ABB machinery drives

Supplement
ACS355 HVAC with BACnet (+N831)

Power and productivity
for a better world™

List of related manuals

Drive manuals and guides	Code (English)
ACS355 user's manual	3AUA0000066143
ACS355 drives with IP66/67/UL Type 4x enclosure supplement	3AUA0000066066
ACS355 quick installation guide	3AUA0000092940
ACS355 common DC application guide	3AUA0000070130
FMBA-01 Modbus Adapter Module user's manual	3AFE68586704
F-series fieldbus adapter modules installation note	3AXD50000008201
Option manuals and guides	
MFDT-01 FlashDrop user's manual	3AFE68591074
MPOT-01 potentiometer module instructions for installation and use	3AFE68591082
MREL-01 output relay module user's manual	3AUA0000035974
MUL1-R1 installation instructions for ACS150, ACS310, ACS320, ACS350 and ACS355	3AFE68642868
MUL1-R3 installation instructions for ACS310, ACS320, ACS350 and ACS355	3AFE68643147
MUL1-R4 installation instructions for ACS310, ACS320, ACS350 and ACS355	3AUA0000025916
Maintenance manuals and guides	
Guide for capacitor reforming in ACS50, ACS55, ACS150, ACS310, ACS350, ACS355, ACS550, ACH550 and R1-R4 OINT/SINT boards	3AFE68735190

You can find manuals and other product documents in PDF format on the Internet. See section Document library on the Internet on the inside of the back cover. For manuals not available in the Document library, contact your local ABB representative.

Supplement ACS355

HVAC with BACnet (+N831)

3AXD0000024172 Rev B
EN EFFECTIVE: 2015-12-15

Contents

Introduction to the supplement

What this chapter contains

The chapter describes safety issues, scope of this supplement, applicability, target audience and purpose of this supplement. It describes the contents of this supplement and refers to a list of related manuals for more information.

Safety

Safety related instructions please refer to ACS355 user's manual (3AUA0000066143 [English]). The safety instructions must be followed when installing, operating and servicing the drive. Please study the complete safety instructions carefully.

Scope

This document is supplement of ACS355 user's manual (3AUA0000066143 [English]). This supplement covers all differences between HVAC with BACnet firmware and ACS355 standard firmware. Only the HVAC with BACnet contents are given in each chapter of this supplement.

Following chapters please refer to ACS355 user's manual (3AUA0000066143 [English]):

- Operation principle and hardware description
- Mechanical installation
- Planning the electrical installation
- Electrical installation
- Installation checklist
- Control panels
- Application macros
- Startup, control with I/O and ID run
- Fault tracing
- Maintenance and hardware diagnostics
- Technical data
- Appendixes

Applicability

The manual is applicable to the ACS355 HVAC with BACnet firmware version 6502 or later. See parameter 3301 FIRMWARE. Option code +N831 in the drive type code shows that the drive has the HVAC with BACnet firmware installed.

Use this supplement manual along with the ACS355 User's manual (3AUA0000066143 [English]) for general instructions on installation and maintenance.

Target audience

This supplement is intended for people who work with ACS355 HVAC with BACnet firmware. The reader of this supplement is expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.

Purpose of this manual

This manual provides information needed for commissioning, operating and maintaining the ACS355 HVAC with BACnet firmware.

Contents of this supplement

This supplement manual consists of the following chapters:

- Introduction to the supplement (this chapter, page 5) describes safety issues, scope of supplement, applicability, target audience and purpose of this manual.
- Program features (page 7) describes program features. There are also lists of related user settings in each section.
- Actual signals and parameters (page 12) describes the actual signals and parameters related to HVAC with BACnet firmware and gives the BACnet equivalent values for each signal/parameter.
- Further information (inside of the back cover) tells how to make product and service inquiries, get information on product training, provide feedback on ABB Drives manuals and how to find documents on the Internet.

Related documents

See List of related manuals on page 2 (inside the front cover).

Program features

About this chapter

This chapter describes the features of HVAC with BACnet firmware. Each feature includes a list of related user settings, actual signals, and/or fault and alarm messages. Also at the end of this section is a list of ACS355 standard features that were removed.

BACnet protocol

BACnet - A Data Communication Protocol for Building Automation and Control Networks. Developed under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), BACnet is an American national standard, a European standard, a national standard in more than 30 countries, and an ISO global standard. The protocol is supported and maintained by ASHRAE Standing Standard Project Committee 135 whose members have created and provided the content for this Website.

The inclusion of the BACnet protocol allow the ACS355 to communicate with a Building Automation and Control system using BACnet.

HVAC panel compatibility

The ACS355 +N831 drive requires an ACH-CP-B panels with the minimum requirements or later:

Panel revision: AF
Firmware: 2.04
Flash content: 4.2

Earlier versions of the ACH-CP-B panel will not have text support of the parameters added by the ACS355 +N831 firmware.

Override

When override DI is activated, the drive stops and then accelerates to the preset speed or frequency. When the DI is deactivated the drive stops and reboots. If the start command, run enable and start enables are active in the AUTO mode the drive starts automatically and continues normally after override mode. In the HAND mode the drive returns to OFF mode.

When override is active:

- Drive runs at preset speed.
- Drive ignores all keypad commands.
- Drive ignores all commands from communication links.
- Drive ignores all digital inputs except override activation/deactivation, RUN ENABLE and START ENABLE.
- Drive displays alarm message 2020 OVERRIDE.

The following faults are ignored:

3	DEV OVERTEMP
5	OVERLOAD
6	DC UNDERVOLT
7	AI1 LOSS
8	AI2 LOSS
9	MOT OVERTEMP
10	PANEL LOSS
12	MOTOR STALL
14	EXT FAULT 1
15	EXT FAULT 2
17	UNDERLOAD
18	THERM FAIL
21	CURR MEAS
22	SUPPLY PHASE
24	OVERSPEED
28	SERIAL 1 ERR
29	EFB CON FILE
30	FORCE TRIP
31	EFB 1
32	EFB 2
33	EFB 3
34	MOTOR PHASE
1003	PAR AI SCALE
1004	PAR AO SCALE
1006	PAR EXT RO
1007	PAR FIELDBUS MISSING

Settings

Parameter	Additional information
1701 OVERRIDE SELECT	Selects the source of the override activation signal.
1702 OVERRIDE FREQUENCY	Defines a preset frequency for the override.
1703 OVERRIDE SPEED	Defines a preset speed for the override.
1704 OVERRIDE PASS CODE	Entering the correct override pass code unlocks parameter 1705 OVERRIDE for one change.
1705 OVERRIDE	Selects whether the override is enabled or disabled.
1706 OVERRIDE DIRECTION	Selects the source of the override direction signal.
1707 OVERRIDE REFERENCE	Selects the source of the override reference.

Diagnostics

Alarm	Additional information
2020 OVERRIDE	Override mode is activated

Motor heating function

The ACS355 drive provides dc current injection that can be used to keep a motor warm, keeping it above the ambient condensation point.

The motor heating function would serve two purposes:

1) Keeping the motor warm and above the condensation point

2) Keeping the drive active and warm in colder climates

Settings

Parameter	Additional information
2104 DC HOLD CTL	Activates the motor heating feature
2114 HEATING CURR REF	A percentage of motor nominal current (MOTOR NOM CURR, 9906) that is to be dc injected into the motor windings
2115 MOT HEATING SEL	Defines the input that turns on/off motor heating

Diagnostics

Alarm	Additional information
2038 MOTOR HEATING ACTIVE	Motor heating active

Low ambient start

The low ambient start firmware for an ACS355 extends the lower temperature limit for starting from -10˚C to -40˚C. This firmware extends the lower temperature operational limit (for starting purposes) to -39˚C. Once the ACS355 is started, it is recommended that the operational environment ambient temperature be -10˚C or above, within sixty (60) minutes.

Starting and operational requirements

The low ambient start firmware requires a sequential start if the drive temperature has dropped below -10˚C. At temperatures below -10˚C, it is desired to have power remain on the drive.

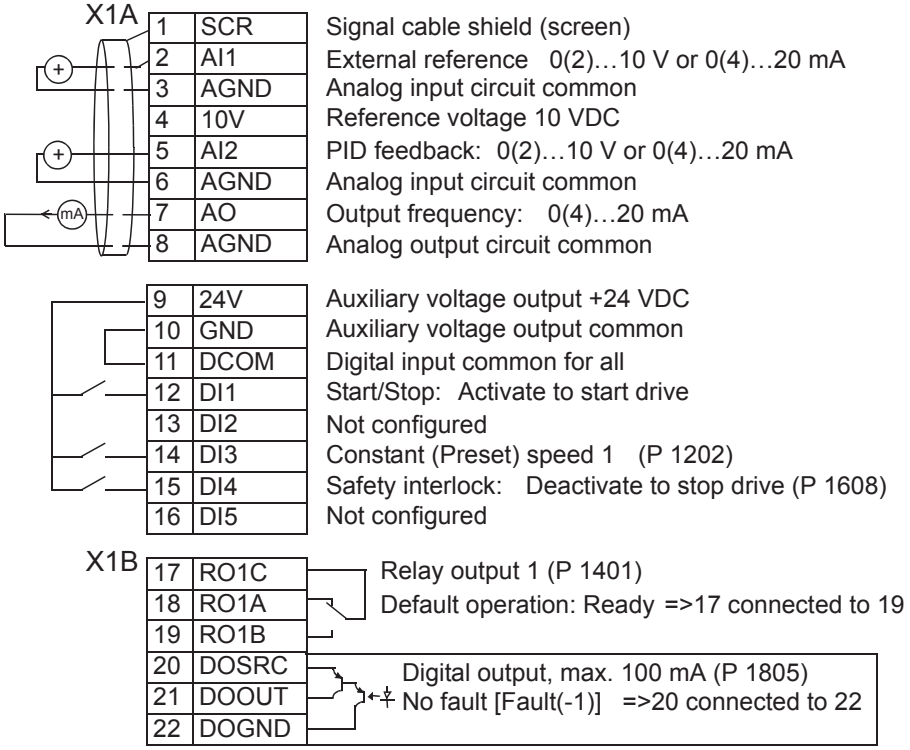
The ACS355 must first be powered on; after waiting five (5) minutes, the START command can be issued.

Once the drive START command is issued, it is recommended that the operational environment ambient temperature be -10˚C or above, within sixty (60) minutes.

This feature does not have any Setting or Diagnostics.

HVAC default MACRO

This macro provides the factory default parameter settings for the drive. Factory defaults can be restored at any time by setting parameter 9902 APPLIC MACRO to 1. The diagram below shows typical wiring using this macro.



Excluded functions

The following features of ACS355 firmware are not supported in the HVAC with BACnet program. Group numbers (GRP XX) are as referenced in the ACS355 User's Manual (3AUA0000066143).

- Timer and counter (GRP 19)
- Torque Control (GRP 24)
- Motor temperature measurement (GRP 35)
- Mechanical brake (GRP 43)
- Encoder (GRP 50)
- Motor potentiometer as external reference source (also the user macro)
- Industrial Fieldbus (GRP 51, 54, 55)
- Jogging (GRP various)
- Joystick control (GRP various)
- PID trimming

Actual signals and parameters

About this chapter

This chapter describes the actual signals and user-adjustable parameters of the HVAC with BACnet firmware. Refer these parameters in addition to the actual signals and parameters described in the ACS355 User's manual (3AUA0000066143 [English]).

Terms and abbreviations

This manual uses the following terms and abbreviations:

Term/Abbreviation	Expansion	Explanation
Actual Signal		Signal measured or calculated by the drive. Can be monitored by the user. No user setting possible. Groups 01…04 contain actual signals.
AM	Asynchronous motor	Three-phase AC voltage induction motor with squirrel cage rotor.
B	Boolean	Data type boolean
Def	Default	Parameter default value.
E	European	Refers to types 01E- and 03E- with European parameterization. EMC filter connected, 50 Hz frequency.
FbEq	Fieldbus equivalent	The scaling between the value and the integer used in serial communication.
I	Integer	Data type integer
P	Power in kW	Power input to determine flow output on the PQ performance curve
Parameter		A user-adjustable operation instruction of the drive. Groups 10…99 contain parameters. Note: Parameter selections are shown on the basic control panel as integer values. Eg parameter 1001 EXT1 COMMANDS selection COMM is shown as value 10 (which is equal to the fieldbus equivalent FbEq).
Pb	Packed Boolean	Data type packer Boolean
PMSM	Permanent magnet synchronous motor	Three-phase AC voltage synchronous motor with permanent magnet rotor and sinusoidal back emf voltage.
R	Real	Data type real
S	String	Data type string
Type	Data type	Data type
U	United States	Refers to types 01U- and 03U- with US parameterization. EMC filter disconnected, 60 Hz frequency.
EFB	Embedded Fieldbus	The communication network used to transfer data and control signals between the drive and a supervisory controller.

Actual signals

<table>
<tr><th>No. Name/Value</th><th>Description</th><th>Def/FbEq</th></tr>
<tr><td>10 START/STOP/DIR</td><td>The sources for external start, stop and direction control</td><td></td></tr>
<tr><td>1001 EXT1 COMMANDS</td><td>Defines the connections and the source for the start, stop and direction commands for external control location 1 (EXT1).
Note: Start signal must be reset if the drive has been stopped through STO (Safe torque off) input (see parameter 3025 STO OPERATION) or emergency stop selection (see parameter 2109 EMERG STOP SEL).</td><td>DI1</td></tr>
<tr><td>NOT SEL</td><td>No start, stop and direction command source</td><td>0</td></tr>
<tr><td>DI1</td><td>Start and stop through digital input DI1. 0 = stop, 1 = start. Direction is fixed according to parameter 1003 DIRECTION (setting REQUEST = FORWARD).</td><td>1</td></tr>
<tr><td>DI1,2</td><td>Start and stop through digital input DI1. 0 = stop, 1 = start. Direction through digital input DI2. 0 = forward, 1 = reverse. To control direction, parameter 1003 DIRECTION setting must be REQUEST.</td><td>2</td></tr>
<tr><td>DI1P,2P</td><td>Pulse start through digital input DI1. 0 -> 1: Start. (In order to start the drive, digital input DI2 must be activated prior to the pulse fed to DI1.)

Pulse stop through digital input DI2. 1 -> 0: Stop. Direction of rotation is fixed according to parameter 1003 DIRECTION (setting REQUEST = FORWARD).

Note: When the stop input (DI2) is deactivated (no input), the control panel start and stop keys are disabled.</td><td>3</td></tr>
<tr><td>DI1P,2P,3</td><td>Pulse start through digital input DI1. 0 -> 1: Start. (In order to start the drive, digital input DI2 must be activated prior to the pulse fed to DI1.)

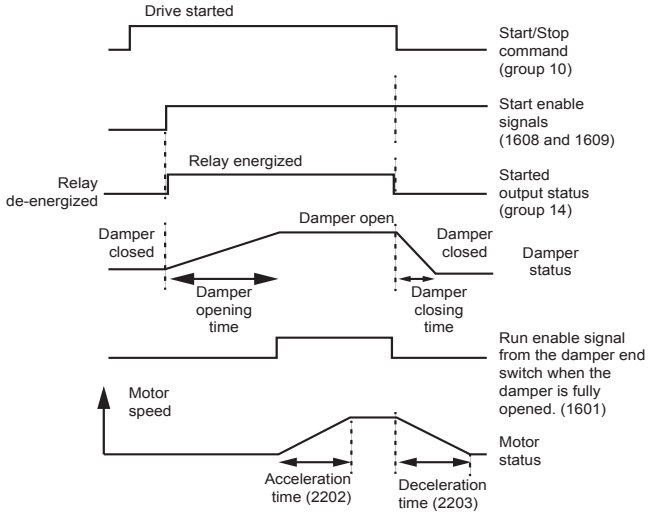
Pulse stop through digital input DI2. 1 -> 0: Stop. Direction through digital input DI3. 0 = forward, 1 = reverse. To control direction, parameter 1003 DIRECTION setting must be REQUEST.

Note: When the stop input (DI2) is deactivated (no input), the control panel start and stop keys are disabled.</td><td>4</td></tr>
<tr><td>DI1P,2P,3P</td><td>Pulse start forward through digital input DI1. 0 -> 1: Start forward. Pulse start reverse through digital input DI2. 0 -> 1: Start reverse. (In order to start the drive, digital input DI3 must be activated prior to the pulse fed to DI1/DI2). Pulse stop through digital input DI3. 1 -> 0: Stop. To control the direction, parameter 1003 DIRECTION setting must be REQUEST.
Note: When the stop input (DI3) is deactivated (no input), the control panel start and stop keys are disabled.</td><td>5</td></tr>
<tr><td>KEYPAD</td><td>Start, stop and direction commands through control panel when EXT1 is active. To control the direction, parameter 1003 DIRECTION setting must be REQUEST.</td><td>8</td></tr>
<tr><td>DI1F,2R</td><td>Start, stop and direction commands through digital inputs DI1 and DI2.
<table><tr><td>DI1</td><td>DI2</td><td>Operation</td></tr><tr><td>0</td><td>0</td><td>Stop</td></tr><tr><td>1</td><td>0</td><td>Start Forward</td></tr><tr><td>0</td><td>1</td><td>Start Reverse</td></tr><tr><td>1</td><td>1</td><td>Stop</td></tr></table>Parameter 1003 DIRECTION setting must be REQUEST.</td><td>9</td></tr>
<tr><td>COMM</td><td>Fieldbus interface as the source for the start and stop commands.</td><td>10</td></tr>
<tr><td>TIMED FUNC 1</td><td>Timed start/stop control. Timed function 1 active = start, timed function 1 inactive = stop. See parameter group 36 TIMED FUNCTIONS.</td><td>11</td></tr>
</table>

No. Name/Value	Description	Def/FbEq
TIMED FUNC 2	See selection TIMED FUNC 1.	12
TIMED FUNC 3	See selection TIMED FUNC 1.	13
TIMED FUNC 4	See selection TIMED FUNC 1.	14
DI5	Start and stop through digital input DI5. 0 = stop, 1 = start. Direction is fixed according to parameter 1003 DIRECTION (setting REQUEST = FORWARD).	20
DI5,4	Start and stop through digital input DI5. 0 = stop, 1 = start. Direction through digital input DI4. 0 = forward, 1 = reverse. To control direction, parameter 1003 DIRECTION must be REQUEST.	21
SEQ PROG	Start, stop and direction commands through Sequence programming. See parameter group 84 SEQUENCE PROG	26
1002 EXT2 COMMANDS	Defines the connections and the source for the start, stop and direction commands for external control location 2 (EXT2).	DI1
	See parameter 1001 EXT1 COMMANDS.	
1003 DIRECTION	Enables the control of rotation direction of the motor, or fixes the direction.	FORWARD
FORWARD	Fixed to forward	1
REVERSE	Fixed to reverse	2
REQUEST	Control of rotation direction allowed	3
12 CONSTANT SPEEDS	Constant speed selection and values. See section Constant speeds in the ACS355 User's Manual (3AUA0000066143).	
1201 CONST SPEED SEL	Activates the constant speeds or selects the activation signal.	DI3
13 ANALOG INPUTS	Analog input signal processing	
1301 MINIMUM AI1	Defines the minimum %-value that corresponds to minimum mA/(V) signal for analog input AI1. When used as a reference, the value corresponds to the reference minimum setting. 0…20 mA = 0…100% 4…20 mA = 20…100% -10…10 mA = -50…50% Example: If AI1 is selected as the source for external reference REF1, this value corresponds to the value of parameter 1104 REF1 MIN. Note: MINIMUM AI1 value must not exceed MAXIMUM AI1 value.	20.0%
-100.0…100.0%	Value as a percentage of the full signal range. Example: If the minimum value for analog input is 4 mA, the percentage value for 0…20 mA range is: (4 mA / 20 mA) • 100% = 20%	1 = 0.1%
1302 MAXIMUM AI1	Defines the maximum %-value that corresponds to maximum mA/(V) signal for analog input AI1. When used as a reference, the value corresponds to the reference maximum setting. 0…20 mA = 0…100% 4…20 mA = 20…100% -10…10 mA = -50…50% Example: If AI1 is selected as the source for external reference REF1, this value corresponds to the value of parameter 1105 REF1 MAX.	100.0%
-100.0…100.0%	Value as a percentage of the full signal range. Example: If the maximum value for analog input is 10 mA, the percentage value for 0…20 mA range is: (10 mA / 20 mA) • 100% = 50%	1 = 0.1%

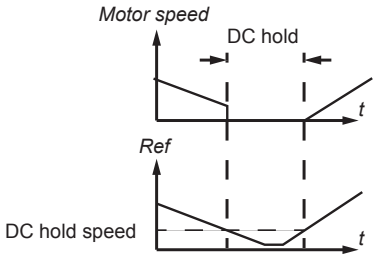
No. Name/Value	Description	Def/FbEq
14 RELAY OUTPUTS	Status information indicated through relay output, and relay operating delays. Note: Relay outputs 2…4 are available only if the MREL-01 output relay module is connected to the drive. See MREL- 01 output relay module user's manual (3AUA0000035974 [English]).	
1401 RELAY OUTPUT 1	Selects a drive status indicated through relay output RO 1. The relay energizes when the status meets the setting.	READY
NOT SEL	Not used	0
READY	Ready to function: Run enable signal on, no fault, supply voltage within acceptable range and emergency stop signal off.	1
RUN	Running: Start signal on, Run enable signal on, no active fault.	2
FAULT(-1)	Inverted fault. Relay is de-energized on a fault trip.	3
FAULT	Fault	4
ALARM	Alarm	5
REVERSED	Motor rotates in reverse direction.	6
STARTED	The drive has received start command. Relay is energized even if Run enable signal is off. Relay is de-energized when drive receives a stop command or a fault occurs.	7
SUPRV1 OVER	Status according to supervision parameters 3201…3203. See parameter group 32 SUPERVISION.	8
SUPRV1 UNDER	See selection SUPRV1 OVER.	9
SUPRV2 OVER	Status according to supervision parameters 3204…3206. See parameter group 32 SUPERVISION.	10
SUPRV2 UNDER	See selection SUPRV2 OVER.	11
SUPRV3 OVER	Status according to supervision parameters 3207…3209. See parameter group 32 SUPERVISION.	12
SUPRV3 UNDER	See selection SUPRV3 OVER.	13
AT SET POINT	Output frequency is equal to the reference frequency.	14
FAULT(RST)	Fault. Automatic reset after the autoreset delay. See parameter group 31 AUTOMATIC RESET.	15
FLT/ALARM	Fault or alarm	16
EXT CTRL	Drive is under external control.	17
REF 2 SEL	External reference REF 2 is in use.	18
CONST FREQ	A constant speed is in use. See parameter group 12 CONSTANT SPEEDS.	19
REF LOSS	Reference or active control location is lost.	20
OVERCURRE NT	Alarm/Fault by overcurrent protection function	21
OVERVOLTAG E	Alarm/Fault by overvoltage protection function	22
DRIVE TEMP	Alarm/Fault by drive overtemperature protection function	23
UNDERVOLTA GE	Alarm/Fault by undervoltage protection function	24
AI1 LOSS	Analog input AI1 signal is lost.	25
AI2 LOSS	Analog input AI2 signal is lost.	26
MOTOR TEMP	Alarm/Fault by motor overtemperature protection function. See parameter 3005 MOT THERM PROT.	27
STALL	Alarm/Fault by stall protection function. See parameter 3010 STALL FUNCTION.	28
UNDERLOAD	Alarm/Fault by underload protection function. See parameter 3013 UNDERLOAD FUNC.	29
PID SLEEP	PID sleep function. See parameter group 40 PROCESS PID SET 1 / 41 PROCESS PID SET 2.	30

<table>
<tr><th>No. Name/Value</th><th>Description</th><th>Def/FbEq</th></tr>
<tr><td>FLUX READY</td><td>Motor is magnetized and able to supply nominal torque.</td><td>33</td></tr>
<tr><td>USER MACRO 2</td><td>User macro 2 is active.</td><td>34</td></tr>
<tr><td>COMM</td><td>Fieldbus control signal 0134 COMM RO WORD. 0 = de- energize output, 1 = energize output.
<table>
<tr><th>134 value</th><th>Binary</th><th>RO4 (MREL)</th><th>RO3 (MREL)</th><th>RO2 (MREL)</th><th>DO</th><th>RO1</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>2</td><td>10</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>3</td><td>11</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>4</td><td>100</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>5…30</td><td>…</td><td>…</td><td>…</td><td>…</td><td>…</td><td>…</td></tr>
<tr><td>31</td><td>11111</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table></td><td>35</td></tr>
<tr><td>COMM(-1)</td><td>Fieldbus control signal 0134 COMM RO WORD. 0 = de- energize output, 1 = energize output.
<table>
<tr><th>134 value</th><th>Binary</th><th>RO4 (MREL)</th><th>RO3 (MREL)</th><th>RO2 (MREL)</th><th>DO</th><th>RO1</th></tr>
<tr><td>0</td><td>00000</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>00001</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>2</td><td>00010</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>3</td><td>00011</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>4</td><td>00100</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>5…30</td><td>…</td><td>…</td><td>…</td><td>…</td><td>…</td><td>…</td></tr>
<tr><td>31</td><td>11111</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table></td><td>36</td></tr>
<tr><td>TIMED FUNC 1</td><td>Timed function 1 is active. See parameter group 36 TIMED FUNCTIONS.</td><td>37</td></tr>
<tr><td>TIMED FUNC 2</td><td>Timed function 2 is active. See parameter group 36 TIMED FUNCTIONS.</td><td>38</td></tr>
<tr><td>TIMED FUNC 3</td><td>Timed function 3 is active. See parameter group 36 TIMED FUNCTIONS.</td><td>39</td></tr>
<tr><td>TIMED FUNC 4</td><td>Timed function 4 is active. See parameter group 36 TIMED FUNCTIONS.</td><td>40</td></tr>
<tr><td>M.TRIG FAN</td><td>Cooling fan running time counter is triggered. See parameter group 29 MAINTENANCE TRIG.</td><td>41</td></tr>
<tr><td>M.TRIG REV</td><td>Revolutions counter is triggered. See parameter group 29 MAINTENANCE TRIG.</td><td>42</td></tr>
<tr><td>M.TRIG RUN</td><td>Run time counter is triggered. See parameter group 29 MAINTENANCE TRIG.</td><td>43</td></tr>
<tr><td>M.TRIG MWH</td><td>MWh counter is triggered. See parameter group 29 MAINTENANCE TRIG.</td><td>44</td></tr>
<tr><td>OVERRIDE</td><td>Energize relay when override is activated.</td><td>45</td></tr>
<tr><td>SEQ PROG</td><td>Relay output control with Sequence programming. See parameter 8423 ST1 OUT CONTROL.</td><td>50</td></tr>
<tr><td>STO</td><td>STO (Safe torque off) has been triggered.</td><td>57</td></tr>
<tr><td>STO(-1)</td><td>STO (Safe torque off) is inactive and the drive operates normally.</td><td>58</td></tr>
<tr><td>MOT. HEATING</td><td>Alarm, energize relay when motor heating is activated.</td><td>69</td></tr>
<tr><td>1402 RELAY OUTPUT 2</td><td>See parameter 1401 RELAY OUTPUT 1. Available only if the MREL-01 output relay module is connected to the drive. See parameter 0181 EXT MODULE STATUS.</td><td>NOT SEL</td></tr>
<tr><td>1403 RELAY OUTPUT 3</td><td>See parameter 1401 RELAY OUTPUT 1. Available only if the MREL-01 output relay module is connected to the drive. See parameter 0181 EXT MODULE STATUS.</td><td>NOT SEL</td></tr>
</table>

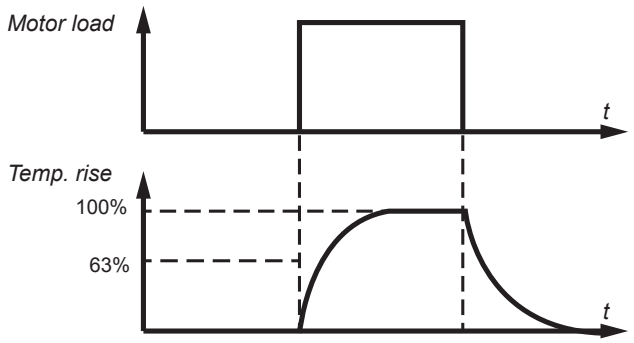
No. Name/Value	Description	Def/FbEq
15 ANALOG OUTPUTS	Selection of the actual signals to be indicated through analog output and output signal processing.	
1504 MINIMUM AO1	Defines the minimum value for the analog output signal AO. See the figure for parameter 1502 AO1 CONTENT MIN.	4.0 mA
0.0…20.0 mA	Minimum value	1 = 0.1 mA
1505 MAXIMUM AO1	Defines the maximum value for the analog output signal AO. See the figure for parameter 1502 AO1 CONTENT MIN.	20.0 mA
0.0…20.0 mA	Maximum value	1 = 0.1 mA
16 SYSTEM CONTROLS	Parameter view, Run enable, parameter lock etc.	
1608 START ENABLE 1	Selects the source for the Start enable 1 signal. Note: Functionality of the Start enable signal is different from the Run enable signal. Example: External damper control application using Start enable and Run enable. Motor can start only after the damper is fully open. 	DI4
NOT SEL	Start enable signal is on.	0
DI1	External signal required through digital input DI1. 1 = Start enable. If Start enable signal is switched off, the drive will not start or it coasts to stop if it is running and alarm START ENABLE 1 MISSING (2021) is activated	1
DI2	See selection DI1.	2
DI3	See selection DI1.	3
DI4	See selection DI1.	4
DI5	See selection DI1.	5
COMM	Fieldbus interface as the source for the inverted Start enable (Start disable) signal.	7
DI1(INV)	External signal required through inverted digital input DI1. 0 = Start enable. If Start enable signal is switched off, the drive will not start or it coasts to stop if it is running and alarm START ENABLE 1 MISSING (2021) is activated.	-1
DI2(INV)	See selection DI1(INV).	-2
DI3(INV)	See selection DI1(INV).	-3
DI4(INV)	See selection DI1(INV).	-4
DI5(INV)	See selection DI1(INV).	-5

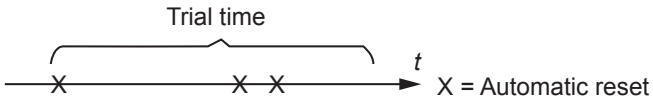
No. Name/Value	Description	Def/FbEq
1610 DISPLAY ALARMS	Activates/deactivates alarms OVERCURRENT (2001), OVERVOLTAGE (2002), PID SLEEP (2018) and DEVICE OVERTEMP (2009). For more information, see chapter Fault tracing in ACS355 User's Manual (3AUA0000066143)	YES
NO	Alarms are inactive.	0
YES	Alarms are active.	1
17 OVERRIDE		
1701 OVERRIDE SEL	Selects the source of the override activation signal.	0
NOT SEL	Override activation signal not selected.	0
DI1	Defines digital input DI1 as the override activation signal. This digital input must be activated for override activation signal.	1
DI2	See selection DI1.	2
DI3	See selection DI1.	3
DI4	See selection DI1.	4
DI5	See selection DI1.	5
DI1 (INV)	Defines an inverted digital input DI1 as the override activation signal.	-1
DI2 (INV)	See selection DI1(INV).	-2
DI3 (INV)	See selection DI1(INV).	-3
DI4 (INV)	See selection DI1(INV).	-4
DI5 (INV)	See selection DI1(INV).	-5
1702 OVERRIDE FREQ	Defines a preset frequency for the override.	0
-500 … 500 Hz	Defines a preset frequency reference. This present is only used Scalar mode	0
1704 OVERR PASS CODE	Entering the correct override pass code unlocks parameter 1705 OVERRIDE for one change. • Enter the pass code always before changing the value of the parameter 1705. • The pass code is 358. • The entry reverts back to zero automatically.	0
0…65535	Passcode range	0.1
1703 OVERRIDE SPEED	Defines a preset speed for the override.	0
0…30,000 rpm	This present is only used in Vector mode	1
1705 OVERRIDE	Selects whether the override is enabled or disabled.	0
ON	Override disabled	0
OFF	Override enabled When enabled, the drive stores the values of all parameters into an override parameter set (see parameter 9902 APPLIC MACRO) and the parameters in Group 17: Override will be write protected (except parameter 1704 OVERR PASS CODE). To change the other parameters in Group 17: Override, override has to be disabled.	1
1706 OVERRIDE DIR	Selects the source of the override direction signal.	0
FORWARD	Assigns forward as the override direction.	0
DI1	Defines digital input 1 as the override direction signal. • Activating the digital input selects the forward direction. • De-activating the digital input selects the reverse direction.	1
DI2	See selection DI1.	2
DI3	See selection DI1.	3
DI4	See selection DI1.	4
DI5	See selection DI1.	5
DI6	See selection DI1.	6
REVERSE	Assigns reverse as the override direction.	7

No. Name/Value	Description	Def/FbEq
DI1 (INV)	Defines an inverted digital input DI1 as the override direction signal. • De-activating the digital input selects the forward direction. • Activating the digital input selects the reverse direction.	-1
DI2 (INV)	See selection DI1(INV).	-2
DI3 (INV)	See selection DI1(INV).	-3
DI4 (INV)	See selection DI1(INV).	-4
DI5 (INV)	See selection DI1(INV).	-5
DI6 (INV)	See selection DI1(INV).	-6
1707 OVERRIDE REF	Selects the source of the override reference.	1
CONSTANT	Selects a preset frequency or speed for the override. The frequency value is defined by parameter 1702 OVERRIDE FREQ.	1
PID Selection	The reference is taken from the PID output, see group Group 40: Process PID set 1. Note: The following conditions must be met when using PID in the override mode: • PID1 setpoint (parameter 4010 SET POINT SEL) can be either A1, A2 OR INTERNAL PID1 parameter set 1 must be active (parameter 4027 PID 1 PARAM SET = set 1). • Override direction (parameter 1706 OVERRIDE DIR) can be either 0 = forward or 7 = reverse.	2
Commissioning the override mode	Commissioning the override mode 1. Enter the parameters in all groups as needed, except Group 17: Override. 2. Select the digital input that will activate the override mode (parameter 1701 OVERRIDE SEL). 3. Enter the frequency reference for the override mode with parameter 1702 OVERRIDE FREQ. 4. Enter the pass code (358) at parameter 1704 OVERR PASS CODE. 5. Enable the override mode with parameter 1705 OVERRIDE.	
Changing the override parameters	Changing the override parameters 1. If override mode is already enabled, disable it: • Enter the pass code (358) at parameter 1704 OVERR PASS CODE. • Disable the override mode with parameter 1705 OVERRIDE. 2. If needed, load the override parameter set with parameter 9902 APPLIC MACRO. 3. Change the parameters as needed, except Group 17: Override. 4. Select the digital input that will activate the override mode (parameter 1701 OVERRIDE SEL). 5. Enter the frequency reference for the override mode with parameter 1702 OVERRIDE FREQ. 6. Enter the pass code (358) at parameter 1704 OVERR PASS CODE. 7. Enable the override mode with parameter 1705 OVERRIDE. The drive replaces the override parameter set with new values of all parameters.	

No. Name/Value	Description	FbEq
21 Start/Stop		
2104 DC HOLD CTL	Activates the DC hold or DC braking function.	NOT SEL
NOT SEL	Inactive	0
DC HOLD	DC hold function active. DC hold is not possible if parameter 9904 MOTOR CTRL MODE setting is SCALAR: FREQ. When both the reference and the motor speed drop below the value of parameter 2105 DC HOLD SPEED, the drive will stop generating sinusoidal current and start to inject DC into the motor. The current is set by parameter 2106 DC CURR REF. When the reference speed exceeds parameter 2105 value, normal drive operation continues.  Note: DC hold has no effect if the start signal is switched off. Note: Injecting DC current into the motor causes the motor to heat up. In applications where long DC hold times are required, externally ventilated motors should be used. If the DC hold period is long, the DC hold cannot prevent the motor shaft from rotating if a constant load is applied to the motor.	1
DC BRAKING	DC current braking function active. If parameter 2102 STOP FUNCTION is set to COAST, DC braking is applied after the start command is removed. If parameter 2102 STOP FUNCTION is set to RAMP, DC braking is applied after the ramp.	2
MOT. HEATING	Motor heating function selected. The percentage of motor nominal current for heating is set by parameter 2115 HEATING CURR REF. Motor heating is activated by the input signal selected in 2115 MOT. HEATING SEL and 1608 or 1609 START ENABLE SIGNAL	3
2114 HEATING CURR REF	A percentage of the motor nominal current (MOTOR NOM CURR, 9906) that is to be DC injected into the motor.	0
0..30.0%	Percentage of motor nominal current (MOTOR NOM CURR, 9906)	1 = 1%
2115 MOT. HEATING SEL	Defines the input that turns on/off motor heating	0
Off	Turns off the injection motor heating	0
DI1	Defines digital input 1 as the motor heating desired signal. When the DI is a 1, motor heating is turned on.	1
DI2	See selection DI1.	2
DI3	See selection DI1.	3
DI4	See selection DI1.	4
DI5	See selection DI1.	5
COMM	Injection on/off is controlled over fieldbus	7
ON	Injection is always on when the drive is on. Exceptions are when the drive is running, STO is on, start enable removed, etc...	8
DI1 (INV)	Defines digital input 1 as the motor heating desired signal. When the DI is a 0, motor heating is turned on.	-1
DI2 (INV)	See selection DI1(INV).	-2
DI3 (INV)	See selection DI1(INV).	-3
DI4 (INV)	See selection DI1(INV).	-4
DI5 (INV)	See selection DI1(INV).	-5

No. Name/Value	Description	FbEq
22 ACCEL/DECEL	Acceleration and deceleration times	
2201 ACC/DEC 1/2 SEL	Defines the source from which the drive reads the signal that selects between the two ramp pairs, acceleration/deceleration pair 1 and 2. Ramp pair 1 is defined by parameters 2202…2204. Ramp pair 2 is defined by parameters 2205…2207.	NOT SEL
NOT SEL	Ramp pair 1 is used.	0
DI1	Digital input DI1. 1 = ramp pair 2, 0 = ramp pair 1.	1
DI2	See selection DI1.	2
DI3	See selection DI1.	3
DI4	See selection DI1.	4
DI5	See selection DI1.	5
COMM	Fieldbus interface as the source for ramp pair 1/2 selection.	7
SEQ PROG	Sequence programming ramp defined by parameter 8422 ST1 RAMP (or 8423/…/8492)	10
DI1(INV)	Inverted digital input DI1. 0 = ramp pair 2, 1 = ramp pair 1.	-1
DI2(INV)	See selection DI1(INV).	-2
DI3(INV)	See selection DI1(INV).	-3
DI4(INV)	See selection DI1(INV).	-4
DI5(INV)	See selection DI1(INV).	-5
2202 ACCELER TIME 1	Defines the acceleration time 1, ie the time required for the speed to change from zero to the speed defined by parameter 2008 MAXIMUM FREQ (in scalar control) / 2002 MAXIMUM SPEED (in vector control). The control mode is selected by parameter 9904 MOTOR CTRL MODE. • If the speed reference increases faster than the set acceleration rate, the motor speed will follow the acceleration rate. • If the speed reference increases slower than the set acceleration rate, the motor speed will follow the reference signal. • If the acceleration time is set too short, the drive will automatically prolong the acceleration in order not to exceed the drive operating limits. Actual acceleration time depends on parameter 2204 RAMP SHAPE 1 setting.	30.0 s
0.0…1800.0 s	Time	1 = 0.1 s
2203 DECELER TIME 1	Defines the deceleration time 1, ie the time required for the speed to change from the value defined by parameter 2008 MAXIMUM FREQ (in scalar control) / 2002 MAXIMUM SPEED (in vector control) to zero. The control mode is selected by parameter 9904 MOTOR CTRL MODE. • If the speed reference decreases slower than the set deceleration rate, the motor speed will follow the reference signal. • If the reference changes faster than the set deceleration rate, the motor speed will follow the deceleration rate. • If the deceleration time is set too short, the drive will automatically prolong the deceleration in order not to exceed drive operating limits. If a short deceleration time is needed for a high inertia application, the drive should be equipped with a brake resistor. Actual deceleration time depends on parameter 2204 RAMP SHAPE 1 setting.	30.0 s
0.0…1800.0 s	Time	1 = 0.1 s

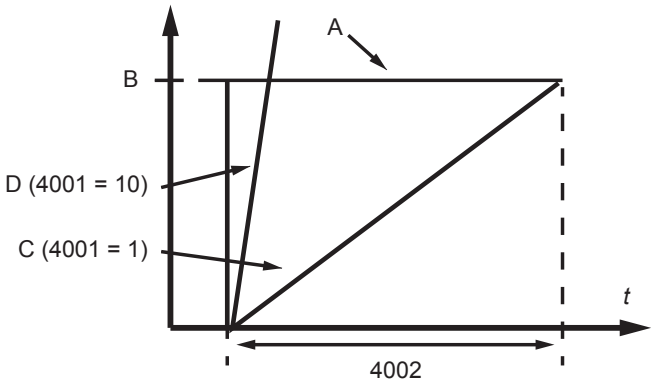
No. Name/Value	Description	FbEq
26 MOTOR CONTROL	Motor control variables	
2605 U/F RATIO	Selects the voltage to frequency (U/f) ratio below the field weakening point. For scalar control only.	SQUARED
LINEAR	Linear ratio for constant torque applications.	1
SQUARED	Squared ratio for centrifugal pump and fan applications. With squared U/f ratio the noise level is lower for most operating frequencies. Not recommended for permanent magnet synchronous motors.	2
USER DEFINED	Custom ratio defined by parameters 2610…2618. See section Custom U/f ratio in the ACS355 User's Manual (3AUA0000066143).	3
30 FAULT FUNCTIONS	Programmable protection functions	
3006 MOT THERM TIME	Defines the thermal time constant for the motor thermal model, ie the time within which the motor temperature has reached 63% of the nominal temperature with steady load. For thermal protection according to UL requirements for NEMA class motors, use the rule of thumb: Motor thermal time = 35 • t6. t6 (in seconds) is specified by the motor manufacturer as the time the motor can safely operate at six times its rated current. Thermal time for a Class 10 trip curve is 350 s, for a Class 20 trip curve 700 s, and for a Class 30 trip curve 1050 s.  Parameter 3006	1050 s
256…9999 s	Time constant	1 = 1 s
3019 COMM FAULT TIME	Defines the time delay for the fieldbus communication break supervision. See parameter 3018 COMM FAULT FUNC.	10.0 s
0.0…600.0 s	Delay time	1 = 0.1 s

No. Name/Value	Description	FbEq
31 AUTOMATIC RESET	Automatic fault reset. Automatic resets are possible only for certain fault types and when the automatic reset function is activated for that fault type.	
3101 NR OF TRIALS	Defines the number of automatic fault resets the drive performs within the time defined by parameter 3102 TRIAL TIME. If the number of automatic resets exceeds the set number (within the trial time), the drive prevents additional automatic resets and remains stopped. The drive must be reset from the control panel or from a source selected by parameter 1604 FAULT RESET SEL. Example: Three faults have occurred during the trial time defined by parameter 3102. Last fault is reset only if the number defined by parameter 3101 is 3 or more. Trial time  	5
0…5	Number of the automatic resets	1 = 1
3102 TRIAL TIME	Defines the time for the automatic fault reset function. See parameter 3101 NR OF TRIALS.	30.0 s
1.0…600.0 s	Time	1 = 0.1 s
3103 DELAY TIME	Defines the time that the drive will wait after a fault before attempting an automatic reset. See parameter 3101 NR OF TRIALS. If delay time is set to zero, the drive resets immediately.	0.5 s
0.0…120.0 s	Time	1 = 0.1 s
3104 AR OVERCURRENT	Activates/deactivates the automatic reset for the overcurrent fault. Automatically resets fault OVERCURRENT (0001) after the delay set by parameter 3103 DELAY TIME.	DISABLE
DISABLE	Inactive	0
ENABLE	Active	1
3105 AR OVERVOLTAGE	Activates/deactivates the automatic reset for the intermediate link overvoltage fault. Automatically resets fault DC OVERVOLT (0002) after the delay set by parameter 3103 DELAY TIME.	ENABLE
DISABLE	Inactive	0
ENABLE	Active	1
3106 AR UNDERVOLTAGE	Activates/deactivates the automatic reset for the intermediate link undervoltage fault. Automatically resets fault DC UNDERVOLT (0006) after the delay set by parameter 3103 DELAY TIME.	ENABLE
DISABLE	Inactive	0
ENABLE	Active	1
3107 AR AI<MIN	Activates/deactivates the automatic reset for AI<MIN (analog input signal under the allowed minimum level) faults AI1 LOSS (0007) and AI2 LOSS (0008). Automatically resets the fault after the delay set by parameter 3103 DELAY TIME.	ENABLE
DISABLE	Inactive	0
ENABLE	Active WARNING! The drive may restart even after a long stop if the analog input signal is restored. Ensure that the use of this feature will not cause danger.	1
3108 AR EXTERNAL FLT	Activates/deactivates the automatic reset for faults EXT FAULT 1 (0014) and EXT FAULT 2 (0015). Automatically resets the fault after the delay set by parameter 3103 DELAY TIME.	ENABLE
DISABLE	Inactive	0
ENABLE	Active	1

No. Name/Value	Description	FbEq
34 PANEL DISPLAY	Selection of actual signals to be displayed on the panel	
3405 OUTPUT1 UNIT	Selects the unit for the displayed signal selected by parameter 3401 SIGNAL1 PARAM. Note: Parameter is not effective if parameter 3404 OUTPUT1 DSP FORM setting is DIRECT. Note: Unit selection does not convert values.	Hz
NO UNIT	No unit selected	0
A	ampere	1
V	volt	2
Hz	hertz	3
%	percentage	4
s	second	5
h	hour	6
rpm	revolutions per minute	7
kh	kilohour	8
°C	celsius	9
lb ft	pounds per foot	10
mA	milliampere	11
mV	millivolt	12
kW	kilowatt	13
W	watt	14
kWh	kilowatt hour	15
°F	fahrenheit	16
hp	horsepower	17
MWh	megawatt hour	18
m/s	meters per second	19
m3/h	cubic meters per hour	20
dm3/s	cubic decimeters per second	21
bar	bar	22
kPa	kilopascal	23
GPM	gallons per minute	24
PSI	pounds per square inch	25
CFM	cubic feet per minute	26
ft	foot	27
MGD	millions of gallons per day	28
inHg	inches of mercury	29
FPM	feet per minute	30
kb/s	kilobytes per second	31
kHz	kilohertz	32
ohm	ohm	33
ppm	pulses per minute	34
pps	pulses per second	35
l/s	liters per second	36
l/min	liters per minute	37
l/h	liters per hour	38

No. Name/Value	Description	FbEq
m3/s	cubic meters per second	39
m3/m	cubic meters per minute	40
kg/s	kilograms per second	41
kg/m	kilograms per minute	42
kg/h	kilograms per hour	43
mbar	millibar	44
Pa	pascal	45
GPS	gallons per second	46
gal/s	gallons per second	47
gal/m	gallons per minute	48
gal/h	gallons per hour	49
ft3/s	cubic feet per second	50
ft3/m	cubic feet per minute	51
ft3/h	cubic feet per hour	52
lb/s	pounds per second	53
lb/m	pounds per minute	54
lb/h	pounds per hour	55
FPS	feet per second	56
ft/s	feet per second	57
inH2O	inches of water	58
in wg	inches of water gauge	59
ft wg	feet on water gauge	60
lbsi	pounds per squared inch	61
ms	millisecond	62
Mrev	millions of revolutions	63
d	days	64
inWC	inches of water column	65
m/min	meters per minute	66
Nm	Newton meter	67
Km3/h	thousand cubic meters per hour	68
%ref	reference as a percentage	117
%act	actual value as a percentage	118
%dev	deviation as a percentage	119
% LD	load as a percentage	120
% SP	set point as a percentage	121
%FBK	feedback as a percentage	122
Iout	output current (as a percentage)	123
Vout	output voltage	124
Fout	output frequency	125
Tout	output torque	126
Vdc	DC voltage	127

No. Name/Value	Description	FbEq
3411 OUTPUT2 DSP FORM	Defines the format for the displayed signal selected by parameter 3408 SIGNAL2 PARAM.	+/-0.0
	See parameter 3404 OUTPUT1 DSP FORM.	
3415 SIGNAL3 PARAM	Selects the third signal to be displayed on the control panel in the Output mode. See parameter 3401 SIGNAL1 PARAM.	120
0 = NOT SELECTED 101…180	Parameter index in group 01 OPERATING DATA. Eg 102 = 0102 SPEED. If value is set to 0, no signal is selected.	1 = 1
3418 OUTPUT3 DSP FORM	Defines the format for the displayed signal selected by parameter 3415 SIGNAL3 PARAM.	+/-0.0
	See parameter 3404 OUTPUT1 DSP FORM.	-
3419 OUTPUT3 UNIT	Selects the unit for the displayed signal selected by parameter 3415 SIGNAL 3 PARAM.	mA
	See parameter 3405 OUTPUT1 UNIT	-
3420 OUTPUT3 MIN	Sets the minimum display value for the signal selected by parameter 3415 SIGNAL 3 PARAM. See parameter 3402 SIGNAL 1 MIN	0
x...x	Setting range depends on parameter 3415 SIGNAL3 PARAM setting	-
3421 OUTPUT3 MAX	Sets the maximum display value for the signal selected by parameter 3415 SIGNAL 3 PARAM. See parameter 3402 SIGNAL 1 MIN	20
x...x	Setting range depends on parameter 3415 setting	-
36 TIMED FUNCTIONS	Time periods 1 to 4 and booster signal. See section Real- time clock and timed functions in the ACS355 User's Manual (3AUA0000066143).	
3602 START TIME 1	Defines the daily start time 1. The time can be changed in 2-second steps.	12:00:00
00:00:00… 23:59:58	hours:minutes:seconds. Example: If parameter value is set to 07:00:00, timed function 1 is activated at 7:00 (7 a.m).	
3603 STOP TIME 1	Defines the daily stop time 1. The time can be changed in 2-second steps.	12:00:00
00:00:00… 23:59:58	hours:minutes:seconds. Example: If parameter value is set to 18:00:00, timed	
3606 START TIME 2	See parameter 3602 START TIME 1.	12:00:00
	See parameter 3602 START TIME 1.	
3607 STOP TIME 2	See parameter 3603 STOP TIME 1	12:00:00
	See parameter 3603 STOP TIME 1	
3610 START TIME 3	See parameter 3602 START TIME 1	12:00:00
	See parameter 3602 START TIME 1	
3611 STOP TIME 3	See parameter 3603 STOP TIME 1	12:00:00
	See parameter 3603 STOP TIME 1	
3614 START TIME 4	See parameter 3602 START TIME 1	12:00:00
	See parameter 3602 START TIME 1	
3615 STOP TIME 4	See parameter 3603 STOP TIME 1	12:00:00
	See parameter 3603 STOP TIME 1	
3623 BOOSTER TIME	Defines the time inside which the booster is deactivated after the booster activation signal is switched off.	12:00:00

No. Name/Value	Description	FbEq
40 PROCESS PID SET 1	Process PID (PID1) control parameter set 1. See section PID control in the ACS355 User's Manual (3AUA0000066143).	
4001 GAIN	Defines the gain for the process PID controller. High gain may cause speed oscillation.	2.5
0.1…100.0	Gain. When value is set to 0.1, the PID controller output changes one-tenth as much as the error value. When value is set to 100, the PID controller output changes one hundred times as much as the error value.	1 = 0.1
4002 INTEGRATION TIME	Defines the integration time for the process PID1 controller. The integration time defines the rate at which the controller output changes when the error value is constant. The shorter the integration time, the faster the continuous error value is corrected. Too short an integration time makes the control unstable. A = Error B = Error value step C = Controller output with gain = 1 D = Controller output with gain = 10 	3.0 s
0.0 = NOT SEL 0.1…3600.0 s	Integration time. If parameter value is set to zero, integration (I-part of the PID controller) is disabled.	1 = 0.1 s
4004 PID DERIV FILTER	Defines the filter time constant for the derivative part of the process PID controller. Increasing the filter time smooths the derivative and reduces noise.	0.1 s
0.0…10.0 s	Filter time constant. If parameter value is set to zero, the derivative filter is disabled.	1 = 0.1 s
4010 SET POINT SEL	Selects the source for the process PID controller reference signal.	KEYPAD
KEYPAD	Control panel	0
AI1	Analog input AI1	1
AI2	Analog input AI2	2
COMM	Fieldbus reference REF2	8
COMM+AI1	Summation of fieldbus reference REF2 and analog input AI1. See section Reference selection and correction in the ACS355 User's Manual (3AUA0000066143).	9
COMM*AI1	Multiplication of fieldbus reference REF2 and analog input AI1. See section Reference selection and correction in the ACS355 User's Manual (3AUA0000066143).	10
DI3U,4D(RNC)	Digital input DI3: Reference increase. Digital input DI4: Reference decrease. Stop command resets the reference to zero. The reference is not saved if the control source is changed from EXT1 to EXT2, from EXT2 to EXT1 or from LOC to REM.	11
DI3U,4D(NC)	Digital input DI3: Reference increase. Digital input DI4: Reference decrease. The program stores the active reference (not reset by a stop command). The reference is not saved if the control source is changed from EXT1 to EXT2, from EXT2 to EXT1 or from LOC to REM.	12

No. Name/Value	Description	FbEq
AI1+AI2	Reference is calculated with the following equation: REF = AI1(%) + AI2(%) - 50%	14
AI1*AI2	Reference is calculated with the following equation: REF = AI1(%) • (AI2(%) / 50%)	15
AI1-AI2	Reference is calculated with the following equation: REF = AI1(%) + 50% - AI2(%)	16
AI1/AI2	Reference is calculated with the following equation: REF = AI1(%) • (50% / AI2 (%))	17
INTERNAL	A constant value defined by parameter 4011 INTERNAL SETPNT	19
DI4U,5D(NC)	See selection DI3U,4D(NC)	31
FREQ INPUT	Frequency input	32
SEQ PROG OUT	Sequence programming output. See parameter group 84 SEQUENCE PROG.	33
41 PROCESS PID SET 2	Process PID (PID2) control parameter set 2. See section PID control in the ACS355 User's Manual (3AUA0000066143).	
4101 GAIN	See parameter 4001 GAIN	2.5
4102 INTEGRATION TIME	See parameter 4002 INTEGRATION TIME	3.0
4104 PID DERIV FILTER	See parameter 4004 PID DERIV FILTER	0.1
4110 SET POINT SEL	See parameter 4010 SET POINT SEL	KEYPAD
98 OPTIONS	External serial communication activation	
9802 COMM PROT SEL	Activates the external serial communication and selects the interface.	BACnet
NOT SEL	No communication	0
STD MODBUS	Embedded fieldbus. Interface: EIA-485 provided by optional FMBA-01 Modbus adapter connected to drive terminal X3. See chapter Fieldbus control with embedded fieldbus in the ACS355 User's Manual (3AUA0000066143).	1
BACnet	The drive communicates through a fieldbus adapter module connected to drive terminal X3. See also parameter group 53 EFB PROTOCOL. See chapter Fieldbus control with fieldbus adapter in the ACS355 User's Manual.	5
MODBUS RS232	Embedded fieldbus. Interface: RS-232 (ie control panel connector).	10

Fieldbus control

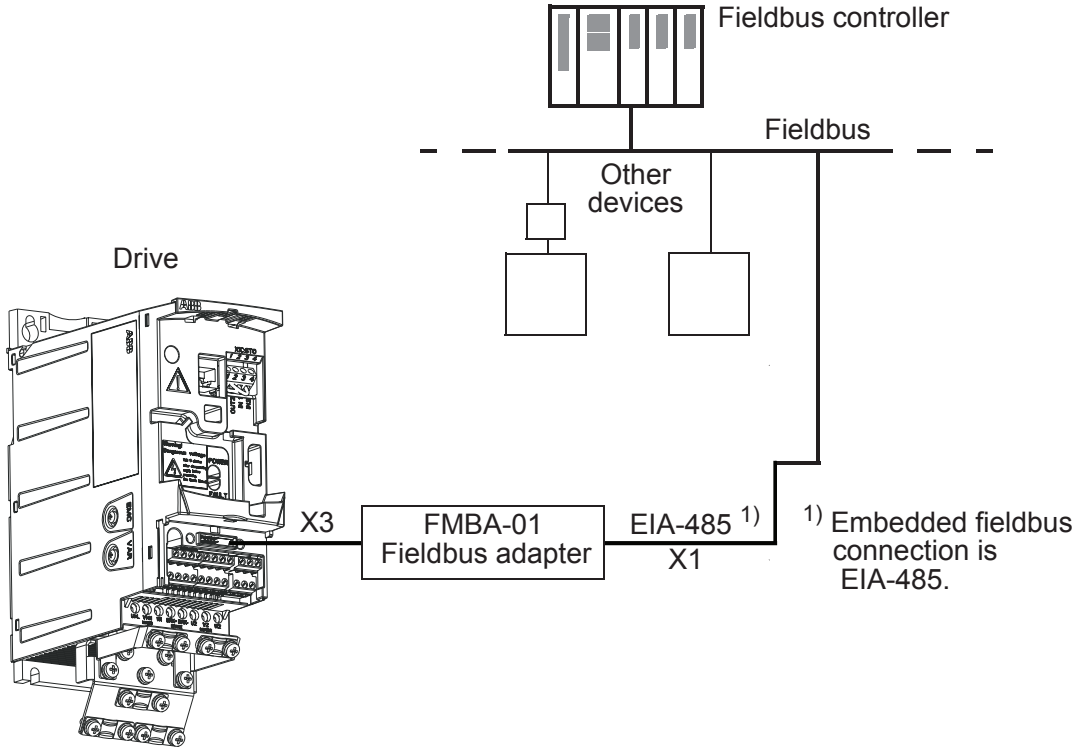
About this chapter

This chapter describes how the drive can be controlled by external devices over a communication network using BACnet. Refer these parameters in addition to the actual signals and parameters described in the ACS355 User's manual (3AUA0000066143 [English]).

System overview

The drive can be connected to an external control system via embedded fieldbus. The embedded fieldbus supports Modbus RTU and BACnet® protocols.

Embedded fieldbus connection for both Modbus RTU and BACnet is EIA-485 using the Adapter Module (FMBA-01) connected to the X3 terminals of the ACS355. EIA-485 is designed for a multipoint application (a single master controlling one or more slaves.



The drive can be set to receive all of its control information through the fieldbus interface, or the control can be distributed between the fieldbus interface and other available sources, for example, digital and analog inputs.

Planning

Network planning should address the following questions:

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

Mechanical and electrical installation – Embedded Fieldbus (EFB)

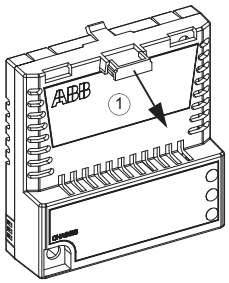
WARNING! Connections should be made only while the drive is disconnected from the power source.

Mechanical addition of FMBA-01 module to the ACS355.

- The FMBA-01 Modbus adapter module is to be inserted into the X3 terminal of the ACS355.
- Insure the guide pins on the back of the module are inserted in the guide holes of the ACS355 and support bracket.

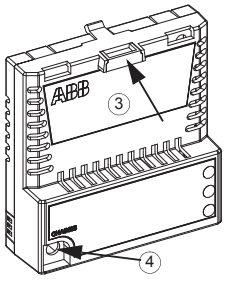
Installation instruction

When you install or remove the module from a control unit:



1. Pull out the lock.

2. Install the module according to the installation instructions in the manual.

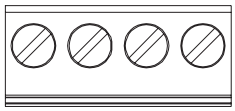


3. Push in the lock.

4. Fasten the screw.

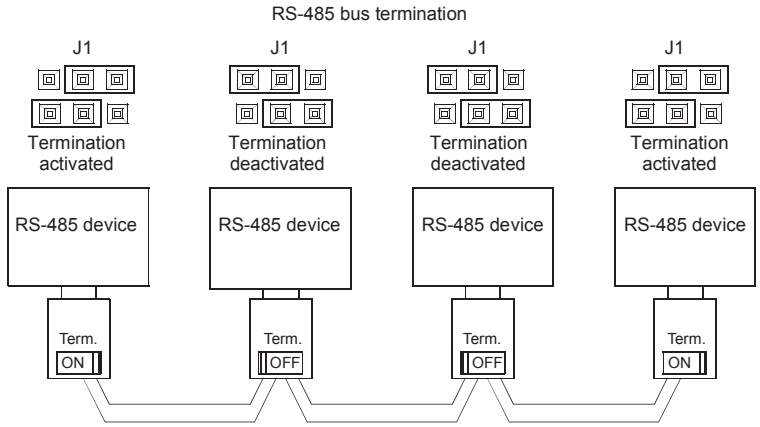
The FMBA-01 Fieldbus Adapter is used for RS485 communications.

- The FMBA-01 module connects to the ACS355 via the X3 terminal.
- Use Belden 9842 or equivalent. Belden 9842 is a dual twisted, shielded pair cable with a wave impedance of 120Ω.
- Use one of these twisted shielded pairs for the RS485 link. Use this pair to connect all A (-) terminals together and all B (+) terminals together.
- On the FMBA-01, the B (+) terminal is X1:2 and the A (-) terminal is X1:3.
- Use one of the wires in the other pair for the logical ground (terminal X1:4), leaving one wire unused.The BACnet standard requires the third (reference) wire be used with isolated devices, such as VFDs. Unstable BACnet communications may occur if the third wire is not used.

X1			Description
	1	SHLD	Bus cable shield. Connected internally to GND_B via an RC filter and directly to CH_GND (chassis).
	2	DATA_B	Data positive
	3	DATA_A	Data negative
	4	GND_B	Isolated signal ground

- Do not directly ground the RS485 network at any point. Ground all devices on the network using their corresponding grounding terminals.
- The shield is typically not connected to SHLD at each FMBA-01. Instead, the wire shields are connected to each other, making one continuous shield through the length of the cable. The shield is often grounded only at the building automation controller. Other SHLD connections should be used for abnormal noise issues and troubleshooting.
- As always, the grounding wires should not form any closed loops, and all the devices should be grounded to a common ground.
- Connect the RS485 link in a daisy-chained bus, without dropout lines.
- The FMBA-01 uses a full unit load transceiver. Do not exceed 31 devices on the network.
- To reduce noise on the network, terminate the RS485 network using 120Ω resistors at both ends of the network.

The wiring diagram below is found in the FMBA-01 module manual. The diagram assumes VFDs are on both ends of the network and that the network was not biased by the controller. However, in BACnet, the building automation controller will typically bias the wire and the controller will be at one end of the network. In a typical BACnet installation where the wire is already biased, ABB does not recommend activating the J1 termination resistor, due to the fact this J1 circuit is also an active biasing circuit. The controls contractor should use their own 120Ω resistor as required. As stated in a previous bullet, three wires should be used for stable BACnet communications.



- For configuration information see the following:
  - Activate drive control functions – EFB on page 33.
  - The appropriate EFB protocol specific technical data. For example, BACnet protocol technical data on page 39.
- See User's Manual Adapter Module FMBA-01 (3AFE68586704) for more information related to the FMBA-01 connections

Communication set-up – EFB

Serial communication selection

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

- 1 (STD MODBUS)
- 5 (BACNET)
- 10 (MODBUS RS232)

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

Serial communication configuration

Setting parameter 9802 COMM PROT SEL automatically sets the appropriate default values in parameters that define the communication process. These parameters and descriptions are defined in the following tables. In particular, note that the station ID may require adjustment.

Code	Description	EFB Protocol Reference (BACnet)
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: XXYY, where xx = protocol ID, and YY = program revision.
5302	EFB STATION ID (0...247) Defines the node address of the RS485 link.	Sets MS/TP MAC ID. A temporary value of 0 places the protocol channel in reset.
5303	EFB BAUD RATE Defines the communication speed of the RS485 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 115.2 kbits/s	When this protocol is selected, the default value for this parameter is: 38400.
5304	EFB PARITY Defines the data length, parity and stop bits to be used with the RS485 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: 0 Sets MS/TP character format.
5305		N/A. When this protocol is selected, the default value for this parameter is:0 Set MS/TP character format.
5310	EFB PAR10	Sets them response turnaround time in milliseconds. When this protocol is selected, the default value is: 5 msec.

Code	Description	EFB Protocol Reference (BACnet)
5311	EFB PAR11	This parameter, together with parameter 5317, sets BACnet Device Object Instance IDs: • For the range 1 to 65,535: This parameter sets the ID directly (5317 must be 0). For example, the following values set the ID to 49134: 5311 = 49134 and 5317 = 0. • For IDs > 65,335: 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.
5312	EFB PAR12	This parameter sets the BACnet Device Object Max Info Frames Property.
5313	EFB PAR13	This parameter sets the BACnet Device Object Max Master Property.
5314	EFB PAR14	
5315	EFB PAR15	
5316	EFB PAR 16	This parameter indicates the count of MS/TP tokens passed to this drive.
5317	EFB PAR 17	This parameter works with parameter 5311 to set BACnet Device Object Instance IDs. See parameter 5311.

Note: After any changes to the communication settings, protocol must be reactivated by either cycling the drive power, or by clearing and then restoring the station Id (5302) or use Reinitialize Device Service.

Activate drive control functions – EFB

Controlling the drive

Fieldbus control of various drive functions requires configuration to:

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

The following sections describe, at a general level, the configuration required for each control function. For the protocol-specific details, see the document supplied with the FBA module.

Start/Stop direction control

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

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

Drive Parameter		Value	Description	BACnet
1001	EXT1 COMMAND S	10 (COMM)	Start/Stop by fieldbus with Ext1 selected.	BV10
1002	EXT2 COMMAND S	10 (COMM)	Start/Stop by fieldbus with Ext2 selected.	BV10
1003	DIRECTION	3 (REQUEST)	Direction by fieldbus.	BV11

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 as defined below.

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

Miscellaneous drive control

Note: The user should change only the parameters for the functions you wish to control vial fieldbus. All other parameters should typically remain at factory default. For simple start/stop and speed reference fieldbus control, only parameters 1001 EXT1 COMMANDS and 1103 REF1 SELECT need to be changed to COMM.

Using the fieldbus for miscellaneous drive control requires:

- Drive parameter values set as defined below.

Drive Parameter		Value	Description	BACnet
1601	RUN ENABLE	7 (COMM)	Run enable by fieldbus. (Not recommended[1]	BV12
1604	FAULT RESET SEL	8 (COMM)	Fault reset by fieldbus.	BV14
1606	LOCAL LOCK	8 (COMM)	Source for local lock selection is the fieldbus.	BV17
1608	START ENABLE 1	7 (COMM)	Source for start enable 1 is the fieldbus Command word. (Not recommended)[1]	BV20
1609	START ENABLE 2	7 (COMM)	Source for start enable 2 is the fieldbus Command word. (Not recommended)[1]	BV21

1. ABB recommends hard wiring run permissive and safeties.

Relay output control

Using the fieldbus for relay output control requires:

- Drive parameter values set as defined below.

Drive Parameter		Value	Description	BACnet
1401	RELAY OUTPUT 1	35 (COMM)	Relay Output 1 controlled by fieldbus.	BO0
1402[1]	RELAY OUTPUT 2	35 (COMM)	Relay Output 2 controlled by fieldbus.	BO1
1403[1]	RELAY OUTPUT 3	35 (COMM)	Relay Output 3 controlled by fieldbus.	BO2
1410[1]	RELAY OUTPUT 4	35 (COMM)	Relay Output 4 controlled by fieldbus.	BO3

1. More than 1 relay 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.

Drive Parameter		Value	Description	BACnet
1501	AO1 CONTENT SEL	135 (COMM VALUE 1)	Analog Output 1 controlled by writing to AO0.	–
0135	COMM VALUE 1	--		AO0

PID control setpoint source

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

Drive Parameter		Value	Description	BACnet
4010	SET POINT SEL (Set 1)	8 (COMM VALUE 1) 9 (COMM + AI1) 10 (COMM * AI1)	Setpoint is either: Input Reference 2 (+/-/* AI1). Control requires parameter 1106 value = comm. Process PID setpoint. Control requires parameter 1106 value = pid1 out and parameter 4010 value = comm.	AV17
4110	SET POINT SEL (Set 2)			
4210	SET POINT SEL (Ext)			

Motor Heating

Use the following settings to configure the motor heating feature:

Drive Parameter		Value	Description	BACnet
2104	DC HOLD CTL	3 (MOT. HEATING)	Motor heating active	–
2114	HEATING CURRENT REF	0...30.0%	A percentage of motor nominal current that is to be DC injected into the motor.	AV29
2115	MOT. HEATING SEL	8 (COMM)	Injection on/off is controlled over fieldbus	BV22

Communication fault

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

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

Feedback from the drive – 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 39.

Drive Parameter		BACnet
0102	SPEED	AV0
0103	FREQ OUTPUT	AV1
0104	CURRENT	AV4
0105	TORQUE	AV5
0106	POWER	AV6
0107	DC BUS VOLT	AV2
0109	OUTPUT VOLTAGE	AV3
0115	KWH COUNTER	AV8
0160	DI 1-5 STATUS	BI6, BI7, BI8, BI9, BI10
0162	RO STATUS	BI0
0173	RO2-4 STATUS (when MREL-01 Relay extension is used)	BI1, BI2,BI3

Mailbox Read/Write

The ACS355 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	BACnet
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

Diagnostics – EFB

Fault queue for drive diagnostics

For general ACS355 diagnostics information, see section LEDs. The three (3) most recent ACS355 faults are reported to the fieldbus as defined below.

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

Serial communication diagnostics

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

- Loose connections
- Incorrect wiring (including swapped wires)
- Bad grounding
- Duplicate station numbers
- Incorrect setup of drives or other devices on the network
- Improper mounting of the FMBA-01 module could cause damage to the X3 connection pins.

The major diagnostic features for fault tracing on an EFB network include Group 53: EFB protocol parameters 5306…5309. Section Parameter listing describes these parameters in detail.

Diagnostic situations

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

Normal operation

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

- 5306 EFB OK MESSAGES advances (advances for each application message properly received and addressed to this drive).
- 5307 EFB CRC ERRORS does not advance at all (advances when an invalid message CRC is received).
- 5308 EFB UART ERRORS does not advance at all (advances when character format errors are detected, such as parity or framing errors).
- 5309 EFB STATUS value varies depending on network traffic.
- 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 ACS355 behavior, if communication is lost, was configured in Communication fault. The parameters are 3018 COMM FAULT FUNC and 3019 COMM FAULT TIME. Section Parameter listing describes these parameter.

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

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

Swapped wires

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

- The value of 5306 EFB OK MESSAGES does not advance.
- The values of 5307 EFB CRC ERRORS and 5308 EFB UART ERRORS are advancing.
- To correct: Check that the EIA-485 lines are not swapped.

Fault 28 – Serial 1 Err

If the drive's control panel shows fault 0028 SERIAL 1 ERR, check for either of the following:

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

Fault 31 – EFB1

For BACnet: If the drive's control panel shows fault 0031 EFB 1, the drive has an invalid Device Object Instance ID. To correct, use parameters 5311 and 5317 and establish a unique drive ID that is in the range 1 to 4,194,303.

Faults 31…33 – EFB1…EFB3

Except as noted above, these three EFB fault codes (0031 EFB 1…0033 EFB 3) are not used.

Intermittent off-line occurrences

The problems described above are the most common problems encountered with ACS355 serial communication. Intermittent problems might also be caused by:

- Marginally loose connections,
- Wear on wires caused by equipment vibrations,
- Insufficient grounding and shielding on both the devices and on the communication cables.

BACnet protocol technical data

Binary input object instance summary

The following table summarizes the Binary input objects supported:

Instance ID	Object Name	Description	Active/Inactive Text	Present Value Access Type
BI0	RO 1 ACT	This object indicates the status of Relay Output 1.	ON/OFF	R
BI1	RO 2 ACT	This object indicates the status of Relay Output 2 (requires MREL-01 option).	ON/OFF	R
BI2	RO 3 ACT	This object indicates the status of Relay Output 3 (requires MREL-01 option).	ON/OFF	R
BI3	RO 4 ACT	This object indicates the status of Relay Output 4 (requires MREL-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
BI12	TO ACT	This object indicates the status of Transistor Output	ON/OFF	R

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

Binary output object instance summary

The following table summarizes the Binary output objects supported:

Instance ID	Object Name	Description	Active/Inactive Text	Present Value Access Type
BO0	RO1 CMD	This object controls the output state of Relay 1. This control requires that parameter 1401 value = COMM.	ON/OFF	C
BO1[1)]	RO2 CMD	This object controls the output state of Relay 2. This control requires that parameter 1402 value = COMM (also requires MREL-01 option).	ON/OFF	C
BO2[1)]	RO3 CMD	This object controls the output state of Relay 3. This control requires that parameter 1403 value = COMM (also requires MREL-01 option).	ON/OFF	C
BO3[1)]	RO4 CMD	This object controls the output state of Relay 4. This control requires that parameter 1410 value = COMM (also requires MREL-01 option).	ON/OFF	C
BO6	TO CMD	This object controls the output state of the Transistor Output. This control requires that parameter 1805 value = COMM.	ON/OFF	C

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

1) BO1-3 requires an MREL module attached to the ACS355. Commanding these BOs without the presence of the MREL will cause an "Error: Value out of range" message.

Binary value object instance summary

The following table summarizes the Binary value objects supported:

Instance ID	Object Name	Description	Units	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: Maintenance trig.	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
BV9	RUN ENA ACT	This object indicates the Run Enable command status, regardless of the control source.	ENABLE/DISABLE	R

Instance ID	Object Name	Description	Units	Present Value Access Type
BV10	RUN/STOP CMD	This object commands a drive start. Control requires either: Parameter 1001 value = COMM for control by EXT1 or Parameter 1002 value = COMM for control by EXT2.	RUN/STOP	C
BV11	FWD/REV CMD	This object commands a motor rotation direction change. Control requires 1003 = REQUEST and either: Parameter 1001 value = COMM for control by EXT1 or Parameter 1002 value = COMM for control by EXT2.	REV/FWD	C
BV12	RUN ENA CMD	This object commands Run Enable. Control requires parameter 1601 value = COMM.	ENABLE/DISABLE	C
BV13	EXT 1/2 CMD	This object selects ext1 or ext2 as the active control source. Control requires parameter 1102 value = COMM.	EXT2/EXT1	C
BV14	FAULT RESET	This object resets a faulted drive. The command is rising-edge triggered. Control requires parameter 1604 value = COMM.	RESET/NO	C
BV15	MBOX READ	This object reads a parameter (defined by AV25 MBOX PARAM) and returns it in AV26 MBOX DATA.	READ/RESET	W
BV16	MBOX WRITE	This object writes the data value specified by AV26, MBOX DATA, to a parameter (defined by AV25, MBOX PARAM).	WRITE/RESET	W
BV17	LOCK PANEL	This object locks the panel and prevents parameter changes. The corresponding drive parameter is 1602.	LOCK/UNLOCK	W
BV18	CTL OVERRIDE CMD	This object commands the drive into BACnet Control Override. In this mode, BACnet takes drive control from the normal source. However, the control panel's HAND mode has priority over BACnet Control Override.	ON/OFF	C
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 par. 1608 value = COMM.	ENABLE/DISABLE	C
BV21	START ENABLE 2	This object commands start enable1. Control requires par. 1609 value = COMM.	ENABLE/DISABLE	C
BV22	HEATING CMD	Turns motor pre-heat on/off	ON/OFF	C
BV23	HEATING STS	Status of motor pre-heat	ON/OFF	R

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

Analog input object instance summary

The following table summarizes the Analog input objects supported:

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

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

Analog output object instance summary

The following table summarizes the Analog output objects supported:

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

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

Analog value object instance summary

The following table summarizes the Analog value objects supported:

Instance ID	Object Name	Description	Units	Present Value Access Type
AV0	OUTPUT SPEED	This object indicates the calculated motor speed in RPM. The corresponding drive parameter is 0102.	RPM	R
AV1	OUTPUT FREQ	This object indicates the output frequency applied to the motor in Hz. The corresponding drive parameter is 0103.	Hertz	R
AV2	DC BUS VOLT	This object indicates the drive's DC bus voltage level. The corresponding drive parameter is 0107.	Volts	R
AV3	OUTPUT VOLT	This object indicates the AC output voltage applied to the motor. The corresponding drive parameter is 0109.	Volts	R

Instance ID	Object Name	Description	Units	Present Value Access Type
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	KWH (NR)	This object indicates the drive's accumulated energy usage in kW hours. The value cannot be reset.	kWh	R
AV10	PRC PID FBCK	This object is the Process PID feedback signal. The corresponding drive parameter is 0130.	Percent	R
AV11	PRC PID DEV	This object is the Process PID output signal's deviation from its setpoint. The corresponding drive parameter is 0132.	Percent	R
AV12	EXT PID FBCK	This object is the External PID feedback signal. The corresponding drive parameter is 0131.	Percent	R
AV13	EXT PID DEV	This object is the External PID output signal's deviation from its setpoint. The corresponding drive parameter is 0133.	Percent	R
AV14	RUN TIME (R)	This object indicates, in hours, the drive's accumulated run time since the last reset. The value can be reset to zero. The corresponding drive parameter is 0114.	Hours	W
AV15	MOTOR TEMP	This object indicates the drive's motor temperature, as set up in Group 35: Motor temp meas. The corresponding drive parameter is 0145.	°C	R
AV16	INPUT REF 1	This object sets Input Reference 1. Control requires parameter 1103 value = COMM.	Percent	C
AV17	INPUT REF 2	This object sets either: Input Reference 2. Control requires parameter 1106 value = COMM. Process PID setpoint. Control requires parameter 1106 value = PID1 OUT and parameter 4010 value = COMM.	Percent	C
AV18	LAST FLT	This object indicates the most recent fault entered in the drive's fault log. The corresponding drive parameter is 0401.	None	R
AV19	PREV FLT 1	This object indicates the second most recent fault entered in the drive's fault log. The corresponding drive parameter is 0412.	None	R
AV20	PREV FLT 2	This object indicates the third most recent fault entered in the drive's fault log. The corresponding drive parameter is 0413.	None	R
AV21	AO 1 ACT	This object indicates Analog Output 1's level. The corresponding drive parameter is 0124.	Milliamps	R
AV23	ACCEL1 TIME	This object sets the Ramp1 acceleration time. The corresponding drive parameter is 2202.	Seconds	W

Instance ID	Object Name	Description	Units	Present Value Access Type
AV24	DECEL1 TIME	This object sets the Ramp1 deceleration time. The corresponding drive parameter is 2203.	Seconds	W
AV25	MBOX PARAM	This object defines the parameter to be read or written to by the mailbox function. See BV15 and BV16.	None	W
AV26	MBOX DATA	This object holds the mailbox function's parameter value – a value that was read, or is to be written. See BV15 and BV16.	None	W
AV27	EXT PID STPT	This object sets the External PID controller setpoint. The corresponding drive parameter is 4211. Control requires parameter 4210,value = 19.	Percent	C
AV28	HEATING CURRENT	Amount of motor nominal current desired for motor heating.	Percent	W

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

BACnet quick-start sequence

The following steps summarize the process for enabling and configuring BACnet on the ACS355:

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

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

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

2. Place the BACnet channel in "reset": Set drive parameter 5302 EFB STATION ID= 0.

   This setting holds the BACnet communication channel in reset while remaining settings are completed.

3. Define the MS/TP baud rate.

   Set drive parameter 5303 EFB BAUD RATE = appropriate value.

4. Define the Device Object Instance ID.

   To define a specific device object instance value, use drive parameters 5311 and 5317 (object instance values must be unique and in the range 1 to 4,194,303).

   To use the drive's MS/TP MAC ID as the device object instance value, set drive parameter 5311 and 5317 = 0.

5. Define a unique MS/TP MAC ID. Set drive parameter 5302 EFB STATION ID = appropriate value.

   Once this parameter is set to a non-zero value, current BACnet settings are “latched” and used for communication until the channel is reset.

   In order to participate in MS/TP token passing, the MAC ID used must be within the limits defined by other masters’ “Max Master” property.

6. Confirm proper BACnet communication.

   When BACnet communication is operating properly, drive parameter 5316 EFB PAR 16 (the MS/TP token counter), should be continually increasing.

   Drive parameter 5306 EFB UART ERRORS, should be stable.

Protocol implementation conformance statement (PICS)

PICS summary

BACnet Standard Device Profile. This version of ACS355 BACnet fully conforms to the 'Application-Specific Controller' standard device profile (B-ASC).

Services Supported. The following services are supported by the ACS355:

- 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 ACS355 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 ACS355 supports separate MAC ID and Device Object Instance parameters:

- Set the MAC ID using drive parameter 5302 EFB STATION ID. Default: 5302 = 1.
- Set the Device Object Instance ID 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:
  - For IDs in the range 1 to 65,535: Parameter 5311sets the ID directly (5317 must be 0). For example, the following values set the ID to 49,134: 5311 = 49134 and 5317 = 0.

- For IDs > 65,335: 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 the associated node.

Statement

The ACS355 +N831 has been submitted to an independent BACnet testing laboratory.

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

BACnet Protocol Implementation Conformance Statement	
Date:	October 2015
Vendor Name:	ABB, Inc
Product Name:	Low Voltage AC Motor Drive
Product Model Number:	ACS355
Applications Software Version:	6504
Firmware Revision:	0529
BACnet Protocol Revision:	7
Product Description:	The ACS355 is a high-performance adjustable frequency drive specifically designed for commercial automation applications. This product supports native BACnet, connecting directly to the MS/TP LAN. All standard MS/TP baud rates are supported, as well as master mode functionality. Over BACnet, the drive can be fully controlled as a standard adjustable frequency drive. In addition, up to 16 configurable I/O ports are available over BACnet for user applications.
BACnet Standardized Device Profile (Annex L):	☐ BACnet Operator Workstation (B-OWS) ☐ BACnet Building Controller (B-BC) ☐ BACnet Advanced Application Controller (B-AAC) ☒ BACnet Application Specific Controller (B-ASC) ☐ BACnet Smart Sensor (B-SS) ☐ BACnet Smart Actuator (B-SA)
List all BACnet Interoperability Building Blocks Supported (Annex K):	DS-RP-B, DS-WP-B, DM-DDB-B, DM-DOB-B, DM- DCC-B, DM-RD-B.
Segmentation Capability:	☐ Segmented requests supported. Window Size ____ ☐ Segmented responses supported. Window Size ____

Standard Object Types Supported: An object type is supported if it may be present in the device. For each standard Object Type supported provide the following data: 1. Whether objects of this type are dynamically creatable using the CreateObject service 2. Whether objects of this type are dynamically detectable using the DeleteObject service 3. List of the optional properties supported 4. List of all properties that are writable where not otherwise required by this standard 5. List of proprietary properties and for each its property identifier, datatype, and meaning 6. List of any property range restrictions	See table at Object/Property support matrix on page 49.
Data Link Layer Options:	☐ BACnet IP, (Annex J) ☐ BACnet IP, (Annex J), Foreign Device ☐ ISO 8802-3, Ethernet (Clause 7) ☐ ANSI/ATA 878.1, 2.5 Mb. ARCNET (Clause 8) ☐ ANSI/ATA 878.1, EIA-485 ARCNET (Clause 8), baud rate(s) ___ ☒ MS/TP master (Clause 9), baud rate(s): 9600, 19200, 38400, 76800 ☒ MS/TP slave (Clause 9), baud rate(s): 9600, 19200, 38400, 76800 ☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s): _ ☐ Point-To-Point, modem, (Clause 10), baud rate(s):_ ☐ LonTalk, (Clause 11), medium: _____ ☐ Other: _____
Device Address Binding: Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.)	☐ Yes ☒ No
Networking Options:	☐ Router, Clause 6 - List all routing configurations, eg, ARCNET-Ethernet, Ethernet-MS/TP, etc. ☐ Annex H, BACnet Tunneling Router over IP ☐ BACnet/IP Broadcast Management Device (BBMD)
Does the BBMD support registrations by Foreign Devices?	☐ Yes ☐ No
Character Sets Supported: Indicating support for multiple character sets does not imply that they can all be supported simultaneously.	☒ ANSI X3.4 ☐ IBM™/Microsoft™ DBCS ISO 8859-1 ☐ ISO 10646 (UCS-2) ☐ ISO 10646 (UCS-4) ☐ JIS C 6226
If this product is a communication gateway, describe the types of non- BACnet equipment/ network(s) that the gateway supports:	

BACnet object definitions

Object/Property support matrix

The following table summarizes the object types/properties supported:

Property	Object Type						
	Device	Binary Input	Binary Output	Binary Value	Analog Input	Analog Output	Analog Value
Object Identifier	✓	✓	✓	✓	✓	✓	✓
Object Name	✓	✓	✓	✓	✓	✓	✓
Object Type	✓	✓	✓	✓	✓	✓	✓
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.

Contact us

www.abb.com/drives

3AXD50000024172 Rev B (US) EFFECTIVE: 2015-12-15