INVERSINE™ Advanced Universal Sine-wave Filter

Key Features

- Low insertion loss and voltage drop (<2% of rated voltage)
- No damping resistors required
- Power delivered to motor >96%
- Efficiency >98%
- Improves Power Factor of the motor near unity
- Reactive power compensation
- Prevents transient overvoltages at motor terminals
- Reduces motor noise
- Filters out high frequency currents while allowing lower fundamental currents to pass
- Reliable and proven performance

Inversine Applications

- When Motor does not have adequate insulation for ASD duty
- Using a number of parallel motors
- Long Motor cable length
- When Step-up/Step-down transformer is used between ASD and motor
- There are specific requirements for peak voltage level and dV/dt rise time
- Motor noise needs to be reduced
- Maximum safety and reliability is needed in hazardous environments
- Submersible pumps with long motor cables used in the oil & gas industry

Problems Associated with PWM Inverter Operation

Pulse Width Modulated (PWM) output voltage waveform of inverter equipped Adjustable Speed Drive (ASD) systems can greatly stress a standard induction motor. This is primarily due to the rapid change in voltage (high dV/dT) produced by the inverter's switching action.

High dV/dT combined with a mismatch between cable and motor surge impedance can result in reflective wave phenomenon back at the motor terminals. Voltages can increase by as much as 2 to 3 times nominal peak levels possibly exceeding the insulation rating of the feeder cables and motor magnetic wire leading to insulation stress, partial discharges and eventual failure. This problem can result with short cable runs but becomes magnified with long cable runs.

Typical problems experienced can include motor and winding failure, motor noise, cable insulation degradation, premature ASD failure, common-mode and reflected wave phenomenon and high EMI/RFI.

INVERSINE Differential Mode

The Inversine Advanced Universal Sine-wave Filter (AUSF) is designed to address the problems resulting from pulse width modulation. It is a low pass filter with cutoff frequency well below the switching frequency of the inverter.

The AUSF is much more than a simple dV/dT filter and will:

- substantially reduce voltage rise time (dV/dt)
- convert output voltage to near sinusoidal waveform (<3%)
- prevent transient overvoltages at motor terminals
- lower harmonic losses in the motor
- reduce motor noise
- reduce motor and cable insulation stress
- extend life of the motor and ASD

INVERSINE Common-mode Option

Common-mode is the phase-to-ground voltage that appears as a result of the instantaneous sum of the 3-phase voltages of the PWM inverter not being zero even when the sum of the average 3-phase voltages is zero. Common-mode voltages will induce common-mode currents to flow through parasitic capacitance in the motor and motor feeder cable. High frequency capacitive coupling exists across the motor bearings and between the feeder conductor or motor winding and ground. Common-mode currents can lead to premature motor bearing failure.

The Inversine Common-mode Filter option will:

- Reduce shaft voltage and bearing currents
- Reduce cable leakage currents
- Reduce common-mode voltages throughout power system

MIRUS International Inc.

General Specifications:

Voltage
Standard voltage up to 690V, 3-phase, 60 or 50Hz

Overload Capability
Suitable for overload of 200% for 180 seconds every 10 minutes

Switching Frequency
2kHz to 8kHz or [8kHz to 16kHz]

Motor Frequency
0Hz to 90Hz

Voltage Distortion (THD)
Max. 5% (at full load and at 60Hz)

Input Current Distortion
<8% at full load

Efficiency
>98%

Winding Material
Copper

Operating Ambient Temperature
-20°C to +40°C (-4°F to 104°F)

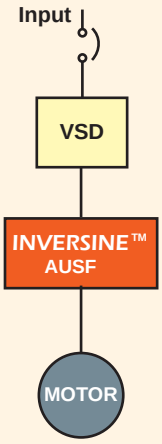
Elevation
≤ 1000m (3300ft) above sea level

Ventilation
Convection air cooled

Enclosure
Type: Nema-3R, ventilated
Paint: Polyester powder coated
Colour: ANSI 61 Grey
Wall Mtg. Capability: 5 to 125HP

Options
Nema-3R Enhanced Outdoor Ventilated

Typical INVERSINE™ Configuration

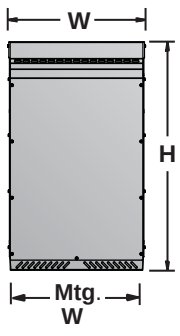


AUSF Rating Table [60Hz]

Motor Size HP	Motor Size kW	Output Amps [A] 3Ph/60Hz 480V	600V	690V	Case Style	Weight* lbs [kg]
5	3.75	7.6	6.1	5.3	SU1	58 [26]
7.5	5.5	11	9	8	SU1	67 [30]
10	7.5	14	11	10	SU1	78 [35]
15	11	21	17	15	SU1	90 [41]
20	15	27	22	19	SU2	118 [54]
25	18.5	34	27	24	SU2	130 [59]
30	22	40	32	28	SU2	142 [65]
40	30	52	41	36	SU2	154 [70]
50	37.5	65	52	45	SU2	186 [84]
60	45	77	62	54	MT2	218 [99]
75	55	96	77	67	MT2	304 [138]
100	75	124	99	86	MT2	323 [147]
125	90	156	125	109	MT2	345 [156]
150	110	180	144	125	MT2	365 [166]
200	150	240	192	167	MT3	415 [189]
250	185	302	242	210	MT3	578 [262]
300	200	361	289	251	MT4	585 [266]
350	250	414	336	292	MT4	800 [363]
400	315	477	382	332	MT4	825 [374]
500	400	590	472	410	MT4	915 [415]
600	450	665	530	465	LT1	1398 [634]

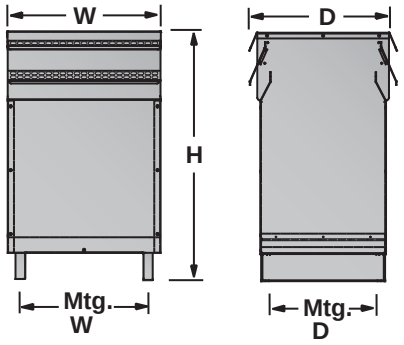
* Estimated values.

'SU' Style Enclosure



Front View *Side View*

'MT', 'LT' Style Enclosure



Front View *Side View*

Dimensions

Case Style	H (Height) inches [mm]	W (Width) inches [mm]	D (Depth) inches [mm]	Mtg. Center W inches [mm]	Mtg. Center D inches [mm]
SU1	23.50 [597]	11.25 [286]	11.25 [286]	9.00 [229]	8.50 [216]
SU2	29.50 [749]	13.25 [336]	12.75 [324]	11.00 [279]	10.00 [254]
SU3	34.00 [864]	20.25 [514]	16.00 [406]	18.00 [457]	13.00 [330]
MT2	38.00 [965]	21.50 [546]	19.50 [495]	17.00 [432]	17.50 [445]
MT3	45.00 [1143]	26.00 [661]	21.00 [534]	21.50 [546]	19.00 [483]
MT4	51.50 [1308]	32.00 [813]	25.50 [648]	23.50 [597]	23.50 [597]
LT1	59.00 [1499]	39.50 [1003]	30.00 [762]	24.00 [610]	24.00 [610]

Product Code:

Motor Horsepower
5 to 600 HP

Nominal Frequency
5 = 50Hz
6 = 60Hz

AUSF - HP - vvv - Ff - En - O

Advanced Universal Sine-wave Filter

Voltage
All standard voltages up to 690VAC

Switching Frequency
1 = 2 to 8 kHz
2 = 8 to 16 kHz

Enclosure
E0 = No Enclosure
E1 = Standard Enclosure
E1E = Type 3R Enhanced

Options

MIRUS International Inc.
31 Sun Pac Blvd.
Brampton, Ontario
Canada L6S 5P6

Tel:(905) 494-1120 Fax:(905) 494-1140
Toll Free: 1-888-TO MIRUS
Email: mirus@mirusinternational.com
Website: www.mirusinternational.com

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