

# User's Manual

## E-Clipse Bypass Embedded Fieldbus (EFB) Control

BACnet®, Modbus®, Metasys® N2 and APOGEE® FLN Protocols for E-Clipse Bypass (BCR, BDR, VCR, or VDR)



# ACH550 Drive Manuals

## GENERAL MANUALS

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### **ACH550-01/UH User's Manual (0.75...90 kW) / (1...150 HP)**

- Safety
- Installation
- Start-Up
- Diagnostics
- Maintenance
- Technical Data

### **ACH550-02/U2 User's Manual (110...355 kW) / (150...550 HP)**

- Safety
- Installation
- Start-Up
- Diagnostics
- Maintenance
- Technical Data

### **ACH550 Technical Reference Manual**

- Detailed Product Description
  - Technical product description including dimensional drawings
  - Cabinet mounting information including power losses
  - Software and control including complete parameter descriptions
  - User interfaces and control connections
  - Complete options descriptions
  - Spare parts
  - Etc.
- Practical Engineering Guides
  - PID & PFA engineering guides
  - Dimensioning and sizing guidelines
  - Diagnostics and maintenance information
  - Etc.

### **ABB E-Clipse Bypass User's Manual**

(BSR, BDR, VCR, or VDR)

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- Safety
- Installation
- Start-Up
- Diagnostics
- Maintenance
- Technical Data

## OPTION MANUALS

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(Fieldbus Adapters, I/O Extension Modules etc., manuals delivered with optional equipment)

Relay Output Extension Module (typical title)

- Installation
- Programming
- Fault tracing
- Technical data

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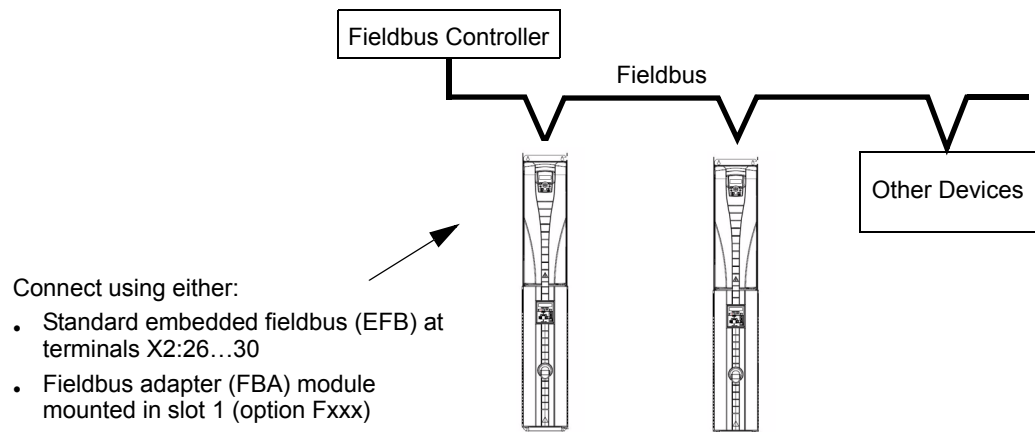
# Embedded Fieldbus

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## Overview

The ABB E-Clipse bypass can be set up to accept control for the ACH550 drive and/or the E-Clipse Bypass from an external system using standard serial communication protocols. When using serial communication, the ABB E-Clipse bypass can:

- Receive system control information from the fieldbus,
- Receive drive only 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 EIA 485 interface at terminals X2:26...30 on the control board, a control system can communicate with the bypass using:
  - Modbus®
  - Metasys® N2EIA 485
  - APOGEE® FLN
  - BACnet®
- Fieldbus adapter (FBA) – See "Fieldbus Adapter" in User's Manual.

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**NOTE:** Throughout this manual, references to parameters pertain to parameters and adjustments in the ABB E-Clipse Bypass.

Unless specifically called-out as drive parameters, all parameter adjustments are in the ABB E-Clipse bypass.

In this document any references to "system" refers to ABB E-Clipse Bypass and ACH550 drive.

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## Control Interface

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

Protocol	Control Interface	Reference for more information
Modbus	<ul style="list-style-type: none"> <li>• Output Words               <ul style="list-style-type: none"> <li>– Control word</li> <li>– Reference1</li> <li>– Reference2</li> </ul> </li> <li>• Input Words               <ul style="list-style-type: none"> <li>– Status word</li> <li>– Actual value 1</li> <li>– Actual value 2</li> <li>– Actual value 3</li> <li>– Actual value 4</li> <li>– Actual value 5</li> <li>– Actual value 6</li> <li>– Actual value 7</li> <li>– Actual value 8</li> </ul> </li> </ul>	The content of these words are defined by profiles. For details on the profiles used, see "Modbus Protocol Technical Data - System"
N2	<ul style="list-style-type: none"> <li>• Binary output objects</li> <li>• Analog output objects</li> <li>• Binary input objects</li> <li>• Analog input objects</li> </ul>	"N2 Protocol Technical Data - System" and "N2 Protocol Technical Data - Bypass"
FLN	<ul style="list-style-type: none"> <li>• Binary output points</li> <li>• Analog output points</li> <li>• Binary input points</li> <li>• Analog input points</li> </ul>	"FLN Protocol Technical Data - System" and "FLN Protocol Technical Data - Bypass"
BACnet	<ul style="list-style-type: none"> <li>• Device management</li> <li>• Binary output objects</li> <li>• Analog output objects</li> <li>• Binary input objects</li> <li>• Analog input objects</li> </ul>	"BACnet Protocol Technical Data - "System Overview"

**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 bypass and appears as an input from the bypass 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 to the system (drive only or system)?
- What feedback information must be sent from the bypass system to the controlling system?

## Mechanical and Electrical Installation – EFB

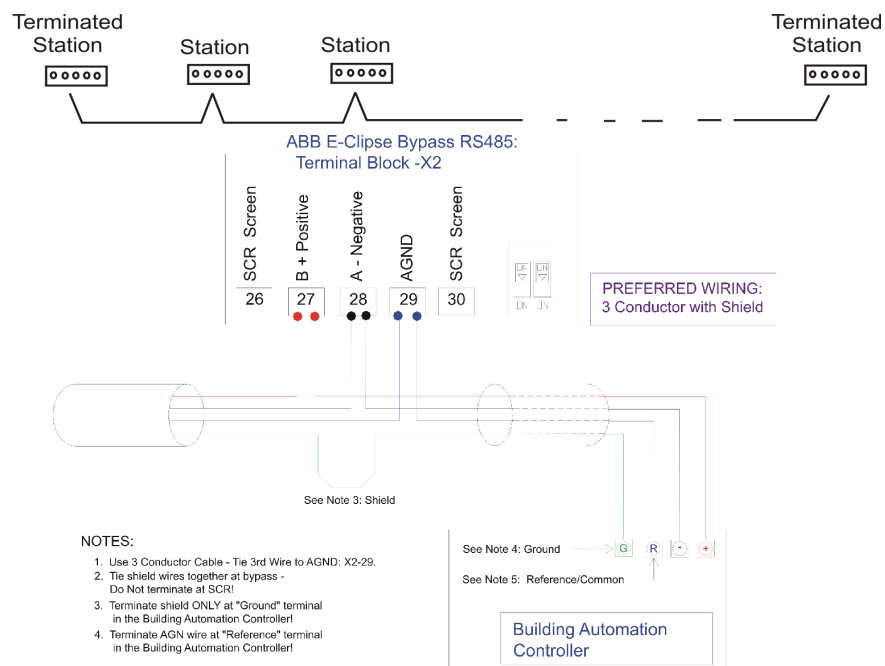


**Warning! Connections should be made only while the bypass is disconnected from the power source.**

Bypass terminals 26...30 are for EIA 485 communications.

- Use Belden 9842 or equivalent. Belden 9842 is a dual twisted, shielded pair cable with a wave impedance of 120  $\Omega$ .
- Use one of these twisted shielded pairs for the EIA 485 link. Use this pair to connect all A (-) terminals together and all B (+) terminals together.
- Use both of the other wires in the other pair for the logical ground (terminal 29)
- Do not directly ground the EIA 485 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 EIA 485 link in a daisy-chained bus, without dropout lines.
- To reduce noise on the network, terminate the EIA 485 network using 120  $\Omega$  resistors at both ends of the network. Use the DIP switch to connect or disconnect the termination resistors. See following diagram and table.

Preferred Wiring Diagram (See ACH550 E-Clipse Bypass EFB User's Manual (3AUA0000031267 REVA) for Alternate Wiring:



- Do not connect the shield at the bypass. Tie the shields together at the bypass. Only load the shield connection at the EIA 485 master.
- For configuration information see the following:
  - "Communication Set-up Overview– EFB" Section.
  - "Activate Drive Control Functions – EFB" Section.
  - The appropriate EFB protocol specific technical data.

## Communication Set-up Overview– EFB

The addition of serial communications to the ABB E-Clipse bypass system is done by bringing the network connection to the bypass and using the bypass software to direct messages either to the drive or to the bypass control software. The user makes no connection to the drive fieldbus terminals since this channel is reserved for the bypass control software's control of the drive.

For all EFB Protocols, the drive is viewed as one node and the bypass is viewed as a separate node. This is illustrated in Figure 1.

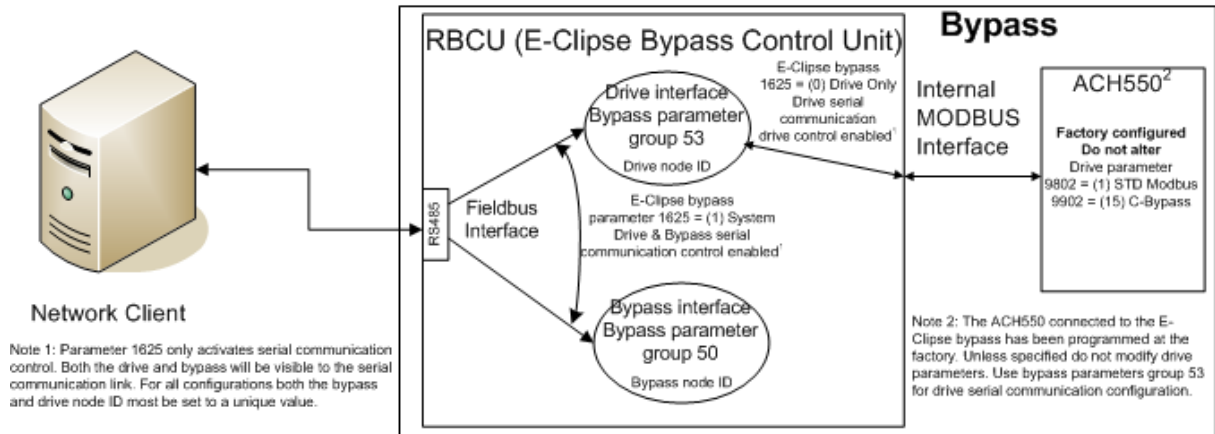


Figure 1 - Communications Physical and Logical Connections

Setup of the drive logical connection is done in parameter group 53 on the bypass keypad. This group contains, among other things, the Drive MAC ID. Group 53 on the drive must not be modified from the settings defined by the drive application macro, 15 (Eclipse Bypass) since this will render the Internal MODBUS Interface inoperable. Also, drive parameter 98.02, Protocol Sel must not be changed since this will also render the Internal MODBUS Interface inoperable.

Selection of the EFB protocol is done in bypass parameter 98.02. Setup of the bypass logical connection is done in parameter group 50 on the bypass keypad. Certain parameters that control the network link are duplicated in group 50 and group 53 (e.g. BAUD RATE) and are presented as read only in group 50.

The user can use bypass parameter 16.25, COMM CTRL to determine if control signals (start and enables) go to the drive or to the system. Parameter 16.25 = 0 (DRIVE ONLY) is intended for legacy applications where the network was only able to control the drive. Parameter 16.25 = 1 (SYSTEM) provides new functionality where control signals control both the drive and bypass depending on the the drive/ bypass mode selected on the bypass keypad. In both cases, non-control related points are visible on the bypass.

## Serial Communication Selection

To activate the serial communication, set bypass parameter 9802 COMM PROT=

- 1 (STD MODBUS).
- 2 (N2)
- 3 (FLN)
- 4 (EXT FBA) - See External Fielbus Adapter User's Manual
- 5 (BACNET)

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**Note!** The bypass is the master for all serial communications. From the bypass keypad, settings in Group 53 are used for the fieldbus communications to the drive. From the bypass keypad, settings in Group 50 are used for the fieldbus communications to the bypass. When using serial communication diagnostics, only the OK message counter & error message counter in the drive section (Group 53 on the bypass keypad) will increment.

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## Serial Communication Configuration - Drive

Setting 9802 automatically sets the appropriate default values in parameters that define the communication process. These parameters and descriptions are defined below. In particular, note that the station Id may require adjustment.

Bypass Parameter	Description	EFB Protocol Reference			
		Modbus	N2	FLN	BACnet
1625	COMM CONTROL	1625 = 0 (Drive Only) for control signals (Start/Stop & enables) go to drive only. 1625 = 1 (System) for control signals to go to the system (drive or bypass, depending on keypad mode selection)			
5301	EFB PROTOCOL ID Contains the identification and program revision of the protocol.	Do not edit. Any non-zero value entered for parameter 9802 COMM PROT SEL, sets this parameter automatically. The format is: XYY, where xx = protocol ID, and YY = program revision.			
5302	EFB STATION ID Defines the drives node address of the EIA 485 link.	Set each bypass on the network with a unique value for this parameter.  Default: 1  <b>Note:</b> For a new address to take affect, the system power must be cycled <b>OR</b> 5302 must first be set to 0 before selecting a new address. Leaving 5302 = 0 places the EIA 485 channel in reset, disabling communication.		Sets MS/TP MAC ID. A temporary value of 0 places the protocol channel in reset.  Default: 128	



Bypass Parameter	Description	EFB Protocol Reference			
		Modbus	N2	FLN	BACnet
5303	<p>EFB BAUD RATE</p> <p>Defines the communication speed of the EIA 485 link in kbits per second (kbits/s).</p> <p>1.2 kbits/s 2.4 kbits/s 4.8 kbits/s 9.6 kbits/s 19.2 kbits/s 38.4 kbits/s 57.6 kbits/s 76.8 kbits/s</p>	<p>Default: 9.6</p> <p>Do not edit for N2</p>		<p>Default: 4.8</p> <p>Do not edit</p>	<p>Default: 38400</p>
5304	<p>EFB PARITY</p> <p>Defines the data length, parity and stop bits to be used with the EIA 485 link communication.</p> <ul style="list-style-type: none"> <li>The same settings must be used in all on-line stations.</li> </ul> <p>0 = 8N1 – 8 data bits, No parity, one stop bit. 1 = 8N2 – 8 data bits, No parity, two stop bits. 2 = 8E1 – 8 data bits, Even parity, one stop bit. 3 = 8O1 – 8 data bits, Odd parity, one stop bit.</p>	<p>Default:1</p>	<p>Default:0</p>		
5305	<p>EFB CTRL PROFILE</p> <p>Selects the communication profile used by the EFB protocol.</p> <p>0 = ABB DRV LIM – Operation of Control/ Status Words conform to ABB bypass Profile, as used in ACH400. 1 = DCU PROFILE – Operation of Control/ Status Words conform to 32-bit DCU Profile. 2 = ABB DRV FULL – Operation of Control/ Status Words conform to ABB Bypass Profile, as used in ACH600/800.</p>	<p>Default:1</p>	<p>Default:0</p>		
5310	<p>EFB PAR10</p>	<p>Not used for Comm setup.</p>	<p>Sets the response turnaround time in milliseconds. When this protocol is selected, the default value is:</p> <p>3 msec.   0 msec.   5 msec.</p>		

Bypass Parameter	Description	EFB Protocol Reference			
		Modbus	N2	FLN	BACnet
5311	EFB PAR11	Not used for Comm setup.			This parameter, together with parameter 5317, EFB PAR 17, sets BACnet Device Object instance IDs: <ul style="list-style-type: none"> <li>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.</li> <li>For IDs &gt; 65,335: The ID equals 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.</li> </ul>
5314...5315	EFB PAR14... EFB PAR15	Not used for Comm setup.			Not Used
5316	EFB PAR16				This parameter indicates the count of MS/TP tokens passed to the unit
5317	EFB PAR17	0			This parameter works with parameter 5311 to set BACnet instance IDs. See parameter 5311.
5318...5320	EFB PAR18...EFB PAR20				N/A - Not supported with BACnet protocol

**Note!** After any changes to the communication settings, the communication channel must be reset by either cycling the system power, or by clearing (set to 0 and enter) and then restoring the station ID(5302) to desired station ID.

## Serial Communication Configuration - Bypass

Setting 9802 automatically sets the appropriate default values in parameters that define the communication process. These parameters and descriptions are defined below. In particular, note that the station Id may require adjustment.

Bypass Parameter	Description	EFB Protocol Reference			
		Modbus	N2	FLN	BACnet
5001	EFB PROTOCOL ID Contains the identification and program revision of the protocol.	Do not edit. Any non-zero value entered for parameter 9802 COMM PROT SEL, sets this parameter automatically. The format is: XXYY, where xx = protocol ID, and YY = program revision.			
5002	EFB STATION ID Defines the bypass node address of the EIA 485 link.	Set each bypass on the network with a unique value for this parameter. When this protocol is selected, the default value for this parameter is: 256 <b>Note:</b> For a new address to take affect, the bypass power must be cycled <b>OR</b> 5002 must first be set to 0 before selecting a new address. Leaving 5002 = 0 places the EIA 485 channel in reset, disabling communication.		Sets MS/TP MAC ID. A temporary value of 0 places the protocol channel in reset. Default Value is: 129	
5003 (Read Only)	EFB BAUD RATE Defines the communication speed of the EIA 485 link in kbits per second (kbits/s). 1.2 kbits/s 2.4 kbits/s 4.8 kbits/s 9.6 kbits/s 19.2 kbits/s 38.4 kbits/s 57.6 kbits/s 76.8 kbits/s	When this protocol is selected, the default value for this parameter is: 9.6	4.8	When this protocol is selected, the default value for this parameter is: 38900. Do not edit.	
5004 (Read Only)	EFB PARITY Defines the data length, parity and stop bits to be used with the EIA 485 link communication. • The same settings must be used in all on-line stations. 0 = 8N1 – 8 data bits, No parity, one stop bit. 1 = 8N2 – 8 data bits, No parity, two stop bits. 2 = 8E1 – 8 data bits, Even parity, one stop bit. 3 = 8O1 – 8 data bits, Odd parity, one stop bit.	When this protocol is selected, the default value for this parameter is: 1	When this protocol is selected, the default value for this parameter is: 0		Sets MS/TP character format.

Bypass Parameter	Description	EFB Protocol Reference						
		Modbus	N2	FLN	BACnet			
5005 (Read Only)	<p>EFB CTRL PROFILE Selects the communication profile used by the EFB protocol.</p> <p>0 = ABB DRV LIM – Operation of Control/Status Words conform to ABB bypass Profile, as used in ACH400.</p> <p>1 = DCU PROFILE – Operation of Control/Status Words conform to 32-bit DCU Profile.</p> <p>2 = ABB DRV FULL – Operation of Control/Status Words conform to ABB Bypass Profile, as used in ACH600/800.</p>	When this protocol is selected, the default value for this parameter is: 0	<p>N/A. When this protocol is selected, the default value for this parameter is: 0.</p> <p>Changing the value for this parameter has no affect on this protocol's behavior.</p>					
5010	EFB PAR10	Not used for Comm setup.	<p>Sets them response turnaround time in milliseconds. When this protocol is selected, the default value is:</p> <table border="1"> <tr> <td>3 msec.</td> <td>0 msec.</td> <td>5 msec.</td> </tr> </table>			3 msec.	0 msec.	5 msec.
3 msec.	0 msec.	5 msec.						
5011	EFB PAR11	Not used for Comm setup.	<p>This parameter, together with parameter 5317, EFB PAR 17, sets BACnet Device Object instance IDs:</p> <ul style="list-style-type: none"> <li>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.</li> <li>For IDs &gt; 65,335: The ID equals 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.</li> </ul>					
5014	EFB PAR14	Not used for Comm setup.	Not Used					
5016	EFB PAR15		Not Used					
5017	EFB PAR17		This parameter indicates the count of MS/TP tokens passed to the unit					

**Note!** After any changes to the communication settings, the communication channel must be reset by either cycling the system power, or by clearing (set to 0 and enter) and then restoring the station ID (5002) to desired station ID.

## Activate Drive Control Functions – EFB

### Controlling the Drive

Fieldbus control of various drive functions requires configuration to:

- Tell the drive (via the bypass) 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, at a general level, the configuration required for each control function. For the protocol-specific details, see the specific protocol technical data section in this manual.

### Start/Stop Control

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

- Bypass parameter values set as defined below.
- Fieldbus controller supplied command(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Bypass Parameter		Value	Description	Protocol Reference				
				Modbus <sup>1</sup>		N2	FLN	BAC net
				ABB DRV	DCU PROFILE			
1601	START/STOP	2 (COMM)	Start/Stop by fieldbus with Ext1 or Ext2 selected.	40001 bits 0...3	40031 bits 0, 1	BO1	24	BV10

1. For Modbus, the protocol reference can depend on the profile used, hence two columns in these tables. One column refers to the ABB Drives profile, selected when bypass parameter 5305 = 0 (ABB DRV LIM) or 5305 = 2 (ABB DRV FULL). The other column refers to the DCU profile selected when bypass parameter 5305 = 1 (DCU PROFILE). See "ABB Control Profiles Technical Data - Drive" on page 101.
2. The reference provides direction control – a negative reference provides reverse rotation.

## Input Reference Select

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

- Drive parameter values set with the drive keypad as defined below.
- Fieldbus controller supplied reference word(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Drive Parameter		Value	Setting	Protocol Reference				
				Modbus		N2	FLN	BAC net
				ABB DRV	DCU PROFILE			
1102	EXT1/EXT2 SEL	8 (COMM)	Reference set selection by fieldbus.	40001 bit 11	40031 bit 5	BO5	26	BV13
1103	REF1 SEL	8 (COMM)	Input reference 1 by fieldbus.	40002		AO1	60	AV16
1106	REF2 SEL	8 (COMM)	Input reference 2 by fieldbus.	40003		AO2	61	AV17

### Reference Scaling

Where required, REFERENCES can be scaled. See the following, as appropriate:

- Modbus Register "40002" in the "With autobaud detection, once the proper baud rate is detected, bypass parameter 5315 EFB PAR 15, shows the active baud rate. Modbus Protocol Technical Data" section.
- "Reference Scaling" in the "ABB Control Profiles Technical Data - Drive" section.
- "N2 Analog Output Objects - Drive" in the "N2 Protocol Technical Data - System" section.
- The slope of points 60 and 61 in the "FLN Protocol Technical Data - System" section.

### Drive Relay Output Control

Using the fieldbus for relay output control requires:

- Drive parameter values set with drive keypad as defined below.
- Fieldbus controller supplied reference word(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Drive Parameter		Value	Setting	Protocol Reference				
				Modbus		N2	FLN	BACnet
				ABB DRV	DCU PROFILE			
1401	RELAY OUTPUT 1	35 (COMM)	Relay Output 1 controlled by fieldbus.	40134 bit 0 or 00033		B07	40	BO0
1402	RELAY OUTPUT 2	35 (COMM)	Relay Output 2 controlled by fieldbus.	40134 bit 1 or 00034		B08	41	BO1
1403	RELAY OUTPUT 3	35 (COMM)	Relay Output 3 controlled by fieldbus.	40134 bit 2 or 00035		B09	42	BO2
1410 <sup>1</sup>	RELAY OUTPUT 4	35 (COMM)	Relay Output 4 controlled by fieldbus.	40134 bit 3 or 00036		B010	43	BO3
1411 <sup>1</sup>	RELAY OUTPUT 5	35 (COMM)	Relay Output 5 controlled by fieldbus.	40134 bit 4 or 00037		B011	44	BO4
1412 <sup>1</sup>	RELAY OUTPUT 6	35 (COMM)	Relay Output 6 controlled by fieldbus.	40134 bit 5 or 00038		B012	45	BO5

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

**For example:** To control relays 1 and 2 using serial communication:

Set drive parameters 1401 RELAY OUTPUT 1 and 1402 RELAY OUTPUT 1 = 35 (COMM).

Then, for example using N2:

- To turn Relay 1 On: Force object B07 to On.
- To turn Relay 2 On: Force object B08 to On.
- To turn both Relay 1 and 2 On: Force objects B07 and B08 On.

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

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Drive Parameter		Value	Setting	Protocol Reference				
				Modbus		N2	FLN	BACnet
				ABB DRV	DCU PROFILE			
0122	RO 1-3 STATUS	Relay 1...3 status.	40122	0122		BI4...BI6	76...78	BI0...BI2
0123	RO 4-6 STATUS	Relay 4...6 status.	40123	0123		BI7...BI9	79...81	BI3...BI5

## Analog Output Control

Using the fieldbus for analog output control requires:

- Drive parameter values set with the drive keypad as defined below.
- Fieldbus controller supplied reference word(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Drive Parameter		Value	Setting	Protocol Reference				
				Modbus		N2	FLN	BAC net
				ABB DRV	DCU PROFILE			
1501	AO1 CONTENT SEL	135 (COMM VALUE 1)	Analog Output 1 controlled by writing to parameter 0135.	–	–	–	–	
0135	COMM VALUE 1	–		40135	AO14	46	AO0	
1507	AO2 CONTENT SEL	136 (COMM VALUE 2)	Analog Output 2 controlled by writing to parameter 0136.	–	–	–	–	
0136	COMM VALUE 2	–		40136	AO15	47	AO1	

## PID Control Setpoint Source

Use the following settings to select the fieldbus as the setpoint source for PID loops:

Drive Parameter		Value	Setting	Protocol Reference				
				Modbus		N2	FLN	BAC net
				ABB DRV	DCU PROFILE			
4010	SET POINT SEL (Set 1)	8 (COMM VALUE 1)	Setpoint is either: <ul style="list-style-type: none"> <li>• Input Reference 2 (+/-/* AI1). Control requires parameter 1106 value = comm.</li> <li>• Process PID setpoint. Control requires parameter 1106 value = pid1 out and parameter 4010 value = comm.</li> </ul>	40003	AO2	61	AV17	
4110	SET POINT SEL (Set 2)	9 (COMM + AI1)						
4210	SET POINT SEL (Ext/Trim)	10 (COMM*AI1)						



## Feedback from the Drive – EFB

### 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 for the appropriate protocol starting on page 88.

Drive Parameter		Protocol Reference			
		Modbus	N2	FLN	BACnet
0102	SPEED	40102	AI3	5	AV0
0103	FREQ OUTPUT	40103	AI1	2	AV1
0104	CURRENT	40104	AI4	6	AV4
0105	TORQUE	40105	AI5	7	AV5
0106	POWER	40106	AI6	8	AV6
0107	DC BUS VOLT	40107	AI11	13	AV2
0109	OUTPUT VOLTAGE	40109	AI12	14	AV3
0115	KWH COUNTER	40115	AI8	10	AV8
0118	DI1-3 STATUS – bit 1 (DI3)	40118	BI12	72	BI6
0122	RO1-3 STATUS	40122	BI4, BI5, BI6	76, 77, 78	BI0
0301	FB STATUS WORD – bit 0 (STOP)	40301 bit 0	BI1	23	BV0
0301	FB STATUS WORD – bit 2 (REV)	40301 bit 2	BI2	21	BV1

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**Note!** With Modbus, any parameter can be accessed using the format: 4 followed by the parameter number.

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## 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.

Name	Description	Protocol Reference			
		Modbus <sub>1</sub>	N2	FLN	BACnet
Mailbox Parameter	Enter the number of the drive parameter to access.	Does not apply.	AO19	95	AV25
Mailbox Data	Contains the parameter value after a read, or enter the desired parameter value for a write.		AO20	96	AV26
Mailbox Read	A binary value triggers a read – the value of the "Mailbox Parameter" appears in "Mailbox data".		BO19	97	BV15
Mailbox Write	A binary value triggers a write – the drive value for the "Mailbox Parameter" changes to the value in "Mailbox data".		BO20	98	BV16

- As noted above, Modbus provides direct access to all parameters using the format: 4 followed by the parameter number.

## Actual Value Scaling

The scaling of actual values can be protocol dependent. In general, for Actual Values, scale the feedback integer using the parameter's resolution. (See "Parameter Descriptions" section in *ACH550 User's Manual* for parameter resolutions.) For example:

Feedback Integer	Parameter Resolution	(Feedback Integer) * (Parameter Resolution) = Scaled Value
1	0.1 mA	1 * 0.1 mA = 0.1 mA
10	0.1%	10 * 0.1% = 1%

Where parameters are in percent, the "Parameter Descriptions" section specifies what parameter corresponds to 100%. In such cases, to convert from percent to engineering units, multiply by the value of the parameter that defines 100% and divide by 100%. For example:

Feedback Integer	Parameter Resolution	Value of the Parameter that defines 100%	(Feedback Integer) * (Parameter Resolution) * (Value of 100% Ref.) / 100% = Scaled Value
10	0.1%	1500 rpm <sup>1</sup>	10 * 0.1% * 1500 RPM / 100% = 15 rpm
100	0.1%	500 Hz <sup>2</sup>	100 * 0.1% * 500 Hz / 100% = 50 Hz

- Assuming, for the sake of this example, that the Actual Value uses parameter 9908 MOT NOM SPEED as the 100% reference, and that 9908 = 1500 rpm.
- Assuming, for the sake of this example, that the Actual Value uses parameter 9907 MOT NOM FREQ as the 100% reference, and that 9907 = 500 Hz.

Although Actual Value scaling could differ from the above for the N2, FLN, and BACnet protocols, it currently does not. To confirm, see the following sections, as appropriate:

- "N2 Analog Input Objects - Bypass" in the "N2 Protocol Technical Data - System" section.
- "Scaling Drive Feedback Values" in the "FLN Protocol Technical Data - System" section.

## Activate Bypass Control Functions – EFB

### Controlling the bypass

Fieldbus control of various bypass functions requires configuration to:

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

The following sections describe, at a general level, the configuration required for each control function.

### Start/Stop Direction Control

Using the fieldbus for start/stop control of the bypass requires:

- Bypass parameter values set as defined below.
- Fieldbus controller supplied command(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Bypass Parameter		Value	Description	Protocol Reference				
				Modbus <sup>1</sup>		N2	FLN	BACnet
				ABB DRV	DCU PROFILE			
1601	START/STOP	2 (COMM)	Start/Stop by fieldbus with Ext1 or Ext2 selected.	40001 bits 0...3	40031 bits 0, 1	BO1	24	BV10

1. For Modbus, the protocol reference can depend on the profile used, hence two columns in these tables. One column refers to the ABB bypass profile, selected when parameter 5305 = 0 (ABB DRV LIM) or 5305 = 2 (ABB DRV FULL). The other column refers to the DCU profile selected when parameter 5305 = 1 (DCU PROFILE). See "ABB Control Profiles Technical Data - Drive" on page 101.

## Miscellaneous System Control

**NOTE:** Control of system commands is dependent upon the setting of bypass parameter 1625

Using the fieldbus miscellaneous system control requires:

- Bypass parameter values set as defined below.
- Fieldbus controller supplied reference word(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Bypass Parameter		Value	Setting	Protocol Reference				
				Modbus		N2	FLN	BACnet
				ABB DRV	DCU PROFILE			
1602	RUN ENABLE	2 (COMM)	Run enable by fieldbus	40001 bit 2	40031 bit 6 (inverted)	BO2	35	BV12
1603	START ENABLE 1	2 (COMM)	Source for start enable 1 is the fieldbus Command word	N/A	40032 bit 2	BO10	50	BV15
1604	START ENABLE 2	2 (COMM)	Source for start enable 2 is the fieldbus Command word		40032 bit 3	BO11	51	BV16
1605	START ENABLE 3	2 (COMM)		N/A	N/A	BO12	52	BV17
1606	START ENABLE 4	2 (COMM)		N/A	N/A	BO13	53	BV18
1607	START RESET SEL	2 (COMM)	Fault reset by fieldbus.	40001 bit 7	40031 bit 4	BO3	94	BV14

## Bypass Relay Output Control

Using the fieldbus for relay output control requires:

- Bypass parameter values set as defined below.
- Fieldbus controller supplied reference word(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Bypass Parameter		Value	Setting	Protocol Reference				
				Modbus		N2	FLN	BACnet
				ABB DRV	DCU PROFILE			
1401	RELAY OUTPUT 1	16 (COMM CTRL)	Relay Output 1 controlled by fieldbus.	40134 bit 0 or 00033		BO5	40	BO0
1404	RELAY OUTPUT 2	16 (COMM CTRL)	Relay Output 2 controlled by fieldbus.	40134 bit 1 or 00034		BO6	41	BO1
1407	RELAY OUTPUT 3	16 (COMM CTRL)	Relay Output 3 controlled by fieldbus.	40134 bit 2 or 00035		BO7	42	BO2
1410	RELAY OUTPUT 4	16 (COMM CTRL)	Relay Output 4 controlled by fieldbus.	40134 bit 3 or 00036		BO8	43	BO3
1413	RELAY OUTPUT 5	16 (COMM CTRL)	Relay Output 5 controlled by fieldbus.	40134 bit 4 or 00037		BO9	44	BO4

**For example:** To control relays 1 and 2 using serial communication:

From the bypass keypad, set parameters 1401 RELAY OUTPUT 1 and 1402 RELAY OUTPUT 2 = 16 (COMM CTRL).

Then, for example using N2:

- To turn Relay 1 On: Force object B05 to On.
- To turn Relay 2 On: Force object B06 to On.
- To turn both Relay 1 and 2 On: Force objects B05 and B06 On.

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

Bypass Parameter		Value	Setting	Protocol Reference				
				Modbus		N2	FLN	BACnet
				ABB DRV	DCU PROFILE			
0122	RO 1-3 STATUS	Relay 1...3 status.	40122	0122		BI16.. BI18	76... 78	BI0... BI2
0123	RO 4-5 STATUS	Relay 4...5 status.	40123	0123		BI19.. BI20	79... 80	BI3... BI4

### Communication Fault

When using fieldbus control, specify the bypass' action if external serial communication is lost.

Bypass Parameter		Value	Description
3004	COMM FAULT FUNC	0 (NOT SEL) 1 (FAULT) 2 (CONST SP7) 3 (LAST SPEED)	Set for appropriate drive/bypass response. NOTE: If the system is in bypass mode when communication is lost, choices 2 and 3 will cause the bypass contactor to remain in it's present state.
3005	COMM FAULT TIME	Set time delay before acting on a communication loss.	

## Feedback from the ABB E-Clipse Bypass EFB

### Pre-defined Feedback

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

Bypass Parameter		Protocol Reference			
		Modbus	N2	FLN	BACnet
0101	MOTOR CURR	40101	A11	6	AV0

**Note!** With Modbus, any parameter can be accessed using the format: 4 followed by the parameter number.

Type	Name	Description	N2	FLN	BACnet
DI	System Ready	System is ready to accept start command (either mode).	BI1	27	BV7
DI	System Enabled	System is enabled to start motor (either mode).	BI2	34	BV9
DI	System Started	System start enables are made and start command has been received (either mode). Motor runs if run enable is active.	BI3	28	BV1
DI	System Running	Motor is running (either mode).	BI4	23	BV0
DI	Fieldbus Local	System is under fieldbus local control (either mode).	BI5	36	N/A
DI	Bypass Fault	Bypass is faulted.	BI6	93	BV2
DI	Bypass Alarm	Bypass is alarming.	BI7	86	BV5
DI	Comm Control	System is configured for control in the comm channel	BI8	37	

Type	Name	Description	N2	FLN	BACnet
DI	Bypass Override	Bypass override 2 status	BI9	25	BV13
DI	DI1 Status	Bypass digital input 1 status	BI10	70	BI5
DI	DI2 Status	Bypass digital input 2 status	BI11	71	BI6
DI	DI3 Status	Bypass digital input 3 status	BI12	72	BI7
DI	DI4 Status	Bypass digital input 4 status	BI13	73	BI8
DI	DI5 Status	Bypass digital input 5 status	BI14	74	BI9
DI	DI6 Status	Bypass digital input 6 status	BI15	75	BI10
DI	RO1 Status	Bypass relay output 1 status	BI16	76	BI0
DI	RO2 Status	Bypass relay output 2 status	BI17	77	BI1
DI	RO3 Status	Bypass relay output 3 status	BI18	78	BI2
DI	RO4 Status	Bypass relay output 4 status	BI19	79	BI3
DI	RO5 Status	Bypass relay output 5 status	BI20	80	BI4
DI	Bypass Select	1=Bypass mode, 0=Drive mode	BI21	32	BV4
DI	System Underload	Reports system underload status (either mode)	BI22	7	BV8
DI	System Fault	Reports system fault status (either mode)	BI23	93	BV3
DI	Bypass Run	Reports motor running status in bypass mode	BI24	33	BV6



## Diagnostics – EFB

### Fault Queue for Drive Diagnostics

For general ACH550 diagnostics information, see “Diagnostics” section in the ACH550 User’s Manual (3AUA0000004092).

Type	Name	Description	Modbus	N2	FLN	BACnet
AI	Last Fault	Reports last drive fault	40401	AI17	90	AV18
AI	Previous Fault	Reports fault previous to last	40402	AI18	91	AV19
AI	Oldest Fault	Reports third-oldest fault	40403	AI19	92	AV20
AI	Alarm Word 1	Reports alarm word 1		N/A	88	N/A
AI	Alarm Word 2	Reports alarm word 2		N/A	89	N/A

### Fault Queue for Bypass Diagnostics

For general E-Clipse Bypass diagnostics information, see “Diagnostics” section in the E-Clipse Bypass User’s Manual (3AUA0000016461).

Type	Name	Description	Modbus	N2	FLN	BACnet
AI	Last Fault	Reports last drive fault	40401	AI2	90	AV3
AI	Previous Fault	Reports fault previous to last	40402	N/A	N/A	N/A
AI	Oldest Fault	Reports third-oldest fault	40403	N/A	N/A	N/A
AI	Alarm Word 1	Reports alarm word 1		AI3	88	AV4
AI	Alarm Word 2	Reports alarm word 2		AI4	89	AV5

### Serial Communication Diagnostics - Drive

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

- Loose connections
- Incorrect wiring (including swapped wires)
- Bad grounding
- Duplicate station numbers
- Incorrect setup of bypass 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 describes these parameters in detail. Group 53 applies to the drive external communications. Group 50 applies to the bypass external communications.

### Diagnostic Situations

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

#### *Normal Operation*

During normal network operation, 5306...5309 bypass parameter values act as follows at each bypass:

- 5306 DV OK MESSAGES advances (advances for each application message properly received and addressed to this drive).
- 5307 DV CRC ERRORS does not advance at all (advances when an invalid message CRC is received).
- 5308 UART ERRORS does not advance at all (advances when character format errors are detected, such as parity or framing errors).
- 5309 DV status value varies depending on network traffic.
- BACnet protocol: 5316 EFB PAR 16 (MS/TP token counter) advances for each token passed to this drive. (Does not apply for other protocols.)

#### *Loss of Communication*

The ABB E-Clipse bypass and ABB E-Clipse Bypass behavior, if communication is lost, was configured in "Communication Fault". The parameters are 3004 COMM LOSS and 3005 COMM TIME. The "Parameter Descriptions" section describes these parameters in detail.

#### *No Master Station on Line*

If no master station is on line: Neither the 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 bypass 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 bypass 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 EIA 485 lines are not swapped.

#### *Fault 3028 – EXT COMM LOSS*

If the bypass' control panel shows fault code 3028 "EXT COMM LOSS", 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 bypass.
- The time-out selection for the bypass is too short for the given installation. The master is not polling the bypass within the specified time-out delay. To correct, increase the time set by parameter 3005 COMM TIME.

## 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 - Bypass

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 50 EFB Protocol parameters 5006...5009. 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, 5006...5009 bypass parameter values act as follows at each drive:

- 5006 BP OK MESSAGES advances (advances for each application message properly received and addressed to this bypass).
- 5007 BP CRC ERRORS does not advance at all (advances when an invalid message CRC is received).
- 5008 UART ERRORS does not advance at all (advances when character format errors are detected, such as parity or framing errors). Read only copy from 5308.
- 5009 BP STATUS value varies depending on network traffic.
- 5016 EFB PAR 16 (MS/TP token counter) advances for each token passed to this drive.

## N2 Protocol Technical Data - System

### System Overview

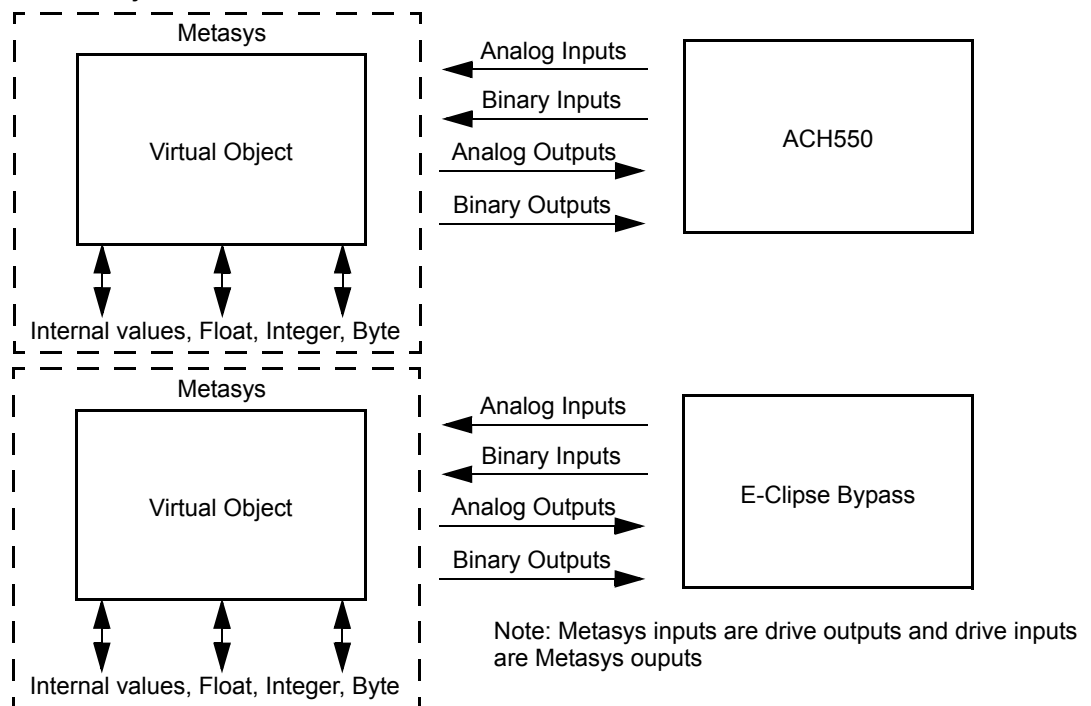
The N2 Fieldbus connection to the system is based on an industry standard RS-485 physical interface. The N2 Fieldbus protocol is a master-slave type, serial communication protocol, used by the Johnson Controls Metasys® system. In the Metasys architecture the N2 Fieldbus connects object interfaces and remote controllers to Network Control Units (NCUs).

The N2 Fieldbus can also be used to connect the system to the Metasys Companion product line.

This section describes the use of the N2 Fieldbus with the E-Clipse Bypass connection.

### Supported Features

In the N2 Fieldbus protocol the ACH550 and E-Clipse Bypass may appear as a "virtual object".



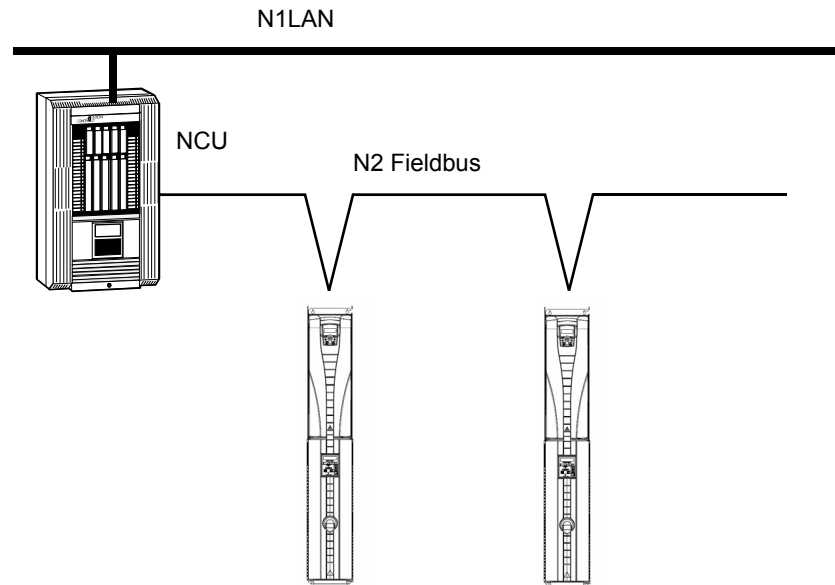
A virtual object is made up of:

- Analog Inputs
- Binary Inputs
- Analog Outputs
- Binary Outputs

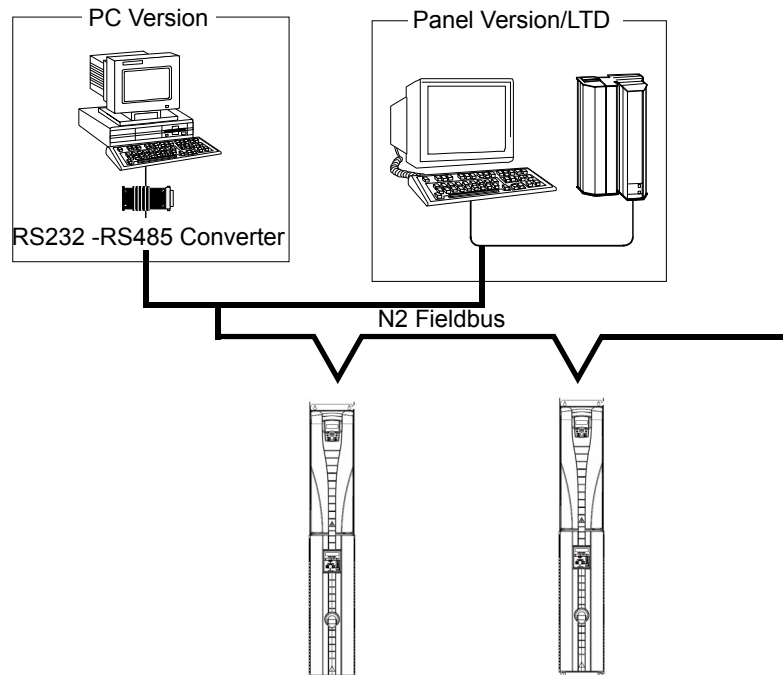
Internal values for Floating point, Integer, and Byte values.

### Metasys Integration

The following diagram shows the system's integration to the Johnson Controls Metasys system.



The following diagram shows the system's integration to the Johnson Controls Metasys Companion system.



On the N2 Fieldbus each system can be accessed by the full complement of Metasys FMS features, including Change-of-State (COS) monitoring, alarm notification, scheduling, trend, and totalization.

On one N2 Fieldbus segment there can be up to 32 nodes while integrating the E-Cclipse Bypass system with Johnson Controls Metasys. Each E-Cclipse bypass may

consume two nodes on a N2 fieldbus segment. If both the drive and bypass objects are being polled by the system.

#### *Drive Device Type*

For the Metasys and Metasys Companion products, the device type for the ACH550 drive is VND.

When bypass parameter 1625 COMM CTL= (0) DRIVE ONLY, drive's N2 objects are all supported using the drive's device address. The bypass's N2 objects related to the control word are no longer valid.

#### **Bypass N2 Objects Not Valid**

Number	Object	Bypass Parameter
BO1	SYSTEM START	Command Word
BO2	SYSTEM DISABLE	Command Word
BO3	SYSTEM RESET	Command Word
BO4	OVERRIDE	Command Word
B10	START ENABLE 1	Command Word
B11	START ENABLE 2	Command Word
B12	START ENABLE 3	Command Word
B13	START ENABLE 4	Command Word

When bypass parameter 1625 COMM CTL= (1) SYSTEM, drive's N2 following objects related to control are no longer available when using the drive's device address.

#### **Drive N2 Objects Not Valid**

Number	Object	Bypass Parameter
BO1	START/STOP	Command Word
BO2	RUN ENABLE	Command Word
BO3	N2 LOCAL CTL	Command Word

#### **Drive Overview**

The ACH550 drive does not support N2 Fieldbus communication "internal values".

All of the Analog and Binary I/O objects are listed below.

**Analog Input** – The analog input objects support the following features:

- Analog Input actual value in engineering units
- Low Alarm limit
- Low Warning limit
- High Warning limit
- High Alarm limit
- Differential value for the hysteresis of the Alarms and Warnings
- Change of State (COS) enabled

- Alarm Enabled
- Warning Enabled
- Override value is received, but there is no action taken.

**Binary Input** – The binary input objects support the following features:

- Binary Input actual value
- Normal / Alarm state specification
- Alarm Enabled
- Change of State (COS) enabled
- Override value is received, but there is no action taken.

**Analog Output** – The analog output objects support the following features:

- Analog Output value in engineering units
- Override value is used to change the Analog Output value. It is not possible to return to the previous value by removing the override. The override feature is used only to change the value.

**Binary Output** – The binary output objects support the following features:

- Binary Output value
- Override value is used to change the Binary Output value. It is not possible to return to the previous value by removing the override. The override feature is used only to change the value.

## N2 Analog Input Objects - Drive

The following table lists the N2 Analog Input objects defined for the ACH550 drive.

N2 Analog Inputs:					
Number	Object	Drive Parameter	Scale Factor	Units	Range
AI1	OUTPUT FREQUENCY	0103	10	Hz	0...250
AI2	RATED SPEED	Note 1	10	%	0 ...100
AI3	SPEED	0102	1	rpm	0 ...9999
AI4	CURRENT	0104	10	A	0...9999
AI5	TORQUE	0105	10	%	-200...200
AI6	POWER	0106	10	kW	0...65,535
AI7	DRIVE TEMPERATURE	0110	10	°C	0 ...125
AI8	KILOWATT HOURS	0115	1	kWh	0...65,535
AI9	MEGAWATT HOURS	0141	1	MWh	0...65,535
AI10	RUN TIME	0114	1	H	0...65,535
AI11	DC BUS VOLTAGE	0107	1	V	0...999
AI12	OUTPUT VOLTAGE	0109	1	V	0...999
AI13	PRC PID FEEDBACK	0130	10	%	0...100
AI14	PRC PID DEVIATION	0132	10	%	0...100



N2 Analog Inputs:					
Number	Object	Drive Parameter	Scale Factor	Units	Range
AI15	EXT PID FEEDBACK	0131	10	%	0...100
AI16	EXT PID DEVIATION	0133	10	%	0...100
AI17	LAST FAULT	0401	1		fault code
AI18	PREV FAULT	0402	1		fault code
AI19	OLDEST FAULT	0403	1		fault code
AI20	AI 1 ACTUAL	0120	10	%	0...100
AI21	AI 2 ACTUAL	0121	10	%	0...100
AI22	AO 1 ACTUAL	0124	10	mA	0...20
AI23	AO 2 ACTUAL	0125	10	mA	0...20
AI24	MOTOR TEMP	0145	1	°C	0...200
AI25	REVOLUTION CNT	0142	1	MREV	0...32767

1. RATED SPEED is a percent of maximum frequency (parameter 2008) if the drive is in scalar mode, and is a percent of maximum speed (parameter 2002) in speed mode.

## N2 Binary Input Objects - Drive

The following table lists the N2 Binary Input objects defined for the ACH550 drive.

N2 Binary Inputs:			
Number	Object	Drive Parameter	Range
BI1	STOP/RUN	Status Word	0 = Stop, 1 = Drive Running
BI2	FORWARD/REVERSE	Status Word	0 = Forward, 1 = Reverse
BI3	FAULT STATUS	Status Word	0 = OK, 1 = Drive Fault
BI4	RELAY 1 STATUS	0122 (bit mask 04)	0 = Off, 1 = On
BI5	RELAY 2 STATUS	0122 (bit mask 02)	0 = Off, 1 = On
BI6	RELAY 3 STATUS	0122 (bit mask 01)	0 = Off, 1 = On
BI7	RELAY 4 STATUS	0123 (bit mask 04)	0 = Off, 1 = On
BI8	RELAY 5 STATUS	0123 (bit mask 02)	0 = Off, 1 = On
BI9	RELAY 6 STATUS	0123 (bit mask 01)	0 = Off, 1 = On
BI10	INPUT 1 STATUS	0118 (bit mask 04)	0 = Off, 1 = On
BI11	INPUT 2 STATUS	0118 (bit mask 02)	0 = Off, 1 = On
BI12	INPUT 3 STATUS	0118 (bit mask 01)	0 = Off, 1 = On
BI13	INPUT 4 STATUS	0119 (bit mask 04)	0 = Off, 1 = On
BI14	INPUT 5 STATUS	0119 (bit mask 02)	0 = Off, 1 = On
BI15	INPUT 6 STATUS	0119 (bit mask 01)	0 = Off, 1 = On
BI16	EXTERNAL 2 SELECT	Status Word	0 = EXT1 = EXT2
BI17	HAND/AUTO	Status Word	0 = AUTO, 1 = HAND
BI18	ALARM	Status Word	0 = OK, 1 = ALARM
BI19	MAINTENANCE REQ	Status Word	0 = OK, 1 = MAINT REQ
BI20	DRIVE READY	Status Word	0 = Not Ready, 1 = Ready

<b>N2 Binary Inputs:</b>			
<b>Number</b>	<b>Object</b>	<b>Drive Parameter</b>	<b>Range</b>
BI21	AT SETPOINT	Status Word	0 = No, 1 = At Setpoint
BI22	RUN ENABLED	Status Word	0 = Not Enabled, 1 = Enabled
BI23	N2 LOCAL MODE	Status Word	0 = Auto, 1 = N2 Local
BI24	N2 CONTROL SRC	Status Word	0 = No, 1 = Yes
BI25	N2 REF1 SRC	Status Word	0 = No, 1 = Yes
BI26	N2 REF2 SRC	Status Word	0 = No, 1 = Yes

### N2 Analog Output Objects - Drive

The following table lists the N2 Analog Output objects defined for the ACH550 drive.

<b>N2 Analog Outputs:</b>					
<b>Number</b>	<b>Object</b>	<b>Drive Parameter</b>	<b>Scale Factor</b>	<b>Units</b>	<b>Range</b>
AO1	REFERENCE 1	Reference 1	10	%	0...100
AO2	REFERENCE 2	Reference 2	10	%	0...100
AO3	ACCEL TIME 1	2202	10	s	0.1...1800
AO4	DECEL TIME 1	2203	10	s	0.1...1800
AO5	CURRENT LIMIT	2003	10	A	0...1.3*I <sub>2N</sub>
AO6	PID1-CONT GAIN	4001	10	%	0.1...100
AO7	PID1-CONT I-TIME	4002	10	s	0.1...600
AO8	PID1-CONT D-TIME	4003	10	s	0...10
AO9	PID1-CONT D FILTER	4004	10	s	0...10
AO10	PID2-CONT GAIN	4101	10	%	0.1...100
AO11	PID2-CONT I-TIME	4102	10	s	0.1...600
AO12	PID2-CONT D-TIME	4103	10	s	0...10
AO13	PID2-CONT D FILTER	4104	10	s	0...10
AO14	COMMAND AO 1	135	10	%	0...100
AO15	COMMAND AO 2	136	10	%	0...100
AO16	EXT PID SETPOINT	4211	10	%	0...100
AO17	SPD OUT MIN	2001/2007	10	%	0...200
AO18	SPD OUT MAX	2002/2008	10	%	0...200
AO19	MAILBOX PARAMETER		1		0...65535
AO20	MAILBOX DATA		1		0...65535

## N2 Binary Output Objects - Drive

The following table lists the N2 Binary Output objects defined for the ACH550 drive.

N2 Binary Outputs:			
Number	Object	Drive Parameter	Range
BO1	STOP/START	Command Word	0 = Stop, 1 = Start to Speed
BO2	FORWARD/REVERSE	Command Word	0 = Forward, 1 = Reverse
BO3	PANEL LOCK	Command Word	0 = Open, 1 = Locked
BO4	RUN ENABLE	Command Word	0 = Enable, 1 = Disable
BO5	REF1/REF2 SELECT	Command Word	0 = Ref1, 1 = Ref2
BO6	FAULT RESET	Command Word	Change 0 -> 1 Resets
BO7	COMMAND RO 1	134 (bit mask 01)	0 = Off, 1 = On
BO8	COMMAND RO 2	134 (bit mask 02)	0 = Off, 1 = On
BO9	COMMAND RO 3	134 (bit mask 04)	0 = Off, 1 = On
BO10	COMMAND RO 4	134 (bit mask 08)	0 = Off, 1 = On
BO11	COMMAND RO 5	134 (bit mask 10)	0 = Off, 1 = On
BO12	COMMAND RO 6	134 (bit mask 20)	0 = Off, 1 = On
BO13	RESET RUN TIME	114 (indirectly)	0 = N/A, 1 = On (Reset Run Time)
BO14	RESET KWH COUNT	115 (indirectly)	0 = N/A, 1 = On (Reset kWh Count)
BO15	PRC PID SELECT	4027 (indirectly)	0 = SET2, 1 = SET2
BO16	N2 LOCAL CTL (Note 1)	Command Word	0 = Auto, 1 = N2
BO17	N2 LOCAL REF (Note 1)	Command Word	0 = Auto, 1 = N2
BO18	SAVE PARAMETERS	1607 (indirectly)	0 = N/A, 1 = On (Save Parameters)
BO19	READ MAILBOX		0 = No, 1 = Yes
BO20	WRITE MAILBOX		0 = No, 1 = Yes

1. N2 LOCAL CTL and N2 LOCAL REF have priority over drive input terminals. Use these binary outputs for temporary N2 control of the drive when COMM is not the selected control source.

## DDL File for NCU - Drive

The listing below is the Data Definition Language (DDL) file for ACH550 drives used with the Network Control Units.

This listing is useful when defining drive I/O objects to the Network Controller Units.

Below is the ACH550.DDL file listing.

```
*****
*   ABB Drives, ACH 550 Variable Frequency Drive
*****
CSMODEL "ACH_550", "VND"

AITITLE "Analog_Inputs"
BITITLE "Binary_Inputs"
AOTITLE "Analog_Outputs"
BOTITLE "Binary_Outputs"

CSAI "AI1",N,N,"FREQ_ACT","Hz"
CSAI "AI2",N,N,"PCT_ACT","%"
CSAI "AI3",N,N,"SPEED","RPM"
CSAI "AI4",N,N,"CURRENT","A"
CSAI "AI5",N,N,"TORQUE","%"
CSAI "AI6",N,N,"POWER","kW"
CSAI "AI7",N,N,"DRV_TEMP","°C"
CSAI "AI8",N,N,"ENERGY_k","kWh"
CSAI "AI9",N,N,"ENERGY_M","MWh"
CSAI "AI10",N,N,"RUN_TIME","H"
CSAI "AI11",N,N,"DC_VOLT","V"
CSAI "AI12",N,N,"VOLT_ACT","V"
CSAI "AI13",N,N,"PID1_ACT","%"
CSAI "AI14",N,N,"PID2_DEV","%"
CSAI "AI15",N,N,"PID2_ACT","%"
CSAI "AI16",N,N,"PID2_DEV","%"
CSAI "AI17",N,N,"LAST_FLT","Code"
CSAI "AI18",N,N,"PREV_FLT","Code"
CSAI "AI19",N,N,"1ST_FLT","Code"
CSAI "AI20",N,N,"AI_1_ACT","%"
CSAI "AI21",N,N,"AI_2_ACT","%"
CSAI "AI22",N,N,"AO_1_ACT","mA"
CSAI "AI23",N,N,"AO_2_ACT","mA"
CSAI "AI24",N,N,"MTR_TEMP","°C"
CSAI "AI25",N,N,"REVL_CNT",""

CSBI "BI1",N,N,"STOP/RUN","STOP","RUN"
CSBI "BI2",N,N,"FWD/REV","FWD","REV"
CSBI "BI3",N,N,"FAULT","OK","FLT"
CSBI "BI4",N,N,"RELAY_1","OFF","ON"
CSBI "BI5",N,N,"RELAY_2","OFF","ON"
CSBI "BI6",N,N,"RELAY_3","OFF","ON"
CSBI "BI7",N,N,"RELAY_4","OFF","ON"
```

```

CSBI "BI8",N,N,"RELAY_5","OFF","ON"
CSBI "BI9",N,N,"RELAY_6","OFF","ON"
CSBI "BI10",N,N,"INPUT_1","OFF","ON"
CSBI "BI11",N,N,"INPUT_2","OFF","ON"
CSBI "BI12",N,N,"INPUT_3","OFF","ON"
CSBI "BI13",N,N,"INPUT_4","OFF","ON"
CSBI "BI14",N,N,"INPUT_5","OFF","ON"
CSBI "BI15",N,N,"INPUT_6","OFF","ON"
CSBI "BI16",N,N,"EXT1/2","EXT1","EXT2"
CSBI "BI17",N,N,"HND/AUTO","HAND","AUTO"
CSBI "BI18",N,N,"ALARM","OFF","ON"
CSBI "BI19",N,N,"MNTNCE_R","OFF","ON"
CSBI "BI20",N,N,"DRV_REDY","NO","YES"
CSBI "BI21",N,N,"AT_SETPT","NO","YES"
CSBI "BI22",N,N,"RUN_ENAB","NO","YES"
CSBI "BI23",N,N,"N2_LOC_M","AUTO","N2_I"
CSBI "BI24",N,N,"N2_CTRL","NO","YES"
CSBI "BI25",N,N,"N2_R1SRC","NO","YES"
CSBI "BI26",N,N,"N2_R2SRC","NO","YES"
CSAO "AO1",Y,Y,"REF_1","%"
CSAO "AO2",Y,Y,"REF_2","%"
CSAO "AO3",Y,Y,"ACCEL_1","s"
CSAO "AO4",Y,Y,"DECEL_1","s"
CSAO "AO5",Y,Y,"CURR_LIM","A"
CSAO "AO6",Y,Y,"PID1_GN","%"
CSAO "AO7",Y,Y,"PID1_I","s"
CSAO "AO8",Y,Y,"PID1_D","s"
CSAO "AO9",Y,Y,"PID1_FLT","s"
CSAO "AO10",Y,Y,"PID2_GN","%"
CSAO "AO11",Y,Y,"PID2_I","s"
CSAO "AO12",Y,Y,"PID2_D","s"
CSAO "AO13",Y,Y,"PID2_FLT","s"
CSAO "AO14",Y,Y,"CMD_AO_1","%"
CSAO "AO15",Y,Y,"CMD_AO_2","%"
CSAO "AO16",Y,Y,"PI2_STPT","%"
CSAO "AO17",Y,Y,"MIN_SPD","%"
CSAO "AO18",Y,Y,"MAX_SPD","%"
CSAO "AO19",Y,Y,"MB_PARAM",""
CSAO "AO20",Y,Y,"MB_DATA",""
CSBO "BO1",Y,Y,"START","STOP","START"
CSBO "BO2",Y,Y,"REVERSE","FWD","REV"
CSBO "BO3",Y,Y,"PAN_LOCK","OPEN","LOCKED"
CSBO "BO4",Y,Y,"RUN_ENAB","DISABLE","ENABLE"
CSBO "BO5",Y,Y,"R1/2_SEL","EXT_1","EXT_2"
CSBO "BO6",Y,Y,"FLT_RSET","-","RESET"
CSBO "BO7",Y,Y,"CMD_RO_1","OFF","ON"
CSBO "BO8",Y,Y,"CMD_RO_2","OFF","ON"
CSBO "BO9",Y,Y,"CMD_RO_3","OFF","ON"
CSBO "BO10",Y,Y,"CMD_RO_4","OFF","ON"
CSBO "BO11",Y,Y,"CMD_RO_5","OFF","ON"

```

```

CSBO "BO12",Y,Y,"CMD_RO_6","OFF","ON"
CSBO "BO13",Y,Y,"RST_RTIM","OFF","RESET"
CSBO "BO14",Y,Y,"RST_KWH","OFF","RESET"
CSBO "BO15",Y,Y,"PID_SEL","SET1","SET2"
CSBO "BO16",Y,Y,"N2_LOC_C","AUTO","N2"
CSBO "BO17",Y,Y,"N2_LOC_R","EUTO","N2"
CSBO "BO18",Y,Y,"SAV_PRMS","OFF","SAVE"
CSBO "BO19",Y,Y,"READ_MB","NO","READ"
CSBO "BO20",Y,Y,"WRITE_MB","NO","WRITE"

```

## Bypass Overview

The ABB E-Clipse bypass does not support N2 Fieldbus communication “internal values”.

All of the Binary I/O objects are listed below.

**Binary Input** – The binary input objects support the following features:

- Binary Input actual value
- Normal / Alarm state specification
- Alarm Enabled
- Change of State (COS) enabled
- Override value is received, but there is no action taken.

**Binary Output** – The binary output objects support the following features:

- Binary Output value
- Override value is used to change the Binary Output value. It is not possible to return to the previous value by removing the override. The override feature is used only to change the value.

## N2 Analog Input Objects - Bypass

The following table lists the N2 Analog Input objects defined for the ABB E-Clipse bypass.

N2 Analog Inputs:					
Number	Object	Bypass Parameter	Scale Factor	Units	Range
AI1	CURRENT	0101	10	A	0...9999
AI2	LAST FAULT	0401	1		fault code
AI3	ALARM WORD 1	0308	1		Alarm mask (see bypass manual description of parameter 0308)

N2 Analog Inputs:					
Number	Object	Bypass Parameter	Scale Factor	Units	Range
AI4	ALARM WORD 2	0309	1		Alarm mask (see bypass manual description of parameter 0309)
AI5	HAND OFF AUTO				0=Off, 1=Hand, 2=Auto

### N2 Analog Output Objects - Bypass

The following table lists the N2 Analog Output objects defined for the ABB E-Clipse bypass.

N2 Analog Outputs:					
Number	Object	Bypass Parameter	Scale Factor	Units	Range
AO1	BYP RUNDLY	1614	1	s	0...300

### N2 Binary Input Objects - Bypass

The following table lists the N2 Binary Input objects defined for the ABB E-Clipse bypass.

N2 Binary Inputs:			
Number	Object	Bypass Parameter	Range
BI1	SYSTEM READY	Status Word	1 = Ready
BI2	SYSTEM ENABLED	Status Word	1 = Enabled
BI3	SYSTEM STARTED	Status Word	1 = System Started
BI4	SYSTEM RUNNING	Status Word	1 = System Running
BI5	N2 LOCAL MODE	Status Word	1 = N2 Local
BI6	FAULT	Status Word	1 = Bypass Fault
BI7	ALARM	Status Word	1 = Bypass Alarm
BI8	N2 CONTROL SRC	Status Word	1 = Yes
BI9	OVERRIDE	Status Word	1 = Override
BI10	INPUT 1 STATUS	0103 (bit mask 1)	1 = On
BI11	INPUT 2 STATUS	0103 (bit mask 2)	1 = On
BI12	INPUT 3 STATUS	0103 (bit mask 4)	1 = On
BI13	INPUT 4 STATUS	0103 (bit mask 8)	1 = On
BI14	INPUT 5 STATUS	0103 (bit mask 10h)	1 = On
BI15	INPUT 6 STATUS	0103 (bit mask 20h)	1 = On
BI16	RELAY 1 STATUS	0104 (bit mas 1)	1 = On
BI17	RELAY 2 STATUS	0104 (bit mas 2)	1 = On
BI18	RELAY 3 STATUS	0104 (bit mas 4)	1 = On

<b>N2 Binary Inputs:</b>			
<b>Number</b>	<b>Object</b>	<b>Bypass Parameter</b>	<b>Range</b>
BI19	RELAY 4 STATUS	0104 (bit mas 8)	1 = On
BI20	RELAY 5 STATUS	0104 (bit mas 10h)	1 = On
BI21	BYPASS MODE	Status Word	0 = Drive mode; 1 = Bypass mode
BI22	SYS UNDERLOAD	Status Word	1 = System Underload
BI23	SYS FAULT	Status Word	1 = System Fault
BI24	BYPASS RUNNING	Status Word	1 = Bypass Running

### **N2 Binary Output Objects - Bypass**

The following table lists the N2 Binary Output objects defined for the ABB E-Clipse bypass.

<b>N2 Binary Outputs:</b>			
<b>Number</b>	<b>Object</b>	<b>Bypass Parameter</b>	<b>Range</b>
BO1	SYSTEM START	Command Word	1 = Started
BO2	SYSTEM DISABLE	Command Word	1 = Disable
BO3	SYSTEM RESET	Command Word	Change 0->1 = Fault Reset
BO4	OVERRIDE	Command Word	1 = Override
BO5	COMMAND RO 1	0107 (bit mask 1)	1 = On
BO6	COMMAND RO 2	0107 (bit mask 2)	1 = On
BO7	COMMAND RO 3	0107 (bit mask 4)	1 = On
BO8	COMMAND RO 4	0107 (bit mask 8)	1 = On
BO9	COMMAND RO 5	0107 (bit mask 10h)	1 = On
BO10	START DISABLE 1	Command Word	1 = Disable
BO11	START DISABLE 2	Command Word	1 = Disable
BO12	START DISABLE 3	Command Word	1 = Disable
BO13	START DISABLE 4	Command Word	1 = Disable



**DDL File for NCU - Bypass**

The listing below is the Data Definition Language (DDL) file for ABB E-Clipse bypass used with the Network Control Units.

This listing is useful when defining bypass I/O objects to the Network Controller Units.

Below is the ABB E-Clipse bypass file listing.

```
*****
*   ABB bypass, ACH 550 Variable Frequency Bypass
*****
CSMODEL "E-Clipse_Bypass", "VND"
```

```
AITITLE "Analog Inputs"
BITITLE "Binary Inputs"
AOTITLE "Analog Outputs"
BOTITLE "Binary Outputs"
```

```
CSAI "AI1",N,N,"CURRENT","A"
CSAI "AI2",N,N,"LAST FLT","Code"
CSAI "AI3",N,N,"ALARM WD 1","Code"
CSAI "AI4",N,N,"ALARM WD 2","Code"
CSAI "AI5",N,N,"HAND OF AUTO","Code"

CSBI "BI1",N,N,"SYST RDY","NO","YES"
CSBI "BI2",N,N,"SYST ENBL","DISABLE","ENABLED"
CSBI "BI3",N,N,"SYST STRT","NO","YES"
CSBI "BI4",N,N,"SYST RUN","NO","YES"
CSBI "BI5",N,N,"N2 LCL MD","NO","YES"
CSBI "BI6",N,N,"FAULT","NO","YES"
CSBI "BI7",N,N,"ALARM","NO","YES"
CSBI "BI8",N,N,"N2 CTRL SRC","NO","YES"
CSBI "BI9",N,N,"OVERRIDE","NO","YES"
CSBI "BI10",N,N,"INPUT 1","OFF","ON"
CSBI "BI11",N,N,"INPUT 2","OFF","ON"
CSBI "BI12",N,N,"INPUT 3","OFF","ON"
CSBI "BI13",N,N,"INPUT 4","OFF","ON"
CSBI "BI14",N,N,"INPUT 5","OFF","ON"
CSBI "BI15",N,N,"INPUT 6","OFF","ON"
CSBI "BI16",N,N,"RELAY 1","OFF","ON"
CSBI "BI17",N,N,"RELAY 2","OFF","ON"
CSBI "BI18",N,N,"RELAY 3","OFF","ON"
CSBI "BI19",N,N,"RELAY 4","OFF","ON"
CSBI "BI20",N,N,"RELAY 5","OFF","ON"
CSBI "BI21",N,N,"BP MODE","OFF","ON"
CSBI "BI22",N,N,"SYS ULOAD","NO","YES"
CSBI "BI23",N,N,"SYS FLT","YES","NO"
CSBI "BI24",N,N,"BP RUN","NO","YES"
```

```
CSAO "A01",Y,Y,"BP RUNDLY","S"  
  
CSBO "B01",Y,Y," SYS STRT","STOP","START"  
CSBO "B02",Y,Y,"SYS DSABLE","ENABLE","DISABLE"  
CSBO "B03",Y,Y,"SYS RSET","OFF","RESET"  
CSBO "B04",Y,Y,"OVERRIDE","OFF","OVERRIDE"  
CSBO "B05",Y,Y,"CMD RO 1","OFF","ON"  
CSBO "B06",Y,Y,"CMD RO 2","OFF","ON"  
CSBO "B07",Y,Y,"CMD RO 3","OFF","ON"  
CSBO "B08",Y,Y,"CMD RO 4","OFF","ON"  
CSBO "B09",Y,Y,"CMD RO 5","OFF","ON"  
CSBO "B010",Y,Y,"STRT DSA 1","OFF","ON"  
CSBO "B011",Y,Y,"STRT DSA 2","OFF","ON"  
CSBO "B011",Y,Y,"STRT DSA 3","OFF","ON"  
CSBO "B011",Y,Y,"STRT DSA 4","OFF","ON"
```

## FLN Protocol Technical Data - System

### System Overview

The FLN fieldbus connection to the E-Clipse Bypass system is based on an industry standard RS-485 physical interface. The FLN (Floor Level Network) Fieldbus protocol is a serial communication protocol, used by the Siemens APOGEE® system. The system interface is specified in Siemens application 2734.

### Supported Features

The system supports all required FLN features.

When bypass parameter 1625 COMM CTL = (0) DRIVE ONLY, the drive's FLN points are all supported using the drive's device address. The bypass's FLN points related to the control word are no longer valid.

### Bypass FLN Points Not Valid

Point #	Name
24	RUN.STOP CMD
26	OVERRIDE CMD
35	RUN ENA CMD
50	START ENA 1
51	START ENA 2
52	START ENA 3
53	START ENA 4
94	RESET FAULT

When bypass parameter 1625 COMM CTL = (1) SYSTEM, the drive's FLN following objects related to control are no longer available when using the drive's device address.

### Drive FLN Objects Not Valid

Point #	Name
24	RUN.STOP CMD
35	ENA DIS CMD

## Drive Overview

### Reports

The ACH550 provides seven pre-defined reports. Using a report request generated from the FLN fieldbus controller, select one of the following sets of points. By providing views of selected points, these reports are often easier to work with than views of the full point database.

#### ABB ACH550

FLN ABB ACH550 Report			
Point		Subpoint Name	Data
#	Type		
01	LAO	CTLR ADDRESS	Each host FLN application (e.g. CIS or Insight) controls both the particular data reported for each point, and the report format.
02	LAO	APPLICATION	
20	LAO	OVRD TIME	
29	LDO	DAY.NIGHT	

#### Startup

FLN Startup Report			
Point		Subpoint Name	Data
#	Type		
21	LDI	FWD.REV	Each host FLN application (e.g. CIS or Insight) controls both the particular data reported for each point, and the report format.
22	LDO	CMD FWD.REV	
23	LDI	STOP.RUN	
24	LDO	CMD STP.STRT	
25	LDI	EXT1.2 ACT	
26	LDO	EXT1.2 CMD	
34	LDI	ENA.DIS ACT	
35	LDO	ENA.DIS CMD	
36	LDI	FLN LOC ACT	
60	LAO	INPUT REF1	
61	LAO	INPUT REF2	
68	LDO	FLN LOC CTL	
69	LDO	FLN LOC REF	
94	LDO	RESET FAULT	

Overview

FLN Overview Report			
Point		Subpoint Name	Data
#	Type		
03	LAI	FREQ OUTPUT	Each host FLN application (e.g. CIS or Insight) controls both the particular data reported for each point, and the report format.
04	LAI	PCT OUTPUT	
05	LAI	SPEED	
06	LAI	CURRENT	
07	LAI	TORQUE	
08	LAI	POWER	
09	LAI	DRIVE TEMP	
10	LAI	DRIVE KWH	
11	LAI	DRIVE MWH	
12	LAI	RUN TIME	
13	LAI	DC BUS VOLT	
14	LAI	OUTPUT VOLT	
17	LAI	MOTOR TEMP	
18	LAI	MREV COUNTER	
21	LDI	FWD.REV	
23	LDI	STOP.RUN	
25	LDI	EXT1.2 ACT	
27	LDI	DRIVE READY	
28	LDI	AT SETPOINT	
33	LDI	HANDAUTO ACT	
34	LDI	ENA.DIS ACT	
36	LDI	FLN LOC ACT	

Drive I/O

FLN Drive I/O Report			
Point		Subpoint Name	Data
#	Type		
40	LDO	RO 1 COMMAND	Each host FLN application (e.g. CIS or Insight) controls both the particular data reported for each point, and the report format.
41	LDO	RO 2 COMMAND	
42	LDO	RO 3 COMMAND	
43	LDO	RO 4 COMMAND	
44	LDO	RO 5 COMMAND	
45	LDO	RO 6 COMMAND	
46	LAO	AO 1 COMMAND	
47	LAO	AO 2 COMMAND	
70	LDI	DI 1 ACTUAL	

FLN Drive I/O Report			
Point		Subpoint Name	Data
#	Type		
71	LDI	DI 2 ACTUAL	
72	LDI	DI 3 ACTUAL	
73	LDI	DI 4 ACTUAL	
74	LDI	DI 5 ACTUAL	
75	LDI	DI 6 ACTUAL	
76	LDI	RO 1 ACTUAL	
77	LDI	RO 2 ACTUAL	
78	LDI	RO 3 ACTUAL	
79	LDI	RO 4 ACTUAL	
80	LDI	RO 5 ACTUAL	
81	LDI	RO 6 ACTUAL	
85	LAI	AO 2 ACTUAL	

*Drive Config*

FLN Drive Config. Report			
Point		Subpoint Name	Data
#	Type		
30	LAO	CURRENT LIM	Each host FLN application (e.g. CIS or Insight) controls both the particular data reported for each point, and the report format.
31	LAO	ACCEL TIME 1	
32	LAO	DECEL TIME 1	
48	LDO	RST RUN TIME	
49	LDO	RESET KWH	
59	LDO	LOCK PANEL	
66	LDO	SPD OUT MIN	
67	LDO	SPD OUT MAX	
95	LAO	MBOX PARAM	
96	LAO	MBOX DATA	
97	LDO	MBOX READ	
98	LDO	MBOX WRITE	

*Process PID*

FLN Process PID Report			
Point		Subpoint Name	Data
#	Type		
15	LAI	PRC PID FBCK	Each host FLN application (e.g. CIS or Insight) controls both the particular data reported for each point, and the report format.
16	LAI	PRC PID DEV	
50	LAO	PRC PID GAIN	

FLN Process PID Report			
Point		Subpoint Name	Data
#	Type		
51	LAO	PRC PID ITIM	
52	LAO	PRC PID DTIM	
53	LAO	PRC PID DFIL	
54	LDO	PRC PID SEL	
60	LAO	INPUT REF1	
61	LAO	INPUT REF2	
82	LAI	AI 1 ACTUAL	
83	LAI	AI 2 ACTUAL	
84	LAI	AO 1 ACTUAL	
85	LAI	AO 2 ACTUAL	

*External PID*

FLN External PID Report			
Point		Subpoint Name	Data
#	Type		
55	LAO	EXT PID GAIN	Each host FLN application (e.g. CIS or Insight) controls both the particular data reported for each point, and the report format.
56	LAO	EXT PID ITIM	
57	LAO	EXT PID DTIM	
58	LAO	EXT PID DFIL	
62	LAO	EXT PID STPT	
63	LAI	EXT PID FBCK	
64	LAI	EXT PID DEV	
82	LAI	AI 1 ACTUAL	
83	LAI	AI 2 ACTUAL	
84	LAI	AO 1 ACTUAL	
85	LAI	AO 2 ACTUAL	

**Scaling Drive Feedback Values**

Feedback values are provided with units of percent, where 0% and 100% correspond to the range of the sensor being used to measure the control variable. These points have default units in Hz. If other units are required:

- Unbundle these points with appropriate slopes and intercepts.
- The new intercept equals the lowest value of the desired range.
- Calculate the new slope as follows:

$$\begin{aligned}
 \text{New Slope} &= \frac{(\text{Desired Range, i.e. high - low values}) \times (\text{Slope of Existing Point})}{\text{Range of Existing Point}} \\
 &= \frac{(60 \text{ Hz} - 0 \text{ Hz}) \times (0.01)}{100\% - 0\%} = 0.006
 \end{aligned}$$

*Example* – You are controlling water temperature from a cooling tower using the ACH550 to control a fan. The temperature sensor has a range of 30 to 250 degrees Fahrenheit.

To unbundle the set point (INPUT REF 2), for commanding in degrees Fahrenheit, where 0...60 Hz is equal to 30...250° F:

New Intercept = 30 (the temperature that corresponds to 0%)

$$\begin{aligned} \text{New Slope} &= \frac{(\text{Desired Range}) \times (\text{Slope of Existing Point})}{\text{Range of Existing Point}} \\ &= \frac{(250^\circ \text{ F} - 30^\circ \text{ F}) \times (0.1)}{100\% - 0\%} = 0.22 \end{aligned}$$

To unbundle the feedback (PRC PID FBCK) for monitoring in degrees Fahrenheit:

New Intercept = 30

$$\begin{aligned} \text{New Slope} &= \frac{(\text{Desired Range}) \times (\text{Slope of Existing Point})}{\text{Range of Existing Point}} \\ &= \frac{(250^\circ \text{ F} - 30^\circ \text{ F}) \times (0.01)}{100\% - 0\%} = 0.022 \end{aligned}$$

## Loop Gains

PRC PID GAIN (Point 50) and PRC PID ITIM (Point 51) are PID parameters similar to the P and I gains in the APOGEE TECs. Because the ABB PI loop and the Siemens loop are structured differently, there is no a one-to-one correspondence between the gains. The following formulas allow translation from ABB gains to Siemens gains and vice versa:

- To convert from ABB PI gains to Siemens P and I gains:

$$P \text{ GAIN}_{\text{Siemens}} = PI \text{ GAIN}_{\text{ABB}} \times 0.0015$$

$$I \text{ GAIN}_{\text{Siemens}} = \frac{PI \text{ GAIN}_{\text{ABB}}}{PI \text{ GAIN}_{\text{ABB}}} \times 0.0015$$

- To convert from Siemens P and I gains to ABB PI gains:

$$P \text{ GAIN}_{\text{ABB}} = PI \text{ GAIN}_{\text{Siemens}} \times 667$$

$$I \text{ GAIN}_{\text{ABB}} = \frac{PI \text{ GAIN}_{\text{Siemens}}}{PI \text{ GAIN}_{\text{Siemens}}} \times 667$$



## Point Database

The following table lists the point database for FLN / ACH550 (Application 2734).

FLN Point Database								
Point		Subpoint Name	Factory Default	Engr. Units	Slope	Intercept	On Text	Off Text
#	Type							
01	LAO	CTLR ADDRESS	99	-	1	0	-	-
02	LAO	APPLICATION	2734	-	1		-	-
{03}	LAI	FREQ OUTPUT	0	Hz	0.1	0	-	-
{04}	LAI	PCT OUTPUT	0	PCT	0.1	0	-	-
{05}	LAI	SPEED	0	RPM	1	0	-	-
{06}	LAI	CURRENT	0	A	0.1		-	-
{07}	LAI	TORQUE	0	PCT	0.1	-200	-	-
{08}	LAI	POWER	0 (0)	HP (KW)	0.134 0.1	0 0	-	-
{09}	LAI	DRIVE TEMP	77 (25)	° F (° C)	0.18 (0.1)	32 0	-	-
{10}	LAI	DRIVE KWH	0	KWH	1		-	-
{11}	LAI	DRIVE MWH	0	MWH	1		-	-
{12}	LAI	RUN TIME	0	HRS	1		-	-
{13}	LAI	DC BUS VOLT	0	V	1		-	-
{14}	LAI	OUTPUT VOLT	0	V	1		-	-
{15}	LAI	PRC PID FBCK	0	PCT	0.1		-	-
{16}	LAI	PRC PID DEV	0	PCT	0.1		-	-
{17}	LAI	MOTOR TEMP	77(25)	° F (° C)	1.8 (1)	32 0	-	-
{18}	LAI	MREV COUNTER	0	MREV	1	0	-	-
20	LAO	OVRD TIME	1	hrs	1	0	-	-
{21}	LDI	FWD.REV	FWD	-	1	0	REV	FWD
{22}	LDO	CMD FWD.REV	FWD	-	1	0	REV	FWD
{23}	LDI	STOP.RUN	STOP	-	1	0	RUN	STOP
{24}	LDO	CMD STP.STRT	STOP	-	1	0	RUN	STOP
{25}	LDI	EXT1.2 ACT	EXT1	-	1	0	EXT2	EXT1
{26}	LDO	EXT1.2 CMD	EXT1	-	1	0	EXT2	EXT1
{27}	LDI	DRIVE READY	NOTRDY	-	1	0	READY	NOTRDY
{28}	LDI	AT SETPOINT	NO	-	1	0	YES	NO
{29}	LDO	DAY.NIGHT	DAY	-	1	0	NIGHT	DAY
30	LAO	CURRENT LIM	0	A	0.1	0	-	-
31	LAO	ACCEL TIME 1	300	sec	0.1	0	-	-
32	LAO	DECEL TIME 1	300	sec	0.1	0	-	-
{33}	LDI	HANDAUTO ACT	AUTO	-	1	0	HAND	AUTO

FLN Point Database								
Point		Subpoint Name	Factory Default	Engr. Units	Slope	Intercept	On Text	Off Text
#	Type							
{34}	LDI	ENA.DIS ACT	DISABL	-	1	0	ENABLE	DISABL
{35}	LDO	ENA.DIS CMD	DISABL	-	1	0	ENABLE	DISABL
{36}	LDI	FLN LOC ACT	AUTO	-	1	0	FLN	AUTO
{37}	LDI	CTL SRC	NO	-	1	0	YES	NO
{38}	LDI	FLN REF1 SRC	NO	-	1	0	YES	NO
{39}	LDI	FLN REF2 SRC	NO	-	1	0	YES	NO
{40}	LDO	RO 1 COMMAND	OFF	-	1	0	ON	OFF
{41}	LDO	RO 2 COMMAND	OFF	-	1	0	ON	OFF
{42}	LDO	RO 3 COMMAND	OFF	-	1	0	ON	OFF
{43}	LDO	RO 4 COMMAND	OFF	-	1	0	ON	OFF
{44}	LDO	RO 5 COMMAND	OFF	-	1	0	ON	OFF
{45}	LDO	RO 6 COMMAND	OFF	-	1	0	ON	OFF
{46}	LAO	AO 1 COMMAND	PCT	PCT	0.1	0	-	-
{47}	LAO	AO 2 COMMAND	PCT	PCT	0.1	0	-	-
48	LDO	RST RUN TIME	NO	-	1	0	RESET	NO
49	LDO	RESET KWH	NO	-	1	0	RESET	NO
50	LAO	PRC PID GAIN	10	PCT	0.1	0	-	-
51	LAO	PRC PID ITIM	600	SEC	0.1	0	-	-
52	LAO	PRC PID DTIM	0	SEC	0.1	0	-	-
53	LAO	PRC PID DFIL	10	SEC	0.1	0	-	-
54	LDO	PRC PID SEL	SET1	-	1	0	SET2	SET1
55	LAO	EXT PID GAIN	10	PCT	0.1	0	-	-
56	LAO	EXT PID ITIM	600	SEC	0.1	0	-	-
57	LAO	EXT PID DTIM	0	SEC	0.1	0	-	-
58	LAO	EXT PID DFIL	10	SEC	0.1	0	-	-
59	LDO	LOCK PANEL	UNLOCK	-	1	0	LOCK	UNLOCK
{60}	LAO	INPUT REF1	0	PCT	0.1	0	-	-
{61}	LAO	INPUT REF2	0	PCT	0.1	0	-	-
{62}	LAO	EXT PID STPT	0	PCT	0.1	0	-	-
{63}	LAI	EXT PID FBCK	0	PCT	0.1	0	-	-
{64}	LAI	EXT PID DEV	0	PCT	0.1	0	-	-

FLN Point Database								
Point		Subpoint Name	Factory Default	Engr. Units	Slope	Intercept	On Text	Off Text
#	Type							
66	LDO	SPD OUT MIN	0	PCT	0.1	0	-	-
67	LDO	SPD OUT MAX	1000	PCT	0.1	0	-	-
{68}	LDO	FLN LOC CTL	AUTO	-	1	0	FLN	AUTO
{69}	LDO	FLN LOC REF	AUTO	-	1	0	FLN	AUTO
{70}	LDI	DI 1 ACTUAL	OFF	-	1	0	ON	OFF
{71}	LDI	DI 2 ACTUAL	OFF	-	1	0	ON	OFF
{72}	LDI	DI 3 ACTUAL	OFF	-	1	0	ON	OFF
{73}	LDI	DI 4 ACTUAL	OFF	-	1	0	ON	OFF
{74}	LDI	DI 5 ACTUAL	OFF	-	1	0	ON	OFF
{75}	LDI	DI 6 ACTUAL	OFF	-	1	0	ON	OFF
{76}	LDI	RO 1 ACTUAL	OFF	-	1	0	ON	OFF
{77}	LDI	RO 2 ACTUAL	OFF	-	1	0	ON	OFF
{78}	LDI	RO 3 ACTUAL	OFF	-	1	0	ON	OFF
{79}	LDI	RO 4 ACTUAL	OFF	-	1	0	ON	OFF
{80}	LDI	RO 5 ACTUAL	OFF	-	1	0	ON	OFF
{81}	LDI	RO 6 ACTUAL	OFF	-	1	0	ON	OFF
{82}	LAI	AI 1 ACTUAL	0	PCT	0.1	0	-	-
{83}	LAI	AI 2 ACTUAL	0	PCT	0.1	0	-	-
{84}	LAI	AO 1 ACTUAL	0	MA	0.1	0	-	-
{85}	LAI	AO 2 ACTUAL	0	MA	0.1	0	-	-
{86}	LDI	OK.ALARM	OK	-	1	0	ALARM	OK
{87}	LDI	OK.MAINT	OK	-	1	0	MAINT	OK
{88}	LAI	ALARM WORD 1	-	-	1	0	-	-
{89}	LAI	ALARM WORD 2	-	-	1	0	-	-
{90}	LAI	LAST FAULT	-	-	1	0	-	-
{91}	LAI	PREV FAULT 1	-	-	1	0	-	-
{92}	LAI	PREV FAULT 2	-	-	1	0	-	-
{93}	LDI	OK.FAULT	OK	-	1	0	FAULT	OK
{94}	LDO	RESET FAULT	NO	-	1	0	RESET	NO
{95}	LAO	MBOX PARAM	-	-	1	0	-	-
{96}	LAO	MBOX DATA	-	-	1	0	-	-
{97}	LDO	MBOX READ	DONE	-	1	0	READ	DONE
{98}	LDO	MBOX WRITE	DONE	-	1	0	WRITE	DONE
{99}	LAO	ERROR STATUS	-	-	1	0	-	-

- a. Points not listed are not used in this application.
- b. A single value in a column means that the value is the same in English units and in SI units.
- c. Point numbers that appear in brackets { } may be unbundled at the field panel.

## Detailed Point Descriptions

FLN Detailed Point Descriptions			
Point	Description	Drive Parameter	
1	CTRL ADDRESS	The FLN address of the drive. It can be set by FLN and by the panel.	5302
2	APPLICATION	The Application ID for FLN on the ACH550. This ID is assigned by Siemens for each unique application. It correlates directly to a particular point list approved at the time of release. Therefore, this point list shall remain fixed once approval is granted. Any changes to the point list shall require a new Application ID and re-approval by Siemens. The Application ID assigned to ACH550 is 2934.	
3	FREQ OUTPUT	The output frequency applied to the motor, in Hertz.	0103
4	PCT OUTPUT	The ratio of output frequency or speed to the corresponding maximum rating, depending on control mode. <ul style="list-style-type: none"> <li>For scalar mode, it is the ratio of Output Frequency (parameter 0103) to Maximum Frequency (parameter 2008).</li> <li>For speed mode, it is the ratio Speed (parameter 0102) to Maximum Speed (2002).</li> </ul>	None. This ratio is calculated by the FLN application.
5	SPEED	The calculated speed of the motor, in RPM.	0102
6	CURRENT	The measured output current.	0104
7	TORQUE	The calculated output torque of the motor as a percentage of nominal torque.	0105
8	POWER	The measured output power in KW. The FLN point definition also supports horsepower by selecting English units.	0106
	DRIVE TEMP	The measured heatsink temperature, in ° C. The FLN point definition also supports ° F by selecting English units.	0110
10	DRIVE KWH	The drive's cumulative power consumption in kilowatt-hours. This value may be reset by commanding FLN point 49, RESET KWH.	0115
11	DRIVE MWH	The drive's cumulative power consumption in megawatt hours. This value cannot be reset.	0141
12	RUN TIME	The drive's cumulative run time in hours. This value may be reset by commanding FLN point 48, RESET RUN TIME.	0114
13	DC BUS VOLT	The DC bus voltage level of the drive.	0107
14	OUTPUT VOLT	The AC output voltage applied to the motor.	0109
15	PRC PID FBCK	The Process PID feedback signal.	0130
16	PRC PID DEV	The deviation of the Process PID output signal from its setpoint.	0132
17	MOTOR TEMP	The measured motor temperature as set up in Group 35.	0145
18	ROTATION CNT	The motor's cumulative revolution count, in mega-revolutions.	0142
19	N/A		
20	OVRD TIME	1 of the 5 mandatory FLN points required for compatibility with Siemens control systems. It has no functionality in the drive application.	None

FLN Detailed Point Descriptions			
Point	Description	Drive Parameter	
21	FWD.REV ACT	Indicates the rotational direction of the motor, regardless of control source (1 = REV, 0 = FWD).	
22	FWD.REV CMD	Commanded by FLN to change the rotational direction of the drive. <ul style="list-style-type: none"> <li>Parameter 1001 must be set to COMM for FLN to control the direction of the motor by EXT1.</li> <li>Parameter 1002 must be set to COMM for FLN to control the direction of the motor by EXT2.</li> </ul>	
23	RUN.STOP ACT	Indicates the drive's run status, regardless of control source (1 = RUN, 0 = STOP).	
24	RUN.STOP CMD	Commanded by FLN to start the drive. <ul style="list-style-type: none"> <li>Parameter 1001 must be set to COMM for FLN to control the run state of the drive by EXT1.</li> <li>Parameter 1002 must be set to COMM for FLN to have this control.</li> </ul>	
25	EXT1.2 ACT	Indicates whether External 1 or External 2 is the active control source (1 = EXT2, 0 = EXT1).	
26	EXT1.2 CMD	Commanded by FLN to select External 1 or External 2 as the active control source (1 = EXT2, 0 = EXT1). Parameter 1102 must be set to COMM for FLN to have this control.	
27	DRIVE READY	Indicates the drive is ready to accept a run command (1 = READY, 0 = NOTRDY).	
28	AT SETPOINT	Indicates the drive has reached its commanded setpoint (1 = YES, 0 = NO)	
29	DAY.NIGHT	1 of the 5 mandatory FLN points required for compatibility with Siemens control systems. It has no functionality in the drive application.	None
30	CURRENT LIM	Sets the output current limit of the drive.	2003
31	ACCEL TIME 1	Sets the acceleration time for Ramp 1.	2202
32	DECEL TIME 1	Sets the deceleration time for Ramp 1.	2203
33	HANDAUTO ACT	Indicates whether the drive is in Hand or Auto control (1 = HAND, 0 = AUTO).	
34	ENA.DIS ACT	Indicates the status of the Run Enable command, regardless of its source (1 = ENABLE, 0 = DISABL).	
35	ENA.DIS CMD	Commanded by FLN to assert the Run Enable command (1 = ENABLE, 0 = DISABL). Parameter 1601 must be set to COMM for FLN to have this control.	
36	FLN LOC ACT	Indicates if the drive has been placed in "FLN LOCAL" mode by commanding either point 68 (FLN LOC CTL) or point 69 (FLN LOC REF). Commanding either of these points to FLN (1) "steals" control from its normal source and places in under FLN control. Note that the HAND mode of the panel has priority over FLN local control.	

FLN Detailed Point Descriptions		
Point	Description	Drive Parameter
37	FLN CTL SRC Indicates if FLN is a source for control inputs (1 = YES, 0 = NO). Note that this status point is true if any of the following control inputs are from FLN: Run/Stop, Ext1/2 Select or Run Enable.	
38	FLN REF1 SRC Indicates if FLN is the source for speed reference 1 (1 = YES, 0 = NO).	
39	FLN REF2 SRC Indicates if FLN is the source for speed reference 2 (1 = YES, 0 = NO).	
40	RO1 COMMAND Controls the output state of Relay 1. Parameter 1401 must be set to COMM for FLN to have this control (1 = ON, 0 = OFF).	0134, bit 0
41	RO2 COMMAND Controls the output state of Relay 2. Parameter 1402 must be set to COMM for FLN to have this control (1 = ON, 0 = OFF).	0134, bit 1
42	RO3 COMMAND Controls the output state of Relay 3. Parameter 1403 must be set to COMM for FLN to have this control (1 = ON, 0 = OFF).	0134, bit 2
43	RO4 COMMAND Controls the output state of Relay 4. Access to relay 4 require ACH550 option OREL. Parameter 1410 must be set to COMM for FLN to have this control (1 = ON, 0 = OFF).	0134, bit 3
44	RO5 COMMAND Controls the output state of Relay 5. Access to relay 5 require ACH550 option OREL. Parameter 1411 must be set to COMM for FLN to have this control (1 = ON, 0 = OFF).	0134, bit 4
45	RO6 COMMAND Controls the output state of Relay 6. Access to relay 6 require ACH550 option OREL. Parameter 1412 must be set to COMM for FLN to have this control (1 = ON, 0 = OFF).	0134, bit 5
46	AO1 COMMAND Controls Analog Output 1. Parameter 1501 must be set to this value for FLN to have this control.	0135 (COMM VALUE 1)
47	AO2 COMMAND Controls Analog Output 2. Parameter 1507 must be set to this value for FLN to have this control.	0136 (COMM VALUE 2)
48	RESET RUN TIME Commanded by FLN to reset the cumulative run timer (1 = RESET, 0 = NO). The control input is rising-edge sensitive, so, once the command is issued, this point automatically returns to its inactive state. This "momentary" operation avoids any need for an explicit command to clear the point before a subsequent reset can be issued.	
49	RESET KWH Commanded by FLN to reset the cumulative kilowatt-hour counter (1 = RESET, 0 = NO). The control input is rising-edge sensitive, so, once the command is issued, this point automatically returns to its inactive state. This "momentary" operation avoids any need for an explicit command to clear the point before a subsequent reset can be issued.	

FLN Detailed Point Descriptions			
Point		Description	Drive Parameter
50	PRC PID GAIN	Sets the proportional gain of the active Process PID set, as selected by Point 54, PRC PID SEL (1 = SET2, 0 = SET1).	4001 (SET1) 4101 (SET2)
51	PRC PID ITIM	Sets the integration time of the active Process PID set, as selected by Point 54, PRC PID SEL (1 = SET2, 0 = SET1).	4002 (SET1) 4102 (SET2)
52	PRC PID DTIM	Sets the derivation time of the active Process PID set, as selected by Point 54, PRC PID SEL (1 = SET2, 0 = SET1).	4001 (SET1) 4101 (SET2)
53	PRC PID DFIL	Sets the time constant for the error-derivative of the active Process PID set, as selected by Point 54, PRC PID SEL (1 = SET2, 0 = SET1).	4004 (SET1) 4104 (SET2)
54	PRC PID SEL	Selects the active Process PID set (1 = SET2, 0 = SET1).	4027
55	EXT PID GAIN	Sets the proportional gain of the External PID controller.	4201
56	EXT PID ITIM	Sets the integration time of the External PID controller.	4202
57	EXT PID DTIM	Sets the derivation time of the External PID controller.	4203
58	EXT PID DFIL	Sets the time constant for the error-derivative of the External PID controller.	4204
59	LOCK PANEL	Command by FLN to lock the panel and prevent parameter changes (1 = LOCK, 0 = UNLOCK).	1602
60	INPUT REF 1	Sets Input Reference 1. Parameter 1102 must be set to COMM for FLN to control this value.	
61	INPUT REF 2	Sets Input Reference 2. Parameter 1106 must be set to COMM for FLN to control this value.	
62	EXT PID STPT	The setpoint for the External PID controller. The function of this point requires parameter 4210, PID Setpoint Select, to be set to 19 (Internal).	4211
63	EXT PID FBCK	The External PID feedback signal.	0131
64	EXT PID DEV	The deviation of the External PID output signal from its setpoint.	0133
65	N/A		
66	SPD OUT MIN	Sets the minimum output speed of the drive as a percentage of the motor nominal rating.	2007 (SCALAR) 2001 (SPEED)
67	SPD OUT MAX	Sets the maximum output speed of the drive as a percentage of the motor nominal rating.	2008 (SCALAR) 2002 (SPEED)
68	FLN LOC CTL	Commanded by FLN to temporarily "steal" start/stop control of the drive from its normal source and place it under FLN control. This functionality is analogous to placing the drive in HAND mode at the panel, with the control being taken by FLN instead. HAND mode at the panel has priority over this point. Thus, this point is only effective in temporarily taking control from the digital inputs or some other internal control functionality.	

FLN Detailed Point Descriptions			
Point	Description	Drive Parameter	
69	FLN LOC REF	Commanded by FLN to temporarily "steal" input reference control of the drive from its normal source and place it under FLN control. This functionality is analogous to placing the drive in HAND mode at the panel, with the reference control being taken by FLN instead. HAND mode at the panel has priority over this point. Thus, this point is only effective in temporarily taking control from the analog inputs or some other internal control functionality.	
70	DI 1 ACTUAL	Indicates the status of Digital Input 1 (1 = ON, 0 = OFF).	0118, bit 2
71	DI 2 ACTUAL	Indicates the status of Digital Input 2 (1 = ON, 0 = OFF).	0118, bit 1
72	DI 3 ACTUAL	Indicates the status of Digital Input 3 (1 = ON, 0 = OFF).	0118, bit 0
73	DI 4 ACTUAL	Indicates the status of Digital Input 4 (1 = ON, 0 = OFF).	0119, bit 2
74	DI 5 ACTUAL	Indicates the status of Digital Input 5 (1 = ON, 0 = OFF).	0119, bit 1
75	DI 6 ACTUAL	Indicates the status of Digital Input 6 (1 = ON, 0 = OFF).	0119, bit 0
76	RO 1 ACTUAL	Indicates the status of Relay Output 1 (1 = ON, 0 = OFF).	0122, bit 2
77	RO 2 ACTUAL	Indicates the status of Relay Output 2 (1 = ON, 0 = OFF).	0122, bit 1
78	RO 3 ACTUAL	Indicates the status of Relay Output 3 (1 = ON, 0 = OFF).	0122, bit 0
79	RO 4 ACTUAL	Indicates the status of Relay Output 4 (1 = ON, 0 = OFF).	0123, bit 2
80	RO 5 ACTUAL	Indicates the status of Relay Output 5 (1 = ON, 0 = OFF).	0123, bit 1
81	RO 6 ACTUAL	Indicates the status of Relay Output 6 (1 = ON, 0 = OFF).	0123, bit 0
82	AI 1 ACTUAL	Indicates the input level of Analog Input 1.	0120
83	AI 2 ACTUAL	Indicates the input level of Analog Input 2.	0121
84	AO 1 ACTUAL	Indicates the output level of Analog Output 1.	0124
85	AO 2 ACTUAL	Indicates the output level of Analog Output 2.	0125
86	OK.ALARM	Indicates the current alarm state of the drive (1 = ALARM, 0 = OK).	
87	OK.MAINT	Indicates the current maintenance state of the drive (1 = MAINT, 0 = OK). Maintenance triggers are configured in drive parameter Group 29.	
88	ALARM WORD1	This point is a bit-field indicating active alarms in the drive.	0308
89	ALARM WORD2	This point is a bit-field indicating active alarms in the drive.	0309
90	LAST FAULT	This point is first in the drive's fault log and indicates the most recent fault declared.	0401
91	PREV FAULT 1	This point is second in the drive's fault log and indicates the previous fault declared.	0412
92	PREV FAULT 2	This point is last in the drive's fault log and indicates the oldest fault in the log.	0413
93	OK.FAULT	Indicates the current fault state of the drive (1 = FAULT, 0 = OK).	



FLN Detailed Point Descriptions			
Point		Description	Drive Parameter
94	RESET FAULT	Command by FLN to reset a faulted drive (1 = RESET, 0 = NO). Parameter 1604 must be set to COMM for FLN to control this state. The control input is rising-edge sensitive, so, once the command is issued, this point automatically returns to its inactive state. This "momentary" operation avoids any need for an explicit command to clear the point before a subsequent reset can be issued.	
95	MBOX PARAM	Sets the parameter to be used by the mailbox function.	
96	MBOX DATA	Sets or indicates the data value of the mailbox function.	
97	MBOX READ	Command by FLN to read the parameter value specified by Point 95, MBOX PARAM. The parameter value is returned in Point 96, MBOX DATA. The control input is rising-edge sensitive, so, once the command is issued, this point automatically returns to its inactive state. This "momentary" operation avoids any need for an explicit command to clear the point before a subsequent reset can be issued.	
98	MBOX WRITE	Command by FLN to write the data value specified by Point 96, MBOX DATA, to the parameter value specified by Point 95, MBOX PARAM. The control input is rising-edge sensitive, so, once the command is issued, this point automatically returns to its inactive state. This "momentary" operation avoids any need for an explicit command to clear the point before a subsequent reset can be issued.	
99	ERROR STATUS	1 of the 5 mandatory FLN points required for compatibility with Siemens control systems. It has no functionality in the drive application.	None

## Bypass Overview

The FLN fieldbus connection to the ABB E-Clipse bypass is based on an industry standard EIA 485 physical interface. The FLN (Floor Level Network) Fieldbus protocol is a serial communication protocol, used by the Siemens APOGEE® system. The ABB E-Clipse bypass interface is specified in Siemens application 2734.

### Supported Features

The ABB E-Clipse bypass supports all required FLN features.

## Reports

The ABB E-Clipse bypass provides seven pre-defined reports. Using a report request generated from the FLN fieldbus controller, select one of the following sets of points. By providing views of selected points, these reports are often easier to work with than views of the full point database.

*ABB E-Clipse Bypass*

FLN E-Clipse bypass Report			
Point		Subpoint Name	Data
#	Type		
01	LAO	CTLR ADDRESS	Each host FLN application (e.g. CIS or Insight) controls both the particular data reported for each point, and the report format.
02	LAO	APPLICATION	
20	LAO	OVRD TIME	
29	LDO	DAY.NIGHT	

*Bypass Startup*

FLN Report #1 (STARTUP)		
Point		Subpoint Name
#	Type	
23	LDI	MTR RUNNING
24	LDO	RUN.STOP CMD
27	LDI	SYSTEM READY
28	LDI	SYS STARTED
32	LDI	DRIVE.BYPASS
33	LDI	BYP RUNNING
34	LDI	RUN ENA ACT
35	LDO	RUN ENA CMD
50	LDO	START ENA 1
51	LDO	START ENA 2
52	LDO	START ENA 3
53	LDO	START ENA 4
94	LDO	RESET FAULT

*Bypass Overview*

FLN Overview Report			
Point		Subpoint Name	Data
#	Type		
06	LAI	CURRENT	Each host FLN application (e.g. CIS or Insight) controls both the particular data reported for each point, and the report format.
86	LDI	BYPASS ALARM	
90	LAI	LAST FAULT	
93	LDI	OK FAULT BYP	

Bypass I/O

FLN Bypass I/O Report			
Point		Subpoint Name	Data
#	Type		
40	LDO	RO 1 COMMAND	Each host FLN application (e.g. CIS or Insight) controls both the particular data reported for each point, and the report format.
41	LDO	RO 2 COMMAND	
42	LDO	RO 3 COMMAND	
43	LDO	RO 4 COMMAND	
44	LDO	RO 5 COMMAND	
70	LDI	DI 1 ACTUAL	
71	LDI	DI 2 ACTUAL	
72	LDI	DI 3 ACTUAL	
73	LDI	DI 4 ACTUAL	
74	LDI	DI 5 ACTUAL	
75	LDI	DI 6 ACTUAL	
76	LDI	RO 1 ACTUAL	
77	LDI	RO 2 ACTUAL	
78	LDI	RO 3 ACTUAL	
79	LDI	RO 4 ACTUAL	
80	LDI	RO 5 ACTUAL	

Point Database - Bypass

The following table lists the point database for FLN / ABB E-Clipse bypass (Application 2737).

FLN Point Database								
Point		Subpoint Name	Factory Default	Engr. Units	Slope	Intercept	On Text	Off Text
#	Type							
01	LAO	CTRL ADDRESS	2	-	1	0	-	-
02	LAO	APPLICATION	2737	-	1	0	-	-
{06}	LAI	CURRENT	0	A	0.1	0	-	-
{07}	LDI	SYS UNDRLOAD	NO	-	1	0	[YES]	[NO]
20	LAO	OVRD TIME	1	HRS	1	0	-	-
{23}	LDI	MTR RUNNING	STOP	-	1	0	[RUN]	[STOP]
{24}	LDO	RUN.STOP CMD	STOP	-	1	0	[RUN]	[STOP]
{25}	LDI	OVERRIDE ACT	OFF	-	1	0	[ON]	[OFF]
{26}	LDO	OVERRIDE CMD	OFF	-	1	0	[ON]	[OFF]
{27}	LDI	SYSTEM READY	NOT READY	-	1	0	[READY]	[NOT READY]
{28}	LDI	SYS STARTED	NO	-	1	0	[YES]	[NO]
{29}	LDO	DAY.NIGHT	DAY	-	1	0	[NIGHT]	[DAY]
30	LAO	BYP RUN DLY	0	SEC	1	0	-	-

FLN Point Database								
Point		Subpoint Name	Factory Default	Engr. Units	Slope	Intercept	On Text	Off Text
#	Type							
{31}	LAI	BYPASS MODE	0	-	1	0	-	-
{32}	LDI	DRIVE.BYPASS	DRIVE	-	1	0	[BYPASS]	[DRIVE]
{33}	LDI	BYP RUNNING	NO	-	1	0	[YES]	[NO]
{34}	LDI	RUN ENA ACT	DISABL	-	1	0	[ENABLE]	[DISABL]
{35}	LDO	RUN ENA CMD	DISABL	-	1	0	[ENABLE]	[DISABL]
{36}	LDI	FLN LOC ACT	AUTO	-	1	0	[FLN]	[AUTO]
{37}	LDI	FLN CTL SRC	NO	-	1	0	[YES]	[NO]
{40}	LDO	RO 1 COMMAND	OFF	-	1	0	[ON]	[OFF]
{41}	LDO	RO 2 COMMAND	OFF	-	1	0	[ON]	[OFF]
{42}	LDO	RO 3 COMMAND	OFF	-	1	0	[ON]	[OFF]
{43}	LDO	RO 4 COMMAND	OFF	-	1	0	[ON]	[OFF]
{44}	LDO	RO 5 COMMAND	OFF	-	1	0	[ON]	[OFF]
{50}	LDO	START ENA 1	DISABL	-	1	0	[ENABLE]	[DISABL]
{51}	LDO	START ENA 2	DISABL	-	1	0	[ENABLE]	[DISABL]
{52}	LDO	START ENA 3	DISABL	-	1	0	[ENABLE]	[DISABL]
{53}	LDO	START ENA 4	DISABL	-	1	0	[ENABLE]	[DISABL]
{70}	LDI	DI 1 ACTUAL	OFF	-	1	0	[ON]	[OFF]
{71}	LDI	DI 2 ACTUAL	OFF	-	1	0	[ON]	[OFF]
{72}	LDI	DI 3 ACTUAL	OFF	-	1	0	[ON]	[OFF]
{73}	LDI	DI 4 ACTUAL	OFF	-	1	0	[ON]	[OFF]
{74}	LDI	DI 5 ACTUAL	OFF	-	1	0	[ON]	[OFF]
{75}	LDI	DI 6 ACTUAL	OFF	-	1	0	[ON]	[OFF]
{76}	LDI	RO 1 ACTUAL	OFF	-	1	0	[ON]	[OFF]
{77}	LDI	RO 2 ACTUAL	OFF	-	1	0	[ON]	[OFF]
{78}	LDI	RO 3 ACTUAL	OFF	-	1	0	[ON]	[OFF]
{79}	LDI	RO 4 ACTUAL	OFF	-	1	0	[ON]	[OFF]
{80}	LDI	RO 5 ACTUAL	OFF	-	1	0	[ON]	[OFF]
{86}	LDI	BYPASS ALARM	OK	-	1	0	[ALARM]	[OK]
{88}	LAI	ALARM WORD 1	0	-	1	0	-	-
{89}	LAI	ALARM WORD 2	0	-	1	0	-	-
{90}	LAI	LAST FAULT	-	-	1	0	-	-
{93}	LDI	OK.FAULTBYP	OK	-	1	0	[FAULT]	[OK]
{94}	LDO	RESET FAULT	NO	-	1	0	[RESET]	[NO]
{99}	LAO	ERROR STATUS	-	-	1	0	-	-

a. Points not listed are not used in this application.

b. A single value in a column means that the value is the same in English units and in SI units.

c. Point numbers that appear in brackets { } may be unbundled at the field panel.

## Detailed Point Descriptions

FLN Detailed Point Descriptions			
	Point	Description	Bypass Parameter
1	CTRL ADDRESS	The FLN address of the bypass. It can be set by FLN and by the panel.	5002
2	APPLICATION	This is the Application ID for FLN on the E-Clipse Bypass. This ID is assigned by Siemens for each unique application. It correlates directly to a particular point list approved at the time of release. Therefore, this point list shall remain fixed once approval is granted. Any changes to the point list shall require a new Application ID and re-approval by Siemens. The Application ID assigned to the E-Clipse bypass is 2737.	
{6}	CURRENT	Measured output current.	0101
{7}	SYS UNDRLOAD	This point indicates if the system is in an underload condition. Detection of this condition is done with bypass parameters 3001-3003.	
20	OVRD TIME	This is 1 of 5 mandatory FLN points required for compatibility with Siemens control systems. It has no functionality in the bypass application.	
{23}	MTR RUNNING	This point indicates the system's run status, regardless of control source (1 = RUN, 0 = STOP).	
{24}	RUN.STOP CMD	This point is commanded by FLN to start the system. Bypass parameter 1601 must be set to COMM for FLN to control the run state of the system.	
{25}	OVERRIDE ACT	This point indicates if the bypass is in override 1 or override 2.	
{26}	OVERRID CMD	This point is commanded by FLN to select bypass override 2. Override 2 is configured by parameters in bypass group 17.	
{27}	SYSTEM READY	This point indicates the system is ready to accept a run command (1 = READY, 0 = NOTRDY).	
{28}	SYS STARTED	This point the system has received a run command and is started. It may or may not be running based on the RUN ENABLE status.	
{29}	DAY.NIGHT	This is 1 of 5 mandatory FLN points required for compatibility with Siemens control systems. It has no functionality in the bypass application.	
30	BYP RUN DLY	This allows FLN to delay running of the system after a run command has been issued.	1614
{31}	BYPASS MODE	This point indicates the Hand/Off/Auto status of the bypass. 0=OFF; 1=HAND; 2=AUTO.	
{32}	DRIVE.BYPASS	This point indicates if the system is selected to operate the motor from the drive or from the bypass.	
{33}	BYP RUNNING	This point indicates the bypass's run status. It differs from the system running status in that it only applies to the bypass's status not the logical OR of the drive and bypass status.	
{34}	RUN ENA ACT	This point indicates the status of the system Run Enable command, regardless of its source (1 = ENABLE, 0 = DISABL).	

FLN Detailed Point Descriptions			
Point	Description	Bypass Parameter	
{35}	RUN ENA CMD	This point is commanded by FLN to assert the system Run Enable command (1 = ENABLE, 0 = DISABL). Bypass parameter 1602 must be set to COMM for FLN to have this control.	
{36}	FLN LOC ACT	This point indicates if the bypass has been placed in "FLN LOCAL" mode by commanding ??????. Commanding this point to FLN (1) "steals" control from its normal source and places in under FLN control. Note that the HAND mode of the panel has priority over FLN local control.	
{37}	FLN CTL SRC	This point indicates if FLN is a source for control inputs (1 = YES, 0 = NO). Note that this status point is true if any of the following control inputs are from FLN: Run/Stop, Run Enable, Start Enable 1, Start Enable 2, Start Enable 3 or Start Enable 4.	
{40}	RO 1 COMMAND	This point controls the output state of bypass Relay 1. Bypass parameter 1401 must be set to COMM for FLN to have this control (1 = ON, 0 = OFF).	0107, bit 0
{41}	RO 2 COMMAND	This point controls the output state of bypass Relay 2. Bypass parameter 1401 must be set to COMM for FLN to have this control (1 = ON, 0 = OFF).	0107, bit 1
{42}	RO 3 COMMAND	This point controls the output state of bypass Relay 3. Bypass parameter 1401 must be set to COMM for FLN to have this control (1 = ON, 0 = OFF).	0107, bit 2
{43}	RO 4 COMMAND	This point controls the output state of bypass Relay 4. Bypass parameter 1401 must be set to COMM for FLN to have this control (1 = ON, 0 = OFF).	0107, bit 3
{44}	RO 5 COMMAND	This point controls the output state of bypass Relay 5. Bypass parameter 1401 must be set to COMM for FLN to have this control (1 = ON, 0 = OFF).	0107, bit 4
{50}	START ENA 1	This point is commanded by FLN to assert the system Start Enable 1 command (1 = ENABLE, 0 = DISABL). Bypass parameter 1603 must be set to COMM for FLN to have this control.	
{51}	START ENA 2	This point is commanded by FLN to assert the system Start Enable 1 command (1 = ENABLE, 0 = DISABL). Bypass parameter 1603 must be set to COMM for FLN to have this control.	
{52}	START ENA 3	This point is commanded by FLN to assert the system Start Enable 1 command (1 = ENABLE, 0 = DISABL). Bypass parameter 1603 must be set to COMM for FLN to have this control.	
{53}	START ENA 4	This point is commanded by FLN to assert the system Start Enable 1 command (1 = ENABLE, 0 = DISABL). Bypass parameter 1603 must be set to COMM for FLN to have this control.	
{70}	DI 1 ACTUAL	This point indicates the status of bypass Digital Input 1 (1 = ON, 0 = OFF).	0103, bit 5
{71}	DI 2 ACTUAL	This point indicates the status of bypass Digital Input 2 (1 = ON, 0 = OFF).	0103, bit 4
{72}	DI 3 ACTUAL	This point indicates the status of bypass Digital Input 3 (1 = ON, 0 = OFF).	0103, bit 3

FLN Detailed Point Descriptions			
Point		Description	Bypass Parameter
{73}	DI 4 ACTUAL	This point indicates the status of bypass Digital Input 4 (1 = ON, 0 = OFF).	0103, bit 2
{74}	DI 5 ACTUAL	This point indicates the status of bypass Digital Input 5 (1 = ON, 0 = OFF).	0103, bit 1
{75}	DI 6 ACTUAL	This point indicates the status of bypass Digital Input 6 (1 = ON, 0 = OFF).	0103, bit 0
{76}	RO 1 ACTUAL	This point indicates the status of bypass Relay Output 1 (1 = ON, 0 = OFF).	0104, bit 4
{77}	RO 2 ACTUAL	This point indicates the status of bypass Relay Output 2 (1 = ON, 0 = OFF).	0104, bit 3
{78}	RO 3 ACTUAL	This point indicates the status of bypass Relay Output 3 (1 = ON, 0 = OFF).	0104, bit 2
{79}	RO 4 ACTUAL	This point indicates the status of bypass Relay Output 4 (1 = ON, 0 = OFF).	0104, bit 1
{80}	RO 5 ACTUAL	This point indicates the status of bypass Relay Output 5 (1 = ON, 0 = OFF).	0104, bit 0
86	BYPASS ALARM	This point indicates the current alarm state of the bypass (1 = ALARM, 0 = OK).	
88	ALARM WORD1	This point is a bit-field indicating active alarms in the bypass.	0308
89	ALARM WORD2	This point is a bit-field indicating active alarms in the bypass.	0309
90	LAST FAULT	This point is first in the bypass's fault log and indicates the most recent fault declared.	0401
93	OK.FAULT BYP	This point indicates the current fault state of the bypass (1 = FAULT, 0 = OK).	
94	RESET FAULT	This point is commanded by FLN to reset a faulted bypass (1 = RESET, 0 = NO). Bypass parameter 1607 must be set to COMM for FLN to control this state. This point is "momentary", i.e. it will automatically return to its inactive state once the command is issued. This is a convenience for the user, since this control input is rising-edge sensitive and would otherwise require an explicit command to clear it before a subsequent reset could be issued.	
99	ERROR STATUS	This is 1 of 5 mandatory FLN points required for compatibility with Siemens control systems. It has no functionality in the bypass application.	

## BACnet Protocol Technical Data — System

### System Overview -

When bypass parameter 1625 COMM CTL = (0) DRIVE ONLY, the drive's BACnet objects are all supported using the drive's device address. The bypass's BACnet objects related to the control word are no longer valid.

#### *Bypass BACnet Objects Not Valid*

Point #	Name
BV10	RUN/STOP CMD
BV11	OVERRIDE CMD
BV12	RUN ENA CMD
BV14	FAULT RESET
BV15	START ENA 1
BV16	START ENA 2
BV17	START ENA 3
BV18	START ENA 4

When bypass parameter 1625 COMM CTL = (1) SYSTEM, the drive's BACnet following objects related to control are no longer available when using the drive's device address.

#### *Drive BACnet Objects Not Valid*

Point #	Name
BV10	RUN/STOP CMD
BV12	RUN ENA CMD
BV20	START ENABLE 1
BV21	START ENABLE 2

### Drive Overview

Bypass 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 bypass 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. <sup>1</sup>
5303	EFB BAUD RATE	38400	This parameter sets the BACnet MS/TP baud rate.



Parameter		Default Value	BACnet-specific Description
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: <ul style="list-style-type: none"> <li>• IDLE – BACnet channel is configured but not receiving messages.</li> <li>• TIMEOUT – Time between valid messages has exceeded the interval set by parameter 3019.</li> <li>• OFFLINE – BACnet channel is receiving messages NOT addressed to this drive.</li> <li>• ONLINE – BACnet channel is receiving messages addressed to this drive.</li> <li>• RESET – BACnet channel is in reset.</li> <li>• LISTEN ONLY – BACnet channel is in listen-only mode.</li> </ul>
5310	EFB PAR 10	5	This parameter sets the BACnet MS/TP response turn-around time, in milliseconds.
5311	EFB PAR 11	0	This parameter, together with parameter 5317, EFB PAR 17, sets BACnet object instance IDs: <ul style="list-style-type: none"> <li>• 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.</li> <li>• For IDs &gt; 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/</li> </ul>
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.

Parameter		Default Value	BACnet-specific Description
5318	EFB PAR 18...20		N/A - Not supported with BACnet protocol.
...			
5320			

Note: The system will function as a master/slave with MAC ID's in the range of 1-127. With MAC ID settings of 128-254, the drive is in slave only mode.

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

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

### Quick-Start Sequence - Drive Communications

The following steps summarize the process for enabling and configuring BACnet on the ABB E-Clipse Bypass:

1. Enable BACnet protocol: Set bypass parameter 9802, COMM PROTOCOL SEL = BACNET (5).
  - To confirm this selection, read bypass parameter 5301, EFB PROTOCOL ID. It should read x5xx (where "x" is any value).
2. Place the BACnet channel in "reset": Set bypass 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 bypass parameter 5303, EFB BAUD RATE = appropriate value
4. Define the Device Object instance.
  - To define a specific device object instance value, use bypass parameters 5311 and 5317 (object instance values must be unique and in the range 1 to 4,194,303).
  - To use the bypass' MS/TP MAC ID as the device object instance value, set bypass parameter 5311 and 5317 = 0.
5. Define a unique MS/TP MAC ID. Set bypass 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, bypass parameter 5316, EFB PAR 16 (the MS/TP token counter), should be continually increasing.
- Bypass 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 system data required for control (drive only or system)
- 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.

### Start/Stop Direction Control - Drive

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.

Bypass Parameter		Value	Description	BACnet Access Point
1601	START/STOP	2 (COMM)	Start/Stop by fieldbus with Ext1 or Ext2 <sup>2</sup> selected	BV10
1625	COMM CONTROL	0 (Drive Only) 1 (System)	1625 = 0 for control signals (Start/Stop and enables) go to drive only 1625 = 1 for control signals to go to the system (drive or bypass, depending on keypad mode selection)	N/A

Note: <sup>2</sup> 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 <sup>2</sup>	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

Note: <sup>2</sup> Ext1 = Ref 1

Ext 2 = Ref 2; Ref 2 normally used for PID setpoint commands.

## Drive 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 <sup>3</sup>	RELAY OUTPUT 4	COMM (35)	Relay Output 4 controlled by fieldbus.	BO3
1411 <sup>3</sup>	RELAY OUTPUT 5	COMM (35)	Relay Output 5 controlled by fieldbus.	BO4
1412 <sup>3</sup>	RELAY OUTPUT 6	COMM (35)	Relay Output 6 controlled by fieldbus.	BO5

Note: 3. 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

## 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

Drive Parameter		BACnet Access Point
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

## Drive Overview

# Protocol Implementation Conformance Statement (PICS) - Drive

## 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” as the 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.

<b>BACnet Protocol Implementation Conformance Statement</b>	
<b>Date:</b>	November 1, 2006
<b>Vendor Name:</b>	ABB, Inc.
<b>Product Name:</b>	Low Voltage AC Motor Drive
<b>Product Model Number:</b>	ACH550
<b>Applications Software Version:</b>	0506
<b>Firmware Revision:</b>	310D
<b>BACnet Protocol Revision:</b>	4
<b>Product Description:</b>	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.
<b>BACnet Standardized Device Profile (Annex L):</b>	<input type="checkbox"/> BACnet Operator Workstation (B-OWS) <input type="checkbox"/> BACnet Building Controller (B-BC) <input type="checkbox"/> BACnet Advanced Application Controller (B-AAC) <input checked="" type="checkbox"/> BACnet Application Specific Controller (B-ASC) <input type="checkbox"/> BACnet Smart Sensor (B-SS) <input type="checkbox"/> BACnet Smart Actuator (B-SA)
<b>List all BACnet Interoperability Building Blocks Supported (Annex K):</b>	DS-RP-B, DS-WP-B, DM-DDB-B, DM-DOB-B, DM-DCC-B, DM-RD-B.
<b>Segmentation Capability:</b>	<input type="checkbox"/> Segmented requests supported. Window Size ____ <input type="checkbox"/> Segmented responses supported. Window Size ____
<b>Standard Object Types Supported:</b> 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 83.



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

## Object Definitions - Drive

### 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 - Drive

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 - Drive

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 - Drive

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: <ul style="list-style-type: none"> <li>Parameter 1001 value = COMM for control by EXT1 or</li> <li>Parameter 1002 value = COMM for control by EXT2.</li> </ul>	RUN/STOP	C
BV11	FWD/REV CMD	This object commands a motor rotation direction change. Control requires 1003 = REQUEST and either: <ul style="list-style-type: none"> <li>Parameter 1001 value = COMM for control by EXT1 or</li> <li>Parameter 1002 value = COMM for control by EXT2.</li> </ul>	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 - Drive

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 - Drive

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 - Drive

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
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

Instance ID	Object Name	Description	Units	Present Value Access Type
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: <ul style="list-style-type: none"> <li>Input Reference 2. Control requires parameter 1106 value = COMM.</li> <li>Process PID setpoint. Control requires parameter 1106 value = PID1 OUT and parameter 4010 value = COMM.</li> </ul>	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
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



Instance ID	Object Name	Description	Units	Present Value Access Type
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

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

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## Bypass Overview

### BACnet Binary Input Object Summary - Bypass

Bypass Binary Input Objects				
Instance ID	Object Name	Description	Active/Inactive Text	Present Value Access Type
BI0	RO 1 ACT	This object indicates the status of bypass Relay Output 1	ON/OFF	R
BI1	RO 2 ACT	This object indicates the status of bypass Relay Output 2	ON/OFF	R
BI2	RO 3 ACT	This object indicates the status of bypass Relay Output 3	ON/OFF	R
BI3	RO 4 ACT	This object indicates the status of bypass Relay Output 4	ON/OFF	R
BI4	RO 5 ACT	This object indicates the status of bypass Relay Output 5	ON/OFF	R
BI5	DI 1 ACT	This object indicates the status of bypass Digital Input 1	ON/OFF	R
BI6	DI 2 ACT	This object indicates the status of bypass Digital Input 2	ON/OFF	R
BI7	DI 3 ACT	This object indicates the status of bypass Digital Input 3	ON/OFF	R
BI8	DI 4 ACT	This object indicates the status of bypass Digital Input 4	ON/OFF	R
BI9	DI 5 ACT	This object indicates the status of bypass Digital Input 5	ON/OFF	R
BI10	DI 6 ACT	This object indicates the status of bypass Digital Input 6	ON/OFF	R

### BACnet Binary Output Object Summary - Bypass

Bypass Binary Output Objects				
Instance ID	Object Name	Description	Active/Inactive Text	Present Value Access Type
BO0	RO1 COMMAND	This object controls the output state of bypass Relay Output 1 This control requires that bypass parameter 1401 value = COMM	ON/OFF	C
BO1	RO2 COMMAND	This object controls the output state of bypass Relay Output 2 This control requires that bypass parameter 1404 value = COMM	ON/OFF	C
BO2	RO3 COMMAND	This object controls the output state of bypass Relay Output 3 This control requires that bypass parameter 1407 value = COMM	ON/OFF	C

<b>Bypass Binary Output Objects</b>				
<b>Instance ID</b>	<b>Object Name</b>	<b>Description</b>	<b>Active/ Inactive Text</b>	<b>Present Value Access Type</b>
BO3	RO4 COMMAND	This object controls the output state of bypass Relay Output 4 This control requires that bypass parameter 1410 value = COMM	ON/OFF	C
BO4	RO5 COMMAND	This object controls the output state of bypass Relay Output 5 This control requires that bypass parameter 1413 value = COMM	ON/OFF	C

**BACnet Binary Value Object Summary - Bypass**

<b>Bypass Binary Value Objects</b>				
<b>Instance ID</b>	<b>Object Name</b>	<b>Description</b>	<b>Active/ Inactive Text</b>	<b>Present Value Access Type</b>
BV0	SYS RUN ACT	This Object indicates the system run status regardless of the control source.	RUN/ STOP	R
BV1	SYS START ACT	This Object indicates the system started status regardless of the control source.	START/ NO START	R
BV2	BYP FLT ACT	This Object indicates the bypass fault status.	FAULT/ OK	R
BV3	SYS FLT ACT	This Object indicates the system fault status.	FAULT/ OK	R
BV4	SYSTEM MODE	This Object indicates if the bypass or the drive is controlling the motor.	BYPASS/ DRIVE	R
BV5	ALARM ACT	This Object indicates the bypass alarm status.	ALARM/ OK	R
BV6	BYP RUN ACT	This Object indicates the bypass run status regardless of the control source.	RUN/ STOP	R
BV7	READY TO RUN	This Object indicates whether the system is ready to receive a run command.	READY/ NO READY	R
BV8	UNDERLOAD	This Object indicates whether the system is in an underload condition.	YES/NO	R
BV9	RUN ENA ACT	This Object indicates if the Run Enable status regardless of the control source.	ENABLE/ DISABLE	R
BV10	RUN/STOP CMD	This Object commands a system start. This requires bypass parameter 16.01 value = COMM for BACnet to control.	RUN/ STOP	C
BV11	OVERRIDE CMD	This Object commands the system to an override 2 condition. This requires bypass parameter 17.01 value = COMM for BACnet to control.	YES/NO	C
BV12	RUN ENA CMD	This Object commands the system Run Enable. This requires bypass parameter 16.02 value = COMM for BACnet to control.	ENABLE/ DISABLE	C
BV13	OVERRIDE ACT	This Object indicates if bypass override 1 or bypass override 2 is active regardless of the control source.	YES/NO	R
BV14	FAULT RESET	This Object resets a faulted bypass. This requires bypass parameter 16.07 value = COMM for BACnet to control.	RESET/ NO	C
BV15	START ENABLE 1	This Object commands the system Start Enable 1. This requires bypass parameter 16.03 value = COMM for BACnet to control.	ENABLE/ DISABLE	C

<b>Bypass Binary Value Objects</b>				
<b>Instance ID</b>	<b>Object Name</b>	<b>Description</b>	<b>Active/ Inactive Text</b>	<b>Present Value Access Type</b>
BV16	START ENABLE 2	This Object commands the system Start Enable 2. This requires bypass parameter 16.04 value = COMM for BACnet to control.	ENABLE/ DISABLE	C
BV17	START ENABLE 3	This Object commands the system Start Enable 3. This requires bypass parameter 16.05 value = COMM for BACnet to control.	ENABLE/ DISABLE	C
BV18	START ENABLE 4	This Object commands the system Start Enable 4. This requires bypass parameter 16.06 value = COMM for BACnet to control.	ENABLE/ DISABLE	C

### BACnet Analog Value Object Summary - Bypass

<b>Bypass Analog Value Objects</b>				
<b>Instance ID</b>	<b>Object Name</b>	<b>Description</b>	<b>Active/ Inactive Text</b>	<b>Present Value Access Type</b>
AV0	CURRENT	This Object indicates the measured output current. The corresponding bypass parameter is 0101.	Amps	R
AV1	BYPASS MODE	This Object indicates the Hand/Off/Auto status of the bypass. 0=OFF; 1=HAND; 2=AUTO.	None	R
AV2	BYP RUN DLY	This Object sets the bypass Run delay. The corresponding bypass parameter is 1614	Secs	W
AV3	LAST FLT	This Object indicates the last fault recorded by the bypass. The corresponding bypass parameter is 0401	None	R
AV4	ALARM WORD 1	This Object indicates the first alarm status word of the bypass. The corresponding bypass parameter is 0308	None	R
AV5	ALARM WORD 2	This Object indicates the first alarm status word of the bypass. The corresponding bypass parameter is 0309	None	R

<b>BACnet Protocol Implementation Conformance Statement</b>	
<b>Date:</b>	March 1, 2008
<b>Vendor Name:</b>	ABB, Inc.
<b>Product Name:</b>	ABB E-Clipse Bypass
<b>Product Model Number:</b>	VCR, VDR, BCR, and BDR
<b>Applications Software Version:</b>	0.92
<b>Firmware Revision:</b>	1501
<b>BACnet Protocol Revision:</b>	4
<b>Product Description:</b>	The ABB E-Clipse Bypass is an optional feature to the ACH550 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 and bypass can be fully controlled as a standard adjustable frequency drive and a constant speed drive bypass. In addition, up to 24 configurable I/O are available over BACnet to the user application.
<b>BACnet Standardized Device Profile (Annex L):</b>	<input type="checkbox"/> BACnet Operator Workstation (B-OWS) <input type="checkbox"/> BACnet Building Controller (B-BC) <input type="checkbox"/> BACnet Advanced Application Controller (B-AAC) <input checked="" type="checkbox"/> BACnet Application Specific Controller (B-ASC) <input type="checkbox"/> BACnet Smart Sensor (B-SS) <input type="checkbox"/> BACnet Smart Actuator (B-SA)
<b>List all BACnet Interoperability Building Blocks Supported (Annex K):</b>	DS-RP-B, DS-WP-B, DM-DDB-B, DM-DOB-B, DM-DCC-B, DM-RD-B
<b>Segmentation Capability:</b>	<input type="checkbox"/> Segmented requests supported. Window Size ____ <input type="checkbox"/> Segmented responses supported. Window Size ____
<b>Standard Object Types Supported:</b>	Object instantiation is static, i.e. objects cannot be created or deleted. Refer to tables at end of this document for object details.
<b>Data Link Layer Options:</b>	<input type="checkbox"/> BACnet IP, (Annex J) <input type="checkbox"/> BACnet IP, (Annex J), Foreign Device <input type="checkbox"/> ISO 8802-3, Ethernet (Clause 7) <input type="checkbox"/> ANSI/ATA 878.1, 2.5 Mb. ARCNET (Clause 8) <input type="checkbox"/> ANSI/ATA 878.1, RS-485 ARCNET (Clause 8), baud rate(s) ____ <input checked="" type="checkbox"/> MS/TP master (Clause 9), baud rate(s): 9600, 19200, 38400, 76800 <input type="checkbox"/> MS/TP slave (Clause 9), baud rate(s): ____ <input type="checkbox"/> Point-To-Point, EIA 232 (Clause 10), baud rate(s): ____ <input type="checkbox"/> Point-To-Point, modem, (Clause 10), baud rate(s): ____ <input type="checkbox"/> LonTalk, (Clause 11), medium: _____ <input type="checkbox"/> Other: _____
<b>Device Address Binding:</b> Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.)	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

<b>BACnet Protocol Implementation Conformance Statement</b>	
<b>Networking Options:</b>	<input type="checkbox"/> Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc. <input type="checkbox"/> Annex H, BACnet Tunneling Router over IP <input type="checkbox"/> BACnet/IP Broadcast Management Device (BBMD)
<b>Does the BBMD support registrations by Foreign Devices?</b>	<input type="checkbox"/> Yes <input type="checkbox"/> No
<b>Character Sets Supported:</b> Indicating support for multiple character sets does not imply that they can all be supported simultaneously.	<input checked="" type="checkbox"/> ANSI X3.4 <input type="checkbox"/> IBM™/Microsoft™ DBCS <input type="checkbox"/> ISO 8859-1 <input type="checkbox"/> ISO 10646 (UCS-2) <input type="checkbox"/> ISO 10646 (UCS-4) <input type="checkbox"/> JIS C 6226
<b>If this product is a communication gateway, describe the types of non-BACnet equipment/networks(s) that the gateway supports:</b>	

## 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



### BACnet Input Object Instance Summary

The following table summarizes the Binary Input Objects supported:

Bypass Binary Input Objects				
Instance ID	Object Name	Description	Active/ Inactive Text	Present Value Access Type
BI0	RO 1 ACT	This object indicates the status of bypass Relay Output 1	ON/OFF	R
BI1	RO 2 ACT	This object indicates the status of bypass Relay Output 2	ON/OFF	R
BI2	RO 3 ACT	This object indicates the status of bypass Relay Output 3	ON/OFF	R
BI3	RO 4 ACT	This object indicates the status of bypass Relay Output 4	ON/OFF	R
BI4	RO 5 ACT	This object indicates the status of bypass Relay Output 5	ON/OFF	R
BI5	DI 1 ACT	This object indicates the status of bypass Digital Input 1	ON/OFF	R
BI6	DI 2 ACT	This object indicates the status of bypass Digital Input 2	ON/OFF	R
BI7	DI 3 ACT	This object indicates the status of bypass Digital Input 3	ON/OFF	R
BI8	DI 4 ACT	This object indicates the status of bypass Digital Input 4	ON/OFF	R
BI9	DI 5 ACT	This object indicates the status of bypass Digital Input 5	ON/OFF	R
BI10	DI 6 ACT	This object indicates the status of bypass Digital Input 6	ON/OFF	R

NOTE: For Present Value Access Types, R= Ready Only, W= Writable, C = Commandable. Commandable values support priority arrays and relinquish defaults

### BACnet Output Object Instance Summary

The following table summarizes the Binary Output Objects supported:

Bypass Binary Output Objects				
Instance ID	Object Name	Description	Active/ Inactive Text	Present Value Access Type
BO0	RO1 COMMAND	This object controls the output state of bypass Relay Output 1 This control requires that bypass parameter 1401 value = COMM	ON/OFF	C
BO1	RO2 COMMAND	This object controls the output state of bypass Relay Output 2 This control requires that bypass parameter 1404 value = COMM	ON/OFF	C

Bypass Binary Output Objects				
Instance ID	Object Name	Description	Active/ Inactive Text	Present Value Access Type
BO2	RO3 COMMAND	This object controls the output state of bypass Relay Output 3 This control requires that bypass parameter 1407 value = COMM	ON/OFF	C
BO3	RO4 COMMAND	This object controls the output state of bypass Relay Output 4 This control requires that bypass parameter 1410 value = COMM	ON/OFF	C
BO4	RO5 COMMAND	This object controls the output state of bypass Relay Output 5 This control requires that bypass parameter 1413 value = COMM	ON/OFF	C

NOTE: For Present Value Access Types, R= Ready Only, W= Writable, C = Commandable. Commandable values support priority arrays and relinquish defaults

### BACnet Value Object Instance Summary

The following table summarizes the Binary Input Objects supported:

Bypass Binary Value Objects				
Instance ID	Object Name	Description	Active/ Inactive Text	Present Value Access Type
BV0	SYS RUN ACT	This Object indicates the system run status regardless of the control source.	RUN/ STOP	R
BV1	SYS START ACT	This Object indicates the system started status regardless of the control source.	START/ NO START	R
BV2	BYP FLT ACT	This Object indicates the bypass fault status.	FAULT/ OK	R
BV3	SYS FLT ACT	This Object indicates the system fault status.	FAULT/ OK	R
BV4	SYSTEM MODE	This Object indicates if the bypass or the drive is controlling the motor.	BYPASS/ DRIVE	R
BV5	ALARM ACT	This Object indicates the bypass alarm status.	ALARM/ OK	R
BV6	BYP RUN ACT	This Object indicates the bypass run status regardless of the control source.	RUN/ STOP	R
BV7	READY TO RUN	This Object indicates whether the system is ready to receive a run command.	READY/ NO READY	R
BV8	UNDERLOAD	This Object indicates whether the system is in an underload condition.	YES/NO	R
BV9	RUN ENA ACT	This Object indicates if the Run Enable status regardless of the control source.	ENABLE/ DISABLE	R

Bypass Binary Value Objects				
Instance ID	Object Name	Description	Active/ Inactive Text	Present Value Access Type
BV10	RUN/STOP CMD	This Object commands a system start. This requires bypass parameter 16.01 value = COMM for BACnet to control.	RUN/ STOP	C
BV11	OVERRIDE CMD	This Object commands the system to an override 2 condition. This requires bypass parameter 17.01 value = COMM for BACnet to control.	YES/NO	C
BV12	RUN ENA CMD	This Object commands the system Run Enable. This requires bypass parameter 16.02 value = COMM for BACnet to control.	ENABLE/ DISABLE	C
BV13	OVERRIDE ACT	This Object indicates if bypass override 1 or bypass override 2 is active regardless of the control source.	YES/NO	R
BV14	FAULT RESET	This Object resets a faulted bypass. This requires bypass parameter 16.07 value = COMM for BACnet to control.	RESET/ NO	C
BV15	START ENABLE 1	This Object commands the system Start Enable 1. This requires bypass parameter 16.03 value = COMM for BACnet to control.	ENABLE/ DISABLE	C
BV16	START ENABLE 2	This Object commands the system Start Enable 2. This requires bypass parameter 16.04 value = COMM for BACnet to control.	ENABLE/ DISABLE	C
BV17	START ENABLE 3	This Object commands the system Start Enable 3. This requires bypass parameter 16.05 value = COMM for BACnet to control.	ENABLE/ DISABLE	C
BV18	START ENABLE 4	This Object commands the system Start Enable 4. This requires bypass parameter 16.06 value = COMM for BACnet to control.	ENABLE/ DISABLE	C

NOTE: For Present Value Access Types, R= Ready Only, W= Writable, C = Commandable. Commandable values support priority arrays and relinquish defaults

**BACnet Analog Value Object Instance Summary**

Bypass Analog Value Objects				
Instance ID	Object Name	Description	Active/ Inactive Text	Present Value Access Type
AV0	CURRENT	This Object indicates the measured output current. The corresponding bypass parameter is 0101.	Amps	R
AV1	BYPASS MODE	This Object indicates the Hand/Off/Auto status of the bypass. 0=OFF; 1=HAND; 2=AUTO.	None	R

<b>Bypass Analog Value Objects</b>				
<b>Instance ID</b>	<b>Object Name</b>	<b>Description</b>	<b>Active/Inactive Text</b>	<b>Present Value Access Type</b>
AV2	BYP RUN DLY	This Object sets the bypass Run delay. The corresponding bypass parameter is 1614	Secs	W
AV3	LAST FLT	This Object indicates the last fault recorded by the bypass. The corresponding bypass parameter is 0401	None	R
AV4	ALARM WORD 1	This Object indicates the first alarm status word of the bypass. The corresponding bypass parameter is 0308	None	R
AV5	ALARM WORD 2	This Object indicates the first alarm status word of the bypass. The corresponding bypass parameter is 0309	None	R

## Modbus Protocol Technical Data - System

### System Overview

The Modbus® protocol was introduced by Modicon, Inc. for use in control environments featuring Modicon programmable controllers. Due to its ease of use and implementation, this common PLC language was quickly adopted as a de-facto standard for integration of a wide variety of master controllers and slave devices.

Modbus is a serial, asynchronous protocol. Transactions are half-duplex, featuring a single Master controlling one or more Slaves. While RS232 can be used for point-to-point communication between a single Master and a single Slave, a more common implementation features a multi-drop EIA 485 network with a single Master controlling multiple Slaves. The ABB E-Clipse bypass features EIA 485 for its Modbus physical interface.

### RTU

The Modbus specification defines two distinct transmission modes: ASCII and RTU. The ABB E-Clipse Bypass supports RTU only.

### Feature Summary

The following Modbus function codes are supported by the system.

Function	Code (Hex)	Description
Read Coil Status	0x01	Read discrete output status. For the system, the individual bits of the control word are mapped to Coils 1...16. Relay outputs are mapped sequentially beginning with Coil 33 (e.g. RO1=Coil 33).
Read Discrete Input Status	0x02	Read discrete inputs status. For the system, the individual bits of the status word are mapped to Inputs 1...16 or 1...32, depending on the active profile. Terminal inputs are mapped sequentially beginning with Input 33 (e.g. DI1=Input 33).
Read Multiple Holding Registers	0x03	Read multiple holding registers. For the system, the entire parameter set is mapped as holding registers, as well as command, status and reference values.
Read Multiple Input Registers	0x04	Read multiple input registers. For the system, the 2 analog input channels are mapped as input registers 1 & 2.
Force Single Coil	0x05	Write a single discrete output. For the system, the individual bits of the control word are mapped to Coils 1...16. Relay outputs are mapped sequentially beginning with Coil 33 (e.g. RO1=Coil 33).
Write Single Holding Register	0x06	Write single holding register. For the system, the entire parameter set is mapped as holding registers, as well as command, status and reference values.
Diagnostics	0x08	Perform Modbus diagnostics. Subcodes for Query (0x00), Restart (0x01) & Listen Only (0x04) are supported.
Force Multiple Coils	0x0F	Write multiple discrete outputs. For the system, the individual bits of the control word are mapped to Coils 1...16. Relay outputs are mapped sequentially beginning with Coil 33 (e.g. RO1=Coil 33).
Write Multiple Holding Registers	0x10	Write multiple holding registers. For the system, the entire parameter set is mapped as holding registers, as well as command, status and reference values.
Read/Write Multiple Holding Registers	0x17	This function combines functions 0x03 and 0x10 into a single command.

## Mapping Summary

The following table summarizes the mapping between the system (parameters and I/O) and Modbus reference space. For details, see "Modbus Addressing" below.

ABB E-Clipse bypass system	Modbus Reference	Supported Function Codes
<ul style="list-style-type: none"> <li>Control Bits</li> <li>Relay Outputs</li> </ul>	Coils(0xxxx)	<ul style="list-style-type: none"> <li>01 – Read Coil Status</li> <li>05 – Force Single Coil</li> <li>15 – Force Multiple Coils</li> </ul>
<ul style="list-style-type: none"> <li>Status Bits</li> <li>Discrete Inputs</li> </ul>	Discrete Inputs(1xxxx)	<ul style="list-style-type: none"> <li>02 – Read Input Status</li> </ul>
<ul style="list-style-type: none"> <li>Analog Inputs</li> </ul>	Input Registers(3xxxx)	<ul style="list-style-type: none"> <li>04 – Read Input Registers</li> </ul>
<ul style="list-style-type: none"> <li>Parameters</li> <li>Control/Status Words</li> <li>References</li> </ul>	Holding Registers(4xxxx)	<ul style="list-style-type: none"> <li>03 – Read 4X Registers</li> <li>06 – Preset Single 4X Register</li> <li>16 – Preset Multiple 4X Registers</li> <li>23 – Read/Write 4X Registers</li> </ul>

## Drive Overview

### Communication Profiles

When communicating by Modbus, the drive supports multiple profiles for control and status information. Bypass parameter 5305 (EFB CTRL PROFILE) selects the profile used. If bypass parameter 1625 = (1) SYSTEM then the drive and bypass profile are fixed ABB BYPASS PROFILE. See section Bypass Overview for ABB BYPASS PROFILE

- ABB DRV LIM – The primary (and default) profile is the ABB DRV LIM profile, which standardizes the control interface with ACH400 drive. This profile is based on the PROFIBUS interface, and is discussed in detail in the following sections.
- DCU PROFILE – Another profile is called the DCU PROFILE. It extends the control and status interface to 32 bits, and is the internal interface between the main bypass application and the embedded fieldbus environment.
- ABB DRV FULL – This profile standardizes the control interface with ACS600 and ACS800 drive. This profile is also based on the PROFIBUS interface, and supports two control word bits not supported by the ABB DRV LIM profile.

## Modbus Addressing

With Modbus, each function code implies access to a specific Modbus reference set. Thus, the leading digit is not included in the address field of a Modbus message.

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**Note:** The drive supports the zero-based addressing of the Modbus specification. Holding register 40002 is addressed as 0001 in a Modbus message. Similarly, coil 33 is addressed as 0032 in a Modbus message.

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Refer again to the "Mapping Summary" above. The following sections describe, in detail, the mapping to each Modbus reference set.

**0xxxx Mapping – Modbus Coils.** The bypass maps the following information to the 0xxxx Modbus set called Modbus Coils:

- Bit-wise map of the CONTROL WORD (selected using bypass parameter 5305 EFB CTRL PROFILE). The first 32 coils are reserved for this purpose.
- Relay output states, numbered sequentially beginning with coil 00033.

The following table summarizes the 0xxxx reference set:

Modbus Ref.	Internal Location (All Profiles)	ABB DRV LIM BP Param (5305 = 0)	DCU PROFILE BP Param (5305 = 1)	ABB DRV FULL BP Param (5305 = 2)
00001	CONTROL WORD – Bit 0	OFF1*	STOP	OFF1*
00002	CONTROL WORD – Bit 1	OFF2*	START	OFF2*
00003	CONTROL WORD – Bit 2	OFF3*	REVERSE	OFF3*
00004	CONTROL WORD – Bit 3	START	LOCAL	START
00005	CONTROL WORD – Bit 4	N/A	RESET	RAMP_OUT_ZERO*
00006	CONTROL WORD – Bit 5	RAMP_HOLD*	EXT2	RAMP_HOLD*
00007	CONTROL WORD – Bit 6	RAMP_IN_ZERO*	RUN_DISABLE	RAMP_IN_ZERO*
00008	CONTROL WORD – Bit 7	RESET	STPMODE_R	RESET
00009	CONTROL WORD – Bit 8	N/A	STPMODE_EM	N/A
00010	CONTROL WORD – Bit 9	N/A	STPMODE_C	N/A
00011	CONTROL WORD – Bit 10	N/A	RAMP_2	REMOTE_CMD*
00012	CONTROL WORD – Bit 11	EXT2	RAMP_OUT_0	EXT2
00013	CONTROL WORD – Bit 12	N/A	RAMP_HOLD	N/A
00014	CONTROL WORD – Bit 13	N/A	RAMP_IN_0	N/A
00015	CONTROL WORD – Bit 14	N/A	REQ_LOCALLOCK	N/A
00016	CONTROL WORD – Bit 15	N/A	TORQLIM2	N/A
00017	CONTROL WORD – Bit 16	Does not apply	FBLOCAL_CTL	Does not apply
00018	CONTROL WORD – Bit 17		FBLOCAL_REF	
00019	CONTROL WORD – Bit 18		START_DISABLE1	
00020	CONTROL WORD – Bit 19		START_DISABLE2	
00021... 00032	Reserved	Reserved	Reserved	Reserved
00033	RELAY OUTPUT 1	Relay Output 1	Relay Output 1	Relay Output 1
00034	RELAY OUTPUT 2	Relay Output 2	Relay Output 2	Relay Output 2
00035	RELAY OUTPUT 3	Relay Output 3	Relay Output 3	Relay Output 3
00036	RELAY OUTPUT 4	Relay Output 4	Relay Output 4	Relay Output 4
00037	RELAY OUTPUT 5	Relay Output 5	Relay Output 5	Relay Output 5
00038	RELAY OUTPUT 6	Relay Output 6	Relay Output 6	Relay Output 6

\* = Active low

For the 0xxxx registers:

- Status is always readable.
- Forcing is allowed by user configuration of the system for fieldbus control.
- Additional relay outputs are added sequentially.

The system supports the following Modbus function codes for coils:

Function Code	Description
01	Read coil status
05	Force single coil
15 (0x0F Hex)	Force multiple coils

**1xxxx Mapping – Modbus Discrete Inputs.** The drive maps the following information to the 1xxxx Modbus set called Modbus Discrete Inputs:

- Bit-wise map of the STATUS WORD (selected using bypass parameter 5305 EFB CTRL PROFILE). The first 32 inputs are reserved for this purpose.
- Discrete hardware inputs, numbered sequentially beginning with input 33.

The following table summarizes the 1xxxx reference set:

Modbus Ref.	Internal Location (All Profiles)	ABB DRV BP Param (5305 = 0 or 2)	DCU PROFILE BP Param (5305 = 1)
10001	STATUS WORD – Bit 0	RDY_ON	READY
10002	STATUS WORD – Bit 1	RDY_RUN	ENABLED
10003	STATUS WORD – Bit 2	RDY_REF	STARTED
10004	STATUS WORD – Bit 3	TRIPPED	RUNNING
10005	STATUS WORD – Bit 4	OFF_2_STA*	ZERO_SPEED
10006	STATUS WORD – Bit 5	OFF_3_STA*	ACCELERATE
10007	STATUS WORD – Bit 6	SWC_ON_INHIB	DECELERATE
10008	STATUS WORD – Bit 7	ALARM	AT_SETPOINT
10009	STATUS WORD – Bit 8	AT_SETPOINT	LIMIT
10010	STATUS WORD – Bit 9	REMOTE	SUPERVISION
10011	STATUS WORD – Bit 10	ABOVE_LIMIT	REV_REF
10012	STATUS WORD – Bit 11	EXT2	REV_ACT
10013	STATUS WORD – Bit 12	RUN_ENABLE	PANEL_LOCAL
10014	STATUS WORD – Bit 13	N/A	FIELD BUS_LOCAL
10015	STATUS WORD – Bit 14	N/A	EXT2_ACT
10016	STATUS WORD – Bit 15	N/A	FAULT
10017	STATUS WORD – Bit 16	Reserved	ALARM
10018	STATUS WORD – Bit 17	Reserved	REQ_MAINT
10019	STATUS WORD – Bit 18	Reserved	DIRLOCK
10020	STATUS WORD – Bit 19	Reserved	LOCALLOCK
10021	STATUS WORD – Bit 20	Reserved	CTL_MODE
10022	STATUS WORD – Bit 21	Reserved	Reserved
10023	STATUS WORD – Bit 22	Reserved	Reserved
10024	STATUS WORD – Bit 23	Reserved	Reserved
10025	STATUS WORD – Bit 24	Reserved	Reserved
10026	STATUS WORD – Bit 25	Reserved	Reserved



Modbus Ref.	Internal Location (All Profiles)	ABB DRV BP Param (5305 = 0 or 2)	DCU PROFILE BP Param (5305 = 1)
10027	STATUS WORD – Bit 26	Reserved	REQ_CTL
10028	STATUS WORD – Bit 27	Reserved	REQ_REF1
10029	STATUS WORD – Bit 28	Reserved	REQ_REF2
10030	STATUS WORD – Bit 29	Reserved	REQ_REF2EXT
10031	STATUS WORD – Bit 30	Reserved	ACK_STARTINH
10032	STATUS WORD – Bit 31	Reserved	ACK_OFF_ILCK
10033	DI1	DI1	DI1
10034	DI2	DI2	DI2
10035	DI3	DI3	DI3
10036	DI4	DI4	DI4
10037	DI5	DI5	DI5
10038	DI6	DI6	DI6

\* = Active low

For the 1xxxx registers:

- Additional discrete inputs are added sequentially.

The system supports the following Modbus function codes for discrete inputs:

Function Code	Description
02	Read input status

**3xxxx Mapping – Modbus Inputs.** The drive maps the following information to the 3xxxx Modbus addresses called Modbus input registers:

- Any user defined analog inputs.

The following table summarizes the input registers:

Modbus Reference	Internal Location (All Profiles)	Remarks
30001	AI1	This register shall report the level of Analog Input 1 (0...100%).
30002	AI2	This register shall report the level of Analog Input 2 (0...100%).

The drive supports the following Modbus function codes for 3xxxx registers:

Function Code	Description
04	Read 3xxxx input status

**4xxxx Register Mapping.** The drive maps its parameters and other data to the 4xxxx holding registers as follows:

- 40001...40099 map to drive control and actual values. These registers are described in the table below.
- 40101...49999 map to drive parameters 0101...9999. Register addresses that do not correspond to bypass parameters are invalid. If there is an attempt to read or

write outside the parameter addresses, the Modbus interface returns an exception code to the controller.

The following table summarizes the 4xxxx drive control registers 40001...40099 (for 4xxxx registers above 40099, see the drive parameter list, e.g. 40102 is parameter 0102):

Modbus Register		Access	Remarks
40001	CONTROL WORD	R/W	Maps directly to the profile's CONTROL WORD. Supported only if bypass parameter 5305 = 0 or 2 (ABB drive profile). Bypass parameter 5319 holds a copy in hex format.
40002	Reference 1	R/W	Range = 0...+20000 (scaled to 0...1105 REF1 MAX), or -20000...0 (scaled to 1105 REF1 MAX...0).
40003	Reference 2	R/W	Range = 0...+10000 (scaled to 0...1108 REF2 MAX), or -10000...0 (scaled to 1108 REF2 MAX...0).
40004	STATUS WORD	R	Maps directly to the profile's STATUS WORD. Supported only if bypass parameter 5305 = 0 or 2 (ABB bypass profile). Bypass parameter 5320 holds a copy in hex format.
40005	Actual 1 (select using 5310)	R	By default, stores a copy of 0103 OUTPUT FREQ. Use parameter 5310 to select a different actual value for this register.
40006	Actual 2 (select using 5311)	R	By default, stores a copy of 0104 CURRENT. Use parameter 5311 to select a different actual value for this register.
40007	Actual 3 (select using 5312)	R	By default, stores nothing. Use bypass parameter 5312 to select an actual value for this register.
40008	Actual 4 (select by 5313)	R	By default, stores nothing. Use bypass parameter 5313 to select an actual value for this register.
40009	Actual 5 (select using 5314)	R	By default, stores nothing. Use bypass parameter 5314 to select an actual value for this register.
40010	Actual 6 (select using 5315)	R	By default, stores nothing. Use bypass parameter 5315 to select an actual value for this register.
40011	Actual 7 (select using 5316)	R	By default, stores nothing. Use bypass parameter 5316 to select an actual value for this register.
40012	Actual 8 (select using 5317)	R	By default, stores nothing. Use bypass parameter 5317 to select an actual value for this register.
40031	ACH550 CONTROL WORD LSW	R/W	Maps directly to the Least Significant Word of the DCU profile's CONTROL WORD. Supported only if BP Param 5305 = 1. See bypass parameter 0301.
40032	ACH550 CONTROL WORD MSW	R	Maps directly to the Most Significant Word of the DCU profile's CONTROL WORD. Supported only if BP Param 5305 = 1. See bypass parameter 0302.
40033	ACH550 STATUS WORD LSW	R	Maps directly to the Least Significant Word of the DCU profile's CONTROL WORD. Supported only if BP Param 5305 = 1. See bypass parameter 0303.
40034	ACH550 STATUS WORD MSW	R	Maps directly to the Most Significant Word of the DCU profile's CONTROL WORD. Supported only if BP Param 5305 = 1. See bypass parameter 0304.

For the Modbus protocol, bypass parameters in group 53 report the parameter mapping to 4xxx Registers.

BP Param	Description
5310	EFB PAR 10 Specifies the parameter mapped to Modbus register 40005.
5311	EFB PAR 11 Specifies the parameter mapped to Modbus register 40006.
5312	EFB PAR 12 Specifies the parameter mapped to Modbus register 40007.
5313	EFB PAR 13 Specifies the parameter mapped to Modbus register 40008.
5314	EFB PAR 14 Specifies the parameter mapped to Modbus register 40009.
5315	EFB PAR 15 Specifies the parameter mapped to Modbus register 40010.
5316	EFB PAR 16 Specifies the parameter mapped to Modbus register 40011.
5317	EFB PAR 17 Specifies the parameter mapped to Modbus register 40012.
5318	Reserved.
5319	EFB PAR 19 Holds a copy (in hex) of the CONTROL WORD, Modbus register 40001.
5320	EFB PAR 20 Holds a copy (in hex) of the STATUS WORD, Modbus register 40004.

Except where restricted by the system, all parameters are available for both reading and writing. The parameter writes are verified for the correct value, and for a valid register addresses.

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**Note!** Parameter writes through standard Modbus are always volatile i.e. modified values are not automatically stored to permanent memory. Use bypass parameter 1615 PARAM. SAVE to save all altered values.

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The system supports the following Modbus function codes for 4xxx registers:

Function Code	Description
03	Read holding 4xxx registers
06	Preset single 4xxx register
16 (0x10 Hex)	Preset multiple 4xxx registers
23 (0x17 Hex)	Read/write 4xxx registers

### Actual Values

The contents of the register addresses 40005...40012 are ACTUAL VALUES and are:

- Specified using bypass parameters 5310...5317.
- Read-only values containing information on the operation of the drive.
- 16-bit words containing a sign bit and a 15-bit integer.
- When negative values, written as the two's complement of the corresponding positive value.
- Scaled as described earlier in "Actual Value Scaling".

### Exception Codes

Exception codes are serial communication responses from the drive. The drive supports the standard Modbus exception codes defined below.

Exception Code	Name	Meaning
01	ILLEGAL FUNCTION	Unsupported Command
02	ILLEGAL DATA ADDRESS	The data address received in the query is not allowable. It is not a defined parameter/group.
03	ILLEGAL DATA VALUE	A value contained in the query data field is not an allowable value for the drive, because it is one of the following: <ul style="list-style-type: none"> <li>• Outside min. or max. limits.</li> <li>• Parameter is read-only.</li> <li>• Message is too long.</li> <li>• Parameter write not allowed when start is active.</li> <li>• Parameter write not allowed when factory macro is selected.</li> </ul>

## ABB Control Profiles Technical Data - Drive

### Overview

#### ABB Drives Profile

The ABB Drives profile provides a standard profile that can be used on multiple protocols, including Modbus and the protocols available on the FBA module. Two implementations of the ABB drives profile are available:

- ABB DRV FULL – This implementation standardizes the control interface with ACS600 and ACS800 drives.
- ABB DRV LIM – This implementation standardizes the control interface with ACS400 drives. This implementation does not support two control word bits supported by ABB DRV FULL.

Except as noted, the following “ABB Drives Profile” descriptions apply to both implementations.

#### DCU Profile

The DCU profile extends the control and status interface to 32 bits, and is the internal interface between the main bypass application and the embedded fieldbus environment.

#### Control Word

The CONTROL WORD is the principal means for controlling the bypass from a fieldbus system. The fieldbus master station sends the CONTROL WORD to the system. The drive switches between states according to the bit-coded instructions in the CONTROL WORD. Using the CONTROL WORD (ABB drives profile version) requires that:

- The drive is in remote (REM) control.
- The serial communication channel used is configured to use an ABB control profile. For example, to use the control profile ABB DRV FULL, requires both bypass parameter 9802 COMM PROT SEL = 1 (STD MODBUS), and bypass parameter 5305 EFB CTRL PROFILE = 2 (ABB DRV FULL).

#### ABB Drives Profile

The following table and the state diagram later in this sub-section describe the CONTROL WORD content for the ABB Drives Profile.

ABB Drives Profile (EFB) CONTROL WORD				
Bit	Name	Value	Commanded State	Comments
0	OFF1 CONTROL	1	READY TO OPERATE	Enter READY TO OPERATE
		0	EMERGENCY OFF	Drive ramps to stop according to currently active deceleration ramp (2203 or 2205) Normal command sequence: <ul style="list-style-type: none"> <li>• Enter OFF1 ACTIVE</li> <li>• Proceed to READY TO SWITCH ON, unless other interlocks (OFF2, OFF3) are active.</li> </ul>

ABB Drives Profile (EFB) CONTROL WORD				
Bit	Name	Value	Commanded State	Comments
1	OFF2 CONTROL	1	OPERATING	Continue operation (OFF2 inactive)
		0	EMERGENCY OFF	Drives coasts to stop. Normal command sequence: <ul style="list-style-type: none"> <li>• Enter OFF2 ACTIVE</li> <li>• Proceed to SWITCHON INHIBITED</li> </ul>
2	OFF3 CONTROL	1	OPERATING	Continue operation (OFF3 inactive)
		0	EMERGENCY STOP	Drive stops within the time specified by drive parameter 2208. Normal command sequence: <ul style="list-style-type: none"> <li>• Enter OFF3 ACTIVE</li> <li>• Proceed to SWITCH ON INHIBITED</li> </ul> <b>WARNING! Be sure motor and bypass equipment can be stopped using this mode.</b>
3	INHIBIT OPERATION	1	OPERATION ENABLED	Enter OPERATION ENABLED (Note the Run enable signal must be active. See bypass parameter 1601. If 1601 is set to COMM, this bit also activates the Run Enable signal.)
		0	OPERATION INHIBITED	Inhibit operation. Enter OPERATION INHIBITED
4	Unused (ABB DRV LIM)			
	RAMP_OUT_ZERO (ABB DRV FULL)	1	NORMAL OPERATION	Enter RAMP FUNCTION GENERATOR: ACCELERATION ENABLED
		0	RFG OUT ZERO	Force ramp function generator output to Zero. Drive ramps to stop (current and DC voltage limits in force).
5	RAMP_HOLD	1	RFG OUT ENABLED	Enable ramp function. Enter RAMP FUNCTION GENERATOR: ACCELERATOR ENABLED
		0	RFG OUT HOLD	Halt ramping (Ramp Function Generator output held)
6	RAMP_IN_ZERO	1	RFG INPUT ENABLED	Normal operation. Enter OPERATING
		0	RFG INPUT ZERO	Force Ramp Function Generator input to zero.
7	RESET	0=>1	RESET	Fault reset if an active fault exists (Enter SWITCH-ON INHIBITED). Effective if bypass parameter 1604 = COMM.
		0	OPERATING	Continue normal operation
8...9	Unused			

ABB Drives Profile (EFB) CONTROL WORD				
Bit	Name	Value	Commanded State	Comments
10	Unused (ABB DRV LIM)			
	REMOTE_CMD (ABB DRV FULL)	1		Fieldbus control enabled.
0			<ul style="list-style-type: none"> <li>CW ≠ 0 or Ref ≠ 0: Retain last CW and Ref.</li> <li>CW = 0 and Ref = 0: Fieldbus control enabled.</li> <li>Ref and deceleration/acceleration ramp are locked.</li> </ul>	
11	EXT CTRL LOC	1	EXT2 SELECT	Select external control location 2 (EXT2). Effective if drive parameter 1102 = COMM.
		0	EXT1 SELECT	Select external control location 1 (EXT1). Effective if drive parameter 1102 = COMM.
12...15	Unused			

### DCU Profile

The following tables describe the CONTROL WORD content for the DCU profile.

DCU Profile CONTROL WORD (See Bypass parameter 0301)				
Bit	Name	Value	Command/Req.	Comments
0	STOP	1	Stop	Stops according to either the stop mode parameter or the stop mode requests (bits 7 and 8).
		0	(no op)	
1	START	1	Start	Simultaneous STOP and START commands result in a stop command.
		0	(no op)	
2	REVERSE	1	Reverse direction	This bit XOR'd with the sign of the reference defines direction.
		0	Forward direction	
3	LOCAL	1	Local mode	When the fieldbus sets this bit, it steals control and the bypass moves to fieldbus local control mode.
		0	External mode	
4	RESET	-> 1	Reset	Edge sensitive.
		other	(no op)	
5	EXT2	1	Switch to EXT2	
		0	Switch to EXT1	
6	RUN_DISABLE	1	Run disable	Inverted run enable.
		0	Run enable on	
7	STPMODE_R	1	Normal ramp stop mode	
		0	(no op)	
8	STPMODE_EM	1	Emergency ramp stop mode	
		0	(no op)	
9	STPMODE_C	1	Coast stop mode	
		0	(no op)	

DCU Profile CONTROL WORD (See Bypass parameter 0301)				
Bit	Name	Value	Command/Req.	Comments
10	RAMP_2	1	Ramp pair 2	
		0	Ramp pair 1	
11	RAMP_OUT_0	1	Ramp output to 0	
		0	(no op)	
12	RAMP_HOLD	1	Ramp freeze	
		0	(no op)	
13	RAMP_IN_0	1	Ramp input to 0	
		0	(no op)	
14	RREQ_LOCALLOC	1	Local mode lock	In lock, drive will not switch to local mode.
		0	(no op)	
15	TORQLIM2	1	Torque limit pair 2	
		0	Torque limit pair 1	

DCU Profile CONTROL WORD (See Bypass parameter 0302)				
Bit	Name	Value	Function	Comments
16...26	Reserved			
27	REF_CONST	1	Constant speed ref.	These bits are only for supervision purposes.
		0	(no op)	
28	REF_AVE	1	Average speed ref.	
		0	(no op)	
29	LINK_ON	1	Master is detected in link	
		0	Link is down	
30	REQ_STARTINH	1	Start inhibit request is pending	
		0	Start inhibit request is OFF	
31	OFF_INTERLOCK	1	Panel OFF button pressed	For the control panel (or PC tool) this is the OFF button interlock.
		0	(no op)	

### Status Word

The contents of the STATUS WORD is status information, sent by the drive to the master station.



### ABB Bypass Profile

The following table and the state diagram later in this sub-section describe the status word content for the ABB Bypass Profile.

ABB Bypass Profile (EFB) STATUS WORD			
Bit	Name	Value	Description (Correspond to states/boxes in the state diagram)
0	RDY_ON	1	READY TO SWITCH ON
		0	NOT READY TO SWITCH ON
1	RDY_RUN	1	READY TO OPERATE
		0	OFF1 ACTIVE
2	RDY_REF	1	OPERATION ENABLED
		0	OPERATION INHIBITED
3	TRIPPED	0...1	FAULT
		0	No fault
4	OFF_2_STA	1	OFF2 INACTIVE
		0	<b>OFF2 ACTIVE</b>
5	OFF_3_STA	1	OFF3 INACTIVE
		0	<b>OFF3 ACTIVE</b>
6	SWC_ON_INHIB	1	SWITCH-ON INHIBIT ACTIVE
		0	SWITCH-ON INHIBIT NOT ACTIVE
7	ALARM	1	Warning/alarm (See "Alarm Listing" in the "Diagnostics" section for details on alarms.)
		0	No warning/alarm
8	AT_SETPOINT	1	OPERATING. Actual value equals (within tolerance limits) the reference value.
		0	Actual value is outside tolerance limits (not equal to reference value).
9	REMOTE	1	Bypass control location: REMOTE (EXT1 or EXT2)
		0	Bypass control location: LOCAL
10	ABOVE_LIMIT	1	Supervised parameter's value $\geq$ supervision high limit. Bit remains "1" until supervised parameter's value < supervision low limit. See group 32, Supervision
		0	Supervised parameter's value < supervision low limit. Bit remains "0" until supervised parameter's value > supervision high limit. See group 32, Supervision
11	EXT CTRL LOC	1	External control location 2 (EXT2) selected
		0	External control location 1 (EXT1) selected
12	EXT RUN ENABLE	1	External Run Enable signal received
		0	No External Run Enable signal received
13... 15	Unused		

**DCU Profile**

The following tables describe the STATUS WORD content for the DCU profile.

<b>DCU Profile STATUS WORD (See Parameter 0303)</b>			
<b>Bit</b>	<b>Name</b>	<b>Value</b>	<b>Status</b>
0	READY	1	Bypass is ready to receive start command.
		0	Bypassbypass is not ready.
1	ENABLED	1	External run enable signal received.
		0	No external run enable signal received.
2	STARTED	1	Bypass has received start command.
		0	Bypass has not received start command.
3	RUNNING	1	Bypass is modulating.
		0	Bypass is not modulating.
4	ZERO_SPEED	1	Bypass is at zero speed.
		0	Bypass has not reached zero speed.
5	ACCELERATE	1	Bypass is accelerating.
		0	Bypass is not accelerating.
6	DECELERATE	1	Bypass is decelerating.
		0	Bypass is not decelerating.
7	AT_SETPOINT	1	Bypass is at setpoint.
		0	Bypass has not reached setpoint.
8	LIMIT	1	Operation is limited by Group 20 settings.
		0	Operation is within Group 20 settings.
9	SUPERVISION	1	A supervised parameter (Group 32) is outside its limits.
		0	All supervised parameters are within limits.
10	REV_REF	1	Bypass reference is in reverse direction.
		0	Bypass reference is in forward direction.
11	REV_ACT	1	Bypass is running in reverse direction.
		0	Bypass is running in forward direction.
12	PANEL_LOCAL	1	Control is in control panel (or PC tool) local mode.
		0	Control is not in control panel local mode.
13	FIELDBUS_LOCAL	1	Control is in fieldbus local mode (steals control panel local).
		0	Control is not in fieldbus local mode.
14	EXT2_ACT	1	Control is in EXT2 mode.
		0	Control is in EXT1 mode.
15	FAULT	1	Bypass is in a fault state.
		0	Bypass is not in a fault state.

DCU Profile STATUS WORD (See Parameter 0304)			
Bit	Name	Value	Status
16	ALARM	1	An alarm is on.
		0	No alarms are on.
17	REQ_MAINT	1	A maintenance request is pending.
		0	No maintenance request is pending.
18	DIRLOCK	1	Direction lock is ON. (Direction change is locked out.)
		0	Direction lock is OFF.
19	LOCALLOCK	1	Local mode lock is ON. (Local mode is locked out.)
		0	Local mode lock is OFF.
20	CTL_MODE	1	Bypass is in vector control mode.
		0	Bypass is in scalar control mode.
21...25	Reserved		
26	REQ_CTL	1	Copy the control word
		0	(no op)
27	REQ_REF1	1	Reference 1 requested in this channel.
		0	Reference 1 is not requested in this channel.
28	REQ_REF2	1	Reference 2 requested in this channel.
		0	Reference 2 is not requested in this channel.
29	REQ_REF2EXT	1	External PID reference 2 requested in this channel.
		0	External PID reference 2 is not requested in this channel.
30	ACK_STARTINH	1	A start inhibit from this channel is granted.
		0	A start inhibit from this channel is not granted.
31	ACK_OFF_ILCK	1	Start inhibit due to OFF button
		0	Normal operation

## State Diagram

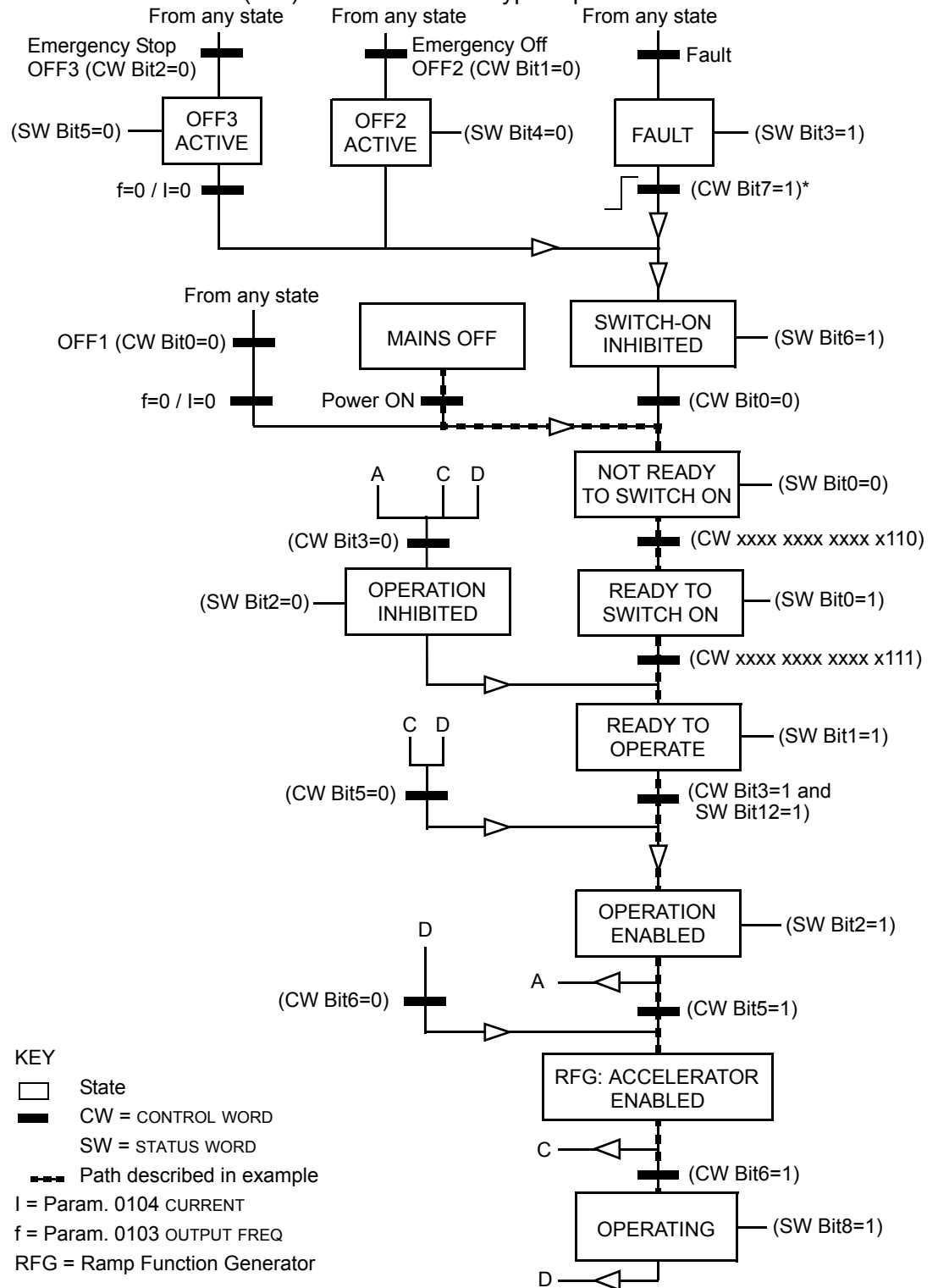
### ABB Bypass Profile

To illustrate the operation of the state diagram, the following example (ABB DRV LIM implementation of the ABB Bypass profile) uses the control word to start the bypass:

- First, the requirements for using the CONTROL WORD must be met. See above.
- When the power is first connected, the state of the bypass is not ready to switch on. See dotted lined path ( --- ) in the state diagram below.
- Use the CONTROL WORD to step through the state machine states until the OPERATING state is reached, meaning that the bypass is running and follows the given reference. See table below.

Step	CONTROL WORD Value	Description
1	CW = 0000 0000 0000 0110 <div style="display: flex; justify-content: space-around; width: 100%;"> <div style="text-align: center;">  bit 15</div> <div style="text-align: center;">  bit 0</div> </div>	This CW value changes the bypass state to READY TO SWITCH ON.
2		Wait at least 100 ms before proceeding.
3	CW = 0000 0000 0000 0111	This CW value changes the bypass state to READY TO OPERATE.
4	CW = 0000 0000 0000 1111	This CW value changes the bypass state to OPERATION ENABLED. The bypass starts, but will not accelerate.
5	CW = 0000 0000 0010 1111	This CW value releases the ramp function generator (RFG) output, and changes the bypass state to RFG: ACCELERATOR ENABLED.
6	CW = 0000 0000 0110 1111	This CW value releases the ramp function generator (RFG) output, and changes the bypass state to OPERATING. The bypass accelerates to the given reference and follows the reference.

- The state diagram below describes the start-stop function of CONTROL WORD (CW) and STATUS WORD (SW) bits for the ABB Bypass profile.



\*This state transition also occurs if the fault is reset from any other source (e.g. digital input).

## Bypass Overview

The new mode that is available on the E-Clipse bypass is selected by setting bypass parameter 16.25 to SYSTEM. With this configuration the drive node is still present but network commands to start the drive are ignored. Instead, the user should send start commands to the bypass node. In this mode, a start command will start the bypass if in bypass mode or start the drive if in drive mode.

In system mode, the profile that controls system logic is always the ABB BYPASS PROFILE which is sent to the bypass device. The setting of bypass parameter 53.05, PROFILE is only used for reference related control (e.g. ramp control bits) and for the drive status word. These bits are used when writing to or reading the drive device.

The following table defines the ABB bypass profile control word. Note that this word is written to the bypass.

ABB Bypass Profile control word (see bypass parameter 0301)				
Bit	NAME	Value	Description	Comments
0	START	1	Start	
		0	Stop	
1	RESET	0->1	Reset command	Fault reset. Edge sensitive.
		Other	(no op)	
2	RUN_DISABLE	1	Run disabled	Inverted Run Enable. The STARTED status bit may be set even when Run Enable is missing.
		0	Run enable on	
3	FBLOCAL_CTL	1	FB Local mode for control word requested	Field bus sets these bits to move the bypass to field bus local control mode of control word (field bus steals the control).
		0	FB Local mode for control word not requested	
4	START_DISABLE1	1	Start disabled 1	Inverted Start Enables. When Start Enable is missing, the drive doesn't set STARTED status bit.
		0	Start enable 1 on	
5	START_DISABLE2	1	Start disabled 2	
		0	Start enable 2 on	
6	START_DISABLE3	1	Start disabled 3	
		0	Start enable 3 on	
7	START_DISABLE4	1	Start disabled 4	
		0	Start enable 4 on	
8	OVERRIDE	1	Override selected	The selects override 2 which is controlled by group 17.
		0	Override not selected	
9	LINK_ON	1	Master is detected in link	This is not settable from the field bus but reflects the internal state of the link.
		0	Link is down	
10-15	Reserved			

The drive control words when bypass parameter 1625 = (1) SYSTEM are summarized in the following table. Note that these are written to the drive.

<b>DRIVE CONTROL WORD</b>			
<b>Bit</b>	<b>ABB DRV LIM</b>	<b>DCU PROFILE</b>	<b>ABB DRV FULL</b>
0	N/A	N/A	N/A
1	N/A	N/A	N/A
2	N/A	REVERSE	N/A
3	N/A	N/A	N/A
4	N/A	RESET	RAMP_OUT_ZERO
5	RAMP_HOLD	EXT2	RAMP_HOLD
6	RAMP_IN_ZERO	N/A	RAMP_IN_ZERO
7	RESET	STP_MODE_R	RESET
8	N/A	STP_MODE_EM	N/A
9	N/A	STP_MODE_C	N/A
10	N/A	RAMP_2	REMOTE_CMD (ref only)
11	EXT2	RAMP_OUT_0	EXT2
12	N/A	RAMP_HOLD	N/A
13	N/A	RAMP_IN_0	N/A
14	N/A	REQ_LOCALLOCK	N/A
15	N/A	TORQLIM2	N/A
16	N/A	N/A	N/A
17	N/A	FBLOCAL_REF	N/A
18	N/A	N/A	N/A
19	N/A	N/A	N/A
20-31	N/A	Reserved	N/A

The bypass status word is defined in table below. The drive status word depends on the profile selected and does not change when bypass parameter 1625 = DRIVE ONLY or SYSTEM modes (see drive manual).

BYPASS STATUS WORD					
Bit	NAME	Value	Description	Comments	
0	READY	1	Bypass is ready to receive start command		
		0	Bypass is not ready		
1	ENABLED	1	External run enable and start enable signals received		
		0	External run enable or start enable signals missing		
2	STARTED	1	Bypass has received start command		
		0	Bypass has not received start command		
3	RUNNING	1	Motor is running		
		0	Motor is not modulating		
4	FIELDBUS_LOCAL	1	Bypass is in fieldbus local mode		Field bus is controlling all inputs that can have COMM setting.
		0	Bypass is not in fieldbus local mode		
5	FAULT	1	Bypass is in fault state		
		0	No faults		
6	ALARM	1	Alarm is on		
		0	No alarms		
7	Reserved				
8	REQ_CTL	1	Control word requested in this channel	This bit set indicates that the bypass is expecting at least one control bit from the serial channel.	
		0	Control word not requested		
9	OVERRIDE	1	In override	Override 1 or override 2 is active	
		0	Not in override		
10	POWERED_UP	1	Powered up	Input voltage has passed minimum level beyond which normal bypass operation can proceed including writing of parameters from the field bus.	
11-15	Reserved				



## MODBUS ADDRESSING - Bypass

### 0xxxx Registers

MODBUS addressing of 0xxxx registers maps the profile control words shown in the following table, to the first 32 coils when using the drive device ID. The Bypass Control Word defined in the ABB Bypass Profile control word table is mapped to the first 16 coils when using the bypass device ID. For both device IDs, the coil number is the bit number plus 1. In other words, bits 0 – 31 are mapped to coils 1 – 32.

Relay output control is possible on the drive by using the drive device ID and possible on the bypass by using the bypass device ID.

These registers are summarized in **Error! Reference source not found..**

Reminder: stop and enable related bits are valid at only one device subject to the status of bypass parameter 16.25, COMM CTRL.

MODBUS Registers (0xxxx)		
MODBUS Ref.	Bit	Bypass Device ID
		<b>BCU PROFILE</b>
00001	0	START
00002	1	RESET
00003	2	RUN_DISABLE
00004	3	FBLOCAL_CTL
00005	4	START_DISABLE1
00006	5	START_DISABLE2
00007	6	START_DISABLE3
00008	7	START_DISABLE4
00009	8	OVERRIDE
00010	9	LINK_ON
00011	10	N/A
00012	11	N/A
00013	12	N/A
00014	13	N/A
00015	14	N/A
00016	15	N/A
00017	16	N/A
00018	17	N/A
00019	18	N/A
00020	19	N/A
00021.. 00032	20- 31	N/A
00033		Bypass Relay Output 1
00034		Bypass Relay Output 2
00035		Bypass Relay Output 3
00036		Bypass Relay Output 4
00037		Bypass Relay Output 5
00038		N/A

### 1xxxx Registers - Bypass

MODBUS addressing of 1xxxx registers maps the profile status words to the first 32 MODBUS discrete inputs when using the drive device ID. The bypass status word is mapped to the first 16 MODBUS discrete inputs when using the bypass device ID.

For both device IDs, the discrete input is the bit number plus 1. In other words, bits 0 – 31 are mapped to inputs 1 – 32.

These registers are summarized in the following table.

<b>1.1.1 MODBUS Registers (1xxxx)</b>		
<b>MODBUS Ref.</b>	<b>Bit</b>	<b>Bypass Device ID</b>
		<b>BCU PROFILE</b>
10001	0	READY
10002	1	ENABLED
10003	2	STARTED
10004	3	RUNNING
10005	4	FIELDBUS_LOCAL
10006	5	FAULT
10007	6	ALARM
10008	7	Reserved
10009	8	REQ_CTL
10010	9	OVERRIDE
10011	10	POWERED_UP
10012	11	N/A
10013	12	N/A
10014	13	N/A
10015	14	N/A
10016	15	N/A
10017	16	N/A
10018	17	N/A
10019	18	N/A
10020	19	N/A
10021	20	
10022	21	
10023	22	
10024	23	
10025	24	
10026	25	
10027	26	
10028	27	
10029	28	
10030	29	
10031	30	
10032	31	
10033		Bypass DI1
10034		Bypass DI2
10035		Bypass DI3
10036		Bypass DI4
10037		Bypass DI5
10038		Bypass DI6

## 4xxxx Registers - Bypass

MODBUS addressing of 4xxxx registers maps the drive's parameters and other values when using the drive device ID. The bypass's parameters and other values are mapped when using the bypass device ID.

### Registers 40001 ... 40099 - Bypass

Control and actual values are mapped to these registers according to the table below:

NOTE: all parameters referenced are bypass parameters.

At this time, 40001, Control Word at the drive device ID is not valid if parameter 16.25, COMM CTRL = 1 (SYSTEM). This should be changed to reflect the control word bits that are valid. These registers map to bypass parameters 0101...9999.

<b>MODBUS Registers (40001 to 40099)</b>		
<b>MODBUS Ref.</b>	<b>Internal location (All profiles)</b>	<b>Bypass Device ID</b>
40001	Control Word	Maps directly to BCU profile control word.
40002	Reference 1	N/A
40003	Reference 2	N/A
40004	Status Word	Maps directly to BCU profile status word.
40005	Actual 1 (select using 5310)	N/A
40006	Actual 2 (select using 5311)	N/A
40007	Actual 3 (select using 5312)	N/A
40008	Actual 4 (select using 5313)	N/A
40009	Actual 5 (select using 5314)	N/A
40010	Actual 6 (select using 5315)	N/A
40011	Actual 7 (select using 5316)	N/A
40012	Actual 8 (select using 5317)	N/A
40031	ACH550 Control Word LSW	N/A
40032	ACH550 Control Word MSW	N/A
40033	ACH550 Status Word LSW	N/A
40034	ACH550 Status Word MSW	N/A







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