INSTALLATION GUIDE

8 Isolated Thermocouple or mV Input (8 TC/mV ISO) Module
M1432C

General Description

The M1432C 8 TC/mV ISO module consists of eight isolated analog inputs where each input can be configured as a mV input or a thermocouple input.

The input types and standard ranges handled by the module are as follows :-

MV : -10mV to +80mV

Thermocouple	Type E :	-50ºC to 1000ºC	Type N:	0ºC to 1200ºC
	Type J :	-200ºC to 750ºC	Type B:	400ºC to 1800ºC
	Type K:	-200ºC to 1300ºC	Type R:	-50ºC to 1600ºC
	Type T	-150ºC to 400ºC	Type S:	-50ºC to 1600ºC

The TC inputs are linearised in the module and the module comes standard with a built in CJC.

For thermocouple inputs, the temperature can be read in degrees Celsius or degrees Fahrenheit to 0.1 degrees resolution. For mV inputs, the mV value can be read as either a scaled percentage value or the actual mV value in signed integer to 2 decimal places, i.e. 0.00% to 100.00% or –10.00 mV to +80.00 mV. Over-range and under-range inputs are read as +32767 and –32767 values respectively for the particular input selected. TC upscale or downscale burnout can be selected by setting or clearing a bit. In addition, each input has four programmable trip setpoints and a deadband value. A status register is then used to indicate the status of each trip setpoint.

Isolation of 1500 VACrms is provided between the inputs and bus logic. Isolation of 500 VACrms is provided between inputs.

The module plugs into any I/O slot and has a Scan Code and Module ID which are used by the CPU module to detect the module and run the appropriate driver for the module. A CPU OK green LED is viewable through the front cover which shows the status of the module as follows:-

Table 1 : LED Indicator

CPU OK	MODULE
On	Operating correctly
Flashing	Failure
Off	No power or failure

With the aid of an accurate DC mV source and the M1432C Ezi-forth calibration program*, the module can be field calibrated by the user. Calibration of the internal TC CJC requires the removal of the LED cover. The module is factory calibrated at an ambient temperature of 25°C.

(* - available on request).

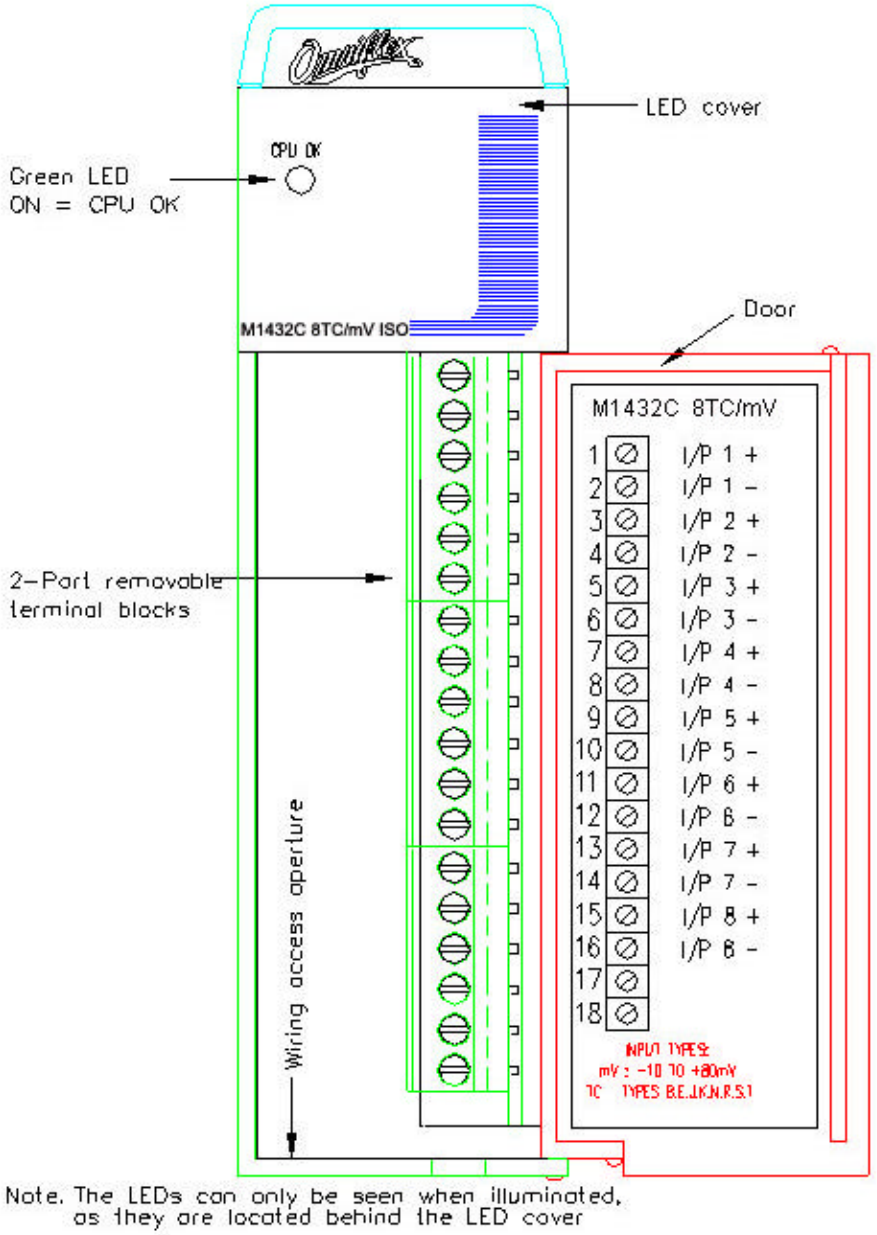
Removing/Replacing LED Cover

1. Remove top screw and lift off vent cover.

2. Open the door and gently force down the door until the door is free of the LED cover. Remove door.
3. Holding the LED cover, gently force the housing apart until the LED cover is freed.

Replace in reverse order.

Figure 1 : Layout of M1432C Module



Installation

The M1432C can be installed in any I/O slot of a Maxiflex base located on the right hand side of the bases.

Figure 2 : Layout of the 7 I/O Master Base

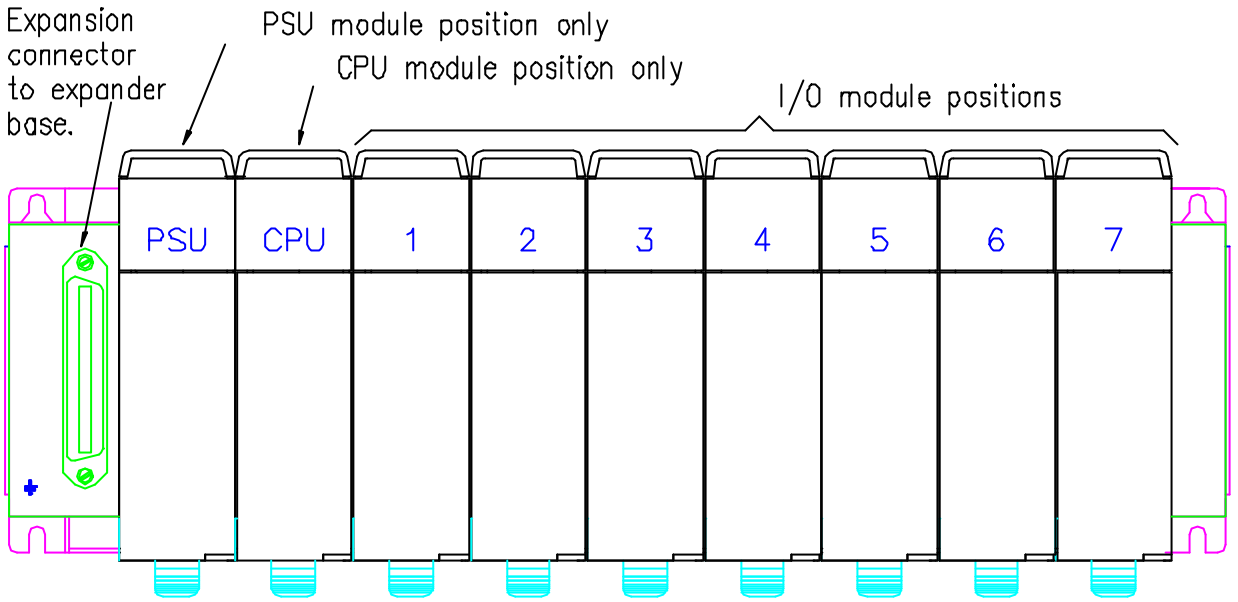
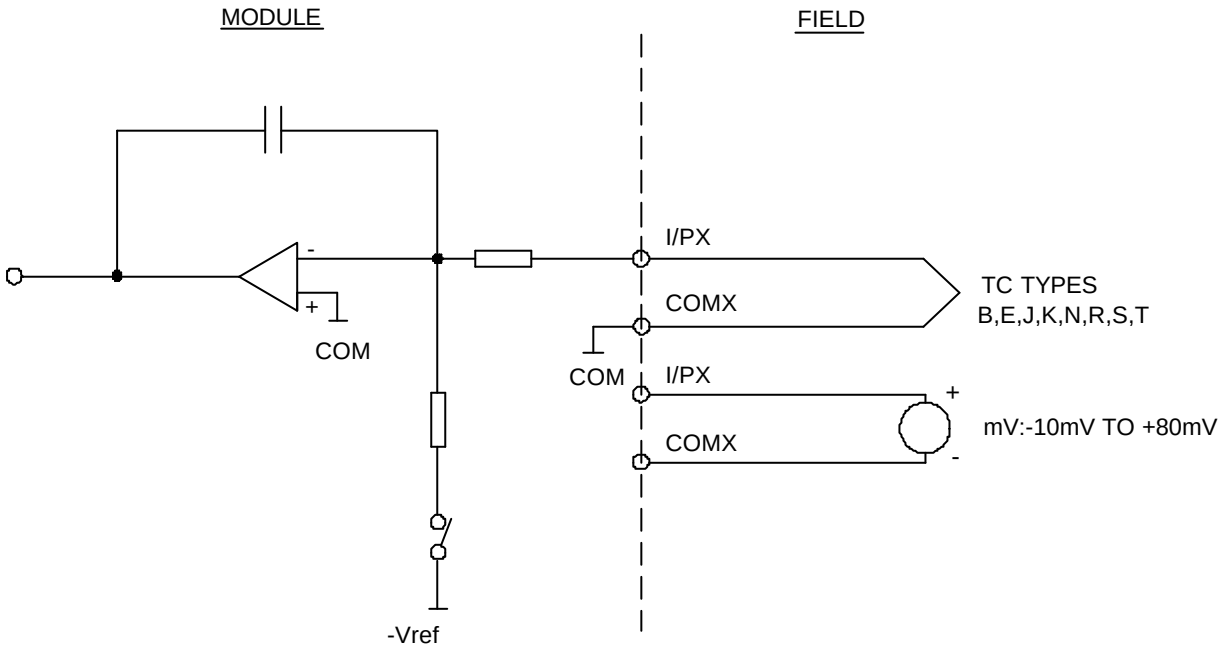


Figure 3 : Electrical Connections



Module Memory Map

The input type, data display format and setpoints and upscale/downscale configuration for each input are downloaded to the module by the Maxiflex CPU user application Ezi-forth program. The layout and description of the modules registers are provided in the Table below, as well as a sample forth program that configures and reads a module's inputs. If after configuration the module loses power for any reason, then the module will revert back to default values and the module will therefore have to be reconfigured.

Table 2 : M1432C Memory Map

Register	Description
0	Scancode (41) MSB
	Module ID (41) LSB
1	Input 1 Value
2	Input 2 Value
3	Input 3 Value
4	Input 4 Value
5	Input 5 Value
6	Input 6 Value
7	Input 7 Value
8	Input 8 Value
9	Input 1 Status
10	Input 2 Status
11	Input 3 Status
12	Input 4 Status
13	Input 5 Status
14	Input 6 Status
15	Input 7 Status
16	Input 8 Status
17	Input 1 Type
18	Input 2 Type
19	Input 3 Type
20	Input 4 Type
21	Input 5 Type
22	Input 6 Type
23	Input 7 Type
24	Input 8 Type
25	Display Format
26	Temperature Format
27	Upscale/Downscale Burnout
28	CJC Type
29	External CJC Temperature
30	Input 1 High High Limit
31	Input 1 High Limit
32	Input 1 Low Limit
33	Input 1 Low Low Limit
34	Input 1 Deadband
35	Input 2 High High Limit
36	Input 2 High Limit
37	Input 2 Low Limit
38	Input 2 Low Low Limit
39	Input 2 Deadband

Register	Description
40	Input 3 High High Limit
41	Input 3 High Limit
42	Input 3 Low Limit
43	Input 3 Low Low Limit
44	Input 3 Deadband
45	Input 4 High High Limit
46	Input 4 High Limit
47	Input 4 Low Limit
48	Input 4 Low Low Limit
49	Input 4 Deadband
50	Input 5 High High Limit
51	Input 5 High Limit
52	Input 5 Low Limit
53	Input 5 Low Low Limit
54	Input 5 Deadband
55	Input 6 High High Limit
56	Input 6 High Limit
57	Input 6 Low Limit
58	Input 6 Low Low Limit
59	Input 6 Deadband
60	Input 7 High High Limit
61	Input 7 High Limit
62	Input 7 Low Limit
63	Input 7 Low Low Limit
64	Input 7 Deadband
65	Input 8 High High Limit
66	Input 8 High Limit
67	Input 8 Low Limit
68	Input 8 Low Low Limit
69	Input 8 Deadband
70-80	Spare
81	Firmware Version Number
82	Calibration Done Flag
83	CJC Temperature
*91	Cal Mode
*92	Cal Channel
*93	Cal Zero
*94	Cal Span
*95	Cal Middle
*96	Cal Type
*97	Cal Status

* - used by the M1433A Ezi-Forth calibration program to calibrate the module

Scancode and Module ID

The scancode and module ID's are used by the Maxiflex CPU module to detect and identify the M1432C module. The scancode is 41 and the module ID is 41. Refer to Table 2 for the addresses.

Input Values

This table consists of eight integer values corresponding to inputs 1 to 8. If the input is a temperature input, then the output value is a signed integer to 0.1 degrees resolution. If the input is an mV input, then the value is a signed integer output either as an mV value or a % value to two decimal places. Refer to Table 2 for the addresses.

Input Status

This table contains one register per input. If a particular trip limit is transgressed then its corresponding bit is set. If the calibration data in EEprom is corrupted, then bit D4 is set and the module needs re-calibration. If module variables in ram are corrupted, then bit D5 is set. If an input is unconfigured or an invalid input type is downloaded, then bit D6 is set. If TC burnout occurred, then bit D7 is set. Table 3 lists the allocation of the bits. Refer to Table 2 for the addresses of the table.

Table 3 : Format of Input Status Register		
Input >= High Limit	D0 = 1	*All unused bits are set to zero.* ***N.B.*** *If module variables in ram are corrputed, the user configuration data must be downloaded to the module again*
Input >= High High Limit	D1 = 1	
Input <= Low Limit	D2 = 1	
Input <= Low Low Limit	D3 = 1	
EEprom calibration data corrupted	D4 = 1	
Ram Corrupted	D5 = 1	
Invalid Input Type	D6 = 1	
TC Burnout	D7 = 1	

Input Types

This table consists of eight integer values corresponding to input types 1 to 8. Table 4 below lists the various input t ypes and their corresponding input type numbers. Refer to Table 2 for the addresses

Table 4 : Input Types			
Input Type No.	**Description**	**Input Type No.**	**Description**
0	Input not used *	5	Thermocouple type T
1	Thermocouple type K	6	Thermocouple type R
2	Thermocouple type J	7	Thermocouple type S
3	Thermocouple type E	8	Thermocouple type B
4	Thermocouple type N	20	mV input

** - default value*

Display Format

If the input is an mV input, this register indicates whether the value is outputted as a percentage value or as an mV vale. Refer to Table 2 for the addresses.

Table 5 : Format of the Display Format Register							
D15	**D14**	**D13**	**D12**	**D11**	**D10**	**D9**	**D8**
0	0	0	0	0	0	0	0
D7	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
Input 8	Input 7	Input 6	Input 5	Input 4	Input 3	Input 2	Input 1

Each input has a bit allocated to it and if the bit is set, the value is outputted as a percentage value, and if not, as an mV value. The default setting of the register is zero, i.e. all values output as mV values if input is specified to be an mV input.

Temperature Format

This register indicates whether the temperature should be displayed in degrees œlsius or in degrees fahrenheit. The default setting is zero which indicates that temperatures will be displayed in degrees celsius. If the register is non-zero, the temperatures will be displayed in degrees fahrenheit. Refer to Table 2 for the address.

Up/Down Scale Burnout

The register specifies whether TC burnout should be displayed as up scale burnout or as down scale burnout. Refer to Table 2 for the address.

Table 6 : Format of the up/down Scale Burnout Register							
D15	**D14**	**D13**	**D12**	**D11**	**D10**	**D9**	**D8**
0	0	0	0	0	0	0	0
D7	**D6**	**D5**	**D4**	**D3**	**D2**	**D1**	**D0**
Input 8	Input 7	Input 6	Input 5	Input 4	Input 3	Input 2	Input 1

Each input has a bit allocated ot it and if the bit is set down scale burnout is selected, and if not, upscale burnout is selected. Upscale selection will cause the input to output 32767 and downscale selection will output –32768 when a sensor break is detected. The default setting of the register is zero, i.e. all inputs set to upscale burnout.

CJC Type

This register is used to determine whether the software is to measure and calculate the CJC temperature or whether the CJC terminal is at an external point which is at a fixed temperature. If the register is set to zero, the CJC temperature is measured, and if it is set to one, then the external CJC temperature is used. Default value internal CJC.

External CJC Temperature

This register is used to specify the external CJC temperature. The temperature must be specified to 0.1 degrees resolution in signed integer format. The temperature can be specified in either degrees centigrade or in degrees fahrenheit (must be the same as the Temperature Type Register).

Trip Limits

This Table contains two high trip limits, two low trip limits, and a deadband for each input. The limits are used to determine if the input signal has transgressed a particular limit. Refer to Table 2 for the addresses. Default value zero.

Firmware Version Number

The register contains the installed firmware version number in hex format.

Calibration Done Flag

The value of one indicates the module has been calibrated. Any other value indicates calibration not done or corrupt.

CJC Temperature

The register contains the measured CJC temperature to 0.1 degrees resolution. If the external CJC temperature is selected by setting the CJC Type register to 1, then the CJC Temperature register is not updated.

Sample Forth Program

The following program provides a “TO” and a “FROM” command which allows the module’s registers to be directly accessed. The program assumes that the module is in slot 3 and configures it as follows : All inputs set to type J thermocouples and all inputs set to down scale burnout. The temperature format is degrees celcius (default) and the CJC measured internally (default). The trip limits are set as follows : High High = 600.0ºC, High = 500.0ºC, Low = 200.0ºC, Low Low = 100.0ºC and deadband = 20.0ºC.

```
FORGET ALL
: ALL ;

3  CONSTANT SLOT3
2 CONSTANT TYPE_J
27 CONSTANT UP_DOWN_SCALE
30 CONSTANT INPUT_1_HH
31 CONSTANT INPUT_1_H
32 CONSTANT INPUT_1_L
33 CONSTANT INPUT_1_LL
34 CONSTANT INPUT_1_DB

: TO ( value reg slot --- ) 33 BIOS
: FROM ( reg slot --- value ) 32 BIOS

: CONFIG_MOD
255 UP_DOWN?_SCALE SLOT3 TO(set all inputs to downscale burnout)
   9 1 DO
      TYPE_J I 16 + SLOT3 TO ( set all inputs to type J )
      6000 I 1 - 5 * INPUT_1_HH + SLOT3 TO   ( HH trip = 600.0 °C )
      5000 I 1 - 5 * INPUT_1_H  + SLOT3 TO    ( H trip = 500.0 °C )
      2000 I 1 - 5 * INPUT_1_L  + SLOT3 TO     ( L trip = 200.0 °C )
      1000 I 1 - 5 * INPUT_1_LL + SLOT3 TO    ( LL trip = 100.0 °C )
      200  I 1 - 5 * INPUT_1_DB + SLOT3 TO    ( DB  = 20.0 °C  )
     LOOP
;
: RD_INPUTS
  CR
  9 1 DO
      ." TEMP = " I SLOT3 FROM .                    ( read input value  )
      ." STATUS = " I 8 + SLOT3 FROM . CR            ( read input status )
     LOOP
  CR
 ;
```

Specifications		
Inputs		
Quantity	8	
MV Range	-10 mV to + 80mV STD Range -2.5 to +20mV Special Ranges on request only 0-6.7mV (ECO 1642) 0-10mV (ECO 1643) 0-20mV (ECO 1644)	
Accuracy	0,04% of span	
Drift	100ppm/°C typ.	
Display	mV or % (software config)	
Thermocouple Temperature Ranges Type E: -50ºC to 1000ºC Type J: -200ºC to 750ºC Type K: -200ºC to 1300ºC Type T : -150ºC to 400ºC	 Type N: 0ºC to 1200ºC Type B: 400ºC to 1800ºC Type R: -50ºC to 1600ºC Type S: -50ºC to 1600ºC	
Performance		
Thermocouple and mV inputs		
Resolution	10uV	
Thermocouple Inputs:		
TC Type	**Typ. Reading Error**	**Max. Reading Error**

Specifications		
B	2.50ºC	4.00ºC
E	0.80ºC	0.83ºC
J	0.47ºC	0.84ºC
K	1.10ºC	1.20ºC
N	1.00ºC	1.12ºC
R	1.83ºC	3.90ºC
S	2.45ºC	4.40ºC
T	0.96ºC	1.21ºC
-10 to 180mV	7µV	15µV
-2.5 to 20mV(Special on Request)	10µV	20µV
CJC error	0.75ºC over 0 to 60ºC ambient temperature typical; 1.75ºC maximum	
Drift	100ppm/ºC typ.	
Burnout	Upscale or downscale (software configurable)	
Linearisation Technique	Software breakpoint with linear interpolation	
Resolution	0.1ºC/0.1ºF	
Display	MV or % (software configurable)	
Response Time		
Step Input	10% to 90%. Settles to within 3% in 200ms maximum (all inputs T.C with ºF selected)	
Isolation		
Input to system logic	1500 VACrms	
Input to input	500 VACrms	
Insulation		
Input to system logic	>20MΩ at 500 V dc	
Interference Rejection		
CMRR @50Hz	No effect up to 400 VACrms	
MMRR @50Hz	50 dB	
Input Impedance		
TC/mV Inputs	± 1 MΩ	
Power Supply		
Voltage	+5 V dc ± 5%	
Current	300 mA (maximum)	
Environmental		
Operating Temperature	0ºC to 60ºC	
Storage Temperature	-40ºC to +85ºC	
Operating Humidity	5% to 95% (non-condensing)	
Identification Codes		
Scan Code	41	
Module ID	41	
Mass		
Including Packaging	505g	
Excluding Packaging	419g	
Ordering Information		
Order Code	M1432C	