MARLEY®

AIO control panel

Overview

Marley AIO (all in one) Control Panel combines various cooling tower fan cell electrical component controls into a stand-alone package with a single-point power connection. The main circuit breaker accepts a single power feed at the highest voltage then internally distributes and reduces the voltage to power the various integrated control features.

Integrated controls are customer selectable and typically include VFD for the fan motor, basin heater controls and water level controls.

One Convenient Control Panel per Cooling Tower Fan Cell

Functionally tested and operated at the factory

Single-point power connection
- Uses a main circuit breaker with short circuit protection
- No upstream MOCP-rated device required
- Fewer power feeds

Includes VFD and other cooling tower controls:
- Conductivity or ultrasonic water level controls
- Basin heater control with readout and element test functions
- Power for solid-state vibration switch and gearbox oil level switch

Standard Features:

- Built and marked to UL508A Industrial Control Panel standards
- Main circuit breaker (MOCP device) with thermal and magnetic over current protection
- Through the door operating handle with provisions for lock-out and tag-out procedures
- Wiring clearly labeled
- As-built wiring diagram showing internal and field connection points
- NEMA rated enclosure with swing and latch door

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ACH550 VFD standard features

- UL, cUL labeled and CE marked
- EMI/RFI Filter (1st Environment, Restricted Distribution)
- Start-Up Assistants
- Maintenance Assistants
- Diagnostic Assistants
- Real Time Clock
  - Includes Day, Date and Time
- Operator Panel Parameter Backup (read/write)
- Full Graphic and Multilingual Display for Operator Control, Parameter Set-Up and Operation
- 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
  - (Three (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)
  - 3-Wire (Momentary Contact)
  - Application of Input Power
  - Application of Reference Signal (PID Sleep/Wake-Up)
  - 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 Independent Ramps
  - Linear or Adjustable S-Curve Accel/Decel Ramps
- HVAC Specific Application Macros
- Separate Safety (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 (4) 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/Wake-Up
- 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 (I^2T)
- 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

- Fieldbus Adapter Modules
  - LonWorks
  - Profibus
  - Ethernet

Input Connection

Input Voltage (U_1)	208/220/230/240 VAC 3-phase +/-10% 208/220/230/240 VAC 1-phase +/-10% 380/400/415/440/460/480 VAC 3-phase +/-10% 500/600 VAC 3-phase +/-10%
Frequency	48 - 63 Hz
Line Limitations	Max +/-3% of nominal phase to phase input voltage
Fundamental Power Factor ($\cos\varphi$)	0.98 at nominal load
Connection	U_1, V_1, W_1 (U_1, V_1, 1-phase)
Output (Motor) Connection	
Output Voltage	0 to U_1, 3-phase symmetrical, U_2 at the field weakening point
Output Frequency	-500 to 500 Hz
Frequency Resolution	0.01 Hz
Continuous Output Current	
Variable Torque	1.0 I_{2N} (nominal rated output current, variable torque)
Short Term Overload Capacity	
Variable Torque	1.1 I_{2N} (1 min/10 min)
Peak Overload Capacity:	
Variable Torque	1.35 I_{2N} (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 1800s
Deceleration Time	0.1 to 1800s
Efficiency	0.98 at nominal power level
Short Circuit Withstand Rating	100,000 AIC (UL) w/o fuses
Connection	U_2, V_2, W_2
Enclosure Style	UL (NEMA) Type 1,
Agency Approval Listing and Compliance	UL, cUL, CE

Ambient Conditions, Operation

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.
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

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.
Max 3.0 mm (0.12 in) 2 to 9 Hz, Max 10 m/s^2 (33 ft/s^2) 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^2 (330 ft/s^2) 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 to (IEC 60068-2-6)	Max 3.0 mm (0.14 in) 2 to 9 Hz, Max 15 m/s^2 (49 ft/s^2) 9 to 200 Hz sinusoidal
Bump Tested to (IEC 60068-2-29)	Max 100 m/s^2 (330 ft/s^2) 11 ms (Tested 500 times each axis, each pole; 3000 times total)
Shock Tested to (IEC 60068-2-27)	R1: 76 cm (30 in), R2: 61 cm (24 in), R3: 46 cm (18 in), R4: 31 cm (12 in), R5 and R6: 25 cm (10 in)

Cooling Information

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 10 KOhms)
Input Updating Time	8 ms
Terminal Block Size	2.3 mm^2/14 AWG

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Reference Power Supply

Reference Voltage	+10 VDC, 1% at 25°C (77°F)
Maximum Load	10 mA
Applicable Potentiometer	1 kOhm to 10 kOhm
Terminal Block Size	2.3mm²/14AWG

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	2.3mm²/14AWG

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	2.3mm²/ 4AWG

Internal Power Supply

Primary Us	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	2.3mm²/14AWG

Protections

Single Phase	Protected (input and output)
Overcurrent Trip Limit	3.5 x I_{2N} instantaneous
Adjustable Current Regulation Limit	1.1 x I_{2N} (RMS) max.
Overvoltage Trip Limit	1.30 x U_N
Undervoltage Trip Limit	0.65 x U_N
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_2t)	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_1 = Input Voltage U_N = Nominal Motor Voltage U_2 = Output Voltage f_N = Nominal Motor Frequency
P_N = Power – Normal Duty (hp) I_{2N} = Nominal Motor Current

SPX COOLING TECHNOLOGIES, INC.
7401 WEST 129 STREET
OVERLAND PARK, KS 66213 USA
913 664 7400 | spxcooling@spx.com
spxcooling.com

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