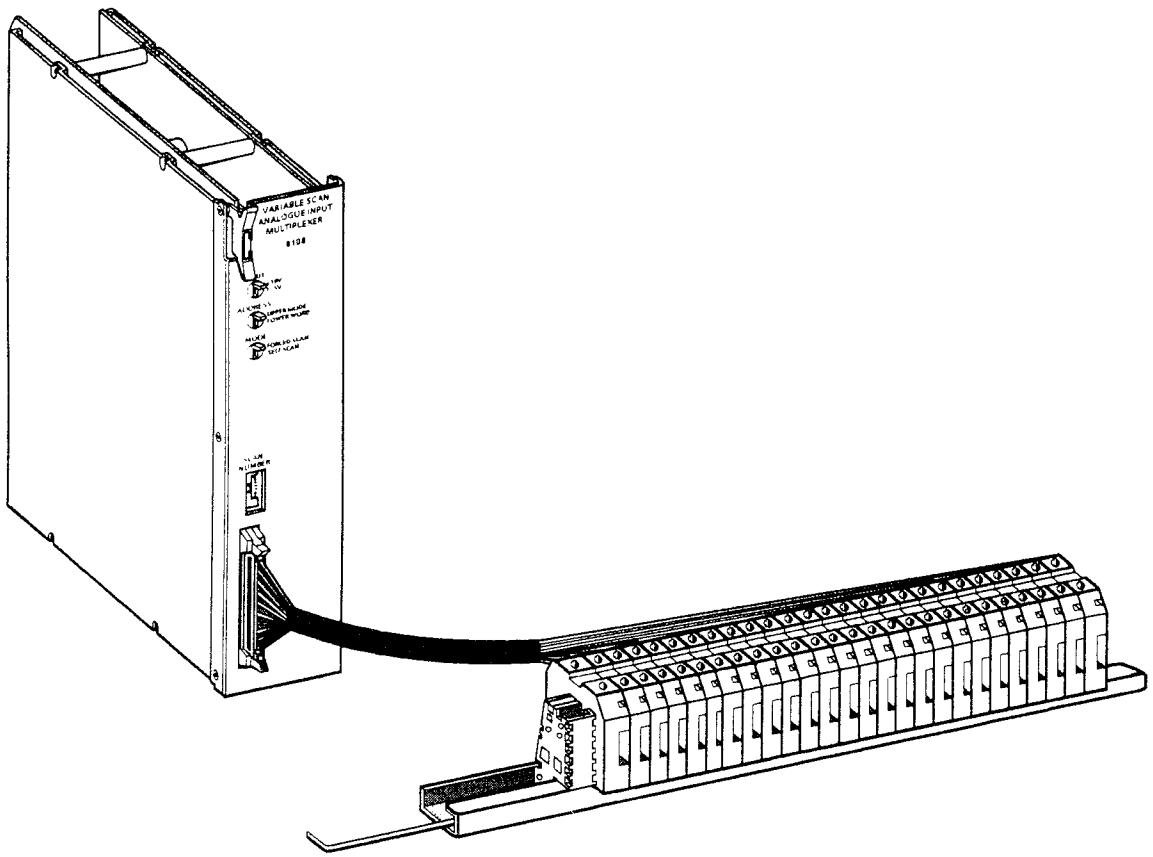
CEGELEC
INDUSTRIAL CONTROLS

COMPACT ANALOG INPUT MODULE 8108



GEM 80 USER INFORMATION

CONTENTS PAGE

This page left intentionally blank.

1. INTRODUCTION

The 8108 Compact Analog Input Module accepts up to 16 analog signals, all in the range, ±10V or all ±5V or all 0 to 20mA, for input to the GEM 80 controller. Two terminals are provided for each channel and they are electrically independent of each other.

These analog signals are converted to digital representations with a conversion accuracy of ±0.2% at 25°C and the conversion time is 70±20ms per channel. Since the module uses mercury wetted relays it must be mounted vertically and is unsuitable for applications where rolling may occur, including marine applications and tumblers in the car industry.

The design includes optical isolation of each channel from the GEM 80 controller and two operating modes are available, Self-scan or Forced Scan.

In the self-scan mode, each channel in use is converted in turn automatically on a cyclic basis.

In the forced-scan mode, the host controller defines which channel is to be converted, although in the absence of that information, the module automatically reverts to the self-scan mode.

The 8108 is twice the width of other compact I/O modules and occupies two slots of a compact subrack in the self-scan mode. However, in the forced-scan mode, four slots must be reserved for each 8108. Section 6.2 details the subrack layout.

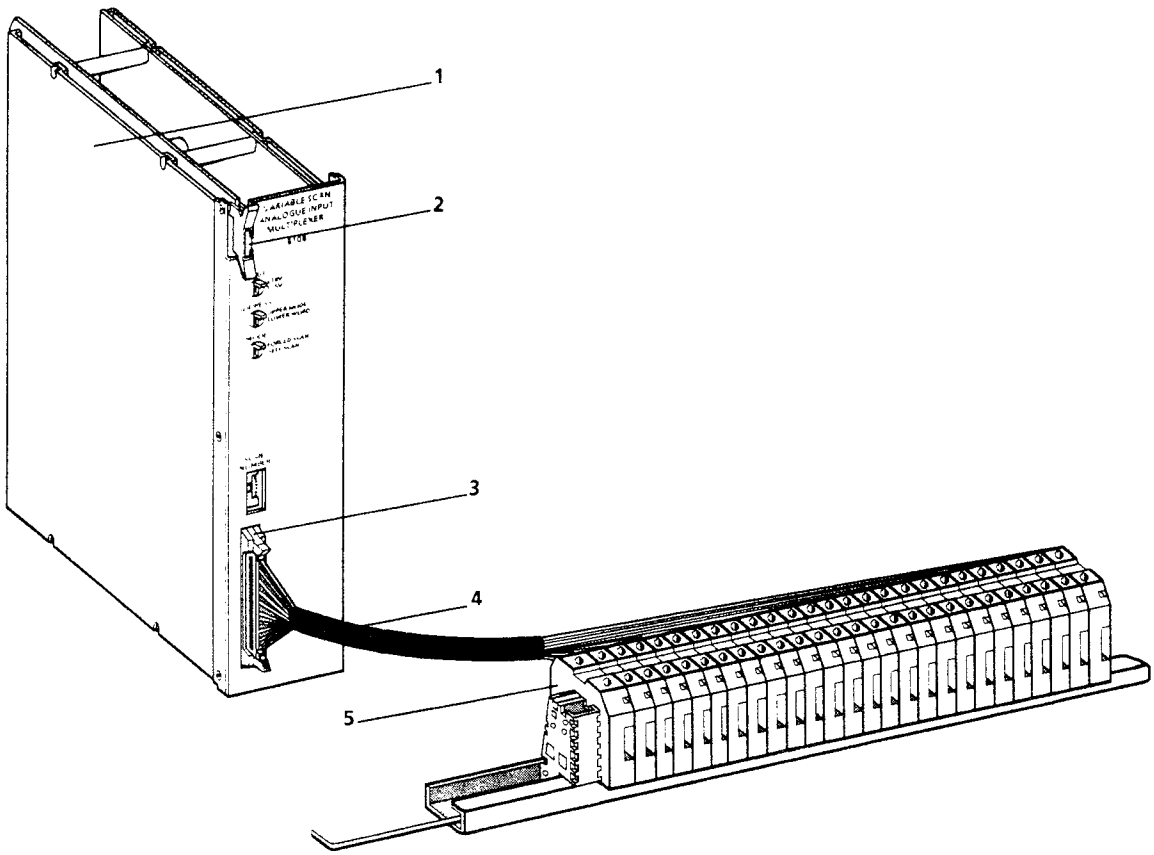
Since it is addressed in the same way as 8-point modules, it may be fitted into any compact subrack which accommodates 8-point digital I/O modules, including 8859 and the compact controllers.

2. SPECIFICATION

Channels	:	16 analogue inputs
Ranges	:	±5V or ±10V (nominal) ±5.117V or ±10.235V (full scale)
	:	20mA (using 20mA Termination Panel)
Input impedance	:	>10Mohms (5V range) 500kohms (10V range)
Conversion time	:	70ms ±20ms per channel
Accuracy 25°C	:	±0.2%
0 to 60°C	:	±0.5%
Resolution	:	11 bits plus sign
Filtering	:	4.5ms
Electrical isolation	:	100V between GEM 80 and plant
	:	50V between channels
Power from host controller	:	150mA @ 15V
Installation	:	Any Basic I/O subrack occupying two slots
Temperature	:	0 to 60°C operating
	:	-20 to +70°C storage
Humidity	:	10 to 90% non-condensing
Termination Panel dimensions	:	156 x 481 x 32mm
Termination Rail dimensions	:	40 x 483 x 46mm

3. HARDWARE LAYOUT

Figure 1 shows the 8108 Analog Input Multiplexer, termination rail and cable harness.



1. Module with moulded side covers.
2. Ejection handle.
3. Connector for plant signals.
4. Cable harness.
5. Plant terminals on DIN rail (termination rail).

Figure 1 - 8108 Compact Analog Input Multiplexer

4. ANALOG INPUT MULTIPLEXER OPERATION

4.1 General

Figure 2 shows a block diagram of the system in which 16 electricaly independent channels are each connected to two-pole mercury wetted relays. Energising any one of these relays allows data in the associated channel to be processed. The channel selection circuit determines for a particular moment which of the relays is energised, as discussed later.

The signal to be measured is passed through analog signal processing and then into an analog to digital converter. A digital number is produced which represents the analog signal level. After opto-isolation, a 16-bit word is produced which consists of a digital bit pattern, representing the analog signal value and the channel number. This word is then output to the host GEM 80 controller. The channel number is derived from the output of the channel selection circuit.

The 16-bit word is held in the 8108 output while the analog to digital converter measures another channel. The second channel is later output by the 8108, instead of the first channel measured, while the converter moves on to read a third channel. This cycle of measuring one channel while outputting the previous channel is a continuous process.

A timer circuit prevents the channel selection from changing until a fixed time after a new channel selection has been made and the analog to digital converter has been allowed to settle.

The two operating modes, self-scan and forced-scan, generate channel selection.

4.2 Self-scan Mode

The self-scan mode is selected by setting the Forced-Scan/Self-Scan switch on the front panel of the 8108 module, to the Self-Scan position. See Figure 4. In the self-scan mode, an internally generated routine scans each channel from 1 to 16 in turn, then returns to scan channel 1 and repeats the sequence.

If all 16 channels are being used, to ensure that they are all scanned, set the 'Scan Number' switch to position '8'. When less than 16 channels are in use, the 8108 scans twice the 'Scan Number' selected. For example, if 10 channels are required, set the 'Scan Number' to 5. If an odd number of channels are in use, assume one higher and set the 'Scan Number' switch accordingly.

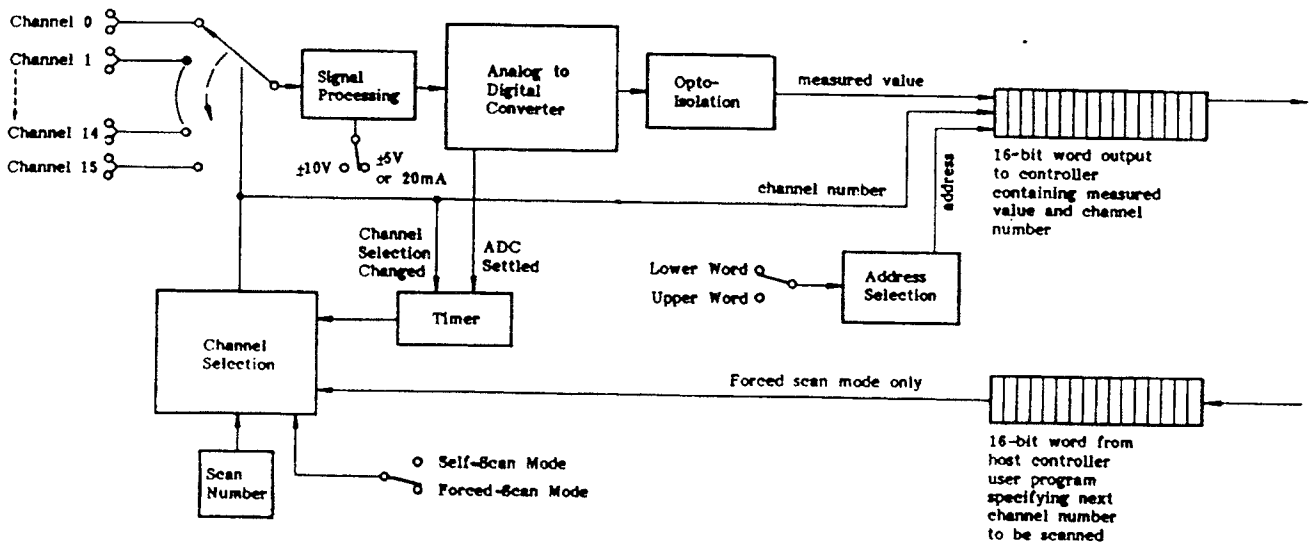


Figure 2 - 8108 Block Diagram

4.3 Forced-Scan Mode

In the forced-scan mode, the host controller user program must be arranged to output to the 8108, a 16-bit B-table word which specifies a channel number. One bit only of the B-table word must be set to '1' and this bit defines which channel is specified. For example, if bit 0 is ON, channel 0 is specified and if bit 1 is ON, channel 1 is specified. Figure 3 shows three examples.

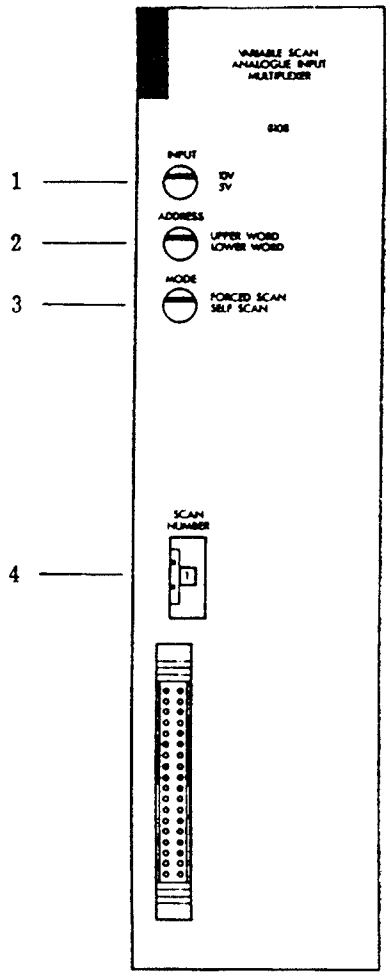
If the channel selection word is set to zero, that is all bits OFF, the module reverts to the self-scan mode, stepping forward one channel at a time and using the rotary switch on the front of the module to limit the number of channels to be scanned. This facility allows the forced-scan mode to be used when plant conditions require a fast response, with the user programme in the host GEM 80 controller changing between self-scan and forced-scan as required.

The 8108 does not respond immediately to the host controller requests because such requests are overridden by the timer circuit, even in the forced-scan mode. The forced-scan option is selected by setting the Forced-Scan/Self-Scan switch. See Figure 4.

The address of the B-table word which specifies the channel number is discussed in Section 6.2.

	bit 15	bit 14	bit 13	bit 12	bit 11	bit 10	bit 9	bit 8	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	
example 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	channel 0
example 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	channel 1
example 3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	channel 15

Figure 3 - B-Table Word Specifying Channel Number



1. Input level selector switch.
2. Address selector switch.
3. Forced-scan/self-scan mode selector switch.
4. Scan number.

Figure 4 - 8108 Front Panel

4.4 Relationship Between Host Controller Scan Time and 8108 Output

The host controller reads the output of the 8108 once at the start of every controller scan. The 8108 detects when the host controller has read the 16-bit word on the 8108 output because it can identify when it is being addressed from the address lines.

For the 8108 to change its output to a new 16-bit word of measurement and channel number, two conditions must be satisfied:

1. the 16-bit word of measurement and channel number currently being output, has been read by the host controller.

2. the timer circuit has timed out (70±20ms.) This prevents channel selection changing until the analog to digital converter has settled.

If the host controller scan time is less than 70±20ms, the timer circuit prevents the channel selection from changing. Therefore, it is possible that the host controller may read the same 8108 output more than once. The host controller user programme may be arranged to handle this data as detailed in Section 8.3. The speed at which the controller obtains this data is limited, by the timer circuit, to 70±20ms for each channel.

If the host controller scan time is more than 70±20ms, the 8108 holds the data in its output until the host controller reads it. Section 8.3 shows an example of a suitable user programme to handle this data. The speed at which the controller obtains the 8108 data is limited by the host controller scan time. Thus, 16 channels are read in 16 times the host controller scan time.

5. POWER SUPPLIES

5.1 Power Drawn from the Host Controller

Each 8108 module used in a subrack system draws approximately 150mA at +15V d.c. nominal, through the basic I/O ribbon.

When designing or configuring a subrack layout, it is necessary to calculate the total current required for I/O to ensure that the host controller is not overloaded. The host controller technical manual provides a blank 'data form' page which should be used as a design aid facility.

5.2 Plant-Side Power Requirements

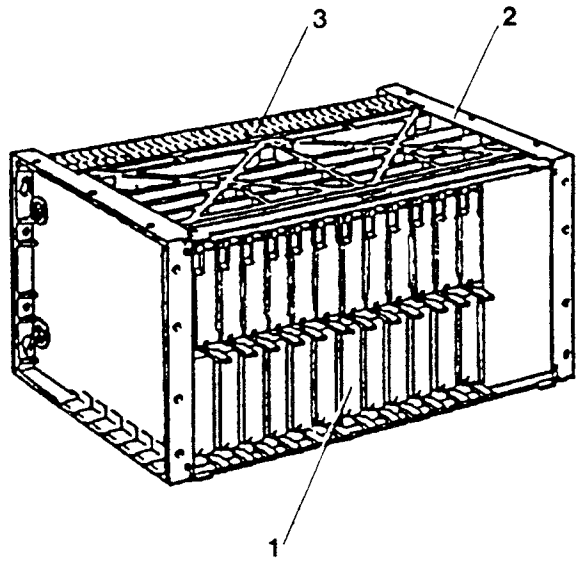
Apart from the analog signals, plant-side power is not required for the 8108.

6. FITTING MODULES IN THE SUBRACK

6.1 Subracks

Figure 5 shows an 8859 subrack with 12 compact I/O modules fitted. The modules slide along guide rails and plug into the backplane at the rear of the subrack.

Each module is mechanically coded to ensure that input modules are fitted in spaces allocated only to input modules and that output modules are fitted in spaces allocated only to output modules. Section 6.3 details the mechanical coding.



1. Compact module.
2. Subrack.
3. Backplane.

Figure 5 - 8859 Subrack Fitted with Compact Modules

6.2 Addressing, Subrack Layout, Upper and Lower Addresses Switch

6.2.1 General

As already stated, the 8108 module is twice the width of other compact I/O modules, and occupies two slots of a compact subrack in the self-scan mode. However, in the forced-scan mode, four slots are required.

The module is addressed in the same way as an 8-point module and is accompanied by any compact subrack which accepts 8-point modules, including the 8859 and the Compact Controller.

The method of setting the decoder switches and deriving the data table addresses is detailed in the 8859 User Information, Publication No.T1504. The following paragraphs describe how these data table addresses are used and how the module is set up for self-scan and forced-scan modes.

6.2.2 Self-Scan Mode

In the self-scan mode the one 16-bit word, for the combined channel number and measured value, is composed of two 8-bit bytes, addressed by the host controller A-table. The exact address depends on which slot number the 8108 occupies and the decoder switch setting (if fitted). For example, if the 8108 module is fitted into slots 1 and 2 of an 8859 subrack and the decoder switch S1 is set to '0', the address would be 'A0'.

When an 8108 module is fitted in slot numbers which are addressed by even numbered addresses, for example A0, A2, A4 etc., the UPPER WORD/LOWER WORD ADDRESS switch on the module front panel must be set to LOWER WORD.

When an 8108 module is fitted in slot numbers which are addressed by odd numbered addresses, for example A1, A3, A5 etc., the UPPER WORD/LOWER WORD ADDRESS switch on the module front panel must be set to UPPER WORD.

6.2.3 Forced-Scan Mode

In the forced-scan mode, the 8108 module requires two 16-bit data table words which comprise four 8-bit bytes so that four module slots must be reserved. The 8108 module itself must be fitted in the two lower slot numbers. For example, if slot numbers 1, 2, 3, and 4 in an 8859 subrack are reserved for the 8108, the module itself must be fitted in slot numbers 1 and 2. Although 8-way modules cannot be fitted into slots 3 and 4, 16- or 32-way modules may be fitted if required. A blanking panel may be fitted to cover these slots if not used.

In this mode, the UPPER WORD/LOWER WORD ADDRESS switch on the 8108 module front panel must be set to LOWER WORD.

In the forced-scan mode, the host controller receives the 16-bit word from the 8108 which contains a measured value and channel number in the A-table. The exact address depends on the slot number in which the 8108 is fitted and on the decoder switch setting. For example, if the 8108 is in slot numbers 1 and 2 of the 8859 subrack with the address decoder switch set to 0, the host controller would receive this word in address A0.

The channel request is output by the host controller to a B-table word. Similarly to the self-scan mode, the exact address is related to the position of the module in the subrack and the decoder switch setting. If, for example, the 8108 is in slot numbers 1 and 2 of the 8859 subrack with address decoder switch S1 set to 0, the host controller user programme must be arranged to output this data in address B1.

6.3 Mechanical Coding

6.3.1 General

The edge connector at the rear of the multiplexer I/O module is a mechanically coded connector. The coding ensures that input modules can be fitted only in subrack locations allocated to input modules and output modules can be fitted only in subrack locations allocated to output modules.

The subracks are supplied with mechanical coding fitted over the connector fingers in positions 5, 10, 12 and 31 as shown in Figure 6.

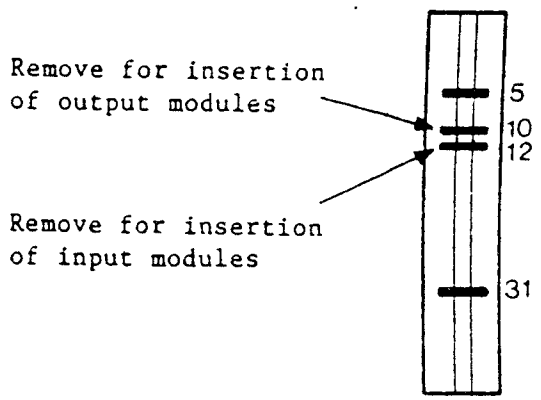


Figure 6 - Mechanical Coding in Subrack Edge Connector

6.3.2 Coding Input Modules

Input modules are supplied with cut-outs corresponding to subrack connector positions 5, 10 and 31 as shown in Figure 7. Therefore, to fit an input module in the subrack, the coding peg fitted in the subrack edge connector at position 12 should be removed with a pair of long-nosed pliers.

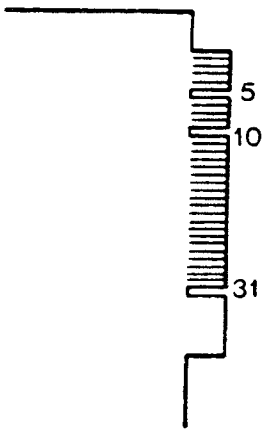


Figure 7 - 32- and 16-Channel Input Module Coding Cut-outs

6.4 Fitting a Module

To insert a module, locate the rear edge of the circuit board in the top and bottom guide rails. Push the module home using gentle pressure only. If the module jams, release it by pulling it out a short distance and try again. Excessive force will make the problem worse and may damage the equipment. When the module reaches the rear of the subrack, apply firm pressure to locate the circuit board fingers in the backplane connector.

To release a module, lift the ejection handle at the top. This disengages the rear connector, pushing the module out sufficiently for it to be grasped and withdrawn completely.

7. INPUT LEVELS AND PLANT CONNECTIONS

7.1 Input Signal Levels

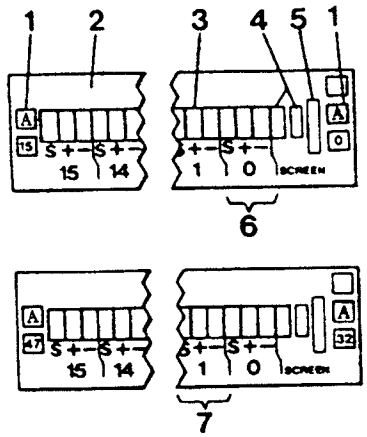
The 8108 may be set to accept all signals in the range ± 5V nominal or all ±10V nominal or all 0 to 20mA nominal. It is not possible to set certain channels to 5V and others to 10V and so on. The termination rails or panels are designed to accept either voltage or current signals but not both, since those termination rails accepting current signals include precision resistors to convert the 20mA signals to 5V levels.

A toggle switch, labelled INPUT, on the front panel of the 8108 module must be set to the required range, ±5V or ± 10V. The switch location is shown on Figure 4.

7.2 Termination Details

All plant connections are made to terminals on the termination panel or terminal rail.

On the termination panels, three adjacent terminals are provided for each input channel, i.e. two for the signal and one for the screen(shield). A 34-way ribbon cable, 8891-4053, is available for connecting between 8108 and 8033 termination panels. Figure 8 shows the panel and terminal identification.

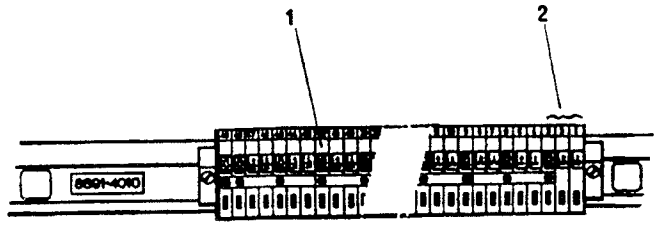


1. Panel labels.
2. Termination panel.
3. Row of plant terminals.
4. Terminals for wire to connect screens to earth.
5. Ribbon cable connector.
6. Terminals for input A0.
7. Terminals for input A33.

Terminal marking: +/- = signal
S = screen

Figure 8 - Panel and Terminal Identification

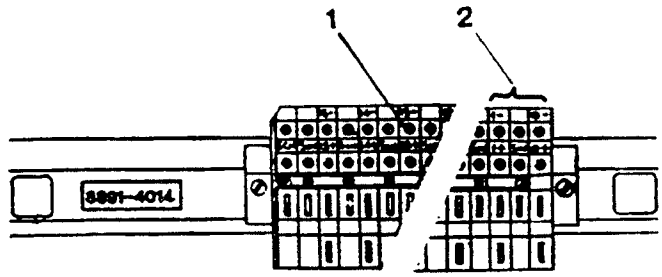
Terminal rail ordering code 8891-4010 is suitable for voltage input signals. Similar to the termination panels, it provides three adjacent terminals for each channel. See Figure 9 for details.



1. Plant terminal.
2. Input or output terminal group.

Figure 9 - 8891-4010 Rail and Terminal Identification

Terminal rail to ordering code 8891-4014 is suitable for current input signals only. The terminals used are of the 'double decker' type in which two terminals are accomodated in one housing. Two of these housings, giving four terminals are provided for each channel. Two terminals are for the input signals, one is for the screen and the fourth is not connected. Figure 10 shows the connections.



1. Plant terminal.
2. Input terminal group.

Figure 10 - 8891-4014 Rail Termination Identification

For any of the termination panels and terminal rails listed above, used for input signals, if the signal polarity is the same as the terminal markings, a positive number is placed in the A-table. Polarity reversal gives a negative number.

7.3 Harness Connections

Each harness is fitted with a socket at one end and flying leads at the other. The socket is to be connected into the plug on the front panel of an 8108 module and the flying leads connected to the terminal rail.

The wiring harness comprises 16 colour-coded, twisted pairs of wires. Each channel is distinguished by the colours in the pair, which use the standard resistor colour code, for example

Black/Black is 00
Brown/Black is 10

Table 1 Harness/Terminal Rail Connections

WIRING HARNESS		TERMINAL RAIL	
8891-4068		8891-4010	8891-4014
		Connect to Terminal Number	
Wire Colour	Twisted Pair Number	For Voltage Input	For Current Input
Black Black/White Screen	00	1 (0-) 2 (0+) 3 (0S)	0- 0+
Brown Black/White Screen	01	4 (1-) 5 (1+) 6 (1S)	1- 1+
Red Black/White Screen	02	7 (2-) 8 (2+) 9 (2S)	2- 2+
Orange Black/White Screen	03	10 (3-) 11 (3+) 12 (3S)	3- 3+
Yellow Black/White Screen	04	13 (4-) 14 (4+) 15 (4S)	4- 4+
Green Black/White Screen	05	16 (5-) 17 (5+) 18 (5S)	5- 5+
Blue Black/White Screen	06	19 (6-) 20 (6+) 21 (6S)	6- 6+
Violet Black/White Screen	07	22 (7-) 23 (7+) 24 (7S)	7- 7+
Grey Black/White Screen	08	25 (8-) 26 (8+) 27 (8S)	8- 8+
White Black/White Screen	09	28 (9-) 29 (9+) 30 (9S)	9- 9+

Table 1 Harness/Terminal Rail Connections (Continued)

WIRING HARNESS		TERMINAL RAIL	
8891-4068		8891-4010	8891-4014
		Connect to Terminal Number	
Wire Colour	Twisted Pair Number	For Voltage Input	For Current Input
Black Brown/White Screen	10	31 (10-) 32 (10+) 33 (10S)	10- 10+
Brown Brown/White Screen	11	34 (11-) 35 (11+) 36 (11S)	11- 11+
Red Brown/White Screen	12	37 (12-) 38 (12+) 39 (12S)	12- 12+
Orange Brown/White screen	13	40 (13-) 41 (13+) 42 (13S)	13- 13+
Yellow Brown/White Screen	14	43 (14-) 44 (14+) 45 (14S)	14- 14+
Green Brown/White Screen	15	46 (15-) 47 (15+) 48 (15S) 49 (SCN)	15- 15+

8. USER PROGRAMME

8.1 16-Bit Data Table Word, Output by the 8108

The 16-bit data table word, output by the 8108, contains the channel number and the measured value.

The twelve most significant bits are used for the measured value and the remaining four bits indicate the channel number. The most significant bit is the sign bit, see Figure 11.

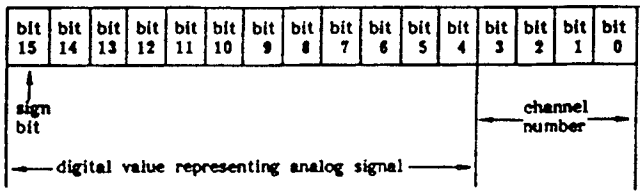
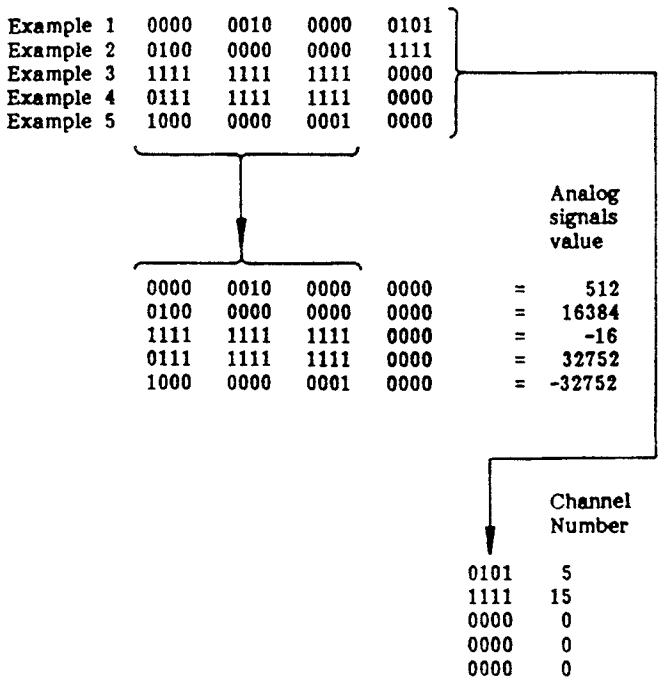


Figure 11 - Output of 8108

Below are five examples of the output of the 8108 and how they are to be interpreted:-



The negative numbers are interpreted by 2's complement arithmetic. For example, number 5:

		1000	0000	0001	0000	
2's complement	=	0111	1111	1110	1111	+1
	=	1111	1111	1111	0000	
	=	32,752 (decimal)				

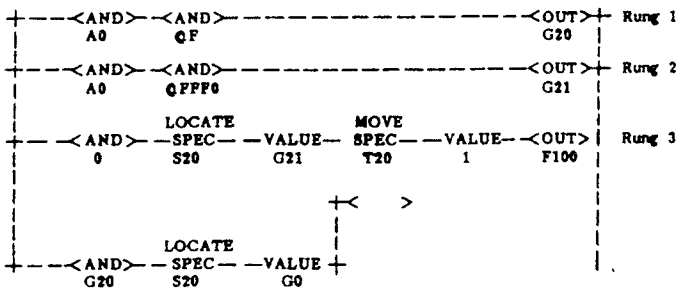
since the sign bit is 1, the number is negative, i.e. -32,752

8.2 Address of 8108 Output

The address of the 8108 output word will be in the A-table. Further details are given in Section 6.2.

8.3 Reading the Data into the Host Controller

A dedicated data table location is usually reserved for each channel. The example below is designed to read 16 channels and it accepts data from an 8108 module in address A0.



Rung 1 masks the 8108 output word (A0) with @F to produce the channel number in data table location G20. Rung 2 masks the 8108 output word with @FFF0 to produce the measured value in data table location G21. Rung 3 copies the measured values into data tables G0 to G15 based on the channel number in G20. This is arranged so that the measured value for channel 0 is put in G0 and the measured value for channel 1 is put in G1 and so on.

At each host controller scan, the output of the 8108 is read into G0 to G15 depending on the channel number. These data table locations are continuously updated with the latest 8108 output data for that channel.

This programme automatically over-writes the old values.

9. ORDERING CODES

9.1 Equipment

Module only	8108-4003
3m Cable Harness for use with terminal rail	8891-4068
Terminal Rail:	
Voltage inputs	8891-4010
Current inputs	8891-4014
2m Ribbon Cable for use with termination panel	8891-4053
Termination Panel:	
Voltage inputs	8891-4133
Current inputs	8891-4633

INDUSTRIAL CONTROLS

Kidsgrove, Stoke-on-Trent, ST7 1TW, England
Tel: (0782) 783511 Fax: (0782) 776329 Telex: 36293/4 CICKID G
Registered in England No. 2259095

Note: The Company's policy is one of continuous development. Products supplied may differ from those described herein.

T443 Issue 2 3.91