Break	comA124	chA124	1	182	CH61 Fault1	comA182	chA182
1	125	CH42 Fault1	comA125	chA125	1	183	CH61 Fault2	comA183	chA183
1	126	CH42 Fault2	comA126	chA126	1	184	CH62 Break	comA184	chA184
1	127	CH43 Break	comA127	chA127	1	185	CH62 Fault1	comA185	chA185
1	128	CH43 Fault1	comA128	chA128	1	186	CH62 Fault2	comA186	chA186
1	129	CH43 Fault2	comA129	chA129	1	187	CH63 Break	comA187	chA187
1	130	CH44 Break	comA130	chA130	1	188	CH63 Fault1	comA188	chA188
1	131	CH44 Fault1	comA131	chA131	1	189	CH63 Fault2	comA189	chA189
1	132	CH44 Fault2	comA132	chA132	1	190	CH64 Break	comA190	chA190
1	133	CH45 Break	comA133	chA133	1	191	CH64 Fault1	comA191	chA191
1	134	CH45 Fault1	comA134	chA134	1	192	CH64 Fault2	comA192	chA192
1	135	CH45 Fault2	comA135	chA135	1	193	CH65 Break	comA193	chA193
1	136	CH46 Break	comA136	chA136	1	194	CH65 Fault1	comA194	chA194
1	137	CH46 Fault1	comA137	chA137	1	195	CH65 Fault2	comA195	chA195
1	138	CH46 Fault2	comA138	chA138	1	196	CH66 Break	comA196	chA196
1	139	CH47 Break	comA139	chA139	1	197	CH66 Fault1	comA197	chA197
1	140	CH47 Fault1	comA140	chA140	1	198	CH66 Fault2	comA198	chA198
1	141	CH47 Fault2	comA141	chA141	1	199	CH67 Break	comA199	chA199
1	142	CH48 Break	comA142	chA142	1	200	CH67 Fault1	comA200	chA200
1	143	CH48 Fault1	comA143	chA143	1	201	CH67 Fault2	comA201	chA201
1	144	CH48 Fault2	comA144	chA144	1	202	CH68 Break	comA202	chA202
1	145	CH49 Break	comA145	chA145	1	203	CH68 Fault1	comA203	chA203
1	146	CH49 Fault1	comA146	chA146	1	204	CH68 Fault2	comA204	chA204
1	147	CH49 Fault2	comA147	chA147	1	205	CH69 Break	comA205	chA205
1	148	CH50 Break	comA148	chA148	1	206	CH69 Fault1	comA206	chA206
1	149	CH50 Fault1	comA149	chA149	1	207	CH69 Fault2	comA207	chA207
1	150	CH50 Fault2	comA150	chA150	1	208	CH70 Break	comA208	chA208
1	151	CH51 Break	comA151	chA151	1	209	CH70 Fault1	comA209	chA209
1	152	CH51 Fault1	comA152	chA152	1	210	CH70 Fault2	comA210	chA210
1	153	CH51 Fault2	comA153	chA153	1	211	CH71 Break	comA211	chA211
1	154	CH52 Break	comA154	chA154	1	212	CH71 Fault1	comA212	chA212
1	155	CH52 Fault1	comA155	chA155	1	231	CH71 Fault2	comA213	chA213
1	156	CH52 Fault2	comA156	chA156	1	214	CH72 Break	comA214	chA214
1	157	CH53 Break	comA157	chA157	1	215	CH72 Fault1	comA215	chA215
1	158	CH53 Fault1	comA158	chA158	1	216	CH72 Fault2	comA216	chA216
1	159	CH53 Fault2	comA159	chA159	1	217	CH73 Break	comA217	chA217
1	160	CH54 Break	comA160	chA160	1	218	CH73 Fault1	comA218	chA218
1	161	CH54 Fault1	comA161	chA161	1	219	CH73 Fault2	comA219	chA219
1	162	CH54 Fault2	comA162	chA162	1	220	CH74 Break	comA220	chA220
1	163	CH55 Break	comA163	chA163	1	221	CH74 Fault1	comA221	chA221
1	164	CH55 Fault1	comA164	chA164	1	222	CH74 Fault2	comA222	chA222
1	165	CH55 Fault2	comA165	chA165	1	223	Fault Select 1	comA223	chA223
1	166	CH56 Break	comA166	chA166	1	224	Fault Select 2	comA224	chA224
1	167	CH56 Fault1	comA167	chA167	1	225	Fault Select 3	comA225	chA225
1	168	CH56 Fault2	comA168	chA168	1	226	Fault Select 4	comA226	chA226
1	169	CH57 Break	comA168	chA169	1	227	Fault Select 5	comA227	chA227
1	170	CH57 Fault1	comA170	chA170	1	228	Fault Select 6	comA228	chA228
1	171	CH57 Fault2	comA171	chA171	1	229	Fault Select 7	comA229	chA229
1	172	CH58 Break	comA172	chA172	1	230	Fault Select 8	comA230	chA230
1	173	CH58 Fault1	comA173	chA173	1	231	Monitor 1	comA231	chA231
1	174	CH58 Fault2	comA174	chA174	1	232	Monitor 2	comA232	chA232



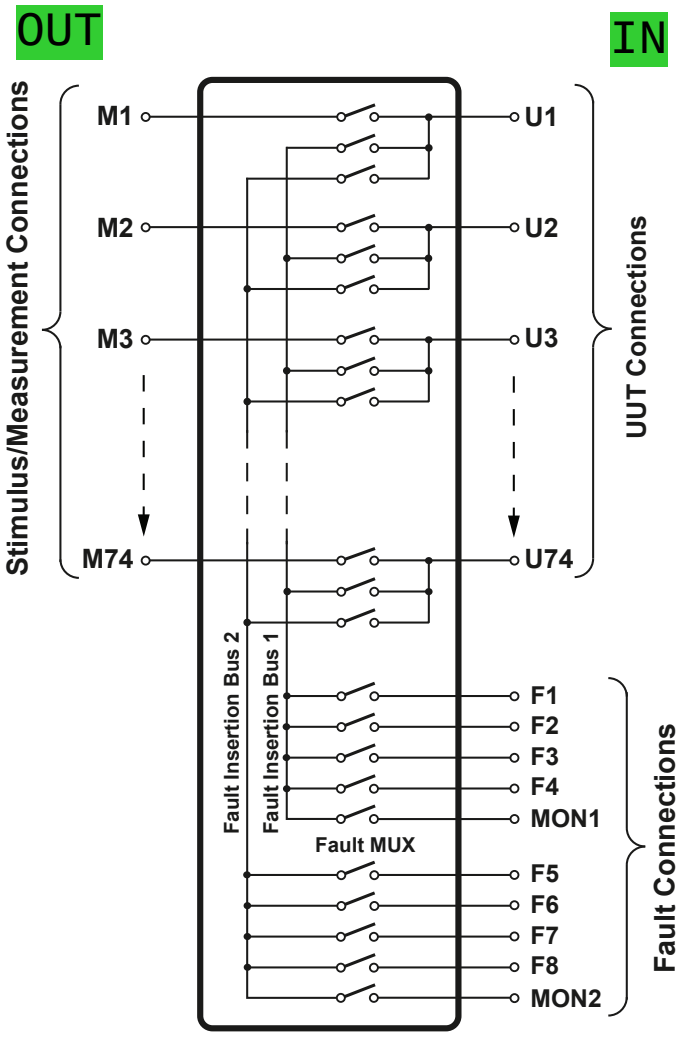


Figure 5.8 - Pinouts: 2A Fault Insertion Module 40-190B-302
(74-channel, dual bus version with normally open through relays)
160-pin male DIN 41612 connector viewed from front of module.