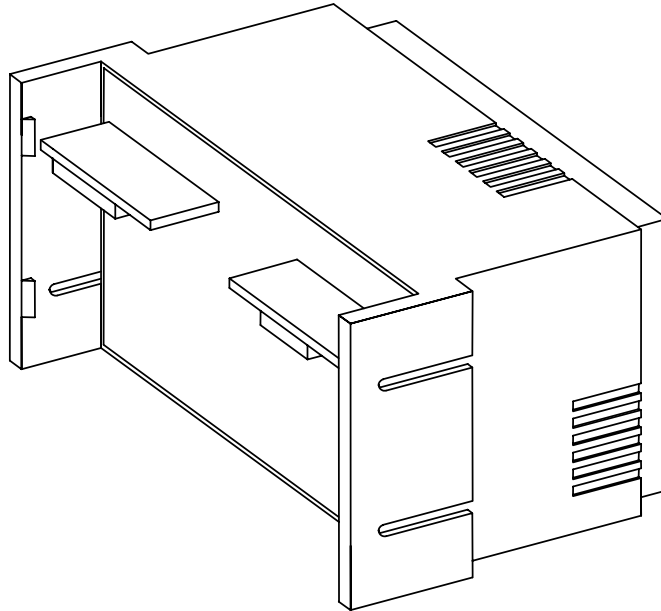


MultiCube Options

Quad Analogue Output



Installation and Operation

PREFACE

**MultiCube
Quad Analogue Output Options Module
Operating Guide
Revision 1.02
May 2001**

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).

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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.

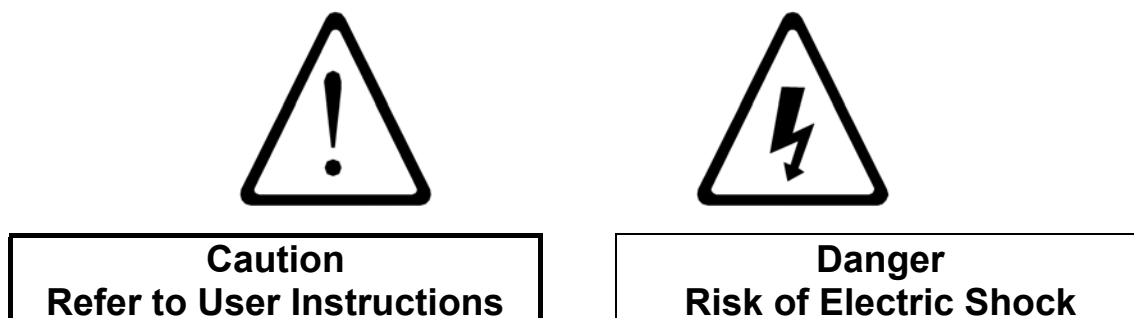


Figure 1-1 Safety Symbols

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).

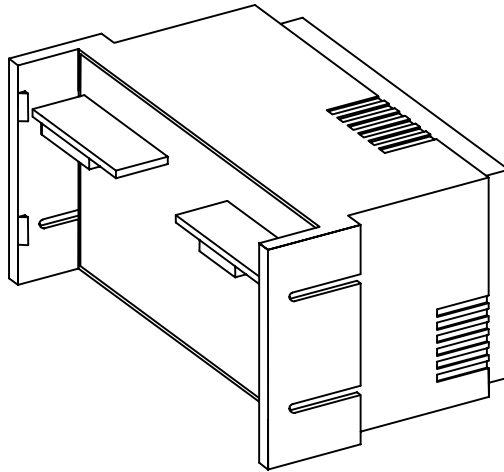


Figure 2-1 Options Module

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.

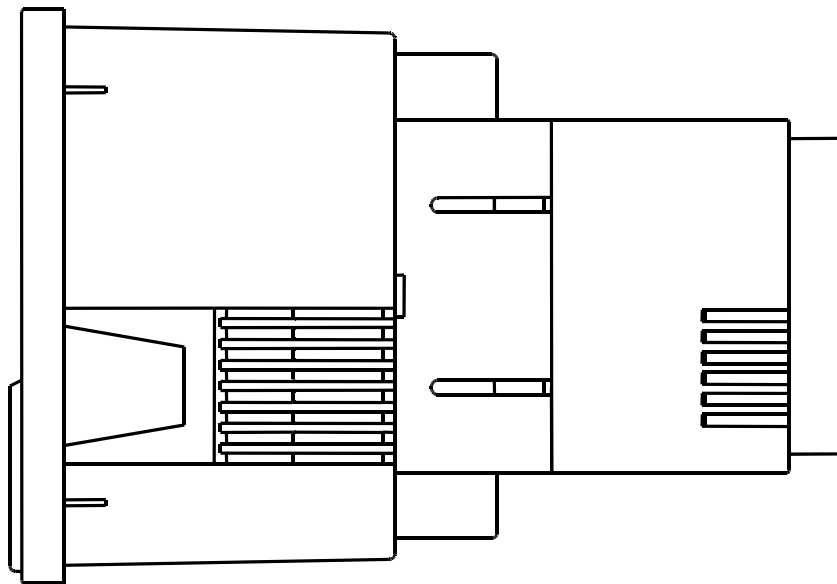


Figure 3-1 Options Module Attached to MultiCube

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

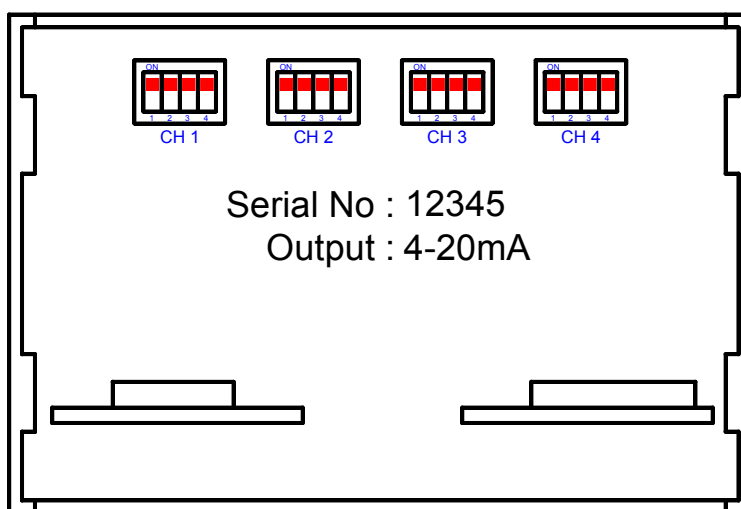


Figure 4-1 Parameter Selection DIP Switches

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 ₁)	ABS (PF ₂)	ABS (PF ₃)	\pm Sys PF
8	ON ■ ■■ ■■	\pm PF ₁	\pm PF ₂	\pm PF ₃	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 ■ ■■ ■■	Sys S	Sys S	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 ■■■■	$V_1 \pm 12.5\%$	$V_2 \pm 12.5\%$	$V_3 \pm 12.5\%$! TEST MODE !

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 (^{ON} ).

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.

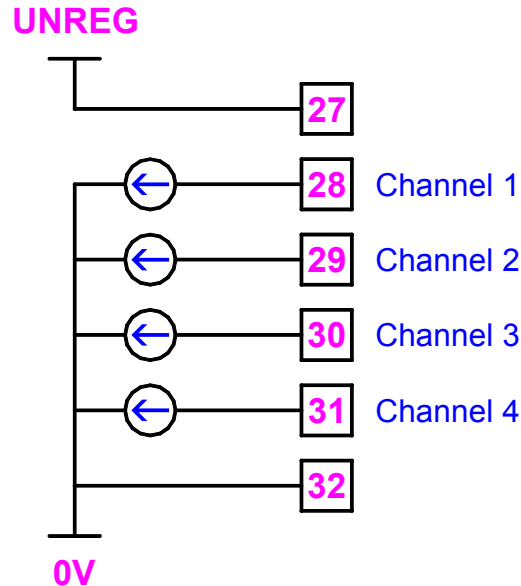


Figure 5-1 Internal 4-20mA Circuit

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.

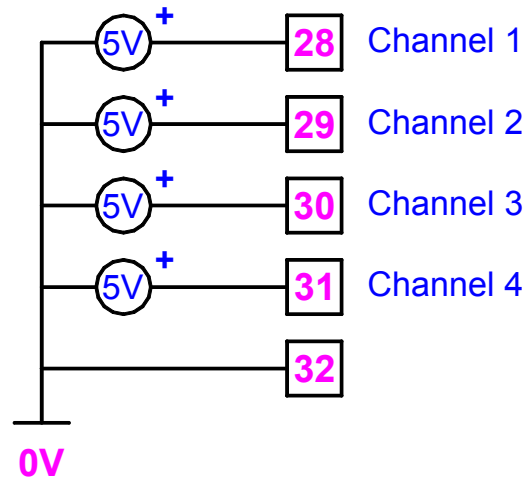


Figure 5-2 Internal Circuit (showing 5V rating)

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

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

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

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

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

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

Notes

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