# Altath Corn ${ }^{\circledR}$ <br> Gitrean Corp. 

Serving the Automation \& Control Industry since 1984 Endorsed Company

## M. W $384 \times 0$



## RMS





Digital Panel Meters

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


## 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) $\qquad$

UL Listed $\qquad$
$\qquad$ 8 2


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


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|  | - |  | 0 | 0 |  |  |  | 0 |  |  |  | $\bigcirc$ |  |  |  |  |  |



## 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

CAT. NO.
Display
Display Type
Digits
Bargraph
Display Scrolling
Supply Specification
Input Specification Electrical Wire System Input Voltage Range

Input Current Range Frequency
Parameter Resolution
Energy
Power, Voltage, Current Power Factor
Accuracy Class
Voltage (L-N, L-L), Current
Power Factor
Frequency
Active, Reactive, Apparent Power
Active, Reactive, Apparent Energy
Output Specifications
Pulse Output
Pulse Voltage
Pulse Current
Pulse Duration
Communication
Programmable Parameters
CT Primary
CT Secondary
PT Primary
PT Secondary
Environmental Specifications
Temperature
Humidity
Protection Level
Physical Specifications
Size
Weight
Terminal Size Acceptability and Torque


MFM384-C-CU

## LCD Display with backlight 4 rows of 4 digits

1 row of 8 digits for energy display Bargraph for current percentage Automatic/ Manual
85 ~ 270 VAC ( $50 / 60 \mathrm{~Hz}$ )

3 Phase (3/4 wires), 2 Phase ( 3 wire), 1 Phase ( 2 wire) 11 ~ 300 VAC (Phase to Neutral)
19 ~ 519 VAC (Phase to Phase)
10mA ~ 5A (External CT required for current >5A) $45 \sim 65 \mathrm{~Hz}$
$0.01 \mathrm{k}, 0.1 \mathrm{k}, 1 \mathrm{k}, 0.01 \mathrm{M}, 0.1 \mathrm{~m}, 1 \mathrm{M}$
Auto resolution
0.001
+/- 0.5\% of Full-Scale Value
+/-1\%
$0.1 \mathrm{~Hz}+/-0.1 \mathrm{~Hz}$
1\%
Class 1
1
$\square$

24 VDC max.
100mA max
$100 \mathrm{~ms}+$ - -5 ms
RS485 MODBUS Communication
1A/5A~10,000A (Programmable for any value)
1A/ 5 A (External CT must be connected for current $>5 \mathrm{~A}$ )
$100 \mathrm{~V} \sim 500 \mathrm{kV}$ (any value)
100V ~ 500 VAC (any value)
Operating: $-10^{\circ} \mathrm{C} \sim 55^{\circ} \mathrm{C}$, Storage: $-20^{\circ} \mathrm{C} \sim 75^{\circ} \mathrm{C}$
Up to $85 \%$ RH
IP65 for Faceplate
1/4 DIN, $96 \mathrm{~mm} \times 96 \mathrm{~mm}$
0.70 lbs (318g)

20-14 AWG ( $\left.0.5-2.5 \mathrm{~mm}^{2}\right), 6-7 \mathrm{lb}-\mathrm{in} .(0.68-0.79 \mathrm{Nm})$


MFM383A-CU
LCD Display with backlight
3 rows of 4 digits
1 row of 7.5 digits for energy display
Automatic/ Manual
85 ~ 270 VAC ( $50 / 60 \mathrm{~Hz}$ )

3 Phase (3/4 wires), 2 Phase ( 3 wire), 1 Phase (2 wire) 11 ~ 300 VAC (Phase to Neutral) 19 ~ 519 VAC (Phase to Phase)
$10 \mathrm{~mA} \sim 5 \mathrm{~A}$ (External CT required for current $>5 \mathrm{~A}$ ) $45 \sim 65 \mathrm{~Hz}$
$0.01 \mathrm{k}, 0.1 \mathrm{k}, 1 \mathrm{k}$ depending on CT ratio x PT ratio Auto resolution 0.001

+ +- $0.5 \%$ of Full-Scale Value
+/-1\%
$0.1 \mathrm{~Hz}+/-0.1 \mathrm{~Hz}$
1\%
Class 1

24 VDC max.
100mA max.
$100 \mathrm{~ms}+/-5 \mathrm{~ms}$

1A $5 \mathrm{~A} \sim 10,000 \mathrm{~A}$ (Programmable for any value) 1A/5A (External CT must be connected for current >5A) 100V ~ 10 kV (any value)
100V ~ 500 VAC (any value)
Operating: $-10^{\circ} \mathrm{C} \sim 55^{\circ} \mathrm{C}$, Storage: $-20^{\circ} \mathrm{C} \sim 75^{\circ} \mathrm{C}$
Up to $85 \%$ RH
IP65 for Faceplate

1/4 DIN, $96 \mathrm{~mm} \times 96 \mathrm{~mm}$
$0.70 \mathrm{lbs}(318 \mathrm{~g})$
20-14 AWG ( $\left.0.5-2.5 \mathrm{~mm}^{2}\right), 6-7 \mathrm{ld}-\mathrm{in} .(0.68-0.79 \mathrm{Nm})$

DIMENSIONS



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| $+\quad \square$ |
| PULSE |



MFM384-C-CU


MFM383A-CU

## 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

CAT. NO.
Display
Display Type
Digits
Bargraph
Display Scrolling
Supply Specification
Input Specification
Electrical Wire System
Input Voltage Range
Input Current Range
Frequency
Parameter Resolution
Energy
Power, Voltage, Current
Power Factor
Accuracy Class
Voltage (L-N, L-L), Current
Power Factor
Frequency
Active, Reactive, Apparent Power
Active, Reactive, Apparent Energy
Output Specifications
Pulse Output
Pulse Voltage
Pulse Current
Pulse Duration
Communication
Programmable Parameters
CT Primary
CT Secondary
PT Primary
PT Secondary
Environmental Specifications
Temperature
Humidity
Protection Level
Physical Specifications
Size
Weight
Terminal Size Acceptability and Torque


MFM374-C-CU

| 7 Segment LED Display |
| :---: |
| 3 rows of 4 digits |
| 8 digits for energy display |
| - |
| Automatic/ Manual |
| $85 \sim 270$ VAC $(50 / 60 \mathrm{~Hz})$ |

3 Phase ( $3 / 4$ wires), 2 Phase ( 3 wire), 1 Phase ( 2 wire) 11 ~ 300 VAC (Phase to Neutral)
19 ~ 519 VAC (Phase to Phase)
10mA ~5A (External CT required for current >5A) $45 \sim 65 \mathrm{~Hz}$
$0.01 \mathrm{k}, 0.1 \mathrm{k}, 1 \mathrm{k}, 0.01 \mathrm{M}, 0.1 \mathrm{M}, 1 \mathrm{M}$
Auto resolution
0.001
$+/-0.5 \%$ of Full-Scale Value
+/-1\%
0.1 Hz

1\%
Class 1

1
24 VDC max.
100mA max.
$100 \mathrm{~ms}+/-5 \mathrm{~ms}$
RS485 MODBUS Communication

1A/ 5A ~ 10,000A (Programmable for any value)
$1 \mathrm{~A} / 5 \mathrm{~A}$ (External CT must be connected for current $>5 \mathrm{~A}$ )
100 V ~ 500 kV (any value)
100 V ~ 500 VAC (any value)

Operating: $-10^{\circ} \mathrm{C} \sim 55^{\circ} \mathrm{C}$, Storage: $-20^{\circ} \mathrm{C} \sim 75^{\circ} \mathrm{C}$
Up to 85\% RH
IP65 for Faceplate

1/4 DIN, $96 \mathrm{~mm} \times 96 \mathrm{~mm}$
$0.71 \mathrm{lbs}(320 \mathrm{~g})$
20-14 AWG (0.5-2.5mm²), 6-7 lb-in. (0.68-0.79Nm)

Please contact Altech for UL status.

MFM374-CU

7 Segment LED Display
3 rows of 4 digits
8 digits for energy display
Automatic/ Manual
85 ~ 270 VAC ( $50 / 60 \mathrm{~Hz}$ )

3 Phase ( $3 / 4$ wires), 2 Phase ( 3 wire), 1 Phase ( 2 wire)
11 ~ 300 VAC (Phase to Neutral)
19 ~ 519 VAC (Phase to Phase)
$10 \mathrm{~mA} \sim 5 \mathrm{~A}$ (External CT required for current $>5 \mathrm{~A}$ )
$0.01 \mathrm{k}, 0.1 \mathrm{k}, 1 \mathrm{k}, 0.01 \mathrm{M}, 0.1 \mathrm{M}, 1 \mathrm{M}$
Auto resolution
0.001
$+/-0.5 \%$ of Full-Scale Value
+/-1\%
0.1 Hz

1\%
Class 1
1
24 VDC max.
100mA max.
$100 \mathrm{~ms}+/-5 \mathrm{~ms}$

1A/5A~10,000A (Programmable for any value)
$1 \mathrm{~A} / 5 \mathrm{~A}$ (External CT must be connected for current $>5 \mathrm{~A}$ )
$100 \mathrm{~V} \sim 10 \mathrm{kV}$ (any value)
100 V ~ 500 VAC (any value)

Operating: $-10^{\circ} \mathrm{C} \sim 55^{\circ} \mathrm{C}$, Storage: $-20^{\circ} \mathrm{C} \sim 75^{\circ} \mathrm{C}$
Up to 85\% RH
IP65 for Faceplate

1/4 DIN, $96 \mathrm{~mm} \times 96 \mathrm{~mm}$
$0.71 \mathrm{lbs}(320 \mathrm{~g})$
20-14 AWG ( $0.5-2.5 \mathrm{~mm}^{2}$ ), 6-7 lb-in. ( $0.68-0.79 \mathrm{Nm}$ )

DIMENSIONS




MFM374-C-CU

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MFM374A-CU

## 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


VAF36A-110V-CU
LCD Display with backlight
3 rows of 3 digits
Bargraph for current percentage Automatic/ Manual
110 VAC +/- $20 \%$ ( $50 / 60 \mathrm{~Hz}$ )
3 Phase (3/4 wires)
11 ~ 300 VAC (Phase to Neutral)
19 ~ 519 VAC (Phase to Phase)
20mA ~ 6A (External CT required for current >5A) $45 \sim 65 \mathrm{~Hz}$
0.01, 0.1, 1 A/KA
$0.1 \mathrm{~V} / \mathrm{KV}$
0.1
0.1 hr (0~99999.9 hr)

Accuracy Class
Voltage (L-N, L-L), Current
Average Voltage (L-N, L-L), Current Frequency
RPM
Run Hour
Output Specifications
Pulse Output
Communication
Programmable Parameters
CT Primary
CT Secondary
PT Primary
PT Secondary
Environmental Specifications
Temperature
Humidity
Protection Level
Physical Specifications
Size
Weight
Terminal Size Acceptability and Torque



VAF39A-110V-CU
7 Segment LED Display 3 rows of 3 digits

Automatic/ Manual
110 VAC +/- $20 \%$ (50/60Hz)

3 Phase ( $3 / 4$ wires)
11 ~ 300 VAC (Phase to Neutral)
19 ~ 519 VAC (Phase to Phase)
20mA ~ 6A (External CT required for current >5A) $45 \sim 65 \mathrm{~Hz}$
0.01, 0.1, 1 A/KA
0.1 V/KV
0.1
0.1 hr (0~99999.9 hr)
+/- $0.5 \%$ of Full-Scale Value, +/- 2 digits
$+/-0.5 \%$ of Full-Scale Value, $+/-2$ digits 0.1 Hz
+/- 0.5\%
+/-1\%

5 A ~ 10,000A (Programmable for any value)
5A fixed (External CT must be connected for current >5A)
100 V ~ 500 kV (any value)
100V ~ 500 VAC (any value)
Operating: $-10^{\circ} \mathrm{C} \sim 55^{\circ} \mathrm{C}$, Storage: $-20^{\circ} \mathrm{C} \sim 75^{\circ} \mathrm{C}$
Up to 85\% RH
IP65 for Faceplate

1/8 DIN, 48 mm x 96 mm
$0.79 \mathrm{lbs}(357 \mathrm{~g})$
20-14 AWG ( $0.5-2.5 \mathrm{~mm}^{2}$ ), 6-7 lb-in. ( $0.68-0.79 \mathrm{Nm}$ )

## DIMENSIONS



Panel cutout

TERMINAL CONNECTIONS


## 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


CAT. NO.

| Display |
| :---: |
| Display Type |
| Digits |
| Bargraph |
| Display Scrolling |
| Supply Specification |
| Input Specification |
| Electrical Wire System |
| Input Voltage Range |
| Input Current Range |
| Frequency |
| Parameter Resolution |
| Energy |
| Power |
| Power Factor |
| Accuracy Class |
| Power Factor |
| Active, Reactive, Apparent Powe |
| Active, Reactive, Apparent Energ |
| Output Specifications |
| Pulse Output |
| Pulse Voltage |
| Pulse Current |
| Pulse Duration |
| Communication |
| Programmable Parameters |
| CT Primary |
| CT Secondary |
| PT Primary |
| PT Secondary |
| Environmental Specifications |
| Temperature |
| Humidity |
| Protection Level |
| Physical Specifications |
| Size |
| Weight |
| Terminal Size Acceptability and Torque |

EM368-C-CU

| LCD Display with backlight |
| :---: |
| 8 digits |
| - |
| Automatic |
| $85 \sim 270$ VAC (50/60Hz) |
|  |
| 3 Phase (3/4 wires) |
| 11 ~ 300 VAC (Phase to Neutral) 19 ~ 519 VAC (Phase to Phase) |
| $10 \mathrm{~mA} \sim 5 \mathrm{~A}$ (External CT required for current $>5 \mathrm{~A}$ ) |
| $45 \sim 65 \mathrm{~Hz}$ |
|  |
| 0.01k, 0.1k, 1k, 0.01M, 0.1M, 1M, 10M |
| Auto resolution |
| 0.01 |
|  |
| +/-1\% |
| +/-1\% |
| Class 1 |
|  |
| 1 |
| 24 VDC max. |
| 100 mA max. |
| $100 \mathrm{~ms}+/-5 \mathrm{~ms}$ |
| RS485 MODBUS Communication |
|  |
| 1A/ 5A ~ 10,000A (Programmable for any value) |
| 1A/5A (External CT must be connected for current >5A) |
| $100 \mathrm{~V} \sim 500 \mathrm{kV}$ (any value) |
| 100V ~ 500 VAC (any value) |
|  |
| Operating: $-10^{\circ} \mathrm{C} \sim 55^{\circ} \mathrm{C}$, Storage: $-20^{\circ} \mathrm{C} \sim 75^{\circ} \mathrm{C}$ |
| Up to 85\% RH |
| IP65 for Faceplate |
|  |
| 1/4 DIN, $96 \mathrm{~mm} \times 96 \mathrm{~mm}$ |
| $0.69 \mathrm{lbs}(312 \mathrm{~g})$ |
| 20-14 AWG (0.5-2.5mm²), 6-7 lb-in. (0.68-0.79Nm) |



## 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 ( $50 \mathrm{mV} / 100 \mathrm{mV}$ ) is required for measurement.)
-4 Digit LED Display

CAT. NO.
Display
Display Type
Digits
Bargraph
Display Range
Supply Specification
Input Specification Electrical Wire System Measurement Type

Shunt Size Input Current Range Frequency Range
Parameter Resolution Current Sampling Rate
Accuracy Class
Current

Output Specifications
Pulse Output
Communication
Programmable Parameters
CT Primary / Shunt Setting

CT Secondary
Environmental Specifications
Temperature
Humidity
Protection Level
Physical Specifications
Size
Weight
Terminal Size Acceptability and Torque


MA12-110V-CU

| 7 segment LED display |
| :---: |
| 4 digits |
| - |
| 0-4960A |
| 110 VAC +/-20\% (60Hz) |
|  |
| 1 Phase (2 wire) |
| AC, CT Type (External CT required for current > 5A) |
| - |
| $50 \mathrm{~mA} \sim 5 \mathrm{~A}$ (External CT required for current $>5 \mathrm{~A}$ ) |
| $45 \sim 65 \mathrm{~Hz}$ |
|  |
| $0.001,0.01,0.1,1 \mathrm{~A}$ (depending on CT Primary)3 samples / sec. |
|  |  |
|  |
|  |
|  |
| - |
| - |
| $5,10,20,30,40,50,60,75,80,100,150,200,250$, 300, 400, 500, 600, 800, 1000, 1200, 1500, 1600, 2000, 2500, 3000, 4000 |
| 5 A fixed (External CT must be connected for current $>5 \mathrm{~A}$ ) |
|  |
| Operating: $-10^{\circ} \mathrm{C} \sim 55^{\circ} \mathrm{C}$, Storage: $-20^{\circ} \mathrm{C} \sim 75^{\circ} \mathrm{C}$ |
| Up to 85\% RH |
| IP65 for Faceplate |
|  |
| 1/8 DIN, $48 \mathrm{~mm} \times 96 \mathrm{~mm}$ |
| 0.37 lbs (170g) |
| 20-14 AWG (0.5-2.5mm²), 6-7 lb-in. (0.68-0.79Nm) |

## ( $\epsilon$ <br> c UL us <br> E253771

MA12-50mV-DC-110V-CU MA12-100mV-DC-110V-CU

7 segment LED display
4 digits
0-4960A
110 VAC +/-20\% (60Hz)

1 Phase (2 wire)
DC, Shunt Type (External shunt is required for current $>5 \mathrm{~A}$ )
50 mV (MA12-50mV) $\quad 100 \mathrm{mV}$ (MA12-100mV)
$50 \mathrm{~mA} \sim 5 \mathrm{~A}$ (External shunt required for current $>5 \mathrm{~A}$ ) $45 \sim 65 \mathrm{~Hz}$
$0.001,0.01,0.1,1 \mathrm{~A}$ (depending on shunt setting) 3 samples / sec.

+     - $0.5 \%$ of Full-Scale Value
$5,10,20,30,40,50,60,75,80,100,150,200,250$, $300,400,500,600,800,1000,1200,1500$, $1600,2000,2500,3000,4000$

Operating: $-10^{\circ} \mathrm{C} \sim 55^{\circ} \mathrm{C}$, Storage: $-20^{\circ} \mathrm{C} \sim 75^{\circ} \mathrm{C}$
Up to 85\% RH
IP65 for Faceplate
$1 / 8 \mathrm{DIN}, 48 \mathrm{~mm} \times 96 \mathrm{~mm}$
$0.37 \mathrm{lbs}(170 \mathrm{~g})$
20-14 AWG ( $0.5-2.5 \mathrm{~mm}^{2}$ ), 6-7 lb-in. ( $0.68-0.79 \mathrm{Nm}$ )

DIMENSIONS


TERMINAL CONNECTIONS


MA12-110V-CU (CT Type)


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

230 VAC versions also available, please consult Altech.

## 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

MA501-110V-CU
LCD display with backlight 4 digits
Analog bargraph indicator 0 ~ 6200A
Display Range
Display Scrolling
Supply Specification
Input Specification Electrical Wire System Measurement Type

Input Current Range Frequency Range
Parameter Resolution Current
Sampling Rate
Accuracy Class
Current
Pulse Output
Communication
Programmable Parameters CT Primary

CT Secondary
Environmental Specifications Temperature
Humidity
Protection Level
Physical Specifications
Size
Weight
Terminal Size Acceptability and Torque



MA2301-110V-CU

LCD display with backlight 4 digits
Analog bargraph indicator 0 ~6200A
manual phase selector switch
$85 \sim 270$ VAC ( $50 / 60 \mathrm{~Hz}$ )

3 Phase/4 wire
AC, CT Type (External CT required for current > 5A)
$50 \mathrm{~mA} \sim 5 \mathrm{~A}$ (External CT required for current $>5 \mathrm{~A}$ )
$45 \sim 65 \mathrm{~Hz}$
$0.001,0.01,0.1,1 \mathrm{~A}$ (depending on CT Primary) 3 samples / sec.
$+/-0.5 \%$ of Full-Scale Value
$300,400,500,600,800,1000,1200,1500$,
1600, 2000, 2250, 2500, 3000, 4000, 5000
5 A fixed (External CT must be connected for current $>5 \mathrm{~A}$ )

Operating: $-10^{\circ} \mathrm{C} \sim 55^{\circ} \mathrm{C}$, Storage: $-20^{\circ} \mathrm{C} \sim 75^{\circ} \mathrm{C}$
Up to 85\% RH
IP65 for Faceplate
$72 \mathrm{~mm} \times 72 \mathrm{~mm}$
$0.40 \mathrm{lbs}(163 \mathrm{~g})$
20-14 AWG (0.5-2.5mm²), 6-7 lb-in. ( $0.68-0.79 \mathrm{Nm}$ )


Front bezel


Front bezel


MA501



TERMINAL CONNECTIONS


MA501-110V-CU


MA2301-110V-CU

230 VAC versions also available, please consult Altech.

## MV15 Series (LED Voltage Meters)

## FEATURES

- Measurement Function


## -1 Ø Voltage (True RMS)

- 3 Digit LED Display



CAT. NO.

| 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 | $50 / 60 \mathrm{~Hz}$ | $50 / 60 \mathrm{~Hz}$ |
| Input Impedance | $1 \mathrm{M} \Omega(+/-5 \%)$ | $1 \mathrm{M} \Omega(+/-5 \%)$ |
| 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: $-10^{\circ} \mathrm{C} \sim 55^{\circ} \mathrm{C}$, Storage: $-20^{\circ} \mathrm{C} \sim 75^{\circ} \mathrm{C}$ | Operating: $-10^{\circ} \mathrm{C} \sim 55^{\circ} \mathrm{C}$, Storage: $-20^{\circ} \mathrm{C} \sim 75^{\circ} \mathrm{C}$ |
| Humidity | Up to 85\% RH | Up to 85\% RH |
| Protection Level | IP65 for Faceplate | IP65 for Faceplate |
| Physical Specifications <br> Size <br> Weight <br> Terminal Size Acceptability and Torque | $\begin{gathered} 1 / 8 \mathrm{DIN}, 48 \mathrm{mmx} 96 \mathrm{~mm} \\ 0.38 \mathrm{lbs}(170 \mathrm{~g}) \\ \text { 20-14 AWG }\left(0.5-2.5 \mathrm{~mm}^{2}\right), 6-7 \mathrm{lb}-\mathrm{in} .(0.68-0.79 \mathrm{Nm}) \\ \hline \end{gathered}$ | $\begin{gathered} 1 / 8 \mathrm{DIN}, 48 \mathrm{mmx} 96 \mathrm{~mm} \\ 0.38 \mathrm{lbs}(170 \mathrm{~g}) \\ \text { 20-14 AWG }\left(0.5-2.5 \mathrm{~mm}^{2}\right), 6-7 \mathrm{lb}-\mathrm{in} .(0.68-0.79 \mathrm{Nm}) \\ \hline \end{gathered}$ |

DIMENSIONS


TERMINAL CONNECTIONS


MV15-110V-CU (AC Type)


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

## 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


MV507-110V-CU

|  |  |
| :---: | :---: |
| LCD display with backlight | LCD display with backlight |
| 3 digits | 3 digits |
| Analog style bargraph indicator | Analog style bargraph indicator |
| 0-516V | 0-516V |
| - | manual phase selector switch |
| $110 \mathrm{VAC}+/-20 \%$ (60Hz) | $110 \mathrm{VAC}+/-20 \%(60 \mathrm{~Hz})$ |
|  |  |
| 1 Phase (2 wire) | 3 Phase/4 wire |
| $50 \sim 516$ VAC | $50 \sim 516$ VAC |
| 60 Hz | 60 Hz |
| $1 \mathrm{M} \Omega$ (+/-5\%) | $1 \mathrm{M} \Omega$ (+/-5\%) |
|  |  |
| 1V | 1V |
| 3 samples / sec. | 3 samples / sec. |
|  |  |
|  |  |
| +/- 0.5\% of Full-Scale Value | +/- $0.5 \%$ of Full-Scale Value |
|  |  |
| - | - |
| - | - |
| - | - |
|  |  |
| Operating: $-10^{\circ} \mathrm{C} \sim 55^{\circ} \mathrm{C}$, Storage: $-20^{\circ} \mathrm{C} \sim 75^{\circ} \mathrm{C}$ | Operating: $-10^{\circ} \mathrm{C} \sim 55^{\circ} \mathrm{C}$, Storage: $-20^{\circ} \mathrm{C} \sim 75^{\circ} \mathrm{C}$ |
| Up to 85\% RH | Up to 85\% RH |
| IP65 for Faceplate | IP65 for Faceplate |
| $\begin{gathered} \text { 1/16 DIN, } 48 \mathrm{~mm} \times 48 \mathrm{~mm} \\ 0.36 \mathrm{lbs}(165 \mathrm{~g}) \\ \text { 20-14 AWG ( } \left.0.5-2.5 \mathrm{~mm}^{2}\right), 6-7 \mathrm{lb}-\mathrm{in} .(0.68-0.79 \mathrm{Nm}) \end{gathered}$ | $\begin{gathered} 72 \mathrm{~mm} \times 72 \mathrm{~mm} \\ 0.43 \mathrm{lbs}(194 \mathrm{~g}), 0.45 \mathrm{lbs}(206 \mathrm{~g}) \\ 20-14 \mathrm{AWG}\left(0.5-2.5 \mathrm{~mm}^{2}\right), 6-7 \mathrm{lb}-\mathrm{in} .(0.68-0.79 \mathrm{Nm}) \end{gathered}$ |

DIMENSIONS


Front bezel


Front bezel
3.5 mm


MV507

46.5 mm


Panel cutout


TERMINAL CONNECTIONS


MV507


MV2307

## MV2307

230 VAC versions also available, please consult Altech.

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

## FEATURES

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



CAT. NO.
Display
Display Typ
Digits
Bargraph
Display Range
Supply Specification
Input Specification Electrical Wire System Input Current Range Frequency Range
Parameter Resolution Frequency Power Factor
Accuracy Class Frequency Power Factor

Output Specifications
Pulse Output
Communication
Programmable Parameters
Environmental Specifications
Temperature
Humidity
Protection Level
Physical Specifications
Size
Weight
Terminal Size Acceptability and Torque

MF16-110V-CU

| MF16-110V-CU | MP14-110V-CU |
| :---: | :---: |
|  |  |
| 7 segment LED Display | 7 segment LED Display |
| 4 digits | 4 digits |
| - | - |
| $45.00 \sim 65.00 \mathrm{~Hz}$ | $-1.000 \sim+1.000$ |
| 110 VAC +/- 20\% (60Hz) | 110 VAC +/- $20 \%$ (60Hz) |
|  |  |
| 1 Phase (2 wire) | 1 Phase (2 wire) |
| - | $0.25 \sim 6 \mathrm{~A}$ |
| $45 \sim 65 \mathrm{~Hz}$ | $50 / 60 \mathrm{~Hz}$ |
|  |  |
| 0.01 Hz | - |
| - | 0.001 |
|  |  |
| $+/-0.05 \mathrm{~Hz}$ | - |
| - | +/- 0.05\% +/- 2 digits |
|  |  |
| - | - |
| - | - |
| - | - |
|  |  |
| Operating: $-10^{\circ} \mathrm{C} \sim 55^{\circ} \mathrm{C}$, Storage: $-20^{\circ} \mathrm{C} \sim 75^{\circ} \mathrm{C}$ | Operating: $-10^{\circ} \mathrm{C} \sim 55^{\circ} \mathrm{C}$, Storage: $-20^{\circ} \mathrm{C} \sim 75^{\circ} \mathrm{C}$ |
| Up to 85\% RH | Up to 85\% RH |
| IP65 for Faceplate | IP65 for Faceplate |
|  |  |
| 1/8 DIN, 48 mmx 96 mm | 1/8 DIN, 48 mmx 96 mm |
| $0.37 \mathrm{lbs}(170 \mathrm{~g})$ | $0.37 \mathrm{lbs}(170 \mathrm{~g})$ |
| 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


TERMINAL CONNECTIONS



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

| Terminal Width | 8 mm |  |  | 8 mm |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Height x Length | $50 \times 82 \mathrm{~mm}$ |  |  | $50 \times 82 \mathrm{~mm}$ |  |  |
| Stripping Length | 10 mm |  |  | 10 mm |  |  |
| Insulation Material | Polyamide 6.6 |  |  | Polyamide 6.6 |  |  |
| Type of Connection | 2 screw clamps |  |  | 2 screw clamps |  |  |
| Approvals | $\underbrace{}_{\mathrm{CS}}$ | $\underset{\text { E0947-7-1 }}{\text { IEC }}$ | ${ }_{c}^{-1}$ | ${ }_{c} \$_{\mathrm{US}}$ | $\underset{\text { IEC }}{\text { IE947-7-1 }}$ | ${ }_{c}{ }_{\mathrm{E} 220514}$ |
| 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 | $14 \mathrm{lb}-\mathrm{in}$ |
| Other Approvals | (3)H8) CE |  |  | (애S) $C \in$ |  |  |



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




| 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

Comparison measurement for L1


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 test for L1 through external power supply


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.

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 .

## 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)
Active energy
Active Energy is the product of Active Power and Time. The unit is Wh.
Active Energy $=P * t[W h]$
$\mathrm{P}=$ active power [W]
$\mathrm{t}=$ 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 $P=\left.V^{*}\right|^{*} \cos \theta[W]$
$\mathrm{V}=$ Voltage [V]
I=Current [A]
$\theta=$ 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 $=S$ * HAh$]$
S= apparent power [VA]
$\mathrm{t}=$ 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 $S=V^{*}$ [VA]
$\mathrm{V}=$ 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)
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.

half cycle) $=\frac{A+B+C+D+E+F+G+H+1+J}{10}$
For a pure sine wave $\mathrm{V}_{\text {Av }}$ will always be the PEAK value $\left(\mathrm{V}_{\text {pk }}\right) \times 0.637$

## 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.

## 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)
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.
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 $P(t)=I(t) * V(t)$.


Figure 4


## 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]
$\mathrm{t}=$ 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: $Q=\left.V^{\star}\right|^{\star} \sin \theta$ [VArh]
$\mathrm{V}=$ Voltage [ V ]
I =Current [A]
$\theta=$ 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).

## 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, $A C$ or $D C$ 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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TITLE - Title to the products of ALTECH shall remain with ALTECH until payment is made in full by Customer. Such reservation of title is for the purpose of securing the purchase price and shall not relieve Customer of the duty to inspect the products upon receipt, to notify ALTECH of any deficiencies or defects, and to exercise due care in the use, installation, operation, and maintenance of the products when on the premise of the Customer or under the control of the Customer. Notwithstanding any reservation of title by ALTECH, risk of loss shall pass to customer at any time of shipment.

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.

Delivery dates given in the acceptance of any order are approximate. ALTECH shall not be liable for delays in delivery or in performance due to causes beyond its reasonable control including acts of God, acts of Customer, acts of civil or military authority, fires, strikes or other labor disturbances, war, riot or delays in transportation. In the event of such delay, the date of delivery or performance shall be extended for a period equal to the time lost by reason of the delay.

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PAYMENT - Customer agrees to make payment within thirty (30) days of date of the invoice from ALTECH. Customer agrees to pay a late payment charge of one and one-half percent ( $1.5 \%$ per month, or the maximum late payment charge permitted by applicable law, whichever is less, on any unpaid amount for each calendar month (or fraction thereof) that such payment is in default. Orders amounting to less than $\$ 100.00$ will be billed at $\$ 100.00$ plus freight. Full carton purchases are required. In the event of referral to an attorney for collection, reasonable attorney's fees for collection of the overdue amount shall be paid by Customer. In the event payment is not received within 30 days from the date of invoice, any discount shall be cancelled and the full list price will be due.

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.

EXCEPT AS SPECIFICALLY PROVIDED IN THIS AGREEMENT, THERE ARE NO OTHER WARRANTIES EXPRESSED OR IMPLIED INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

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 noninfringing, 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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