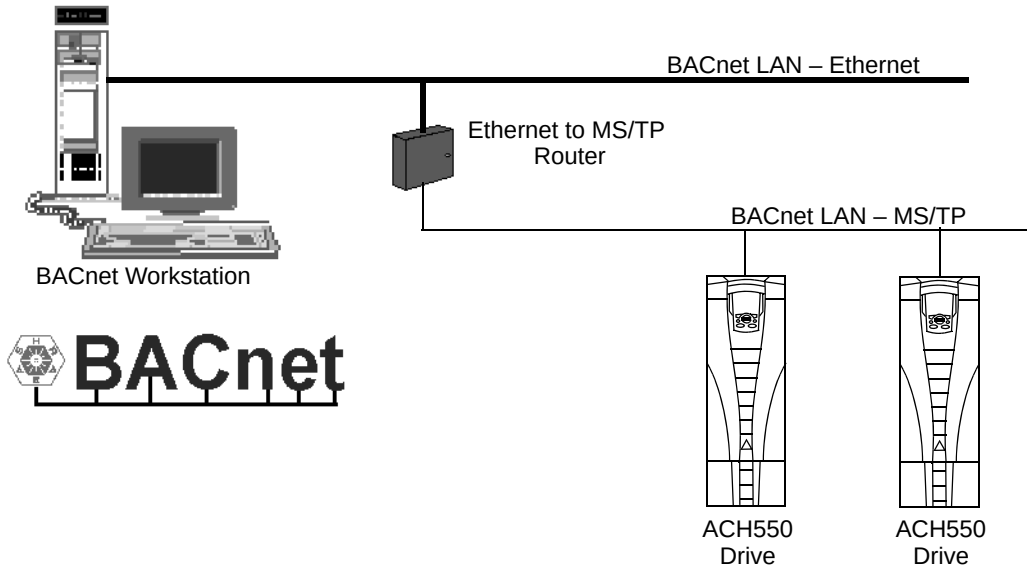
BACnet® Protocol
ACH550 AC Drives



BACnet is a registered trademark of ASHRAE.

IBM is a registered trademark of International Business Machines inc.

Microsoft is a registered trademark of the Microsoft Corporation.

© 2004, 2005 ABB Inc. All Rights Reserved.

Safety

WARNING! The ACH550 adjustable speed AC drive should ONLY be installed by a qualified electrician.

WARNING! Even when the motor is stopped, dangerous voltage is present at the Power Circuit terminals U1, V1, W1 and U2, V2, W2 and, depending on the frame size, UDC+ and UDC-, or BRK+ and BRK-.

WARNING! Dangerous voltage is present when input power is connected. After disconnecting the supply, wait at least 5 minutes (to let the intermediate circuit capacitors discharge) before removing the cover.

WARNING! Even when power is removed from the input terminals of the ACH550, there may be dangerous voltage (from external sources) on the terminals of the relay outputs R01…R03.

WARNING! When the control terminals of two or more drive units are connected in parallel, the auxiliary voltage for these control connections must be taken from a single source which can either be one of the units or an external supply.

WARNING! The ACH550-01/U1 is not a field repairable unit. Never attempt to repair a malfunctioning unit; contact the factory or your local Authorized Service Center for replacement.

WARNING! The ACH550 will start up automatically after an input voltage interruption if the external run command is on.

Note! For more technical information, contact the factory or your local ABB sales representative.

Use of Warnings and Notes

There are two types of safety instructions throughout this manual:

- Notes draw attention to a particular condition or fact, or give information on a subject.
- Warnings caution you about conditions which can result in serious injury or death and/or damage to the equipment. They also tell you how to avoid the danger. The warning symbols are used as follows:

Dangerous voltage warning warns of high voltage which can cause physical injury and/or damage to the equipment.

General warning warns about conditions, other than those caused by electricity, which can result in physical injury and/or damage to the equipment.

Table of Contents

Safety

Use of Warnings and Notes 3

Table of Contents

Installation

Introduction 7
Overview 7
Control Interface 7
Planning 8
Hardware Installation 8

Start-up

Communications Setup 10
Drive Parameter Group 53 10
Quick-Start Sequence 11
Activate Drive Control Functions 12
Controlling the Drive 12
Start/Stop Direction Control 13
Input Reference Select 13
Miscellaneous Drive Control 13
Relay Output Control 14
Analog Output Control 14
Communication Fault 14
Feedback from the Drive 15
Pre-defined Feedback 15
Mailbox Read/Write 15

Diagnostics

Fault Queue for Drive Diagnostics 16
Serial Communication Diagnostics 16
Diagnostic Situations 16

Technical Data

Protocol Implementation Conformance Statement (PICS) 19
PICS Summary 19
Statement 21
Object Definitions 23
Object/Property Support Matrix 23
Binary Input Object Instance Summary 24
Binary Output Object Instance Summary 24
Binary Value Object Instance Summary 25
Analog Input Object Instance Summary 27
Analog Output Object Instance Summary 29

Analog Value Object Instance Summary 28

Index

Installation

Introduction

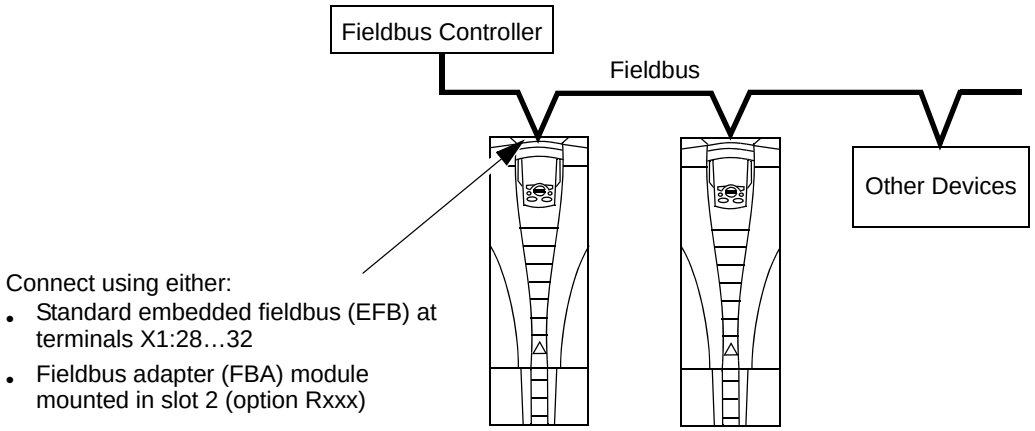
Intended Audience

This manual is designed for users who are familiar with ACH550 terminology, functions, and parameterization. For further information, please see the ACH550 User's Manual

Overview

The ACH550 can be set up to accept control from an external system using standard serial communication protocols. When using serial communication, the ACH550 can either:

- Receive all of its control information from the fieldbus, or
- Be controlled from some combination of fieldbus control and other available control locations, such as digital or analog inputs, and the control panel.



Two basic serial communications configurations are available:

- Embedded fieldbus (EFB) – Using the RS485 interface at terminals X1:28…32 on the control board, a control system can communicate through the drive's standard EFB using standard protocols, one of which is BACnet.
- Fieldbus adapter (FBA) – See the ACH550 User's Manual.

Control Interface

In general, the basic control interface between the fieldbus system and the drive consists of:

Protocol	Control Interface	Reference for more information
BACnet	• Device management • Binary output objects • Analog output objects • Binary input objects • Analog input objects	"Technical Data"

Note! The words “output” and “input” are used as seen from the fieldbus controller point of view. For example an output describes data flow from the fieldbus controller to the drive and appears as an input from the drive point of view.

Planning

Network planning should address the following questions:

- What types and quantities of devices must be connected to the network?
- What control information must be sent down to the drives?
- What feedback information must be sent from the drives to the controlling system?

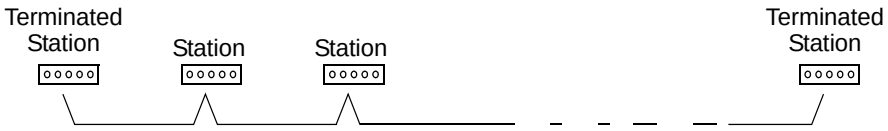
Hardware Installation

WARNING! Connections should be made only while the drive is disconnected from the power source.

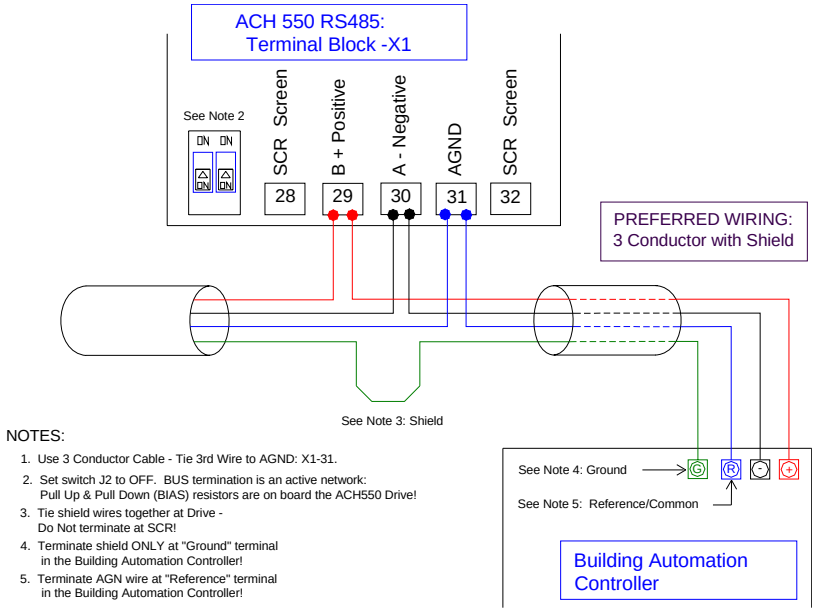
Drive terminals 28...32 are for RS485 communications.

- Use Belden 9842 or equivalent. Belden 9842 is a dual twisted, shielded pair cable with a wave impedance of 120 Ω.
- Use one of these twisted shielded pairs for the RS485 link. Use this pair to connect all A (-) terminals together and all B (+) terminals together.
- Use one of the wires in the other pair for the logical ground (terminal 31), leaving one wire unused.
- Do not directly ground the RS485 network at any point. Ground all devices on the network using their corresponding earthing terminals.
- As always, the grounding wires should not form any closed loops, and all the devices should be earthed to a common ground.
- Connect the RS485 link in a daisy-chained bus, without dropout lines.

- To reduce noise on the network, terminate the RS485 network using 120 Ω resistors at both ends of the network. See following diagram and table.



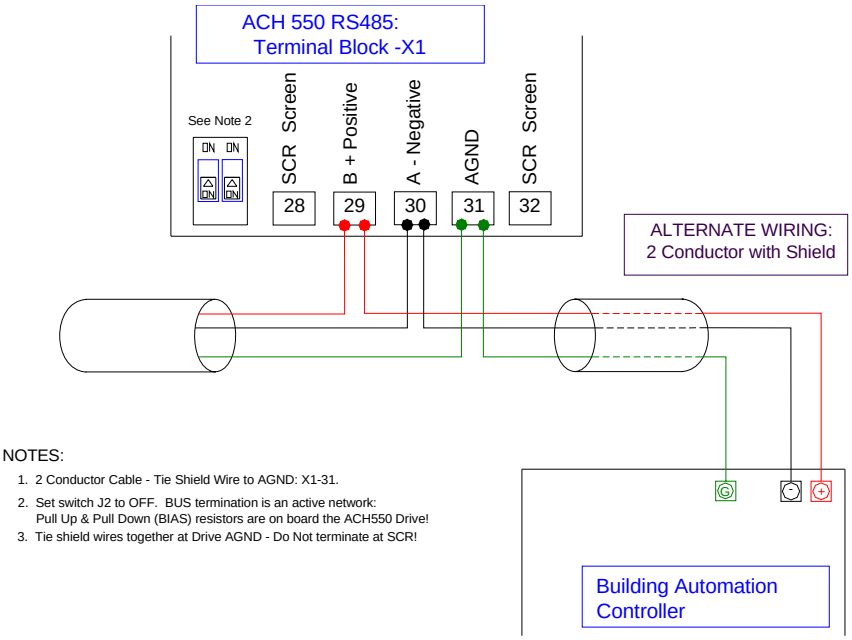
Preferred - three conductors and a shield



NOTES:

1. Use 3 Conductor Cable - Tie 3rd Wire to AGND: X1-31.
2. Set switch J2 to OFF. BUS termination is an active network: Pull Up & Pull Down (BIAS) resistors are on board the ACH550 Drive!
3. Tie shield wires together at Drive - Do Not terminate at SCR!
4. Terminate shield ONLY at "Ground" terminal in the Building Automation Controller!
5. Terminate AGN wire at "Reference" terminal in the Building Automation Controller!

Alternate - two conductors and a shield



NOTES:

1. 2 Conductor Cable - Tie Shield Wire to AGND: X1-31.
2. Set switch J2 to OFF. BUS termination is an active network: Pull Up & Pull Down (BIAS) resistors are on board the ACH550 Drive!
3. Tie shield wires together at Drive AGND - Do Not terminate at SCR!

Start-up

Communications Setup

Drive Parameter Group 53

Drive parameter Group 53 defines features unique to BACnet, as described below:

Parameter		Default Value	BACnet-specific Description
5301	EFB PROTOCOL ID	x5xx	This parameter indicates the active protocol and its revision. It should read x50xx if BACnet is properly loaded. If this is not the case, confirm that drive parameter 9802 = BACNET (5).
5302	EFB STATION ID	128	This parameter sets the drive's BACnet MS/TP MAC ID. A temporary value of 0 places the protocol channel in reset.[1]
5303	EFB BAUD RATE	38400	This parameter sets the BACnet MS/TP baud rate.
5304	EFB PARITY	0	This parameter sets the BACnet MS/TP character format as follows: 0 = 8N1 1 = 8N2 2 = 8E1 3 = 8O1.
5305	EFB CTRL PROFILE	-	This parameter indicates the active control profile. This parameter has no affect on BACnet behavior.
5306	EFB OK MESSAGES	-	This parameter indicates the number of valid application messages received at this drive. This count does not include MS/TP token passing and polling messages. (For such messages, see 5316).
5307	EFB CRC ERRORS	-	This parameter indicates the number of CRC errors detected, in either the header or data CRCs.
5308	EFB UART ERRORS	-	This parameter indicates the number of UART-related errors (framing, parity) detected.
5309	EFB STATUS	-	This parameter indicates the internal status of the BACnet channel as follows: • IDLE – BACnet channel is configured but not receiving messages. • TIMEOUT – Time between valid messages has exceeded the interval set by parameter 3019. • OFFLINE – BACnet channel is receiving messages NOT addressed to this drive. • ONLINE – BACnet channel is receiving messages addressed to this drive. • RESET – BACnet channel is in reset. • LISTEN ONLY – BACnet channel is in listen-only mode.
5310	EFB PAR 10	5	This parameter sets the BACnet MS/TP response turn-around time, in milliseconds.

[1] Note: The ACH550 will function as a Master/Slave with MAC IDs in the range of 1 - 127. With MAC ID settings of 128 - 254, the drive is in Slave only behavior.

Parameter		Default Value	BACnet-specific Description
5311	EFB PAR 11	0	This parameter, together with parameter 5317, EFB PAR 17, sets BACnet instance IDs: • For the range 1 to 65,535: This parameter sets the ID directly (5317 must be 0). FOr example, the following values set the ID to 49134: 5311 = 49134 and 5317 = 0. • For IDs > 65,535: The ID equales 5311's value plus 10,000 times 5317's value. For example, the following values set the ID to 71234: 5311 = 1234 and 5317 =7/
5312	EFB PAR 12	1	This parameter sets the BACnet Device Object Max Info Frames property.
5313	EFB PAR 13	127	This parameter sets the BACnet Device Object Max Master property.
5314	EFB PAR 14	0	N/A Not supported with BACnet Protocol Version 0506 and higher
5315	EFB PAR 15		N/A Not supported with BACnet Protocol Version 0506 and higher
5316	EFB PAR 16	0	This parameter indicates the count of MS/TP tokens passed to this drive.
5317	EFB PAR 17	0	This parameter works with paramter 5311 to set BACnet instance IDs. See parameter 5311.
5318 … 5320	EFB PAR 18…20		N/A - Not supported with BACnet protocol.

Changes made to drive parameter Group 53, EFB Protocol, do not take affect until you perform one of the following:

- Cycle the drive power OFF and ON, or
- Set parameter 5302 to 0, and then back to a unique MAC ID, or
- Use the ReinitializeDevice service.

Quick-Start Sequence

The following steps summarize the process for enabling and configuring BACnet on the ACH550:

1. Enable BACnet protocol: Set drive parameter 9802, COMM PROTOCOL SEL = BACNET (5).

Note! If you cannot see the desired selection on the panel, your drive does not have that protocol software in the application memory.

- To confirm this selection, read drive parameter 5301, EFB PROTOCOL ID. It should read x5xx (where "x" is any value).

2. Place the BACnet channel in "reset": Set drive parameter 5302, EFB STATION ID = 0.
   - This setting holds the BACnet communication channel in reset while remaining settings are completed.
3. Define the MS/TP baud rate.
   - Set drive parameter 5303, EFB BAUD RATE = appropriate value
4. Define the Device Object instance.
   - To define a specific device object instance value, use drive parameters 5311 and 5317 (object instance values must be unique and in the range 1 to 4,194,303).
   - To use the drive's MS/TP MAC ID as the device object instance value, set drive parameter 5311 and 5317 = 0.
5. Define a unique MS/TP MAC ID. Set drive parameter 5302, EFB STATION ID = appropriate value.
   - Once this parameter is set to a non-zero value, current BACnet settings are "latched" and used for communication until the channel is reset.
   - In order to participate in MS/TP token passing, the MAC ID used must be within the limits defined by other masters' "Max Master" property.
6. Confirm proper BACnet communication.
   - When BACnet communication is operation properly, drive parameter 5316, EFB PAR 16 (the MS/TP token counter), should be continually increasing.
   - Drive parameter 5306, UART ERRORS, should be stable.

Activate Drive Control Functions

Controlling the Drive

Fieldbus control of various drive functions requires configuration to:

- Tell the drive to accept fieldbus control of the function.
- Define as a fieldbus input, any drive data required for control.
- Define as a fieldbus output, any control data required by the drive.

The following sections describe the configuration required for each control function.

Note: The user should change only the parameters for the functions you wish to control via BACnet. All other parameters should typically remain at factory default. For simple start/stop and speed reference BACnet control, only parameters 1001 and 1103 need to be changed to COMM.

Start/Stop Direction Control

Using the fieldbus for start/stop/direction control of the drive requires:

- Drive parameter values set as defined below.
- Fieldbus controller supplied command(s) in the appropriate location.

Drive Parameter		Value	Description	BACnet Access Point
1001	EXT1 COMMANDS	COMM (10)	Start/Stop by fieldbus with Ext1 selected.	BV10
1002	EXT2 COMMANDS	COMM (10)	Start/Stop by fieldbus with Ext2 selected.	BV10
1003	DIRECTION	REQUEST (3)	Direction by fieldbus-if required.	BV11

Note: Ext1 = Ref 1
Ext 2 = Ref 2; Ref 2 normally used for PID setpoint commands.

Input Reference Select

Using the fieldbus to provide input references to the drive requires:

- Drive parameter values set as defined below.
- Fieldbus controller supplied reference word(s) in the appropriate location.

Drive Parameter		Value	Description	BACnet Access Point
1102	EXT1/EXT2 SEL	COMM (8)	Reference set selection by fieldbus.	BV13
1103	REF1 SEL	COMM (8)	Input reference 1 by fieldbus.	AV16
1106	REF2 SEL	COMM (8)	Input reference 2 by fieldbus.	AV17

Miscellaneous Drive Control

Using the fieldbus for miscellaneous drive control requires:

- Drive parameter values set as defined below.
- Fieldbus controller supplied command(s) in the appropriate location.

Drive Parameter		Value	Description	BACnet Access Point
1601	RUN ENABLE	COMM (7)	Run enable by fieldbus (not recommended).	BV12
1604	FAULT RESET SEL	COMM (8)	Fault reset by fieldbus.	BV14
1608	START ENABLE 1	7 (COMM)	Source for start enable 1 is the fieldbus Command word (not recommended).	BV20
1609	START ENABLE 2	7 (COMM)	Source for start enable 2 is the fieldbus Command word (not recommended).	BV21

Relay Output Control

Using the fieldbus for relay output control requires:

- Drive parameter values set as defined below.
- Only make these drive programming changes if you require control via BACnet.
- Fieldbus controller supplied, binary coded, relay command(s) in the appropriate location.

Drive Parameter		Value	Description	BACnet Access Point
1401	RELAY OUTPUT 1	COMM (35)	Relay Output 1 controlled by fieldbus.	BO0
1402	RELAY OUTPUT 2	COMM (35)	Relay Output 2 controlled by fieldbus.	BO1
1403	RELAY OUTPUT 3	COMM (35)	Relay Output 3 controlled by fieldbus.	BO2
1410[1]	RELAY OUTPUT 4	COMM (35)	Relay Output 4 controlled by fieldbus.	BO3
1411[1]	RELAY OUTPUT 5	COMM (35)	Relay Output 5 controlled by fieldbus.	BO4
1412[1]	RELAY OUTPUT 6	COMM (35)	Relay Output 6 controlled by fieldbus.	BO5

1. More than 3 relays requires the addition of a relay extension module.

Analog Output Control

Using the fieldbus for analog output control requires:

- Drive parameter values set as defined below.
- Fieldbus controller supplied analog value(s) in the appropriate location.

Drive Parameter		Value	Description	BACnet Access Point
1501	AO1 CONTENT SEL	135 (COMM VALUE 1)	Analog Output 1 controlled by writing to parameter 0135.	AO0
1507	AO2 CONTENT SEL	136 (COMM VALUE 2)	Analog Output 2 controlled by writing to parameter 0136.	AO1

Communication Fault

When using fieldbus control, specify the drive's action if serial communication is lost.

Drive Parameter		Value	Description
3018	COMM FAULT FUNC	0 (NOT SEL) 1 (FAULT) 2 (CONST SP7) 3 (LAST SPEED)	Set for appropriate drive response.
3019	COMM FAULT TIME	Set time delay before acting on a communication loss.	

Feedback from the Drive

Pre-defined Feedback

Inputs to the controller (drive outputs) have pre-defined meanings established by the protocol. This feedback does not require drive configuration. The following table lists a sample of feedback data. For a complete listing, see input word/point/object listings in the "Technical Data" section.

Drive Parameter		BACnet Access Point
0102	SPEED	AV0
0103	FREQ OUTPUT	AV1
0104	CURRENT	AV4
0105	TORQUE	AV5
0106	POWER	AV6
0107	DC BUS VOLT	AV2
0109	OUTPUT VOLTAGE	AV3
0115	KWH COUNTER	AV8
0118	DI1-3 STATUS	BI6, BI7, BI8
0122	RO1-3 STATUS	BI0, BI1, BI2

Mailbox Read/Write

The ACH550 provides a "Mailbox" function to access parameters that have not been pre-defined by the protocol. Using mailbox, any drive parameter can be identified and read. Mailbox can also be used to adjust parameter settings by writing a value to any parameter identified. The following table describes the use of this function.

Drive Parameter		BACnet Access Point
Mailbox Parameter	Enter the number of the drive parameter to access.	AV25
Mailbox Data	Contains the parameter value after a read, or enter the desired parameter value for a write.	AV26
Mailbox Read	A binary value triggers a read – the value of the "Mailbox Parameter" appears in "Mailbox data".	BV15
Mailbox Write	A binary value triggers a write – the drive value for the "Mailbox Parameter" changes to the value in "Mailbox data".	BV16

Note! You must read and write mailbox values using the drive's internal scaling. For example, the parameter 2202, ACCEL TIME1, has a resolution of 0.1 sec., which means that, in the drive (and in the mailbox), the value 1 = 0.1 seconds. So, a mailbox value of 10 translates to 1.0 second, a mailbox value of 300 translates to 30.0 seconds, etc. Refer to the parameter listing in the ACH550 User's Manual for each parameter's resolution and units of measure.

Note! Relay status feedback occurs without configuration as defined below.

Drive Parameter		Value	BACnet Access Point
0122	RO 1-3 STATUS	Relay 1…3 status.	BI0, BI1, BI2
0123	RO 4-6 STATUS	Relay 4…6 status.	BI3, BI4, BI5

Diagnostics

Fault Queue for Drive Diagnostics

For general ACH550 diagnostics information, see "Diagnostics" in the ACH550 User's Manual. The three most recent ACH550 faults are reported to the fieldbus as defined below.

Drive Parameter		BACnet Access Point
0401	Last Fault	AV18
0412	Previous Fault 1	AV19
0413	Previous Fault 2	AV20

Serial Communication Diagnostics

Network problems can be caused by multiple sources. Some of these sources are:

- Loose connections
- Incorrect wiring (including swapped wires)
- Incorrect baud rate
- Bad grounding
- Duplicate station numbers
- Incorrect setup of drives or other devices on the network

The major diagnostic features for fault tracing on an EFB network include Group 53 EFB Protocol parameters 5306…5309. The "Parameter Descriptions" section, in the ACH550 User's Manual, describes these parameters in detail.

Diagnostic Situations

The sub-sections below describe various diagnostic situations – the problem symptoms and corrective actions.

Normal Operation

During normal network operation, 5306…5309 parameter values act as follows at each drive:

- 5306 EFB OK MESSAGES advances (advances for each application message properly received and addressed to this drive).
- 5307 EFB CRC ERRORS does not advance at all (advances when an invalid message CRC is received).
- 5308 EFB UART ERRORS does not advance at all (advances when character format errors are detected, such as parity or framing errors).
- 5309 EFB status value varies depending on network traffic.

- 5316 EFB PAR 16 (MS/TP token counter) advances for each token passed to this drive.

Loss of Communication

The ACH550 behavior, if communication is lost, was configured earlier in "Communication Fault" on page 14. The parameters are 3018 COMM FAULT FUNC and 3019 COMM FAULT TIME. The "Parameter Descriptions" section in the ACH550 User's Manual describes these parameters in detail.

No Master Station on Line

If no master station is on line: Neither 5306, EFB OK MESSAGES, nor the errors (5307 EFB CRC ERRORS and 5308 EFB UART ERRORS) increase on any of the stations.

To correct:

- Check that a network master is connected and properly programmed on the network.
- Verify that the cable is connected, and is not cut or short circuited.

Duplicate Stations

If two or more stations have duplicate numbers:

- Two or more drives cannot be addressed.
- Every time there is a read or write to one particular station, the value for 5307 EFB CRC ERRORS or 5308 EFB UART ERRORS advances.

To correct: Check all station numbers and edit conflicting values.

Swapped Wires

If the communication wires are swapped (terminal A on one drive is connected to terminal B on another):

- The value of 5306 EFB OK MESSAGES does not advance.
- The values of 5307 EFB CRC ERRORS and 5308 EFB UART ERRORS are advancing.

To correct: Check that the RS-485 lines are not swapped.

Fault 28 – Serial 1 Err

If the drive's control panel shows fault code 28 "SERIAL 1 ERR", check for either of the following:

- The master system is down. To correct, resolve problem with master system.
- The communication connection is bad. To correct, check communication connection at the drive.
- The time-out selection for the drive is too short for the given installation. The master is not polling the drive within the specified time-out delay. To correct, increase the time set by parameter 3019 COMM FAULT TIME.

Faults 31 - EFB1

If the drive's control panel shows fault code 31 "EFB1", the drive has an invalid object instance ID. To correct, use parameters 5311 and 5317 and establish a unique drive ID that is in the range 1 to 4,194,303.

Faults 32...33 - EFB2...EFB3

Two EFB fault codes (fault codes 32...33) listed for the drive in the "Diagnostics" section of the ACH550 User's Manual are not used.

Incorrect Baud Rate

If the baud rate setting does not match the network's rate, the value of 5308, EFB UART ERRORS, increases and the value of 5306, EFB OK MESSAGES, remains fixed.

Intermittent Off-line Occurrences

The problems described above are the most common problems encountered with ACH550 serial communication. Intermittent problems might also be caused by:

- Marginally loose connections.
- Wear on wires caused by equipment vibrations.
- Insufficient grounding and shielding on both the devices and on the communication cables.
- Missing network terminations (stations at both ends of a network require termination resistors).

Technical Data

Protocol Implementation Conformance Statement (PICS)

PICS Summary

BACnet Standard Device Profile

This version of ACH550 BACnet fully conforms to the 'Application-Specific Controller' standard device profile (B-ASC).

Services Supported

The following services are supported by the ACH550:

- I-Am (Response to Who-Is, also broadcast on power-up & other reset)
- I-Have (Response to Who-Has)
- ReadProperty
- WriteProperty
- DeviceCommunicationControl
- ReinitializeDevice

Data Link Layer

The ACH550 implements MS/TP (Master) Data Link Layer. All standard MS/TP baud rates are supported (9600, 19200, 38400 & 76800).

MAC ID / Device Object Instance

The ACH550 supports separate MAC ID and Device Object Instance parameters:

- Set the MAC ID using drive parameter 5302. Default: 5302 = 1.
- Set the Device Object Instance using drive parameters 5311 and 5317. Default: Both 5311 and 5317 = 0, which causes the MAC ID to "double" ast he Device Object Instance. For Device Object Instance values not linked to the MAC ID, set ID values using 5311 and 5317 = 0.
  - For IDs in the range of 1 to 65,535: Parameter 5311 sets the ID directly (5317 must be 0). For example, the following values set the ID to 49134: 5311 = 49134 and 5317 = 0.
  - For IDs > 65,535: The ID equals 5311's value plus 10,000 times 5317's value. For example, the following values set the ID to 71,234: 5311 = 1234 and 5317 = 7.

Max Info Frames Property

Configure the Device Object Max Info Frames property using drive parameter 5312. Default: 5312 = 1.

Max Master Property

Configure the Device Object Max Master property using drive parameter 5313. Default: 5313 = 127.

MS/TP Token Counter

Parameter 5316 stores the count of MS/TP tokens passed to this drive.

Statement

This statement is part of this Standard and is required for its use.

BACnet Protocol Implementation Conformance Statement	
Date:	November 1, 2006
Vendor Name:	ABB, Inc.
Product Name:	Low Voltage AC Motor Drive
Product Model Number:	ACH550
Applications Software Version:	0506
Firmware Revision:	310D
BACnet Protocol Revision:	4
Product Description:	The ACH550 is a high-performance adjustable frequency drive specifically designed for commercial automation applications. This product supports native BACnet, connecting directly to the MS/TP LAN. All standard MS/TP baud rates are supported, as well as master mode functionality. Over BACnet, the drive can be fully controlled as a standard adjustable frequency drive. In addition, up to 16 configurable I/O ports are available over BACnet for user applications.
BACnet Standardized Device Profile (Annex L):	☐ BACnet Operator Workstation (B-OWS) ☐ BACnet Building Controller (B-BC) ☐ BACnet Advanced Application Controller (B-AAC) ☒ BACnet Application Specific Controller (B-ASC) ☐ BACnet Smart Sensor (B-SS) ☐ BACnet Smart Actuator (B-SA)
List all BACnet Interoperability Building Blocks Supported (Annex K):	DS-RP-B, DS-WP-B, DM-DDB-B, DM-DOB-B, DM-DCC-B, DM-RD-B.
Segmentation Capability:	☐ Segmented requests supported. Window Size ____ ☐ Segmented responses supported. Window Size ____
Standard Object Types Supported: An object type is supported if it may be present in the device. For each standard Object Type supported provide the following data: 1) Whether objects of this type are dynamically creatable using the CreateObject service 2) Whether objects of this type are dynamically detectable using the DeleteObject service 3) List of the optional properties supported 4) List of all properties that are writable where not otherwise required by this standard 5) List of proprietary properties and for each its property identifier, data type, and meaning 6) List of any property range restrictions	See table at "Object/Property Support Matrix" on page 23.

BACnet Protocol Implementation Conformance Statement	
Data Link Layer Options:	☐ BACnet IP, (Annex J) ☐ BACnet IP, (Annex J), Foreign Device ☐ ISO 8802-3, Ethernet (Clause 7) ☐ ANSI/ATA 878.1, 2.5 Mb. ARCNET (Clause 8) ☐ ANSI/ATA 878.1, RS-485 ARCNET (Clause 8), baud rate(s) ___ ☒ MS/TP master (Clause 9), baud rate(s): 9600, 19200, 38400, 76800 ☐ MS/TP slave (Clause 9), baud rate(s): ___ ☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s): ___ ☐ Point-To-Point, modem, (Clause 10), baud rate(s): ___ ☐ LonTalk, (Clause 11), medium: _____ ☐ Other: _____
Device Address Binding: Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.)	☐ Yes ☒ No
Networking Options:	☐ Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc. ☐ Annex H, BACnet Tunneling Router over IP ☐ BACnet/IP Broadcast Management Device (BBMD)
Does the BBMD support registrations by Foreign Devices?	☐ Yes ☐ No
Character Sets Supported: Indicating support for multiple character sets does not imply that they can all be supported simultaneously.	☒ ANSI X3.4 ☐ IBM™/Microsoft™ DBCS ☐ ISO 8859-1 ☐ ISO 10646 (UCS-2) ☐ ISO 10646 (UCS-4) ☐ JIS C 6226
If this product is a communication gateway, describe the types of non-BACnet equipment/networks(s) that the gateway supports:	

Object Definitions

Object/Property Support Matrix

The following table summarizes the Object Types/Properties Supported:

Property	Object Type						
	Device	Binary Input	Binary Output	Binary Value	Analog Input	Analog Output	Analog Value
Object Identifier	✓	✓	✓	✓	✓	✓	✓
Object Name	✓	✓	✓	✓	✓	✓	✓
Object Type	✓	✓	✓	✓	✓	✓	✓
Description	✓						
System Status	✓						
Vendor Name	✓						
Vendor Identifier	✓						
Model Name	✓						
Firmware Revision	✓						
Appl Software Revision	✓						
Protocol Version	✓						
Protocol Revision	✓						
Services Supported	✓						
Object Types Supported	✓						
Object List	✓						
Max APDU Length	✓						
Segmentation Support	✓						
APDU Timeout	✓						
Number APDU Retries	✓						
Max Master	✓						
Max Info Frames	✓						
Device Address Binding	✓						
Database Revision	✓						
Present Value		✓	✓	✓	✓	✓	✓
Status Flags		✓	✓	✓	✓	✓	✓
Event State		✓	✓	✓	✓	✓	✓
Out-of-Service		✓	✓	✓	✓	✓	✓
Units					✓	✓	✓
Priority Array			✓	✓ *		✓	✓ *
Relinquish Default			✓	✓ *		✓	✓ *
Polarity		✓	✓				
Active Text		✓	✓	✓			
Inactive Text		✓	✓	✓			

* For commandable values only.

Binary Input Object Instance Summary

The following table summarizes the Binary Input Objects supported:

Instance ID	Object Name	Description	Active/ Inactive Text	Present Value Access Type
BI0	RO 1 ACT	This object indicates the status of Relay Output 1.	ON/OFF	R
BI1	RO 2 ACT	This object indicates the status of Relay Output 2.	ON/OFF	R
BI2	RO 3 ACT	This object indicates the status of Relay Output 3.	ON/OFF	R
BI3	RO 4 ACT	This object indicates the status of Relay Output 4 (requires OREL-01 option).	ON/OFF	R
BI4	RO 5 ACT	This object indicates the status of Relay Output 5 (requires OREL-01 option)	ON/OFF	R
BI5	RO 6 ACT	This object indicates the status of Relay Output 6 (requires OREL-01 option)	ON/OFF	R
BI6	DI 1 ACT	This object indicates the status of Digital Input 1.	ON/OFF	R
BI7	DI 2 ACT	This object indicates the status of Digital Input 2.	ON/OFF	R
BI8	DI 3 ACT	This object indicates the status of Digital Input 3.	ON/OFF	R
BI9	DI 4 ACT	This object indicates the status of Digital Input 4.	ON/OFF	R
BI10	DI 5 ACT	This object indicates the status of Digital Input 5.	ON/OFF	R
BI11	DI 6 ACT	This object indicates the status of Digital Input 6.	ON/OFF	R

Note! For Present Value Access Types, R = Read-only, W = Writeable, C = Commandable. Commandable values support priority arrays & relinquish defaults.

Binary Output Object Instance Summary

The following table summarizes the Binary Output Objects supported:

Instance ID	Object Name	Description	Active/ Inactive Text	Present Value Access Type
BO0	RO1 COMMAND	This object controls the output state of Relay 1. This control requires that parameter 1401 value = COMM.	ON/OFF	C
BO1	RO2 COMMAND	This object controls the output state of Relay 2. This control requires that parameter 1402 value = COMM.	ON/OFF	C
BO2	RO3 COMMAND	This object controls the output state of Relay 3. This control requires that parameter 1403 value = COMM.	ON/OFF	C

Instance ID	Object Name	Description	Active/ Inactive Text	Present Value Access Type
BO3	RO4 COMMAND	This object controls the output state of Relay 4. This control requires that parameter 1410 value = COMM (also requires OREL-01 option).	ON/OFF	C
BO4	RO5 COMMAND	This object controls the output state of Relay 5. This control requires that parameter 1411 value = COMM (also requires OREL-01 option).	ON/OFF	C
BO5	RO6 COMMAND	This object controls the output state of Relay 6. This control requires that parameter 1412 value = COMM (also requires OREL-01 option).	ON/OFF	C

Note! For Present Value Access Types, R = Read-only, W = Writeable, C = Commandable. Commandable values support priority arrays & relinquish defaults.

Binary Value Object Instance Summary

The following table summarizes the Binary Value Objects supported:

Instance ID	Object Name	Description	Active/Inactive Text	Present Value Access Type
BV0	RUN/STOP ACT	This object indicates the drive Run Status, regardless of the control source.	RUN/STOP	R
BV1	FWD/REV ACT	This object indicates the motor's rotation direction, regardless of the control source.	REV/FWD	R
BV2	FAULT ACT	this object indicates the drive's fault status.	FAULT/OK	R
BV3	EXT 1/2 ACT	This object indicates which control source is active: External 1 or External 2.	EXT2/EXT1	R
BV4	HAND/AUTO ACT	This object indicates whether the drive is under Hand or Auto control.	HAND/AUTO	R
BV5	ALARM ACT	This object indicates the drive's alarm status.	ALARM/OK	R
BV6	MAINT REQ	This object indicates the drive's maintenance status. Refer to Group 29 in the drive's parameter descriptions.	MAINT/OK	R
BV7	DRIVE READY	This object indicates whether the drive is ready to accept a run command.	READY/NOT READY	R
BV8	AT SETPOINT	This object indicates whether the drive is at the commanded setpoint.	YES/NO	R

Instance ID	Object Name	Description	Active/Inactive Text	Present Value Access Type
BV9	RUN ENA ACT	This object indicates the Run Enable command status, regardless of the control source.	ENABLE/ DISABLE	R
BV10	RUN/STOP CMD	This object commands a drive start. Control requires either: • Parameter 1001 value = COMM for control by EXT1 or • Parameter 1002 value = COMM for control by EXT2.	RUN/STOP	C
BV11	FWD/REV CMD	This object commands a motor rotation direction change. Control requires 1003 = REQUEST and either: • Parameter 1001 value = COMM for control by EXT1 or • Parameter 1002 value = COMM for control by EXT2.	REV/FWD	C
BV12	RUN ENA CMD	This object commands Run Enable. Control requires parameter 1601 value = COMM.	ENABLE/ DISABLE	C
BV13	EXT 1/2 CMD	This object selects ext1 or ext2 as the active control source. Control requires parameter 1102 value = COMM.	EXT2/EXT1	C
BV14	FAULT RESET	This object resets a faulted drive. The command is rising-edge triggered. Control requires parameter 1604 value = COMM.	RESET/NO	C
BV15	MBOX READ	This object reads a parameter (defined by AV25 MBOX PARAM) and returns it in AV26 MBOX DATA.	READ/RESET	W
BV16	MBOX WRITE	This object writes the data value specified by AV26, MBOX DATA, to a parameter (defined by AV25, MBOX PARAM).	WRITE/RESET	W
BV17	LOCK PANEL	This object locks the panel and prevents parameter changes. The corresponding drive parameter is 1602.	LOCK/UNLOCK	W
BV18	CTL OVERRIDE CMD	This object commands the drive into BACnet Control Override. In this mode, BACnet takes drive control from the normal source. However, the control panel's HAND mode has priority over BACnet Control Override.	ON/OFF	C

Instance ID	Object Name	Description	Active/Inactive Text	Present Value Access Type
BV19	CTL OVERRIDE ACT	This object indicates whether the drive is in BACnet Control Override. (See BV18.)	ON/OFF	R
BV20	START ENABLE 1	This object commands start enable1. Control requires parameter 1608 value=COMM.	ENABLE/ DISABLE	C
BV21	START ENABLE 2	This object commands start enable1. Control requires parameter 1608 value=COMM.	ENABLE/ DISABLE	C

Note! For Present Value Access Types, R = Read-only, W = Writeable, C = Commandable. Commandable values support priority arrays & relinquish defaults.

Analog Input Object Instance Summary

The following table summarizes the Analog Input Objects supported:

Instance ID	Object Name	Description	Units	Present Value Access Type
AI0	ANALOG INPUT 1	This object indicates the value of Analog Input 1. The corresponding drive parameter is 0120.	Percent	R
AI1	ANALOG INPUT 2	This object indicates the value of Analog Input 2. The corresponding drive parameter is 0121.	Percent	R

Note! For Present Value Access Types, R = Read-only, W = Writeable, C = Commandable. Commandable values support priority arrays & relinquish defaults.

Analog Output Object Instance Summary

The following table summarizes the Analog Output Objects supported:

Instance ID	Object Name	Description	Units	Present Value Access Type
AO0	AO 1 COMMAND	This object controls Analog Output 1. The corresponding drive parameter is 0135, COMM VALUE 1. Control requires parameter 1501 value = 135.	Percent	C
AO1	AO 2 COMMAND	This object controls Analog Output 2. The corresponding drive parameter is 0136, COMM VALUE 2. Control requires parameter 1507 value = 136.	Percent	C

Note! For Present Value Access Types, R = Read-only, W = Writeable, C = Commandable. Commandable values support priority arrays & relinquish defaults.

Analog Value Object Instance Summary

The following table summarizes the Analog Value Objects supported:

Instance ID	Object Name	Description	Units	Present Value Access Type
AV0	OUTPUT SPEED	This object indicates the calculated motor speed in RPM. The corresponding drive parameter is 0102.	RPM	R
AV1	OUTPUT FREQ	This object indicates the output frequency applied to the motor in Hz. The corresponding drive parameter is 0103.	Hertz	R
AV2	DC BUS VOLT	This object indicates the drive's DC bus voltage level. The corresponding drive parameter is 0107.	Volts	R
AV3	OUTPUT VOLT	This object indicates the AC output voltage applied to the motor. The corresponding drive parameter is 0109.	Volts	R
AV4	CURRENT	This object indicates the measured output current. The corresponding drive parameter is 0104.	Amps	R
AV5	TORQUE	This object indicates the calculated motor output torque as a percentage of nominal torque. The corresponding drive parameter is 0105.	Percent	R
AV6	POWER	This object indicates the measured output power in kW. The corresponding drive parameter is 0106.	Kilowatts	R
AV7	DRIVE TEMP	This object indicates the measured heatsink temperature in °C. The corresponding drive parameter is 0110.	°C	R

Instance ID	Object Name	Description	Units	Present Value Access Type
AV8	KWH (R)	This object indicates, in kW hours, the drive's accumulated energy usage since the last reset. The value can be reset to zero. The corresponding drive parameter is 0115.	kWh	W
AV9	MWH (NR)	This object indicates the drive's accumulated energy usage inMW hours. The value cannot be reset.	MWh	R
AV10	PRC PID FBCK	This object is the Process PID feedback signal. The corresponding drive parameter is 0130.	Percent	R
AV11	PRC PID DEV	This object is the Process PID output signal's deviation from its setpoint. The corresponding drive parameter is 0132.	Percent	R
AV12	EXT PID FBCK	This object is the External PID feedback signal. The corresponding drive parameter is 0131.	Percent	R
AV13	EXT PID DEV	This object is the External PID output signal's deviation from its setpoint. The corresponding drive parameter is 0133.	Percent	R
AV14	RUN TIME (R)	This object indicates, in hours, the drive's accumulated run time since the last reset. The value can be reset to zero. The corresponding drive parameter is 0114.	Hours	R
AV15	MOTOR TEMP	This object indicates the drive's motor temperature, as set up in parameter Group 35. The corresponding drive parameter is 0145.	°C	R
AV16	INPUT REF 1	This object sets Input Reference 1. Control requires parameter 1103 value = COMM.	Percent	C
AV17	INPUT REF 2	This object sets either: • Input Reference 2. Control requires parameter 1106 value = COMM. • Process PID setpoint. Control requires parameter 1106 value = PID1 OUT and parameter 4010 value = COMM.	Percent	C
AV18	LAST FLT	This object indicates the most recent fault entered in the drive's fault log. The corresponding drive parameter is 0401.	None	R
AV19	PREV FLT 1	This object indicates the second most recent fault entered in the drive's fault log. The corresponding drive parameter is 0412.	None	R
AV20	PREV FLT 2	This object indicates the third most recent fault entered in the drive's fault log. The corresponding drive parameter is 0413.	None	R
AV21	AO 1 ACT	This object indicates Analog Output 1's level. The corresponding drive parameter is 0124.	Milliamps	R

Instance ID	Object Name	Description	Units	Present Value Access Type
AV22	AO 2 ACT	This object indicates Analog Output 2's level. The corresponding drive parameter is 0125.	Milliamps	R
AV23	ACCEL1 TIME	This object sets the Ramp1 acceleration time. The corresponding drive parameter is 2202.	Seconds	W
AV24	DECEL1 TIME	This object sets the Ramp1 deceleration time. The corresponding drive parameter is 2203.	Seconds	W
AV25	MBOX PARAM	This object defines the parameter to be read or written to by the mailbox function. See BV15 and BV16.	None	W
AV26	MBOX DATA	This object holds the mailbox function's parameter value – a value that was read, or is to be written. See BV15 and BV16.	None	W
AV27	EXT PID STPT	This object sets the External PID controller setpoint. The corresponding drive parameter is 4211. Control requires parameter 4210, PID SETPOINT SEL, value = 19 (INTERNAL).	Percent	C

Note! For Present Value Access Types, R = Read-only, W = Writeable, C = Commandable. Commandable values support priority arrays & relinquish defaults.

Index

A

autobaud detection 19

B

baud rate detection 19
bus
  connections 8

C

comm (EFB)
  analog output control, activate 14
  comm fault response 14
  configuration 10
  configure for loss of communication 17
  control interface 7
  drive control of functions, activate 12
  fault code 28 17
  fault code 31 17
  fault code 32 17
  fault code 33 17
  fault tracing parameters 16
  fault, duplicate stations 17
  fault, intermittent off-line 18
  fault, no master station on line 17
  fault, swapped wires 17
  feedback from drive 14
  feedback from drive, mailbox 15
  input ref. sel., activate 13
  mailbox, param. read/write 15
  misc. drive control, activate 13
  normal operation 16
  relay output control, activate 13
  setup 10
  start/stop control, activate 12
  termination 8
connections
  bus 8

D

data link layer 19
diagnostics 16
drive
  bus connections 8

F

fault
  comm failure (EFB) 14
fault code
  28 serial 1 err 17

G

group 53 parameters 28

I

installation 7

M

mac id 19
mailbox, EFB comm 15
max info frame property 20

N

network
  planning 8

O

object
  analog inputs 27
  analog outputs 27
  analog values 28
  binary inputs 24
  binary outputs 24
  binary values 25
  definitions 23

P

pics
  statement 21
  summary 19
planning 8
protocol implementation conformance statement
  see pics

Q

quick-start sequence 10

R

RS485 comm 8

S

serial 1 error (fault code 28) 17
services supported 19
start
  control, EFB comm 12
start-up 10
support
  matrix 23

T

technical data 19
termination 8

3AUA0000004591 REV D / EN
EFFECTIVE: NOV. 1, 2006
SUPERSEDES: OCT. 27, 2005

ABB Oy
AC Drives
P.O. Box 184
FIN-00381 HELSINKI
FINLAND
Telephone +358 10 22 11
Telefax +358 10 22 22681
Internet http://www.abb.com

ABB Inc.
Automation Technologies
Drives & Machines
16250 West Glendale Drive
New Berlin, WI 53151
USA
Telephone 262 785-3200
800 HELP-365
Telefax 262 780-5135