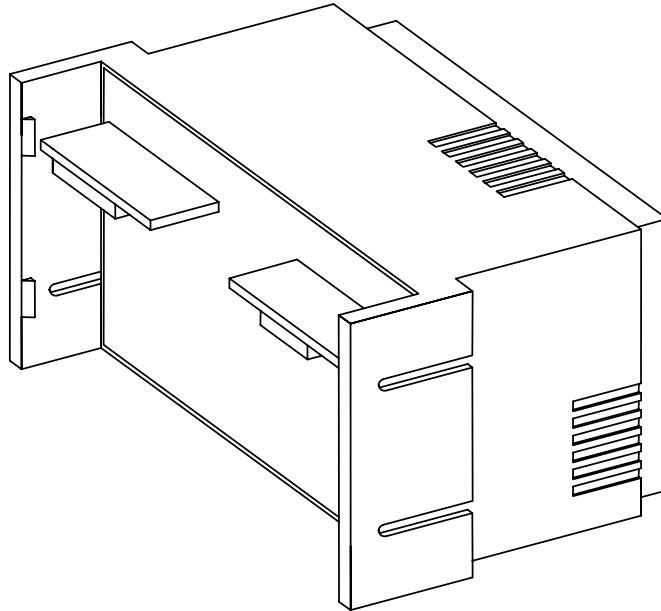


# **MultiCube Options**

## **Quad Analogue Output**



**Installation and Operation**



# PREFACE

**MultiCube  
Quad Analogue Output Options Module  
Operating Guide  
Revision 9.01  
Oct 2003**

This manual represents your options module as manufactured at the time of publication. It assumes standard software. Special versions of software may be fitted, in which case you will be provided with additional details.

Every effort has been made to ensure that the information in this manual is complete and accurate. We revised this manual but cannot be held responsible for errors or omissions.

The apparatus has been designed and tested in accordance with EN 61010-1, 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use'. This operating guide contains information and warnings, which must be followed by the user to ensure safe operation and to maintain the apparatus in a safe condition.

We reserve the right to make changes and improvements to the product without obligation to incorporate these changes and improvements into units previously shipped.

General Editor : Ian Sykes BSc (hons).  
Copyright © 2003 : Northern Design (Electronics) Ltd,  
228 Bolton Road, Bradford. West Yorkshire. UK.

## Table Of Contents

<b>1. Safety</b> .....	<b>5</b>
1.1 Warning Symbols .....	5
1.2 Maintenance .....	5
<b>2. Description</b> .....	<b>6</b>
<b>3. Operation</b> .....	<b>7</b>
3.1 Connecting The Options Unit .....	7
3.2 Local Communications (Meter-Options Module) .....	8
<b>4. Analogue Outputs</b> .....	<b>9</b>
4.1 Selecting Parameters For Output .....	9
4.2 Output Scaling .....	11
4.3 Test Mode.....	13
<b>5. Connection</b> .....	<b>14</b>
5.1 Connecting The 4-20mA Options Module .....	14
5.2 Connecting The Voltage Options Module.....	15
<b>6. Specification</b> .....	<b>16</b>

## 1. Safety

### 1.1 Warning Symbols

This manual provides details of safe installation and operation of the options module. Safety may be impaired if the instructions are not followed. Labels on individual devices give details of equipment ratings for safe operation. Take time to examine all labels on the meter and to read this manual before commencing installation.

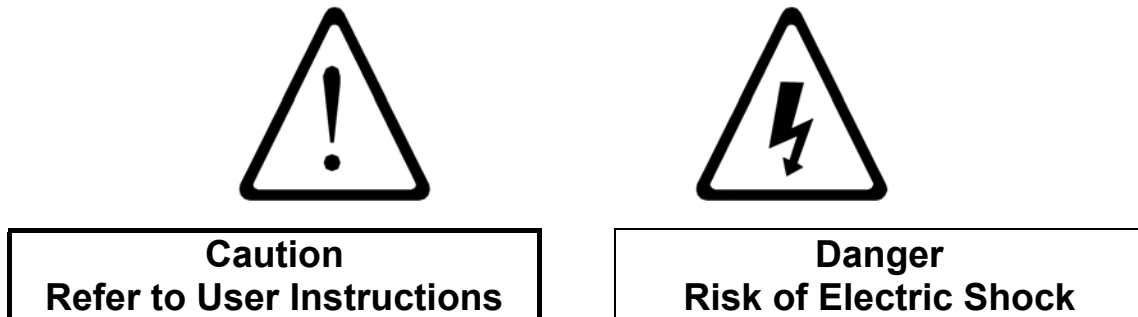


Figure 1-1 Safety Symbols

**WARNING**  
The equipment contains no user serviceable parts. Installation and commissioning should be carried out by qualified personnel

### 1.2 Maintenance

The equipment should be maintained in good working order. Damage to the product should be repaired by the manufacturer. The options module may be cleaned by wiping lightly with a soft cloth. No solvents or cleaning agents should be used. All inputs and supplies, to the meter and options module must be isolated before cleaning any part of the equipment.

## Description

---

### 2. Description

The Quad Analogue Output Options Module adds four dc analogue outputs to any standard MultiCube meter. Two versions of the output unit are available 4-20mA and Voltage. All outputs are isolated from the metering elements to provide safe connection to external systems. The device uses a high-speed microprocessor to extract information from the meter and a precision Digital to Analogue converter to produce the output signals.

4-20mA Options units provide four dc current sinks with a common signal return, which allows connection to PLCs and other equipment fitted with a suitable interface. 4-20mA systems are commonly used where the signals require transmission over long distances.

Voltage Options units provide four dc voltage outputs with a common ground which allow connection to voltage inputs of PLCs, PC A/D cards etc. DC voltage systems provide simple transmission of signals over short distances (typically <5m).

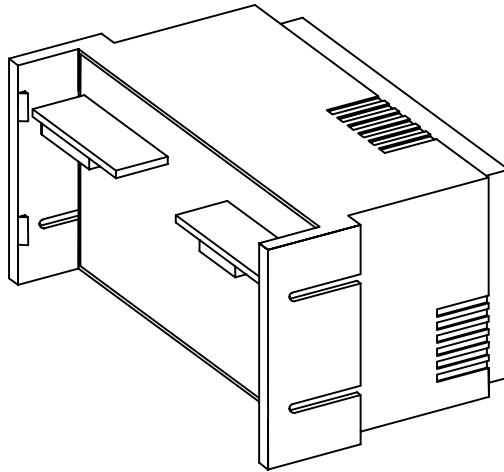


Figure 2-1 Options Module

## 3. Operation

### 3.1 Connecting The Options Unit

To connect the Options Module to the MultiCube:

1. Isolate **All** inputs/outputs to the MultiCube.
2. Check the ratings on the options module and meter to ensure compatibility.
3. Use a sharp knife to remove the cut-out section from the rear of the MultiCube. Ensure the knife blade does not penetrate > 3mm.
4. Insert the Options Module into the slot on the rear of the meter.
5. Slide the Module fully home until all four mounting lugs 'click' into place as shown below.

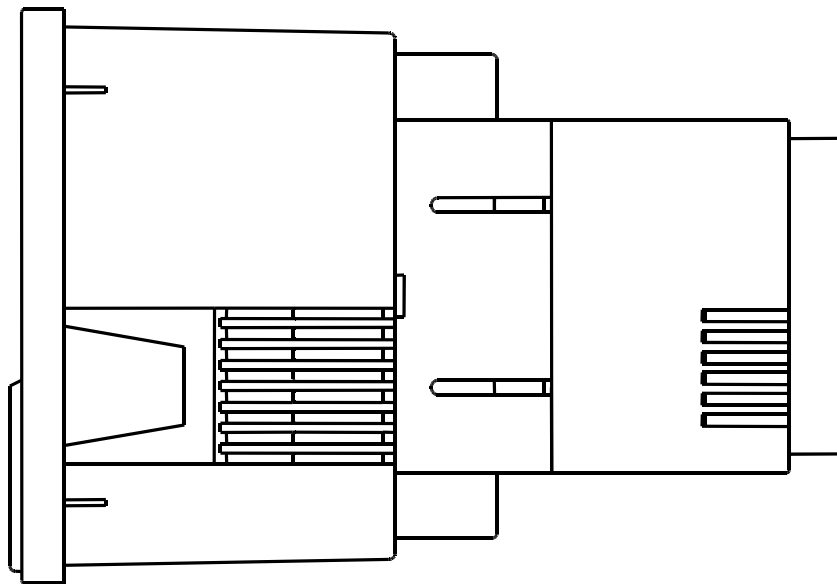


Figure 3-1 Options Module Attached to MultiCube

### 3.2 Local Communications (Meter-Options Module)

Once connected and powered up, the MultiCube and Options Unit will begin communicating with each other automatically. All readings taken by the meter are sent to the Options Module each second along with all meter program settings. The Options Module replies with confirmation of the values.

The MultiCube will confirm that it is correctly connected to an Options Module by illuminating the '*Options*' LED on its front panel. If for any reason the local communications fails this LED will switch off.

## 4. Analogue Outputs

### 4.1 Selecting Parameters For Output

Each of the four analogue output channels may be set up to provide a dc signal (4-20mA or Voltage) in proportion to one of 16 selected instantaneous parameters measured by the MultiCube to which it is attached.

Selection is carried out using DIP switches located on the underside of the options module as shown below.

**⚡ WARNING ⚡**  
**Isolate** All Inputs to the MultiCube before adding/removing an Options Module

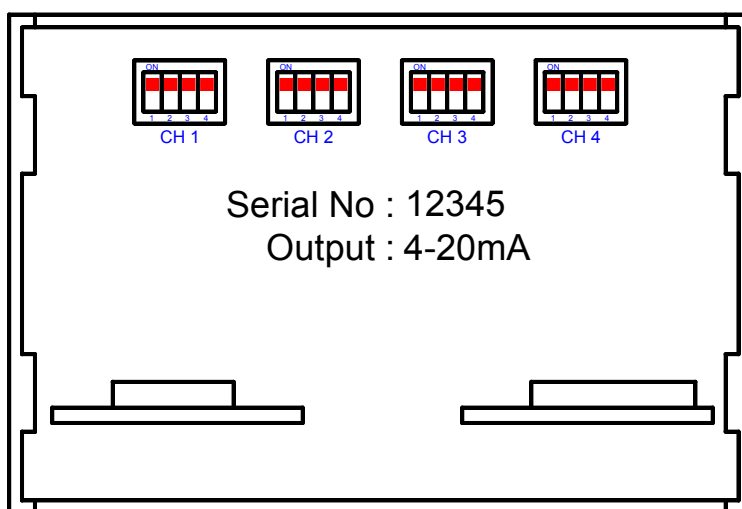


















Figure 4-1 Parameter Selection DIP Switches

## Analogue Outputs

DIP switches for each output channel may be set individually to provide the required parameter for output as shown in the following table.

No.	DIP SW	CHANNEL 1	CHANNEL 2	CHANNEL 3	CHANNEL 4
0	ON 	$V_1$	$V_1$	$V_1$	Sys P
1	ON 	$V_2$	$V_2$	$V_2$	2 x Sys P
2	ON 	$V_3$	$V_3$	$V_3$	Sys S
3	ON 	$I_1$	$I_1$	$I_1$	2 x Sys S
4	ON 	$I_2$	$I_2$	$I_2$	2 x (ABS) Sys Q
5	ON 	$I_3$	$I_3$	$I_3$	$\pm$ Sys Q
6	ON 	$P_1$	$P_2$	$P_3$	ABS (Sys PF)
7	ON 	ABS (PF <sub>1</sub> )	ABS (PF <sub>2</sub> )	ABS (PF <sub>3</sub> )	$\pm$ Sys PF
8	ON 	$\pm$ PF <sub>1</sub>	$\pm$ PF <sub>2</sub>	$\pm$ PF <sub>3</sub>	Freq (50Hz $\pm$ 5Hz)
9	ON 	ABS (Sys PF)	ABS (Sys PF)	ABS (Sys PF)	Freq (60Hz $\pm$ 5Hz)
10	ON 	Sys P	Sys P	Sys P	kW MD
11	ON 	Ave Amps	Ave Volts	Sys S	In
12	ON 	ABS (Sys Q)	ABS (Sys Q)	ABS (Sys Q)	5 x In
13	ON 	$\pm$ Sys Q	$\pm$ Sys Q	$\pm$ Sys Q	Ave Volts
14	ON 	2 x $I_1$	2 x $I_2$	2 x $I_3$	Ave Amps
15	ON 	$V_1 \pm 12.5\%$	$V_2 \pm 12.5\%$	$V_3 \pm 12.5\%$	<b>! TEST MODE !</b>

## 4.2 Output Scaling

The following tables show the scaling of the selected parameters. Refer to the MultiCube ratings and programmed settings for details of full-scale (FS) values.

Selected Parameter	Description	4-20mA (0-FS Volts) Represents
$V_1, V_2, V_3$	Phase 1-3 Voltage 120% FS = 20mA	4mA (0% V) = 0.0V 12mA (50% V) = 60% FS Volts 20mA (100% V) = 120% FS Volts
$V_1 \pm 12.5\%$ $V_2 \pm 12.5\%$ $V_3 \pm 12.5\%$	Phase 1-3 $\pm 12.5\%$ Voltage Deviation From Nominal	4mA (0% V) = 87.5% FS Volts 12mA (50% V) = 100% FS Volts 20mA (100% V) = 112.5% FS Volts
Ave Volts	$(V_1+V_2+V_3) / 3$ 120% FS = 20mA	4mA (0% V) = 0.0V 12mA (50% V) = 60% FS Volts 20mA (100% V) = 120% FS Volts
$I_1, I_2, I_3$	Phase 1-3 Current	4mA (0% V) = 0.0A 12mA (50% V) = 50% FS Amps 20mA (100% V) = 100% FS Amps
$2 \times I_1,$ $2 \times I_2,$ $2 \times I_3$	Phase 1-3 Current Scaled x 2	4mA (0% V) = 0.0A 12mA (50% V) = 25% FS Amps 20mA (100% V) = 50% FS Amps
Ave Amps	$(I_1+I_2+I_3) / 3$	4mA (0% V) = 0.0A 12mA (50% V) = 50% FS Amps 20mA (100% V) = 100% FS Amps
$P_1, P_2, P_3$	Phase 1-3 kW	4mA (0% V) = 0.0 kW 12mA (50% V) = 50% FS kW 20mA (100% V) = 100% FS kW
Sys P (And kW MD)	System kW (and kW Max Demand)	4mA (0% V) = 0.0 kW 12mA (50% V) = 50% FS kW 20mA (100% V) = 100% FS kW
$2 \times \text{Sys P}$	System kW Scaled x 2	4mA (0% V) = 0.0 kW 12mA (50% V) = 25% FS kW 20mA (100% V) = 50% FS kW

## Analogue Outputs


Selected Parameter	Description	4-20mA (0-FS Volts) Represents
(Abs) Sys Q	Absolute System kvar	4mA (0% V) = 0.0 kvar 12mA (50% V) = 50% FS kvar 20mA (100% V) = 100% FS kvar
± Sys Q	Signed System kvar	4mA (0% V) = 100% kvar (cap) 12mA (50% V) = 0.0 kvar 20mA (100% V) = 100% kvar (ind)
2 x (Abs) Sys Q	Absolute System kvar Scaled x 2	4mA (0% V) = 0.0 kvar 12mA (50% V) = 25% FS kvar 20mA (100% V) = 50% FS kvar
Sys S	System kVA	4mA (0% V) = 0.0 kVA 12mA (50% V) = 50% FS kVA 20mA (100% V) = 100% FS kVA
2 x Sys S	Absolute System kVA Scaled x 2	4mA (0% V) = 0.0 kVA 12mA (50% V) = 25% FS kVA 20mA (100% V) = 50% FS kVA
Freq (50Hz ±5Hz)	Frequency Deviation From 50Hz	4mA (0% V) = 45 Hz 12mA (50% V) = 50 Hz 20mA (100% V) = 55 Hz
Freq (60Hz ±5Hz)	Frequency Deviation From 60Hz	4mA (0% V) = 55 Hz 12mA (50% V) = 60 Hz 20mA (100% V) = 65 Hz
$I_n$	Neutral Current	4mA (0% V) = 0.0A 12mA (50% V) = 50% FS Amps 20mA (100% V) = 100% FS Amps
5 x $I_n$	Neutral Current Scaled x 5	4mA (0% V) = 0.0A 12mA (50% V) = 10% FS Amps 20mA (100% V) = 20% FS Amps



## 4.3 Test Mode

Test Mode is provided for use during commissioning only. The 'TEST LED', situated on the rear of the options module, flashes rapidly during Test Mode.

**⚡ WARNING ⚡**  
**Isolate** All Inputs to the MultiCube before adding/removing an Options Module

During Test Mode all channels provide test output levels irrespective of MultiCube measurements.

To enter Test Mode select No. 15 on Channel 4 ( <sup>ON</sup>  ).

No.	DIP SW (Ch 1-3)	CHANNEL 1 Test Output	CHANNEL 2 Test Output	CHANNEL 3 Test Output	CHANNEL 4 Test Output
5	ON 	4.0mA (0V)	4.0mA (0V)	4.0mA (0V)	20.0mA (100% V)
10	ON 	20.0mA (100% V)	20.0mA (100% V)	20.0mA (100% V)	20.0mA (100% V)
	OTHER	12.0mA (50% V)	12.0mA (50% V)	12.0mA (50% V)	20.0mA (100% V)

Test Mode allows the commissioning engineer to test external systems, connected to the MultiCube Quad Analogue Output, without the need to feed three phase measurement signals into the MultiCube. The Options Unit must be connected to a working MultiCube during Test Mode.

## 5. Connection

### 5.1 Connecting The 4-20mA Options Module

Each Channel of the 4-20mA Analogue Output Options Module acts as a **CURRENT SINK** with a common ground. The circuit inside the Module is represented by the schematic below.

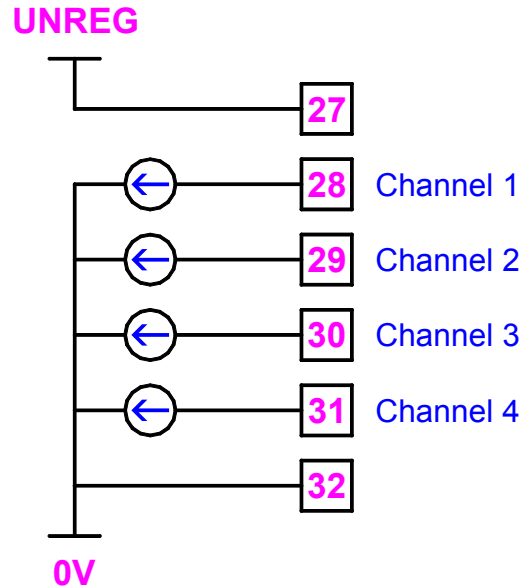


Figure 5-1 Internal 4-20mA Circuit

The UNREG output (Pin 27) may be used as a local loop supply, providing current to each of the four sink inputs with a cable + load impedance  $< 250\Omega$ . For longer runs (cable + load  $< 600\Omega$ ) an external 24V dc supply should be used. Use of screened twisted pair cable(s) is recommended, with the screen(s) connected via a short tail, to ground at the external system measurement input.

## 5.2 Connecting The Voltage Options Module

Each Channel of the Voltage Analogue Output Options outputs 0-100% of the rated dc voltage with a common ground. The full scale Output Voltage is shown on the unit rating label. The circuit inside the Module is represented by the schematic below.

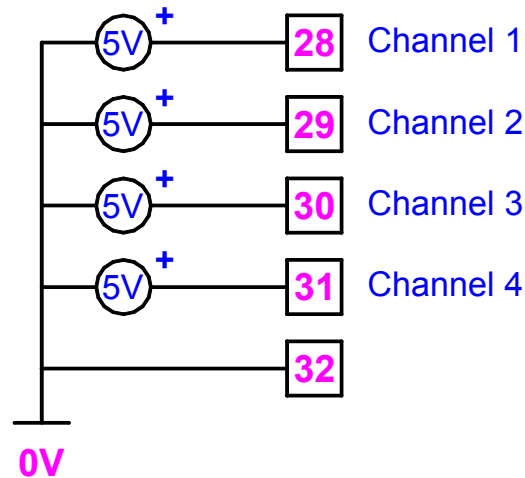


Figure 5-2 Internal Circuit (showing 5V rating)

Voltage outputs should only be used for local connections (<5m) to high impedance inputs (>150k $\Omega$ )

Use of 5 core, screened cable is recommended with a short tail connecting the screen to ground at the input to the external system.

## 6. Specification

<b>Auxiliary Supply</b>	
<b>Option Module</b>	230vac or 110vac 50/60Hz $\pm 15\%$ Automatic voltage selection when inserted into MultiCube MultiCube MUST be rated to match option module rating.
<b>Load</b>	4 VA Maximum
<b>Isolation</b>	2.5 kV continuous (Supply internally wired to MultiCube Auxiliary mains inputs)

<b>Mechanical (Options Module)</b>	
<b>Enclosure</b>	Custom Options Enclosure. Material Mablex UL94-V-0
<b>Dimensions</b> <b>Options Unit Unfitted</b> <b>MultiCube + Options</b>	W=87mm x H=59mm x L=75mm W=96mm x H=96mm x L= 138mm (130mm behind panel)
<b>Weight</b>	Approx. 200g
<b>Terminals</b>	Rising Cage. 0.2 – 1.0mm <sup>2</sup> Conductors

<b>4-20mA Output</b>	
<b>Output</b>	Quad 4-20mA DC Current Sink with common signal return
<b>Loop Supply</b>	Nominal 24V DC Max 28V DC (At Options Module) Min 5V DC (At Options Module)
<b>Internal Supply</b>	Unregulated 18V DC Max 30V DC Min 10V DC
<b>Load Impedance External Supply Internal (Unreg) Supply</b>	600Ω per channel (maximum 950Ω) at 24V supply 250Ω per channel (maximum 500Ω) at nominal $V_{aux}$
<b>Over Range</b>	Max output 21mA
<b>Resolution</b>	10 Bit (830 Levels from 4mA to 21mA)
<b>Update Speed</b>	Outputs updated every second (As MultiCube)
<b>Output Accuracy</b>	Test Range 4mA to 20mA, Load Impedance = 250Ω $I_{out} < 5.6mA$ $\pm 0.75\%$ Reading + MultiCube Errors $I_{out} \geq 5.6mA$ $\pm 0.5\%$ Reading + MultiCube Errors
<b>Effect of Loop Impedance</b>	< 0.02% (0Ω to 250Ω)
<b>Effect of Supply Voltage</b>	< 0.05% for $V_{aux} \pm 15\%$ (Internal Supply, 250Ω load)

<b>DC Voltage Output</b>	
<b>Output</b>	Quad DC Voltage with Common Ground (0V) Voltage rating as shown on unit rating label
<b>Load Impedance</b>	Min 150kΩ
<b>Over Range</b>	Max output 110% of rated output voltage
<b>Update Speed</b>	Outputs updated every second (As MultiCube)
<b>Accuracy</b>	Test Range 0V to 110% rated voltage $V_{out} > 0.25V$ $\pm 0.5\%$ Reading + MultiCube Errors
<b>Resolution</b>	10 Bit (1024 Levels including over-range)

# Notes

---



Northern Design (Electronics) Ltd,  
228 Bolton Road, Bradford,  
West Yorkshire, BD3 0QW, England.  
Telephone: +44 (0) 1274 729533  
Fax: +44 (0) 1274 721074  
Email: [sales@ndmeter.co.uk](mailto:sales@ndmeter.co.uk)  
Or: [support@ndmeter.co.uk](mailto:support@ndmeter.co.uk)  
Copyright © Northern Design 2001

Mmm-YY QKP