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Product Bulletin

ABB drives for HVAC applications
ACH550, 1 to 550 Hp

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ACH550 Product Overview

The ACH550 is an variable frequency AC drive designed specifically for the HVAC market that achieves the ultimate in flexible motor control performance. Offering two modes of motor control: Scalar (V/Hz) and Sensorless Vector, the ACH550 provides accurate speed control for any standard squirrel cage motor.
With drives ranging from 1 to 550 HP, the ACH550 series features an 'intuitively obvious' multi-lingual, graphic display panel that also provides an assistant to aid users in start-up. The control panel can be mounted on the cover of the drive, or remotely, and can upload, store, and download parameters.
The ACH550 comes equipped with an extensive library of preprogrammed HVAC application macros that, at the touch of a button, allow rapid configuration of inputs, outputs, and parameters for specific HVAC applications to maximize convenience and minimize start-up time.

The ACH550 can be used for the simplest to the most demanding HVAC applications. Two internal option slots can be configured with additional relay outputs as well as a host of different communication bus adapters.

The ACH550 has a 110% short term overload rating for one (1) minute out of ten (10) and is capable of >130% short-term overload rating for 2 seconds out of each minute. This provides the torque you need to start high inertia fan(s).

Standard Features

UL, cUL labeled, CE marked, BTL listed (BACnet Testing Lab) & UL Plenum Rated
EMI/RFI Filter (1st Environment, Restricted Distribution)
Seismic Certification in accordance to
IBC 2000 referencing ASCE 7-98 and ICC AC156
IBC 2003 referencing ASCE 7-02 and ICC AC156
IBC 2006 referencing ASCE 7-05 and ICC AC156
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 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 (resettable)
- KWh (reset-able)
- Input / Output Terminal Monitor
- PID Actual Value (Feedback) & 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 Buildings 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 (DC brake) on Start
- Automatic Torque Boost
- Automatic Torque Boost with Flying Start

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Standard Features

- 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 Adjustable 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/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 (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% Equivalent Impedance
- 5% Equivalent Impedance with Internal Reactor(s)
- Patented Swinging Choke Design for Superior Harmonic Mitigation in frame sizes (R1 to R6)
  - 3% Equivalent Impedance for frame R8

Available Options

- 3 Relay Extension Module (OREL-01)
- 115/230 V Digital input Interface Card (OHDI-01)
- Fieldbus Adapter Modules
  - LonWorks
  - Profibus
  - DeviceNet
  - Ethernet
  - ControlNet
  - BACnet IP to MS/TP router
- DriveWindow Light Start-up, Operation, Programming and Diagnostic Tool

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Specifications

Input Connection

Input Voltage (U1)	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% 500/575/600 VAC 3-phase +/- 10%
Frequency:	48 - 63 Hz
Line Limitations:	Max +/-3% of nominal phase to phase input voltage
Fundamental Power Factor (cosj):	0.98 at nominal load
Connection:	U1, V1, W1 (U1, V1, 1-phase)

Output (Motor) Connection

Output Voltage:	0 to U1, 3-phase symmetrical, U2 at the field weakening point
Output Frequency:	-500 to 500 Hz
Frequency Resolution:	0.01 Hz
Continuous Output Current:	
Variable Torque:	1.0 * I2N (Nominal rated output current, Variable Torque)
Short Term Overload Capacity:	
Variable Torque:	1.1 * I2N, (1 min/10 min)
Peak Overload Capacity:	
Variable Torque:	1.35 * I2N, (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
Connection:	U2, V2, W2
Enclosure Style:	UL (NEMA) Type 1, Type 12, or Type 3R
Agency Approval Listing and Compliance:	UL, cUL, CE, BTL (BACnet Testing Laboratory), IBC2000, 2003, 2006

Ambient Conditions, Operation

Air Temperature:	-15° to 40°C (5° to 104°F), above 40°C the maximum output current is de-rated 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 de-rated 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/s2 (33 ft/s2) 9 to 200 Hz sinusoidal Seismic Certified referencing IBC 2000, 2003 and 2006

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:	In accordance with ISTA 1A and 1B specifications
Shock (IEC 60086-2-29):	Max 100 m/s2 (330 ft/s2) 11 ms

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:	Max 3.5 mm (0.14 in) 2 to 9 Hz, Max 15 m/s2 (49 ft/s2) 9 to 200 Hz sinusoidal
Shock (IEC 60086-2-29):	Max 100 m/s2 (330 ft/s2) 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 & 6: 25 cm (10 in)

Cooling Information

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

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Specifications

Analog Inputs

Quantity	Two (2) programmable
Voltage Reference:	0 (2) to 10 V, 250kOhm, single ended
Current Reference:	0 (4) to 20 mA, 100Ohm, single ended
Potentiometer:	10 VDC, 10 mA (1K to 10KOhms)
Input Updating Time	8 ms
Terminal Block Size	2.3mm2 / 14AWG

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 / 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	2.3mm2 / 14AWG

Protections

Single Phase	Protected (input & output)
Overcurrent Trip Limit:	3.5 x I2N instantaneous
Adjustable Current Regulation Limit:	1.3 x I2N (RMS) max.
Overvoltage Trip Limit:	1.30 x UN
Undervoltage Trip Limit:	0.65 x UN
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 (I2t):	Protected
Input Power Loss of Phase:	Protected
Loss of Reference:	Protected
Short Circuit Current Rating:	100,000 RMS symmetrical Amperes
Input Line Impedance:	5% Equivalent Input Impedance with internal reactor(s) Patented swinging choke design for superior harmonic mitigation in frame sizes R1-R6
Printed Circuit Boards	Conformal coated

Notes

U1 = Input Voltage
U2 = Output Voltage
UN = Nominal Motor Voltage
fN = Nominal Motor Frequency

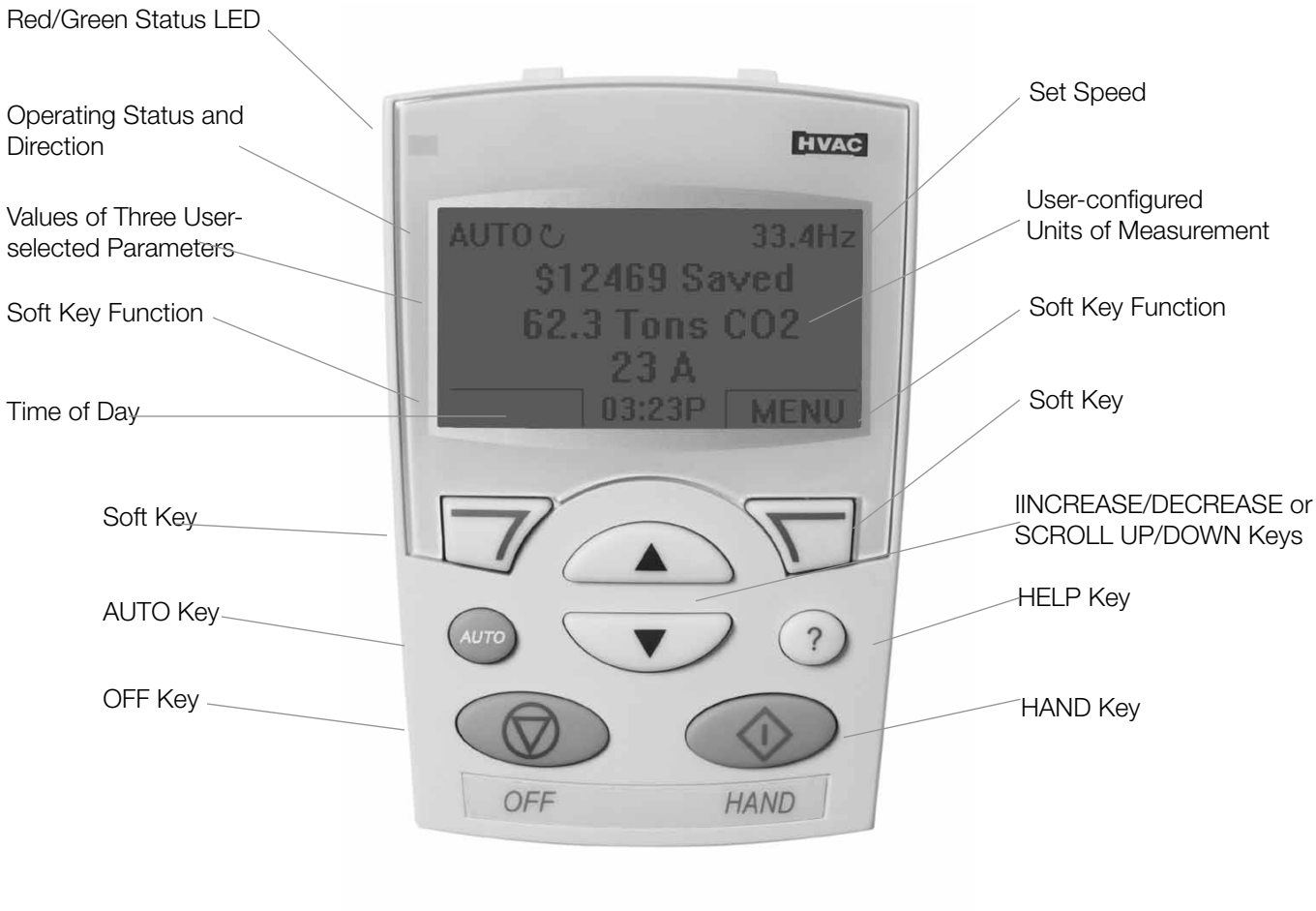
PN = Power – Normal Duty (HP)
2N = Nominal Motor Current Normal Duty

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Drive Features - Human Interface

User Friendly Operator Control Panel
The ACH550 includes an operator control panel that is as easy to understand and use as a cell phone. The standard display mode can be user-configured to show the operating status information that you want to see. The panel is mounted on the front face of the drive and can be hand held or mounted remotely.

Designed specifically for HVAC applications, the operator panel includes HAND, OFF, AUTO and speed INCREASE and DECREASE keys are provided for manual operation. Two multi-function Soft Keys are provided for navigating through the menus and setting parameters. A HELP key pulls up a brief description of the displayed or highlighted item.



Backlit, Multilingual, Text/Graphics Display
The liquid crystal display (LCD) is backlit and provided with a contrast adjustment for optimum legibility under a range of viewing conditions.

Graphical Display
Parameter values can be displayed in bar graph meter format.
Plain English
The ACH550 presents information in “plain” English (no codes).
User-selected Languages
In addition to US English, ten other languages are available including French, Spanish, German, Italian, Swedish, Finnish, Danish, Portuguese, Dutch and international English.

Standard Display Mode
When the operator panel is in the standard display mode as shown above, the top line of the display always shows the drive operating status, HAND, OFF or AUTO, the direction of motor rotation and the speed command setting.
The center three lines show the values of three user-selected parameters in large numbers with user-selected units of measurement.

The bottom line shows the functions assigned to the Soft Keys for that particular display. In the menus, the function of the Soft Key on the left is generally EXIT or CANCEL. Repeatedly pressing the EXIT or CANCEL key brings the display back to the standard display mode.

The local time is displayed in the center of the bottom line of the standard display (12 or 24 hour format).

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Drive Features - Human Interface

Control Panel Mounting Options

An optional panel mounting kit (OPMP-01) allows the control panel to be mounted remotely or hand held. See “Control Panel Mounting Kit” on page 33.

The control panel can be connected to and disconnected from the drive at any time. If the drive is running under HAND keypad control, disconnecting the keypad will cause the drive to stop and display a fault message. Alternatively, the drive can be programmed to continue operation after the keypad is disconnected and run at a preset speed or at the average speed over the previous 10 seconds.

Control Panel Keypad Operating Modes

Start/Stop and Speed Reference commands can be given from the control panel keypad, from external command signals connected to the customer terminal strip or transmitted through a serial communication interface.

- **Hand – Off – Auto Control**
  When the HAND key is pressed, the drive starts and the reference frequency can be modified by pressing the UP/DOWN keys. The HAND (keypad) control mode is indicated on the LCD display.
  When the OFF key is pressed, the drive stops and the OFF control mode is indicated on the LCD display.
  When the AUTO key is pressed, the AUTO mode is indicated on the LCD display. The drive can be started and stopped using whichever remote start/stop command has been configured, a contact closure applied to the Start/Stop input or a serial communication command. The drive speed is controlled by the external speed reference input or by the PID controller.

- **Bumpless Transfer**
  If the HAND key is pressed while the drive is running in the AUTO control mode, the drive continues to run without changing speed, but ceases to respond to external input or PID speed reference changes (Bumpless transfer). The reference frequency can be modified by pressing the UP/DOWN keys.
  If the AUTO key is pressed while the drive is running in the HAND control mode, the drive continues to run and follows the acceleration or deceleration control ramp to the speed set by the external input or PID speed reference (Bumpless transfer).

- **Keypad Control Lock**
  Keypad HAND – OFF – AUTO control can be locked out or enabled only when permitted by a terminal block or serial communications input.

Date and Time Clock

The operator panel contains a clock with a battery backup (10 year life). The clock provides the date and time for use in the FAULT LOGGER and timer functions.

Help Key

The HELP key pulls up a brief description of various displayed or highlighted items including the Main Menu items, parameter groups and individual parameters. In addition, help messages and warnings are displayed automatically when parameter changes or set-up procedures are initiated. The HELP Key also displays possible causes and corrective actions for drive faults

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Drive Features - Human Interface

- **User Friendly Menu Structure**
  The MAIN MENU contains just seven items:
- **PARAMETERS**
  The parameter menu displays the parameter values and allows them to be edited. The parameters are organized by function into numbered groups. See “Parameter Group Functional Descriptions” on page 22. The first two digits of the parameter number are the group number. Parameters include items with adjustable values, configuration alternative selections and read-only displays of actual values of operating data items.
- **ASSISTANTS**
  The programming assistants provide help in configuring the drive. See below.
- **CHANGED PAR**
  The changed parameters menu displays only the parameters that have been changed from the default values as loaded at the factory or loaded by executing an application macro.
- **FAULT LOGGER**
  The FAULT LOGGER displays the most recent faults. See “Fault Logger” on page 9.
- **CLOCK SET**
  The clock setting menu provides a means for selecting the display format and setting the date and time.
- **PAR BACKUP**
  The parameter backup menu has commands for uploading the parameter settings to the operator panel and downloading all or subsets of stored parameters to any ACH550 drive.
- **I/O SETTINGS**
  The I/O settings menu displays the I/O configuration settings and allows them to be edited.

Programming Assistants

The programming assistants, used in conjunction with the HELP key, provide a guided, step-by-step method for setting parameters.

- **Spin the Motor**
  For use prior to commissioning or during troubleshooting. Allows manual operation with minimal control functionality using the control panel keypad.
- **Commission Drive**
  Provides a step-by-step procedure for the drive commissioning configuration.
- **Application**
  Provides direct access for loading an Application Macro. Loading an application macro configures the I/O parameters for the typical control circuit connections required for common applications. The ACH550 User’s Manual contains the appropriate control circuit connection diagram for each macro. In addition to the I/O configurations, some macros also set other parameters such as initial PID tuning adjustments. Loading the HVAC DEFAULT macro resets the drive to the factory default I.O configuration.

The following programming assistants can be used to step through and manually set the more common configuration parameters without entering the PARAMETERS menu.

- **References 1 & 2**
  Defines the speed reference source or the means of selecting the speed reference. Sets the reference and output frequency limits.
- **Start/Stop Control**
  Defines the source and configuration of the Start/Stop and Direction commands. Selects start/stop functions such as ramp or coast stop and flying start. Sets acceleration and deceleration times.
- **Protections**
  Configures protective functions such as current limit, external interlocks, fault trip functions and automatic reset functions.
- **Constant Speeds**
  Configures preset speed selection functions.
- **PID Control**
  Enables and configures the process PID controller.
- **Low Noise Set-up**
  Configures the drive to minimize acoustical noise produced by the motor. Sets the switching frequency, enables flux optimization and configures the critical speed avoidance feature.
- **Panel Display**
  Selects the process variables displayed on the operator’s panel and configures the display.
- **Timed Functions**
  Configures the daily and weekly event program timers.
- **Outputs**
  Configures the relay outputs and sets their delay times. Configures and adjusts the analog outputs.

Application Macros

The ACH550 offers a choice of fourteen (14) HVAC application macros and has been designed to offer users the ability to program common applications in a simple and flexible manner. By using the application macros supplied as standard with all ACH550 drives, building-wide standardization will be greatly simplified.

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- **Configure I/O Terminals Automatically**
  Application macros allow for complete configuring of the analog and digital I/O's, and certain drive parameters for specific applications.
- **Edit Automatically Configured Settings**
  The function of automatically configured analog or digital I/O or drive parameters may be customized, providing added flexibility.
- **User 1 / User 2 Macros for Customized Settings**
  Customized user settings can be saved as USER S1 and USER S2 macros, and reloaded or loaded into other drives for quicker set-up in installations with multiple drives or switch between two different settings and drive operation profile on one drive

Maintenance Assistant

The maintenance assistant is a series of usage level measurement functions and trigger points that can be used to prompt users to perform periodic preventative maintenance tasks. When usage reaches the set trigger point, a notice is displayed on the operator's panel.

- **Maintenance Trigger Parameters**
  The maintenance trigger parameters include the following operating data items and associated trigger setpoints. See "Maintenance Triggers – Group 29" on page 27.
  - Cooling fan accumulated operating time
  - Accumulated motor revolutions
  - Accumulated hours of drive run time
  - Accumulated megawatt hours of drive power usage
- **Supervision Functions**
  Supervision functions monitor up to three user-selected operating data parameters and energize relay outputs if the parameter values deviate beyond user-set limits. These functions can be used to set up maintenance prompts based on deviations from normal operating conditions. See "Supervision – Group 32" on page 28.
  - **Air Filter Alarm**
    With a fan drive, high load current can indicate restricted air flow due to a dirty air filter.
  - **Broken Belt Alarm or Proof of Flow**
    An unusually low load current can indicate a broken fan drive belt or a dry pump.

Diagnostic Assistant

The ACH550 includes several valuable diagnostic tools to assist in getting the drive back into operation quickly if a protective shutdown occurs.

- **Fault Messages**
  When the drive detects a severe error or hazardous operating condition, the motor is stopped, the red operator's panel LED is illuminated and a fault message is displayed on the operator's panel.
- **Diagnostic Assistance Message**
  If a fault message is displayed, pressing the HELP key displays a diagnostic assistance message. The message displays, in plain language, possible causes of the problem and potential solutions. For example:
  - Fault 2
    DC OVERVOLT
    Check: Overvoltage in the input power supply, insuff decel time, undersized brake chopper.
- **Fault Logger**
  The three most recent fault messages are displayed by entering the FAULT LOGGER, a MAIN MENU item.
  Detail Key
  For the most recent fault message, pressing the DETAIL Soft Key displays additional operating data including:
  - Operating speed and frequency
  - Motor voltage, current and torque
  - Status of the digital inputs

  Diagnostic Message Key
  From the Detail display, pressing the DIAG Soft Key displays the diagnostic assistance message.
  The FAULT LOGGER data is also available in parameter group 04. See "Fault History – Group 04" on page 22.
- **Test Meter and Monitoring Functions**
  The capability to display an extensive range of operating data means that the ACH550 control panel is a powerful tool for use in commissioning and troubleshooting. It can be used to monitor performance and diagnose problems in the ACH550, the motor or the driven equipment and process. See "Operating Data – Group 01 and Information – Group 33" on page 22.
- **Load Analyzer**
  Used for analyzing the customer's process and sizing the drive and motor the peak value is logged at a 2 ms level, and the distribution loggers are updated on a 0.2 (200 ms) time level. Three different valves can be logged.

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Drive Features - Terminal Block Interface

Introduction
The ACH550 is equipped with a very flexible complement of programmable inputs and outputs for connecting a wide variety of field devices to the drive.

Programmable Analog and Digital Inputs and Outputs
The ACH550 includes 13 I/O terminals as standard and 3 additional relay outputs can be added (page 24). I/O functions are assigned by the user by loading an application macro or by setting individual parameters (Group 10 to 81 pages 22 to 31.).

- **2 Analog Inputs**
  Group 11 & 12 Speed Reference inputs.
  Group 35 Motor Temp PT100 or PTC input.
  Group 40, 41 & 42 Process or External PID set point and feedback inputs.
- **2 Analog Outputs**
  Group 15 Analog Outputs
  Group 35 Motor Temp PT100 or PTC regulated current.
- **6 Digital Inputs**
  Group 10 & 21 Start/Stop/Direction control functions
  Group 11 & 12 Speed Reference and Preset Speed selection functions
  Group 16, 17 & 30 System Control, Override, and
- **External Fault functions**
  Group 20 Torque Limit functions
  Group 22 Accel/Decel time select and reset functions
  Group 35 Motor Temp thermistor input
  Group 36 Timer functions
  Group 40 & 42 PID functions
  Group 81 Pump or Fan Alternation (PFA) functions
  Group 99 USER1 and USER2 save and load
- **3 Standard and 3 Optional Relay Outputs**
  Group 14 Relay Outputs

The Drive Provides Unitary Control Functions
The drive's control capabilities and I/O complement allow the ACH550 to handle auxiliary device functions in addition to controlling the motor.

Built-in Control Capabilities

- **Two Independent PID Controllers**
  Setpoints sent via serial communications or set locally
  Feedback hard-wired to drive I/O terminals
  - **Flow or Pressure Control Based on Motor Speed**
    Air duct static pressure control
  - **Independent PID Control for an External Device**
    Chilled water valve control
    Cooling tower bypass valve control
- **Direct-to-Drive Contact-Closure Inputs**
  Firestat/Freezestat safety contacts
  Fireman's override (smoke purge) command
  Damper end-switch proof contact
- **Direct-from-Drive Contact-Closure Outputs**
  Maintained contact to open isolation damper
  Maintained contact to override VAV box
- **Built-In Timers**
  Built-in timers - utilizing the real-time clock - allow starting and stopping the drive or changing the speed according to the time of day or night. Relay outputs can be operated with timers to control any auxiliary equipment on site.
- **Monitor Hard-Wired Devices Over Serial Link**
  All hard-wired analog and digital I/O points can be monitored over the serial link.
- **Pass-Thru I/O**
  Serial communications can be used to send and receive analog signals and digital commands through the ACH550 I/O points that are used not for control functions provided by the drive. The Building Management System can use the drive's I/O to control auxiliary devices.
- **Advantages of Offloading Unitary Control Functions to the Drive**
  - Eliminating external control components simplifies the system and provides a more economical installation.
  - Integrating the auxiliary control into the drive provides closer functional coordination and better compatibility.

Customer Terminal Block
The analog I/O and digital input circuit common potential of the customer terminal block is optically isolated from power circuits and resistively isolated from the chassis by a 1 Mega-Ohm resistor. Shielded cable screen connection terminals are connected to the drive chassis.

- **24VDC Control Power Supply**
  An internal power supply is available for contact closure digital inputs.
- **External 24VDC Control Voltage Inputs**
  Digital inputs can be supplied by an external voltage source of either polarity.
- **Optional 115/230VAC Control Voltage Inputs**
  See "115/230v digital input Interface Module" on page 32.
- **10VDC Reference Power Supply**
  An internal power supply is provided for potentiometer voltage inputs.
- **Several Separate Circuit Common and Grounding Terminals**
  Separate terminals are provided for shielded cable screen connections, analog input signal common, analog output signal common, and digital input signal common.

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Drive Features - Communications Suite

Introduction
Serial communications is a powerful mode of operator and supervisory control interface that provides a number of benefits compared to other types of interface. The ACH550 is equipped with an (RS) EIA-485 serial communications port that supports a full range of drive monitoring and control functions through serial communications.

Fieldbus
A fieldbus is serial communications network that connects a master control unit such as a Building Management System with several or many slave devices such as AFDs.

- **ABB Leadership in Fieldbus Technology**
  ABB is a leading drives supplier to the U.S. HVAC market, and has connected hundreds of thousands of drives to building automation systems. Using its standard (RS) EIA-485 port and embedded protocols or internally mounted fieldbus adapter modules the ACH550 can be connected directly to any of the fieldbus network configurations commonly used in the US HVAC industry. ABB is the first drive manufacturer to offer BACnet as an embedded protocol.
- **Embedded Fieldbus Protocols**
  Using the drive's standard (RS) EIA-485 port, the ACH550 can communicate using any of the following protocols:
  - Modbus®
  - Metasys® N2
  - APOGEE® FLN
  - BACnet® (BTL Listed)
- **Fieldbus Adapter Modules**
  Internally mounted adapter modules are available for communication using the following protocols:
  - DeviceNet®
  - LonWorks®
  - Profibus-DP®
  - ControlNet
  - EtherNet
  - BACnet IP to MS/TP

Benefits of Serial Communications
- **Reduced I/O Connections**
  One serial I/O connection can provide the functions of multiple conventional I/O connections. This provides wiring cost savings and savings in the number of I/O points required in the Building Management System.
- **Enhanced Energy Management Strategies**
  Low cost data collection through serial communications makes it feasible to use enhanced energy management strategies that result in lower operating costs.

DriveWindow® Light PC Software
ABB's DriveWindow Light provides a user-friendly way to set up and control a drive system easily and comfortably from a PC. It is ideal for drive commissioning as well as maintenance and service purposes, troubleshooting and training. Learning and using DriveWindow is easy – the look and feel of the user interface is just like that of any Windows® application. All features are easily accessed by clicking an icon or through a clearly structured menu tree. This makes drive programming and system configuration management simpler than ever.

The following are the DriveWindow Light features that are available for use with ACH550 drives.

- **System Configuration**
  The starting point of DriveWindow, providing an overview of the system. All drives connected to the system are clearly indicated here, along with the type and status of each drive.
- **Drives Panel**
  Enables full control of a drive with the following commands: Local/Remote, Start, Stop, Change Direction, Reference Setting, Step Function and Fault Reset.
- **Signals and Parameters Tool**
  Displays a list of all or selected signals and parameters, along with their values, units, types and setting ranges. Features include parameter upload and download, changing parameter values, saving values to a file, reading values from a file, comparing two parameter sets, and finding a parameter.
- **Monitor**
  A trending tool providing a graphic interface to actual drive values. Up to six items from different drives can be selected for monitoring simultaneously. Actions such as setting triggering conditions, scaling the axis, zooming and printing the graphs can be performed.
- **Data Logger Tool**
  Used for controlling the drive data loggers, selecting their variables and setting triggering conditions. It allows high-precision analyses of rapid phenomena. Data logger contents can be presented in a numeric or graphic form.
- **Event logger**
  Shows the application specific drive events, each with a description and a time stamp.
- **Fault Logger**
  Shows the last 10 faults and warnings, each with a time stamp. The FAULT LOGGER also allows resetting of an active fault.

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Drive Features - Power

Introduction
The ABB ACH550 AC drive combines a sophisticated microprocessor with an advanced IGBT power switching technology to deliver a full featured drive in an extremely compact design. The ACH550 is a highly efficient and dependable (PWM) drive designed specifically for the HVAC industry.

- **Input Power – Tolerated Voltage Window**
  The ACH550 is available in three line voltage ratings each with a 35% undervoltage to 30% overvoltage window of tolerated voltage deviation.

Line Voltage Range	Undervoltage -35% Trip Point	Overvoltage +30% Trip Point
208 - 240V	135V	312V
380 - 480V	247V	624V
500 - 600V	325V	780V

- **Low Line Harmonics – Swinging Choke**
  Drives and other non-linear load equipment contribute to harmonic currents in a power distribution system. IEEE Standard 519-1992 explains the reasons for limiting harmonics and recommends limits to be applied in various situations.
- **Swinging Choke**
  ACH 550 drives have a unique, built-in harmonic limiting device, a swinging choke. The swinging choke is an inductor that has an inductance value that is inversely proportional to its operating current.
- **Swinging Choke Advantages**
  - **Limits harmonics as effectively as a 5% linear choke but requires less space in the drive**
  - **A built-in component, no extra equipment to purchase, mount and wire**
  - **High efficiency, minimal power loss**
  - **Configured as a 3-phase input reactor or dual DC bus choke for added impedance**
  - **No need to oversize branch circuit wiring**
    The swinging choke assures that the drive's input current will never exceed the output current supplied to the motor. The rated input current marked on the drive's nameplate is the same as the rated output current. This means that there is no need to oversize the branch circuit wiring, disconnecting means and protection to comply with the National Electrical Code.
  - **Contributes to electromagnetic compatibility and transient voltage protection**

- **Electromagnetic Compatibility (EMC)**
  Electromagnetic compatibility (EMC) is the ability of electrical/electronic equipment to operate in its installation environment while neither causing nor experiencing electromagnetic interference (EMI). EMI is any interference with normal equipment operation caused by abnormal energy entering the equipment either by conduction though wiring connections or by radiated wave reception. Radiated EMI is also called radio frequency interference (RFI). Conducted EMI is also called high frequency line noise.

  The ACH550 is equipped with built-in EMI / RFI filters to assure that the drive will not interfere with any sensitive equipment.

EMC Standards
- **IEC EN61800-3**
  The ACH550 includes standard filters that meet the IEC 61800-3 EMI/RFI standards and emission limits for Restricted Distribution and installation in the First Environment.
- **Federal Communications Commission Regulations, Part 15, Requirements for Class A Digital Devices**
  As an item of industrial equipment or a component of a commercial HVAC system, an adjustable frequency drive is exempt from any FCC labeling or authorization requirements.
- **CE Marking**
  The ACH550 conforms to the European Union Electromagnetic Compatibility directive and meets the other requirements that allow it to carry the CE marking.

Easily Serviceable Cooling Fans
The cooling fans in the ACH550 can easily be removed to clean the heatsink and fans or to replace the fans. The fans can be removed without removing the drive from the wall or removing circuit boards. To maximize their operating life, the fans are cycled on and off as required to maintain the drive at a safe operating temperature.

Vector Drive – Vector or Scalar Control Mode
The ACH550 is a sensorless vector controlled drive with user-selectable vector and scalar control modes.
- **Scalar Control – Optimum for HVAC Drives**
  The scalar control mode is normally used in HVAC applications. It provides all the performance you want with no motor profiling.
- **Vector Control Advantages in the Scalar Control Mode**
  The ACH550 vector control design enhances scalar mode performance of the following features:
  - **High Performance Current Limit**
    The ACH550 current limit is fast, accurate and reliable.
  - **Flying Start to Catch a Forward or Reverse**

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Spinning Motor
The ACH550 starts smoothly and reliably with a spinning motor connected. If the motor is spinning in the forward direction, the drive simply picks up the motor at its current speed and smoothly accelerates or decelerates to the desired operating speed. If the motor is spinning in the reverse direction the drive decelerates the motor and re-accelerates in the forward direction.

- **Flux Optimization**
  Flux Optimization provides the right motor excitation for every set of operating conditions. This results in reduced energy consumption plus cooler and quieter motor operation.
- **The Vector Mode is Available if Needed**
  For unusually demanding applications, the sensorless vector mode of operation can be engaged by making the appropriate parameter selections.

Energy Savings
The ACH550 provides some unique energy savings features to complement the inherent energy savings gained by using an adjustable frequency drive to modulate flow.

- **Swinging Choke DC Bus Filter Design**
  The swinging choke helps provide the ACH550 with a DC bus filter that saves energy both inside the drive and in the power distribution system. See “Low Line Harmonics – Swinging Choke” on page 12.
- **Fan Modulation**
  The cooling fans in the ACH550 operate upon application of power to provide indication of their proper operation. The fans turn on given a run command and remains on after a stop command is give until drive temperature is to an acceptable level.
- **Flux Optimization**
  The flux optimization feature monitors the load and automatically adjusts the motor excitation to suit the operating conditions. Whenever load conditions permit, the magnetic flux in the motor is reduced to save energy, and provide cooler and quieter motor operation. The energy used by the motor is automatically optimized in balance with the load requirements.

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Drive Features – Protection

Introduction
Drive protection features assure reliable operation and long-lasting equipment. The ACH550 has a very flexible and extensive line-up of protection features.

Power Line Protection
Surge Withstand Capability
ACH550 drives include a coordinated AC transient voltage protection system consisting of four Metal Oxide Varistors (MOVs) rated 120 joules each (phase to phase & phase to ground), a capacitor clamp, and 5% impedance swinging chokes.

Short Circuit Current Rating
The UL 508A short circuit current rating of the ACH550 is 100,000 A when installed with any NEC compliant branch circuit protection. Class T (Bussmann Type JJS) fuses are recommended but not required. The ACH550 has electronic protection circuits and other design features that eliminate the need for fast acting semiconductor input fuses.
The drive is fully protected from an output short circuit whether it is present when the drive is started or occurs after the drive is running.

Mis-wiring Protection
ACH550 units rated 75 Hp and smaller are protected from input and output power mis-wiring. If one or more input power conductors are connected to motor terminals, the drive will sense the problem and display an OUTPUT WIRING fault message.

Switching Frequency Foldback
Since reducing the drive's switching frequency reduces the heat generated by the IGBTs, the ACH550 has a switching frequency control feature that can be set to reduce the drive's switching frequency if the heatsink temperature rises above 80-90°C. This would only engage when both the ambient and load are at the maximum load. When the load and temperature drops, the carrier frequency will revert back to the initial setting.

Enclosure Offerings
Since the NEMA enclosure designations can be used without third party certification, ABB has chosen to obtain UL listings that include the enclosures to assure customers that the ACH550 enclosures meet nationally recognized standards.

- **UL Type 1 (NEMA 1)**
  Suitable for most mounting locations
- **UL Type 12 (NEMA 12)**
  Increased protection from dirt and dust but still rated to deliver continuous full output current at 40°C.
- **UL Type 3R (NEMA 3R)**
  Increased protection against falling rain and is undamaged with the formation of ice on the enclosure
- **Enclosures are Plenum Rated by UL**
  Offers more flexibility in selecting a mounting location. Note that plenum ratings are available only for UL listed enclosures.

Integral Protection Circuits
The ACH550 was designed to protect the drive and motor from the hazards of continuous service in the most demanding of applications. Built-in protection circuits include the following:

- **Overcurrent trip limit - 350% instantaneous**
- **Adjustable current regulator limit - 130%**
- **Overvoltage trip limit - 130%**
- **Undervoltage trip limit - 65%**
- **Over temperature protection (heatsink)**
- **Switching frequency foldback temperature limiter**
- **Auxiliary voltage short circuit protection**
- **Output ground fault and mis-wiring protection**
- **Output short circuit protection**
- **Microprocessor fault protection**
- **Adjustable motor stall protection**
- **Adjustable motor overload protection (I2t) - UL listed**
- **Motor PTC thermistor and Pt100 RTD inputs**
- **Loss of reference protection (programmable)**
- **Single phasing protection on input and output**
- **Underload protection (programmable)**
- **Keypad control panel loss protection (programmable)**
- **Serial communication loss protection**
- **Two (2) programmable external fault interlock inputs**
- **Adjustable output frequency and motor speed limits**
- **Pass code parameter-change protection**
- **Keypad operator control lockout**
- **Extended power loss ride-thru by inertial energy recovery**

Automatic Reset
In order to minimize the nuisance shutdowns, the ACH550 can be set to automatically reset certain faults and attempt to restart. See "Automatic Reset (Auto Restart) – Group 31" on page 28.

Versatile Protection
Many of the protection features are adjustable or programmable to suit the requirements of individual applications. Refer to the following parameter group descriptions for additional information:

- **"System Controls – Group 16" on page 24**
- **"Limits – Group 20" on page 25**
- **"Motor Control – Group 26" on page 26**
- **"Fault Functions – Group 30" on page 27**
- **"Automatic Reset (Auto Restart) – Group 31" on page 28**
- **"Supervision – Group 32" on page 28**
- **"Motor Temperature Measurement – Group 35" on page 28**

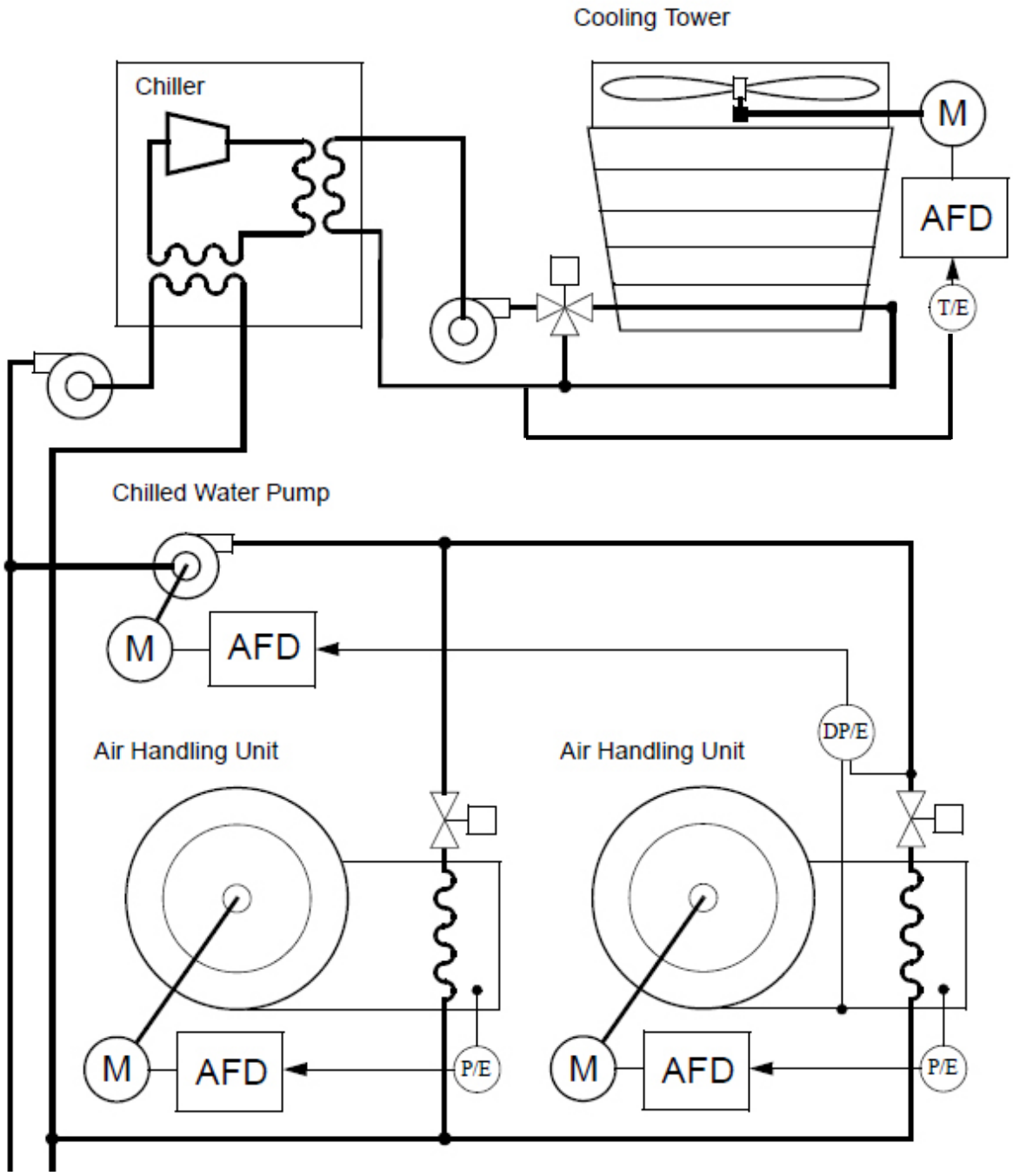
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Application Control Diagrams

HVAC System Overview
The HVAC System Diagram on the following page shows the principal elements of an HVAC system including typical adjustable frequency drive applications.

- **Chiller**
  Speed control of the chiller compressor is a special application undertaken only with close coordination between the drive and chiller manufacturer.
- **Cooling Tower**
  The cooling tower fan speed control is typically based on the water temperature at the discharge point.
  See “Air Handling Unit Application Functions” on page 16
- **Chilled Water Pump**
  The chilled water pump speed control is typically based on the differential pressure across the cooling coil that is located farthest from the chiller or the most distant significant load.
  See “Chilled Water Pump Application Functions” on page 18.
- **Air Handling Units (AHU)**
  The AHU fan speed control is typically based on the pressure in the air duct.
  See “Cooling Tower Application Functions” on page 20.

HVAC System Overview Diagram



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Air Handling Unit Application Functions

The AHU application diagram on the following page shows a typical control system with an ACH550 drive.

Fan Speed Control
The AHU fan speed is typically controlled to regulate the static pressure in the air duct. The ACH550 process PID controller compares the desired pressure (the Setpoint) with the actual pressure (the Feedback) from a pressure sensor and adjusts the fan speed to maintain the pressure at the desired level. The Setpoint is typically entered using the Operator Control Panel or a serial communications command.

See “Process PID Controller – Groups 40 & 41” on page 29.

Damper Control

- **Drive Started Output**
  The Drive Started output indicates that the drive has received a Start command and the drive is not prevented from starting by a fault trip or an open Start Enable (safety) input.
  The Drive Started relay output serves as the command to open a damper such as an outdoor air damper, fire damper, isolation damper, etc.
- **Run Enable Input**
  The Run Enable input operates as a permissive run input. Once the Drive Started status is achieved, closing the Run Enable input allows the motor to run. When the damper is fully open, a normally open dry contact (damper end-switch) closes and provides the Run Enable command and allows the motor to operate.
  See “Run Enable” on page 24.
- **Stop Sequence**
  When the drive is commanded to stop during the normal course of operation or through the operation of a safety interlock or fault trip, the motor stops and the damper is commanded to close.
- **Bypass Operation**
  When the E-Clipse Bypass is furnished, the Started and Run Enable functions are provided by the bypass so that the damper control function is provided in either the Drive or Bypass mode of operation.

Fireman’s Override (Smoke Purge)
This is a dry contact input that causes the drive to ignore keypad and serial communication commands and run at an adjustable preset speed or operate in PID mode. Certain fault conditions are also ignored. This input would typically be used for purging smoke or pressurizing an area.

- **Bypass Operation**
  When the E-Clipse Bypass is furnished, Fireman’s Override causes the motor to operate in the bypass mode.

Night Setback Input
A dry contact input or a serial communications command changes drive settings for night or weekend operation.
See alternative parameter settings under “Process PID Controller” on page 10.

Fire / Freezestat interlock
This is a dry contact safety interlock input that operates as a permissive start interlock. See “Start Enable 1 & 2” on page 24.

Overpressure Interlock
This is a dry contact safety interlock input that operates as a permissive start interlock.
See “Start Enable 1 & 2” on page 24.

Chilled Water Valve PID Loop
The ACH550 External PID Controller can be used to control a valve to regulate the flow of chilled water to maintain the chilled water coils at a set temperature.
See “External PID Controller – Group 42” on page 30.

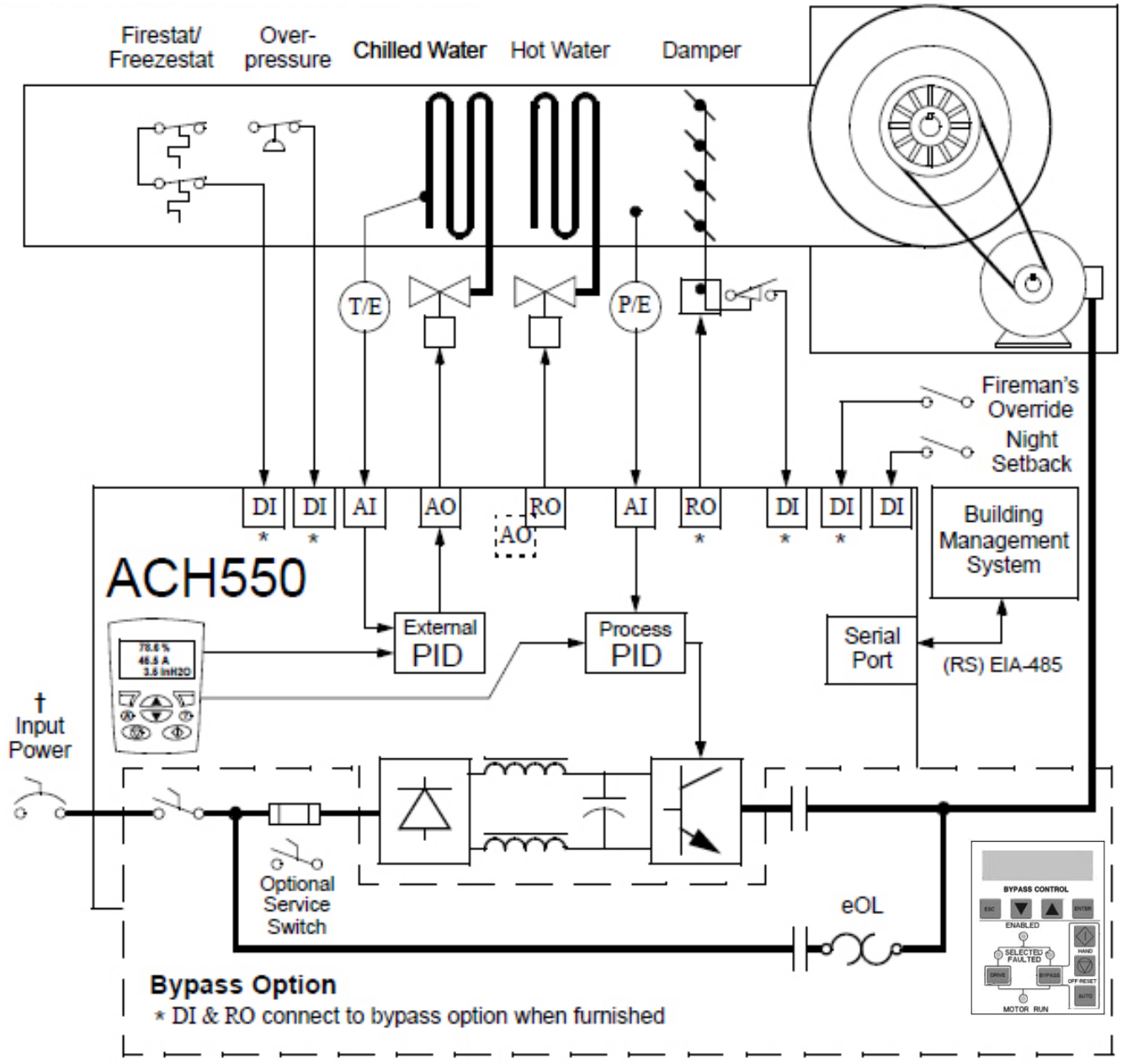
Hot Water Valve Control
The hot water valve can be connected to an ACH550 relay or analog output terminal for control by the Building Management System using the ACH550 Pass-Thru I/O capability.
See “Pass-Thru I/O” on page 10

Building Management System
The Building Management System can monitor and control all aspects of the ACH550 through serial communications.
See “Drive Features - Communications Suite” on page 11.

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Air Handling Unit Application Functions

Air Handling Unit Application Diagram



Key:
AI = Analog Input
AO = Analog Output
DI = Digital Input
DO = Digital Output
T/E = Temperature to Electric
P/E = Pressure to Electric

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Chilled Water Pump Application Functions

The Chilled Water Pump application diagram on the following page shows a typical control system with an ACH550 drive.

Pump Speed Control
The chilled water pump speed is typically controlled to regulate the differential across the most distant chilled water coil or the most distant significant load. The ACH550 process PID controller compares the desired pressure (the Setpoint) with the actual pressure (the Feedback) from a pressure sensor and adjusts the pump speed to maintain the pressure at the desired level. The Setpoint is typically entered using the Operator Control Panel or a serial communications command.
See “Process PID Controller – Groups 40 & 41” on page 29.

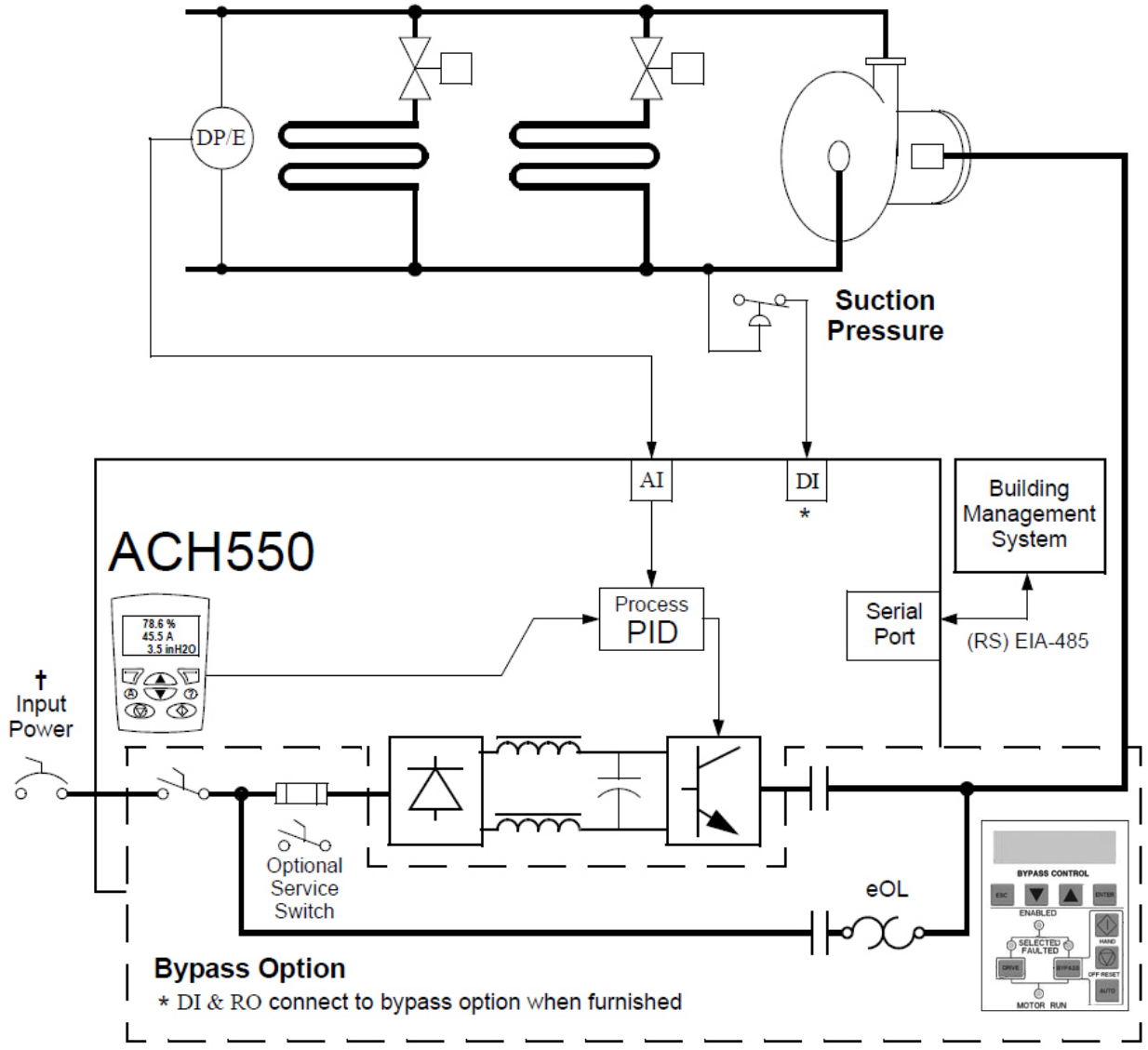
Low Suction Interlock
This is a dry contact safety interlock input that operates as a permissive start interlock.
See “Start Enable 1 & 2” on page 24.

Building Management System
The Building Management System can monitor and control all aspects of the ACH550 through serial communications.
See “Drive Features - Communications Suite” on page 11.

Proof of Flow
The ACH550 (with and without bypass) can provide indication when the system is providing flow in the application

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Chilled Water Pump Application Diagram



Key:
AI = Analog Input
AO = Analog Output
DI = Digital Input
DO = Digital Output
T/E = Temperature to Electric
P/E = Pressure to Electric

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Cooling Tower Application Functions

The Cooling Tower Application diagram on the following page shows a typical control system with an ACH550 drive.

Fan Speed Control
The cooling tower fan speed is typically controlled to regulate the water temperature of the return condenser water from the cooling tower. The ACH550 process PID controller compares the desired temperature (the Setpoint)with the actual temperature (the Feedback) from a temperature sensor and adjusts the fan speed to maintain the temperature at the desired level. The Setpoint is typically entered using the Operator Control Panel or a serial communications command.
See “Process PID Controller – Groups 40 & 41” on page 29.

Bypass Valve Control
The ACH550 External PID Controller can be used to control a valve to regulate the flow water bypassing the cooling tower when the desired temperature can be maintained without full flow through the cooling tower. In this mode of operation, the cooling tower fan speed will have dropped to the minimum speed and stopped. (Free coding mode)
See “External PID Controller – Group 42” on page 30.

Summer / Winter Settings
A dry contact input or a serial communications command changes drive settings to suit seasonal conditions.
Winter operation may include operating a valve to divert water from the chiller to a plate and frame heat exchanger. For free cooling applications.
See alternative parameter settings under “Process PID Controller” on page 30.

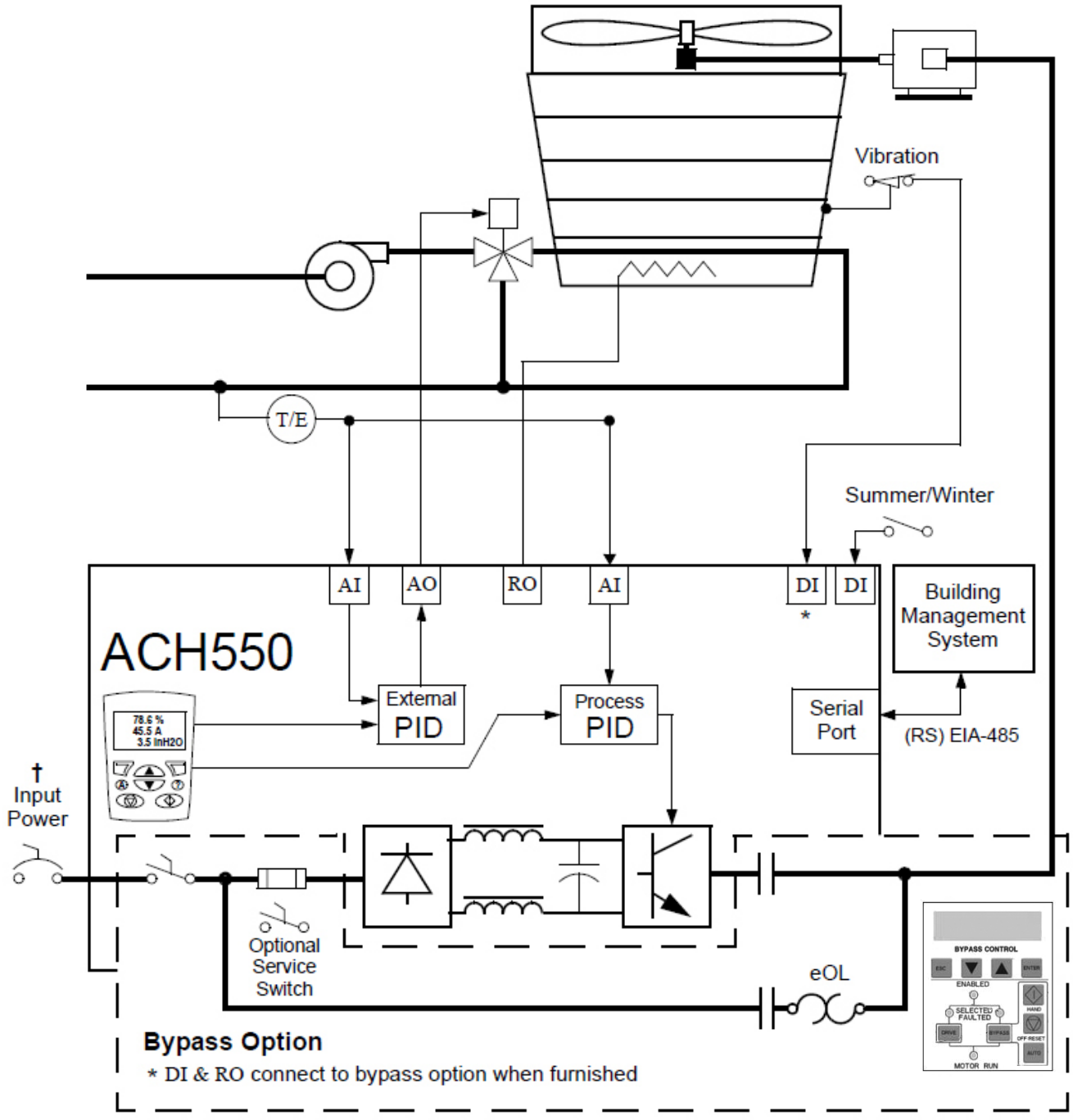
Vibration Protection
The Critical Speed Lockout function can be set to avoid operation at speeds that might cause excessive vibration.
See “Critical Speeds – Group 25” on page 26.
A vibration switch can be connected as is a dry normally closed contact safety interlock input that operates as a permissive start interlock.
See “Start Enable 1 & 2” on page 24.

Freeze Protection
A Supervision Function can be set to monitor the temperature feedback signal. If the water temperature approaches freezing, the drive provides a contact closure to turn on a sump heater or can modulate a bypass valve. An alarm (dry contact) can be provided to the Building Management System.
See “Supervision – Group 32” on page 28

Building Management System
The Building Management System can monitor and control all aspects of the ACH550 through serial communications.
See “Drive Features - Communications Suite” on page 11.

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Cooling Tower Application Diagram



Key:
AI = Analog Input
AO = Analog Output
DI = Digital Input
DO = Digital Output
T/E = Temperature to Electric
P/E = Pressure to Electric

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Parameter Group Functional Descriptions

The drive's control features are described in the following paragraphs. The feature descriptions are organized into groups that relate to the menu groups which contain the parameters that select and configure the various control features.

Start-up Data – Group 99
The ACH550 displays parameter names and operational messages in English, but another language can be selected using the first parameter in the Start-up Data parameter group. This parameter group is used to load a set of default parameter settings by selecting an Application Macro. Parameters for entering motor nameplate data are also located in this group.

Operating Data – Group 01 and Information – Group 33
The Operating Data group contains drive operating data, including Actual Signals and I/O terminal status indication. Actual Signals are parameters such as motor speed, output frequency and motor current that are measured or calculated by the drive rather than set by the user.
The Information group displays the drive's voltage and current ratings, the version number of the software (firmware) loaded in the drive's microprocessor and the date that the drive was tested at the factory.

Available Operating Data
Actual Signals

Speed	Output Frequency
Torque	Output Current
DC Bus Volts	Output Volts
Power (kW)	Digital Input Status
Kilowatt Hours (resettable)	MW Hours
Reference Signals	PID Signals
Motor Temperature	Drive Temperature
Two Run Time Displays (1 resettable)	Accumulated motor revolutions
Accumulated time with power applied	Two word of user-defined data from serial link
Energy Saved	Tons of CO_2 reduced

I/O Terminal Status Indication
Control location source indication (Oper. panel, Ext 1/2)
Digital input high/low indicator
Relay output high/low indicator
Serial communications relay control word
Analog input signal value
Analog output signal value

Test Meter Functionality
The capability to display an extensive range of operating data means that the ACH550 control panel is a powerful tool for use in commissioning and troubleshooting. It can be used to monitor performance and diagnose problems in the ACH550, the motor, or the driven equipment and process.

Actual Signals (Fieldbus) – Group 03
This group provides a read-only display of the fieldbus communications command, status, fault and alarm words.

Fault History – Group 04
When the drive detects a severe error or hazardous operating condition, the motor is stopped, the red operator's panel LED is illuminated and a fault message is displayed on the operator's panel.
The three most recent fault message displays can be retrieved in parameter group 04.
For the most recent fault message, additional operating data can be retrieved including:

- Operating speed and frequency
- Motor voltage, current and torque
- Status of the digital inputs

Start/Stop/Direction Commands – Group 10
Start/Stop/Direction command parameters are used to define sources for commands that start and stop the motor and control its direction of rotation.

Start/Stop/Direction Command Sources:

- **Two Sets of Command Sources: EXT1 & EXT2**
  Two sets of command sources, EXT1 and EXT2, can be defined. A single terminal, serial communication or timer input can then be defined to switch between the EXT1 and EXT2 sets of command sources. EXT1 & EXT2 define the command sources for both the Start/Stop/Direction command and the Reference Select command. See Group 11 below.
- **Operator's Panel Keypad**
  The keypad HAND-OFF-AUTO keys can be for Start/Stop control.
  Terminal Block Inputs DI1 - DI6
  These parameters also select whether terminal inputs are maintained or momentary contact closures.
- **Serial Communications Commands**
  Start/Stop/Direction commands can be transmitted to the drive via serial communications.

Timer Functions
The drive's programmable timer functions can also serve as Start/Stop/Direction command sources. See "Timer Functions – Group 36" on page 29.

Reference Select Commands – Group 11
The Reference Select command parameters determine how the speed reference is selected and scaled. This group also contains the parameter for determining a means for selecting between the two external control locations EXT1 or EXT2.

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Speed Reference Command Sources:

- **Two Sets of Command Sources: EXT1 & EXT2**
  Two sets of command sources, EXT1 and EXT2, can be defined. A single terminal, serial communication or timer input can then be defined to switch between the EXT1 and EXT2 sets of command sources. EXT1 & EXT2 define the command sources for both the Start/Stop/Direction command and the Reference Select command. See Group 10 above.
- **Operator's Panel Keypad**
  The keypad INCREASE/DECREASE keys can be used to set the speed reference.
- **Terminal Block Inputs AI1 and AI2**
  Analog signal inputs to the terminal block can be used as speed reference or feedback signals.
- **Terminal Block Inputs DI1 - DI6**
  Digital inputs are used to set the speed reference by emulation of a motor operated potentiometer or floating point control. By using two digital inputs for the speed reference, you can connect two dry contacts, such as a Dwyer Photohelic™ gauge, to the ACH550. One contact, when closed, will cause the ACH550 to increase speed; the other contact will cause the ACH550 to decrease speed.
- **Serial Communications Commands**
  Speed reference settings and/or setpoint can be transmitted to the drive via serial communications.
- **Analog Reference Scaling**
  The two analog reference terminal block inputs can each be independently scaled, so that the minimum and maximum input levels can correspond to a frequency other than the minimum and maximum frequency.
- **Analog Input Inversion**
  The analog input signal can be inverted so that the minimum analog input signal can correspond to the maximum reference and the maximum analog input signal can correspond to the minimum reference.
- **Input Sum, Difference, Product, Quotient**
  Several sum, difference, product and quotient functions are available to calculate a speed reference using two analog input signals.

Constant (Preset) Speeds – Group 12

The ACH550 allows for seven (7) programmable preset speeds to be selected from the digital inputs.

- **Digital Input Combinations**
  - One input can be used to select one preset speed.
  - Combinations of two inputs can be used to select any of three preset speeds.
  - Combinations of 3 inputs can be used to select any of seven preset speeds

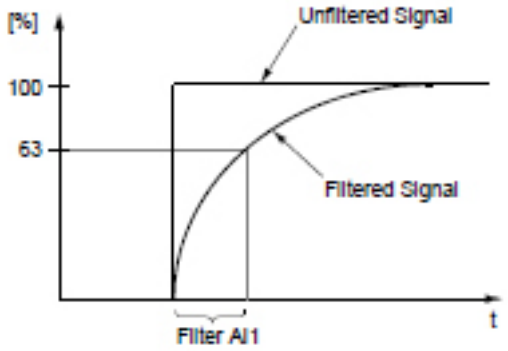
One of the seven preset speeds is also used as a fault speed in case of an internal serial communication fault or loss of analog input signal.

- **Timer Selected Preset Speeds**
  Timers can be used to select up to four preset speeds. A speed determined by an external speed reference can be selected in combination with up to three preset speeds. See "Timer Functions – Group 36" on page 29.

Analog Inputs – Group 13

The ACH550 has two analog inputs as standard which are both capable of operating from 0(2)-10 VDC or 0(4)-20 mA, or from a potentiometer. The inputs can be assigned as external speed reference inputs, external PID control reference inputs or PID control feedback signal inputs. The inputs are subject to minimum, maximum and filter adjustments as described below:

- **Analog Input Min/Max Settings**
  The analog input minimum setting operates a percentage offset adjustment. If the minimum is set to 20%, the input signal must exceed 20% of its 10V or 20mA range to increase the reference (or feedback) value above zero.
  The Analog input maximum setting operates as a percentage scale adjustment. If the maximum is set to 90%, the reference or feedback value will reach its maximum value when the input signal reaches 90% of its 10V or 20mA range.
- **Analog Input Filters**
  Analog inputs are filtered with a time constant that can be adjusted from 0.0 to 10.0 seconds. The time setting is the time required for the filtered signal to reach 63% of the final value after a step change of the analog input takes place. (If the minimum value of 0.0 seconds is selected, the signal is filtered with a 25ms time constant)



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Parameter Group Functional Descriptions

Relay Outputs – Group 14

The ACH550 provides three (3) relay outputs as form C dry contacts for connection to external circuitry. The relay outputs can be configured to annunciate the state of a number of drive operating status and fault or alarm conditions. On delay and off delay times can be set for each relay. The following conditions can be annunciated:

Ready	Undervoltage
Run	AI1,2 Loss
Fault (direct or inverse)	Motor Temp
Alarm	Motor Stall
Reversed	Underload (Proof of Flow)
Started	PID Sleep
Supervision 1,2,3 Over	PFA Command
Supervision 1,2,3 Under	Autochange
At Set Point	Flux Ready
Auto Restart Pending	User Set 2 Active
Fault or Alarm	Comm (Direct or Inv)
External Control	Active Timer 1,2,3,4
Ref 2 Selected	Maint Trig Fan
Preset Speed Operation	Maint Trig Rev
Reference Loss	Maint Trig Run
Overcurrent	Maint Trig MWH
Overvoltage	Override
Drive Temp	

Analog Outputs – Group 15

Analog output signals are 0(4) to 20mA and can be proportional to:

Output Frequency	Speed Reference
Motor Speed	Analog Inputs
Output Current	PID Setpoint
Motor Torque	PID Feedback
Motor Power (Kw)	PID Output
Dc Bus Voltage	PID Error
Motor Voltage	Comm Value

These signals can be scaled so that small or large changes in the parameter can represent full scale. Adjustable filtering is provided.

System Controls – Group 16

The System Controls group provides the following control access limits and interlock functions:

- **Run Enable**
  Run Enable is a permissive run interlock input. If a Start command is present but the Run Enable is not present, the drive status will be indicated as Started, but the motor will not run. The motor will not run unless the Run Enable input is present. If the input is lost while the motor is running, the motor will coast to stop and not restart until the Run Enable input is restored. Run Enable can be assigned to a serial communications command or to one of the terminal block inputs. This input is typically used for a damper end-switch contact input.
- **Parameter Lock**
  The Parameter Lock restricts saving and/or changing parameters using the keypad. Unlocking requires access code number entry.
- **Fault Reset Select**
  Faults can always be reset by pressing the RESET Soft Key on the control panel. Fault resetting can also be assigned a serial communications command, to one of the digital inputs on the customer terminal strip or to be activated by executing a Stop command.
- **User Set Parameter Change**
  Assigns a digital input to initiate loading a user settings macro, USER S1 or USER S2.
- **Local Lock**
  When the Local Lock is open, the drive can be controlled from the control panel by pressing the HAND key. When Local Lock is locked, the drive can be stopped by pressing the OFF key on the control panel, but an alarm will be displayed and the drive will not respond to the HAND key. Remote control will be restored by pressing the AUTO key and the drive will start if the Auto Start command is present.
- **Parameter Save**
  The Parameter Save command saves to permanent memory parameters that have been altered by serial communications or manually altered when Parameter Lock is set to prevent saving parameters.
- **Start Enable 1 & 2**
  Two Start Enable commands can be transmitted via serial communications or assigned to terminal block inputs. The Start Enables are permissive start interlock inputs. The drive cannot be started unless the Start Enable inputs are present. An alarm message is displayed when a Start Enable is absent. If an input is lost while the motor is running, the motor will coast to stop and not restart until the input is restored. The started relay will open causing any damper to close. These inputs are typically used for connection of safety interlock contacts (firestat, freezestat, over-pressure).
- **Display Alarms**
  A setting is available to suppress or display overcurrent, overvoltage, undervoltage and overtemperature alarms.

Override – Group 17

This group of parameters is used to configure the Override function. When Override is active:

- The drive runs at preset speed or in PID mode
- The drive ignores all keypad commands.
- The drive ignores all commands from communication links.
- The drive ignores all digital inputs except:
- override activation/deactivation, Run Enable and Start Enable.
- The drive displays alarm message:

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- 2020 OVERRIDE MODE.
- The drive ignores certain fault conditions.
- This input would typically be used for purging smoke or pressurizing an area.

Limits – Group 20

The Limits group of parameters provides for setting the following output limiting control functions:

- **Minimum and Maximum Speed Limits**
  The minimum and maximum speed settings limit the range of motor speed regardless of reference signal level, operator setting adjustment and control function action.
- **Max Current or Current Limit**
  The current limiting control limits the output current to the motor. When the current limiting control is active, an Overcurrent alarm is displayed and the motor speed may decrease or the motor may stall.
- **Undervoltage Control**
  Settings are provided to enable the undervoltage control with or without a 500 ms time limit for operation. If the DC bus voltage drops due to loss of input power, the undervoltage controller will decrease the motor speed in order to keep the DC bus voltage above the lower limit. By decreasing the motor speed, the inertia of the load will cause regeneration back into the ACH550, thus keeping the DC bus charged, and preventing an undervoltage trip. This will increase power loss ride-through on systems with a high inertia. When the undervoltage control is active, an Undervoltage alarm is displayed.
- **Overvoltage Control**
  Fast deceleration of high load inertia can cause the DC bus voltage to rise to the overvoltage control limit. To prevent the DC voltage from exceeding the limit and causing a DC overvoltage fault, the Overvoltage Control extends the decel time to avoid nuisance trips.
- **Minimum and Maximum Frequency**
  The minimum and maximum frequency settings limit the range of output frequency regardless of reference signal level, operator setting adjustment and control function action.
- **Minimum and Maximum Torque Limits**
  Two values can be set for minimum and maximum torque. Terminal block inputs or serial communication commands can be used to select either of the minimum limits or either of the maximum limits.

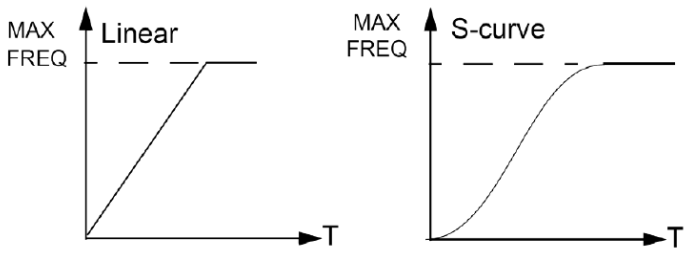
Start/Stop Functions – Group 21

Parameters are provided for selecting and adjusting several starting and stopping modes.

- **Starting Modes**
  - Normal start
  - Start from zero frequency and voltage.
  - Flying start
  - Catch a forward or reverse spinning motor. See page 13.
  - Torque boost at start
  - Provides a voltage boost for increased motor starting torque.
  - DC pre-magnetizing start
  - DC current can be applied to the motor for up to 10 seconds before starting. Pre-magnetizing can be used as an anti-windmilling feature.
  - Start inhibit
  - When start inhibit is ON, a new Start command is required to restart the drive after fault reset, interlock reset or command source change.
- **Stopping Modes**
  - Coast-to-stop
  - The motor is de-energized at operating speed.
  - Ramp-to-stop
  - The motor is ramped to zero speed and then generalized.
  - DC braking
  - DC braking can be applied immediately with coast-to-stop or applied after ramping down with ramp-to-stop.
  - Emergency stop
  - A separate terminal block input is selected for initiating emergency stop. The deceleration time is adjusted separately.

Acceleration/Deceleration Rates – Group 22

- **Two Sets of Accel/Decel rates**
  The ACH550 provides two individually controlled, selectable sets of acceleration/deceleration rates from 0.1 to 1800 seconds. A terminal block input or communication command can be assigned to switch between the two sets of rates.
- **Linear or "S" Curve Ramping**
  The ACH550 also offers selection of the shape of the accel/decel ramp curves; linear or adjustable S-curve. A Linear curve selection is suitable for drives requiring steady acceleration/deceleration and/or slow ramps. S-curve is ideal for applications where a smooth transition is required when changing from one speed to another.



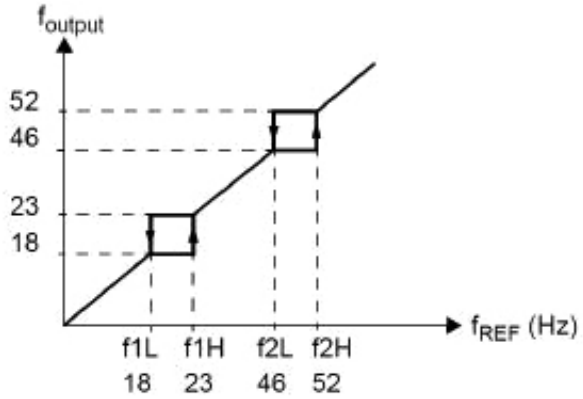
Linear acceleration results in a constant accel/decel torque. S-curve acceleration results in a gradual torque change at the beginning and end of the ramp. S-curve accel/decel is intended to reduce the "jerk" that can occur at the transition between constant speed and acceleration or deceleration.

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Parameter Group Functional Descriptions

Speed Control – Group 23
Group 23 parameters are used to tune the motor speed regulation in the vector speed control mode.

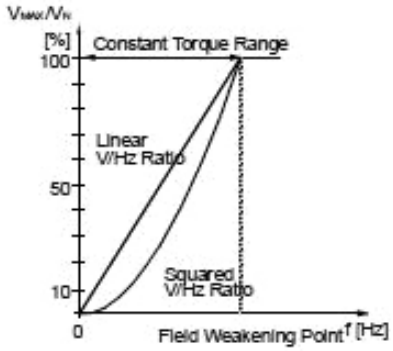
Critical Speeds – Group 25
For application where it may be necessary to avoid specific frequencies due to mechanical resonance problems in the driven equipment, the ACH550, with its Critical Speed Lockout function, makes it possible to set up frequency ranges which will be avoided during operation of the drive.



- **Three Critical Speed Ranges Can Be Defined**
- **High and Low Limits Are Set For Each Range**
- **Operation Within the Range Is Avoided**
  If the speed reference signal requires the ACH550 to operate within a critical speed range, the Critical Speed Lockout function will keep the ACH550 operating at the low (or high) limit until the reference is out of the critical range, at which time the drive will ramp through the range at the set accel or decel ramp.

Motor Control – Group 26
The ACH550 is equipped with the following motor control features which are intended to enhance motor performance:

- **U/f (Volts/Hz) Ratio Profile**
- **The Volts/Hz Profile can be set to Linear or Squared.**
  - **Linear V/Hz Profile**
    The linear V/Hz profile is required to provide full torque at low speed for constant torque loads.
  - **Squared V/Hz Profile**
    The squared V/Hz profile is suitable for variable torque fan and pump loads. The squared V/Hz profile saves energy, and provides cooler and quieter motor operation.



- **Flux Optimization**
  When Flux Optimization is on, the voltage applied to the motor is automatically reduced below the normal level when the motor does not require normal voltage to deliver the required torque. Reducing the motor flux saves energy, and provides cooler and quieter motor operation.
- **IR Compensation**
  The IR Compensation adjustments set a voltage boost at zero frequency that tapers down to zero boost at a set frequency. When Flux Optimization is on, the voltage boost is automatically reduced below the levels set when the motor does not require the extra voltage to deliver the required torque.
- **Flux Braking**
  When Flux Braking is enabled, the level of motor magnetization is raised when braking is required. This increases the braking energy dissipated in the motor.
- **Switching Frequency**
  Switching frequency of 1, 4, 8, and 12 are available. The default switching frequency setting is 4kHz. The setting can be increased to 8 or 12kHz for cooler and quieter motor operation.
- **Switching Frequency Control**
  Since reducing the drive's switching frequency reduces the heat generated by the IGBTs, the ACH550 has a switching frequency control feature that can be set to reduce the drive's switching frequency if the heatsink temperature rises above 80-90°C.
- **Noise Smoothing**
  The ACH550 has a noise smoothing feature that can be turned on to introduce a random variation to the switching frequency. This distributes the acoustic noise over a range of frequencies to lower the peak noise intensity.
- **Slip Compensation Ratio**
  Slip compensation is a feature that improves speed regulation by increasing the drive output frequency slightly in proportion to an increase in motor load. The slight frequency increase compensates for the speed decrease that would otherwise occur as the motor's slip increases due to the increased load. An adjustment is provided for optimum speed regulation.

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Maintenance Triggers – Group 29

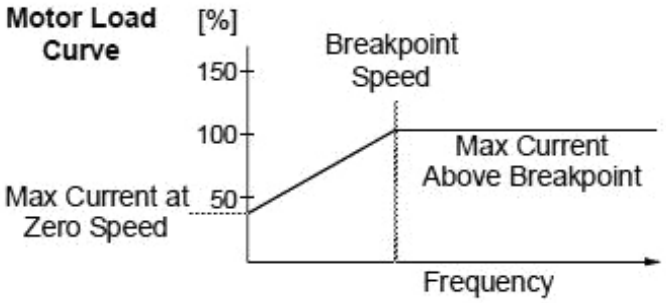
The maintenance trigger parameters include usage related operating data items and associated trigger setpoints. When usage reaches the set trigger point, a notice displayed on the control panel signals that maintenance is due. Activation of the triggers can also be assigned to relay outputs. When maintenance has been performed, the usage parameter can be reset to zero or the trigger point can be raised to the next maintenance point.

- **Maintenance Trigger Parameters**
  - Cooling fan accumulated operating time
  - Accumulated motor revolutions
  - Accumulated hours of drive run time
  - Accumulated megawatt hours of drive power usage

Fault Functions – Group 30

The ACH550 includes the following drive, motor and process control protection functions that can be configured by the user.

- **Analog Input Signal Loss**
  The ACH550 can be set to monitor the analog inputs and detect that the reference is lost if the input signal drops below the AI MIN setting. When signal loss is detected, the ACH550 will run at the average speed of the past 10 seconds, a preset speed or give a fault indication and shut down as selected by the user. One of the relay outputs can also be programmed to indicate that the reference is lost.
- **Control Panel Loss**
  In the event that the drive loses communication with the control panel, the drive can be programmed to continue operation, stop and display a fault indication, operate at a preset speed and display a warning or operate at the average speed of the past 10 seconds and display a warning.
- **External Fault**
  Two of the digital inputs on the customer's terminal strip can be configured to function as external fault inputs. If the contact opens (or closes), the drive coasts to a stop and displays a fault message.
- **UL Listed Smart Motor Overload Protection**
  The "smart" motor overload feature of the ACH550 is designed to take into account the thermal characteristics of the AC motor and calculate the motor temperature. When this function is activated, it will display a warning when the calculated temperature exceeds 90°C. When the calculated temperature exceeds 110°C the drive will shut down and display a fault message. This feature can also be set to display the warning when the motor exceeds 90°C, but continue to run when it exceeds 110°C.
- **Overload Adjustments**
  - Motor Thermal Time Constant
  - Setable for NEMA Class 10, 20 or 30 trip curve or to suit motor manufacturer data.
  - Motor Load Curve for Reduced Speed
    Set maximum percent current values at zero speed and above breakpoint speed. Set breakpoint frequency.



Stall Protection

The ACH550 provides protection against a stalled motor. When activated, this function can provide a warning or a fault condition caused by excessive motor current at low speeds. The stall current, frequency and time are adjustable.



- **Ground Fault and Mis-wiring Protection**
  The ACH550 ground fault protection can detect a ground fault whether or not the drive is running. Units rated 50 Hp and smaller are also protected from input and output power mis-wiring. If one or more input power conductors are connected to motor terminals, the drive will sense the problem and display an "OUTPUT WIRING" fault message. Both of these protections can be disabled.
- **Fieldbus Communications Loss Protection**
  The fieldbus communication loss protection can be disabled or enabled and set to shut down the drive and display a fault message or display a warning and continue operation an a preset speed or at the average speed during the previous 10 seconds. The protection can be set to ignore communications interruptions of up to 60 seconds.

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Parameter Group Functional Descriptions

Automatic Reset (Auto Restart) – Group 31
The Automatic Reset feature will automatically reset selected faults and attempt to restart the drive.

- **The following parameters control the operation of the Automatic Reset operation:**
  - Delay Time (0-120s)
  - Sets a delay after each fault before the attempted restart occurs. An Autoreset alarm is displayed during the delay time.
  - Number of Trials (0-5)
  - Sets the maximum number of restart attempts.
  - Trial Time (0-600s)
  - If the drive is successfully restarted within the set number of attempts, the trial counter is reset when the trial time has elapsed. If a fault occurs before the trial time has elapsed and after the set number of trials has been attempted the additional fault stops the drive and no further automatic resets are attempted until the fault has been reset manually.
- **The following faults can be selected for Automatic Reset:**
  - Overcurrent
  - Overvoltage
  - Undervoltage
  - Analog Input Signal Reference Loss
  - External Fault

Supervision – Group 32
The supervision functions are a unique feature of the ACH550 which can be set to monitor operating data signals and energize relays when the signals are above or below set limits.

- **Up to 3 signals can be monitored.**
- **All Group 01 Actual Signals can be monitored.**
  See “Actual Signals” under “Available Operating Data” on page 22.
- **Full-range hysteresis adjustment is provided.**
- **Relay pull-in and drop-out points are separately adjustable.**
- **Relay outputs can be assigned to each supervision function.**
  See “Relay Outputs – Group 14” on page 24.
- **On delay and off delay times can be set.**

Panel Display Process Variables – Group 34
The three center lines of the operator control panel display show the values of three user-selected parameters with user-selected units of measurements.

- **Any Group 01 Actual Signals can selected.**
  See “Actual Signals” under “Available Operating Data” on page 22.
- **Actual Signals can be displayed directly**
  By selecting the DIRECT output display form, the display will show the unaltered value of the Actual Signal using the default units of measurement and decimal location for the selected signal.
- **Displayed values can be scaled.**
  Scaled values of Actual Signals can be used to represent proportional process variables. Scaled values are set by adjusting the minimum and maximum displayed numbers corresponding to the minimum and maximum values of the Actual Signals. The decimal point location can also be specified.
- **Select from a wide range of units.**
  About 70 typical drive-related and process-related units of measurement alternatives are provided.
- **Bar-graph meter displays are available.**
  When the BAR METER output display form is selected, the value of the Actual Signal will be shown as a bar-graph meter with a small display of the numerical value.

Motor Temperature Measurement – Group 35
In addition to motor overload protection based on motor current, the ACH550 offers motor protection based on measured motor temperature.

- **Temperature Sensing Devices**
  - **Pt100 (RTD)**
    Use platinum resistance temperature detector(s) (RTD) rated 100 ohms at 0°C. One Pt100 or three Pt100’s wired in series can be connected. One ACH550 analog output provides current and one analog input senses voltage. Alarm Limit and Fault Limit temperatures are adjustable up to 200°C.
    PTC Thermistor (analog connection)
    Use a positive temperature coefficient (PTC) thermistor. One ACH550 analog output provides current and one analog input senses voltage. Alarm Limit and Fault Limit resistance values are adjustable up to 5000 ohms.
  - **PTC Thermistor (digital connection)**
    Use a positive temperature coefficient (PTC) thermistor. One ACH550 digital input monitors the resistance and generates an Alarm and/or Fault when a high resistance is detected.
  - **Thermistor relay or external monitor**
    An external device can be used to monitor any type of sensor. A relay contact from the monitor is connected to a digital input in the ACH550. An Alarm and/or Fault is generated when the contact opens or closes.

Timer Functions – Group 36
Several daily and weekly event timing functions are available in the ACH550. Event timers can be used to control other drive functions or to control external functions using relay outputs or the external PID controller.

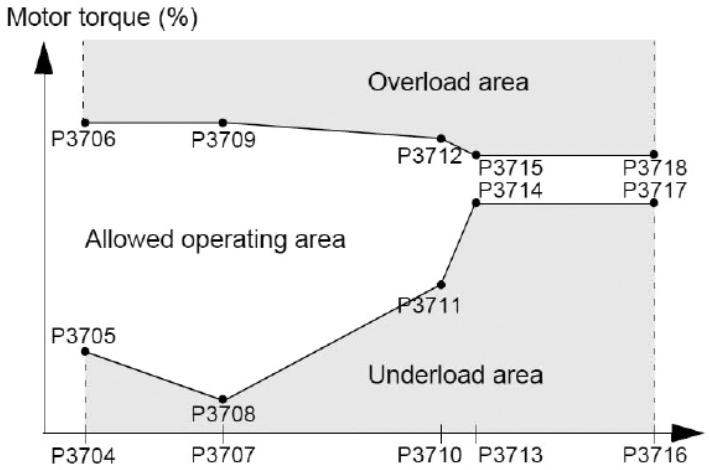
- **The timer functions include:**
  - Four daily start and stop times.
    A daily “on” time period occurs between the “start” and “stop” times.
  - Four weekly start and stop days.
    Each daily time period is enabled between the beginning of the “start” day and the end of the “stop” day for that time period.

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- One boost time
  The boost time is a time interval added to an “on” override that can be assigned as a terminal block input.
- Timing enable/disable
  The Timers Enable parameter enables or disables the entire timing function or assigns Timers Enable/ Disable to a terminal block input.

- **Four timers are provided**
  Timers contain one or more time periods selected from the daily, weekly and boost settings. Timers are available for selection as sources for relay outputs and various drive control commands.
  A timer can be connected to multiple time periods and a time period can be in multiple timers. A relay output or drive control command parameter can be connected to only one timer.

User Load Curve - Group 37
Defines supervision of user adjustable load curves (motor torque as a function of frequency). An underload curve and overload curve can be set individually or combined. Each curve is defined by five points using parameters. Each of these five points are further defined by parameters for output frequency. Using these parameters provides the user to establich an allowed operating area.



Process PID Controller – Groups 40 & 41
A built-in PID controller with more than twenty (20) programmable parameters is standard in the ACH550. The PID controller can be configured to control a process variable such as pressure, flow, or fluid level by adjusting the motor speed to correct the process variable.

- **PID Controller Output**
  In order to regulate a process variable by controlling the motor speed, the output of the PID controller must be selected as the drive’s speed reference.
- **Setpoint**
  Instead of applying a speed reference to the ACH550, a Process Reference (Setpoint) is applied via keypad, analog input or serial communications.
  - Setpoint correcting signal
  The setpoint can be the sum, difference. product or quotient of a reference setting and a correction signal.
- **Feedback Signal**
  An Actual Value Signal (Feedback) is brought back to the ACH550 as an analog input.
  - **Mathematical function of two feedback signals**
    The Actual Value Signal can be configured as a mathematical function of two analog input signals. Available functions include sum, difference, product, quotient, smaller or greater of 2 values, square root of sum or difference and sum of square roots.
- **PID Control**
  The ACH550 compares the setpoint with the feedback signal, and adjusts the output frequency up or down to minimize the error, the difference between the reference and feedback signals. The speed correcting output of the PID controller is a mathematical function proportional to the error signal plus the integral and derivative of the error.
- **PID Tuning Adjustments**
  The PID controller has the following tuning adjustments:
  - Proportional Gain
  - Integration Time
  - Derivation Time
  - Additional Adjustments

  Setpoint and feedback limits and several other adjustments are also provided.
- **Two alternative sets of parameter settings**
  Using two menu groups (40 and 41), two alternative values can be set for each parameter. The active parameter groups can be selected using a digital input.
- **PID Sleep Function**
  When the process demand is very low, the PID Sleep function stops the motor rather than allow sustained operation at a low speed. If the process demand remains low, the motor will cycle off. When the demand returns to normal, the drive resumes normal PID regulation and the drive restarts automatically. Several adjustments are available for the PID Sleep function.

External PID Controller – Group 42
The ACH550 has a second PID controller that is similar to the controller described above but completely independant. The External PID Controller is intended to control a process that is not related to motor speed. This PID loop is typically used to control a chilled water valve or cooling tower bypass valve or any device requiring a 4-20 mA signal control.

- **Output to an External Actuator**
  The output of the External PID Controller must be assigned to an analog output so that it can be connected to an external actuator.

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- **Setpoint, Feedback, Control and Adjustments**
  Except that the output is transmitted to the actuator of a valve or some other external device, the operation of the External PID Controller is the same as described above for the Process PID Controller. The setpoint, feedback signal, PID control and tuning adjustments are as described above. The External PID Controller has only one set of parameter settings and does not have a Sleep function.
- **External PID Controller Activation**
  The external PID controller can be configured to be activated whenever power is applied to the drive, whenever the drive is running or whenever commanded by a digital input or timer. An PID Offset adjustment can be used to define the initial and final value assumed by the PID output when it is activated and deactivated.
- **Trim Mode**
  The External PID Controller can be used to provide a speed reference correction factor to perform a speed trimming function.

Communications Modules – Group 51
See “Drive Features - Communications Suite” on page 11 for a more complete discussion of the communications capabilities of the ACH550.

- **Optional Communications Modules**
  This group of parameters defines set-up variables for an optional fieldbus adapter (FBA) communication module. See “fieldbus adapter Modules” on page 32 For more information on these parameters, refer to the user’s manual supplied with the FBA module.
- **Built-in Communications Capability**
  The ACH550 has the built-in capability to communicate using the embedded fieldbus protocols listed under “Embedded Fieldbus Protocol – Groups 53” below.

Operator’s Panel Communications – Group 52
This group of parameters defines the communication settings for the operator control panel port on the drive. Normally, when using the standard operator control panel, there is no need to change settings in this group.

Embedded Fieldbus Protocol – Groups 53
See “Drive Features - Communications Suite” on page11 for a more complete discussion of the communications capabilities of the ACH550.

- **Built-in Communications Capability**
  With its standard (RS) EIA-485 port, the ACH550 has the built-in capability to communicate using any of the following embedded fieldbus protocols:
  - Modbus®
  - Metasys® N2
  - APOGEE® FLN (P1)
  - BACnet® (BTL listed)

Pump & Fan Alternation (PFA) – Group 81
The pump and fan control macro (HVAC PFC) of the ACH 550 provides on/off commands to control constant speed pumps, fans or compressors operating in parallel with the pump, fan or compressor controlled by the ACH550.

- **Coordinated Control of Up To Six* Motors**
  - One Adjustable Speed Motor
    The PID Setpoint Controller in the ACH550 controls the process pressure or flow by controlling the speed of the motor connected to the ACH550.
  - Up To Five* Constant Speed Motors
    The PFA control starts additional constant speed auxiliary motors whenever maximum speed operation of the adjustable speed motor is not sufficient to satisfy the process requirement. This feature can eliminate the need for a PLC or pump sequencer.
    Note: The optional relay output extension module is required to control more than two constant speed motors.
- **Coordination Adjustments**
  - Start and Stop Points and Delay Times
    Auxiliary motors are started and stopped when the main motor has operated outside of a preset speed range for a preset time. The PFA provides relay contact closures to energize external starters to control the auxiliary motors.
  - Reference Steps and Alternate PID Settings
    Three step adjustments to the reference and two groups of PID settings can be applied to accommodate different operating characteristics with various numbers of parallel units in operation.
- **Automatic Sequence Change**
  An automatic sequence change feature helps ensure equal duty time for all of the motors.
  - AFD Output Contactors and Motor Starters
    A motor starter and an AFD output contactor is required for each motor if all motors are to be rotated to adjustable speed duty.
  - Sequence Operation
    The PFA controller regulates the timing and lead/lag sequencing of all of the motors. The PFA selects each motor when it is required and provides a contact closure to energize the appropriate contactors.
- **PID Controller Bypass Operation**
  Instead of using the PID controller of the ACH550 to regulate the process, an open-loop capacity output command can be used to directly set the flow provided by the parallel combination of pumps, fans or compressors.

Group 98: Options
This group of parameters configures optional features.

- **Communication Protocol Selection**
  Select the use of an embedded communications protocol or a fieldbus adapter module. See Group 51 and Group 53.

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Standard Product Options

Introduction
Several options are available for ACH550 drives. Most items are available as kits for installation in the field.

Input/Output Option Modules
- **Relay Output Extension**
  The Relay Output Extension module provides three (3) Form C relay outputs numbered RO 4, 5 and 6. The module mounts in option slot 1 inside the drive. It is available as a kit or factory installed. The relay functions are user-configured through the group 14 parameters.
- **115/230v digital input Interface Module**
  The Digital Input Interface module provides six (6) AC voltage inputs used to drive the six standard digital inputs of the ACH550. The 115/230VAC must be provided by the user. The module mounts in option slot 2 inside the drive. It is available as a kit or factory installed. The module cannot be installed if a Fieldbus Adapter module is installed.
- **BACnet Router**
  The RBIP-01 BACnet router is a BACnet/IP to MS/TP router. One (1) RBIP-01 router can connect up to 31 drives to a BACnet MS/TP (EIA-485) network. RBIP-01 supports BBMD (BACnet Broadcast Management Device) functionality. The router mounts inside the drive enclosure. The X1 port provides an Ethernet connection to a BACnet/Ethernet or BACnet/IP network. It can be powered from the drive's internal power supply or from an external power supply (24 V AC or 24 V DC). The routers X3 terminal provides connection to a BACnet MS/TP (EIA-485) network. The router is also equipped with bus termination resistors, network bias resistors and LEDs for status indication.

Fieldbus adapter Modules
Fieldbus Adapter modules are used to add communications protocols that are not embedded in the drive as standard or available to add as an optional embedded protocol.
Any one of the Fieldbus Adapter modules can be mounted in option slot 2 inside the drive. The modules are available as kits or factory installed. A Fieldbus Adapter module cannot be installed if a Digital Input Interface module is installed.
- **DeviceNet Adapter**
  The DeviceNet Adapter is used for connecting the ACH550 to DeviceNet networks. DeviceNet network uses a linear bus topology. Terminating resistors are required on each end of the trunk line. Drop lines as long as 6 meters (20 feet) each are permitted, allowing one or more nodes to be attached. DeviceNet allows branching structures only on drop lines. The drive is considered as a slave in the DeviceNet network.
- **LonWorks Adapter**
  The LonWorks Adapter permits the ACH550 to communicate to a LonWorks network protocol. The RLON-01 module uses the FT-X1 Free Topology Transceiver (compatible with FTT-10A transceiver) from Echelon Corporation. This is the most commonly used twisted-pair media in building automation and this architecture supports star, bus, and loop wiring. The FT-X1 transceiver connects to a twisted pair cable with a baud rate of 78 kbit/s and appears as a high impedance to the network when unpowered, hence it does not interfere with the network communications when powered down. The drive object realizes the LONMARK® Functional Profile: Variable Speed Motor Drive Version, 1.1.
- **Profibus-DP Adapter**
  The Profibus Adapter is used for connecting the ACH550 to Profibus networks. The RPBA-01 is compatible with the Profibus-FMS and Profibus-DP protocols. ACH550 acts as a slave on the Profibus link. The connection is a screw connector, with a selectable Baud rate of 9.6, 19.2, 93.75, 187, 300 and 1500 Kbps. Contact Applications Engineering for approved PLC connectivity. Profibus is an open serial communication standard that enables data exchange between all kinds of automation components. The physical transmission medium of the bus is a twisted pair cable (according to the (RS) EIA-485 standard). The maximum length of the bus cable is 100 to 1200 meters, depending on the selected transmission rate. Up to 31 stations can be connected to the same Profibus system without the use of repeaters.
- **ControlNet Adapter**
  The ControlNet adapter is used for connecting the ACH550 to ControlNet networks. The RCNA-01 module supports RG-6 quad-shielded cable for the bus connection and supports bus, tree and star topologies. Fieldbus speed it 5 Mbits/s. The ControlNet adapter protocol is in accordance to the ControlNet International specification for a communication adapter (profile number 12).
- **Ethernet Adapter**
  SREA-01 is an optional device for web browser-based remote interface to the ACH550 drives via ethernet. This din rail mounted adapter enables remote data acquisition through a standard web browser, utilizing an internal web server for drive configuration and access. Multiple drives (up to 10) can be connected to the Modbus-RTU network through the drive's Modbus-RTU port. The ACH550 can also be connected through the control panel port, although an additional RS-485 converter is neeed for each drive if several drives are connect by their panel port.

DriveWindow Light Software
DriveWindow Light is software designed for online drive commissioning and maintenance purposes. It is possible to adjust parameters, read the actual values and control the drive with DriveWindow Light instead of the drive control panel. It is also possible to follow trends and draw graphs. DriveWindow Light requires the use of a RJ45 to DB9 adapter and CAT 5 patch cable, which are provided.

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Standard Product Options

RJ45/DB9 Adapter
This adapter converts the drive's panel port RJ45 (CAT 5 cable connector) plug to a 9 pin RS-232 computer serial port connector for connecting the ACH550 to a PC when using DriveWindow Light 2.

Operator's Panel Extension Cable
A 7 foot CAT 5 patch cable that allows remote operation of the standard operator's panel or connection of the drive to a PC using the RJ45/DB9 Adapter which must be purchased separately.

Operator Control Panel (spare/additional)
The operator's control panel that is furnished with the drive is available as a separate item. Spare control panels can be used to store backup copies of parameter settings.

Control Panel Mounting Kit (OPMP-01)
Control Panel Mounting Kit for ACH550 drives allows remote mounting of the ACH550 keypad on the door of an enclosure. The kit includes a 10 ft (3 m) CAT 5 patch cable, gasket for NEMA 12, mounting hardware and drilling template.

Flange Mounting Kits
A Flange Mounting Kit for the ACH550 drive allows mounting the drive with the heatsink external to a 3rd party enclosure. Use of the flange kit requires removal of the drive cover, reducing protection to IP00. The flange kit can be used with 3rd party UL type 1 & 12 (NEMA 1 & 12) enclosures.

Flange Mounting Gasket
The flange gasket is for flange mounting NEMA 12 drives.

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E-Clipse Bypass Product Options

Introduction
The ACH550 with E-Clipse Bypass is an ACH550 AC adjustable frequency drive in an integrated package with a bypass motor starter.

Vertical Enclosures Style
The vertical enclosure style is a narrow package with the ACH550 above the bypass compartment.

- **UL Type 1 (NEMA 1) Enclosure**
- **Wall mounted enclosures:**
  - 208/230V models: 1 to 25 HP
  - 480V models: 1 to 60 HP
  - 600V models: 2 to 60 HP
- **Door**
  - Door-mounted operator (padlockable in the OFF position)
  - Cover-mounted ACH550 Operator Panel
  - Door-mounted E-Clipse Bypass Operator Panel

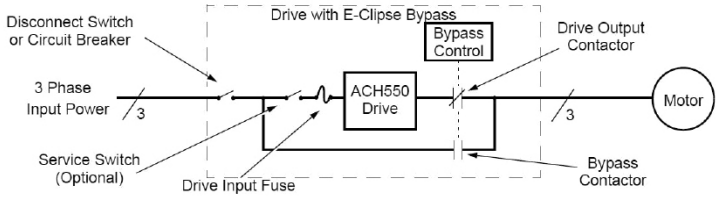
Standard Enclosures Style
In the standard enclosure style the ACH550 and the bypass unit are mounted side-by-side.

- **Available Enclosure Types**
  UL Type 1 (NEMA 1)
  UL Type 12 (NEMA 12)
  UL Type 3R (NEMA 3R)
- **Wall mounted enclosures:**
  - 208/230V models: 1 to 100 HP
  - 480V models: 1 to 200 HP
  - 600V models: 2 to 150 HP
- **Floor mounted enclosures:**
  - 480V models: 250 to 400 HP
- **Door**
  - Door-mounted operator (padlockable in the OFF position)
  - Cover/door-mounted ACH550 Operator Panel
  - Door-mounted E-Clipse Bypass Operator Panel

Available Input Disconnect Device

- **Disconnect switch (non-fused)**
  Fuses are supplied in the drive path only. Upstream motor branch circuit protection is required. See “Drive Isolation” on page 34 and “Motor Branch Circuit Protection” on page 35.
- **Circuit breaker**
  Fuses are supplied in the drive path only. See “Drive Isolation” on page 34. Drive and options as a package are UL Listed for 100 K short circuit rating.

Bypass Features
The ACH550 with E-Clipse Bypass is a microprocessor-controlled “HVAC Enhanced” system which includes the following features:



- **Energy Savings Estimator**
  The E-Clipse bypass is capable of displaying the estimated energy savings provided by drive operation. Additional displays provide estimated dollar savings based upon a user provided cost per kilowatt hour and estimated CO2 avoidance in tons.
- **Operator Control**
  - Bypass Control Keypad
    The E-Clipse Bypass has a separate keypad that is used for selecting the Drive or Bypass mode of operation and manually starting and stopping the motor in the Bypass mode. The bypass keypad has LED indicating lights that indicate the status of both the bypass and the drive.
    Bypass safties faults and alarms are displayed on the 2 line back lit LCD display. Displays for AC line volts (3-phase), amps (amperage), kW, bypass run time, as well as other functions are available. Distinct annunciation of safety interlocks such as firestat, freezestat, damper end switch, over pressure, vibration switch, low suction, and safety open can also be displayed. Up to 4 independent safeties can be selected and tied to a display message
  - ACH550 Control Panel
    In normal operation with the Electronic Bypass, the ACH550 is placed in the AUTO mode of operation and the ACH550 control panel is used only as a display unit for monitoring the operation of the drive.
  - Regulated Control Circuit Power Supply
    A regulated control circuit power supply with voltage tolerance of +30%/-35% assures reliable operation with protection against single phase and contactor coil burn out. This protection is provided in drive and bypass.
- **Bypass Contactors**
  The ACH550 E-Clipse Bypass includes two contactors. One contactor is the bypass contactor that connects the motor directly to the incoming power line in the event that the ACH550 is out of service. The other is the ACH550 output contactor that disconnects the ACH550 from the motor when the motor is operating in the Bypass mode. The drive output contactor and the bypass contactor are electrically interlocked to prevent “back feeding,” applying line voltage to the ACH550 output terminals.

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E-Clipse Bypass Product Options

- **Manual or Automatic Transfer to Bypass**
  The user can manually switch the motor to the Bypass mode or select Automatic Bypass operation. When Automatic Bypass operation is selected, the motor is automatically transferred to line power if the drive trips out on a protective trip. Auto transfer capability can be programmed as conditional depending upon the type of fault. If an overcurrent, over voltage, under voltage or loss of analog input fault occurs transfer will take place. If a ground fault occurs, a transfer will not take place.
  If Automatic Restart has been enabled in the drive, the drive will attempt to automatically restart before the motor is transferred to line power.
- **Drive Isolation**
  - Drive Fuses
    Fast acting fuses exclusive to the ACH550 drive path disconnect the drive from the line prior to clearing upstream branch circuit protection, maintaining bypass capability.
  - Optional Service Switch
    The optional service switch allows the drive to be connected or disconnected from power during troubleshooting and repair without disturbing bypass operation.
- **IBC 2006 Seismic Certified**
  Bypass and drive have been tested to standard testing procedure ICC-ES AC156. An importance factor of 1.5 has been assigned allowing the drive and bypass to be referred to as a designated seismic system.

Motor Branch Circuit Protection

- **Short Circuit and Ground Fault Protection**
  In the Drive mode, 100 K short circuit and ground fault protection is provided by the electronic protection circuits of the drive.
  In the Bypass mode, 100 K short circuit and ground fault protection can be provided by the optional input circuit breaker described above.
- **Motor Overload Protection**
  UL listed (UL 508C) adjustable electronic motor overload protection (I2t) is provided. Class 20 or 30 overload curves can be selected.
  In the Drive mode, motor overload protection is provided by the ACH550.
  In the Bypass mode, motor overload protection is provided by the bypass control board.
- **Single Phase Protection**
  In the Drive mode, single phase protection is provided by the ACH550.
  In the Bypass mode, single phase protection is provided by the bypass control board.
- **Motor Control / Contactor Protection**
  All E-Clipse Bypass contactors use 115 VAC rated coils and then power is controlled by the Bypass control unit thus providing enhanced protection against “brown-outs” and the elimination of contactor chatter. By monitoring coil current, the bypass control unit can detect and annunciate an open coil or welded contacts.

HVAC Control Features

- **Damper Control**
  The damper control circuit closes a dry contact upon a Start command to open a damper such as an outdoor air damper, fire damper, isolation damper, etc. before the motor is allowed to operate in drive or bypass regardless of the source of the Run command. When the damper is fully open, a normally open dry contact (damper end-switch) closes and allows the motor to operate. When the drive is commanded to stop during the normal course of operation or through the operation of a safety interlock or fault trip, the motor stops (in drive or bypass mode) and the damper is commanded to close.
- **Safety Interlocks**
  A dedicated input is provided for safety interlocks such as firestats, smoke detectors, etc. When this contact opens, the motor stops (in drive or bypass mode).
- **Underload (Broken Belt / Proof of Flow) Trip**
  Both ACH550 and the E-Clipse Bypass underload conditions are monitored by the bypass control unit and a common system relay output is provided
- **Fireman’s Override**
  The ACH550 with E-Clipse Bypass has two Override modes of operation for critical control situations.
  In the smoke control (override 1) mode, the motor is powered by AC line power through the bypass contactor. The system ignores all commands from either the drive or bypass control panels when in this mode. In the bypass override (override 2) mode, the motor is powered by AC line power through the bypass contactor. While in bypass override the system responds to bypass overloads and programmed faults, which can be programmed to satisfy local requirements.

Control Connections

In typical installations, only serial communications and analog input wires connect to the ACH550 terminal block, with other control connections made on the E-Clipse Bypass control board.

- **Two Programmable Analog Inputs**
  Specifications as described for the standard ACH550.
- **Six Digital Inputs – Five Programmable**
  - Start/Stop (Auto)
    This input control the motor in both the Drive mode and the Bypass mode.
  - Run Enable (Damper Open)
    This input control the motor in both the Drive mode and the Bypass mode.

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- Safety Interlocks
  This input control the motor in both the Drive mode and the Bypass mode.
- Override 1 (Smoke Control)
  This input forces the motor to run in bypass
- **Override 2 (Bypass Override)**
  This input overrides the Bypass Control Keypad and forces the unit to remain in Bypass mode while the remote input contact remains closed.
- Programmable Inputs
  Four programmable inputs are available with specifications as described for the standard ACH550.

- **Two Programmable Analog Outputs**
  Specifications as described for the standard ACH550.
- **E-Clipse Bypass Relay Outputs**
  The following form C relay contacts are available.
  - **System Ready**
    The relay is energized when the Drive/Bypass system is ready to be started.
  - **System Running**
    The relay is energized when the Drive/Bypass system is running.
  - **System Started**
    The relay is energized when the Drive/Bypass system is started.
  - **Bypass Selected**
    The relay is energized when Bypass mode has been selected.
  - **Bypass Run**
    The relay is energized when bypass is running
  - **Bypass Fault**
    The relay is energized when the bypass is faulted.
  - **Bypass No Fault**
    The relay is energized during normal operation.
  - **Bypass Alarm**
    The relay is energized when the bypass alarm is present.
  - **Drive Fault**
    The relay is energized when a drive fault has occurred.
  - **Drive No Fault**
    The relay is energized during normal operation.
  - **Drive Alarm**
    The relay is energized when a drive alarm is present.
  - **Override**
    The relay is energized when smoke control override or bypass override mode is selected and denergizes in all other modes.
  - **Bypass Hand**
    The relay is energized when the motor is running bypass mode and HAND (manual operation) is selected.
  - **Bypass Off**
    The relay is energized when the bypass control mode OFF is selected.
  - **Bypass Auto**
    The relay is energized when the bypass control mode AUTO is selected.
  - **Communications Control**
    The relay is energized when the appropriate ON command is provided over the serial communications connection.
  - **System Alarm**
    The relay is energized when a drive/bypass alarm is present.
  - **Bypass Fault/Alarm**
    The relay is energized then either a bypass fault has occurred, the bypass motor overload/ underload protection has tripped or a bypass alarm is present.
  - **Bypass Overload**
    The relay is energized when the bypass motor overload level has exceeded the programmed protection settings.
- **ACH550 Relay Outputs**
  One ACH550 relay output is available for customer configuration and use. Three additional relay outputs are available if the Relay Output option is installed. Specifications are as described for the standard ACH550.

Serial Communications

The ACH550 with E-Clipse Bypass has the ability to monitor VFD/Bypass mode of operation, the status of the bypass H-O-A switch, bypass fault and override status over serial communication. The serial communication link can also force the motor into bypass. See “Drive Features - Communications Suite” on page 11, “Communications Modules – Group 51” on page 30 and “Embedded Fieldbus Protocol – Groups 53” on page 30.

One connection point for both drive and bypass serial communications is provided at the bypass control unit. With the E-Clipse bypass all available I/O can be accessed and operated using serial communications independent of the drive. E-Clipse bypass serial communications are maintained regardless of the ACH550 drive condition

Options

- **Drive Service Switch**
  The service switch allows the drive to be connected or disconnected from power during troubleshooting and repair without disturbing bypass operation.

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ACH550 Drive Pack

Introduction

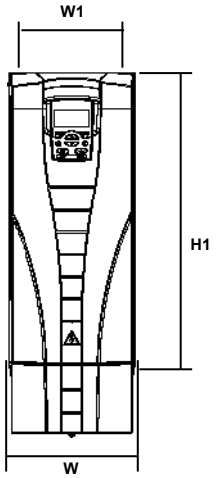
The ACH550 Drive Pack is an ACH550 Drive packaged with an input disconnect device.

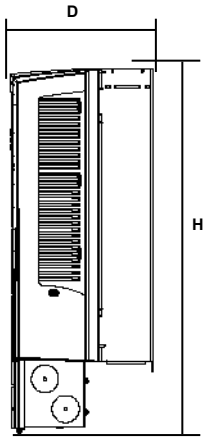
Enclosures and Horsepower Ranges

- **Available Enclosure Types**
  - UL Type 1 (NEMA 1)
  - UL Type 12 (NEMA 12)
  - UL Type 3R (NEMA 3R)
- **Wall mounted enclosures:**
  - 208/230V models: 1 to 100 HP
  - 480V models: 1 to 200 HP
  - 600V models: 2 to 150 HP
- **Floor mounted enclosures:**
  - 480V models: 250 to 550 HP
- **Door**
  - Door-mounted operator (padlockable in the OFF position)
  - Cover/door-mounted ACH550 Operator Panel
- **Available Input Disconnect Device**
  - Disconnect switch and fuses
  - Circuit breaker
- **Other semi-custom options include:**
  - 12 or 18 pulse rectifiers
  - Passive harmonic filters
  - Out put filters

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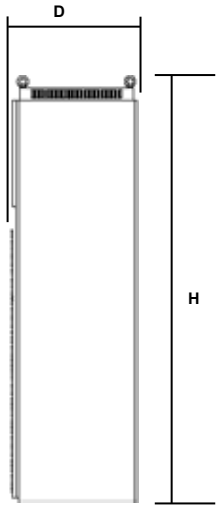
Dimensions: ACH550-UH UL Type 1 / NEMA 1 R1 through R8 Frame Size





Wall Mount (UH1-1 - UH1-6)





Floor Mount (UH1-8)

Dimension Reference	UL Type 1 / NEMA 1 Mounting Dimensions mm [inches]			UL Type 1 / NEMA 1 Dimensions and Weights mm kg [inches] [lbs]				
	H1	W1	Mounting Hardware	Height (H)	Width (W)	Depth (D)	Weight	Dimension Drawing
UH1-1	318 [12.5]	98 [3.9]	M5 [#10]	369 [14.5]	125 [4.9]	212 [8.3]	6.5 [14]	3AUA0000001559 Sheet 1
UH1-2	418 [16.4]	98 [3.9]	M5 [#10]	469 [18.5]	125 [4.9]	222 [8.7]	9 [20]	3AUA0000001560 Sheet 1
UH1-3	473 [18.6]	160 [6.3]	M5 [#10]	583 [23]	203 [8]	231 [9.1]	16 [35]	3AUA0000001571 Sheet 1
UH1-4	578 [22.8]	160 [6.3]	M5 [#10]	689 [27.1]	203 [8]	262 [10.3]	24 [53]	3AUA0000001572 Sheet 1
UH1-5	588 [23.1]	238 [9.4]	M6 [0.25]	736 [29]	267 [10.5]	286 [11.2]	34 [75]	3AUA0000004629 Sheet 1
UH1-6	675 [26.6]	263 [10.3]	M6 [0.25]	881 [34.7]	302 [11.9]	400 [15.7]	69 [152]	3AUA0000004633 Sheet 1
UH1-8	Free Standing		Ø16 [Ø0.63]	2125 [83.7]	806 [31.7]	639 [25.2]	354 [780]	3AUA0000021150 Sheet 1

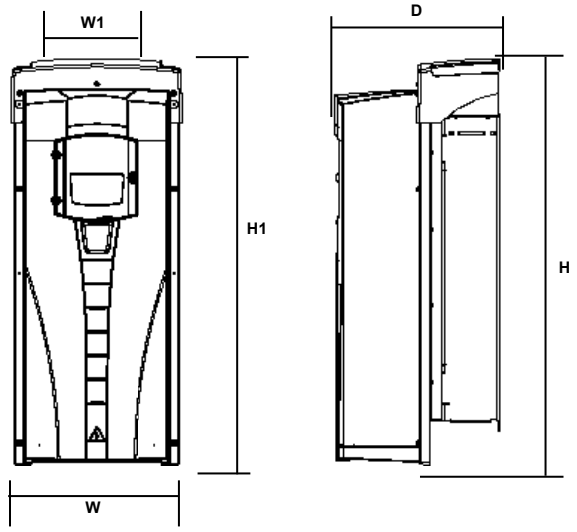
Drawing is not for engineering purposes.

A larger conduit box provided on units with ratings above 200 amps extends the Height (H) dimension an additional 107 mm [4.2 inches].

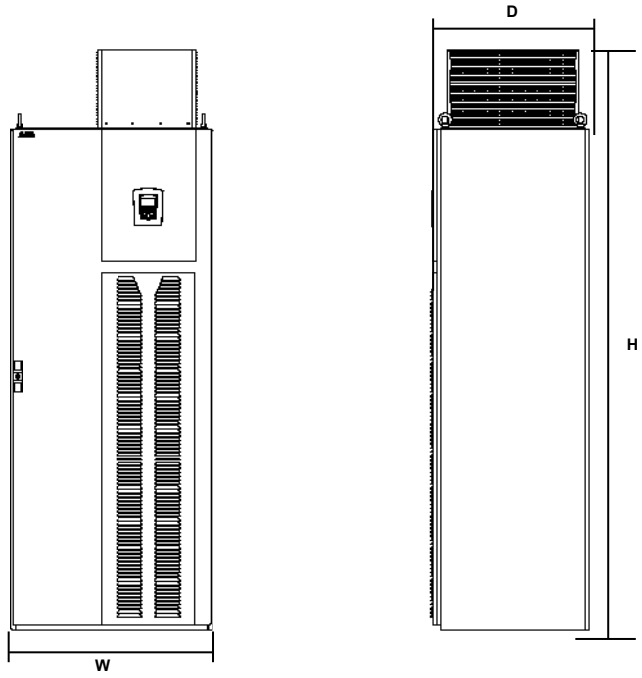
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Dimensions: ACH550-UH UL Type 12 / NEMA 12 R1 through R8 Frame Size



Wall Mount (UH12-1 - UH12-6)



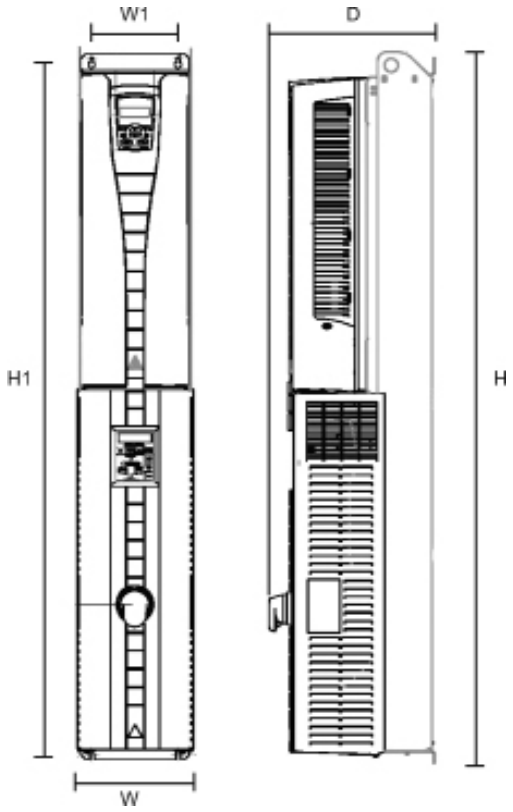
Floor Mount (UH12-8)

Dimension Reference	UL Type 12 / NEMA 12 Mounting Dimensions mm [inches]			UL Type 12 / NEMA 12 Dimensions and Weights mm [inches] kg [lbs]				
	H1	W1	Mounting Hardware	Height (H)	Width (W)	Depth (D)	Weight	Dimension Drawing
UH12-1	318 [12.5]	98 [3.9]	M5 [#10]	461 [18.1]	222 [8.7]	234 [9.2]	8.2 [18]	3AUA0000004031 Sheet 1
UH12-2	418 [16.4]	98 [3.9]	M5 [#10]	561 [22.1]	222 [8.7]	245 [9.6]	11.2 [25]	3AUA0000004032 Sheet 1
UH12-3	473 [18.6]	160 [6.3]	M5 [#10]	629 [24.8]	267 [10.5]	253 [10]	18.5 [41]	3AUA0000004029 Sheet 1
UH12-4	578 [22.8]	160 [6.3]	M5 [#10]	760 [29.9]	267 [10.5]	284 [11.2]	26.5 [58]	3AUA0000004043 Sheet 1
UH12-5	588 [23.1]	238 [9.4]	M6 [0.25]	816 [32.1]	369 [14.5]	309 [12.1]	38.5 [85]	3AUA0000004634 Sheet 1
UH12-6	675 [26.6]	263 [10.3]	M6 [0.25]	984 [38.7]	410 [16.1]	423 [16.6]	86 [190]	3AUA0000004635 Sheet 1
UH12-8	Free Standing		Ø16 [Ø0.63]	2377 [93.6]	806 [31.7]	639 [25.2]	375 [827]	3AUA0000021151 Sheet 1

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Dimensions: ACH550-Vx UL Type 1 / NEMA 1 R1 through R4 Frame Size



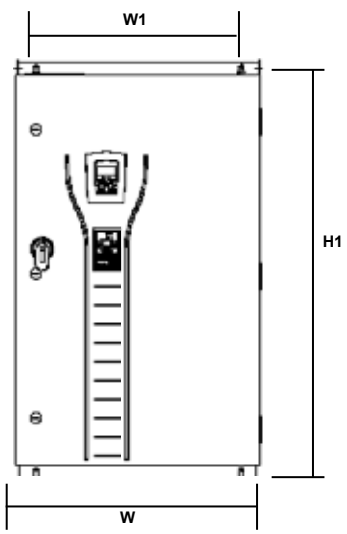
Wall Mount (VX1-1 - VX1-4)

Dimension Reference	UL Type 1 / NEMA 1 MountingDimensions mm [inches]			UL Type 1 / NEMA 1 Dimensions and Weights mm kg [inches] [lbs]				
	H1	W1	Mounting Hardware	Height (H)	Width (W)	Depth (D)	Weight	Dimension Drawing
VX1-1	1004 [39.5]	98 [3.9]	M6 [0.25]	1021 [40.2]	136 [5.4]	256 [10.1]	15 [33]	3AUA0000016371 Sheet 1
VX1-2	1103 [43.4]	98 [3.9]	M6 [0.25]	1120 [44.1]	136 [5.4]	262 [10.3]	18 [40]	3AUA0000016372 Sheet 1
VX1-3	1180 [46.5]	160 [6.3]	M6 [0.25]	1211 [47.7]	214 [8.4]	278 [10.9]	32 [71]	3AUA0000016373 Sheet 1
VX1-4	1285 [50.6]	160 [6.3]	M6 [0.25]	1316 [51.8]	214 [8.4]	307 [12.1]	42 [93]	3AUA0000016374 Sheet 1

Drawing is not for engineering purposes.

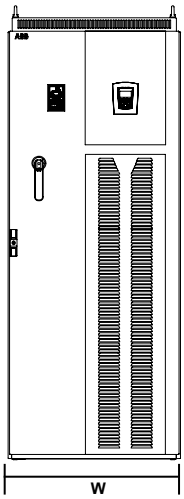
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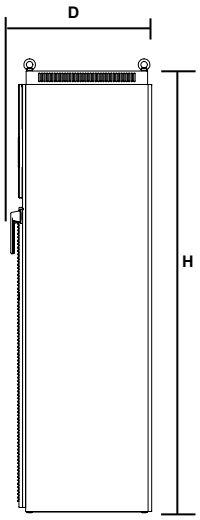
Dimensions: ACH550-BxR UL Type 1 / NEMA 1 R1 through R8 Frame Size





Wall Mount (BX1-1 - BX1-6)





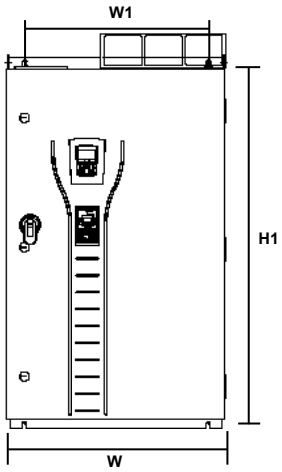
Floor Mount (BX1-8)

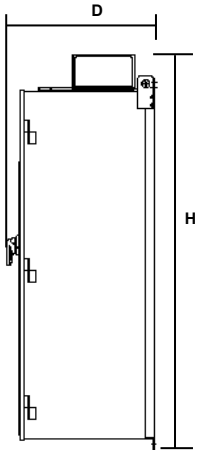
Dimension Reference	UL Type 1 / NEMA 1 Mounting Dimensions mm [inches]			UL Type 1 / NEMA 1 Dimensions and Weights mm kg [inches] [lbs]				
	H1	W1	Mounting Hardware	Height (H)	Width (W)	Depth (D)	Weight	Dimension Drawing
BX1-1	810 [31.9]	320 [12.6]	M10 [0.375]	842 [33.2]	443 [17.4]	343 [13.5]	35.4 [78]	3AUA0000016375 Sheet 1
BX1-2	810 [31.9]	320 [12.6]	M10 [0.375]	842 [33.2]	443 [17.4]	343 [13.5]	38.1 [84]	3AUA0000016375 Sheet 1
BX1-3	918 [36.1]	400 [15.7]	M10 [0.375]	950 [37.4]	521 [20.5]	389 [15.3]	54.4 [120]	3AUA0000016378 Sheet 1
BX1-4	918 [36.1]	400 [15.7]	M10 [0.375]	950 [37.4]	521 [20.5]	389 [15.3]	62.6 [138]	3AUA0000016378 Sheet 1
BX1-5	1175 [46.3]	600 [23.6]	M10 [0.375]	1212 [47.7]	713 [28.1]	483 [19]	121 [267]	3AUA0000016381 Sheet 1
BX1-6	1175 [46.3]	600 [23.6]	M10 [0.375]	1212 [47.7]	713 [28.1]	483 [19]	163 [359]	3AUA0000016381 Sheet 1
BX1-8	Free Standing		Ø16 [Ø0.63]	2125 [83.7]	806 [31.7]	659 [25.9]	474 [1045]	3AUA0000016384 Sheet 1

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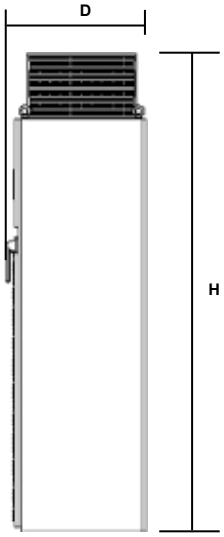
Dimensions: ACH550-BxR UL Type 12 / NEMA 12 R1 through R8 Frame Size





Wall Mount (BX12-1 - BX12-6)





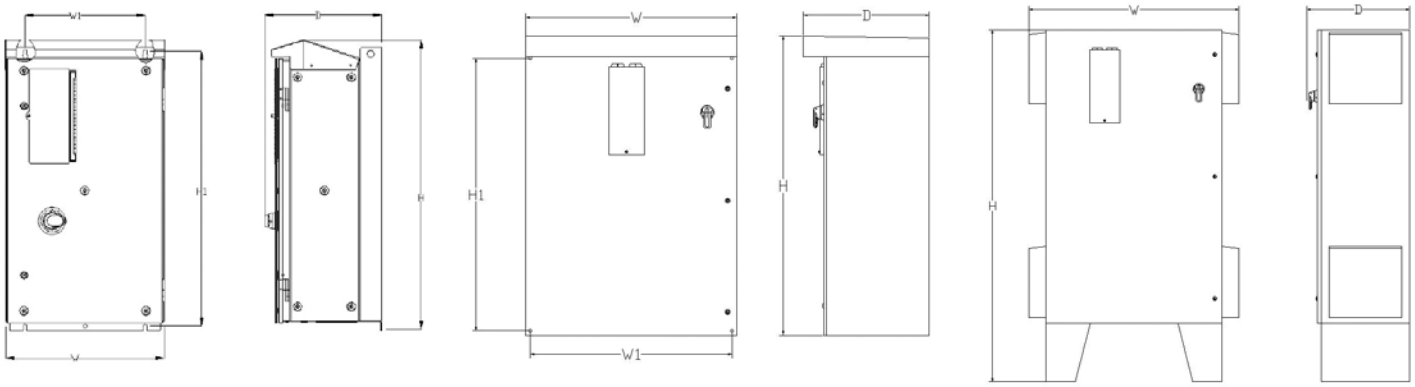
Floor Mount (BX12-8)

Dimension Reference	UL Type 12 / NEMA 12 Mounting Dimensions mm [inches]			UL Type 12 / NEMA 12 Dimensions and Weights mm [inches] kg [lbs]				
	H1	W1	Mounting Hardware	Height (H)	Width (W)	Depth (D)	Weight	Dimension Drawing
BX12-1	810 [31.9]	320 [12.6]	M10 [0.375]	842 [33.2]	443 [17.4]	343 [13.5]	35.4 [78]	3AUA0000016376 Sheet 1
BX12-2	810 [31.9]	320 [12.6]	M10 [0.375]	842 [33.2]	443 [17.4]	343 [13.5]	38.1 [84]	3AUA0000016376 Sheet 1
BX12-3	918 [36.1]	400 [15.7]	M10 [0.375]	950 [37.4]	521 [20.5]	389 [15.3]	54.4 [120]	3AUA0000016379 Sheet 1
BX12-4	918 [36.1]	400 [15.7]	M10 [0.375]	950 [37.4]	521 [20.5]	389 [15.3]	62.6 [138]	3AUA0000016379 Sheet 1
BX12-5	1175 [46.3]	600 [23.6]	M10 [0.375]	1380 [54.3]	713 [28.1]	483 [19]	121 [267]	3AUA0000016382 Sheet 1
BX12-6	1175 [46.3]	600 [23.6]	M10 [0.375]	1380 [54.3]	713 [28.1]	483 [19]	163 [359]	3AUA0000016382 Sheet 1
BX12-8	Free Standing		Ø16 [Ø0.63]	2377 [93.6]	806 [31.7]	659 [25.9]	474 [1045]	3AUA0000016385 Sheet 1

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Dimensions: ACH550-BxR UL Type 3R/ NEMA 3R R1 through R8 Frame Size



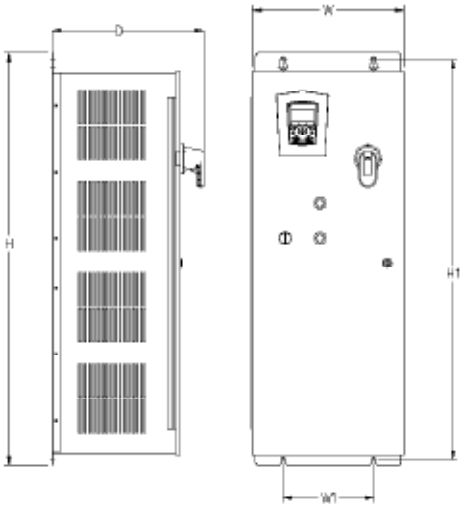
Wall Mount (BX3R-1 - BX3R-4) *Wall Mount (BX3R-5 - BX3R-6)* *Floor Mount (BX3R-7)*

Dimension Reference	UL Type 3R / NEMA 3R Mounting Dimensions mm [inches]			UL Type 3R / NEMA 3R Dimensions and Weights mm kg [inches] [lbs]				
	H1	W1	Mounting Hardware	Height (H)	Width (W)	Depth (D)	Weight	Dimension Drawing
BX3R-1	810 [31.9]	320 [12.6]	M10 [0.375]	865 [34]	452 [17.8]	343 [13.5]	58 [128]	3AUA0000016377 Sheet 1
BX3R-2	810 [31.9]	320 [12.6]	M10 [0.375]	865 [34]	452 [17.8]	343 [13.5]	61 [134]	3AUA0000016377 Sheet 1
BX3R-3	918 [36.1]	400 [15.7]	M10 [0.375]	968 [38.1]	530 [20.9]	389 [15.3]	80 [176]	3AUA0000016380 Sheet 1
BX3R-4	918 [36.1]	400 [15.7]	M10 [0.375]	968 [38.1]	530 [20.9]	389 [15.3]	88 [194]	3AUA0000016380 Sheet 1
BX3R-5	876 [34.5]	724 [28.5]	M10 [0.375]	991 [39]	762 [30]	394 [15.5]	96.8 [213]	3AUA0000060123 Sheet 2
BX3R-6	1181 [46.5]	876 [34.5]	M10 [0.375]	1295 [51]	914 [36]	546 [21.5]	185.5 [409]	3AUA0000060124 Sheet 2
BX3R-7	Free Standing		Ø14.2 [Ø0.56]	1829 [72]	1092 [43]	533 [21]	251.4 [554]	3AUA00000603R5 Sheet 2

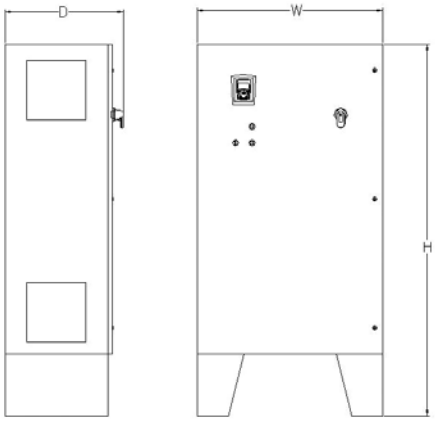
Drawing is not for engineering purposes.

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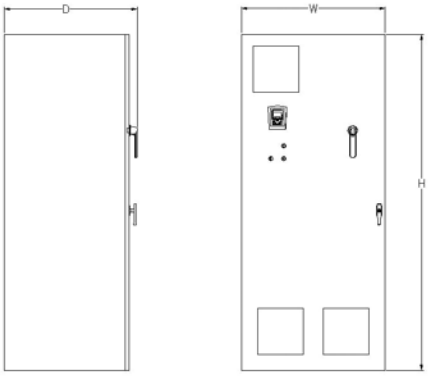
Dimensions: ACH550-Cx UL Type 1 / NEMA 1 R1 through R8 Frame Size



Wall Mount (CX1-1 - CX1-8)



Wall Mount (CX1-9 - CX1-11)



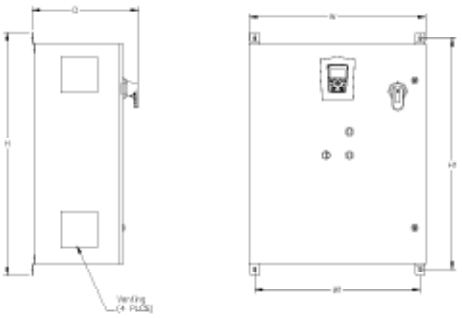
Floor Mount (CX1-12- CX1-13)

Dimension Reference	UL Type 1 / NEMA 1 Mounting Dimensions mm [inches]			UL Type 1 / NEMA 1 Dimensions and Weights mm kg [inches] [lbs]				
	H1	W1	Mounting Hardware	Height (H)	Width (W)	Depth (D)	Weight	Dimension Drawing
CX1-1	920 [36.2]	208 [8.2]	M10 [0.375]	948 [37.3]	348 [13.7]	349 [13.7]	35 [77]	3AUA0000012797 Sheet 3
CX1-2	920 [36.2]	208 [8.2]	M10 [0.375]	948 [37.3]	348 [13.7]	349 [13.7]	37 [82]	3AUA0000012797 Sheet 3
CX1-3	1352 [53.2]	254 [10]	M10 [0.375]	1380 [54.3]	414 [16.3]	371 [14.6]	49 [108]	3AUA0000012798 Sheet 3
CX1-4	1352 [53.2]	254 [10]	M10 [0.375]	1380 [54.3]	414 [16.3]	371 [14.6]	61 [134]	3AUA0000012798 Sheet 3
CX1-5	1352 [53.2]	254 [10]	M10 [0.375]	1380 [54.3]	414 [16.3]	371 [14.6]	76 [168]	3AUA0000012798 Sheet 3
CX1-6	1568 [61.7]	330 [13]	M10 [0.375]	1596 [62.8]	491 [19.3]	489 [19.2]	90 [198]	3AUA0000012799 Sheet 3
CX1-7	1568 [61.7]	330 [13]	M10 [0.375]	1596 [62.8]	491 [19.3]	489 [19.2]	119 [262]	3AUA0000012799 Sheet 3
CX1-8	1568 [61.7]	330 [13]	M10 [0.375]	1596 [62.8]	491 [19.3]	489 [19.2]	154 [340]	3AUA0000012799 Sheet 3
CX1-9	Free Standing		Ø14.2 [Ø0.56]	1883 [74.1]	889 [35]	527 [20.7]	126 [278]	3AUA0000012800 Sheet 3
CX1-10	Free Standing		Ø14.2 [Ø0.56]	1883 [74.1]	889 [35]	527 [20.7]	190 [419]	3AUA0000012800 Sheet 3
CX1-11	Free Standing		Ø14.2 [Ø0.56]	1829 [72]	914 [36]	584 [23]	247 [545]	3AUA0000024944 Sheet 3
CX1-12	Free Standing		N/A [N/A]	2134 [84]	914 [36]	848 [33.4]	579 [1276]	3AUA0000013236 Sheet 3
CX1-13	Free Standing		N/A [N/A]	2134 [84]	1524 [60]	848 [33.4]	662 [1459]	3AUA0000013223 Sheet 3

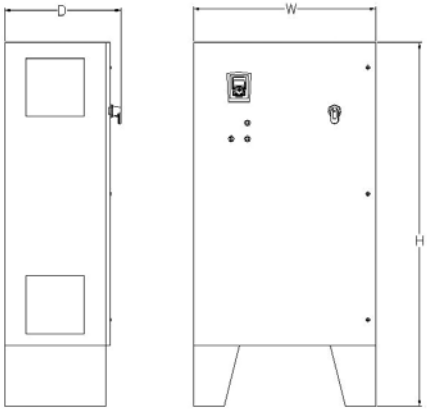
Drawing is not for engineering purposes.
CX1-9 and CX1-11 are wall mount configurations with 12 inch high mounting feet. Feet are removable.
CX1-13 enclosure is double door construction.

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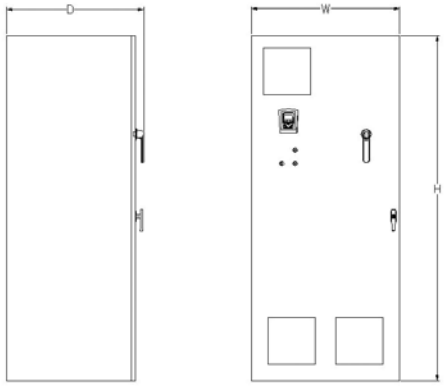
Dimensions: ACH550-Cx UL Type 12 / NEMA 12 R1 through R8 Frame



Wall Mount (CX12-1 - CX12-9)



Wall Mount (CX12-10)



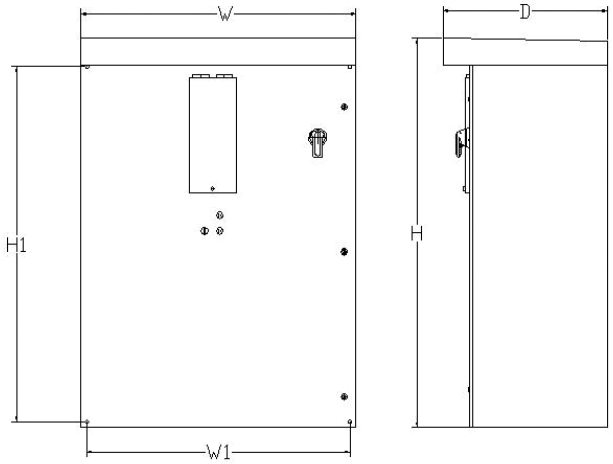
Floor Mount (CX12-11 - CX12-12)

Dimension Reference	UL Type 12 / NEMA 12 Mounting Dimensions mm [inches]			UL Type 12 / NEMA 12 Dimensions and Weights mm [inches] kg [lbs]				
	H1	W1	Mounting Hardware	Height (H)	Width (W)	Depth (D)	Weight	Dimension Drawing
CX12-1	648 [25.5]	419 [16.5]	M10 [0.375]	686 [27]	457 [18]	369 [14.5]	36 [79]	3AUA0000012801 Sheet 3
CX12-2	648 [25.5]	419 [16.5]	M10 [0.375]	686 [27]	457 [18]	369 [14.5]	38 [84]	3AUA0000012801 Sheet 3
CX12-3	800 [31.5]	572 [22.5]	M10 [0.375]	838 [33]	610 [24]	369 [14.5]	51 [112]	3AUA0000012802 Sheet 3
CX12-4	800 [31.5]	572 [22.5]	M10 [0.375]	838 [33]	610 [24]	369 [14.5]	64 [141]	3AUA0000012802 Sheet 3
CX12-5	953 [37.5]	724 [28.5]	M10 [0.375]	991 [39]	762 [30]	369 [14.5]	78 [172]	3AUA0000012803 Sheet 3
CX12-6	953 [37.5]	724 [28.5]	M10 [0.375]	991 [39]	762 [30]	369 [14.5]	93 [205]	3AUA0000012803 Sheet 3
CX12-7	1257 [49.5]	876 [34.5]	M10 [0.375]	1304 [51.4]	914 [36]	572 [22.5]	118 [260]	3AUA0000012804 Sheet 3
CX12-8	1257 [49.5]	876 [34.5]	M10 [0.375]	1304 [51.4]	914 [36]	572 [22.5]	147 [324]	3AUA0000012804 Sheet 3
CX12-9	1257 [49.5]	876 [34.5]	M10 [0.375]	1304 [51.4]	914 [36]	572 [22.5]	182 [401]	3AUA0000012804 Sheet 3
CX12-10	Free Standing		Ø14.2 [Ø0.56]	1829 [72]	914 [36]	584 [23]	247 [545]	3AUA0000012805 Sheet 3
CX12-11	Free Standing		N/A [N/A]	2134 [84]	914 [36]	848 [33.4]	579 [1276]	3AUA0000013237 Sheet 3
CX12-12	Free Standing		N/A [N/A]	2134 [84]	1524 [60]	848 [33.4]	662 [1459]	3AUA0000013224 Sheet 3

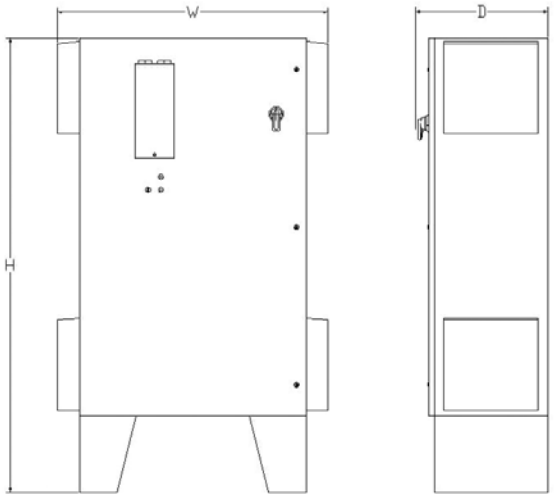
Drawing is not for engineering purposes.
CX12-10 is a wall mount configurations with 12 inch high mounting feet. Feet are removable.
CX12-12 enclosure is double door construction.

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Dimensions: ACH550-Cx UL Type 3R / NEMA 3R R1 through R6 Frame Size



Wall Mount (CX3R-1-CX3R-6)



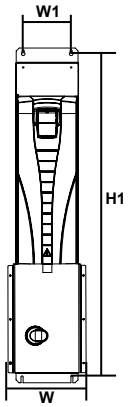
Floor Mount (CX3R-7)

Dimension Reference	UL Type 3R / NEMA 3R Mounting Dimensions mm [inches]			UL Type 3R / NEMA 3R Dimensions and Weights mm [inches] kg [lbs]				
	H1	W1	Mounting Hardware	Height (H)	Width (W)	Depth (D)	Weight	Dimension Drawing
CX3R-1	571.5 22.5	419.1 16.5	M10 0.375	685.8 27	457.2 18	342.9 13.5	37.4 82	3AUA0000060121 Sheet 3
CX3R-2	571.5 22.5	419.1 16.5	M10 0.375	685.8 27	457.2 18	342.9 13.5	39.9 88	3AUA0000060121 Sheet 3
CX3R-3	723.9 28.5	571.5 22.5	M10 0.375	838.2 33	609.6 24	342.9 13.5	65.9 145	3AUA0000060122 Sheet 3
CX3R-4	876.3 34.5	723.9 28.5	M10 0.375	990.6 39	762 30	393.7 15.5	96.8 213	3AUA0000060123 Sheet 3
CX3R-5	1181.1 46.5	876.3 34.5	M10 0.375	1295.4 51	914.4 36	546.1 21.5	121.4 268	3AUA0000060124 Sheet 3
CX3R-6	1181.1 46.5	876.3 34.5	M10 0.375	1295.4 51	914.4 36	546.1 21.5	150.5 332	3AUA0000060124 Sheet 3
CX3R-7	1181.1 46.5	876.3 34.5	M10 0.375	1295.4 51	914.4 36	546.1 21.5	185.5 409	3AUA0000060124 Sheet 3
CX3R-8	Free Standing		M10 0.375	1828.8 72	1092.2 43	524.6 20.7	251.4 554	3AUA0000060125 Sheet 3

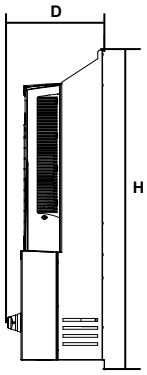
Drawing is not for engineering purposes.

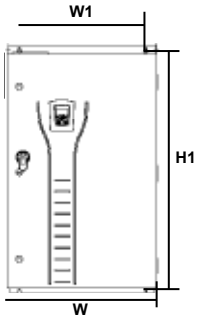
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Dimensions: ACH550-PxR UL Type 1 / NEMA 1 R1 through R8 Frame Size

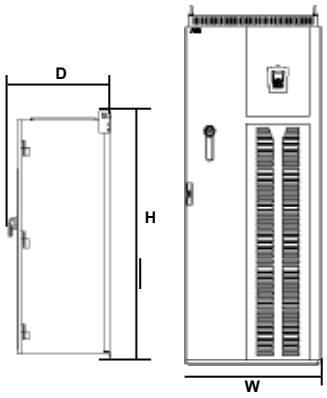


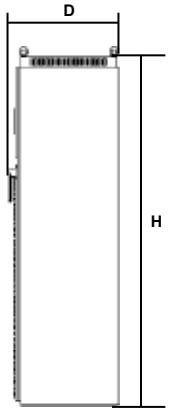
Wall Mount (PX1-1 - PX1-4)





Wall Mount (PX1-5 - PX1-6)





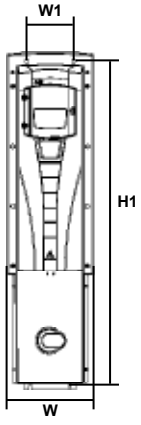
Floor Mount (PX1-8)

Dimension Reference	UL Type 1/ NEMA 1 Mounting Dimensions mm [inches]			UL Type 1 / NEMA 1 Dimensions and Weights mm kg [inches] [lbs]				
	H1	W1	Mounting Hardware	Height (H)	Width (W)	Depth (D)	Weight	Dimension Drawing
PX1-1	712 [28]	98 [3.9]	M6 [0.25]	729 [28.7]	198 [7.8]	283 [11.2]	15 [33]	3AUA0000008216 Sheet 1
PX1-2	812 [32]	98 [3.9]	M6 [0.25]	829 [32.6]	198 [7.8]	295 [11.6]	19 [42]	3AUA0000008218 Sheet 1
PX1-3	983 [38.7]	160 [6.3]	M6 [0.25]	1013 [39.9]	260 [10.2]	304 [11.9]	34 [75]	3AUA0000008220 Sheet 1
PX1-4	1117 [44]	160 [6.3]	M6 [0.25]	1147 [45.2]	260 [10.2]	332 [13.1]	43 [95]	3AUA0000008221 Sheet 1
PX1-5	1175 [46.3]	600 [23.6]	M10 [0.375]	1212 [47.7]	713 [28.1]	483 [19]	121 [267]	3AUA0000021148 Sheet 1
PX1-6	1175 [46.3]	600 [23.6]	M10 [0.375]	1212 [47.7]	713 [28.1]	483 [19]	163 [359]	3AUA0000021148 Sheet 1
PX1-8	Free Standing		Ø16 [Ø0.63]	2125 [83.7]	806 [31.7]	659 [25.9]	360 [794]	3AUA0000021152 Sheet 1

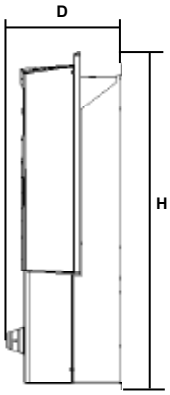
Drawing is not for engineering purposes.

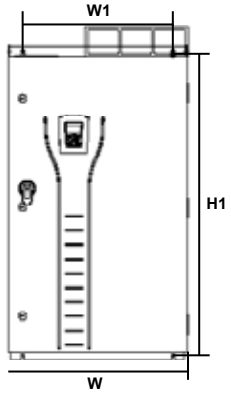
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Dimensions: ACH550-PxR UL Type 12 / NEMA 12 R1 through R8 Frame Size

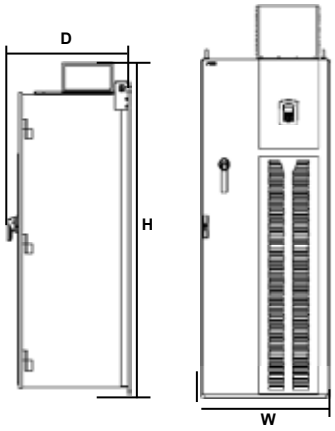


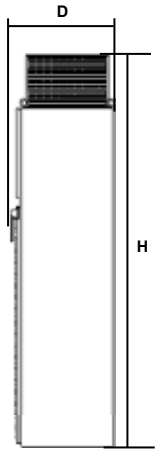
Wall Mount (PX12-1 - PX12-4)





Wall Mount (PX12-5 - PX12-6)





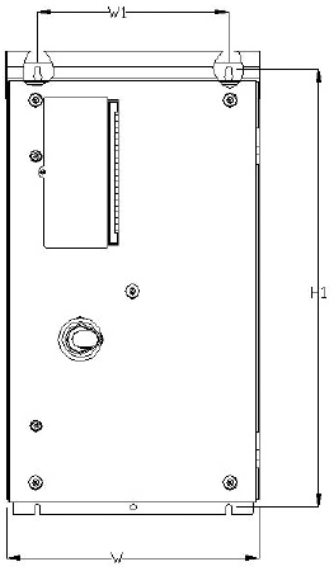
Floor Mount (PX12-8)

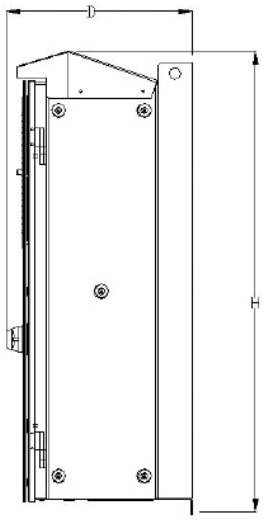
Dimension Reference	UL Type 12/ NEMA 12 Mounting Dimensions mm [inches]			UL Type 12 / NEMA 12 Dimensions and Weights mm [inches] kg [lbs]				
	H1	W1	Mounting Hardware	Height (H)	Width (W)	Depth (D)	Weight	Dimension Drawing
PX12-1	712 [28]	98 [3.9]	M6 [0.25]	744 [29.3]	221 [8.7]	283 [11.2]	17 [37]	3AUA0000008216 Sheet 2
PX12-2	812 [32]	98 [3.9]	M6 [0.25]	844 [33.2]	221 [8.7]	295 [11.6]	21 [46]	3AUA0000008218 Sheet 2
PX12-3	983 [38.7]	160 [6.3]	M6 [0.25]	1030 [40.6]	267 [10.5]	304 [11.9]	36 [79]	3AUA0000008220 Sheet 2
PX12-4	1117 [44]	160 [6.3]	M6 [0.25]	1163 [45.8]	267 [10.5]	332 [13.1]	45 [99]	3AUA0000008221 Sheet 2
PX12-5	1175 [46.3]	600 [23.6]	M10 [0.375]	1380 [54.3]	713 [28.1]	483 [19]	121 [267]	3AUA0000021149 Sheet 1
PX12-6	1175 [46.3]	600 [23.6]	M10 [0.375]	1380 [54.3]	713 [28.1]	483 [19]	163 [359]	3AUA0000021149 Sheet 1
PX12-8	Free Standing		Ø16 [Ø0.63]	2377 [93.6]	806 [31.7]	659 [25.9]	380 [838]	3AUA0000021153 Sheet 1

Drawing is not for engineering purposes.

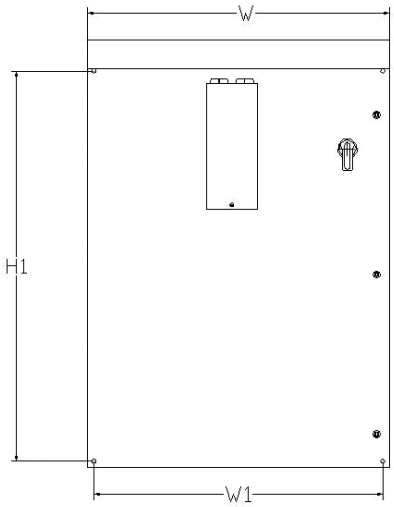
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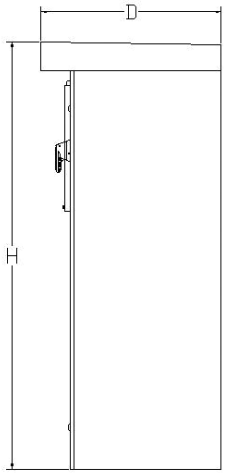
Dimensions: ACH550-PxR UL Type 3R / NEMA 3R R1 through R6 Frame Size





Wall Mount (PX3R-1 - PX3R-4)





Wall Mount (PX3R-5 - PX3R-6)

Dimension Reference	UL Type 3R / NEMA 3R Mounting Dimensions mm [inches]			UL Type 3R / NEMA 3R Dimensions and Weights mm kg [inches] [lbs]				
	H1	W1	Mounting Hardware	Height (H)	Width (W)	Depth (D)	Weight	Dimension Drawing
PX3R-1	810 [31.9]	320 [12.6]	M10 [0.375]	865 [34]	452 [17.8]	343 [13.5]	58 [128]	3AUA0000016377 Sheet 1
PX3R-2	810 [31.9]	320 [12.6]	M10 [0.375]	865 [34]	452 [17.8]	343 [13.5]	61 [134]	3AUA0000016377 Sheet 1
PX3R-3	918 [36.1]	400 [15.7]	M10 [0.375]	968 [38.1]	530 [20.9]	389 [15.3]	80 [176]	3AUA0000016380 Sheet 1
PX3R-4	918 [36.1]	400 [15.7]	M10 [0.375]	968 [38.1]	530 [20.9]	389 [15.3]	88 [194]	3AUA0000016380 Sheet 1
PX3R-5	876 [34.5]	724 [28.5]	M10 [0.375]	991 [39]	762 [30]	394 [15.5]	92.3 [203]	3AUA0000060123 Sheet 2
PX3R-6	1181 [46.5]	876 [34.5]	M10 [0.375]	1295 [51]	914 [36]	546 [21.5]	179.1 [395]	3AUA0000060124 Sheet 2

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