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Serving the Automation & Control Industry since 1984

Quality System

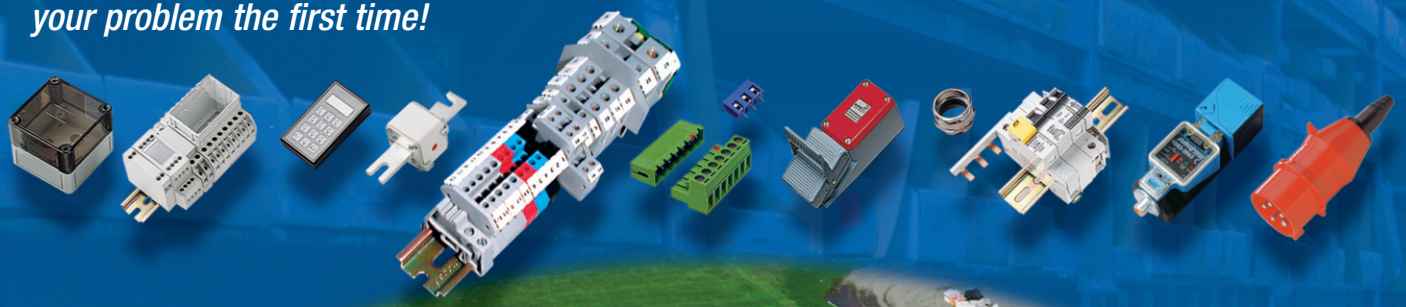
Quality Endorsed Company

Digital Panel Meters

Altech Corp.®

Since 1984, Altech Corporation has grown to become a leading supplier of automation and industrial control components. Headquartered in Flemington, NJ, Altech has an experienced staff of engineering, manufacturing and sales personnel to provide the highest quality products with superior service. This is the Altech Commitment!

With experienced Product Engineers and Customer Service personnel, Altech provides solutions to your most pressing application challenges. All with one thought in mind - ***to ensure that we solve your problem the first time!***



Quality Commitment

Altech's control components meet diverse national and international standards such as UL, NEC, CSA, IEC, VDE and more. Altech provides superior customer service and delivery through Total Quality Management and Continuous Process Improvement. Altech is ISO 9001 approved. We perform these services with honesty and integrity and are committed to achieve these goals.

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Digital Panel Meter Features

RS485 MODBUS Communication (available in MFM, VAF and EM Series)

Pulse Output (24VDC, 100mA)

UL Listed

c UL us

E253771

MFM374-C-CU sample meter.

Faceplate; IP65 Protection Rating

7 Segment LED Display

Available Functions; Voltage, Current, Power, Energy, Frequency and Power Factor (true RMS values)

Standard DIN sizes (1/4 DIN, 1/8 DIN and 1/16 DIN)

RS485 MODBUS Communication (available in MFM, VAF and EM Series)

Pulse Output (24VDC, 100mA)

Analog Bar Graph Indicator for Current Percentage

UL Listed

c UL us

E253771

MFM384-C-CU sample meter.

Faceplate; IP65 Protection Rating

Modern LCD Display

Available Functions; Voltage, Current, Power, Energy, Frequency and Power Factor (true RMS values)

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Selection Guide

Altech®

PART NUMBER	Supply Voltage		Phases		Functions						Display			Pulse Output	RS485 MODBUS Communication	PAGE
	110VAC	85-270VAC	1 Phase	3 Phase	Voltage	Current	Power Factor	Power	Frequency	Energy	LED	LCD	Bar Graph			
MFM384-C-CU		✓		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	6
MFM383A-CU		✓		✓	✓	✓	✓	✓	✓	✓		✓		✓		6
MFM374-CU		✓		✓	✓	✓	✓	✓	✓	✓	✓			✓		7
MFM374-C-CU		✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	7
VAF36A-110V-CU	✓			✓	✓	✓			✓			✓	✓			8
VAF39A-110V-CU	✓			✓	✓	✓			✓		✓					8
EM368-C-CU		✓		✓			✓	✓		✓		✓		✓	✓	9
MA12-110V-CU	✓		✓			✓					✓					10
MA12-50mV-DC-110V-CU	✓		✓			✓					✓					10
MA12-100mV-DC-110V-CU	✓		✓			✓					✓					10
MA501-110V-CU	✓		✓			✓						✓	✓			11
MA2301-110V-CU	✓			✓		✓						✓	✓			11
MV15-110V-CU	✓		✓		✓						✓					12
MV15-DC-20V-110V-CU	✓		✓		✓						✓					12
MV15-DC-200V-110V-CU	✓		✓		✓						✓					12
MV507-110V-CU	✓		✓		✓							✓	✓			13
MV2307-110V-CU	✓			✓	✓							✓	✓			13
MF16-110V-CU	✓		✓						✓		✓					14
MP14-110V-CU	✓		✓					✓			✓					14

DIGITAL PANEL METERS

MFM Series (Multi-Function Meters)

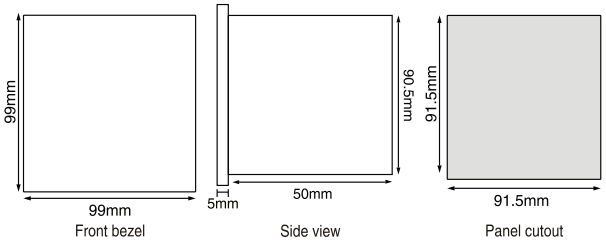
FEATURES

- Measurement Functions
  - **3 Ø Voltage (True RMS)**
  - **3 Ø Current (True RMS)**
  - **3 Ø Power Factor**
  - **3 Ø Power (Active, Reactive, Apparent)**
  - **Energy (Active, Reactive, Apparent)**
  - **Frequency**
- Programmable CT/ PT Primary/ Secondary
- RS485 Modbus RTU Communication
- Single Pulse Output

E253771

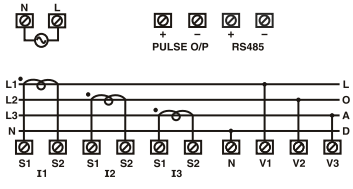
CAT. NO.	MFM384-C-CU	MFM383A-CU
Display		
Display Type	LCD Display with backlight	LCD Display with backlight
Digits	4 rows of 4 digits 1 row of 8 digits for energy display	3 rows of 4 digits 1 row of 7.5 digits for energy display
Bargraph	Bargraph for current percentage	–
Display Scrolling	Automatic/ Manual	Automatic/ Manual
Supply Specification	85 ~ 270 VAC (50/ 60Hz)	85 ~ 270 VAC (50/ 60Hz)
Input Specification		
Electrical Wire System	3 Phase (3/4 wires), 2 Phase (3 wire), 1 Phase (2 wire)	3 Phase (3/4 wires), 2 Phase (3 wire), 1 Phase (2 wire)
Input Voltage Range	11 ~ 300 VAC (Phase to Neutral) 19 ~ 519 VAC (Phase to Phase)	11 ~ 300 VAC (Phase to Neutral) 19 ~ 519 VAC (Phase to Phase)
Input Current Range	10mA ~ 5A (External CT required for current >5A)	10mA ~ 5A (External CT required for current >5A)
Frequency	45 ~ 65Hz	45 ~ 65Hz
Parameter Resolution		
Energy	0.01k, 0.1k, 1k, 0.01M, 0.1M, 1M	0.01k, 0.1k, 1k depending on CT ratio x PT ratio
Power, Voltage, Current	Auto resolution	Auto resolution
Power Factor	0.001	0.001
Accuracy Class		
Voltage (L-N, L-L), Current	+/- 0.5% of Full-Scale Value	+/- 0.5% of Full-Scale Value
Power Factor	+/-1%	+/-1%
Frequency	0.1 Hz +/- 0.1 Hz	0.1 Hz +/- 0.1 Hz
Active, Reactive, Apparent Power	1%	1%
Active, Reactive, Apparent Energy	Class 1	Class 1
Output Specifications		
Pulse Output	1	1
Pulse Voltage	24 VDC max.	24 VDC max.
Pulse Current	100mA max.	100mA max.
Pulse Duration	100ms +/-5ms	100ms +/-5ms
Communication	RS485 MODBUS Communication	–
Programmable Parameters		
CT Primary	1A/ 5A ~ 10,000A (Programmable for any value)	1A/ 5A ~ 10,000A (Programmable for any value)
CT Secondary	1A/ 5A (External CT must be connected for current >5A)	1A/ 5A (External CT must be connected for current >5A)
PT Primary	100V ~ 500 kV (any value)	100V ~ 10 kV (any value)
PT Secondary	100V ~ 500 VAC (any value)	100V ~ 500 VAC (any value)
Environmental Specifications		
Temperature	Operating: -10°C~55°C, Storage: -20°C~ 75°C	Operating: -10°C~55°C, Storage: -20°C~ 75°C
Humidity	Up to 85% RH	Up to 85% RH
Protection Level	IP65 for Faceplate	IP65 for Faceplate
Physical Specifications		
Size	1/4 DIN, 96 mm x 96 mm	1/4 DIN, 96 mm x 96 mm
Weight	0.70 lbs (318g)	0.70 lbs (318g)
Terminal Size Acceptability and Torque	20-14 AWG (0.5 - 2.5mm²), 6-7 lb-in. (0.68 - 0.79Nm)	20-14 AWG (0.5 - 2.5mm²), 6-7 lb-in. (0.68 - 0.79Nm)

DIMENSIONS

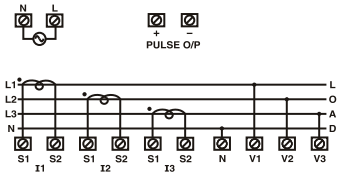


MFM Series

TERMINAL CONNECTIONS



MFM384-C-CU



MFM383A-CU

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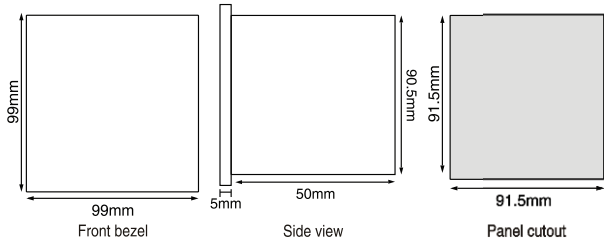
FEATURES

- Measurement Functions
  - **3 Ø Voltage (True RMS)**
  - **3 Ø Current (True RMS)**
  - **3 Ø Power Factor**
  - **3 Ø Power (Active, Reactive, Apparent)**
  - **Energy (Active, Reactive, Apparent)**
  - **Frequency**
- Programmable CT/ PT Primary/ Secondary
- RS485 Modbus RTU Communication
- Single Pulse Output

Please contact Altech for UL status.

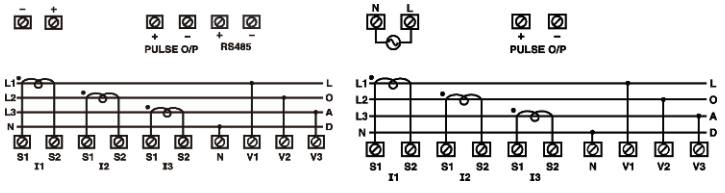
CAT. NO.	MFM374-C-CU	MFM374-CU
Display		
Display Type	7 Segment LED Display	7 Segment LED Display
Digits	3 rows of 4 digits 8 digits for energy display	3 rows of 4 digits 8 digits for energy display
Bargraph	–	–
Display Scrolling	Automatic/ Manual	Automatic/ Manual
Supply Specification	85 ~ 270 VAC (50/ 60Hz)	85 ~ 270 VAC (50/ 60Hz)
Input Specification		
Electrical Wire System	3 Phase (3/4 wires), 2 Phase (3 wire), 1 Phase (2 wire)	3 Phase (3/4 wires), 2 Phase (3 wire), 1 Phase (2 wire)
Input Voltage Range	11 ~ 300 VAC (Phase to Neutral) 19 ~ 519 VAC (Phase to Phase)	11 ~ 300 VAC (Phase to Neutral) 19 ~ 519 VAC (Phase to Phase)
Input Current Range	10mA ~ 5A (External CT required for current >5A)	10mA ~ 5A (External CT required for current >5A)
Frequency	45 ~ 65Hz	
Parameter Resolution		
Energy	0.01k, 0.1k, 1k, 0.01M, 0.1M, 1M	0.01k, 0.1k, 1k, 0.01M, 0.1M, 1M
Power, Voltage, Current	Auto resolution	Auto resolution
Power Factor	0.001	0.001
Accuracy Class		
Voltage (L-N, L-L), Current	+/- 0.5% of Full-Scale Value	+/- 0.5% of Full-Scale Value
Power Factor	+/-1%	+/-1%
Frequency	0.1 Hz	0.1 Hz
Active, Reactive, Apparent Power	1%	1%
Active, Reactive, Apparent Energy	Class 1	Class 1
Output Specifications		
Pulse Output	1	1
Pulse Voltage	24 VDC max.	24 VDC max.
Pulse Current	100mA max.	100mA max.
Pulse Duration	100ms +/-5ms	100ms +/-5ms
Communication	RS485 MODBUS Communication	–
Programmable Parameters		
CT Primary	1A/ 5A ~ 10,000A (Programmable for any value)	1A/ 5A ~ 10,000A (Programmable for any value)
CT Secondary	1A/ 5A (External CT must be connected for current >5A)	1A/ 5A (External CT must be connected for current >5A)
PT Primary	100V ~ 500 kV (any value)	100V ~ 10 kV (any value)
PT Secondary	100V ~ 500 VAC (any value)	100V ~ 500 VAC (any value)
Environmental Specifications		
Temperature	Operating: -10°C~55°C, Storage: -20°C~ 75°C	Operating: -10°C~55°C, Storage: -20°C~ 75°C
Humidity	Up to 85% RH	Up to 85% RH
Protection Level	IP65 for Faceplate	IP65 for Faceplate
Physical Specifications		
Size	1/4 DIN, 96 mm x 96 mm	1/4 DIN, 96 mm x 96 mm
Weight	0.71 lbs (320g)	0.71 lbs (320g)
Terminal Size Acceptability and Torque	20-14 AWG (0.5 - 2.5mm²), 6-7 lb-in. (0.68 - 0.79Nm)	20-14 AWG (0.5 - 2.5mm²), 6-7 lb-in. (0.68 - 0.79Nm)

DIMENSIONS



MFM Series

TERMINAL CONNECTIONS



MFM374-C-CU **MFM374A-CU**

DIGITAL PANEL METERS

VAF Series (Volt-Ampere-Frequency Meters)

FEATURES

- Measurement Functions
  - **3 Ø Voltage (True RMS)**
  - **3 Ø Current (True RMS)**
  - **Frequency**
  - **RPM**
  - **Run Hour**
- Programmable CT Primary, PT Primary/Secondary

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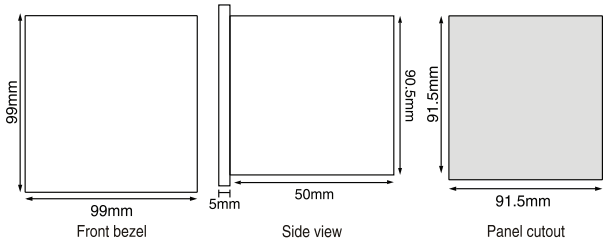
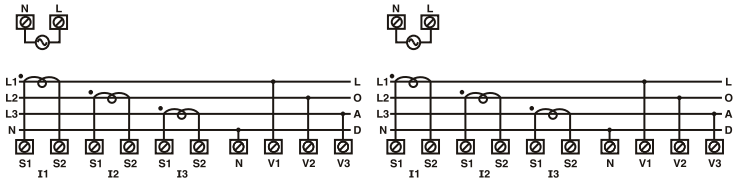
CAT. NO.	VAF36A-110V-CU	VAF39A-110V-CU
Display		
Display Type	LCD Display with backlight	7 Segment LED Display
Digits	3 rows of 3 digits	3 rows of 3 digits
Bargraph	Bargraph for current percentage	–
Display Scrolling	Automatic/ Manual	Automatic/ Manual
Supply Specification	110 VAC +/- 20% (50/60Hz)	110 VAC +/- 20% (50/60Hz)
Input Specification		
Electrical Wire System	3 Phase (3/4 wires)	3 Phase (3/4 wires)
Input Voltage Range	11 ~ 300 VAC (Phase to Neutral) 19 ~ 519 VAC (Phase to Phase)	11 ~ 300 VAC (Phase to Neutral) 19 ~ 519 VAC (Phase to Phase)
Input Current Range	20mA ~ 6A (External CT required for current >5A)	20mA ~ 6A (External CT required for current >5A)
Frequency	45 ~ 65Hz	45 ~ 65Hz
Parameter Resolution		
Current	0.01, 0.1, 1 A/KA	0.01, 0.1, 1 A/KA
Voltage	0.1 V/KV	0.1 V/KV
RPM	0.1	0.1
Run Hour	0.1 hr (0~99999.9 hr)	0.1 hr (0~99999.9 hr)
Accuracy Class		
Voltage (L-N, L-L), Current	+/- 0.5% of Full-Scale Value, +/- 2 digits	+/- 0.5% of Full-Scale Value, +/- 2 digits
Average Voltage (L-N, L-L), Current	+/-0.5% of Full-Scale Value, +/- 2 digits	+/-0.5% of Full-Scale Value, +/- 2 digits
Frequency	0.1 Hz	0.1 Hz
RPM	+/- 0.5%	+/- 0.5%
Run Hour	+/- 1%	+/- 1%
Output Specifications		
Pulse Output	–	–
Communication	–	–
Programmable Parameters		
CT Primary	5A ~ 10,000A (Programmable for any value)	5A ~ 10,000A (Programmable for any value)
CT Secondary	5A fixed (External CT must be connected for current >5A)	5A fixed (External CT must be connected for current >5A)
PT Primary	100V ~ 500 kV (any value)	100V ~ 500 kV (any value)
PT Secondary	100V ~ 500 VAC (any value)	100V ~ 500 VAC (any value)
Environmental Specifications		
Temperature	Operating: -10°C~55°C, Storage: -20°C~ 75°C	Operating: -10°C~55°C, Storage: -20°C~ 75°C
Humidity	Up to 85% RH	Up to 85% RH
Protection Level	IP65 for Faceplate	IP65 for Faceplate
Physical Specifications		
Size	1/4 DIN, 96 mm x 96 mm	1/8 DIN, 48 mm x 96 mm
Weight	0.79 lbs (357g)	0.79 lbs (357g)
Terminal Size Acceptability and Torque	20-14 AWG (0.5 - 2.5mm²), 6-7 lb-in. (0.68 - 0.79Nm)	20-14 AWG (0.5 - 2.5mm²), 6-7 lb-in. (0.68 - 0.79Nm)

DIMENSIONS



VAF Series

TERMINAL CONNECTIONS



VAF36A-110V-CU

VAF39A-110V-CU

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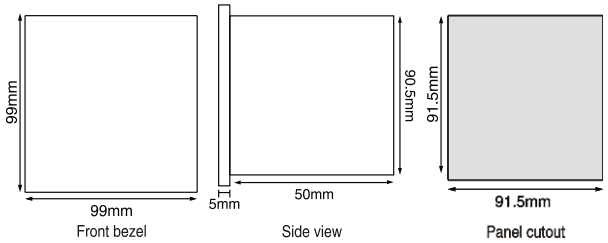
FEATURES

- Measurement Functions
  - **3 Ø Power (Active, Reactive, Apparent)**
  - **3 Ø Power Factor**
  - **Energy (Active, Reactive, Apparent)**
- Programmable CT Primary, PT Primary/Secondary
- RS485 Modbus RTU Communication
- Single Pulse Output

E253771

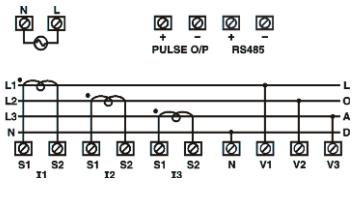
CAT. NO.	EM368-C-CU
Display	
Display Type	LCD Display with backlight
Digits	8 digits
Bargraph	–
Display Scrolling	Automatic
Supply Specification	85 ~ 270 VAC (50/ 60Hz)
Input Specification	
Electrical Wire System	3 Phase (3/4 wires)
Input Voltage Range	11 ~ 300 VAC (Phase to Neutral) 19 ~ 519 VAC (Phase to Phase)
Input Current Range	10mA ~ 5A (External CT required for current >5A)
Frequency	45 ~ 65Hz
Parameter Resolution	
Energy	0.01k, 0.1k, 1k, 0.01M, 0.1M, 1M, 10M
Power	Auto resolution
Power Factor	0.01
Accuracy Class	
Power Factor	+/-1%
Active, Reactive, Apparent Power	+/-1%
Active, Reactive, Apparent Energy	Class 1
Output Specifications	
Pulse Output	1
Pulse Voltage	24 VDC max.
Pulse Current	100mA max.
Pulse Duration	100ms +/-5ms
Communication	RS485 MODBUS Communication
Programmable Parameters	
CT Primary	1A/ 5A ~ 10,000A (Programmable for any value)
CT Secondary	1A/ 5A (External CT must be connected for current >5A)
PT Primary	100V ~ 500 kV (any value)
PT Secondary	100V ~ 500 VAC (any value)
Environmental Specifications	
Temperature	Operating: -10°C~55°C, Storage: -20°C~ 75°C
Humidity	Up to 85% RH
Protection Level	IP65 for Faceplate
Physical Specifications	
Size	1/4 DIN, 96 mm x 96 mm
Weight	0.69 lbs (312g)
Terminal Size Acceptability and Torque	20-14 AWG (0.5 - 2.5mm²), 6-7 lb-in. (0.68 - 0.79Nm)

DIMENSIONS



EM Series

TERMINAL CONNECTIONS



EM368-C

DIGITAL PANEL METERS

MA12 Series (LED Ampere Meters)

FEATURES

- Measurement Function
  - **1 Ø Current (True RMS)**
- Programmable CT Primary / Shunt Setting
- AC version (CT Type)
- DC version (Shunt Type, External Shunt (50mV/100mV) is required for measurement.)
- 4 Digit LED Display

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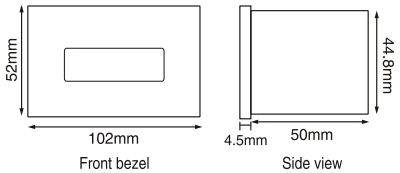
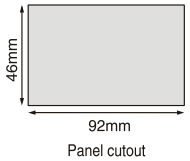
CAT. NO.	MA12-110V-CU	MA12-50mV-DC-110V-CU MA12-100mV-DC-110V-CU
Display		
Display Type	7 segment LED display	7 segment LED display
Digits	4 digits	4 digits
Bargraph	–	–
Display Range	0 - 4960A	0 - 4960A
Supply Specification	110 VAC +/-20% (60Hz)	110 VAC +/-20% (60Hz)
Input Specification		
Electrical Wire System	1 Phase (2 wire)	1 Phase (2 wire)
Measurement Type	AC, CT Type (External CT required for current > 5A)	DC, Shunt Type (External shunt is required for current > 5A)
Shunt Size	–	**50mV (MA12-50mV) 100mV (MA12-100mV)**
Input Current Range	50mA ~ 5A (External CT required for current >5A)	50mA ~ 5A (External shunt required for current >5A)
Frequency Range	45 ~ 65Hz	45 ~ 65Hz
Parameter Resolution		
Current	0.001, 0.01, 0.1, 1A (depending on CT Primary)	0.001, 0.01, 0.1, 1A (depending on shunt setting)
Sampling Rate	3 samples / sec.	3 samples / sec.
Accuracy Class		
Current	+/- 0.5% of Full-Scale Value	+/- 0.5% of Full-Scale Value
Output Specifications		
Pulse Output	–	–
Communication	–	–
Programmable Parameters		
CT Primary / Shunt Setting	5, 10, 20, 30, 40, 50, 60, 75, 80, 100, 150, 200, 250, 300, 400, 500, 600, 800, 1000, 1200, 1500, 1600, 2000, 2500, 3000, 4000	5, 10, 20, 30, 40, 50, 60, 75, 80, 100, 150, 200, 250, 300, 400, 500, 600, 800, 1000, 1200, 1500, 1600, 2000, 2500, 3000, 4000
CT Secondary	5A fixed (External CT must be connected for current >5A)	–
Environmental Specifications		
Temperature	Operating: -10°C~55°C, Storage: -20°C~ 75°C	Operating: -10°C~55°C, Storage: -20°C~ 75°C
Humidity	Up to 85% RH	Up to 85% RH
Protection Level	IP65 for Faceplate	IP65 for Faceplate
Physical Specifications		
Size	1/8 DIN, 48 mm x 96 mm	1/8 DIN, 48 mm x 96 mm
Weight	0.37 lbs (170g)	0.37 lbs (170g)
Terminal Size Acceptability and Torque	20-14 AWG (0.5 - 2.5mm²), 6-7 lb-in. (0.68 - 0.79Nm)	20-14 AWG (0.5 - 2.5mm²), 6-7 lb-in. (0.68 - 0.79Nm)

DIMENSIONS





MA12 Series

TERMINAL CONNECTIONS

MA12-110V-CU (CT Type)

MA12-mV-DC-110V-CU (Shunt Type)

230 VAC versions also available, please consult Altech.

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FEATURES

- Measurement Functions
  - **1 Ø Current (True RMS)**
  - **3 Ø Current (True RMS)**
- Integrated selector switch for phase selection (MA2301)
- LCD Display with Backlight
- Bargraph Indicator

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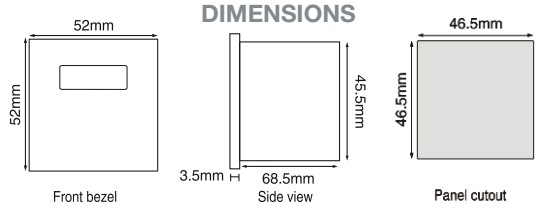
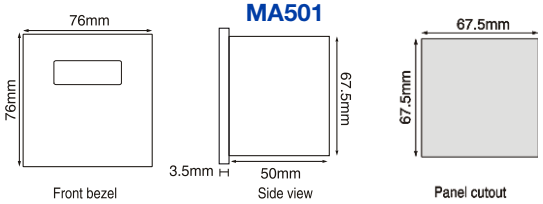
CAT. NO.	MA501-110V-CU	MA2301-110V-CU
Display		
Display Type	LCD display with backlight	LCD display with backlight
Digits	4 digits	4 digits
Bargraph	Analog bargraph indicator	Analog bargraph indicator
Display Range	0 ~ 6200A	0 ~ 6200A
Display Scrolling	–	manual phase selector switch
Supply Specification	110 VAC +/-20% (60Hz)	85 ~ 270 VAC (50/ 60Hz)
Input Specification		
Electrical Wire System	1 Phase (2 wire)	3 Phase/4 wire
Measurement Type	AC, CT Type (External CT required for current > 5A)	AC, CT Type (External CT required for current > 5A)
Input Current Range	50mA ~ 5A (External CT required for current >5A)	50mA ~ 5A (External CT required for current >5A)
Frequency Range	45 ~ 65Hz	45 ~ 65Hz
Parameter Resolution		
Current	0.001, 0.01, 0.1, 1A (depending on CT Primary)	0.001, 0.01, 0.1, 1A (depending on CT Primary)
Sampling Rate	3 samples / sec.	3 samples / sec.
Accuracy Class		
Current	+/- 0.5% of Full-Scale Value	+/- 0.5% of Full-Scale Value
Output Specifications		
Pulse Output	–	–
Communication	–	–
Programmable Parameters		
CT Primary	5, 10, 20, 30, 40, 50, 60, 75, 80, 100, 125, 150, 200, 250, 300, 400, 500, 600, 800, 1000, 1200, 1500, 1600, 2000, 2250, 2500, 3000, 4000, 5000	5, 10, 20, 30, 40, 50, 60, 75, 80, 100, 125, 150, 200, 250, 300, 400, 500, 600, 800, 1000, 1200, 1500, 1600, 2000, 2250, 2500, 3000, 4000, 5000
CT Secondary	5A fixed (External CT must be connected for current >5A)	5A fixed (External CT must be connected for current >5A)
Environmental Specifications		
Temperature	Operating: -10°C~55°C, Storage: -20°C~ 75°C	Operating: -10°C~55°C, Storage: -20°C~ 75°C
Humidity	Up to 85% RH	Up to 85% RH
Protection Level	IP65 for Faceplate	IP65 for Faceplate
Physical Specifications		
Size	1/16 DIN, 48 mm x 48mm	72 mm x 72 mm
Weight	0.25 lbs (113g)	0.40 lbs (163g)
Terminal Size Acceptability and Torque	20-14 AWG (0.5 - 2.5mm²), 6-7 lb-in. (0.68 - 0.79Nm)	20-14 AWG (0.5 - 2.5mm²), 6-7 lb-in. (0.68 - 0.79Nm)

DIMENSIONS

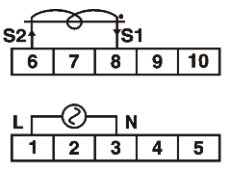


MA501

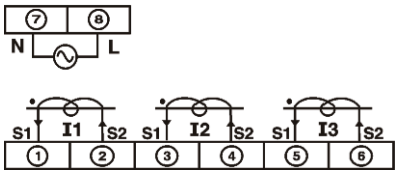


MA2301

TERMINAL CONNECTIONS



MA501-110V-CU



MA2301-110V-CU

230 VAC versions also available, please consult Altech.

DIGITAL PANEL METERS

MV15 Series (LED Voltage Meters)

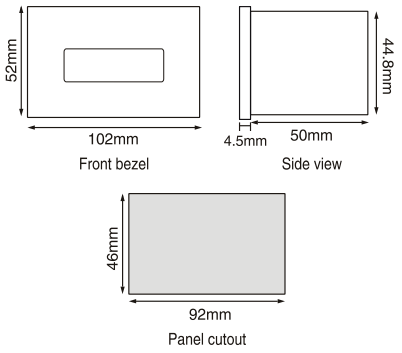
FEATURES

- Measurement Function
  - **1 Ø Voltage (True RMS)**
- 3 Digit LED Display

E253771

CAT. NO.	MV15-110V-CU	MV15-DC-20V-110V-CU MV15-DC-200V-110V-CU
Display		
Display Type	7 segment LED Display	7 segment LED Display
Digits	3 digits	3 digits
Bargraph	–	–
Display Range	0 - 516V	0 - 516V
Supply Specification	110 VAC +/-20% (60Hz)	110 VAC +/-20% (60Hz)
Input Specification		
Electrical Wire System	1 Phase (2 wire)	1 Phase (2 wire)
Input Voltage Range	50 ~ 516 VAC	**0 ~ 20 VDC (MV15-20V) 0 ~ 200 VDC (MV15-200V)**
Frequency	50/60 Hz	50/60 Hz
Input Impedance	1 MΩ (+/-5%)	1 MΩ (+/-5%)
Parameter Resolution		
Voltage	1V	1V
Sample Rate	3 samples / sec.	3 samples / sec.
Accuracy Class		
Voltage	+/- 0.5% of Full-Scale Value	+/- 0.5% of Full-Scale Value
Output Specifications		
Pulse Output	–	–
Communication	–	–
Programmable Parameters	–	–
Environmental Specifications		
Temperature	Operating: -10°C~55°C, Storage: -20°C~ 75°C	Operating: -10°C~55°C, Storage: -20°C~ 75°C
Humidity	Up to 85% RH	Up to 85% RH
Protection Level	IP65 for Faceplate	IP65 for Faceplate
Physical Specifications		
Size	1/8 DIN, 48 mmx 96 mm	1/8 DIN, 48 mmx 96 mm
Weight	0.38 lbs (170g)	0.38 lbs (170g)
Terminal Size Acceptability and Torque	20-14 AWG (0.5 - 2.5mm²), 6-7 lb-in. (0.68 - 0.79Nm)	20-14 AWG (0.5 - 2.5mm²), 6-7 lb-in. (0.68 - 0.79Nm)

DIMENSIONS



MV15 Series

TERMINAL CONNECTIONS

MV15-110V-CU (AC Type)

MV15-DC-20V-110V-CU (DC Type)
MV15-DC-200V-110V-CU (DC Type)

230 VAC versions also available, please consult Altech.

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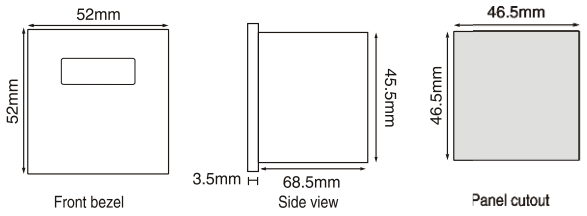
FEATURES

- Measurement Functions
  - **1 Ø Voltage (True RMS)**
  - **3 Ø Voltage (True RMS)**
- Integrated selection switch for Phase Selection (MV2307)
- LCD Display with Backlight
- Bargraph Indicator

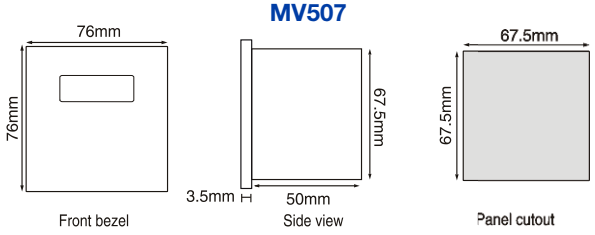
E253771

CAT. NO.	MV507-110V-CU	MV2307-110V-CU
Display		
Display Type	LCD display with backlight	LCD display with backlight
Digits	3 digits	3 digits
Bargraph	Analog style bargraph indicator	Analog style bargraph indicator
Display Range	0 - 516V	0 - 516V
Display Scrolling	–	manual phase selector switch
Supply Specification	110 VAC +/-20% (60Hz)	110 VAC +/-20% (60Hz)
Input Specification		
Electrical Wire System	1 Phase (2 wire)	3 Phase/4 wire
Input Voltage Range	50 ~ 516 VAC	50 ~ 516 VAC
Frequency	60 Hz	60 Hz
Input Impedance	1 MΩ (+/-5%)	1 MΩ (+/-5%)
Parameter Resolution		
Voltage	1V	1V
Sample Rate	3 samples / sec.	3 samples / sec.
Run Hour		
Accuracy Class		
Voltage	+/- 0.5% of Full-Scale Value	+/- 0.5% of Full-Scale Value
Output Specifications		
Pulse Output	–	–
Communication	–	–
Programmable Parameters	–	–
Environmental Specifications		
Temperature	Operating: -10°C~55°C, Storage: -20°C~ 75°C	Operating: -10°C~55°C, Storage: -20°C~ 75°C
Humidity	Up to 85% RH	Up to 85% RH
Protection Level	IP65 for Faceplate	IP65 for Faceplate
Physical Specifications		
Size	1/16 DIN, 48 mm x 48mm	72 mm x 72 mm
Weight	0.36 lbs (165g)	0.43 lbs (194g), 0.45 lbs (206g)
Terminal Size Acceptability and Torque	20-14 AWG (0.5 - 2.5mm²), 6-7 lb-in. (0.68 - 0.79Nm)	20-14 AWG (0.5 - 2.5mm²), 6-7 lb-in. (0.68 - 0.79Nm)

DIMENSIONS

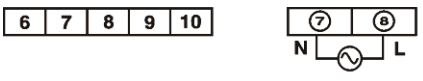


MV507

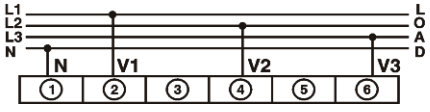


MV2307

TERMINAL CONNECTIONS



MV507



MV2307

230 VAC versions also available, please consult Altech.

DIGITAL PANEL METERS

MF16 Series (Frequency Meter) - MP14 Series (Power Factor Meter)

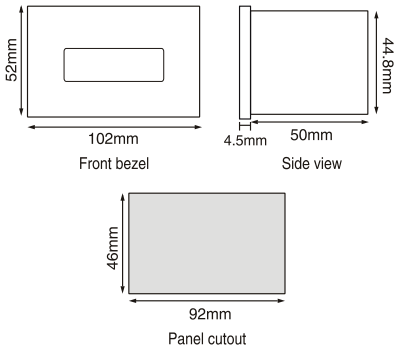
FEATURES

- Measurement Function
  - **Frequency (MF16)**
  - **Power Factor (MP16)**
- 4 Digit LED Display

CE
c UL us
E253771

CAT. NO.	MF16-110V-CU	MP14-110V-CU
Display		
Display Type	7 segment LED Display	7 segment LED Display
Digits	4 digits	4 digits
Bargraph	–	–
Display Range	45.00 ~ 65.00 Hz	-1.000 ~ +1.000
Supply Specification	110 VAC +/- 20% (60Hz)	110 VAC +/- 20% (60Hz)
Input Specification		
Electrical Wire System	1 Phase (2 wire)	1 Phase (2 wire)
Input Current Range	–	0.25 ~ 6A
Frequency Range	45 ~ 65 Hz	50/60Hz
Parameter Resolution		
Frequency	0.01 Hz	–
Power Factor	–	0.001
Accuracy Class		
Frequency	+/- 0.05Hz	–
Power Factor	–	+/- 0.05% +/- 2 digits
Output Specifications		
Pulse Output	–	–
Communication	–	–
Programmable Parameters	–	–
Environmental Specifications		
Temperature	Operating: -10°C~55°C, Storage: -20°C~ 75°C	Operating: -10°C~55°C, Storage: -20°C~ 75°C
Humidity	Up to 85% RH	Up to 85% RH
Protection Level	IP65 for Faceplate	IP65 for Faceplate
Physical Specifications		
Size	1/8 DIN, 48 mmx 96 mm	1/8 DIN, 48 mmx 96 mm
Weight	0.37 lbs (170g)	0.37 lbs (170g)
Terminal Size Acceptability and Torque	20-14 AWG (0.5 - 2.5mm²), 6-7 lb-in. (0.68 - 0.79Nm)	20-14 AWG (0.5 - 2.5mm²), 6-7 lb-in. (0.68 - 0.79Nm)

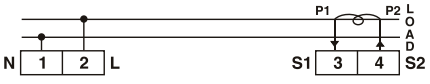
DIMENSIONS



MF / MP Series

TERMINAL CONNECTIONS

MF16-110V-CU



MP14-110V-CU

230 VAC versions also available, please consult Altech.

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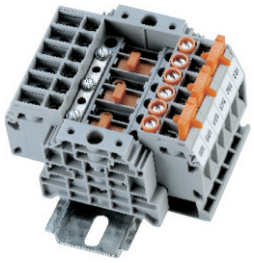
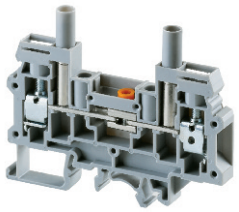




Disconnect and Test Terminals Blocks are an ideal choice for measuring control and regulatory circuits. The terminals provide a clear functional advantage for devices having utility instruments and associated transformers when it is mandatory to keep the secondary side shorted at any point while taking current measurements. Specially designed socket head screws act as test/monitoring points.

In the **CDS6U** separate testing points facilitate insertion of test probes. Disconnection is achieved by means of a slide link operated with a Screw Driver.

In the **CDS6U/TS**, the insulated test point screw system **(TPSLS)** is integrated.

The **SLS2** and **SLS4** slide shorting link can be used in combination with either the supplied screw or the **TPSLS** Test point screw system.

Lock out cap LCCDS can be used to lock the center shorting screw, to prevent accidental opening of circuits.

Specially designed socket head screws act as test/monitoring points in CDTTU and CDTTU-SH.

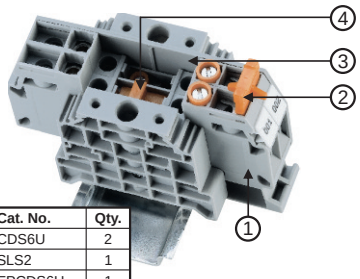
	CDS6U			CDS6U/TS		
Terminal Width	8 mm			8 mm		
Height x Length	50 x 82 mm			50 x 82 mm		
Stripping Length	10 mm			10 mm		
Insulation Material	Polyamide 6.6			Polyamide 6.6		
Type of Connection	2 screw clamps			2 screw clamps		
Approvals	c SP us	IEC 60947-7-1	c UL us E220514	c SP us	IEC 60947-7-1	c UL us E220514
Wire Range	22-8 AWG	0.2-6 sq.mm	22-8 AWG	22-8 AWG	0.2-6 sq.mm	22-8 AWG
Voltage Rating	600 V	800 V	600 V	600 V	630 V	600 V
Current Rating	45 A	41 A	45 A	45 A	41 A	45 A
Torque	14 lb-in	0.8 Nm	14 lb-in	14 lb-in	0.8 Nm	14 lb-in
Other Approvals	RoHS, CE, VDE			RoHS, CE		

		Cat. No.	Std. Pk.	Cat. No.	Std. Pk.
Terminal Block		**CDS6U**	50	**CDS6U/TS**	50
End Plate		EPCDS6U	50	EPCDS6U	50
DIN Rail for ordering info.		32mm 35mm, 35mm		32mm 35mm, 35mm	
End Stop		CA702 CA802	50 50	CA702 CA802	50 5
Internal Jumper	2 pole 3 pole 4 pole 5pole 10 pole	CA723/2 CA723/3 CA723/4 CA723/5 CA723/10	100 50 50 50 10	CA723/2 CA723/3 CA723/4 CA723/5 CA723/10	100 50 50 50 10
Slide Shorting Link	2 pole 4 pole	SLS2 SLS4	50 25	SLS2 SLS4	50 25
Insulated Test Socket	Gray Red Yellow Blue Black	TPSLS TPSLSR TPSLSY TPSLSBU TPSLSBK	100 100 100 100 100	TPSLSR TPSLSY TPSLSBU TPSLSBK	100 100 100 100
Switchable Link Assembly		SWCDS	50	SWCDS	50
Lock Out Cap		LCCDS	50	LCCDS	50
Marking Tags		MT8	100	MT8	100

DIGITAL PANEL METERS

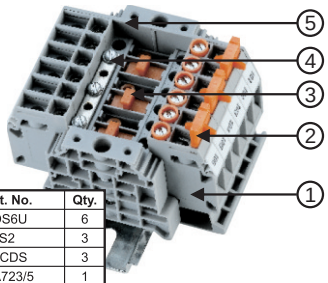
Usage of Altech Disconnect & Test Terminal Block
In Ampere Meter / Current Transformer Circuits

1 Phase



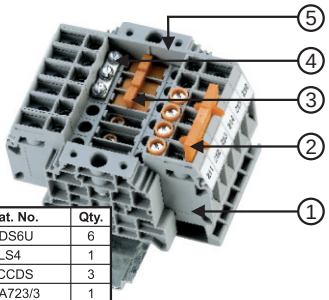
No.	Cat. No.	Qty.
1	CDS6U	2
2	SLS2	1
3	EPCDS6U	1
4	LCCDS	1

3 Phase
(internal distribution of K-Point)



No.	Cat. No.	Qty.
1	CDS6U	6
2	SLS2	3
3	LCCDS	3
4	CA723/5	1
5	EPCDS6U	1

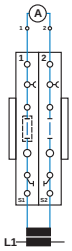
3 Phase
(linked)

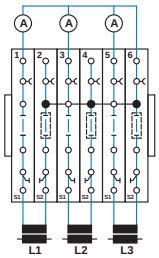


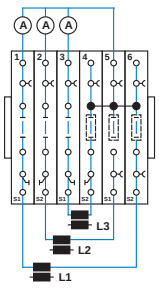
No.	Cat. No.	Qty.
1	CDS6U	6
2	SLS4	1
3	LCCDS	3
4	CA723/3	1
5	EPCDS6U	1

Operating status

SLS2 / SLS4 in open condition

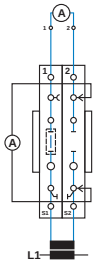




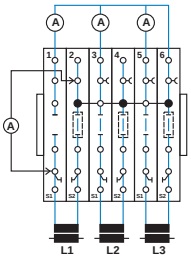


Comparison measurement for L1

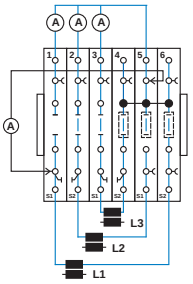
SLS2 / SLS4 in open condition



Sequence for test:
1) Remove SLS2 screw from terminal 2.
2) Connect ammeter to test sockets of terminal 2.
3) Open disconnect slide link of terminal 2.



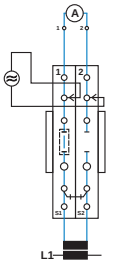
Sequence for test :
1) Remove SLS2 screw from terminal 1.
2) Connect ammeter to test sockets of terminal 1 and 2.
3) Open disconnect slide link of terminal 1.



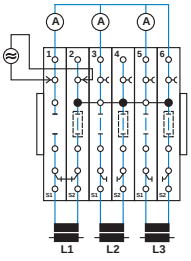
Sequence for test :
1) Remove SLS4 screw from terminal 1.
2) Connect ammeter to test sockets of terminal 1 and 5.
3) Open disconnect slide link of terminal 1.

Meter test for L1 through external power supply

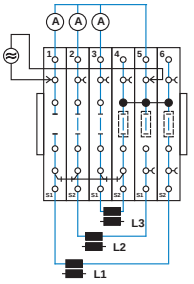
Closing of SLS2 / SLS4



Sequence for test:
1) Close short circuit slide SLS2 of terminals 1 and 2.
2) Open disconnect slide link of terminal 2.
3) Connect external power supply to test sockets of terminals 1 and 2.



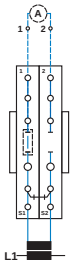
Sequence for test :
1) Close short circuit slide SLS2 of terminals 1 and 2.
2) Open disconnect slide link of terminal 1.
3) Connect external power supply to test sockets of terminals 1 and 2.



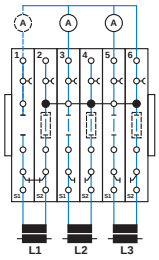
Sequence for test :
1) Close short circuit slide SLS4 of terminals 1,2, 3 and 4.
2) Open disconnect slide link of terminal 1.
3) Connect external power supply to test sockets of terminals 1and 5.

Meter Exchange for L1

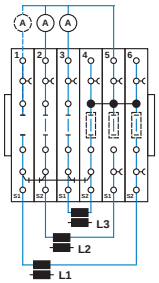
Closing of SLS2 / SLS4



Sequence for test:
1) Close short circuit slide SLS2 of terminals 1 and 2.
2) Open disconnect slide link of terminal 2.
3) Disconnect meter for L1 at terminals 1 and 2.



Sequence for test :
1) Close short circuit slide SLS2 of terminals 1 and 2.
2) Open disconnect slide link of terminal 1.
3) Disconnect meter for L1.



Sequence for test :
1) Close short circuit slide SLS4 of terminals 1,2, 3 and 4.
2) Open disconnect slide link of terminal 1.
3) Disconnect meter for L1.

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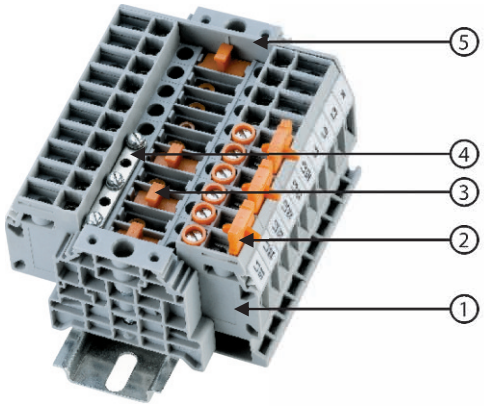
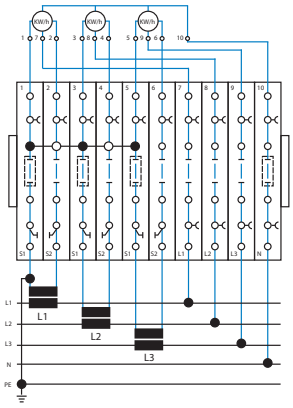


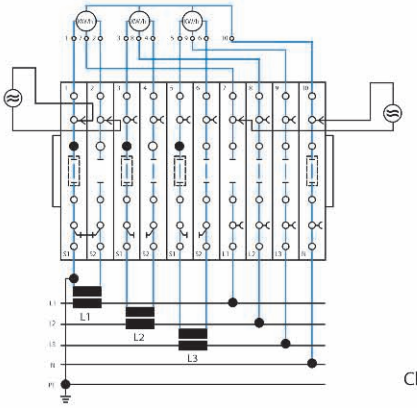
No.	Cat. No.	Qty.
1	CDS6U	10
2	SLS2	3
3	LCCDS	4
4	CA723/5	1
5	EPCDS6U	1

Operating status (with internal distribution of the k-point)



SLS2 in open condition

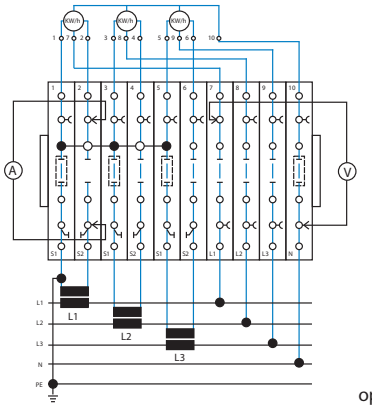
Meter test for L1 through external power supply



Closing of SLS2

Sequence for test :
1) Close short circuit slide SLS2 of terminals 1 and 2.
2) Open disconnect slide link of terminal 2 and 7.
3) Connect external power supply to test sockets of terminals 1, 2 and 7, 10.

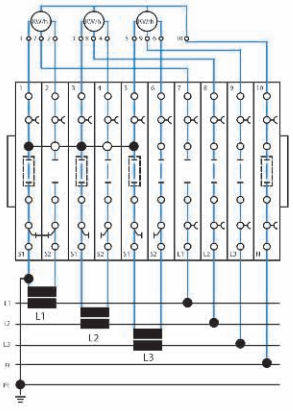
Comparison measurement for L1



SLS2 in open condition

Sequence for test :
1) Remove SLS2 screw from terminal 2.
2) Connect ammeter to test sockets of terminal 2.
3) Open disconnect slide link of terminal 2.
4) Connect voltameter to test sockets of terminals 7 and 10.

Meter exchange for L1



Closing of SLS2

Sequence for test :
1) Close short circuit slide SLS2 of terminals 1 and 2.
2) Open disconnect slide link of terminal 2 and 7.
3) Disconnect meter for L1 at terminals 1, 2 and 7.

DIGITAL PANEL METERS

Glossary

Accuracy
The maximum deviation to be expected between a true meter reading and the actual value being measured under specified operating conditions. Usually indicated as percentage of full scale value for analog instruments or percentage of reading for digital instruments. *(see figure 1)*

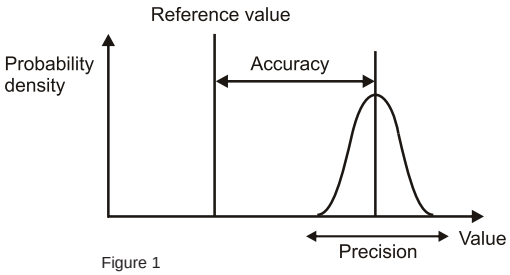


Figure 1

Active energy
Active Energy is the product of Active Power and Time. The unit is Wh.

Active Energy = P * t [Wh]
P= active power [W]
t = time in hour [h]

Active (Real or True) Power
It is measured in watts [W] and is the Power drawn by a electrical system.

Active Power
Active Power P= V*I*cos θ [W]
V=Voltage [V]
I=Current [A]
θ=Power factor

Ampere
Unit of electrical current. Amount of electrical current which flows through a 1 ohm resistor with 1 volt applied at a specific time.

Apparent Energy
Apparent Energy is the product of Apparent Power and Time. It's unit is VAh.

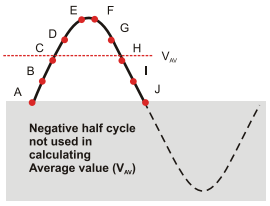
Apparent energy = S * t [VAh]
S= apparent power [VA]
t = time in hour [h]

Apparent Power
It is measured in volt-amperes (VA) and is the voltage on an AC system multiplied by all the current that flows in it. It is the vector sum of the active and the reactive power.

Apparent Power S =V*I [VA]
V =Voltage [V]
I =Current [A]

Average
Average value is normally taken to mean the average value of only half a cycle of the wave. *(see figure 2)*

Figure 2



(V_{AV}) (for positive half cycle) = $\frac{A+B+C+D+E+F+G+H+I+J}{10}$

For a pure sine wave V_{AV} will always be the PEAK value (V_{PK}) x 0.637

Burden
The electrical load taken from an electrical circuit by measuring instruments expressed in Volt-Ampere (VA) or watts. In current transformers burden in VA is the maximum the transformer can support while operating within its rated accuracy.

Crest Factor
The ratio of peak voltage to the RMS voltage of a waveform (with the DC component removed).

CT (Current Transformer)
A current transformer (CT) is used to step down the large value of current. When current in a circuit is too high to directly apply to measuring instruments, a current transformer produces a reduced current proportional to the current in the circuit, which can be conveniently connected to measuring and recording instruments.

CT Ratio (Current Transformer Ratio)
CT ratio is the ratio of primary (input) current to secondary (output) current. A CT with a listed ratio of 4000:1 would provide 1A of output current, when the primary current was 4000A.

DC Shunt
A low-value resistor typically embedded in Ampere Meters. This low-value resistor "shunts" high currents around the Ampere Meters sensitive input circuit.

Export of energy
When energy accumulation is negative, it is defined as "Export of Energy".

Energy
It is Defined as the ability to do work & work is the transfer of Energy from one form to another.

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End Scale Value
The end scale value of an instrument is the value of the actuating electrical quantity that corresponds to end scale indication. When zero is not at the end or at the electrical center of the scale, the higher value is taken.

Error
The difference between measured value, set value, or rated value, and the measured or supplied true value.

Frequency
Number of times an electrical signal replicates in one second; it's unit is Hertz [Hz].

Frequency Output
An output in the form of frequency, which varies as a function of the applied input.

Frequency Response
A measure of how effectively a circuit or device transmits the different frequencies applied to it.

Full-Scale Input
The maximum value of an input voltage or current that can be safely applied to a digital panel meter.

Full-Scale Value
The arithmetic difference of the two end-scale values. When zero is not on the scale, the full-scale value is the higher end-scale value.

Impedance
The combination of resistance and reactance affecting the flow of an alternating current generally expressed in ohms.

Import of energy
When energy accumulation is positive it is defined as "Import of Energy".

Input Impedance
The resistance and reactance of a panel meter. In the case of a voltmeter, this impedance has to be taken into account when the source impedance is high.

Kwh
kWh stands for Kiliwatt- Hour, it is the energy consumed by 1000 Watts in 1Hour.

KVAh
kVAh stands for kilo-Volt-Ampere-hour known as Apparent Energy. It is the technical name for 'total' electrical energy, that includes both its 'useful' and the 'lossy' components. The unit of Apparent Energy is kVAh.

Lagging Power Factors
When load is capacitive the current waveform leads the voltage waveform. Capacitive reactances produce lagging power factor. Capacitive loads are capacitor banks or buried cables.

Leading Power Factors
When load is inductive the current waveform is lagging behind the voltage waveforms. Inductive reactances produce a leading power factor. Inductive loads are transformers, motors and wound coils.

LSD (Least Significant Digit)
The right-most active digit of a digital display.

Load
The amount of electrical power required by the connected electrical equipment.

Max Demand
It is the highest of demand values recorded .It is the highest value of power recorded within a particular interval. The Meter stores the reading only if it exceeds the previous maximum Demand value recorded.

MSD (Most Significant Digit)
The left-most digit on a digital display.

Nominal
The normal operating value.

Nominal Voltage
A nominal voltage value assigned to a circuit or system for the purpose of conveniently designating its voltage class.

Ohm
Unit of electrical resistance; one Volt can force one Ampere of current through a resistance of one Ohm.

Glossary

Output Load
The total effective resistance of the circuits and apparatus connected externally to the output terminals.

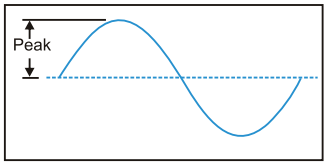
Over Voltage
A voltage greater than that at which a device or circuit is designed to operate.

Rated Overload
The maximum load over full scale value that an instrument can withstand without damage or failure. Displayed as a percentage of a full scale value.

Over Range
In digital meters, a reading that exceeds full scale (but is less than an overload) that does not require switching to a higher range.

Peak Voltage
The maximum value present in a varying or altering voltage. This value may be either positive or negative. This is known as the peak or crest value of an AC waveform. *(see figure 3)*

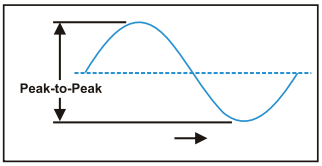
Figure 3



Peak to Peak Voltage
The total height between opposite peaks is known as peak to peak value of ac AC waveform. *(see figure 4)*

Phase Angle
The difference in degrees by which the voltage wave lags or leads the current wave in an AC circuit.

Figure 4



Power
Power is the rate at which energy is transferred, used, or transformed or Measure of the amount of work an electrical signal can do. The instantaneous electrical power P delivered to a component is given by P(t)= I(t) * V(t).

Power Consumption
The power necessary to operate the meter.

Power Factor
It is the ratio between the KW and the KVA drawn by an electrical load. Where, the KW is the actual load power and the KVA is the apparent load power. It is a measure of how effectively electrical power is being used. Power Factor is usually expressed as a number between 0 and 1.

Power Supply
Separate unit or part of a circuit that supplies power to the rest of the circuit or to a system.

Pulse Output
In meters a pulse o/p corresponds to a pulse generated after a certain unit of energy is recorded by the meter which (Energy) intern is dependent on the product of CT & PT Ratio.

Range (Full Scale)
The difference between minimum and maximum values that an input or output can reach.

Ratio
The ratio of a current transformer indicates the multiple between the current in the secondary lines and the current in the primary lines. For example: a 50:5 transformer will transmit 5 Amperes through the secondary line when the primary line is carrying 50 Amperes.

Reactive Energy
Reactive energy is the product of power and time. Its unit is VArh.

Reactive energy = Q * t [VArh]
Q= reactive power [VAr]
t = time in hour [h]

Reactive Power
It is measured in volt-amperes (VAR). Reactive Power is stored in and discharged by inductive motors, transformers and solenoids.

Reactive power: $Q = V*I*\sin\theta$ [VArh]
V =Voltage [V]
I =Current [A]
θ =Power factor

Repeatability
The ability of an instrument to repeat its indications when the pointer is deflected upscale, compared to the indications taken when the pointer is deflected down-scale, expressed as a percentage of the fiducial value.

RMS
The RMS (Root Mean Square) value of a set of values (or a continuous time waveform) is the square root of arithmetic mean(Average) of the squares of the original values (or the function that defines the continuous waveform).

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Sampling Rate
The sampling rate, sample rate, or sampling frequency (Fs) defines the number of samples per unit of time (usually seconds) taken from a continuous signal to make a discrete signal.

Scaling
For direct read out in engineering units, the capability of the meter to associate any desired value to the electrical input range.

Shunt
A calibrated low resistance connected in parallel with the input terminals of a voltmeter in order to enable measurements of large currents. It can be internal or external. The voltmeter measures the voltage drop typically in the milli volt range across the shunt resistor and displays a number corresponding to the current flowing through the shunt.

True RMS
'rms' stands for "root-mean-square". True RMS reading meters can accurately measure the value of non-sinusoidal waveforms (step, triangle, square, etc.). For significantly non-sinusoidal signals, a True RMS is required.

Volt
Unit of measurement of electrical potential. One volt applied across a one ohm resistor will produce a current of one ampere.

Voltage Burden
Burden voltage is the voltage drop caused by current (amps) flowing through a current measuring device. A large burden voltage can affect the circuit being measured, corrupting the measurement. For this reason, it is necessary for burden voltage to be kept as low as possible.

Volt Ampere
An AC unit of measure. Volt Amperes [VA] is the product a circuit's RMS voltage and its RMS current. The volt-ampere is also referred to as 'apparent power'.

Voltmeter
An instrument designed to measure and display, in either digital or analog format, AC or DC volts.

Watt
Unit of measurement of electrical power; one Watt is the amount of work that one Ampere at one Volt can do.

Wye
A three phase, four-wire electrical configuration where each of the individual phases is connected to a common point, the "center" of the Y. This common point normally is connected to an electrical ground.

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SHIPMENT AND DELIVERY - All orders for destination in the mainland United States (less Hawaii, Alaska and non-continental United States possessions) will be shipped F.O.B. Flemington, N.J. All destination, shipping and other charges shall be paid by the Customer in accordance with ALTECH's then current shipping and billing practices.

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LIMITED WARRANTY - ALTECH warrants to Customer that the equipment purchases shall be free from defects in material and workmanship under normal use and service for a period of one year from shipment.

Written notice as an explanation of the circumstances of any claim that the equipment has proved defective in material or workmanship shall be given promptly by the Customer to ALTECH.

ALTECH will not be liable for any misuse, improper operations, improper installation, improper maintenance, alteration, modification, accident or unusual degradation of the equipment or parts due to an unsuitable installation environment.

No representation of other affirmation of facts, including but not limited to statements regarding capacity, suitability for use or performance of the equipment, shall be or be deemed to be a warranty or representation by ALTECH for any purpose, nor give rise to any liability or obligation of ALTECH whatsoever.

Customer's sole and exclusive remedy in the event of breach of warranty, as set forth herein, is expressly limited to (1) the correction of the defect by adjustment, repair, modification, or replacement, or (2) issuance of a credit or refund of the purchase price for the defective equipment at ALTECH's election and sole expense.

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THIS WARRANTY EXTENDS ONLY TO THE CUSTOMER FROM ALTECH OR ITS AUTHORIZED DISTRIBUTOR.

LIMITATION OF LIABILITY - IN NO EVENT, SHALL ALTECH BE LIABLE FOR LOSS OF PROFITS, INDIRECT, SPECIAL, CONSEQUENTIAL OR OTHER SIMILAR DAMAGES ARISING OUT OF ANY BREACH OF THIS AGREEMENT OR OBLIGATIONS UNDER THE AGREEMENT.

ALTECH SHALL NOT BE LIABLE FOR ANY DAMAGES CAUSED BY DELAY IN SHIPMENT, INSTALLATION OR FURNISHING OF EQUIPMENT OR SERVICES UNDER THIS AGREEMENT.

No action arising out of any claimed breach of this Agreement may be brought by either party more than two (2) years after the cause of action has accrued.

PATENT INDEMNITY - ALTECH shall defend or settle any suit or proceeding brought against Customer based on a claim that any equipment made to ALTECH design and furnished hereunder constitutes an infringement of any existing United States patent, provided (ALTECH) is notified promptly in writing and is given complete authorization and information required for the defense, and ALTECH shall pay all damages and costs awarded against Customer, but shall not be responsible for any costs, expense or compromise incurred or made by Customer without ALTECH's prior written consent. If any equipment is in ALTECH's opinion likely to or does become the subject of a claim for patent infringement, ALTECH may at its option and expense procure for Customer the right to continue using the device, modify it to become non-infringing, but in the event ALTECH is not reasonably able to modify, substitute, or otherwise procure for Customer the right to continue using it, ALTECH will remove such equipment and refund to Customer the amount paid in excess of a reasonable rental for past use.

ALTECH shall not be liable for any infringement or claim based upon use of the equipment in combination with other equipment not supplied by ALTECH or with modifications made by Customer.

The foregoing states the entire liability of ALTECH to Customer arising from patent infringement.

SELLER'S REMEDIES - Should Customer fail to make any payment within ten (10) days of its due date, or fail to perform any other of the Customer's obligation hereunder upon thirty (30) days written notice, or should Customer be or become insolvent or be a party to any bankruptcy receivership proceeding prior to full payment of all amounts payable hereunder, ALTECH may: (a) with or without demand or notice to customer declare the entire amount unpaid immediately due and payable; (b) enter upon the premises where the equipment may be found and remove it (Customer shall assemble the equipment and make it available to ALTECH at a place reasonably convenient to both parties and shall permit and assist ALTECH in effecting the retaking and removal of the equipment); and (c) sell any or all the equipment as permitted under applicable law, applying the proceeds of the sale to payment of the expenses of retaking, repairing and selling the equipment, reasonable attorney fees and to the satisfaction of all indebtedness then due and unpaid under this Agreement. Any surplus shall be paid to Customer and any deficiency shall be paid to ALTECH by Customer.

The remedies provided herein shall be cumulative and in addition to all other remedies provided by law or equity or under the Uniform Commercial Code.

GOVERNING LAW - This agreement will be governed by the Laws of the State of New Jersey.

GENERAL - This Agreement shall only become effective and binding when either (a) it has been accepted and executed by an authorized representative of ALTECH, or (b) the equipment has been shipped to Customer, with or without acceptance in writing hereon. Notice of acceptance is hereby waived by Customer. Customer hereby acknowledges receipt of a true and complete copy hereof.

No addition to or modification of any of the Terms and Conditions of Sale as they appear herein shall be binding upon ALTECH unless signed in writing by duly authorized representative of ALTECH in Flemington, N.J.

Typographical and clerical errors in quotations, orders and acknowledgments are subject to correction.

This Agreement is not assignable without the prior written consent of ALTECH. Any attempt to assign any of the rights, duties or obligations of this Agreement without such consent is void.

If any provision or provisions of this Agreement shall be held to be invalid, illegal or unenforceable, the validity, legality and enforceability, of the remaining provisions shall not in any way be affected or impaired thereby.

ALTECH is not responsible for failure to fulfill its obligation under this Agreement due to causes beyond its control, or except as agreed herein.

THE CUSTOMER ACKNOWLEDGES THAT HE HAS READ THE AGREEMENT, UNDERSTANDS IT, AND AGREES TO BE BOUND BY ITS TERMS AND CONDITIONS. FURTHERMORE, THE CUSTOMER AGREES THAT IT IS THE COMPLETE AND EXCLUSIVE STATEMENT OF THE AGREEMENT BETWEEN THE PARTIES, WHICH SUPERSEDES ALL PROPOSALS OR PRIOR AGREEMENTS, ORAL OR WRITTEN, EXPRESSED OR IMPLIED, AND ALL OTHER COMMUNICATIONS BETWEEN THE PARTIES RELATING TO THE SUBJECT MATTER OF THIS AGREEMENT.

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