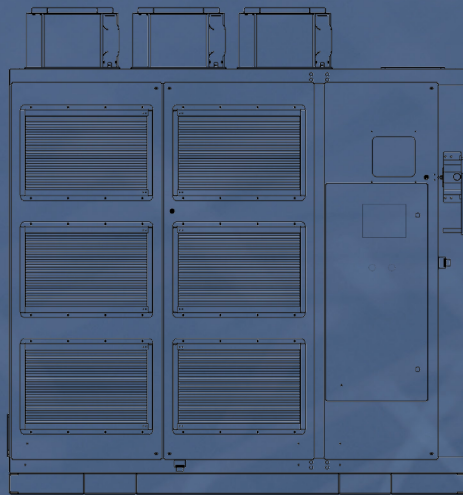




BENSHAW

Applied Motor Controls

AN AMCONEX GROUP COMPANY



MVH2 Series

154A model

Medium Voltage VFD

FULL-SIZE DRIVE PERFORMANCE ... SMALL FOOTPRINT DESIGN
2.3 – 4.16KV UP TO 205A

Rapid | Rugged | Global

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When the application is critical ... and the environment harsh ... customers specify Benshaw more than any other brand.



Benshaw is uniquely qualified to help you achieve your motor and machine control objectives. Our state-of-the-art manufacturing facilities combine the convenience of regional proximity with the cost advantages of a single, large scale operation and an extensive global supply chain.

We thrive on complex applications and work diligently to bring cost-effective standard products and engineered solutions to our customers. All operations are ISO certified, and all components, enclosures, parts, and materials are inspected, tracked, and kitted per ISO 9001 protocols to ensure timely processing of orders.

We manufacture an extensive selection of standard motor controls and drives — serving a wide range of industries. And if a standard product doesn't fit your requirements, our design and engineering teams can help tailor a solution that does, no matter how complex or demanding the application. We approach complex motor and machine control applications with unrivaled engineering and design experience, working closely with our customers to produce cost effective motor controls and drives that precisely match requirements.

From concept to final assembly, Benshaw's objective is to deliver world class performance to customers through our ...

- Broad product lines
- Global operations footprint
- ISO 9001 quality controlled production process
- Commitment to operational excellence



Introduction

Benshaw's MVH2 Series Medium Voltage Variable Frequency Drive provides full-size drive performance with a compact, rugged design.

Benshaw MVH2 Series Medium Voltage VFDs utilize cascaded H-bridge multi-level and overlapping wave technology for low harmonic content and a nearly perfect sine wave output. The latest in phase-locked loop technology is used to adjust drive output ... providing an ideal solution for soft start, speed control, energy savings and intelligent control of any MV induction or synchronous motor.

COMPACT DESIGN

Offering the performance of a full-size standard drive in a small footprint layout, Benshaw MVH2 Series drives are ideal for retrofit projects or any installation with space constraints.

- UL Listed to 205 amps @ 4160V
- NEMA 1 forced air, front access, welded enclosure
- Fully integrated, packaged VFD:
 - Load break fused disconnect (up to 154A)
 - Inline contactor (up to 154A)
 - Built in dry type transformer
 - Door-mounted touch screen HMI
 - IEEE 519 compliant, 24 pulse design
 - V/Hz, open or closed loop, vector control
 - No cable length restrictions
 - Standalone or integrated into an MCC (optional)
 - Synchronous Transfer for up to 4 motors (optional)

STANDARD NEMA 1 ENCLOSURE

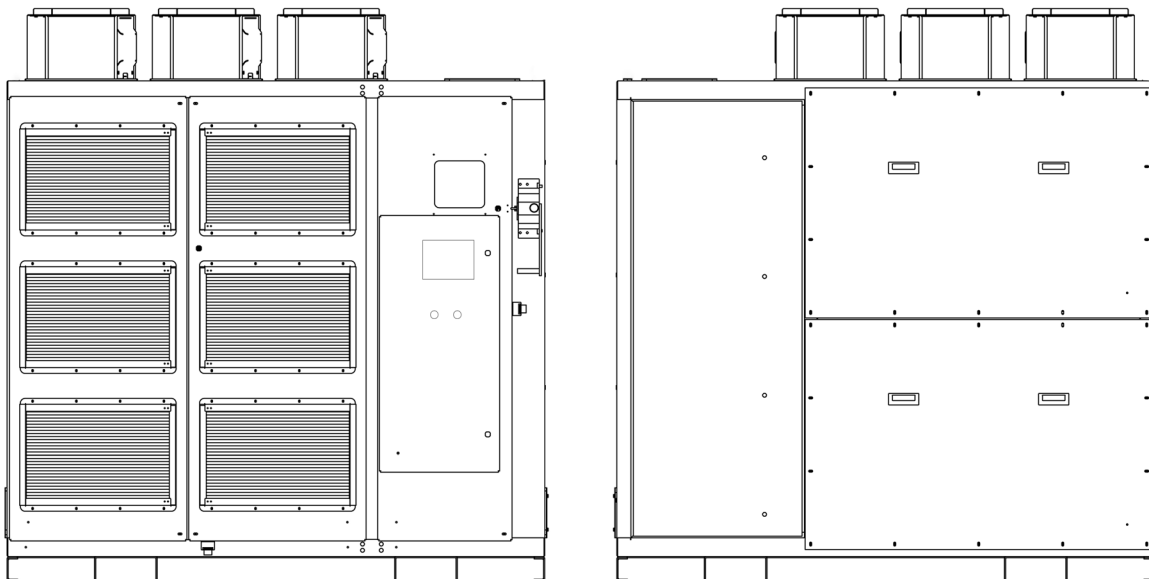
Designed to provide the performance of a full-size standard drive in a small footprint layout. Ideal solution for retrofit projects or any installation with space constraints.



Single-sided front access service zone — Switchgear style VFD ideal for a wall-mounted or back-to-back installation.

Isolation switch, fuses and contactor (up to 154A rating)

2.3 kV – 4.16 kV, up to 205A



PART NUMBER ASSEMBLER

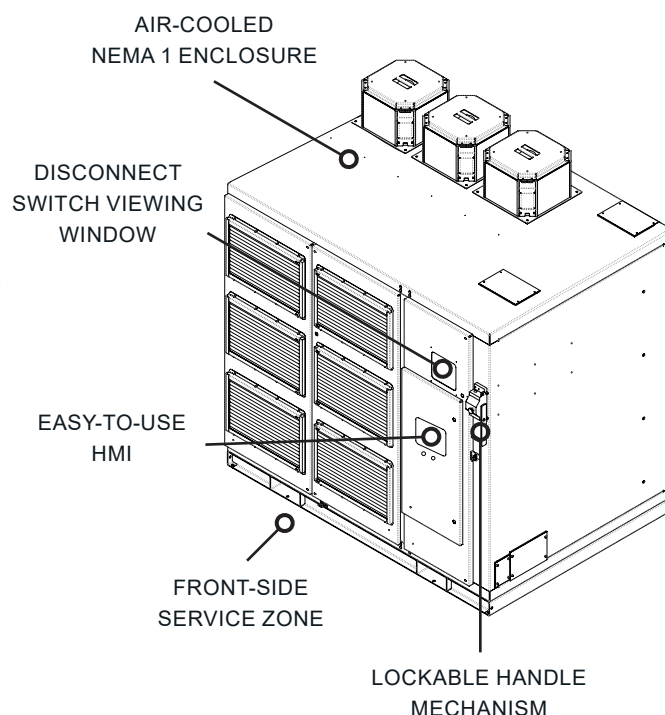
MVH2	-	A	U	6	-	042	-	042	-	0048	A	-	CF	-	I	-	NB	-	FSO	-	N1	N1 = NEMA 1 Enclosure (standard)
																					FSO = Front Service Only / DSO = Double Side Access (e.g. front & rear access)	
																					NB = No cell bypass / CB = Cell Bypass / RB = Redundant Cell Bypass	
																					I = Inline Contactor (up to 154A) / N = No Inline Contactor	
																					CF = Fusible Disconnect (up to 154A) / ND = No Disconnect	
																					A = Air Cooling / W = Water Cooling	
																					Rated Unit Amps rms	
																					Output Rated Voltage Vrms 023 = 2300V, 042 = 4160V	
																					Input Rated Voltage Vrms 023 = 2300V, 042 = 4160V	
																					5 = 50Hz Input Frequency / 6 = 60Hz Input Frequency	
																					I = IEC / U = UL	
																					A = Asynchronous Motor / S = Synchronous	
																					Benshaw MV Drive H2 Product Type	

Product Structure

Benshaw's next generation MVH2 Series multi-purpose variable frequency drive provides a solution for all kinds of applications ... in nearly every industrial sector.

KEY FEATURES

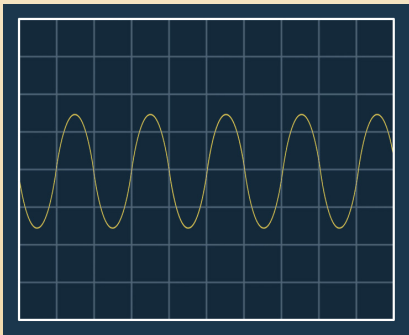
- Current range: 31 – 205 A
- Voltage range: 2.3 – 4.16 kV
- 50 kAIC short circuit fault rating
- 60kV BIL
- 400 A load break, 5 kV rated disconnect switch, mechanically interlocked (up to 154A)
- Supports standard induction, synchronous or permanent magnet motors
- Voltage source multi-cell inverter
- Modbus RTU standard, DeviceNet, Profibus, Ethernet optional
- Class H dry type transformer (Al windings) with embedded RTDs
- Powerful main controller
- HMI monitoring



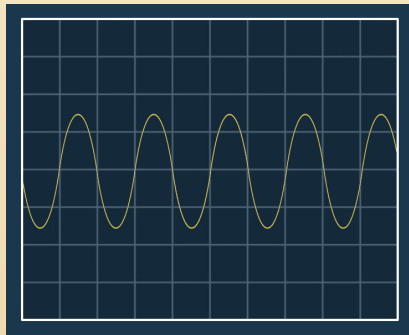
DIGITAL SIGNAL PROCESSOR

The main controller chip uses TI's TMS320 F28335 digital signal processor (DSP). This device has 150 MHz high-speed processing capability, a 32-bit floating-point processing unit and six (6) DMA channels, supporting ADC, McBSP and EMIF.

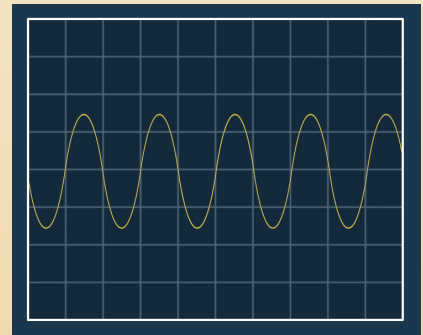
The DSP provides an average performance improvement of 50% over previous generation DSPs. At the same time, through the application of better control algorithms, the waveform and output harmonics of the inverter is significantly improved when running at low-frequency currents.



CURRENT WAVEFORM AT 2 HZ



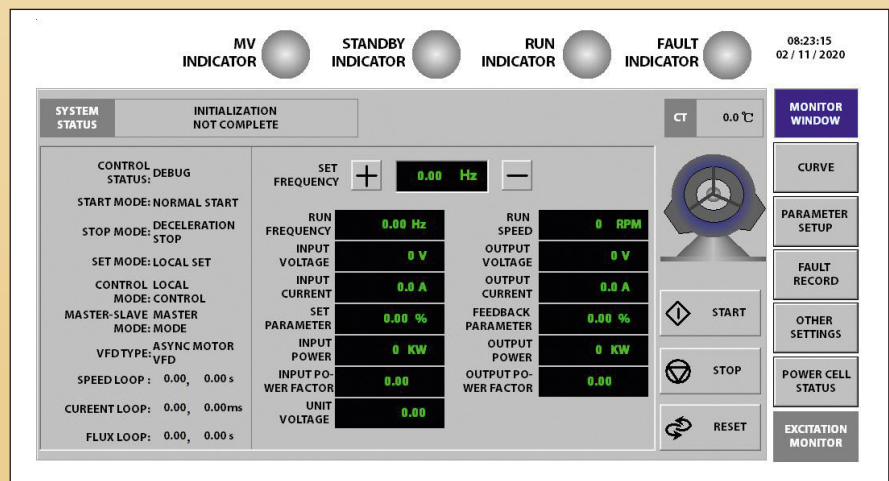
CURRENT WAVEFORM AT 5 HZ



CURRENT WAVEFORM AT 10 HZ

INTUITIVE HMI

- 10-inch touch screen
- Convenient control system status and monitoring
- Powerful data control (data logging, diagnostics and information)
- User-friendly interface (high definition display with high data throughput)
- Multi-language display



Advanced Functions

Benshaw's MVH2 drive is a full-featured, medium voltage VFD designed for global acceptance. The built-in HMI supports multiple languages, meeting IEC and IEEE standards for performance and safety.

Flying Start

The MVH2 drive will automatically estimate the motor running speed, and apply the same voltage waveform as the motor frequency, preventing over current issues when starting into a rotating load. This feature is ideal when the drive automatically restarts after power loss, or when switching from network power to drive mode.

Instant Power Loss

The MVH2 variable frequency drive will continue to run even in the event of a voltage drop or loss of power (less than 1,000 ms). This ensures continuous operation for critical operations.

Torque Boost

Increase the output voltage at low frequency to boost the motor torque when running at low speed. The torque boost function supports high breakaway torque requirements while providing smooth, reliable starting.

Interface Board

The core of the interface board is a commercial PLC. The module comes standard with an Ethernet interface and supports the Siemens S7 and TCP/IP protocols in order to support a variety of terminal connections. In addition, the CPU module is integrated with one RS485 interface, able to communicate with third party equipment such as the MV drive and touch screen. The interface board is also equipped with an expansion CM01 signal board to provide RS232/RS485 free communication and support Profibus and Ethernet TCP/IP communication protocols.

Interface Logic Controller

The interface logic controller uses a smart PLC as a standard (core) component. The PLC is equipped with a dedicated high-speed processor chip. Its basic instruction execution time can be up to 0.15 μ s.

Parameter Downloading and Uploading

System and motor parameters can be easily downloaded and uploaded with a Windows PC-based software tool. The software provides advanced service functionality and guarantees the correct parameter settings after replacement of components.

Master-Slave Control

Supports multiple VFD systems with several motors running on the same load such as mills or conveyor belts. The VFD analyzes torque and load to balance motor speed and torque.

Power Cell Braking Function

This function enables high braking torque at low speed, guaranteeing a quick stop time if required.

Neutral Point Shift*

In the event that one power cell is internally bypassed because of a fault, the other power cells can adjust the output voltage to maintain balance, changing phase position to maintain continuous operation.

Synchronous Transfer*

Phase lock loop technology is used to adjust the output of the drive so that the frequency, phase position and amplitude can be matched to the network. Switch motor power from the medium voltage drive to network power (bypass mode) and back (drive mode). Multi-motor synchronous transfer allows users to start up to four MV motors sequentially in drive mode and control the last motor's speed.

* Future



Technical Data

FEATURE		SPECIFICATION/RATING
Main Power Supply	Voltage	2300 or 4160V (+ 5%, -20% with output power derating)
	Frequency	50 or 60Hz (+/- 10%)
	Phase unbalance	Less than 5%
	True power factor	> 0.96
Control Power Supply*	Voltage	230V single phase*
	Frequency	50 or 60Hz
Enclosure	Standard	NEMA 1
Control	Control type	Sinusoidal multilevel PWM
		Fully digital
	Control mode	Open and closed loop V/F and vector control
	Switching mode	Multilevel IGBT
	Frequency mode	0 ... 80Hz
	Overload capacity	150% instantaneous
		120% for 120 seconds, every 15 minutes
	Efficiency	≥ 96%
Performance	Speed control	0.1% closed loop, 0.5% open loop
		Resolution: 1 RPM
Control Inputs	Analog	2 x Programmable isolated input: 4-20mA, 2-10V
		1 x Excitation feedback 4-20mA, 2-10V
	Digital	14 Isolated inputs: 24Vdc
Control Outputs	Analog	2 Fixed outputs: 4-20mA / 2-10V
		2 Programmable outputs: 4-20mA / 2-10V
	Relay	22 Isolated outputs with dry contacts
Communication	Fieldbus communication	Standard Modbus RTU
		DeviceNet / Profibus / Ethernet IP (optional)
Power Cell Bypass Function (86A and below)	Allows for continued operation with 1 or 2 failed cells	
	Failed cells are bypassed automatically without interruption of equipment process.**	
	Failed cells can be replaced quickly due to draw-out construction of power cell.**	
	High productivity and low mean time to repair (MTTR)	
Ambient	Temperature	23°F ... 104°F (-5°C ... 40°C)
	Humidity	< 95% non-condensing
	Altitude	0 ... 5000 ft (above 3300 ft - 1% de-rating for every additional 330 ft)
Finishing	Color	ANSI 61 Gray
		Special paint color optional
Conformities Standards	Electromagnetic compatibility	IEEE 519-2014
		IEC 61800-3
		UL/cUL (up to 205A) 4160V only. *2300V UL future.

* 230V power supply supplied by others.

** Future

FEATURE	SPECIFICATION/RATING	
Flying Start	Starting into spinning motor	
High Performance	Vector control, open & closed loop for superior dynamic speed accuracy & torque control	
Motor and System Protections	Motor overload	Overvoltage
	Overcurrent	Current limit
	Phase loss	Over temperature
	Ground fault	Cabinet door interlock (optional)
Ratings	Short circuit withstand	50kA @ 4160V
	BIL	60kV
Standard and Approvals	IEC 60038	IEC 61000
	IEC 60050-151, -551	IEC 61800-3
	IEC 60076	IEC 60757
	IEC 60721, relevant chapters	IEC 106
	UL 347A	UL 508A

MODEL RATINGS

MODEL NUMBER	VOLTAGE	APPROX MAX HP*	FLA	DIMENSIONS (IN)**			APPROX WEIGHT (lbs)
				H	W	D	
2300V							
MVH2-AU6-023-023-0077A-CF-I-NB-FSO-N1	2300	300	77	91.5	86	60	5200
MVH2-AU6-023-023-0154A-CF-I-NB-FSO-N1	2300	600	154	91.5	86	60	5250
MVH2-AU6-023-023-0205A-ND-N-NB-FSO-N1	2300	900	205	91.5	86	60	8000
4160V							
MVH2-AU6-042-042-0031A-CF-I-NB-FSO-N1	4160	200	31	91.5	86	60	3820
MVH2-AU6-042-042-0040A-CF-I-NB-FSO-N1	4160	300	40	91.5	86	60	4280
MVH2-AU6-042-042-0048A-CF-I-NB-FSO-N1	4160	350	48	91.5	86	60	4740
MVH2-AU6-042-042-0061A-CF-I-NB-FSO-N1	4160	450	61	91.5	86	60	5660
MVH2-AU6-042-042-0077A-CF-I-NB-FSO-N1	4160	600	77	91.5	86	60	6120
MVH2-AU6-042-042-0096A-CF-I-NB-FSO-N1	4160	700	96	91.5	86	60	6580
MVH2-AU6-042-042-0104A-CF-I-NB-FSO-N1	4160	800	104	91.5	86	60	7500
MVH2-AU6-042-042-0115A-CF-I-NB-FSO-N1	4160	850	115	91.5	86	60	7500
MVH2-AU6-042-042-0130A-CF-I-NB-FSO-N1	4160	1000	130	91.5	86	60	7500
MVH2-AU6-042-042-0154A-CF-I-NB-FSO-N1	4160	1200	154	91.5	86	60	7500
MVH2-AU6-042-042-0165A-ND-N-NB-FSO-N1	4160	1250	165	91.5	86	60	8000
MVH2-AU6-042-042-0205A-ND-N-NB-FSO-N1	4160	1500	205	91.5	86	60	8000

NOTE: 4160V models UL listed. UL testing of 2300V units TBD.

* Approx. Max HP based on a 4-pole motor. Size according to actual motor FLA.

** Overall dimensions. Height includes fans.

Industries and Applications



Benshaw's next generation MVH2 Series multi-purpose variable frequency drive provides a solution for all kinds of applications ... in nearly every industrial sector.

From initial engineering through production, factory acceptance testing, commissioning and beyond, Benshaw is committed to helping customers achieve their applied motor control objectives. Our customer-centric approach to motor control and protection — combined with decades of experience in applying variable speed drive technologies to real world motor control requirements — provides distinct advantages and true value for our customers.

PETROCHEMICAL

- Booster fan
- Induced draft fan
- Pipeline transportation pump
- Water injection pump
- Feed water pump
- Submersible pump
- Oil transfer pump
- Brine pump
- Circulating water pump Compressor

CEMENT

- Kiln draft fan
- Kiln gas blower
- Separator fan
- Kiln drive
- High temperature fan
- Cement mill (Ball mill)
- Dust removal fan
- Circulating fan
- Grate cooler
- Raw material mill fan
- Raw material mill (Vertical mill)
- Coal mill
- Rotating kiln transmission
- Compressive force draft fan

POWER

- Exhaust fan
- Booster fan
- Force draft fan
- Induced draft fan
- Condensation pump
- Slurry pump
- Water pumping energy storage pump
- Circulating water pump
- Boiler (feed) pump
- Compressor

MINING & MINERALS

- BFDS
- De-dusting fan
- Main fan
- Axial flow fan
- De-scaling pump
- Mud pump
- Slurry pump
- Water pump
- Feeding pump
- Stirring pump
- Agitating pump
- Drainage pump
- Process pump
- Belt conveyor
- Kiln drive

MUNICIPAL PROJECTS

- Aeration fan
- Induced draft fan
- Force draft fan
- Submersible pump
- Fresh water pump
- Sewage pump
- Hot water circulating pump
- Lifting pump
- Water booster pump
- Water injection pump

METALS

- Induced draft fan
- Force draft fan
- Secondary de-dusting fan
- Compressing blower
- Blast furnace blower
- Blast de-dusting fan
- Hydraulic pump
- Electric furnace cooling fan
- Sulfur dioxide blower
- Slag-flushing pump
- Feeding pump
- Water-delivery pump
- Phosphorus removal pump
- Mud pump
- De-scaling pump
- Kneading machine
- Oxygen compressor
- Gas compression pump

Service and Support

Why Benshaw? Because when it absolutely has to work, it absolutely has to be from Benshaw.

From retrofits to repairs, Benshaw is committed to meeting your requirements. Whether you need simple modifications made to a Benshaw control or drive package, a custom-engineered upgrade to optimize production from an existing machine control panel, technical training for key personell, or a turnkey, plant-wide modernization program, Benshaw is here to help.

- Phone support hotline (1-800-203-2416)
- Centralized coordination of all support services
- 24-hour dispatch from our operations in Pittsburgh, PA (USA) and Listowel, ON (Canada)
- Overnight parts shipment

FACTORY WARRANTY

Benshaw offers a three year warrantee on all of our medium voltage drive packages.*

Other manufacturers limit their warranties to one year. But at Benshaw, we believe that because we build them better, we can guarantee them longer.



* With factory startup

TECHNICAL SUPPORT SERVICES



***Our technical support team is available 24/7
to answer questions and solve pressing issues ...
before, during and after the sale.***

Benshaw's knowledgeable Technical Support team can help you evaluate both current and future motor control system requirements and develop a sound strategy for retrofit, upgrade or replacement. We can also help you submit a Request for Service Quotation. All services are performed by trained, experienced service technicians using the latest engineering, diagnostics and testing equipment.

- Retrofits
- Field service
- Factory service
- Technical training support
- Spare/repair parts
- Maintenance

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