

# VFD 4x

STAINLESS STEEL ENCLOSURE WITH AC

engineering data  
and specifications



## OVERVIEW

Marley VFD assembly using an ABB model ACH550 VFD, NEMA 4X stainless steel enclosure, NEMA 4X stainless steel air conditioner, MCB disconnect and traditional bypass motor starter.

- NEMA 4X outdoor stainless steel enclosure.
- ABB model ACH550 6 Pulse PWM VFD with IGBT switching.
- Thermal magnetic main circuit breaker disconnect.
- Through-the-door operating disconnect handle with provisions for lock-out tag-out padlocks.
- Traditional bypass starter design with two isolating contactors.
- NEMA 4X stainless steel air conditioner seals out ambient air, recirculating air throughout the VFD enclosure.
- VFD requires a speed reference input signal from a remote source such as a Building Automation System or Marley RTD with 4-20ma transmitter. VFD will accept a 4-20mA, 0-20mA or 0-10 VDC signal. Speed may also be controlled via the onboard keypad.
- Field selectable automatic or manual bypass mode.
- 5%-line impedance standard.
- Programmable output relay contacts for connection to Building Automation System.
- VFD has embedded fieldbus protocols allowing communications with Modbus RTU, Johnson Controls, Metasys N2 and Siemens.
- Optional communication protocols available: LonWorks, Modbus/TCP, EtherNet/IP, EtherCAT, PowerLink, Profinet IO, Profibus DP, CANopen, DeviceNet, and ControlNet.
- Built in Real Time Clock recording actual time and day drive events.
- Fault logger for tracking drive issues so you'll know what happened, when and why.
- Interactive assistance guides user through the startup.
- UL Listed.
- Keypad for VFD control/monitoring.

## WARRANTY

The ABB VFD located inside the enclosure has a 3-year parts, labor and travel warranty from date of shipment for locations in the continental USA. The VFD warranty includes an initial troubleshooting step between ABB and user operating the VFD. Based on findings, ABB will determine whether to replace or repair on site using an ABB-certified technician. Warranty does not extend to storm damage, VFD reprogramming, field power/control wiring or communications interfacing to field computers.

Other control assembly components include a 12-month parts-only warranty from date of shipment supported by the specific component manufacturer.

## STANDARD FEATURES

- UL and cUL labeled
- EMI/RFI Filter (First Environment, Restricted Distribution)
- Startup Assistants
- Maintenance Assistants
- Diagnostic Assistants
- Real Time Clock
  - Includes Day, Date and Time
- Operator Panel Parameter Backup (read/write)
- Display for Operator Control, Parameter Setup and Operating Data Display:
  - Output Frequency (Hz)
  - Speed (RPM)
  - Motor Current
  - Calculated % Motor Torque
  - Calculated Motor Power (kW)
  - DC Bus Voltage
  - Output Voltage
  - Heatsink Temperature
  - Elapsed Time Meter (resetable)
  - KWh (resetable)
  - Input / Output Terminal Monitor
  - PID Actual Value (Feedback) and Error
  - Fault Text
  - Warning Text
  - Three (3) Scalable Process Variable Displays
  - User Definable Engineering Units
- Two (2) Programmable Analog Inputs
- Six (6) Programmable Digital Inputs
- Two (2) Programmable Analog Outputs
- Up to Six (6) Programmable Relay Outputs (3 Standard)
- Adjustable Filters on Analog Inputs and Outputs
- Mathematical Functions on Analog Reference Signals
- All Control Inputs Isolated from Ground and Power
- Four (4) Resident Serial Communication Protocols
  - Johnson Controls N2
  - Siemens Building Technologies FLN (P1)
  - Modbus RTU
  - BACnet (MS/TP)
- Input Speed Signals
  - Current 0 (4) to 20 mA
  - Voltage 0 (2) to 10 VDC
- Increase/Decrease Reference Contacts (Floating Point)
- Serial Communications

## Start/Stop

- 2 Wire (Dry Contact Closure)
- Application of Input Power
- Application of Reference Signal (PID Sleep/Wakeup)
- Serial Communications

## Start Functions

- Ramp Flying Start
- Premagnetization on Start Automatic Torque Boost
- Automatic Torque Boost with Flying Start
- Auto Restart (Reset) – Customer Selectable and Adjustable

## Stop Functions

- Ramp or Coast to Stop
- Emergency Stop
- DC Braking / Hold at Stop
- Flux Braking

## Accel/Decel

- Two (2) sets of Independently Ramps
- Linear or Adjustable S Curve Accel/Decel Ramps

## HVAC Specific Application Macros

## Separate Safeties (2) and Run Permissive Inputs

## Damper Control

## Override Input (Fire Mode)

## Timer Functions

- Four (4) Daily Start/Stop Time Periods
- Four (4) Weekly Start/Stop Time Periods
- Four Timers for Collecting Time Periods and Overrides
- Seven (7) Preset Speeds

## Supervision Functions

## Adjustable Current Limit

## Electronic Reverse

## Automatic Extended Power Loss Ride Through (Selectable)

## Programmable Maximum Frequency to 500 Hz

## PID Control

- Two (2) Integral Independent Programmable PID Setpoint Controllers (Process and External)
- External Selection between Two (2) Sets of Process PID Controller Parameters
- PID Sleep/Wakeup

## Motor Control Features

- Scalar (V/Hz) and Vector Modes of Motor Control
- V/Hz Shapes
  - Linear
  - Squared
- Energy Optimization
- IR Compensation
- Slip Compensation
- Three (3) Critical Frequency Lockout Bands

## Preprogrammed Protection Circuits

- Overcurrent
- Short Circuit
- Ground Fault
- Overvoltage
- Undervoltage
- Input Phase Loss
- Output Device (IGBT) Overtemperature
- Adjustable Current Limit Regulator
- UL508C approved Electronic Motor Overload (I2T)

## Programmable Fault Functions for Protection Include

- Loss of Analog Input
- Panel Loss
- External Fault
- Motor Thermal Protection
- Stall
- Underload
- Motor Phase Loss
- Ground Fault

## 5% Input Impedance

- Equivalent 5% Impedance with Internal Reactor(s)
- Patented Swinging Choke Design for Superior Harmonic Mitigation (R1 to R4)

**OPTIONAL FEATURES**

## 3 Relay Extension Module (OREL-01)

## 115/230 V Digital input Interface Card (OHDI-01)

## Fieldbus Adapter Modules

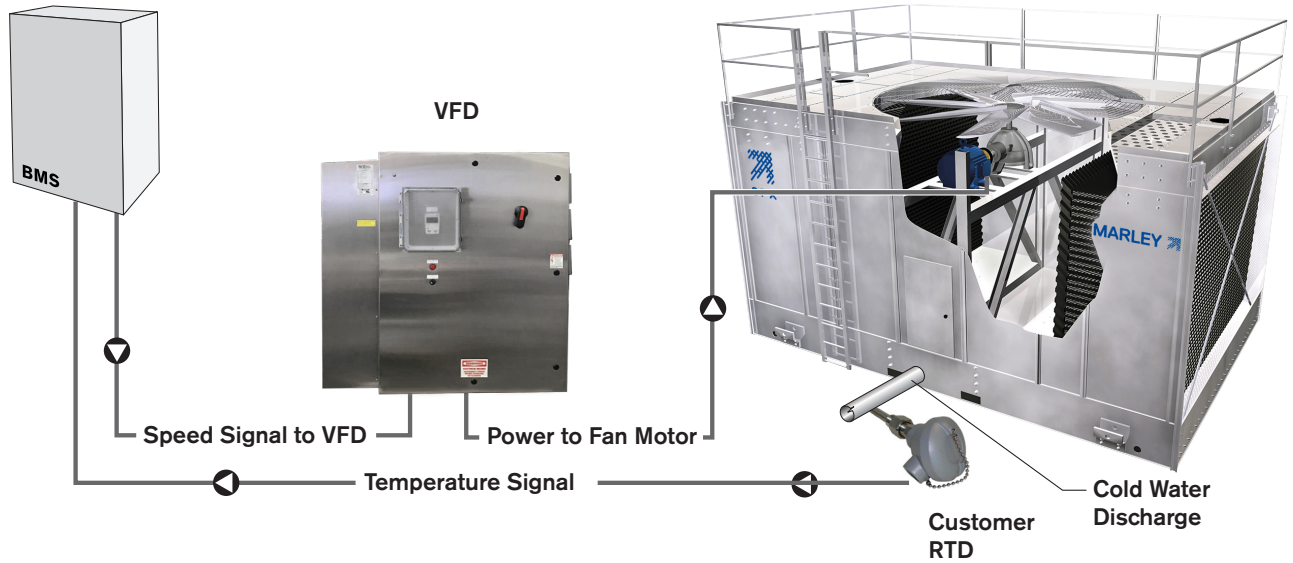
- LonWorks
- Profibus
- Ethernet

## DriveWindow Light Startup, Operation, Programming and Diagnostic Tool

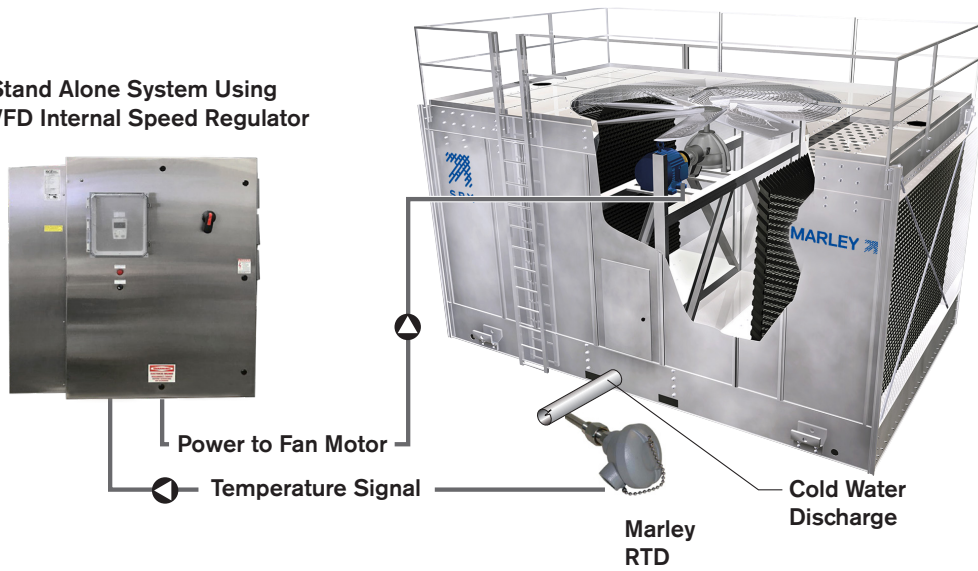
## Fan Replacement Kit

**SPEED CONTROL METHODS**

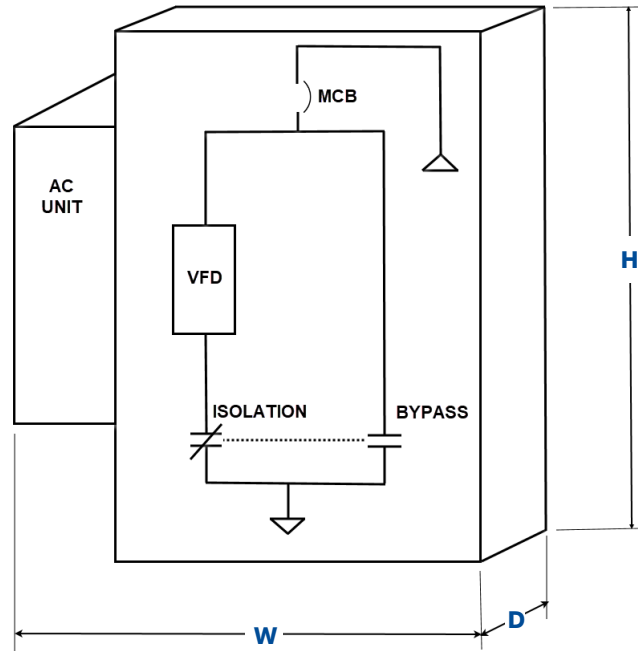
**Speed Controlled by Building Management System (BMS)**



**Stand Alone System Using VFD Internal Speed Regulator**



**DIMENSIONS**



Fan Motor Horsepower	W	H	D
1-7.5	34"	36"	8"
10-20	42"	36"	11"
25-30	48"	48"	11"
40-60	52"	48"	16"
75-100	52"	60"	16"

**Note:** All wiring should be in and out of the bottom of the enclosure. Width dimension includes the air-conditioning unit.

**Input Connection**

Input Voltage (U <sub>1</sub> )	480 VAC 3-phase +/-10%
Frequency	48 - 63 Hz
Line Limitations	Max +/-3% of nominal phase to phase input voltage
Fundamental Power Factor (cos $\phi$ )	0.98 at nominal load
Connection	U <sub>1</sub> , V <sub>1</sub> , W <sub>1</sub> (U <sub>1</sub> , V <sub>1</sub> , 1-phase)

**Output (Motor) Connection**

Output Voltage	0 to U <sub>1</sub> , 3-phase symmetrical, U <sub>2</sub> at the field weakening point
Output Frequency	-500 to 500 Hz
Frequency Resolution	0.01 Hz
Continuous Output Current	
Variable Torque	1.0 * I <sub>2N</sub> (Nominal rated output current, Variable Torque)
Short Term Overload Capacity	
Variable Torque	1.1 * I <sub>2N</sub> (1 min/10 min)
Peak Overload Capacity	
Variable Torque	1.35 * I <sub>2N</sub> (2 sec/1 min)
Base Motor Frequency Range	10 to 500 Hz
Switching Frequency	1, 4, 8 or 12 kHz
Acceleration Time	0.1 to 1800 s
Deceleration Time	0.1 to 1800 s
Efficiency	0.98 at nominal power level
Short Circuit Withstand Rating	100,000 AIC (UL) w/o fuses on VFD (5,000 AIC on 4x Assembly)
Connection	U <sub>2</sub> , V <sub>2</sub> , W <sub>2</sub>
Enclosure Style	UL (NEMA) Type 1, Type 12, or Type 3R UL, Plenum Rated Type 1, Type 12
Agency Approval Listing and Compliance	UL, cUL, CE

**Ambient Conditions, Operation**

Air Temperature	0° to 40°C (32° to 104°F), above 40°C the maximum output current is derated 1% for every additional 1°C (up to 50°C (122°F)) maximum limit.
Relative Humidity	5 to 95%, no condensation allowed, maximum relative humidity is 60% in the presence of corrosive gasses
Contamination Levels	
IEC	60721-3-1, 60721-3-2 and 60721-3-3
Chemical Gasses	3C1 and 3C2
Solid Particles	3S2
Installation Site Altitude	0 to 1000 m (3300 ft) above sea level. At sites over 1000 m (3300 ft) above sea level, the maximum power is derated 1% for every additional 100 m (330 ft). If the installation site is higher than 2000 m (6600 ft) above sea level, please contact your local ABB distributor or representative for further information
Vibration	Max 3.0 mm (0.12 in) 2 to 9 Hz, Max 10 m/s <sup>2</sup> (33 ft/s <sup>2</sup> ) 9 to 200 Hz sinusoidal

**Ambient Conditions, Storage** (In protective shipping package)

Air Temperature	-40° to 70°C (-40° to 158°F)
Relative Humidity	Less than 95%, no condensation allowed
Vibration Tested to (IEC 60068-2-6)	In accordance with ISTA 1A and 1B specifications
Bump Tested to (IEC 60068-2-29)	Max 100 m/s <sup>2</sup> (330 ft/s <sup>2</sup> ) 11 ms (Tested 500 times each axis, each pole; 3000 times total)

**Ambient Conditions, Transportation** (In protective shipping package)

Air Temperature	-40° to 70°C (-40° to 158°F)
Relative Humidity	Less than 95%, no condensation allowed
Atmospheric Pressure	60 to 106 kPa (8.7 to 15.4 PSI)
Vibration Tested	Max 3.5 mm (0.14 in) 2 to 9 Hz, Max 15 m/s <sup>2</sup> (49 ft/s <sup>2</sup> ) 9 to 200 Hz sinusoidal
Shock Tested to (IEC 60086-2-29)	Max 100 m/s <sup>2</sup> (330 ft/s <sup>2</sup> ) 11 ms
Free Fall	R1: 76 cm (30 in) R2: 61 cm (24 in) R3: 46 cm (18 in) R4: 31 cm (12 in) R5 and 6: 25 cm (10 in)

**Cooling Information**

Cooling Method	Integral fan(s)
Power Loss	Approximately 3% of rated power

**Analog Inputs**

Quantity	Two (2) programmable
Voltage Reference	0 (2) to 10 V, 250 kOhm, single ended
Current Reference	0 (4) to 20 mA, 100 Ohm, single ended
Potentiometer	10 VDC, 10 mA (1K to 10K Ohms)
Input Updating Time	8 ms
Terminal Block Size	2.3mm <sup>2</sup> / 14AWG

**Reference Power Supply**

Reference Voltage	+10 VDC, 1% at 250C (77°F)
Maximum Load	10 mA
Applicable Potentiometer	1 kOhm to 10 kOhm
Terminal Block Size	2.3mm <sup>2</sup> / 14AWG

**Analog Outputs**

Quantity	Two (2) programmable current outputs
Signal Level	0 (4) to 20 mA
Accuracy	+/- 1% full scale range at 25°C (77°F)
Maximum Load Impedance	500 Ohms
Output Updating Time	2 ms
Terminal Block Size	2.3mm <sup>2</sup> / 14AWG

**Digital Inputs**

Quantity	Six (6) programmable digital inputs
Isolation	Isolated as one group
Signal Level	24 VDC, (10V Logic 0)
Input Current	15 mA at 24 VDC
Input Updating Time	4 ms
Terminal Block Size	2.3mm <sup>2</sup> / 14AWG

**Internal Power Supply**

Primary Use	Internal supply for digital inputs
Voltage	+24 VDC, max 250 mA
Maximum Current	250 mA
Protection	Short circuit protected

**Relay Outputs**

Quantity	Three (3) programmable relay (Form C) outputs
Switching Capacity:	8 A at 24 VDC or 250 VAC, 0.4 A at 120 VDC
Max Continuous Current	2A RMS
Contact Material	Silver Cadmium Oxide (AgCdO)
Isolation Test Voltage	4 kVAC, 1 minute
Output Updating Time	12 ms
Terminal Block Size	2.3mm <sup>2</sup> / 14AWG

**Protections**

Single Phase	Protected (input and output)
Overcurrent Trip Limit	3.5 x I <sub>2N</sub> instantaneous
Adjustable Current Regulation Limit	1.1 x I <sub>2N</sub> (RMS) max.
Overvoltage Trip Limit	1.30 x U <sub>N</sub>
Undervoltage Trip Limit	0.65 x U <sub>N</sub>
Overtemperature (Heatsink)	+115°C (+239°F)
Auxiliary Voltage	Short Circuit Protected
Ground Fault	Protected
Short Circuit	Protected
Microprocessor Fault	Protected
Motor Stall Protection	Protected
Motor Overtemperature Protection (I <sub>2t</sub> )	Protected
Input Power Loss of Phase	Protected
Loss of Reference	Protected
Short Circuit Current Rating	100,000 RMS symmetrical Amperes
Input Line Impedance	Swinging choke 5% equivalent R1-R6, 3% equivalent R8

U<sub>1</sub> = Input Voltage U<sub>N</sub> = Nominal Motor Voltage U<sub>2</sub> = Output Voltage f<sub>N</sub> = Nominal Motor Frequency

P<sub>N</sub> = Power – Normal Duty (hp) I<sub>2N</sub> = Nominal Motor Current – Normal Duty

Specifications are subject to change without notice. Please consult the factory when specifications are critical.

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