Operations Manual

OM 1190-1

Group: **Applied Air Systems**
Part Number: **OM 1190**
Date: **May 2013**

Daikin MD4

Variable Frequency Drive Controller

People and ideas you can trust.™

This section contains safety instructions which you must follow when installing, operating and servicing the drive. If ignored, physical injury or death may follow, or damage may occur to the drive, motor or driven equipment. Read the safety instructions before you work on the drive.

Use of Warnings

Warnings caution you about conditions which can result in serious injury or death and/or damage to the equipment, and advise on how to avoid the danger. The following warning symbols are used in this manual:

⚠ DANGER

Electricity warning warns of hazards from electricity which can cause physical injury or death and/or damage to the equipment.

⚠ WARNING

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

Safety in Installation and Maintenance

These warnings are intended for all who work on the drive, motor cable or motor.

Electrical safety

⚠ DANGER

Ignoring the following instructions can cause physical injury or death, or damage to the equipment.

Only qualified electricians are allowed to install and maintain the drive!

- Never work on the drive, motor cable or motor when input power is applied. After disconnecting the input power, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you start working on the drive, motor or motor cable.

  Always ensure by measuring with a multimeter (impedance at least 1 Mohm) that there is no voltage between the drive input phases U1, V1 and W1 and the ground.
- Do not work on the control cables when power is applied to the drive or to the external control circuits. Externally supplied control circuits may carry dangerous voltage even when the input power of the drive is switched off.
- Do not make any insulation or voltage withstand tests on the drive.
- If a drive whose EMC filter is not disconnected is installed on an IT system (an ungrounded power system or a high resistance-grounded [over 30 ohms] power system), the system will be connected to ground potential through the EMC filter capacitors of the drive. This may cause danger or damage the drive.
- If a drive whose EMC filter is not disconnected is installed on a corner grounded TN system, the drive will be damaged.
- All ACS320 Drive End Grounding screws are removed at the factory. See Product Overview for location details.

- All ELV (extra low voltage) circuits connected to the drive must be used within a zone of equipotential bonding, ie within a zone where all simultaneously accessible conductive parts are electrically connected to prevent hazardous voltages appearing between them. This is accomplished by a proper factory grounding.

NOTE: Even when the motor is stopped, dangerous voltage is present at the power circuit terminals U1, V1, W1 and U2, V2, W2. For more technical information, contact your local Daikin sales representative.

General Safety

⚠ DANGER

Ignoring the following instructions can cause physical injury or death, or damage to the equipment.

- Never attempt to repair a malfunctioning drive; contact your local Daikin sales representative or authorized Daikin Service for service support.
- Make sure that dust from drilling does not enter the drive during the installation. Electrically conductive dust inside the drive may cause damage or lead to malfunction.
- Ensure sufficient cooling.

Safe Start-Up and Operation

These warnings are intended for all who plan the operation, start up or operate the drive.

General Safety

⚠ WARNING

Ignoring the following instructions can cause physical injury or death, or damage to the equipment.

- Before adjusting the drive and putting it into service, make sure that the motor and all driven equipment are suitable for operation throughout the speed range provided by the drive. The drive can be adjusted to operate the motor at speeds above and below the speed provided by connecting the motor directly to the power line.
- Do not activate automatic fault reset functions if dangerous situations can occur. When activated, these functions will reset the drive and resume operation after a fault.
- Do not control the drive with an AC contactor or disconnecting device (disconnecting means); use the control panel start and stop keys and or external commands (I/O or fieldbus). The maximum allowed number of charging cycles of the DC capacitors (ie power-ups by applying power) is two per minute and the maximum total number of chargings is 15,000.

NOTE: If an external source for start command is selected and it is ON, the drive will start immediately after an input voltage break or fault reset unless the drive is configured for 3-wire (a pulse) start/stop.

When the control location is not set to local (LOC not shown on the display), the stop key on the control panel will not stop the drive. To stop the drive using the control panel, first press the LOC/REM key LOC and then the stop key.

This section describes applicability, target audience and purpose of this manual. It describes the contents of this manual and refers to a list of related manuals for more information. The chapter also contains a flowchart of steps for checking the delivery, installing and commissioning the drive. The flowchart refers to chapters/sections in this manual.

Applicability

The manual is applicable to the ACS320 drive firmware version 4.00E or later. See parameter 3301 FW VERSION on page 56.

Target Audience

The reader is expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.

The manual is written for readers worldwide. Both SI and imperial units are shown. Special US instructions for installations in the United States are given.

Purpose of the Manual

This manual provides information needed for planning the installation, installing, commissioning, using and servicing the drive.

Categorization by Frame Size

The ACS320 is manufactured in frame sizes R0…R4. Some instructions and other information which only concern certain frame sizes are marked with the symbol of the frame size (R0…R4). To identify the frame size of your drive, see the table in section Ratings, types and voltages on page 102.

Contents of this Manual

The manual consists of the following chapters:

- Safety (page 5) gives safety instructions you must follow when installing, commissioning, operating and servicing the drive.
- Introduction to the manual describes applicability, target audience, purpose and contents of this manual. It also contains a quick installation and commissioning flowchart.
- Operation principle and hardware description (page 7) describes the operation principle, layout, power connections and control interfaces, type designation label and type designation information in short.
- Start-Up (page 12) tells how to start up the drive as well as how to start, stop, change the direction of the motor rotation and adjust the motor speed through the I/O interface
- Program features (page 24) describes program features with lists of related user settings, actual signals, and fault and alarm messages.
- Actual signals and parameters (page 30) describes actual signals and parameters. It also lists the default values for the different macros.
- Fault tracing (page 90) tells how to reset faults and view fault history. It lists all alarm and fault messages including the possible cause and corrective actions. Maintenance and hardware diagnostics (page 99) contains preventive maintenance instructions and LED indicator descriptions.
- Technical data (page 102) contains technical specifications of the drive, eg. ratings, sizes and technical requirements as well as provisions for fulfilling the requirements for CE and other marks.

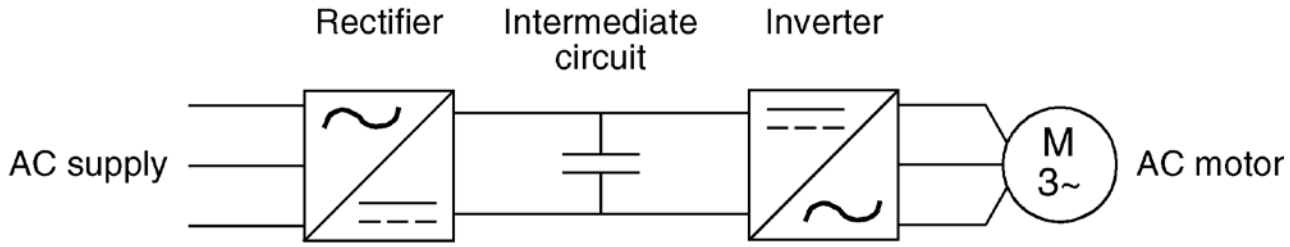
The chapter briefly describes the operation principle, layout, type designation label and type designation information. It also shows a general diagram of power connections and control interfaces.

Operation Principle

The ACS320 is a wall or cabinet mountable drive for controlling AC motors.

The Figure 1 shows the simplified main circuit diagram of the drive. The rectifier converts three-phase AC voltage to DC voltage. The capacitor bank of the intermediate circuit stabilizes the DC voltage. The inverter converts the DC voltage back to AC voltage for the AC motor.

Figure 1: Operation Principle



Product Overview

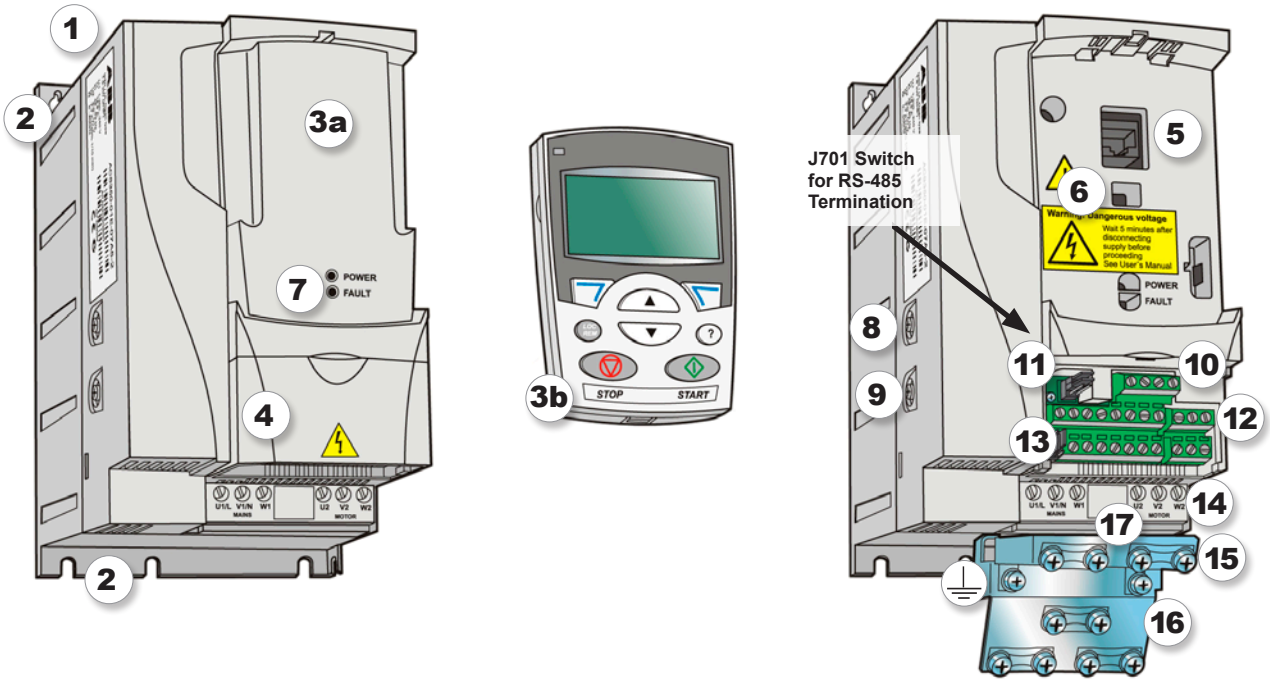
Layout

The layout of the drive is presented in Figure 2. The figure shows a frame size R2 drive. The construction of the different frame sizes R0…R4 varies to some extent.

Power Connections and Control Interfaces

Figure 3 gives an overview of connections. I/O connections are parameterable. See Application Macros on page 72 for I/O connections for the different macros.

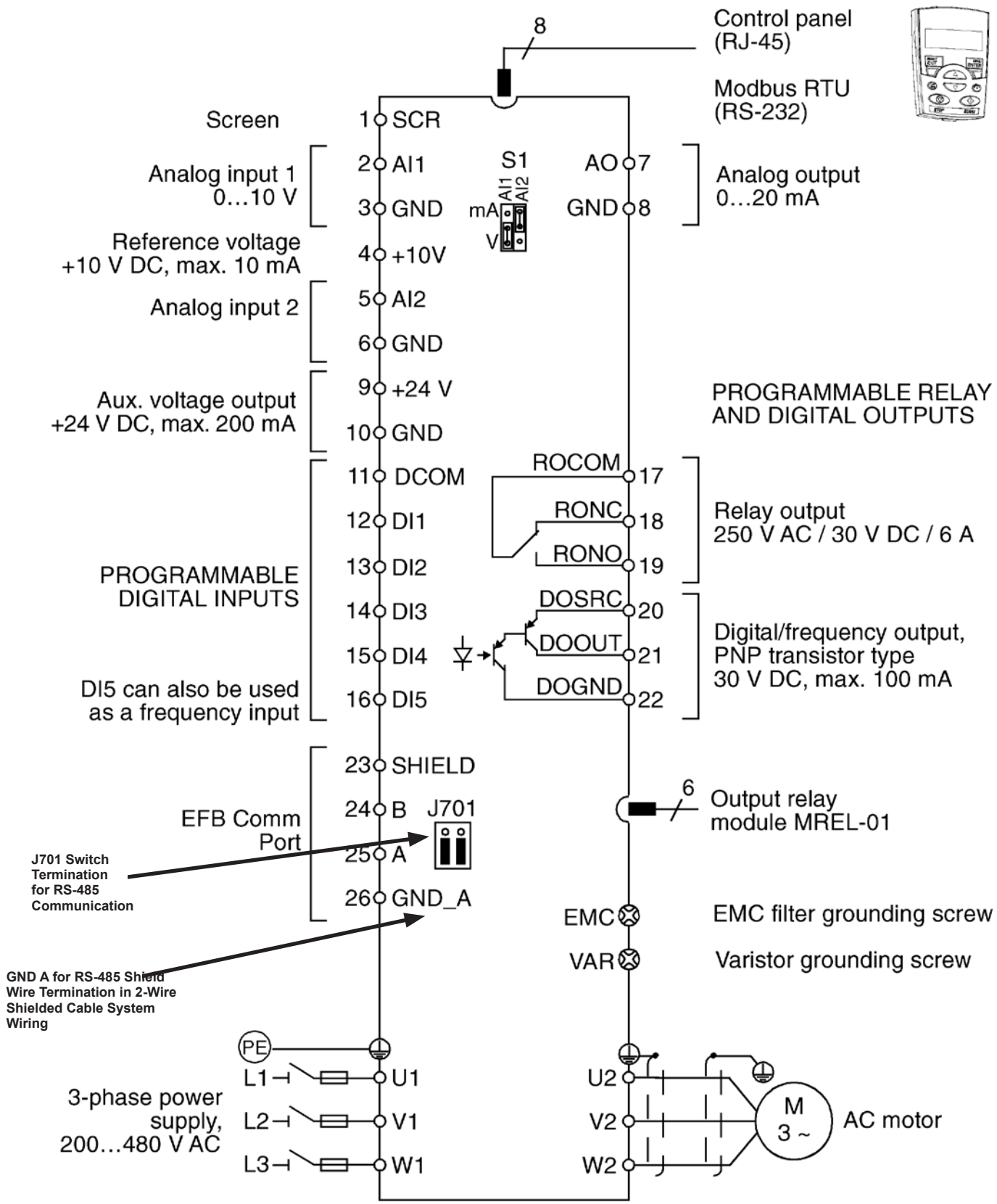
Figure 2: Drive Components



1	Cooling outlet through top cover
2	Mounting holes
3	Panel cover (a) / Assistant Control Panel (c)
4	Terminal cover
5	Panel connection
6	Option connection
7	Power OK and Fault LEDs. See section LEDs on page 101.
8	EMC filter grounding screw (EMC). Note: The screw is on the front in frame size R4.

9	Varistor grounding screw (VAR)
10	RS-485 connection
11	Jumper J701 for connecting RS-485 termination resistor
12	I/O connections
13	Switch S1 for selecting voltage or current for analog inputs
14	Input power connection (U1, V1, W1) and motor connection (U2, V2, W2). (Braking chopper connection is disabled.)
15	I/O clamping plate
16	Clamping plate
17	Clamps

Figure 3: Overview of connections



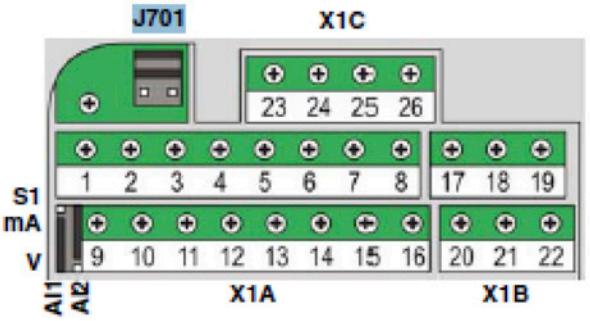
Connecting the Control Cables

This section applies only to units shipping without MicroTech controllers but need field controls installed.

I/O Terminals

Figure 4 shows the I/O terminals. Tighten torque is 0.4 Nm/3.5 in-lbs.

Figure 4: I/O Terminals



J701: Connects 120 ohm termination resistor. See page 51.

S1: Selects voltage or current as the signal types for analog inputs AI1 and AI2.

X1A:
1: SCR
2: AI1
3: GND
4: +10 V
5: AI2
6: GND
7: AO
8: GND
9: +24 V
10: GND
11: DCOM
12: DI1
13: DI2
14: DI3
15: DI4
16: DI5 digital or frequency input

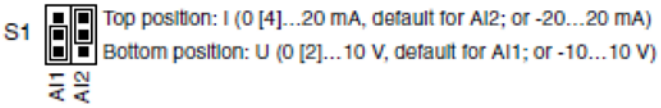
X1B:
17: ROCOM
18: RONC
19: RONO
20: DOSRC
21: DOOUT
22: DOGND

X1C:
23: SCR
24: B
25: A
26: GND_A

Voltage and Current Selection for Analog Inputs

Switch S1 selects voltage (0 [2]…10 V / -10…10 V) or current (0 [4]…20 mA / -20…20 mA) as the signal types for analog inputs AI1 and AI2. The factory settings are unipolar voltage for AI1 (0[2]…10V) and unipolar current for AI2 (0[4]…20mA), which correspond to the default usage in the application macros. The switch is located to the left of I/O terminal 9, Figure 4.

Figure 5: Voltage and Current Switch Locations



Permenently affix control cables with a minimum 1/4" spacing from power cables.

Connecting the Embedded Fieldbus

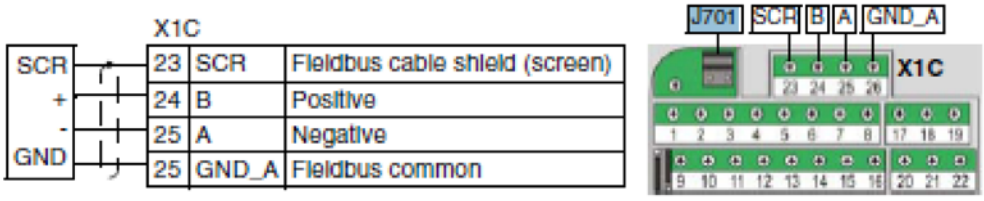
Embedded fieldbus can be connected to the drive with RS-485 or RS-232. This section applies only to units shipping without MicroTech controllers but need field controls installed.

Connection Diagrams

RS-485

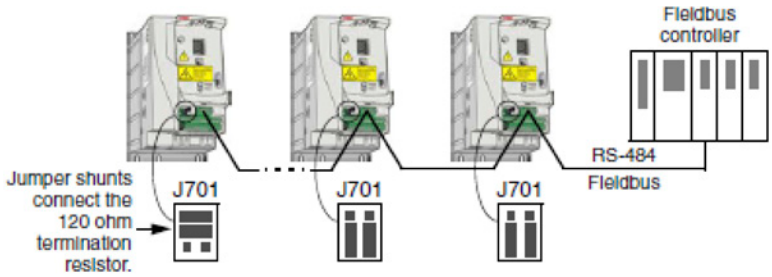
Figure 6 shows the fieldbus connection/

Figure 6: Fieldbus Connections for RS-485



Terminate the RS-485 bus with a 120 ohm resistor at the end of the network by setting the jumper J701 shunts as shown.

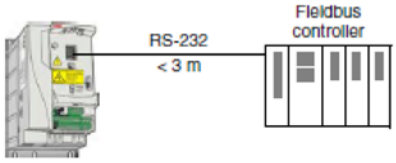
Figure 7: J701 Jumper Shunts



RS-232

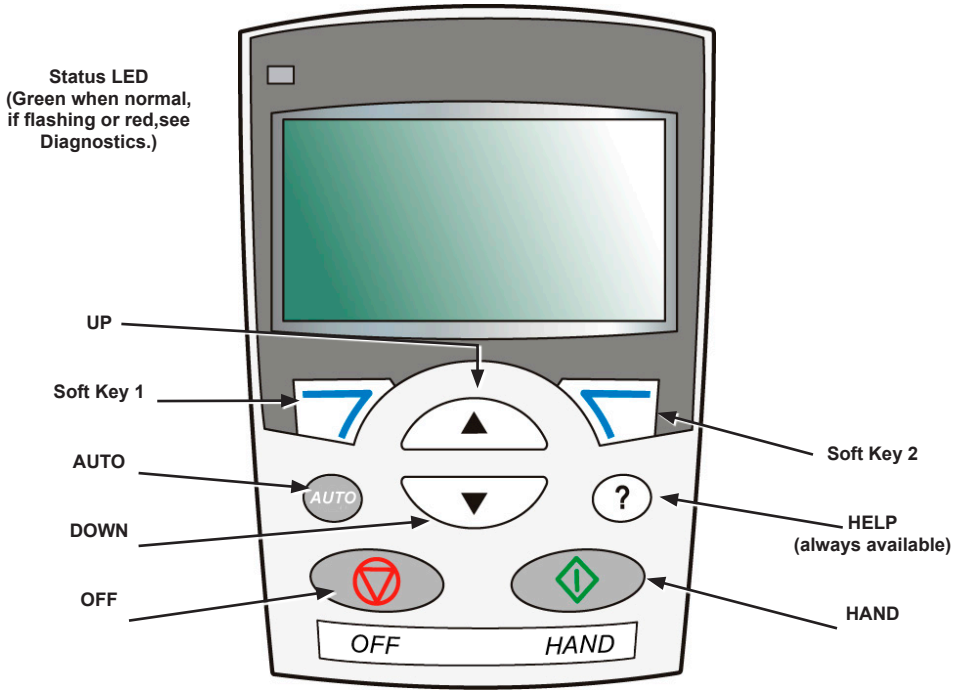
Plug a communication cable into the control panel connection X2. The cable must be sharter than 3 meters.

Figure 8: RS-232 Connection



MD4 HVAC Control Panel Features

Figure 9: MD4 HVAC control panel features



- Language selection for the display
- Drive connection that can be made or detached at any time
- Start-up assistant to facilitate drive commissioning
- Copy function for moving parameters to other MD4 drives
- Backup function for saving parameter sets
- Context sensitive help
- Real-time clock

General Display Features

Soft Key Functions

The soft key functions are defined by text displayed just above each key.

Display Contrast

To adjust display contrast, simultaneously press  and  or  , as appropriate.

Macros

NOTE: Selecting the appropriate macro should be part of the original system design, since the control wiring installed depends on the macro used.

1. Review the macro descriptions on page 30. Use the macro that best fits system needs.
2. Edit parameter 9902 to select the appropriate macro. Use either of the following:
   - Use the Start-up Assistant, which displays the macro selection immediately after motor parameter setup.
   - Refer to "" on page 15, for parameter editing instructions and follow the instructions in the "Appendix" on page 108.

Tuning - Parameters

The system can benefit from one or more of the MD4 special features, and/or fine tuning.

1. Review the parameter descriptions in "ParameterDescriptions" starting on page 30. Enable options and fine tune parameter values as appropriate for the system.
2. Edit parameters as appropriate.

Fault and Alarm Adjustments

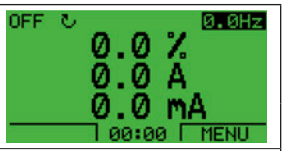
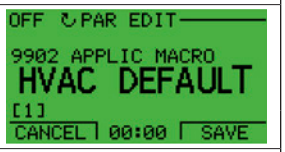
The MD4 can detect a wide variety of potential system problems. For example, initial system operation may generate faults of alarms that indicate set-up problems.

1. Faults and alarms are reported on the control panel with a number. Note the number reported.
2. Review the description provided for the reported fault/ alarm:
   - Use the fault and alarm listings shown in "Fault Tracing" starting on page 90.
   - Press the help key (Assistant Control Panel only) while fault or alarm is displayed.
3. Adjust the system or parameters as appropriate.

Start-Up

Figure 10: Changing the Parameters Individually

To change the parameters, follow these steps:

1	Select MENU to enter the main menu.		
2	Select the Parameters mode with the UP/DOWN buttons and select ENTER to select the Parameters mode.		
3	Select the appropriate parameter group with the UP/DOWN buttons and select SEL		
4	Select the appropriate parameter in a group with the UP/DOWN buttons. Select EDIT to change the parameter value.		
5	Press the UP/DOWN buttons to change the parameter value.		
6	Select SAVE to store the modified value or select CANCEL to leave the set mode. Any modifications not saved are cancelled.		
7	Select EXIT to return to the listing of parameter groups, and again to return to the main menu.		

To complete the control connections by manually entering the parameters, see "Parameters Mode" in this section.

For detailed hardware description, see the "Technical data" section.

NOTE: The current parameter value appears below the highlighted parameter.

To view the default parameter value, press the UP/DOWN buttons simultaneously.

The most typical and necessary parameters to change are parameter groups 99 Start-up data, 10 Start/Stop/Dir, 11 Reference Select, 20 Limits, 21 Start/Stop, 22 Accel/Decel, 30 Fault Functions and 98 & 53 Groups for Comms.

To restore the default factory settings, select the application macro HVAC default.

Modes

The MD4 HVAC control panel has several different modes for configuring, operating and diagnosing the drive. The modes are:

- Standard display mode – Shows drive status information and operates the drive.
- Parameters mode – Edits parameter values individually.
- Changed parameters mode – Shows changed parameters.
- Fault logger mode – Shows the drive fault history.
- Drive parameter backup mode – Stores or uploads the parameters.
- Clock set mode – Sets the time and date for the drive.
- Alarm mode – Reporting mode triggered by drive alarms.

Standard Display Mode

Use the standard display mode to read information on the drive's status and to operate the drive. To reach the standard display mode, press EXIT until the LCD display shows status information as described below.

Status Information

Table 1: Status Information

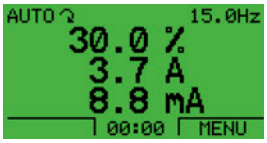
Control Panel Display	Significance
Rotating arrow (clockwise or counterclockwise)	• Drive is running and at setpoint • Shaft direction is forward or reverse
Rotating dotted arrow blinking	Drive is running but not at setpoint
Stationary dotted arrow	Start command is present, but motor is not running. E.g. start enable is missing.

Top. The top line of the LCD display shows the basic status information of the drive.

- **Hand** – Indicates that the drive control is local, that is, from the control panel.
- **Auto** – Indicates that the drive control is remote, such as the basic I/O (X1) or fieldbus.
- ↻ – Indicates the drive and motor rotation status as follows:

Upper Right – shows the active reference.

Middle. Using parameter group 34 on page 57, the middle of the LCD display can be configured to display:



- One to three parameter values
  - — The default display shows parameters 0103 (OUTPUT FREQ) in percentages, 0104 (CURRENT) in amperes and 0120 (AI1) in milliamperes.
  - — Use parameters 3401, 3408, and 3415 to select the parameters (from Group 01) to display. Entering "parameter" 0100 results in no parameter displayed. For example, if 3401 = 0100 and 3415 = 0100, then only the parameter specified by 3408 appears in the Control Panel display.
  - — You can also scale each parameter in the display, for example, to convert the motor speed to a display of conveyor speed. Parameters 3402…3405 scale the parameter specified by 3401, parameters 3409…3412 scale the parameter specified by 3408, etc.
- A bar meter rather than one of the parameter values.
  - — Enable bar graph displays using parameters 3404, 3411 and 3418.

Bottom. The bottom of the LCD display shows:

- **Lower Corners** – show the functions currently assigned to the two soft keys.
- **Lower Middle** – displays the current time (if configured to show the time).

Operating the Drive

Auto/Hand – The very first time the drive is powered up, it is in the auto control (AUTO) mode, and is controlled from the Control terminal block X1.

To switch to hand control (HAND) and control the drive using the control panel, press and hold the (HAND)  or (OFF)  button.

- Pressing the HAND button switches the drive to hand control while keeping the drive running.
- Pressing the OFF button switches to hand control and stops the drive.

To switch back to auto control (AUTO), press and hold the  button.

Hand/Auto/Off – To start the drive press the HAND or AUTO buttons, to stop the drive press the OFF button.

Reference – To modify the reference (only possible if the display in the upper right corner is in reverse video) press the UP or DOWN buttons (the reference changes immediately).

The reference can be modified in the local control mode, and can be parameterized (using Group 11 reference select, page 39) to also allow modification in the remote control mode.

NOTE: The Start/Stop, Shaft direction and Reference functions are only valid in local control (LOC) mode.

Parameters Mode

Figure 11: Changing in the Parameters

To change the parameters, follow these steps:

1	Select MENU to enter the main menu.		
2	Select the Parameters mode with the UP/DOWN buttons and select ENTER to select the Parameters mode.		
3	Select the appropriate parameter group with the UP/DOWN buttons and select SEL		
4	Select the appropriate parameter in a group with the UP/DOWN buttons. Select EDIT to change the parameter value.		
5	Press the UP/DOWN buttons to change the parameter value.		
6	Select SAVE to store the modified value or select CANCEL to leave the set mode. • Any modifications not saved are cancelled. • Each individual parameter setting is valid immediately after pressing SAVE.		
7	Select EXIT to return to the listing of parameter groups, and again to return to the main menu.		

To complete the control connections by manually entering the parameters, see Parameters Mode above.

For detailed hardware description, see the "Technical Data" starting on page 102 .

NOTE: The current parameter value appears below the highlighted parameter.

To view the default parameter value, press the UP/DOWN buttons simultaneously.

The most typical and necessary parameters to change are parameter groups 99 Start-up data, 10 Start/Stop/Dir, 11 Reference Select, 20 Limits, 21 Start/Stop, 22 Accel/Decel, 30 Fault Functions and 98 & 53 Groups for Comms.

To restore the default factory settings, select the application macro HVAC default.

Changed Parameters Mode

Figure 12: Changing in the Parameters Mode

To view (and edit) a listing of all parameters that have been changed from macro default values, follow these steps:

1	Select MENU to enter the main menu.		
2	Select CHANGED PAR with the UP/DOWN buttons and select ENTER.		
6	A list of changed parameters is displayed. Select EXIT to exit the parameters mode.		

To complete the control connections by manually entering the parameters, see Parameters Mode, page 15.

For detailed hardware description, see the "Technical Data" starting on page 102 .

Fault Logger Mode

Use the Fault Logger Mode to see drive fault history, fault state details and help for the faults.

1. Select FAULT LOGGER in the Main Menu.
2. Press ENTER to see the latest faults (up to 10 faults, maximum).
3. Press DETAIL to see details for the selected fault.
   - Details are available for the three latest faults.
4. Press DIAG to see the help description for the fault. See "Fault Tracing", page 90.

NOTE: If a power off occurs, only the three latest faults will remain (with details only in the first fault).

Drive Parameter Backup Mode

Use the parameter backup mode to export parameters from one drive to another. The parameters are uploaded from a drive to the control panel and downloaded from the control panel to another drive. Two options are available:

Par Backup Mode

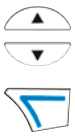
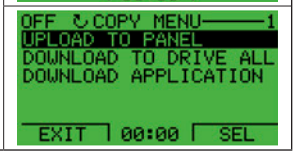
The Assistant Control Panel can store a full set of drive parameters.

The Par Backup mode has these functions:

- **Upload to Panel** – Copies all parameters from the drive to the Control Panel. This includes user sets of parameters (if defined) and internal parameters such as those created by the Motor Id Run. The Control Panel memory is non-volatile and does not depend on the panel's battery.

Figure 13: Changing the Drive Parameter Backup

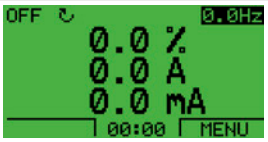
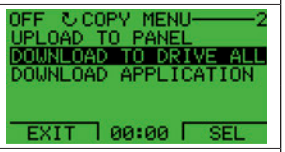
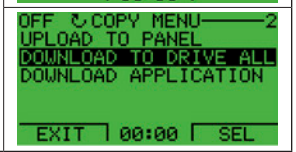
To upload parameters to control panel, follow these steps:

1	Select MENU to enter the main menu.		
2	Select PAR BACKUP with the UP/DOWN buttons and select ENTER.		
3	Scroll to Upload to Panel and select SEL.		
4	The text "Copying parameters" and a progress diagram is displayed. Select ABORT if you want to stop the process		
5	The text "Parameter upload successful" is displayed and the control panel returns to the PAR BACKUP menu. Select EXIT to return to the main menu. Now you can disconnect the panel.		 

Download Full Set – Restores the full parameter set from the Control Panel to the drive. Use this option to restore a drive, or to configure identical drives. This download does not include user sets of parameters.

Figure 14: Downloading All Parameters

To download all parameters to drive, follow these steps:

1	Select MENU to enter the main menu.		
2	Select PAR BACKUP with the UP/DOWN buttons.		
3	Scroll to Download to drive all and select SEL.		
4	The text “restoring parameters” is displayed. Select ABORT if you want to stop the process.		
5	After the download stops, the message “Parameter download successful” is displayed and the control panel goes back to PAR BACKUP menu. Select EXIT to return to the main menu.		 

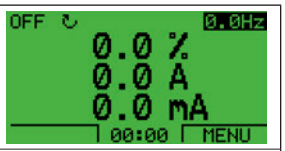
NOTE: Download Full Set writes all parameters to the drive, including motor parameters. Only use this function to restore a drive, or to transfer parameters to systems that are identical to the original system.

Download Application – Copies a partial parameter set from the Control Panel to a drive. The partial set does not include internal motor parameters, parameters 9905…9909, 1605, 1607, 5201, nor any Group 51 and 53 parameters. Use this option to transfer parameters to systems that use similar configurations – the drive and motor sizes do not need to be the same.

- **Download User Set 1** - Copies USER S1 parameters (user sets are saved using parameter 9902 APPLIC MACRO) from the Control Panel to the drive.
- **Download User Set 2** - Copies USER S2 parameters from the Control Panel to the drive.

Figure 15: Downloading Applications

To download application to drive, follow these steps:

1	Select MENU to enter the main menu.		
2	Select PAR BACKUP with the UP/DOWN buttons.		
3	Scroll to DOWNLOAD APPLICATION and select SEL..		
4	The text “Downloading parameters (partial)” is displayed. Select ABORT if you want to stop the process.		
5	The text “Parameter download successful” is displayed and the control panel returns to PAR BACKUP menu. Select EXIT to return to the main menu.		 

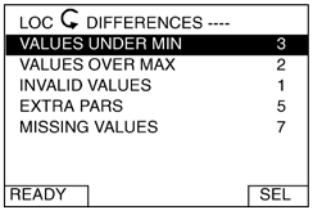
Handling Inexact Downloads

In some situations, an exact copy of the download is not appropriate for the target drive. Some examples:

- A download to an old drive specifies parameters/values that are not available on the old drive.
- A download (from an old drive) to a new drive does not have definitions for the new parameters – parameters that did not originally exist.

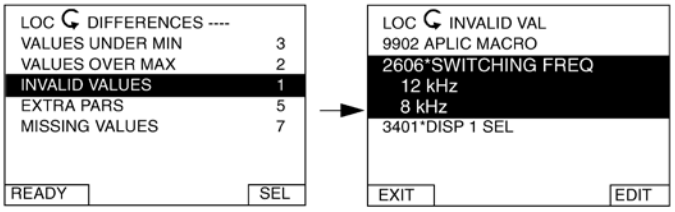
As a default, the control panel handles these situations by:

- Discarding parameters/values not available on the target drive.
- Using parameter default values when the download provides no values or invalid values.
- Providing a Differences List – A listing of the type and number of items that the target cannot accept exactly as specified.



You can either accept the default edits by pressing READY, or view and edit each item as follows:

1. Highlight an item type in the Differences List (left screen below) and press SEL to see the details for the selected type (right screen below).



In the right “details” screen:

- The first item that requires editing is automatically highlighted and includes details: In general, the first item listed in the details is the value defined by the backup file. The second item listed is the “default edit.”
- For tracking purposes, an asterisk initially appears by each item. As edits are made, the asterisks disappear.

2. In the illustrated example, the backup specifies a switching frequency of 12 kHz, but the target drive is limited to 8 kHz.
3. Press EDIT to edit the parameter. The display is the target drive’s standard edit screen for the selected parameter.
4. Highlight the desired value for the target drive.
5. Press SAVE to save setting.
6. Press EXIT to step back to the differences view and continue for each remaining exception.
7. When your editing is complete, press READY in the Differences List and then select “Yes, save parameters.”

Download Failures

In some situations, the drive may be unable to accept a download. In those cases, the control panel display is: “Parameter download failed” plus one of the following causes:

- Set not found – You are attempting to download a data set that was not defined in the backup. The remedy is to manually define the set, or upload the set from a drive that has the desired set definitions.
- Par lock – The remedy is to unlock the parameter set (parameter 1602, page 46).
- Incompat drive/model – The remedy is to perform backups only between drives of the same type and the same model.
- Too many differences – The remedy is to manually define a new set, or upload the set from a drive that more closely resembles the target drive.

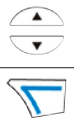
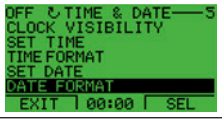
NOTE: If upload or download of parameters is aborted, the partial parameter set is not implemented.

Clock Set Mode

The clock set mode is used for setting the time and date for the internal clock of the ACS320. In order to use the timer functions of the ACS320, the internal clock has to be set first. Date is used to determine weekdays and is visible in Fault logs.

Figure 16: Changing the Clock Set

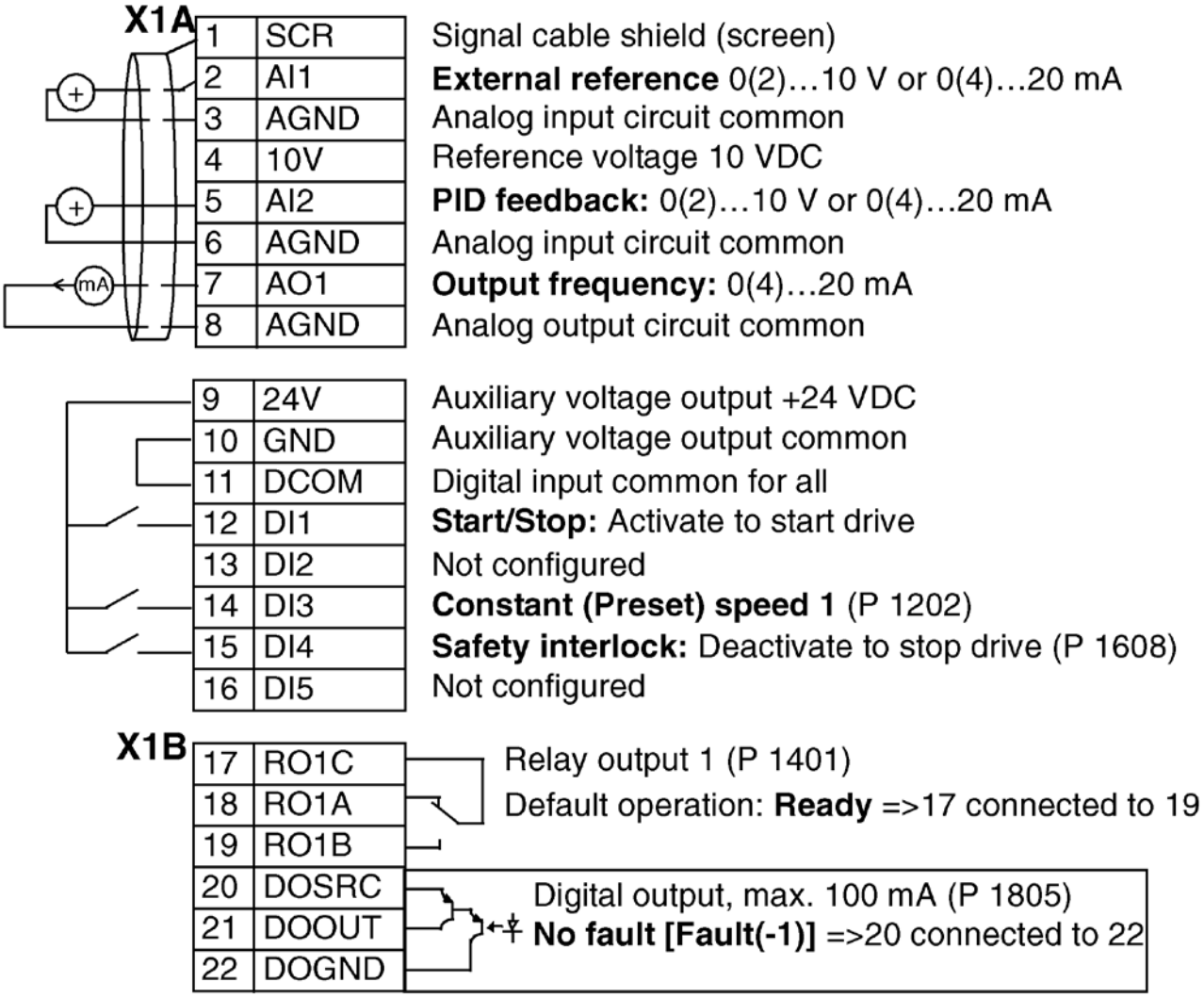
To set the clock, follow these steps:

1	Select MENU to enter the main menu.		
2	Scroll to Clock Set with the UP/ DOWN buttons and select ENTER to enter the Clock Set mode.		
3	Scroll to Clock Visibility with the UP/DOWN buttons and select SEL to change the visibility of the clock.		
4	Scroll to Show Clock with the UP/DOWN buttons and select SEL to make the clock visible.		
5	Scroll to Set Time with the UP/DOWN buttons and select SEL.		
6	Change the hours and minutes with the UP/DOWN buttons and select OK to save the values. The active value is displayed in inverted color.		
7	Scroll to Time Format with the UP/DOWN buttons and select SEL.		
8	The different formats are displayed. Select a format with the UP/DOWN buttons and select SEL to confirm the selection.		
9	Scroll to Set Date with the UP/DOWN buttons and select SEL.		
10	Change the days, months and year with the UP/DOWN buttons and select OK to save the values. The active value is displayed in inverted color.		
11	Scroll to Date Format with the UP/DOWN buttons and select SEL.		
12	The Date formats are displayed. Select a date format with the UP/DOWN buttons and select OK to confirm the selection.		
13	Select EXIT twice to return to the main menu.		

HVAC Default

This macro provides the factory default parameter settings for the MD4. Factory defaults can be restored at any time by setting parameter 9902 to 1. The diagram below shows typical wiring using this macro. When using direct speed reference in AUTO mode or process PID, see “General Considerations” on page 73.

Figure 17: MD4 HVAC Defaults



Recommended Daikin adjustments to the “HVAC Default” are shown on page 108

This section describes program features. For each feature, there is a list of related user settings, actual signals, and fault and alarm messages.

Programmable Analog Inputs

The drive has two programmable analog voltage/current inputs. The inputs can be inverted, filtered and the maximum and minimum values can be adjusted. The update cycle for the analog input is 8 ms (12 ms cycle once per second). The cycle time is shorter when information is transferred to the application program (8 ms -> 2 ms).

Table 2: Programmable Analog Input Settings

Parameter	Additional Information
Group 11:Reference	Select AI as reference source
Group 13: Analog Inputs	Analog input processing
3001, 3021, 3022, 3107	AI loss supervision
Group 35: Motor Temp Meas	AI in motor temperature measurement
Group 40: Process PID Set 1 … Group 42: External PID	AI as PID process control reference or actual value source
Group 44: Pump Protection	AI as pump protection measurement source

Table 3: Programmable Analog Input Diagnostics

Actual Signal	Additional Information
0120, 0121	Analog input values
1401 AI1/A2	signal loss
Alarm	
AI1 LOSS / AI2 LOSS	AI1/AI2 signal below AI1/AI2 FAULT LIMIT (3021/3022)
Fault	
AI1 LOSS / AI2 LOSS	AI1/AI2 signal below limit AI1/AI2 FAULT LIMIT (3021/3022)
PAR AI SCALE	Incorrect AI signal scaling (1302 < 1301 or 1305 < 1304)

Programmable Analog Output

One programmable current output (0…20 mA) is available. Analog output signal can be inverted, filtered and the maximum and minimum values can be adjusted. The analog output signals can be proportional to motor speed, output frequency, output current, motor torque, motor power, etc. The update cycle for the analog output is 2 ms.

It is also possible to write a value to an analog output through a serial communication link.

Table 4: Programmable Analog Output Settings

Parameter	Additional Information
Group 15: Analog Outputs	AO value selection and processing
Group 35: Motor Temp Meas	AO in motor temperature measurement

Table 5: Programmable Analog Output Diagnostics

Actual Signal	Additional Information
0124	AO value
Fault	
PAR AO SCALE	Incorrect AO signal scaling (1503 < 1502)

Programmable Digital Inputs

The drive has five programmable digital inputs. The update time for the digital inputs is 2 ms. It is possible to delay the state change of digital inputs with delays defined in group Group 18: FREQ IN & TRAN OUT. This enables very simple program sequences by connecting several functions with the same physical wire, eg to remove branches and leaves from a pipe by running the fan in reverse before normal operation.

One digital input (DI5) can be programmed as a frequency input. See section “Frequency Input”.

Table 6: Programmable Digital Inputs Settings

Parameter	Additional Information
Group 10: AcStart/Stop/Dir	DI as start, stop, direction
Group 11: Reference Select	DI in reference selection, or reference source
Group 12: Constant Speeds	DI in constant speed selection
Group 16: System Controls	DI as external Run Enable, fault reset or user macro change signal
Group 18: FREQ IN & TRAN OUT	
2109	DI as external emergency stop command source
2201	DI as acceleration and deceleration ramp selection signal
2209	DI as zero ramp force signal

Table 7: Programmable Digital Inputs Diagnostics

Actual Signal	Additional Information
0160	DI status
0414	DI status at the time the latest fault occurred

Programmable Relay Output

The drive has one programmable relay output. It is possible to add three additional relay outputs with the optional Relay Output Extension Module MREL-0. For more information, see MREL-01 Relay Output Extension Module User’s Manual (3AUA0000035974 [English]).

With a parameter setting it is possible to choose what information to indicate through the relay output: Ready, running, fault, alarm, etc. The update time for the relay output is 2 ms.

A value can be written to a relay output through a serial communication link.

Table 8: Programmable Relay Output Settings

Parameter	Additional Information
Group 14: Relay Outputs	RO value selections and operation times

Table 9: Programmable Relay Output Diagnostics

Actual Signal	Additional Information
0134	ROControl Word through fieldbus control
0162	RO 1 status
0173	RO 2…4 status. With option MREL-01 only

Frequency Input

Digital input DI5 can be programmed as a frequency input. Frequency input (0…16000 Hz) can be used as external reference signal source. The update time for the frequency input is 50 ms. Update time is shorter when information is transferred to the application program (50 ms -> 2 ms).

Table 10: Frequency Input Settings

Parameter	Additional Information
Group 18: FREQ IN & TRAN OUT	Frequency input minimum and maximum values and filtering
1103/1106	External reference REF1/2 through frequency input
4010, 4110, 4210	Frequency input as PID reference source

Table 11: Frequency Input Diagnostics

Actual Signal	Additional Information
0161	Frequency input value

Actual Signals

Several actual signals are available:

- Drive output frequency, current, voltage and power
- Motor speed and torque
- Circuit DC voltage
- Active control location (LOCAL, EXT1 or EXT2)
- Drive temperature
- Operating time counter (h), kWh counter
- Digital I/O and analog I/O status

Three signals can be shown simultaneously on the assistant control panel display (one signal on the basic panel display). It is also possible to read the values through the serial communication link or through the analog outputs.

Table 12: Actual Signals Settings

Parameter	Additional Information
1501	Selection of an actual signal to AO
1801	Selection of an actual signal to frequency output
Group 32: Supervision	Actual signal supervision
Group 34: Panel Display Process Variables	Selection of an actual signals to be displayed on the control panel

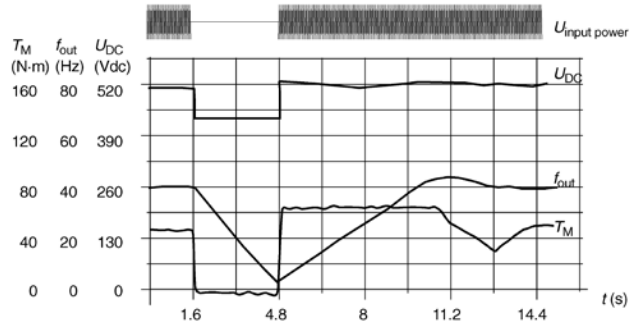
Table 13: Actual Signals Diagnostics

Actual Signal	Additional Information
Group 01: Operating Data … Group 04: Fault History	Lists of actual signals

Power Loss Ride-Through

If the incoming supply voltage is cut off, the drive will continue to operate by utilizing the kinetic energy of the rotating motor. The drive will be fully operational as long as the motor rotates and generates energy to the drive. The drive can continue the operation after the break if the main contactor remained closed.

Figure 18: Power Loss Ride-Through Diagram



U_{DC} = Intermediate circuit voltage of the drive, f_{out} = Output frequency of the drive, T_M = Motor torque

Loss of supply voltage at nominal load (f_{out} = 40 Hz). The intermediate circuit DC voltage drops to the minimum limit. The controller keeps the voltage steady as long as the input power is switched off. The drive runs the motor in generator mode. The motor speed falls but the drive is operational as long as the motor has enough kinetic energy.

Settings

Parameter 2006 UNDERVOLT CTRL, page 48

Maintenance Trigger

A maintenance trigger can be activated to show a notice on the panel display when e.g. drive power consumption has exceeded the defined trigger point.

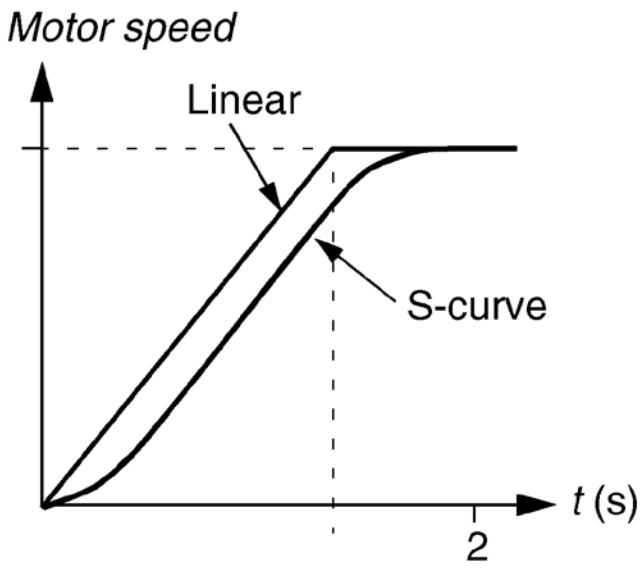
Settings

Parameter Group 29: Maintenance Trig, page 53

Acceleration and Deceleration Ramps

Two user-selectable acceleration and deceleration ramps are available. It is possible to adjust the acceleration/deceleration times and the ramp shape. Switching between the two ramps can be controlled via a digital input or fieldbus. The available ramp shape alternatives are Linear and S-curve.

Figure 19: Acceleration And Deceleration Ramps



Linear: Suitable for drives requiring steady or slow acceleration/deceleration.

S-curve: Ideal for conveyors carrying fragile loads, or other applications where a

smooth transition is required when changing the speed.

Settings

Parameter Group 22: Accel/Decel, page 50

Critical Speeds

A Critical Speeds function is available for applications where it is necessary to avoid certain motor speeds (drive output frequencies) or speed bands (output frequency bands) because of eg mechanical resonance problems. The user can define three critical frequencies or frequency bands.

Settings

Parameter Group 25: Critical Speeds, page 51

Constant Speeds

It is possible to define seven positive constant speeds. Constant speeds are selected with digital inputs. Constant speed activation overrides the external speed reference.

Constant speed selections are ignored if

- PID reference is being followed, or
- Drive is in local control mode.

This function operates on a 2 ms time level.

Settings

Parameter Group 12: Constant Speeds, page 42

Constant speed 7 (1208 CONST SPEED 7) is also used for fault functions, page 42. See parameter group Group 30: Fault Functions, page 53.

Programmable Protection Functions

AI<Min

AI<Min function defines the drive operation if an analog input signal falls below theset minimum limit.

Settings

Parameters 3001 AI<MIN FUNCTION, 3021 AI1 FAULT LIMIT and 3022 AI2 FAULTLIMIT, page 53

Panel Loss

Panel Loss function defines the operation of the drive if the control panel selected as control location for the drive stops communicating.

Settings

Parameter 3002 PANEL COMM ERR, page 53

External Fault

External Faults (1 and 2) can be supervised by defining one digital input as a source for an external fault indication signal.

Settings

Parameters 3003 EXTERNAL FAULT 1 and 3004 EXTERNAL FAULT 2, page 53

Stall Protection

The drive protects the motor in a stall situation. It is possible to adjust the supervision limits (frequency, time) and choose how the drive reacts to the motor stall condition (alarm indication / fault indication & drive stop / no reaction).

Settings

Parameters 3010…3012, page 53

Earth Fault Protection

The Earth Fault Protection detects earth faults in the motor or motor cable. The protection is active only during start.

An earth fault in the input power line does not activate the protection.

Settings

Parameter 3017 EARTH FAULT, page 53

Incorrect Wiring

Defines the operation when incorrect input power cable connection is detected.

Settings

Parameter 3023 WIRING FAULT, page 53

Preprogrammed faults

Overcurrent

The overcurrent trip limit for the drive is 325% of the drive nominal current.

DC Overvoltage

The DC overvoltage trip limit is 420 V (for 200 V drives) and 840 V (for 400 V drives).

DC Undervoltage

The DC undervoltage trip limit is adaptive. See parameter 2006 UNDERVOLT CTRL, page 48.

Drive Temperature

The drive supervises the IGBT temperature. There are two supervision limits: Alarm limit and fault trip limit.

Short Circuit

If a short circuit occurs, the drive will not start and a fault indication is given.

Internal Fault

If the drive detects an internal fault, the drive is stopped and a fault indication is given.

Supply Phase Loss

If the drive detects supply phase loss (excessive DC voltage ripple), the drive is stopped and a fault indication is given.

Operation Limits

The drive has adjustable limits for output frequency, current (maximum) and DC voltage.

Settings

Parameter Group 20: Limits, page 48

Power Limit

Power limitation is used to protect the input bridge and the DC intermediate circuit. If the maximum allowed power is exceeded, the drive torque is automatically limited. Maximum overload and continuous power limits depend on the drive hardware. For specific values, see chapter Technical data on page 102.

Automatic Resets

The drive can automatically reset itself after overcurrent, overvoltage, undervoltage, external and “analog input below a minimum” faults. The Automatic Resets must be activated by the user.

Table 14: Automatic Resets Settings

Parameter	Additional Information
Group 31: Automatic Reset	Automatic reset settings

Table 15: Automatic Resets Diagnostics

Alarm	Additional Information
AUTORESET	Automatic reset alarm

Supervisions

The drive monitors whether certain user selectable variables are within the user-defined limits. The user may set limits for speed, current etc. The supervision status can be indicated through relay or digital output.

The supervision function outputs can be used for triggering some drive functionality (start/stop, sleep, pump cleaning).

The supervision functions operate on a 2 ms time level.

Settings

Parameter group Group 32: Supervision

Table 16: Supervisions Diagnostics

Actual Signal	Additional Information
1001/1002	EXT1/EXT2 start/stop according to supervision functions
140	Supervision status through RO 1
1402/1403/1410	Supervision status through RO 2…4. With option MREL-01 only.
1805	Supervision status through DO
4022/4122	Sleep start according to supervision functions
4601	Pump clean trigger according to supervision functions

Parameter Lock

The user can prevent parameter adjustment by activating the parameter lock.

Settings

Parameters 1602 PARAMETER LOCK and 1603 PASS CODE, page 46

Energy Optimizer

Energy optimizer optimizes the flux so that the total energy consumption and motor noise level are reduced when the drive operates below the nominal load. The total efficiency (motor and drive) can be improved by 1…10% depending on load torque and speed.

Energy saving tools calculate energy saved in kWh and MWh, energy saved in local currency as well as reduction in CO_2 emission, all compared to the situation when the pump is connected directly to the supply.

Table 17: Energy Optimizer Settings

Parameter	Additional Information
Group 45: Energy Savings	Energy saving settings

Table 18: Energy Optimizer Diagnostics

Actual Signal	Additional Information
0174/0175	Energy saved in kWh/Mwh
0176/0177	Energy saved in local currency
0178	Reduction in CO_2 emi

This section describes the actual signals and parameters that a Daikin user needs to understand and gives the fieldbus equivalent values for each signal/parameter. It also contains a table of the default values for the different macros. See page 108 for recommended Daikin values.

NOTE: When the control panel is in the short parameter view, ie when parameter 1611 PARAMETER VIEW is set to 2 (SHORT VIEW), the control panel only shows a subset of all signals and parameters. The list of these signals and parameters starts on page 31.

To be able to view all actual signals and parameters, set parameter 1611 PARAMETER VIEW to 3 (LONG VIEW). The descriptions of parameters start on page 31.

Terms and Abbreviations

Term	Definition
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.
Def	Parameter default value
Parameter	A user-adjustable operation instruction of the drive. Groups 10…99 contain parameters. **NOTE:** 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).
FbEq	Fieldbus equivalent: The scaling between the value and the integer used in serial communication.

Fieldbus Equivalent

Example: If 2008 MAXIMUM FREQ (see page 170) is set from an external control system, an integer value of 1 corresponds to 0.1 Hz. All the read and sent values are limited to 16 bits (-32768…32767).

Table 20: Actual Signals in the Short Parameter View

Actual signals in the short parameter view			
No.	**Name/Value**	**Description**	**FbEq**
04	FAULT HISTORY	Fault history (read-only). See Group 04: Fault History, page 37.	
0401	LAST FAULT	Code of the latest fault.	1 = 1

Table 21: Parameters in the Short Parameter View

Parameters in the short parameter view			
No	**Name/Value**	**Description**	**Default**
1105	REF1 MAX	Defines the maximum value for external reference REF1.	E: 50.0 Hz U: 60.0 Hz
13	**ANALOG INPUTS**	Analog input signal processing. See Group 13: Analog Inputs, page 44.	
1301	MINIMUM AI1	Defines the minimum %-value that corresponds to minimum mA/(V) signal for analog input AI1.	1.0%
21	**START/STOP**	Start and stop modes of the motor. See Group 21: Start/Stop, page 49.	
2102	STOP FUNCTION	Selects the motor stop function.	COAST
22	**ACCEL/DECEL**	Acceleration and deceleration times. See Group 22: Accel/Decel, page 50.	
2202	ACCELER TIME 1	Defines the acceleration time 1.	5.0 s
2203	DECELER TIME 1	Defines the deceleration time 1.	5.0 s
99	**START-UP DATA**	Language selection. Definition of motor set-up data. See Group 99: Start-Up Data, page 32	
9901	LANGUAGE	Selects the display language.	ENGLISH
9902	APPLIC DEFAULT	Selects the application macro	Daikin uses "HVAC"
9905	MOTOR NOM VOLT	Defines the nominal motor voltage.	230 V (200 V units) 400 V (400 V E units) 460 V (400 V U units)
9906	MOTOR NOM CURR	Defines the nominal motor current.	I_{2N}
9907	MOTOR NOM FREQ	Defines the nominal motor frequency.	E: 50.0 Hz U: 60.0 Hz
9908	MOTOR NOM SPEED	Defines the nominal motor speed.	Type dependent
9909	MOTOR NOM POWER	Defines the nominal motor power.	P_N

Parameter Descriptions

Parameter data is specific to ACS320 firmware version 4.01C.

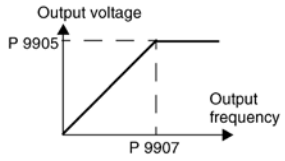
Group 99: Start-Up Data

This group defines special Start-up data required to:

- Set up the drive.
- Enter motor information

NOTE: Parameters checked under the heading “S” can be modified only when the drive is stopped.

Table 22: **Group 99: Start-Up Data**

Code	Description	Range	Resolution	Default	S
9901	**LANGUAGE 0...13 1 0**	—	—	—	—
	Selects the display language. 0= ENGLISH 1= ENGLISH (AM) 2= DEUTSCH 3= ITALIANO 4= ESPAÑOL 5= PORTUGUES 6= NEDERLANDS 7= FRANCAIS 8= DANSK; 9= SUOMI 10= SVENSKA 11= RUSSKI 12= POLSKI 13= TÜRKCE 14= CZECH 15= MAGYAR				
9902	**APPLIC MACRO**	-1…15	1	1	☑
	Daikin uses the "HVAC" macro				
9905	**MOTOR NORM VOLT**	115...345V (200V, US) 230...690V (400V, US) 288...862V (600V, US)	1V 1V 1V	230V 460V 575V	☑
	Defines the nominal motor voltage. • Must equal the value on the motor rating plate. • Sets the maximum drive output voltage supplied to the motor. • The ACH550 cannot supply the motor with a voltage greater than the mains voltage.				
9906	**MOTOR NOM CURR**	0.15*I2N… 1.5*I2N	0.1 A	1.5*I2N	☑
	Defines the nominal motor current. • Must equal the value on the motor rating plate. • Range allowed: (0.2…2.0) · IN (where IN is drive current).				
9907	**MOTOR NOM FREQ**	10.0…500 Hz	0.1 Hz	60 Hz (US)	☑
	Defines the nominal motor frequency. • Range: 10…500 Hz (typically 50 or 60 Hz) • Sets the frequency at which output voltage equals the MOTOR NOM VOLT. • Field weakening point = Norm freq * Supply Volt / Mot Nom Vol				
9908	**MOTOR NOM SPEED**	50…30000 rpm	1 rpm	Size dependent	☑
	Defines the nominal motor speed. • Must equal the value on the motor rating plate.				
9909	**MOTOR NOM POWER**	0.15…1.5*P_N	0.1 Hp	0.2 HP (US)	☑
	Defines the nominal motor power. • Must equal the value on the motor rating plate.				

Group 01: Operating Data

This group contains drive operating data, including actual signals. The drive sets the values for actual signals, based on measurements or calculations. You cannot set these values.

Table 23: Group 01: Operating Data

Code	Description	Range	Resolution	Default	S
0101	**SPEED & DIR**	-30000...30000	1 rpm	—	
	The calculated speed of the motor (rpm) & motor direction.				
0102	**SPEED**	0...30000 rpm	1 rpm	—	
	The calculated speed of the motor (rpm).				
0103	**OUTPUT FREQ**	0.0...500.0 Hz	1Hz	—	
	The frequency (Hz) applied to the motor. (Also shown by default in OUTPUT display.)				
0104	**CURRENT**	0.0...1.5*I2N	0.1 A	—	
	The motor current, as measured by the ACH550. (Also shown by default in OUTPUT display.)				
0105	**TORQUE**	-200%… 200%	0.1%	—	
	Output torque. Calculated value of torque on motor shaft in % of motor nominal torque.				
0106	**POWER**	-1.5…1.5*PN	0.1 kW	—	
	The measured motor power in kW.				
0107	**DC BUS VOLTAGE**	0 V…2.5*VdN	1 V	—	
	The DC bus voltage in VDC, as measured by the ACH550.				
0109	**OUTPUT VOLTAGE**	0 V…2.0*VdN	1 V	—	
	The voltage applied to the motor.				
0110	**DRIVE TEMP**	0°C…150°C	1°C	—	
	The temperature of the drive power transistors in Centigrade.				
0111	**EXTERNAL REF 1**	0...30000 rpm / 0...500 Hz	1 rpm / 0.1 Hz	—	
	External reference, REF1, rpm or Hz - units determined by parameter 9904.				
0112	**EXTERNAL REF 2**	0%...100% (torque: 0%...600%	0.1%	—	
	External reference, REF2, in %				
0113	**CTRL LOCATION**	0...2	1	—	
	Active control location. Alternatives are: 0 = HAND 1 = EXT1 2 = EXT2				
0114	**RUN TIME(R)**	0...65,535 h	1 h	0 h	
	The drive's accumulated running time in hours (h). • Can be reset by pressing UP and DOWN buttons simultaneously when in parameter set mode.				
0115	**KWH COUNTER (R)**	0...65,535 kWh	1 kWh	—	
	The drive's accumulated power consumption in kilowatt hours. • Can be reset by pressing UP and DOWN buttons simultaneously when in parameter set mode.				
0116	**APPL BLK OUTPUT**	0...100% (torque: 0...600%)	0.1%	—	
	Application block output signal. Value is from either: • PFA control, if PFA Control is active, or • Parameter 0112 EXTERNAL REF 2.				
0120	**AI1**	0...100%	0.1%	—	
	Relative value of analog input 1 in %.				
0121	**AI2**	0...100%	0.1%	—	
	Relative value of analog input 2 in %.				
0124	**AO1**	0...20 mA	0.1 mA	—	
	The analog output 1 value in milliamperes.				
0126	**PID 1 OUTPUT**	-1000...1000%	0.1%	—	
	The PID Controller 1 output value in %.				
0127	**PID 2 OUTPUT**	-100...100%	0.1%	—	
	The PID Controller 2 output value in %.				
0128	**PID 1 SETPNT**	—	—	—	
	The PID 1 controller setpoint signal. • Units and scale defined by PID parameters 4006/4106 & 4007/4107.				
0129	**PID 2 SETPNT**	—	—	—	
	The PID 2 controller setpoint signal. • Units and scale defined by PID parameters 4206 & 4207.				
0130	**PID 1 FBK**	—	—	—	
	The PID 1 controller feedback signal. • Units and scale defined by PID parameters 4006/4106 & 4007/4107.				
0131	**PID 2 FBK**	—	—	—	
	The PID 2 controller feedback signal. • Units and scale defined by PID parameters 4206 & 4207.				

Code	Description *(continuation of Table 23)*	Range	Resolution	Default	S
0132	**PID 1 DEVIATION**	—	—	—	
	The difference between the PID 1 controller reference value and actual value. • Units and scale defined by PID parameters 4006/4106 & 4007/4107.				
0133	**PID 2 DEVIATION**	—	—	—	
	The difference between the PID 2 controller reference value and actual value. • Units and scale defined by PID parameters 4206 & 4207.				
0134	**COMM RO WORD**	0...65535	1	0	
	Free data location that can be written from serial link. • Used for relay output control. • See parameter 1401.				
0135	**COMM VALUE 1**	-32768... +32767	1	0	
	Free data location that can be written from serial link.				
0136	**COMM VALUE 2**	-32768... +32767	1	0	
	Free data location that can be written from serial link.				
0137	**PROCESS VAR 1**	—	1	—	
	Process variable 1 • Defined by parameters in Group 34: Panel Display / Process Variables, page 57.				
0138	**PROCESS VAR 2**	—	1	—	
	Process variable 2 • Defined by parameters in Group 34: Panel Display / Process Variables, page 57.				
0139	**PROCESS VAR 3**	—	1	—	
	Process variable 3 • Defined by parameters in Group 34: Panel Display / Process Variables, page 57.				
0140	**RUN TIME**	0...499.99 kh	0.01 kh	0 kh	
	The drive's accumulated running time in thousands of hours (kh).				
0141	**MWH COUNTER**	0...65,535 MWh	1 MWh	-	
	The drive's accumulated power consumption in megawatt hours. Cannot be reset.				
0142	**REVOLUTION CNTR**	0...9999	1	0	
	The motor's accumulated revolutions in millions of revolutions.				
0143	**DRIVE ON TIME (HI)**	0...65535 days	1 day	0	
	The drive's accumulated power on time in days.				
0144	**DRIVE ON TIME (LO)**	0...43200 hh:mm:ss	2s	0	
	The drive's accumulated power on time in 2 second ticks (30 ticks = 60 seconds).				
0145	**MOTOR TEMP**	-10...200 °C/ 0...5000 Ohm / 0...1	1	0	
	Motor temperature in degrees centigrade / PTC rdsistance in Ohms. • Applies only if motor temperature sensor is set up. See parameter 3501, page 59.				
0158	**PID COMM VALUE 1**				
	Data received from fieldbus for PID control (PID1 and PID2).				
0159	**PID COMM VALUE 2**				
	Data received from fieldbus for PID control (PID1 and PID2).				
0160	**DI 1-5 STATUS**				
	Status of digital inputs. EXAMPLE: 10000 = DI1 is on, DI2...DI5 are off.				
0161	**PULSE INPUT FREQ**		1 = 1 Hz		
	Value of frequency input in Hz.				
0162	**RO STATUS**		1 = 1		
	Status of relay output 1.1 = RO is energized, 0 = RO is deenergized.				
0163	**TO STATUS**		1 = 1		
	Status of transistor output when transistor output is used as a digital output.				
0164	**TO FREQUENCY**		1 = 1 Hz		
	Transistor output frequency, when transistor output is used as a frequency output.				
0173	**RO 2-4 STATUS**				
	Status of the relays in the Relay Output Extension Module MREL-0. See MREL-01 Relay Output Extension Module User's Manual (3AUA0000035974 [English]). Example: 100 = RO 2 is on, RO3 and RO 4 are off.				
0174	**SAVED KWH**		1 = 0.1 kWh		
	Energy saved in kWh compared to the energy used when the pump is connected directly to the supply. Can be reset with parameter 4509 ENERGY RESET (resets all energy calculators at the same time). See Group 45 ENERGY SAVING, page 66.				
0175	**SAVED MWH**		1 = 1 MWh		
	Energy saved in MWh compared to the energy used when the pump is connected directly to the supply. Can be reset with parameter 4509 ENERGY RESET (resets all energy calculators at the same time). See Group 45 ENERGY SAVING, page 66.				
0176	**SAVED AMOUNT 1**		1 = 0.1 (Currency)		
	Energy saved in local currency. To find out the total saved energy in currency units, add the value of parameter 0177 multiplied by 1000 to the value for parameter 0176. Example: 0176 SAVED AMOUNT 1 = 123.4 0177 SAVED AMOUNT 2 = 5 Total saved energy = 5 * 1000 + 123.4 = 5123.4 currency units. Local energy price is set with parameter 4502 ENERGY PRICE. Can be reset with parameter 4509 ENERGY RESET (resets all energy calculators at the same time). See Group 45 ENERGY SAVING, page 66.				

Code	Description *(continuation of Table 23)*	Range	Resolution	Default	S
0177	**SAVED AMOUNT 2**	—	1 = 1000 (Currency)	—	
	Energy saved in local currency in thousand currency units. Eg value 5 means 5000 currency units. See parameter 0176 SAVED AMOUNT 1. Local energy price is set with parameter 4502 ENERGY PRICE. Can be reset with parameter 4509 ENERGY RESET (resets all energy calculators at the same time). See Group 45 ENERGY SAVING, page 66.				
0178	**SAVED CO_2**	—	1 = 0.1 tn	—	
	Reduction on carbon dioxide emissions in tn. CO_2 conversion factor is set with parameter 4507 CO_2 CONV FACTOR. Can be reset with parameter 4509 ENERGY RESET (resets all energy calculators at the same time). See Group 45 ENERGY SAVING, page 66.				

Group 03: Actual Signals

This group monitors fieldbus communications.

Table 24: Group 03: Actual Signals

Code	Description	Range	Resolution	Default	S
0301	**FB CMD WORD 1**	—	—	—	

Read-only copy of the Fieldbus Command Word 1.
- The fieldbus command is the principal means for controlling the drive from a fieldbus controller. The command consists of two Command Words. Bit-coded instructions in the Command Words switch the drive between states.
- To control the drive, using the Command Words, an external location (EXT1 or EXT2) must be active and set to COMM. (See parameters 1001 and 1002.)
- The control panel displays the word in hex. For example, all zeros and a 1 in Bit 0 displays as 0001. All zeros and a 1 in BIt 15 displays as 8000.

Bit #	0301, fb cmd word 1	0302, fb cmd word 2	Bit #	0301, fb cmd word 1	0302, fb cmd word 2
0	STOP	FBLOCAL_CTL	8	STPMODE_EM	Reserved
1	START	FBLOCAL_REF	9	STPMODE_C	Reserved
2	REVERSE	START_DISABLE1	10	RAMP_2	Reserved
3	LOCAL	START_DISABLE2	11	RAMP_OUT_0	REF_CONST
4	RESET	Reserved	12	RAMP_HOLD	REF_AVE
5	EXT2	Reserved	13	RAMP_IN_0	LINK_ON
6	RUN_DISABLE	Reserved	14	RREQ_LOCALLOC	REQ_STARTINH
7	STPMODE_R	Reserved	15	TORQLIM2	OFF_INTERLOCK

Code	Description	Range	Resolution	Default	S
0302	**FB CMD WORD 2**	—	—	—	

Read-only copy of the Fieldbus Command Word 2.
- See parameter 0301, page 35.

Code	Description	Range	Resolution	Default	S
0303	**FB STS WORD 1**	—	1	- hex	

Read-only copy of the Status Word 1.
- The drive sends status information to the fieldbus controller. The status consists of two Status Words.

Bit #	0303, sts cmd word 1	0304, fb sts word 2	Bit #	0303, sts cmd word 1	0304, fb sts word 2
0	READY	ALARM	8	LIMIT	Reserved
1	ENABLED	REQ_MAINT	9	SUPERVISION	Reserved
2	STARTED	DIRLOCK	10	REV_REF	REQ_CTL
3	RUNNING	LOCALLOCK	11	REV_ACT	REQ_REF1
4	ZERO_SPEED	CTL_MODE	12	PANEL_LOCAL	REQ_REF2
5	ACCELERATE	Reserved	13	FIELDBUS_LOCAL	REQ_REF2EXT
6	DECELERATE	Reserved	14	EXT2_ACT	ACK_STARTINH
7	AT_SETPOINT	Reserved	15	FAULT ACK_	OFF_ILCK

Code	Description	Range	Resolution	Default	S
0304	**FB STS WORD 2**	—	1	- hex	

Read-only copy of the Status Word 2.
- See parameter 0303, page 35.

Code	Description	Range	Resolution	Default	S
0305	**FAULT WORD 1**	—	1	0000 hex	

Read-only copy of the Fault Word 1.
- When a fault is active, the corresponding bit for the active fault is set in the Fault Words.
- Each fault has a dedicated bit allocated within Fault Words.
- See Fault Tracing, page 90 for a description of the faults.

The control panel displays the word in hex. For example, all zeros and a 1 in Bit 0 displays a 0001. All zeros and a 1 in Bit 15 displays as 8000.

Bit #	0305,fault word 1	0306 fault word 2	0307 fault word 3	Bit #	0305, fault word 1	0306, fault word 2	0307, fault word 3
0	OVERCURRENT	UNDERLOAD	EFB 1	8	MOT OVERTEMP	Reserved	Reserved
1	DC OVERVOLT	THERM FAIL	EFB 2	9	PANEL LOSS	DRIVE ID	Reserved
2	DEV OVERTEMP	OPEX LINK	EFB 3	10	ID RUN FAIL	CONFIG FILE	System Error
3	SHORT CIRC	OPEX PWR	Incompatible software type	11	MOTOR STALL	SERIAL 1 ERR	System Error
4	Reserved	CURR MEAS	Reserved	12	Reserved	EFB CON FILE	System Error
5	DC UNDERVOLT	SUPPLY PHASE	Reserved	13	EXT FLT 1	FORCE TRIP	System Error
6	AI1 LOSS	ENCODER ERROR	Reserved	14	EXT FLT 2	MOTOR PHASE	Hardware Error
7	AI2 LOSS	OVERSPEED	Reserved	15	EARTH FAULT	OUTPUT WIRING	Param. Setting Fault

Code	Description	Range	Resolution	Default	S
0306	**FAULT WORD 2**	-	1	0000 hex	

A16-bit data word. For the possible causes and remedies and fieldbus equivalents, see Fault Tracing, page 90.

Bit #		Bit #		Bit #	
0	Reserved	6	Reserved	11	SERIAL 1 ERR
1	THERM FAIL	7	OVERSPEED	12	EFB CON FILE
2...3	Reserved	8	Reserved	13	FORCE TRIP
4	CURR MEAS	9	DRIVE ID	14	MOTOR PHASE
5	SUPPLY PHASE	10	CONFIG FILE	15	OUTP WIRING

Code	Description *(continuation of Table 24)*	Range	Resolution	Default	S
0307	**FAULT WORD 3**	—	1	0000 hex	

A16-bit data word. For the possible causes and remedies and fieldbus equivalents, see Fault Tracing, page 90.

Bit #		Bit #		Bit #	
0	EFB 1	4	USER LOAD CURVE	8	INLET LOW
1	EFB 2	5	UNKNOWN EXTENSION	9	OUTLET HIGH
2	EFB 3	6	INLET VERY LOW	10...14	System error
3	INCOMPATIBLE SW	7	OUTLET VERY HIGH	15	Parameter setting fault

Code		Range	Resolution	Default	S
0308	**ALARM WORD 1**	—	1	0000 hex	

Read-only copy of the ALARM WORD 1.
- When a fault is active, the corresponding bit for the active fault is set in the Fault Words.
- Each fault has a dedicated bit allocated within Fault Words.
- Bits remain set until the whole alarm word is reset. (Reset by writing zero to the word).
- The control panel displays the word in hex. For example, all zeros and a 1 in Bit 0 displays a 0001. All zeros and a 1 in Bit 15 displays as 80000.

Bit #	0308, alarm word 1	0309, alarm word 2	Bit #	0308, alarm word 1	0309, alarm word 2
0	OVERCURRENT	Reserved	8	DEVICE OVERTEMP	FIRST START
1	OVERVOLTAGE	PID SLEEP	9	MOT OVERTEMP	Reserved
2	UNDERVOLTAGE	Reserved	10	UNDERLOAD	USER LOAD CURVE
3	DIRLOCK	Reserved	11	MOTOR STALL	START DELAY
4	I/O COMM	START ENABLE 1 MISSING	12	AUTORESET	Reserved
5	AI1 LOSS	START ENABLE 2 MISSING	13	PFA AUTOCHANGE	INLET LOW
6	AI2 LOSS	EMERGENCY STOP	14	PFC INTERLOCK	INLET HIGH
7	PANEL LOSS	Reserved	15	Reserved	PIPE FILL

Code		Range	Resolution	Default	S
0309	**ALARM WORD 2**	—	1	0000 hex	

Read-only copy of the ALARM WORD 3.
- See parameter 0308, page 35.

Code		Range	Resolution	Default	S
0310	**ALARM WORD 3**	0	1	0000 hex	

A 16-bit data word. For the possible causes and remedies and fieldbus equivalents, see Fault Tracing, page 90.
An alarm can be reset by resetting the whole alarm word: Write zero to the word.

Bit #	
0	INLET VERY LOW
1	OUTLET VERY HIGH
2...15	Reserved

Group 04: Fault History

This group stores a recent history of the faults reported by the drive.

Table 25: Group 04: Fault History

Code	Description	Range	Resolution	Default	S
0401	**LAST FAULT**	Fault code text	1	0	
	0 = Clear the fault history (on panel = NO RECORD). n = Fault code of the last recorded fault.				
0402	**FAULT TIME 1**	Date dd.mm.yy / power-on days	1	0	
	The day on which the last fault occurred. Either as: • A date – if real time clock is operating. • The number of days after power on – if real time clock is not used, or was not set.				
0403	**FAULT TIME 2**	Time hh:mm:ss	2 s	0	
	The time at which the last fault occurred. Either as: • Real time, in format hh:mm:ss – if real time clock is operating. • The time since power on (less the whole days reported in 0402), in format hh:mm:ss – if real time clock is not used, or was not set.				
0404	**SPEED AT FLT**	-	1 rpm	0	
	The motor speed (rpm) at the time the last fault occurred.				
0405	**FREQ AT FLT**	-	0.1 Hz	0.0	
	The frequency (Hz) at the time the last fault occurred.				
0406	**VOLTAGE AT FLT**	-	0.1 V	0.0	
	The DC bus voltage (V) at the time the last fault occurred.				
0407	**CURRENT AT FLT**	-	0.1 A	0.0	
	The motor current (A) at the time the last fault occurred.				
0408	**TORQUE AT FLT**	-	0.1%	0.0	
	The motor torque (%) at the time the last fault occurred.				
0409	**STATUS AT FLT**	-	1	0000 hex	
	The drive status (hex code word) at the time the last fault occurred.				
0412	**PREVIOUS FAULT 1**	Fault code text	1	0	
	Fault code of the second last fault. Read-only				
0413	**PREVIOUS FAULT 2**	Fault code text	1	0	
	Fault code of the third last fault. Read-only.				
0414	**DI 1-5 AT FLT**				
	Status of digital inputs DI1...5 at the time the latest fault occurred (binary). Example: 10000 = DI1 is on, DI2...DI5 are off.				

Group 10: Start/Stop/Dir

This group:

- Defines external sources (EXT1, and EXT2) for commands that enable start, stop and direction changes.
- Locks direction or enables direction control. To select between the two external locations use the next group, parameter 1102.

Table 26: Group 10: AcStart/Stop/Dir

Code	Description	Range	Resolution	Default	S
1001	**EXT1 COMMANDS**	0...14	1	1	☑
	Defines external control location 1 (EXT1) – the configuration of start, stop and direction commands. 0 = NOT SEL – No external start, stop and direction command source. 1 = DI1 – Two-wire Start/Stop. • Start/Stop is through digital input DI1 (DI1 activated = Start; DI1 de-activated = Stop). • Parameter 1003 defines the direction. Selecting 1003 = 3 (request) is the same as 1003 = 1 (fwd). 2 = DI1, 2 – Two-wire Start/Stop, Direction. • Start/Stop is through digital input DI1 (DI1 activated = Start; DI1 de-activated = Stop). • Direction control (requires parameter 1003 = 3 (request)) is through digital input DI2 (DI2 activated = Reverse; de-activated = Forward). 3 = DI1P, 2P – Three-wire Start/Stop. • Start/Stop commands are through momentary push-buttons (the P stands for “pulse”). • Start is through a normally open push-button connected to digital input DI1. In order to start the drive, the digital input DI2 must be activated prior the pulse in DI1. • Connect multiple Start push-buttons in parallel. • Stop is through a normally closed push-button connected to digital input DI2. • Connect multiple Stop push-buttons in series. • Parameter 1003 defines the direction. Selecting 1003 = 3 (REQUEST) is the same as 1003 = 1 (FWD). 4 = DI1P, 2P, 3 – Three-wire Start/Stop, Direction. • Start/Stop commands are through momentary push-buttons, as described for DI1P, 2P. • Direction control (requires parameter 1003 = 3 (REQUEST)) is through digital input DI3 (DI3 activated = Reverse; de-activated = Forward). 5 = DI1P, 2P, 3P – Start Forward, Start Reverse, and Stop. • Start and Direction commands are given simultaneously with two separate momentary push-buttons (the P stands for “pulse”). • Start Forward command is through a normally open push-button connected to digital input DI1. In order to start the drive, the digital input DI3 must be activated during the pulse in DI1. • Start Reverse command is through a normally open push-button connected to digital input DI2. In order to start the drive, the digital input DI3 must be activated prior the pulse in DI2. • Connect multiple Start push-buttons in parallel. • Stop is through a normally closed push-button connected to digital input DI3. • Connect multiple Stop push-buttons in series. • Requires parameter 1003 = 3 (REQUEST). 6 = DI6 – Two-wire Start/Stop. • Start/Stop is through digital input DI6 (DI6 activated = Start; DI6 de-activated = Stop). • Parameter 1003 defines the direction. Selecting 1003 = 3 (REQUEST) is the same as 1003 = 1 (FWD). 7 = DI6, 5 – Two-wire Start/Stop/Direction. • Start/Stop is through digital input DI6 (DI6 activated = Start; DI6 de-activated = Stop). • Direction control (requires parameter 1003 = 3 (REQUEST)) is through digital input DI5. (DI5 activated = Reverse; de-activated = Forward). 8 = KEYPAD – Control Panel. • Start/Stop and Direction commands are through the control panel when EXT1 is active. • Direction control requires parameter 1003 = 3 (REQUEST). 9 = DI1F, 2R – Start/Stop/Direction commands through DI1 and DI2 combinations. • Start forward = DI1 activated and DI2 de-activated. • Start reverse = DI1 de-activated and DI2 activated. • Stop = both DI1 and DI2 activated, or both de-activated. • Requires parameter 1003 = 3 (REQUEST). 10 = COMM – Assigns the fieldbus Command Word as the source for the start/stop and direction commands. • Bits 0,1, 2 of Command Word 1 (parameter 0301) activates the start/stop and direction commands. • See Fieldbus user’s manual for detailed instructions. 11 = TIMER 1. – Assigns Start/Stop control to Timer 1 (Timer activated = START; Timer de-activated = STOP). See Group 36, Timer Functions. 12…14 = TIMER 2… 4 – Assigns Start/Stop control to Timer 2…4. See Timer Function 1 above.				

Group 11: Reference Select

This group defines:

- How the drive selects between command sources.
- Characteristics and sources for REF1 and REF2.

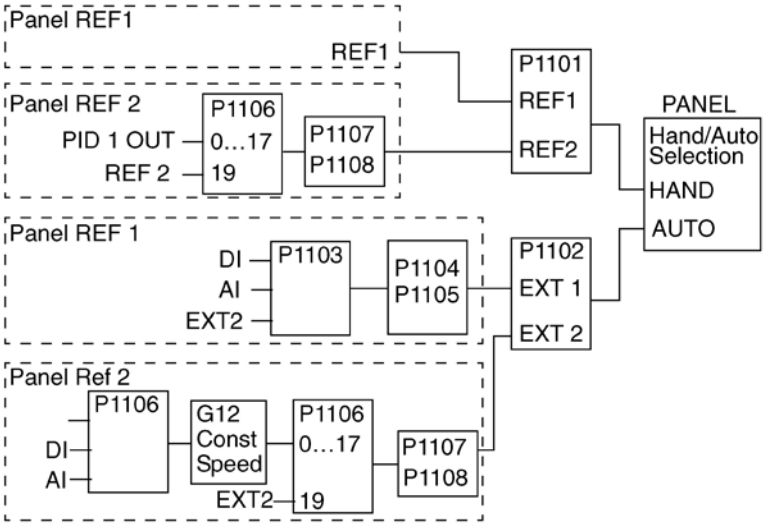


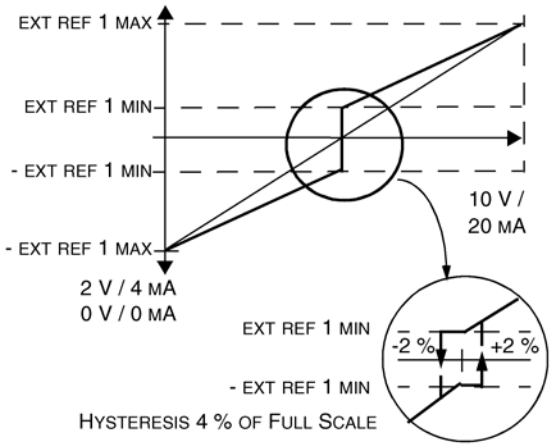
Table 27: Group 11: Reference Select

Code	Description	Range	Resolution	Default	S
1101	**KEYPAD REF SEL**	1,2	1	1	
	Selects the reference controlled in local control mode. 1 = REF1 (Hz/rpm) – Reference type depends on parameter 9904 MOTOR CTRL MODE. • Speed reference (rpm) if 9904 = 1 (VECTOR: SPEED). • Frequency reference (Hz) if 9904 = 3 (SCALAR; FREQ). 2 = REF2 (%)				
1102	**EXT1/EXT2 SEL**	- 6...12	1	0	☑
	Defines the source for selecting between the two external control locations EXT1 or EXT2. Thus, defines the source for Start/Stop/Direction commands and reference signals. 0 = EXT1 – Selects external control location 1 (EXT1). • See parameter 1001 EXT1 COMMANDS for EXT1's Start/Stop/Dir definitions. • See parameter 1103 REF1 SELECT for EXT1's reference definitions. 1 = DI1 – Assigns control to EXT1 or EXT2 based on the state of DI1 (DI1 activated = EXT2; DI1 de-activated = EXT1). 2…6 = DI2…DI6 – Assigns control to EXT1 or EXT2 based on the state of the selected digital input. See DI1 above. 7 = EXT2 – Selects external control location 2 (EXT2). • See parameter 1002 EXT2 COMMANDS for EXT2's Start/Stop/Dir definitions. • See parameter 1106 REF2 SELECT for EXT2's reference definitions. 8 = COMM – Assigns control of the drive via external control location EXT1 or EXT2 based on the fieldbus control word. • Bit 5 of the Command Word 1 (parameter 0301) defines the active external control location (EXT1 or EXT2). • See Fieldbus user's manual for detailed instructions. 9 = TIMER 1 – Assigns control to EXT1 or EXT2 based on the state of the Timer (Timer activated = EXT2; Timer de-activated = EXT1). See Group 36, Timer Functions. 10…12 = TIMER 2… 4 – Assigns control to EXT1 or EXT2 based on the state of the Timer. See Timer 1 above. -1 = DI1(INV) – Assigns control to EXT1 or EXT2 based on the state of DI1 (DI1 activated = EXT1; DI1 de-activated = EXT2). -2…-6 = DI2(INV)…DI6(INV) – Assigns control to EXT1 or EXT2 based on the state of the selected digital input. See DI1(INV) above.				

Code	Description *(continuation of Table 27)*	Range	Resolution	Default	S
1103	**REF1 SELECT**	0...21	1	1	☑

Selects the signal source for external reference REF1.

0 = KEYPAD – Defines the control panel as the reference source.
1 = AI1 – Defines analog input 1 (AI1) as the reference source.
2 = AI2 – Defines analog input 2 (AI2) as the reference source.
3 = AI1/JOYST – Defines analog input 1 (AI1), configured for joystick operation, as the reference source.
- The minimum input signal runs the drive at the maximum reference in the reverse direction. Define the minimum using parameter 1104.
- The maximum input signal runs the drive at maximum reference in the forward direction. Define the maximum using parameter 1105.
- Requires parameter 1003=3 (request). **Warning! Because the low end of the reference range commands full reverse operation, do not use 0 V as the lower end of the reference range. Doing so means that if the control signal is lost (which is a 0 V input) the result is full reverse operation. Instead, use the following set-up so that loss of the analog input triggers a fault, stopping the drive:**
  - **Set parameter 1301 MINIMUM AI1 (1304 MINIMUM AI2) at 20% (2 V or 4 mA).**
  - **Set parameter 3021 AI1 FAULT LIMIT to a value 5% or higher.**
  - **Set parameter 3001 AI<MIN FUNCTION to 1 (FAULT).**



4 = AI2/JOYST – Defines analog input 2 (AI2), configured for joystick operation, as the reference source.
- See above (AI1/JOYST) description.

5 = DI3U,4D(R) – Defines digital inputs as the speed reference source (motor potentiometer control).
- Digital input DI3 increases the speed (the U stands for "up").
- Digital input DI4 decreases the speed (the D stands for "down").
- A Stop command resets the reference to zero (the R stands for "reset").
- Parameter 2205 ACCELER TIME 2 controls the reference signal's rate of change.

6 = DI3U,4D – Same as above (DI3U,4D(R)), except:
- A Stop command does not reset the reference to zero. The reference is stored.
- When the drive restarts, the motor ramps up (at the selected acceleration rate) to the stored reference.

7 = DI5U,6D – Same as above (DI3U,4D), except that DI5 and DI6 are the digital inputs used.
8 = COMM – Defines the fieldbus as the reference source.
9 = COMM+AI1 – Defines a fieldbus and analog input 1 (AI1) combination as the reference source. See Analog Input Reference Correction below.
10 = COMM*AI1 – Defines a fieldbus and analog input 1 (AI1) combination as the reference source. See Analog Input Reference Correction below.
11 = DI3U, 4D(RNC) – Same as DI3U,4D(R) above, except that:
- Changing the control source (EXT1 to EXT2, EXT2 to EXT1, LOC to REM) does not copy the reference.

12 = DI3U,4D(NC) – Same as DI3U,4D above, except that:
- Changing the control source (EXT1 to EXT2, EXT2 to EXT1, LOC to REM) does not copy the reference.

13 = DI5U,6D(NC) – Same as DI3U,4D above, except that:
- Changing the control source (EXT1 to EXT2, EXT2 to EXT1, LOC to REM) does not copy the reference.

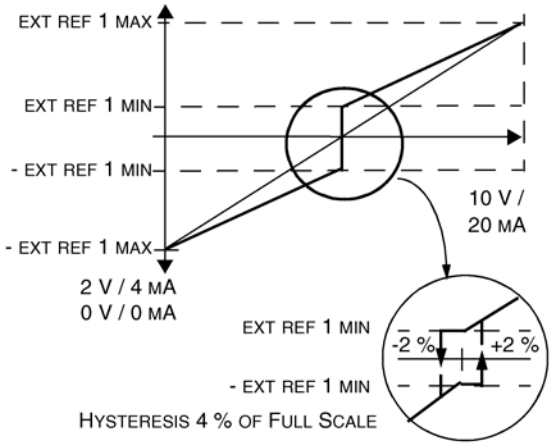
14 = AI1+AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog Input Reference Correction below.
15 = AI1*AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog Input Reference Correction below.
16 = AI1-AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog Input Reference Correction below.
17 = AI1/AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog Input Reference Correction below.

Analog Input Reference Correction.

Parameter values 9, 10, and 14…17 use the formula in the following.

Value Setting	AI reference is calculated as following:
C + B	C value + (B value - 50% of reference value)
C * B	C value * (B value / 50% of reference value)
C - B	(C value + 50% of reference value) - B value
C / B	(C value * 50% of reference value) / B value

Where:
- C = Main Reference value (= COMM for values 9, 10 and = AI1 for values 14…17).
- B = Correcting reference (= AI1 for values 9, 10 and = AI2 for values 14…17).



Example:
The figure shows the reference source curves for value settings 9, 10, and 14…17, where:
- C = 25%.
- P 4012 SETPOINT MIN = 0.
- P 4013 SETPOINT MAX = 0.
- B varies along the horizontal axis.

REF1 SELECT
20 = KEYPAD(RNC) – Defines the control panel as the reference source. A Stop command resets the reference to zero (R stands for reset.). Changing the control source (EXT1 to EXT2, EXT2 to EXT1) does not copy the reference.
21 = KEYPAD(NC) – Defines the control panel as the reference source. A Stop command does not reset the reference to zero. The reference is stored. Changing the control source (EXT1 to EXT2, EXT2 to EXT1) does not copy the reference

Code	Description *(continuation of Table 27)*	Range	Resolution	Default	S
1104	**REF1 MIN**	0.0…500.0 Hz 0...30000 rpm	0.1 Hz 1 rpm	0.0 Hz 0 rpm	
	Sets the minimum for external reference 1. • The minimum analog input signal (as a percent of the full signal in volts or amps) corresponds to REF1 MIN in Hz/rpm. • Parameter 1301 MINIMUM AI1 or 1304 MINIMUM AI2 sets the minimum analog input signal. • These parameters (reference and analog min. and max. settings) provide scale and offset adjustment for the reference.				
1105	**REF1 MAX**	0.0...500.0 Hz 0...30000 rpm	0.1 Hz 1 rpm	60.0 Hz (US) 1800 rpm (US)	
	Sets the maximum for external reference 1. • The maximum analog input signal (as a percent of full the signal in volts or amps) corresponds to REF1 MAX in Hz/rpm. • Parameter 1302 MAXIMUM AI1 or 1305 MAXIMUM AI2 sets the maximum analog input signal.				
1106	**REF2 SELECT**	0...19	1	2	☑
	Selects the signal source for external reference REF2. 0…17 – Same as for parameter 1103 REF1 SELECT. 19 = PID1OUT – The reference is taken from the PID1 output. See Groups 40 and 41.				

Group 12: Constant Speeds

This group defines a set of constant speeds. In general:

- You can program up to 7 constant speeds, ranging from 0…500 Hz or 0…30000 rpm.
- Values must be positive (No negative speed values for constant speeds).
- Constant speed selections are ignored if:
  - the torque control is active, or
  - the process PID reference is followed, or
  - the drive is in local control mode, or
  - PFA (Pump and Fan Alternation) is active

NOTE: Parameter 1208 CONST SPEED 7 acts also as a so-called fault speed which may be activated if the control signal is lost. For example, see parameters 3001 AI<MIN FUNCTION, 3002 PANEL COMM ERROR and 3018 COMM FAULT FUNC.

Table 28: Group 12: Constant Speeds

Code	Description	Range	Resolution	Default	S
1201	**CONST SPEED SEL**	-14...19	1	3	☑

Defines the digital inputs used to select Constant Speeds. See general comments in the introduction.

0 = NOT SEL – Disables the constant speed function.
1 = DI1 – Selects Constant Speed 1 with digital input DI1.
• Digital input activated = Constant Speed 1 activated.
2…5 = DI2…DI5 – Selects Constant Speed 1 with digital input DI2…DI5. See above.
7 = DI1,2 – Selects one of three Constant Speeds (1…3) using DI1 and DI2.
• Uses two digital inputs, as defined below (0 = DI de-activated, 1 = DI activated):

DI1	DI2	Function
0	0	No constant speed
1	0	Constant speed 1 (1202)
0	1	Constant speed 2 (1203)
1	1	Constant speed 3 (1204

• Can be set up as a so-called fault speed, which is activated if the control signal is lost. Refer to parameter 3001 AI<MIN function and parameter 3002 PANEL COMM ERR.
8 = DI2,3 – Selects one of three Constant Speeds (1…3) using DI2 and DI3.
• See above (DI1,2) for code.
9 = DI3,4 – Selects one of three Constant Speeds (1…3) using DI3 and DI4.
• See above (DI1,2) for code.
10 = DI4,5 – Selects one of three Constant Speeds (1…3) using DI4 and DI5.
• See above (DI1,2) for code.
12 = DI1,2,3 – Selects one of seven Constant Speeds (1…7) using DI1, DI2 and DI3.
• Uses three digital inputs, as defined below (0 = DI de-activated, 1 = DI activated):

DI1	DI2	DI3	Function
0	0	0	No constant speed
1	0	0	Constant speed 1 (1202)
0	1	0	Constant speed 2 (1203)
1	1	0	Constant speed 3 (1204)
0	0	1	Constant speed 4 (1205)
1	0	1	Constant speed 5 (1206)
0	1	1	Constant speed 6 (1207)
1	1	1	Constant speed 7 (1208

13 = DI3,4,5 – Selects one of seven Constant Speeds (1…7) using DI3, DI4 and DI5.
• See above (DI1,2,3) for code.
15…18 = TIMER 1…4 – Specifies the timer used to select a Constant Speed as the reference. The reference selection depends on the state of the selected timer, and the value of 1209 TIMED MODE SEL. See table. To enable and set timers, see Group 36, Timer Functions.

1201 =	15	16	17	18	Reference	
Timer:	1	2	3	4	1209 = 1	1209 = 2
Timer State			0		External reference	Constant Speed 1
			1		Constant Speed 1	Constant Speed 2

15…18 = TIMER FUNCTION 1…4 – Selects Constant speed 1 when Timer Function is active. See Group 36, Timer Functions.
19 = TIMER 1 & 2 – Selects a constant depending on the state of Timers 1 & 2.
See parameter 1209.

Code	Description *(continuation of Table 28)*	Range	Resolution	Default	S

-1 = DI1(INV) – Selects Constant Speed 1 with digital input DI1.
- Inverse operation: Digital input de-activated = Constant Speed 1 activated.

-2…- 5 = DI2(INV)…DI5(INV) – Selects Constant Speed 1 with digital input. See previous.

-7 = DI1,2(INV) – Selects one of three Constant Speeds (1…3) using DI1 and DI2.
- Inverse operation uses two digital inputs, as defined below (0 = DI de-activated, 1 = DI activated):

DI1	DI2	Function
1	1	No constant speed
0	1	Constant speed 1 (1202)
1	0	Constant speed 2 (1203)
0	0	Constant speed 3 (1204)

-8 = DI2,3(INV) – Selects one of three Constant Speeds (1…3) using Di2 and DI3.
- See above (DI1,2(INV)) for code.

-9 = DI3,4(INV) – Selects one of three Constant Speeds (1…3) using DI3 and DI4.
- See above (DI1,2(INV)) for code.

-10 = DI4,5(INV) – Selects one of three Constant Speeds (1…3) using DI4 and DI5.
- See above (DI1,2(INV)) for code.

-12 = DI1,2,3(INV) – Selects one of seven Constant Speeds (1...7) using DI1, DI2 and DI3.

DI1	DI2	DI3	Function
1	1	1	No constant speed
0	1	1	Constant speed 1 (1202)
1	0	1	Constant speed 2 (1203)
0	0	1	Constant speed 3 (1204)
1	1	0	Constant speed 4 (1205)
0	1	0	Constant speed 5 (1206)
1	0	0	Constant speed 6 (1207)
0	0	0	Constant speed 7 (1208)

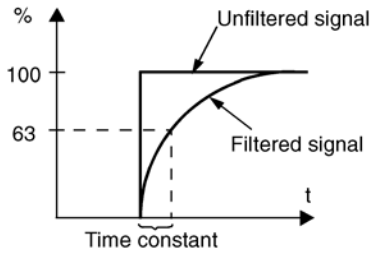
- Inverse operation uses three digital inputs, as defined below (0 = DI de-activated, 1 = DI activated):

-13 = DI3,4,5(INV) – Selects one of seven Constant Speeds (1…3) using DI3, DI4 and DI5.
- See above (DI1,2,3(INV)) for code.

Group 13: Analog Inputs

This group defines the limits and the filtering for analog inputs and are only needed for units shipping without MicroTech controllers but need field controls installed.

Table 29: Group 13: Analog Inputs

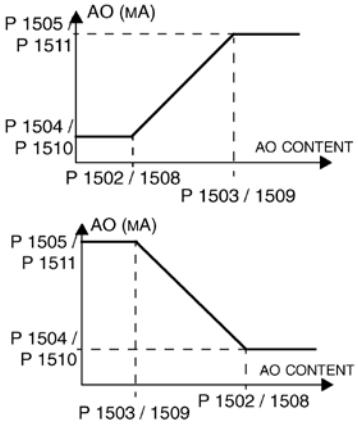
Code	Description	Range	Resolution	Default	S
1301	**MINIMUM AI1**	0.0...100.0%	0.1%	20.0%	
	Defines the minimum value of the analog input. • Define value as a percent of the full analog signal range. See example below. • The minimum analog input signal corresponds to 1104 REF1 MIN or 1107 REF2 MIN. • MINIMUM AI cannot be greater than MAXIMUM AI. • These parameters (reference and analog min. and max. settings) provide scale and offset adjustment for the reference. • See figure at parameter 1104. **Example:** To set the minimum analog input value to 4 mA: • Configure the analog input for 0…20 mA current signal. • Calculate the minimum (4 mA) as a percent of full range (20 mA) = 4 mA / 20 mA * 100% = 20%				
1302	**MAXIMUM AI1**	0.0...100.0%	0.1%	20.0%	
	Defines the maximum value of the analog input. • Define value as a percent of the full analog signal range. • The maximum analog input signal corresponds to 1105 REF1 MAX or 1108 REF2 MAX. • See figure at parameter 1104.				
1303	**FILTER AI1**	0.0...10.0 s	0.1 s	0.1 s	
	Defines the filter time constant for analog input 1 (AI1). • The filtered signal reaches 63% of a step change within the time specified. 				
1304	**MINIMUM AI2**	0.0...100.0%	0.1%	20.0%	
	Defines the minimum value of the analog input. • See MINIMUM AI1 above.				
1305	**MAXIMUM AI2**	0.0...100.0%	0.1%	100.0%	
	Defines the maximum value of the analog input. • See MAXIMUM AI1 above.				
1306	**FILTER AI2**	0.0...10.0 s	0.1 s	0.1 s	
	Defines the filter time constant for analog input 2 (AI2). • See FILTER AI1 above.				

Group 15: Analog Outputs

This group defines the drive's analog (current signal) outputs and is not normally needed. The drive's analog outputs can be:

- Any parameter of the Operating Data group (Group 01).
- Limited to programmable minimum and maximum values of output current.
- Scaled (and/or inverted) by defining the minimum and maximum values of the source parameter (or content). Defining an maximum value (parameter 1503 or 1509) that is less than the content minimum value (parameter 1502 or 1508) results in an inverted output.
- Filtered

Table 30: Group 15: Analog Outputs

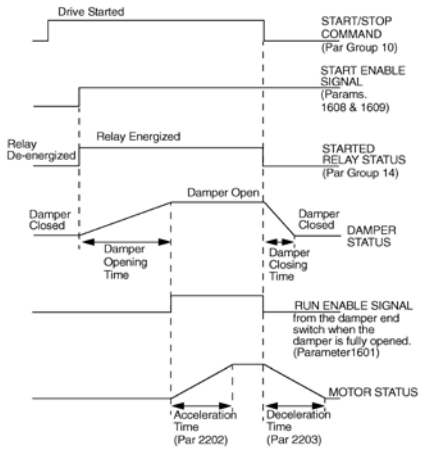
Code	Description	Range	Resolution	Default	S
1501	**AO1 CONTENT SEL**	99…199	1	103	
	Defines the content for analog output AO1. 99 = EXCITE PTC – Provides a current source for sensor type PTC. Output = 1.6 mA. See Group 35. 100 = EXCITE PT100 – Provides a current source for sensor type Pt100. Output = 9.1 mA. See Group 35. 101…145 – Output corresponds to a parameter in the Operating Data group (Group 01). • Parameter defined by value (value 102 = parameter 0102) 146…199 – Not assigned.				
1502	**AO1 CONTENT MIN**	Depends on selection	—	0.0 Hz	
	Sets the minimum content value. • Content is the parameter selected by parameter 1501. • Minimum value refers to the minimum content value that will be converted to an analog output. • These parameters (content and current min. and max. settings) provide scale and offset adjustment for the output.				
1503	**AO1 CONTENT MAX**	Depends on selection	—	60.0 Hz	
	Sets the maximum content value • Content is the parameter selected by parameter 1501. • Maximum value refers to the maximum content value that will be converted to an analog output.				
1504	**MINIMUM AO1**	0.0…20.0mA	0.1 mA	4.0 mA	
	Sets the minimum output current.				
1505	**MAXIMUM AO1**	0.0…20.0mA	0.1 mA	2.0 mA	
	Sets the maximum output current.				
1506	**FILTER AO1**	0…10 s	0.1 s	0.1 s	
	Defines the filter time constant for AO1. • The filtered signal reaches 63% of a step change within the time specified. • See figure in parameter 1303.				

Group 16: System Controls

This group defines a variety of system level locks, resets and enables.

Table 31: Group 16: System Controls

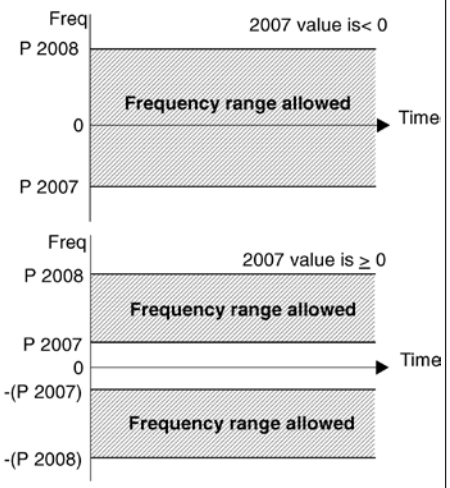
Code	Description	Range	Resolution	Default	S
1601	**RUN ENABLE**	-6…7	1	0	☑
	Selects the source of the run enable signal. 0 = NOT SEL – Allows the drive to start without an external run enable signal. 1 = DI1 – Defines digital input DI1 as the run enable signal. • This digital input must be activated for run enable. • If the voltage drops and de-activates this digital input, the drive will coast to stop and not start until the run enable signal resumes. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the run enable signal. • See DI1 above. 7 = COMM – Assigns the fieldbus Command Word as the source for the run enable signal. • Bit 6 of the Command Word 1 (parameter 0301) activates the run disable signal. • See fieldbus user's manual for detailed instructions. -1 = DI1(INV) – Defines an inverted digital input DI1 as the run enable signal. • This digital input must be de-activated for run enable. • If this digital input activates, the drive will coast to stop and not start until the run enable signal resumes. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the run enable signal. • See DI1(INV) above.				
1602	**PARAMETER LOCK**	0…2	1	1	
	Determines if the control panel can change parameter values. • This lock does not limit parameter changes made by macros. • This lock does not limit parameter changes written by fieldbus inputs. • This parameter value can be changed only if the correct pass code is entered. See parameter 1603, PASS CODE. 0 = LOCKED – You cannot use the control panel to change parameter values. • The lock can be opened by entering the valid pass code to parameter 1603. 1 = OPEN – You can use the control panel to change parameter values. 2 = NOT SAVED – You can use the control panel to change parameter values, but they are not stored in permanent memory. • Set parameter 1607 PARAM SAVE to 1 (SAVE) to store changed parameter values to memory.				
1603	**PASS CODE**	0…65535	1	0	
	Entering the correct pass code allows you to change the parameter lock. • See parameter 1602 above. • The code 358 allows you to change the value of the parameter 1602 once. • This entry reverts back to 0 automatically.				
1604	**FAULT RESET SEL**	-6…8	1	0	
	Selects the source for the fault reset signal. The signal resets the drive after a fault trip if the cause of the fault no longer exists. 0 = KEYPAD – Defines the control panel as the only fault reset source. • Fault reset is always possible with control panel. 1 = DI1 – Defines digital input DI1 as a fault reset source. • Activating the digital input resets the drive. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as a fault reset source. • See DI1 above. 7 = START/STOP – Defines the Stop command as a fault reset source. • Do not use this option when fielbus communication provides the start, stop and direction commands. 8 = COMM – Defines the fieldbus as a fault reset source. • The Command Word is supplied through fieldbus communication. • The bit 4 of the Command Word 1 (parameter 0301) resets the drive. -1 = DI1(INV) – Defines an inverted digital input DI1 as a fault reset source. • De-activating the digital input resets the drive. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as a fault reset source. • See DI1(INV) above.				

Code	Description *(continuation of Table 31)*	Range	Resolution	Default	S
1607	**PARAM. SAVE**	0, 1	1	0	
	Saves all altered parameters to permanent memory. • Parameters altered through a fieldbus are not automatically saved to permanent memory. To save, you must use this parameter. • If 1602 PARAMETER LOCK = 2 (NOT SAVED), parameters altered from the control panel are not saved. To save, you must use this parameter. • If 1602 PARAMETER LOCK = 1 (OPEN), parameters altered from the control panel are stored immediately to permanent memory. 0 = DONE – Value changes automatically when all parameters are saved. 1 = SAVE – Saves altered parameters to permanent memory.				
1608	**START ENABLE 1**	-6…7	1	4	
	Selects the source of the start enable 1 signal. Note: Start enable functionality differs from the run enable functionality. 0 = NOT SEL – Allows the drive to start without an external start enable signal. 1 = DI1 – Defines digital input DI1 as the start enable 1 signal. • This digital input must be activated for start enable 1 signal. • If the voltage drops and de-activates this digital input, the drive will coast to stop and show alarm 2021 on panel display. The drive will not start until start enable 1 signal resumes. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the start enable 1 signal. • See DI1 above. 7 = COMM – Assigns the fieldbus Command Word as the source for the start enable 1 signal. • Bit 2 of the Command word 2 (parameter 0302) activates the start disable 1 signal. • See fieldbus user's manual for detailed instructions. (-1) = DI1(INV) – Defines an inverted digital input DI1 as the start enable 1 signal. (-2)…(-6) = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the start enable 1 signal. • See DI1(INV) above. 				
1611	**PARAMETER VIEW**	1...3	1	2	
	Selects the parameter view, i.e. which parameters are shown. **Note:** This parameter is visible only when it is activated by the optional FlashDrop device. FlashDrop allows fast customization of the parameter list, e.g. selected parameters can be hidden. For more information, see MFDT-01 FlashDrop User's Manual [3AFE68591074 (English)]. FlashDrop parameter values are activated by setting parameter 9902 to 31 (LOAD FD SET). 1 = FLASHDROP – FlashDrop parameter list is shown. Does not include short parameter list. Parameters that are hidden by the FlashDrop device are not visible. 2 = SHORT VIEW – Shows only a subset of all signals and parameters 3 = LONG VIEW – Shows all signals and parameters				

Group 20: Limits

This group defines minimum and maximum limits to follow in driving the motor – speed, frequency, current, torque, etc.

Table 32: Group 20: Limits

Code	Description	Range	Resolution	Default	S
2003	**MAX CURRENT**	0.0… 1.1 * I_{2N}	0.1 A	1.1 * I_{2N}	☑
	Defines the maximum output current (A) supplied by the drive to the motor.				
2006	**UNDERVOLT CTRL**	0…2	1	1	
	Sets the DC undervoltage controller on or off. When on: • If the DC bus voltage drops due to loss of input power, the undervoltage controller decreases the motor speed in order to keep the DC bus voltage above the lower • When the motor speed decreases, the inertia of the load causes regeneration back into the drive, keeping the DC bus charged, and preventing an undervoltage trip. • The DC undervoltage controller increases power loss ride-through on systems with a high inertia, such as a centrifuge or a fan. 0 = DISABLE – Disables controller. 1 = ENABLE (TIME) – Enables controller with 500 ms time limit for operation. 2 = ENABLE – Enables controlled without maximum time limit for operation.				
2007	**MINIMUM FREQ**	-500.0… 500.0 Hz	0.1 Hz	0.0 Hz	☑
	Defines the minimum limit for the drive output frequency. • A positive or zero minimum speed frequency defines two ranges, one positive and one negative. • A negative minimum speed frequency defines one speed range. See figure. **Note!** Keep MINIMUM FREQ ≤ MAXIMUM FREQ. 				
2008	**MAXIMUM FREQ**	0.0…500.0 Hz	0.1 Hz	60.0 Hz (US)	☑
	Defines the maximum limit for the drive output frequency.				

Group 21: Start/Stop

This group defines how the motor starts and stops. The ACH550 supports several start and stop modes.

Table 33: Group 21: Start/Stop

Code	Description	Range	Resolution	Default	S
2101	**START FUNCTION**	1...8	1	1	
	Selects the motor start method. 1 = AUTO – The drive starts the motor instantly from zero frequency. If flying start is required, use selection SCAN START. 2 = DC MAGN – The drive pre-magnetizes the motor with DC current before the start. The pre-magnetizing time is defined by parameter 2103 DC MAGN TIME. **Note:** Starting to a rotating machine is not possible when DC MAGN is selected. **WARNING! The drive will start after the set pre-magnetizing time has passed even if the motor magnetization is not completed. Ensure always in applications where a full break-away torque is essential, that the constant magnetizing time is long enough to allow generation of full magnetization and torque.** 4 = TORQ BOOST – Torque boost should be selected if a high break-away torque is required. The drive pre-magnetizes the motor with DC current before the start. The premagnetizing time is defined by parameter 2103 DC MAGN TIME. Torque boost is applied at start. Torque boost is stopped when output frequency exceeds 20 Hz or when it is equal to the reference value. See parameter 2110 TORQ BOOST CURR. **Note:** Starting to a rotating machine is not possible when TORQ BOOST is selected. **WARNING! The drive will start after the set pre-magnetizing time has passed although the motor magnetization is not completed. Ensure always in applications where a full break-away torque is essential, that the constant magnetizing time is long enough to allow generation of full magnetization and torque.** 6 = SCAN START – Frequency scanning flying start (starting to a rotating machine). Based on frequency scanning (interval 2008 MAXIMUM FREQ…2007 MINIMUM FREQ) to identify the frequency. If frequency identification fails, DC magnetization is used (see selection DC MAGN). 7 = SCAN + BOOST – Combines scanning start (starting to a rotating machine) and torque boost. See selections SCANSTART and TORQ BOOST. If frequency identification fails, torque boost is used.				
2102	**STOP FUNCTION DO NOT CHANGE!! Factory set to Coast.**	1, 2	1	1	
	Selects the motor stop method. 1 = COAST – Selects cutting off the motor power as the stop method. The motor coasts to stop. 2 = RAMP – Selects using a deceleration ramp • Deceleration ramp is defined by 2203 DECELER TIME 1 or 2206 DECELER TIME 2 (whichever is active).				

Group 22: Accel/Decel

This group defines ramps that control the rate of acceleration and deceleration. You define these ramps as a pair, one for acceleration and one for deceleration. You can define two pairs of ramps and use a digital input to select one or the other pair.

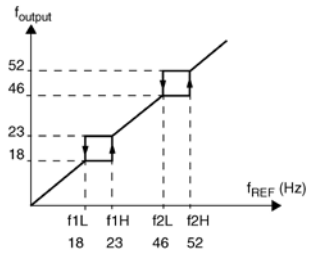
Table 34: Group 22: Accel/Decel

Code	Description	Range	Resolution	Default	S
2201	**ACC/DEC 1/2 SEL** **DO NOT CHANGE!!**	-6…7	1	0	
	Defines control for selection of acceleration/deceleration ramps. • Ramps are defined in pairs, one each for acceleration and deceleration. • See below for the ramp definition parameters. 0 = NOT SEL – Disables selection, the first ramp pair is used. 1 = DI1 – Defines digital input DI1 as the control for ramp pair selection. • Activating the digital input selects ramp pair 2. • De-activating the digital input selects ramp pair 1. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the control for ramp pair selection. • See DI1 above. 7 = COMM – Defines serial communication as the control for ramp pair selection. -1 = DI1(INV) – Defines an inverted digital input DI1 as the control for ramp pair selection. • De-activating the digital input selects ramp pair 2 • Activating the digital input selects ramp pair 1. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the control for ramp pair selection. • See DI1(INV) above.				
2202	**ACCELER TIME 1**	0.0…1800.0s	0.1 s	30.0 s	
	Sets the acceleration time for zero to maximum frequency for ramp pair 1. See A in figure. • Actual acceleration time also depends on 2204 RAMP SHAPE. • See 2008 MAXIMUM FREQUENCY, page 48.				
2203	**DECELER TIME 1**	0.0…1800.0s	0.1 s	30.0 s	
	Sets the deceleration time for maximum frequency to zero for ramp pair 1. • Actual deceleration time also depends on 2204 RAMP SHAPE. • See 2008 MAXIMUM FREQUENCY, page 48.				

Group 25: Critical Speeds

This group defines up to three critical speeds or ranges of speeds that are to be avoided due, for example, to mechanical resonance problems at certain speeds.

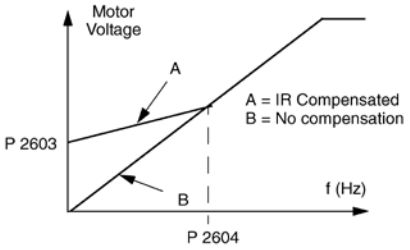
Table 35: Group 25: Critical Speeds

Code	Description	Range	Resolution	Default	S
2501	**CRIT SPEED SEL**	0, 1	1	0	
	Sets the critical speeds function on or off. The critical speed function avoids specific speed ranges.. 0 = OFF – Disables the critical speeds function. 1 = ON – Enables the critical speeds function. Example: To avoid speeds at which a fan system vibrates badly: • Determine problem speed ranges. Assume they are found to be: 18…23 Hz and 46…52 Hz. • Set 2501 CRIT SPEED SEL = 1. • Set 2502 CRIT SPEED 1 LO = 18 Hz. • Set 2503 CRIT SPEED 1 HI = 23 Hz. • Set 2504 CRIT SPEED 2 LO = 46 Hz. • Set 2505 CRIT SPEED 2 HI = 52 Hz.				
2502	**CRIT SPEED 1 LO**	0.0…500.0 Hz	0.1 Hz	0.0 Hz	
	Sets the minimum limit for critical speed range 1. • The value must be less than or equal to 2503 CRIT SPEED 1 HI. • Units are rpm, unless 9904 MOTOR CTRL MODE = 3 (SCALAR SPEED), then units are Hz.				
2503	**CRIT SPEED 1 HI**	0.0…500.0 Hz	0.1 Hz	0.0 Hz	
	Sets the maximum limit for critical speed range 1. • The value must be greater than or equal to 2502 CRIT SPEED 1 LO. • Units are rpm, unless 9904 MOTOR CTRL MODE = 3 (SCALAR SPEED), then units are Hz.				
2504	**CRIT SPEED 2 LO**	0.0…500.0 Hz	0.1 Hz	0.0 Hz	
	Sets the minimum limit for critical speed range 2. • See parameter 2502, page 51.				
2505	**CRIT SPEED 2 HI**	0.0…500.0 Hz	0.1 Hz	0.0 Hz	
	Sets the maximum limit for critical speed range 2. • See parameter 2503, page 51.				
2506	**CRIT SPEED 3 LO**	0.0…500.0 Hz	0.1 Hz	0.0 Hz	
	Sets the minimum limit for critical speed range 3. • See parameter 2502, page 51.				
2507	**CRIT SPEED 3 HI**	0.0…500.0 Hz	0.1 Hz	0.0 Hz	
	Sets the maximum limit for critical speed range 3. • See parameter 2503, page 51.				

Group 26: Motor Control

This group provides controls for fine-tuning the motor control.

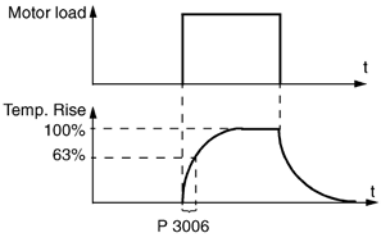
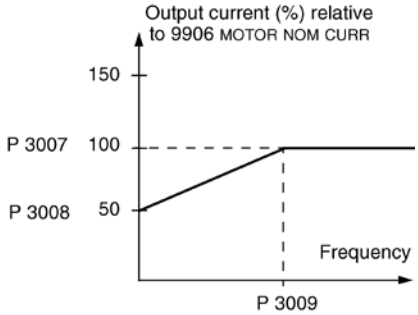
Table 36: Group 26: Motor Control

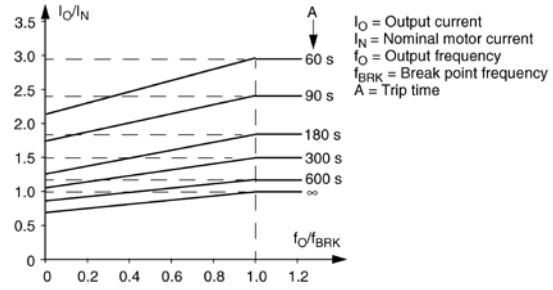
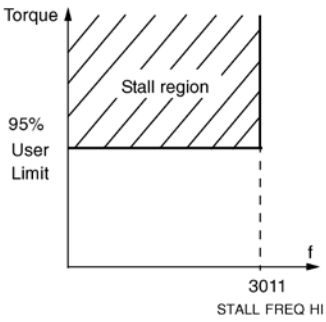
Code	Description	Range	Resolution	Default	S
2603	**IR COMP VOLT**	0…100 V	1 V	Size Dependent	
	Sets the IR compensation voltage used for 0 Hz. • Requires parameter 9904 MOTOR CTRL MODE = 3 (SCALAR SPEED). • Keep IR compensation as low as possible to prevent overheating. • Typical IR compensation values are: 380…480 V Units PN (kW) 3 7.5 15 37 132 IR comp (V) 18 15 12 8 3 IR Compensation • When enabled, IR Compensation provides an extra voltage boost to the motor at low speeds. Use IR Compensation, for example, in applications that require a high breakaway torque.				
2604	**IR COMP FREQ**	0…100%	1	80%	
	Sets the frequency at which IR compensation is 0 V (in % of motor frequency).				
2605	**U/f RATIO**	1, 2	1	2	
	Selects the form for the U/f (voltage to frequency) ratio below field weakening point. 1 = LINEAR – Preferred for constant torque applications. 2 = SQUARED – Preferred for centrifugal pump and fan applications. (Square is more silent for most operating frequencies.)				
2606	**SWITCHING FREQ**	1, 4, 8, 12, 16 kHz	—	4 kHz	
	Sets the switching frequency for the drive. • Higher switching frequencies mean less noise. • The 1, 4 and 8 kHz switching frequencies are available for all frame sizes R1-R6. • The 12 kHz switching frequency is available only if parameter 9904 MOTOR CTRL MODE = 3 (SCALAR:FREQ). **NOTE:** Selecting 12 kHz switching frequency automatically limits parameter 9906 to 0.80 of drive nameplate FLA.				

Group 30: Fault Functions

This group defines situations that the drive should recognize as potential faults and defines how the drive should respond if the fault is detected.

Table 37: Group 30: Fault Functions

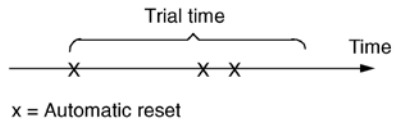
Code	Description	Range	Resolution	Default	S
3001	**AI<MIN FUNCTION**	0…3	1	0	
	Defines the drive response if the analog input (AI) signal drops below the fault limits and AI is used in reference chain. • 3021 AI1 FAULT LIMIT and 3022 AI2 FAULT LIMIT set the fault limits 0 = NOT SEL – No response. 1 = FAULT – Displays a fault (7, AI1 LOSS or 8, AI2 LOSS) and the drive coasts to stop. 2 = CONST SP7 – Displays a warning (2006, AI1 LOSS or 2007, AI2 LOSS) and sets speed using 1208 CONST SPEED 7. 3 = LAST SPEED – Displays a warning (2006, AI1 LOSS or 2007, AI2 LOSS) and sets speed using the last operating level. This value is the average speed over the last 10 seconds. **Warning!** If you select CONST SP7 or LAST SPEED, make sure that continued operation is safe when the analog input signal is lost.				
3002	**PANEL COMM ERR**	1…3	1	1	
	Defines the drive response to a control panel communication error. 1 = FAULT – Displays a fault (10, PANEL LOSS) and the drive coasts to stop. 2 = CONST SP7 – Displays a warning (2008, PANEL LOSS) and sets speed using 1208 CONST SPEED 7. 3 = LAST SPEED – Displays a warning (2008, PANEL LOSS) and sets speed using the last operating level. This value is the average speed over the last 10 seconds. **Warning!** If you select CONST SP7 or LAST SPEED, make sure that continued operation is safe when the control panel communication is lost.				
3003	**EXTERNAL FAULT 1**	-6…6	1	0	
	Defines the External Fault 1 signal input and the drive response to an external fault. 0 = NOT SEL – External fault signal is not used. 1 = DI1 – Defines digital input DI1 as the external fault input. • Activating the digital input indicates a fault. The drive displays a fault (14, EXTERNAL FAULT 1) and the drive coasts to stop. 2…6 = DI2…DI6 – Defines digital input DI2…DI6 as the external fault input. • See DI1 above. -1 = DI1(INV) – Defines an inverted digital input DI1 as the external fault input. • De-activating the digital input indicates a fault. The drive displays a fault (14, EXTERNAL FAULT 1) and the drive coasts to stop. -2…-6 = DI2(INV)…DI6(INV) – Defines an inverted digital input DI2…DI6 as the external fault input. See DI1(INV) above.				
3004	**EXTERNAL FAULT 2 DO NOT CHANGE!!**	-6…6	1	0	
	Defines the External Fault 2 signal input and the drive response to an external fault. • See parameter 3003 above.				
3005	**MOT THERM PROT DO NOT CHANGE!!**	0, 2	1	1	
	Defines the drive response to motor overheating. 0 = NOT SEL – No response and/or motor thermal protection not set up. 1 = FAULT – When the calculated motor temperature exceeds 90 C, displays a warning (2010, MOT OVERTEMP). When the calculated motor temperature exceeds 110 C displays a fault (9, MOT OVERTEMP) and the drive coasts to stop. 2 = WARNING – When the calculated motor temperature exceeds 90 C, displays a warning (2010, MOT OVERTEMP).				
3006	**MOT THERM TIME DO NOT CHANGE!!**	256…9999 s	1	1050 s	
	Sets the motor thermal time constant for the motor temperature model. • This is the time required for the motor to reach 63% of the final temperature with steady load. • For thermal protection according to UL requirements for NEMA class motors, use the rule of thumb: MOTOR THERM TIME equals 35 times t6, where t6 (in seconds) is specified by the motor manufacturer as the time that the motor can safely operate at six times its rated current. • The 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. 				
3007	**MOT LOAD CURVE DO NOT CHANGE!!**	50…150%	1	100%	
	Sets the maximum allowable operating load of the motor. • With the default value 100%, motor overload protection is functioning when the constant current exceeds 127% of the parameter 9906 MOTOR NOM CURR value. • The default overloadability is at the same level as what motor manufacturer's typically allow in the 86°F (30°C) ambient temperature and 3300 ft (1000m) altitude. When the ambient temperature exceeds 86°F (30°C) or the installation altitude is over 3300 ft (1000m), decrease the parameter 3007 value according to the motor manufacturer's recommendation. **Example:** If the constant protection level needs to be 115% of the motor nominal current, set parameter 3007 value to 91% (=115/127*100%). 				

Code	Description *(continuation of Table 37)*	Range	Resolution	Default	S
3008	**ZERO SPEED LOAD**	25…150%	1	70%	
	Sets the maximum allowable current at zero speed. • Value is relative to 9906 MOTOR NOM CURR				
3009	**BREAK POINT FREQ**	**1…250 Hz**	**1**	**35 Hz**	
	Sets the break point frequency for the motor load curve. **Example:** Thermal protection trip times when parameters 3006 MOT THERM TIME, 3007 MOT LOAD CURVE and 3008 ZERO SPEED LOAD have default values. 				
3010	**STALL FUNCTION**	0…2	1	35 Hz	
	This parameter defines the operation of the Stall function. This protection is active if the drive operates in the stall region (see figure) for the time defined by 3012 STALL TIME. The "User Limit" is defined in Group 20 by 2017 MAX TORQUE 1, 2018 MAX TORQUE 2, or the limit on the COMM input. 0 = NOT SEL – Stall protection is not used. 1 = FAULT – When the drive operates in the stall region for the time set by 3012 STALL TIME: • The drive coasts to stop. • A fault indication is displayed. 2 = WARNING – When the drive operates in the stall region for the time set by 3012 STALL TIME: • A warning indication is displayed. • The warning disappears when the drive is out of the stall region for half the time set by parameter 3012 STALL TIME. 				
3011	**STALL FREQUENCY**	0.5…50.0 Hz	0.1 Hz	20.0 Hz	
	This parameter sets the frequency value for the Stall function. Refer to Figure.				
3012	**STALL TIME**	10…400 s	1 s	20 s	
	This parameter sets the time value for the Stall function.				
3017	**EARTH FAULT**	0…1	1	1	
	Defines the drive response if the drive detects a ground fault in the motor or motor cables. The drive monitors for ground faults while the drive is running, and while the drive is not running. Also see parameter 3023 WIRING FAULT. 0 = DISABLE – No drive response to ground faults. 1 = ENABLE – Ground faults display fault 16 (EARTH FAULT), and (if running) the drive coasts to stop.				
3018	**COMM FAULT FUNC**	0…3	1	0	
	Defines the drive response if the fieldbus communication is lost. 0 = NOT SEL – No response. 1 = FAULT – Displays a fault (28, SERIAL 1 ERR) and the drive coasts to stop. 2 = CONST SP7 – Displays a warning (2005, IO COMM) and sets speed using 1208 CONST SPEED 7. This "alarm speed" remains active until the fieldbus writes a new reference value. 3 = LAST SPEED – Displays a warning (2005, IO COMM) and sets speed using the last operating level. This value is the average speed over the last 10 seconds. This "alarm speed" remains active until the fieldbus writes a new reference value. **Caution:** If you select CONST SP7, or LAST SPEED, make sure that continued operation is safe when fieldbus communication is lost.				
3019	**COMM FAULT TIME**	0.0…60.0 s	0.1 s	10.0 s	
	Sets the communication fault time used with 3018 COMM FAULT FUNC. • Brief interruptions in the fieldbus communication are not treated as faults if they are less than the COMM FAULT TIME value.				
3021	**AI1 FAULT LIMIT**	0.0…100.0%	0.1%	0.0%	
	Sets a fault level for analog input 1. See 3001 AI<MIN FUNCTION.				
3022	**AI2 FAULT LIMIT**	0.0…100.0%	0.1%	0.0%	
	Sets a fault level for analog input 2. See 3001 AI<MIN FUNCTION.				
3023	**WIRING FAULT**	0, 1	1	1	
	Defines the drive response to cross wiring faults and to ground faults detected when the drive is NOT running. When the drive is not running it monitors for: • Improper connections of input power to the drive output (the drive can display fault 35, OUTPUT WIRING if improper connections are detected). • Ground faults (the drive can display fault 16, EARTH FAULT if a ground fault is detected). Also, see parameter 3017 EARTH FAULT. 0 = DISABLE – No drive response to either of the above monitoring results. 1 = ENABLE – The drive displays faults when this monitoring detects problems.				

Group 31: Automatic Reset

This group defines conditions for automatic resets. An automatic reset occurs after a particular fault is detected. The drive holds for a set delay time, then automatically restarts. You can limit the number of resets in a specified time period, and you can set up automatic resets for a variety of faults.

Table 38: Group 31: Automatic Reset

Code	Description	Range	Resolution	Default	S
3101	**NR OF TRIALS**	0…5	1	5	
	Sets the number of allowed automatic resets within a trial period defined by 3102 TRIAL TIME. • If the number of automatic resets exceeds this limit (within the trial time), the drive prevents additional automatic resets and remains stopped. • Starting then requires a successful reset performed from the control panel or from a source selected by 1604 FAULT RESET SEL. **Example:** Three faults have occurred in the trial time. The last is reset only if the value for 3101 NR OF TRIALS is 3 or more.  				
3102	**TRIAL TIME**	1.0…600.0 s	0.1 s	30.0 s	
	Sets the time period used for counting and limiting the number of resets. • See 3101 NR OF TRIALS.				
3103	**DELAY TIME**	0.0…120.0 s	0.1 s	0.5 s	
	Sets the delay time between a fault detection and attempted drive restart. • If DELAY TIME = zero, the drive resets immediately.				
3104	**AR OVERCURRENT**	0, 1	1	0	
	Sets the automatic reset for the overcurrent function on or off. 0 = DISABLE – Disables automatic reset. 1 = ENABLE – Enables automatic reset. • Automatically resets the fault (OVERCURRENT) after the delay set by 3103 DELAY TIME, and the drive resumes normal operation.				
3105	**AR OVERVOLTAGE DO NOT USE!!**	0, 1	1	1	
	Sets the automatic reset for the overvoltage function on or off. 0 = DISABLE – Disables automatic reset. 1 = ENABLE – Enables automatic reset. • Automatically resets the fault (DC OVERVOLT) after the delay set by 3103 DELAY TIME, and the drive resumes normal operation.				
3106	**AR UNDERVOLTAGE DO NOT USE!!**	0, 1	1	1	
	Sets the automatic reset for the undervoltage function on or off. 0 = DISABLE – Disables automatic reset. 1 = ENABLE – Enables automatic reset. • Automatically resets the fault (DC UNDERVOLTAGE) after the delay set by 3103 DELAY TIME, and the drive resumes normal operation.				
3107	**AR AI<MIN DO NOT USE!!**	0, 1	1	1	
	Sets the automatic reset for the analog input less than minimum value function on or off. 0 = DISABLE – Disables automatic reset. 1 = ENABLE – Enables automatic reset. • Automatically resets the fault (AI<MIN) after the delay set by 3103 DELAY TIME, and the drive resumes normal operation. **Warning!** When the analog input signal is restored, the drive may restart, even after a long stop. Make sure that automatic, long delayed starts will not cause physical injury and/or damage equipment.				
3108	**AR EXTERNAL FLT DO NOT USE!!**	0, 1	1	1	
	Sets the automatic reset for external faults function on or off. 0 = DISABLE – Disables automatic reset. 1 = ENABLE – Enables automatic reset. • Automatically resets the fault (EXTERNAL FAULT 1 or EXTERNAL FAULT 2) after the delay set by 3103 DELAY TIME, and the drive resumes normal operation.				

Group 33: Information

This group provides access to information about the drive's current programs, versions and test date.

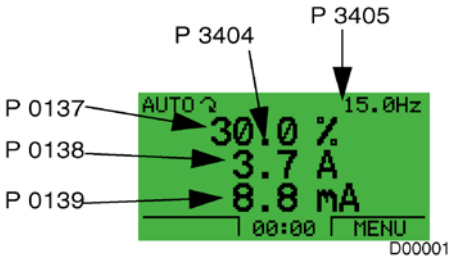
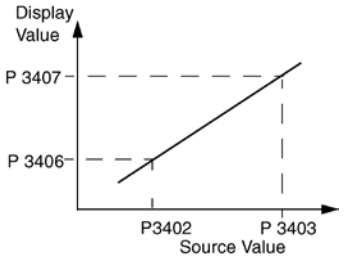
Table 39: Group 33: Information

Code	Description	Range	Resolution	Default	S
3301	**FW VERSION**	10000… FFFF hex	1	Firmware ver.	
	Contains the version of the drive's firmware.				
3302	**LP VERSION**	0000… FFFF hex	1	0	
	Contains the version of the loading package.				
3303	**TEST DATE**	yy.ww	1	0	
	Contains the test date (yy.ww).				
3204	**DRIVE RATING**	—	—	—	
	Indicates the drive's current and voltage rating. The format is XXXY, where: • XXX =The nominal current rating of the drive in amps. If present, an "A" indicates a decimal point in the rating for the current. For example XXX = 8A8 indicates a nominal current rating of 8.8 Amps. • Y = The voltage rating of the drive, where Y = : • 2 indicates a 208…240 Volt rating. • 4 indicates a 380…480 Volt rating. • 6 indicates a 500…600 Volt rating.				
3305	**PARAMETER TABLE**				
	Contains the parameter table version of the drive's firmware				

Group 34: Panel Display Process Variables

This group defines the content for control panel display (middle area), when the control panel is in the output mode.

Table 40: Group 34: Panel Display Process Variables

Code	Description	Range	Resolution	Default	S
3401	**SIGNAL1 PARAM**	100…199	1	103	
	Selects the first parameter (by number) displayed on the control panel. • Definitions in this group define display content when the control panel is in the control mode. • Any Group 01 parameter number can be selected, page __. • Using the following parameters, the display value can be scaled, converted to convenient units, and/or displayed as a bar graph. • The figure identifies selections made by parameters in this group. 100 = not selected – First parameter not displayed. 101…199 = Displays parameter 0101…0199. If parameter does not exist, the display shows “n.a.”.				
3402	**SIGNAL1 MIN**	Depends on selection		0.0 Hz	
	Defines the minimum expected value for the first display parameter. Use parameters 3402, 3403, 3406, and 3407, for example to convert a Group 01 parameter, such as 0102 SPEED (in rpm) to the speed of a conveyor driven by the motor (in ft/min). For such a conversion, the source values in the figure are the min. and max. motor speed, and the display values are the corresponding min. and max. conveyor speed. Use parameter 3405, page 57 to select the proper units for the display. **Note:** Selecting units does not convert values.				
3403	**SIGNAL1 MAX**	Depends on selection	—	600.0 Hz	
	Defines the maximum expected value for the first display parameter.				
3404	**OUTPUT1 DSP FORM**	0…9	1	9	
	Defines the decimal point location for the first display parameter. 3404 Value / Display / Range 0 / + 3 / -32768…+32767 (Signed) 1 / + 3.1 2 / + 3.14 3 / + 3.142 4 / 3 / 0…65535 (Unsigned) 5 / 3.1 6 / 3.14 7 / 3.142 1…7 – Defines the decimal point location. • Enter the number of digits desired to the right of the decimal point. • See table for example using pi (3.14159). 8 = BAR METER – Specifies a bar meter display. 9 = DIRECT – Decimal point location can vary depending on source signal but does not affect unit operation.				
3405	**OUTPUT1 DSP UNIT**	0…127	1	4	
	Selects the units used with the first display parameter. 0 = NOT SEL / 12 = mV / 24 = GPM / 36 = l/s / 48 = gal/m / 60 = ft wg 1 = A / 13 = kW / 25 = PSI / 37 = l/min / 49 = gal/h / 61 = lbsi 2 = V / 14 = W / 26 = CFM / 38 = l/h / 50 = ft3/s / 62 = ms 3 = Hz / 15 = kWh / 27 = ft / 39 = m3/s / 51 = ft3/m / 63 = Mrev 4 = % / 16 = °F / 28 = MGD / 40 = m3/m / 52 = ft3/h / 64 = d 5 = s / 17 = hp / 29 = inHg / 41 = kg/s / 53 = lb/s / 65 = inWC 6 = h / 18 = MWh / 30 = FPM / 42 = kg/m / 54 = lb/m / 66 = m/min 7 = rpm / 19 = m/s / 31 = kb/s / 43 = kg/h / 55 = lb/h / 67 = Nm 8 = kh / 20 = m3/h / 32 = kHz / 44 = mbar / 56 = FPS / 68 = Km3/h 9 = °C / 21 = dm3/s / 33 = Ohm / 45 = Pa / 57 = ft/s 10 = lb ft / 22 = bar / 34 = ppm / 46 = GPS / 58 = inH2O 11 = mA / 23 = kPa / 35 = pps / 47 = gal/s / 59 = in wg 117 = %ref / 119 = %dev / 121 = % SP / 123 = Iout / 125 = Fout / 127 = Vdc 118 = %act / 120 = % LD / 122 = %FBK / 124 = Vout / 126 = Tout				

Code	Description *(continuation of Table 40)*	Range	Resolution	Default	S
3406	**OUTPUT1 MIN**	Depends on selection	1	—	
	Sets the minimum value displayed for the first display parameter.				
3407	**OUTPUT1 MAX**	Depends on selection	1	—	
	Sets the maximum value displayed for the first display parameter.				
3408	**SIGNAL 2 PARAM**	100…199	1	104	
	Selects the second parameter (by number) displayed on the control panel. See parameter 3401.				
3409	**SIGNAL 2 MIN**	Depends on selection	1	—	
	Defines the minimum expected value for the second display parameter. See parameter 3402.				
3410	**SIGNAL 2 MAX**	Depends on selection	1	—	
	Defines the maximum expected value for the second display parameter. See parameter 3403.				
3411	**OUTPUT 2 DSP FORM**	0…8	1	—	
	Defines the decimal point location for the second display parameter. See parameter 3404.				
3412	**OUTPUT 2 DSP UNIT**	0…127	1	1	
	Selects the units used with the second display parameter. See parameter 3405.				
3413	**OUTPUT 2 MIN**	Depends on selection	1	—	
	Sets the minimum value displayed for the second display parameter. See parameter 3406.				
3414	**OUTPUT 2 MAX**	Depends on selection	1	—	
	Sets the maximum value displayed for the second display parameter. See parameter 3407.				
3415	**SIGNAL 3 PARAM**	100…199	1	120	
	Selects the third parameter (by number) displayed on the control panel. See parameter 3401.				
3416	**SIGNAL 3 MIN**	Depends on selection	1	—	
	Defines the minimum expected value for the third display parameter. See parameter 3402.				
3417	**SIGNAL 3 MAX**	Depends on selection	1	—	
	Defines the maximum expected value for the third display parameter. See parameter 3403.				
3418	**OUTPUT 3 DSP FORM**	0…8	1	1	
	Defines the decimal point location for the third display parameter. See parameter 3404.				
3419	**OUTPUT 3 DSP UNIT**	-128…127	1	11	
	Selects the units used with the third display parameter. See parameter 3405.				
3420	**OUTPUT 3 MIN**	Depends on selection	1	—	
	Sets the minimum value displayed for the third display parameter. See parameter 3406.				
3421	**OUTPUT 3 MAX**	Depends on selection	1	—	
	Maximum RPM output of the motor. See parameter 3407. "MA" may be the unit of measure displayed but is actually RPM.				

Group 35: Motor Temp Meas

This group defines the detection and reporting for a particular potential fault – motor overheating, as detected by a temperature sensor. Typical connections are defined below.

Figure 20: One Sensor Connection

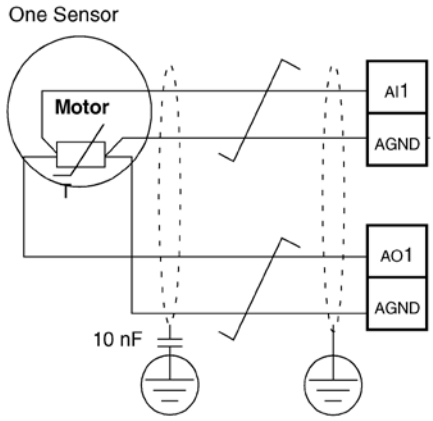
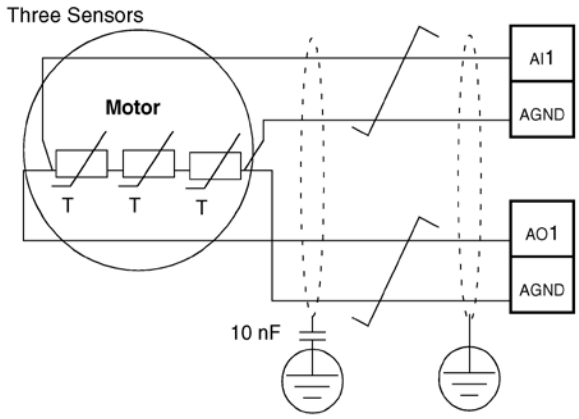


Figure 21: Three Sensor Connection



⚠ WARNING

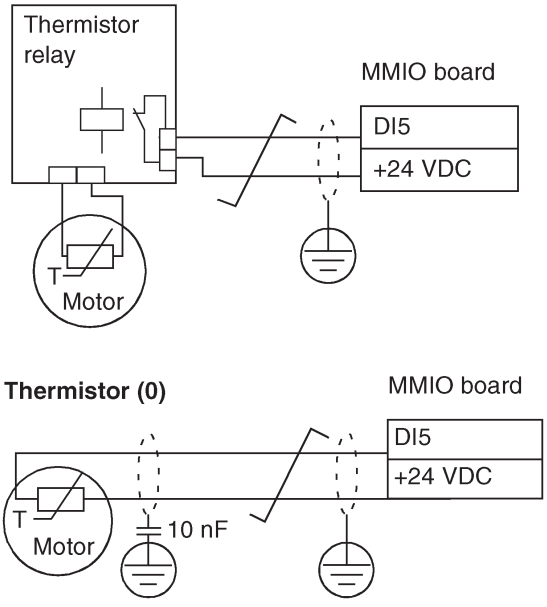
IEC 60664 requires double or reinforced insulation between live parts and the surface of accessible parts of electrical equipment which are either non-conductive or conductive but not connected to the protective earth.

To fulfill the insulation requirement, connect a thermistor (and other similar components) to the drive's control terminals using any of these alternatives:

- Separate the thermistor from live parts of the motor with double reinforced insulation.
- Protect all circuits connected to the drive's digital and analog inputs. Protect against contact, and insulate from other low voltage circuits with basic insulation (rated for the same voltage level as the drive's main circuit).
- Use an external thermistor relay. The relay insulation must be rated for the same voltage level as the drive's main circuit.

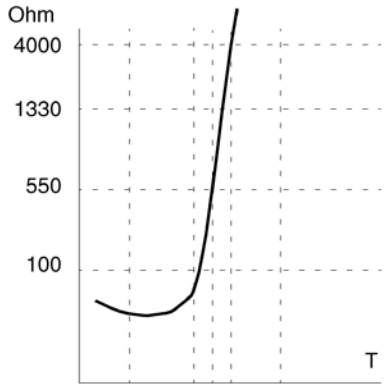
The figure below shows alternate thermistor connections. At the motor end the cable shield should be earthed through a 10 nF capacitor. If this is not possible, leave the shield unconnected.

Figure 22: Alternate Thermistor Connections



For other faults, or for anticipating motor overheating using a model, see Group 30: Fault Functions, page 53.

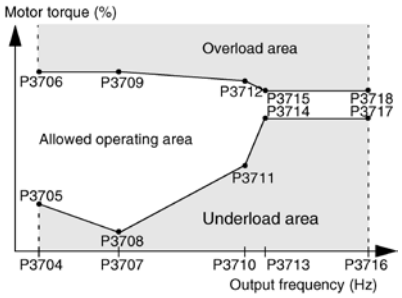
Table 41: Group 35: Motor Temp Meas

Code	Description	Range	Resolution	Default	S
3501	**SENSOR TYPE**	0…6	1	0	
	Identifies the type of motor temperature sensor used, PT100 (°C) or PTC (ohms). See parameters 1501 and 1507, page 45. 0 = NONE 1 = 1 × PT100 – Sensor configuration uses one PT 100 sensor. • Analog output AO1 or AO2 feeds constant current through the sensor. • The sensor resistance increases as the motor temperature rises, as does the voltage over the sensor. • The temperature measurement function reads the voltage through analog input AI1 or AI2 and converts it to degrees centigrade. 2 = 2 × PT100 – Sensor configuration uses two PT 100 sensors. • Operation is the same as for above 1 x PT100. 3 = 3 × PT100 – Sensor configuration uses three PT 100 sensors. • Operation is the same as for above 1 x PT100. 4 = PTC – Sensor configuration uses one PTC. • The analog output feeds a constant current through the sensor. • The resistance of the sensor increases sharply as the motor temperature rises over the PTC reference temperature (Tref), as does the voltage over the resistor. The temperature measurement function reads the voltage through analog input AI1 and converts it into ohms. • The figure shows typical PTC sensor resistance values as a function of the motor operating temperature. Temperature — Resistance Normal — 0 … 1.5 kohm Excessive — > 4 kohm  5 = THERMISTOR (0) – Sensor configuration uses a thermistor. • Motor thermal protection is activated through a digital input. Connect either a PTC sensor or a normally closed thermistor relay to a digital input. The drive reads the digital input states as shown in the above table. • When the digital input is '0' the motor is overheated. • See the figures in the introduction to this Group. 6 = THERMISTOR (1) – Sensor configuration uses a thermistor. • Motor thermal protection is activated through a digital input. Connect a normally open thermistor relay to a digital input. The drive reads the digital input states as shown in the above table. • When the digital input is '1' the motor is overheated. See the figures in the introduction to this Group				
3502	**INPUT SELECTION**	1…8	1	1	
	Defines the input used for the temperature sensor. 1 = AI1 – PT100 and PTC. 2 = AI2 – PT100 and PTC. 3…8 = DI1…DI6 – Thermistor				
3503	**ALARM LIMIT**	-10...200°C/ 0...5000 Ohm/ 0…1	1	-110°C/ 1500 Ohm/ 0	
	Defines the alarm limit for motor temperature measurement. • At motor temperatures above this limit, the drive displays an alarm (2010, MOTOR OVERTEMP) For thermistors: 0 = de-activated 1 = activated				
3504	**FAULT LIMIT**	-10...200°C/ 0...5000 Ohm/ 0…1	1	-130°C/ 4000 Ohm/ 0	
	Defines the fault limit for motor temperature measurement. • At motor temperatures above this limit, the drive displays a fault (9, MOTOR OVERTEMP) and stops the drive. For thermistors: 0 = de-activated 1 = activated				
3505	**AO EXCITATION**			0	
	Enables current feed from analog output AO. Parameter setting overrides parameter Group 15 ANALOG OUTPUTS settings, page 45. With PTC the output current is 1.6 mA. With Pt 100 the output current is 9.1 mA. 0 = disabled 1 = enabled				

Group 37: User Load Curve

This new group defines supervision of user adjustable load curves (motor torque as a function of frequency). The curve is defined by five points. - The function replaces deleted underload parameters 3013…3015

Table 42: Group 37: User Load Curve

Code	Description	Range	Resolution	Default	S
3701	**USER LOAD C MODE**	0...3	1	0	
	Supervision mode for the user adjustable load curves. This functionality replaces the former underload supervision in Group 30: FAULT FUNCTIONS. 0 = NOT SEL – Supervision is not active. 1 = UNDERLOAD – Supervision for the torque dropping below the underload curve. 2 = OVERLOAD – Supervision for the torque exceeding the overload curve. 3 = BOTH – Supervision for the torque dropping below the underload curve or exceeding the overload curve.				
3702	**USER LOAD C FUNC**	1, 2	1	1	
	Action wanted during load supervision. 1 = FAULT – A fault is generated when the condition defined by 3701 USER LOAD C MODE has been valid longer than the time set by 3703 USER LOAD C TIME. 2 = ALARM – An alarm is generated when the condition defined by 3701 USER LOAD C MODE has been valid longer than half of the time defined by 3703 USER LOAD C TIME.				
3703	**USER LOAD C TIME**			20 s	
	Defines the time limit for generating a fault. Half of this time is used as the limit for generating an alarm.				
3704	**LOAD FREQ 1**			5 Hz	
	Defines the frequency value of the first curve definition point. Must be smaller than 3707 LOAD FREQ 2.				
3705	**LOAD TORQ LOW 1**			10%	
	Defines the torque value of the first underload curve definition point. Must be smaller than 3706 LOAD TORQ HIGH 1.				
3706	**LOAD TORQ HIGH 1**			300%	
	Defines the torque value of the first overload curve definition point.				
3707	**LOAD FREQ 2**			25%	
	Defines the frequency value of the second curve definition point. Must be smaller than 3710 LOAD FREQ 3.				
3708	**LOAD TORQ LOW 2**			15%	
	Defines the torque value of the second underload curve definition point. Must be smaller than 3709 LOAD TORQ HIGH 2.				
3709	**LOAD TORQ HIGH 2**			300%	
	Defines the torque value of the second overload curve definition point.				
3710	**LOAD FREQ 3**			43 Hz	
	Defines the frequency value of the third load curve definition point.				
3711	**LOAD TORQ LOW 3**			25%	
	Defines the torque value of the third underload curve definition point. Must be smaller than 3712 LOAD TORQ HIGH 3.				
3712	**LOAD TORQ HIGH 3**			300%	
	Defines the torque value of the third overload curve definition point.				
3713	**LOAD FREQ 4**			50 Hz	
	Defines the frequency value of the fourth load curve definition point.				
3714	**LOAD TORQ LOW 4**			30%	
	Defines the torque value of the fourth underload curve definition point. Must be smaller than 3715 LOAD TORQ HIGH 4.				
3715	**LOAD TORQ HIGH 4**			300%	
	Defines the torque overvalue of the fourth load curve definition point.				
3716	**LOAD FREQ 5**			500 Hz	
	Defines the frequency value of fifth load curve definition point.				
3717	**LOAD TORQ LOW 5**			30%	
	Defines the torque value of the fifth underload curve definition point. Must be smaller than 3718 LOAD TORQ HIGH 5.				
3718	**LOAD TORQ HIGH 5**			300%	
	Defines the torque value of the fifth overload curve definition point.				

Group 40: Process PID Set 1

This group defines a set of parameters used with the Process PID (PID1) controller.

Typically only parameters in this group are needed and are only needed for units shipping without MicroTech controllers but need field controls installed..

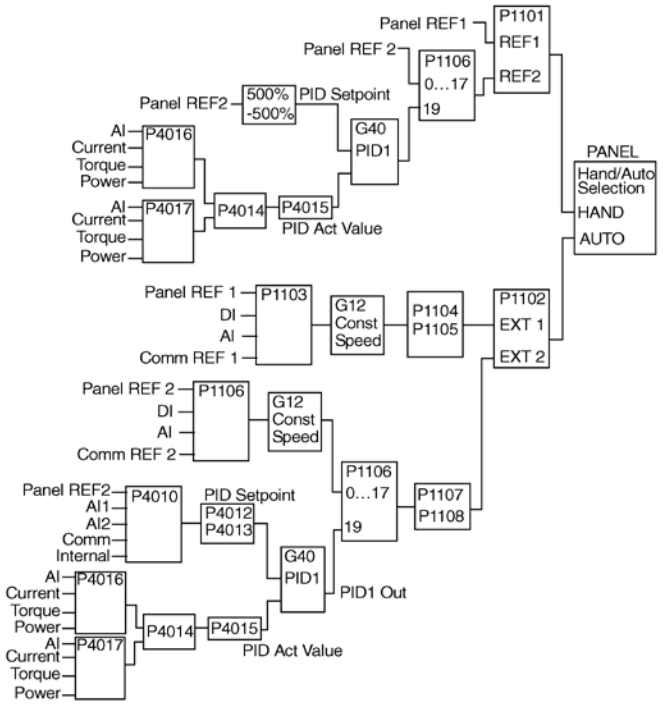
PID Controller – Basic Set-up

In PID control mode, the drive compares a reference signal (setpoint) to an actual signal (feedback), and automatically adjusts the speed of the drive to match the two signals. The difference between the two signals is the error value.

Typically PID control mode is used, when the speed of a fan or pump needs to be controlled based on pressure, flow or temperature. In most cases – when there is only 1 transducer signal wired to the ACS320 – only parameter group 40 is needed.

A Schematic of setpoint/feedback signal flow using parameter Group 40 is presented.

Figure 23: Signal Flow Diagram



⚠ WARNING

In order to activate and use the PID controller Parameter 1106, page 39 must be set to value 19.

PID Controller – Advanced

ACS320 has 2 separate PID Controllers:

- Process PID (PID1) and
- External PID (PID2)

Process PID (PID1) has 2 separate sets of parameters:

- Process PID (PID1) SET1, defined in Group 40 and
- Process PID (PID1) SET2, defined in Group 41

You can select between the 2 different sets by using parameter 4027.

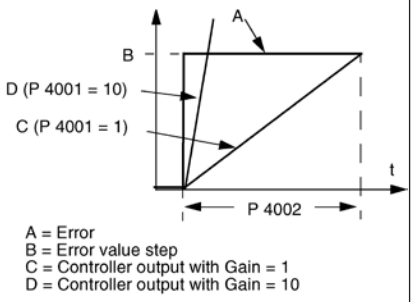
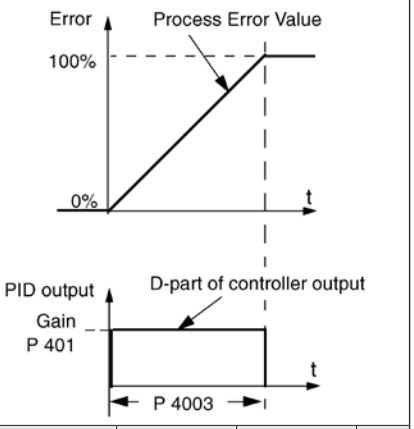
Typically two different PID-Controller sets are used when the load of the motor changes considerably from one situation to another.

You can use External PID (PID2), defined in Group 42, in 2 different ways:

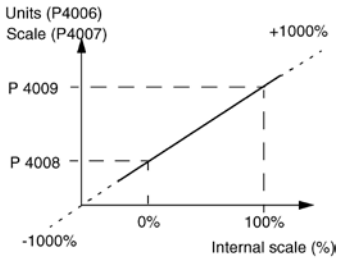
- Instead of using additional PID-controller hardware, you can set outputs of the ACS320 to control a field instrument like a damper or a valve. In this case, set Parameter 4230 to value 0. (0 is the default value.)
- You can use External PID (PID2) as an additional PID-controller to Process PID (PID1) to trim or fine-tune the speed of the ACS320.

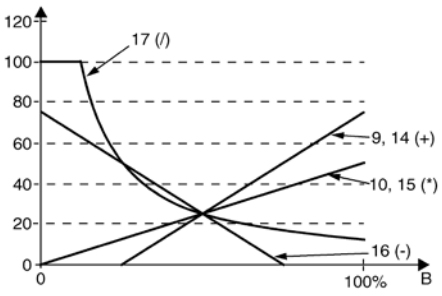
An example of the trimming is a return fan that follows the speed of the supply fan. As the return fan needs to run faster or slower then the supply fan in order to create under- or overpressure, correction factors to the supply fan speed are needed. Use External PID (PID2) in the return fan drive to provide these corrections.

Table 43: Group 40: Process PID Set 1

Code	Description	Range	Resolution	Default	S
4001	**GAIN**	0.1… 100.0	0.1	2.5	
	Defines the PID Controller's gain. • The setting range is 0.1… 100. • At 0.1, the PID Controller output changes one-tenth as much as the error value. • At 100, the PID Controller output changes one hundred times as much as the error value. Use the proportional gain and integration time values to adjust the responsiveness of the system. • A low value for proportional gain and a high value for integral time ensures stable operation, but provides sluggish response. If the proportional gain value is too large or the integral time too short, the system can become unstable. Procedure: • Initially, set: • 4001 GAIN = 0.1. • 4002 INTEGRATION TIME = 20 seconds. • Start the system and see if it reaches the set point quickly while maintaining stable operation. If not, increase GAIN (4001) until the actual signal (or drive speed) oscillates constantly. It may be necessary to start and stop the drive to induce this oscillation. • Reduce GAIN (4001) until the oscillation stops. • Set GAIN (4001) to 0.4 to 0.6 times the above value. • Decrease the INTEGRATION TIME (4002) until the feedback signal (or drive speed) oscillates constantly. It may be necessary to start and stop the drive to induce this oscillation. • Increase INTEGRATION TIME (4002) until the oscillation stops. • Set INTEGRATION TIME (4002) to 1.15 to 1.5 times the above value. • If the feedback signal contains high frequency noise, increase the value of Parameter 1303 FILTER AI1 or 1306 FILTER AI2 until the noise is filtered from the signal.				
4002	**INTEGRATION TIME**	0.0… 3600.0 s	0.1 s	3.0 s	
	Defines the PID Controller's integration time. Integration time is, by definition, is the time required to increase the output by the error value: • Error value is constant and 100%. • Gain = 1. • Integration time of 1 second denotes that a 100% change is achieved in 1 second. 0.0 = NOT SEL – Disables integration (I-part of controller). 0.1…3600.0 = Integration time (seconds). See 4001 for adjustment procedure.	 A = Error B = Error value step C = Controller output with Gain = 1 D = Controller output with Gain = 10			
4003	**DERIVATION TIME**	0.0… 10.0 s	0.1 s	0.0 s	
	Defines the PID Controller's derivation time. • You can add the derivative of the error to the PID controller output. The derivative is the error value's rate of change. For example, if the process error value changes linearly, the derivative is a constant added to the PID controller output. • The error-derivative is filtered with a 1- pole filter. The time constant of the filter is defined by parameter 4004 PID DERIV FILTER. 0.0 = NOT SEL – Disables the errorderivative part of the PID controller output 0.1…10.0 = Derivation time (seconds)				
4004	**PID DERIV FILTER**	0.0… 10.0 s	0.1 s	0.1 s	
	Defines the filter time constant for the error-derivative part of the PID controller output. • Before being added to the PID controller output, the error-derivative is filtered with a 1-pole filter. • Increasing the filter time smooths the error-derivative, reducing noise. 0.0 = NOT SEL – Disables the error-derivative filter. 0.1…10.0 = Filter time constant (seconds).				
4005	**ERROR VALUE INV**	0, 1	—	0	
	Selects either a normal or inverted relationship between the feedback signal and the drive speed. 0 = NO – Normal, a decrease in feedback signal increases drive speed. Error = Ref - Fbk 1 = YES – Inverted, a decrease in feedback signal decreases drive speed. Error = Fbk - Ref				
4006	**UNITS**	0…31	—	4	
	Selects the unit for the PID controller actual values. (PID1 parameters 0128, 0130, and 0132). • See parameter 3405 for list of available units.				

Code	Description *(continuation of Table 43)*	Range	Resolution	Default	S
4007	**UNIT SCALE**	0…4	1	1	
	Defines the decimal point location in PID controller actual values. 4007 Value / Entry / Display 0 / 0003 / 3 1 / 0031 / 3.1 2 / 0314 / 3.14 3 / 3142 / 3.142 • Enter the decimal point location counting in from the right of the entry. • See table for example using pi (3.14159).				
4008	**0 % VALUE**	-1000.0… 1000.0%	0.1%	0.0%	
	Defines (together with the next parameter) the scaling applied to the PID controller's actual values (PID1 parameters 0128, 0130, and 0132). • Units and scale are defined by parameters 4006 and 4007.				
4009	**100 % VALUE**	-1000.0… 1000.0%	0.1%	100%	
	Defines (together with the previous parameter) the scaling applied to the PID controller's actual values. • Units and scale are defined by parameters 4006 and 4007.				
4010	**SET POINT SEL**	0...19	1	0	☑
	Defines the reference signal source for the PID controller. • Parameter has no significance when the PID regulator is by-passed (see 8121 REG BYPASS CTRL). 0 = KEYPAD – Control panel provides reference. 1 = AI1 – Analog input 1 provides reference. 2 = AI2 – Analog input 2 provides reference. 8 = COMM – Fieldbus provides reference. 9 = COMM + AI1 – Defines a fieldbus and analog input 1 (AI1) combination as the reference source. See Analog Input Reference Correction below. 10 = COMM * AI1 – Defines a fieldbus and analog input 1 (AI1) combination as the reference source. See Analog Input Reference Correction below. 11 = DI3U, 4D(RNC) – Digital inputs, acting as a motor potentiometer control, provide reference. • DI3 increases the speed (the U stands for "up") • DI4 decreases the reference (the D stands for "down"). • Parameter 2205 ACCELER TIME 2 controls the reference signal's rate of change. • R = Stop command resets the reference to zero. • NC = Reference value is not copied. 12 = DI3U, 4D(NC) – Same as DI3U, 4D(RNC) above, except: • Stop command does not reset reference to zero. At restart the motor ramps up, at the selected acceleration rate, to the stored reference. 13 = DI5U, 6D(NC) – Same as DI3U, 4D(NC) above, except: • Uses digital inputs DI5 and DI6. 14 = AI1 + AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog Input Reference Correction below. 15 = AI1 * AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog Input Reference Correction below. 16 = AI1 - AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog Input Reference Correction below. 17 = AI1/AI2 – Defines an analog input 1 (AI1) and analog input 2 (AI2) combination as the reference source. See Analog Input Reference Correction below. 19 = INTERNAL – A constant value set using parameter 4011 provides reference. **Analog Input Reference Correction** Parameter values 9, 10, and 14…17 use the formula in the following table. Value Setting / AI reference is calculated as following: C + B / C value + (B value - 50% of reference value) C * B / C value * (B value / 50% of reference value) C - B / (C value + 50% of reference value) - B value C / B / (C value * 50% of reference value) / B value **Where:** • C = Main Reference value (= COMM for values 9, 10 and = AI1 for values 14…17). • B = Correcting reference (= AI1 for values 9, 10 and = AI2 for values 14…17). **Example:** The figure shows the reference source curves for value settings 9, 10, and 14…17, where: • C = 25%. • P 4012 SETPOINT MIN = 0. • P 4013 SETPOINT MAX = 0. • B varies along the horizontal axis. 20 = PID2OUT – Defines PID controller 2 output (parameter 0127 PID 2 OUTPUT) as the reference source.				





Code	Description *(continuation of Table 43)*	Range	Resolution	Default	S
4011	**INTERNAL SETPNT**	-1000.0… 1000.0%	0.1%	40.0%	
	Sets a constant value used for the process reference. • Units and scale are defined by parameters 4006 and 4007.				
4012	**SETPOINT MIN**	-500.0%… 500.0%	0.1%	0.0%	
	Sets the minimum value for the reference signal source. See parameter 4010.				
4013	**SETPOINT MAX**	-500.0%… 500.0%	0.1%	100.0%	
	Sets the maximum value for the reference signal source. See parameter 4010.				
4014	**FBK SEL**	1…10	1	1	
	Defines the PID controller feedback (actual signal). • You can define a combination of two actual values (ACT1 and ACT2) as the feedback signal. • Use parameter 4016 to define the source for actual value 1 (ACT1). • Use parameter 4017 to define the source for actual value 2 (ACT2). 1 = ACT1 – Actual value 1 (ACT1) provides the feedback signal. 2 = ACT1-ACT2 – ACT1 minus ACT2 provides the feedback signal. 3 = ACT1+ACT2 – ACT1 plus ACT2 provides the feedback signal. 4 = ACT1*ACT2 – ACT1 times ACT2 provides the feedback signal. 5 = ACT1/ACT2 – ACT1 divided by ACT2 provides the feedback signal. 6 = MIN (A1, A2) – The smaller of ACT1 or ACT2 provides the feedback signal. 7 = MAX (A1, A2) – The greater of ACT1 or ACT2 provides the feedback signal. 8 = SQRT (A1-A2) – Square root of the value for ACT1 minus ACT2 provides the feedback signal. 9 = SQA1 + SQA2 – Square root of ACT1 plus the square root of ACT2 provides the feedback signal. 10 = SQRT (ACT1) – Square root of ACT1 provides the feedback signal. 11 = COMM FBK 1 – Signal 0158 PID COMM VALUE 1 provides the feedback signal. 12 = COMM FBK 2 – Signal 0159 PID COMM VALUE 2 provides the feedback signal. 13 = AVE(ACT1,2) – The average of ACT1 and ACT2 provides the feedback signal.				
4015	**FBK MULTIPLIER**	-32.768… 32.767	0.001	0	
	Defines an extra multiplier for the PID FBK value defined by parameter 4014. • Used mainly in applications where the flow is calculated from the pressure difference. 0 = NOT SELECTED. -32.768…32.767 = Multiplier applied to the signal defined by parameter 4014 FBK SEL. Example: FBK = Multiplier $\times\sqrt{A1 - A2}$				
4016	**ACT1 INPUT**	1…5	1	2	☑
	Defines the source for actual value 1 (ACT1). 1 = AI 1 – Uses analog input 1 for ACT1. 2 = AI 2 – Uses analog input 2 for ACT1. 3 = Current – Uses current for ACT1, scaled so: • Min ACT1 = 0 current • Max ACT1 = 2 x nominal current 4 = Torque – Uses torque for ACT1, scaled so: • Min ACT1 = -2 x nominal torque • Max ACT1 = 2 x nominal torque 5 = Power – Uses power for ACT1, scaled so: • Min ACT1 = -2 x nominal power • Max ACT1 = 2 x nominal power 6 = COMM ACT 1 – Uses value of signal 0158 PID COMM VALUE 1 for ACT1. 7 = COMM ACT 2 – Uses value of signal 0159 PID COMM VALUE 2 for ACT1.				
4017	**ACT2 INPUT**	1…5	1	2	☑
	Defines the source for actual value 2 (ACT2). 1 = AI 1 – Uses analog input 1 for ACT2. 2 = AI 2 – Uses analog input 2 for ACT2. 3 = Current – Uses current for ACT2, scaled so: • Min ACT2 = 0 current • Max ACT2 = 2 x nominal current 4 = Torque – Uses torque for ACT2, scaled so: • Min ACT2 = -2 x nominal torque • Max ACT2 = 2 x nominal torque 5 = Power – Uses power for ACT2, scaled so: • Min ACT2 = -2 x nominal power • Max ACT2 = 2 x nominal power 6 = COMM ACT 1 – Uses value of signal 0158 PID COMM VALUE 1 for ACT2. 7 = COMM ACT 2 – Uses value of signal 0159 PID COMM VALUE 2 for ACT2.				

Group 42: External PID

This group defines the parameters used for the second PID controller (PID2) of ACS320. The operation of parameters 4201…4221 is analogous with Process PID set 1 (PID1) parameters 4001…4021.

Table 44: Group 42: External PID

Code	Description	Range	Resolution	Default	S
4201 ... 4221	4202 is integration time and factory set. Typical values are shown in Table 74 on page 109.				

Group 45: Energy Savings

This group defines the set-up for calculation and optimization of energy savings.

Table 45: Group 45: Energy Savings

Code	Description	Range	Resolution	Default	S
4501	**ENERGY OPTIMIZER**			OFF	
	Enables or disables the energy optimizer, which optimizes the flux so that the total energy consumption and motor noise level are reduced when the drive operates below the nominal load. The total efficiency (motor and drive) can be improved by 1…10% depending on load torque and speed. **OFF** . . . . . 0 Disabled **ON** . . . . . 1 Enabled				
4502	**ENERGY PRICE**	0.00… 655.35	1 = 0.1 (Currency)	0.00 (Currency)	
	Price of energy per kWh. Used for reference when energy savings are calculated. See parameters 0174 SAVED KWH, 0175 SAVED MWH, 0176 SAVED AMOUNT 1, 0177 SAVED AMOUNT 2 and 0178 SAVED CO_2.				
4507	**CO_2 CONV FACTOR**	0.0… 655.35 tn/MWh	1 = 0.1 tn/MWh	0.5 tn/MWh	
	Conversion factor used for multiplying the saved energy in MWh to calculate the value of parameter 0178 SAVED CO_2.				
4508	**PUMP POWER**	0.0… 1000.0%	1 = 0.1%	100.0%	
	Pump power when connected directly to supply. Used for reference when energy savings are calculated. See parameters 0174 SAVED KWH, 0175 SAVED MWH, 0176 SAVED AMOUNT 1, 0177 SAVED AMOUNT 2 and 0178 SAVED CO_2.				
4509	**ENERGY RESET**			DONE	
	Resets energy calculators 0174 SAVED KWH, 0175 SAVED MWH, 0176 SAVED AMOUNT 1, 0177 SAVED AMOUNT 2 and 0178 SAVED CO_2. **DONE** . . . . . 0 Reset not requested (normal operation). **RESET** . . . . . 1 Reset energy counters, The value reverts automatically to DONE				

Group 52: Panel Communication

This group defines the communication settings for the control panel port on the drive. Normally, when using the supplied control panel, there is no need to change settings in this group. In this group, parameter modifications take effect on the next power-up

Table 46: Group 52: Panel Communication

Code	Description	Range	Resolution	Default	S
5201	**STATION ID**	1…247	1	1	
	Defines the address of the drive. • Two units with the same address are not allowed on-line. • Range: 1…247				
5202	**BAUDRATE**	9.6… 115.2 kbits/s	—	9.6 kbits/s	
	Defines the communication speed of the drive in kbits per second (kbits/s). 9.6 19.2 38.4 57.6 115.2				
5203	**PARITY**	0…3	1	0	
	Sets the character format to be used with the panel communication. 0 = 8N1 – No parity, one stop bit. 1 = 8N2 – No parity, two stop bits. 2 = 8E1 – Even parity, one stop bit. 3 = 8O1 – Odd parity, one stop bit.				
5204	**OK MESSAGES**	0… 65535	1	—	
	Contains a count of valid Modbus messages received by the drive. • During normal operation, this counter is increasing constantly.				
5205	**PARITY ERRORS**	0… 65535	1	—	
	Contains a count of the characters with a parity error that is received from the fieldbus. For high counts, check: • Parity settings of devices connected on the fieldbus – they must not differ. • Ambient electro-magnetic noise levels – high noise levels generate errors.				
5206	**FRAME ERRORS**	0… 65535	1	—	
	Contains a count of the characters with a framing error that the fieldbus receives. For high counts, check: • Communication speed settings of devices connected on the fieldbus – they must not differ. • Ambient electro-magnetic noise levels – high noise levels generate errors.				
5207	**BUFFER OVERRUNS**	0… 65535	1	—	
	Contains a count of the characters received that cannot be placed in the buffer. • Longest possible message length for the drive is 128 bytes. • Received messages exceeding 128 bytes overflow the buffer. The excess characters are counted.				
5208	**CRC ERRORS**	0… 65535	1	—	
	Contains a count of the messages with a CRC error that the drive receives. For high counts, check: • Ambient electro-magnetic noise levels – high noise levels generate errors. • CRC calculations for possible errors.				

Group 53: EFB Protocol

This group defines set-up variables used for an embedded fieldbus (EFB) communication protocol. Refer to communication protocol documentation for more information on these parameters.

Table 47: Group 53: EFB Protocol

Code	Description	Range	Resolution	Default	S
5301	**EFB PROTOCOL ID**	0000… FFFF hex	1	0000 hex	
	Contains the identification and program revision of the protocol. • Format: XXYY, where xx = protocol ID, and YY = program revision.				
5302	**EFB STATION ID**	0… 65535	1	1	☑
	Defines the node address of the RS485 link. • The node address on each unit must be unique. Daikin MicroTech III controls the following: • Address 1 = SAF • Address 2 = RAF or EAF • Address 3 = Energy Recovery Wheel				
5303	**EFB BAUD RATE**	1.2… 76.8 kbits/s	—	9.6 kbits/s	
	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				
5304	**EFB PARITY**	0…3		0	
	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.				

Group 98: Options

This group configures for options, in particular, enabling serial communication with the drive.

Table 48: Group 98: Options

Code	Description	Range	Resolution	Default	S
9802	**COMM PROT SEL**	0…5	1	0	
	Selects the communication protocol. 0 = NOT SEL – No communication protocol selected. 1 = STD MODBUS – The drive communicates with Modbus via the RS485 channel (X1- communications, terminal). • See also parameter Group 53 EFB PROTOCOL, page 67. 2 = N2 – Enables fieldbus communication with the drive using Metasys N2 protocol via the RS485 serial link (X1-communications terminal). 3 = FLN – Enables fieldbus communication with the drive using FLN protocol via the RS485 serial link (X1-communications terminal). 5 = BACNET – Enables fieldbus communication with the drive using BACnet protocol via the RS485 serial link (X1-communications terminal).				

Daikin uses the "STD Modbus" selection on all VFDs applied with MicroTech III controls except for RPE and RDE condenser fans.

Fieldbus Control with Embedded Fieldbus

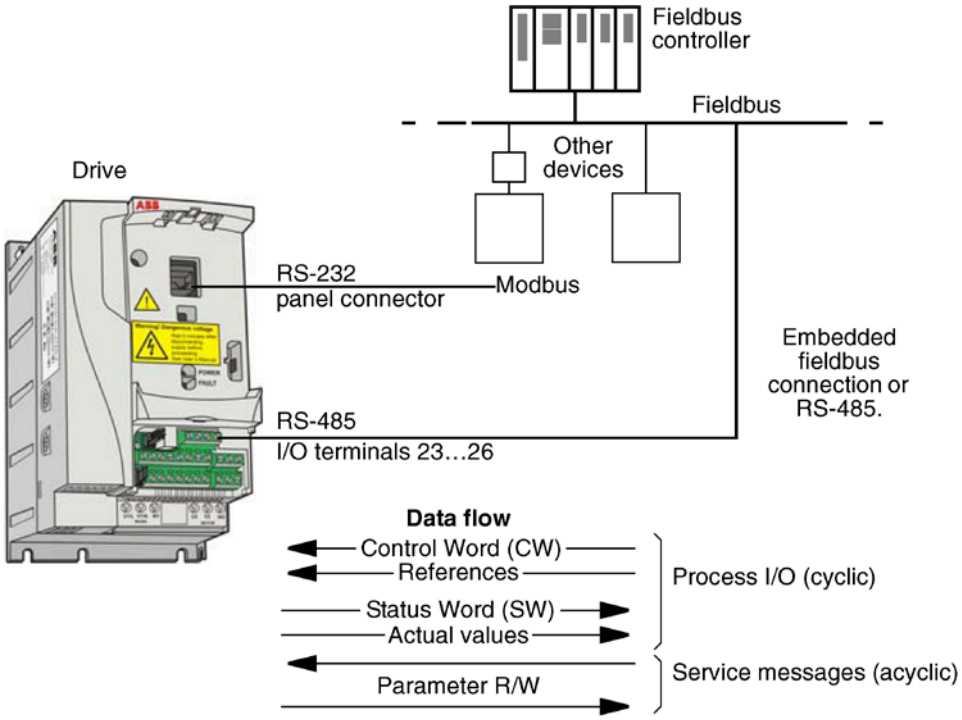
System Overview

The drive can be connected to an external control system via embedded fieldbus. The embedded fieldbus supports Modbus RTU, BACnet®, Metasys® N2 and APOGEE® FLN Protocols.

Embedded fieldbus connection is either RS-232 (control panel connector X2) or RS-485 (I/O terminals 23…26). The maximum length of the communication cable with RS-232 is restricted to 3 meters.

RS-232 is designed for a point-to-point application (a single master controlling one slave). RS-485 is designed for a multipoint application (a single master controlling one or more slaves).

Figure 24: Control Information through Fieldbus Interface



Control Interface

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

Protocol	Control Interface	Reference for more information
Modbus	• Output Words – Control word – Reference1 – Reference2 • Input Words – Status word – Actual value 1 – Actual value 2 – Actual value 3 – Actual value 4 – Actual value 5 – Actual value 6 – Actual value 7 – Actual value 8	Daikin MicroTech II controls communicate with the MD4 over Modbus and all parameters are factory set. No field adjustments are recommended.
N2	• Binary output objects • Analog output objects • Binary input objects • Analog input objects	Not supported by Daikin
FLN	• Binary output points • Analog output points • Binary input points • Analog input points	Not supported by Daikin
BACnet	• Device management • Binary output objects • Analog output objects • Binary input objects • Analog input objects	BACnet Protocol Technical Data page 87

⚠ IMPORTANT

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

Planning

Network planning should address the following questions:

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

Mechanical and Electrical Installation – EFB

⚠ WARNING

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

Drive terminals 23…26 are for RS485 communications.

- Use Belden® 9842 or equivalent. Belden 9842 is a dual twisted, shielded pair cable with a wave impedance of 120 Ω.
- Use one of these twisted shielded pairs for the RS485 link. Use this pair to connect all A (-) terminals together and all B (+) terminals together.
- Use one of the wires in the other pair for the logical ground (terminal 26), leaving one wire unused.
- Do not directly ground the RS485 network at any point. Ground all devices on the network using their corresponding earthing terminals.
- As always, the grounding wires should not form any closed loops, and all the devices should be earthed to a common ground.
- Connect the RS485 link in a daisy-chained bus, without dropout lines.
- To reduce noise on the network, terminate the RS485 network using 120 Ω resistors at both ends of the network. Use the DIP switch to connect or disconnect the termination resistors. See following wiring diagram.
- For configuration information see the following:
  - following.
  - Activate Drive Control Functions – EFB on page 75.
  - The appropriate EFB protocol specific technical data. For example, Modbus Protocol Technical Data on page 68 — 82

Figure 25: Preferred Wiring Diagram

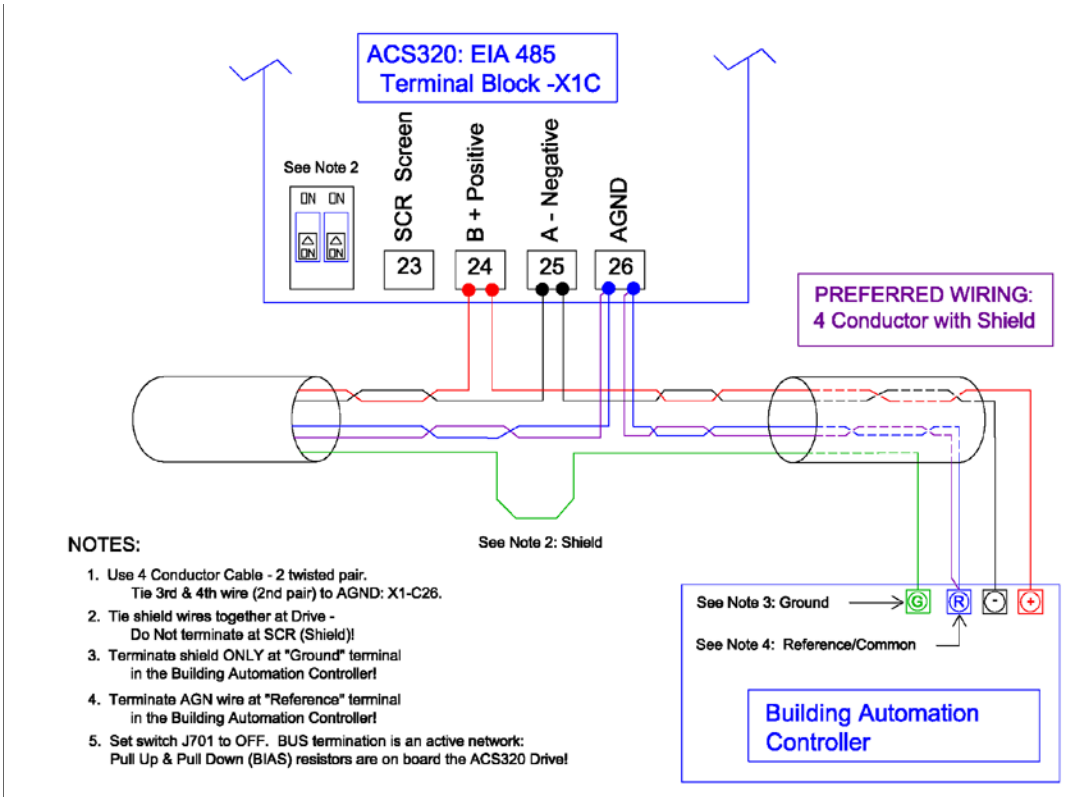
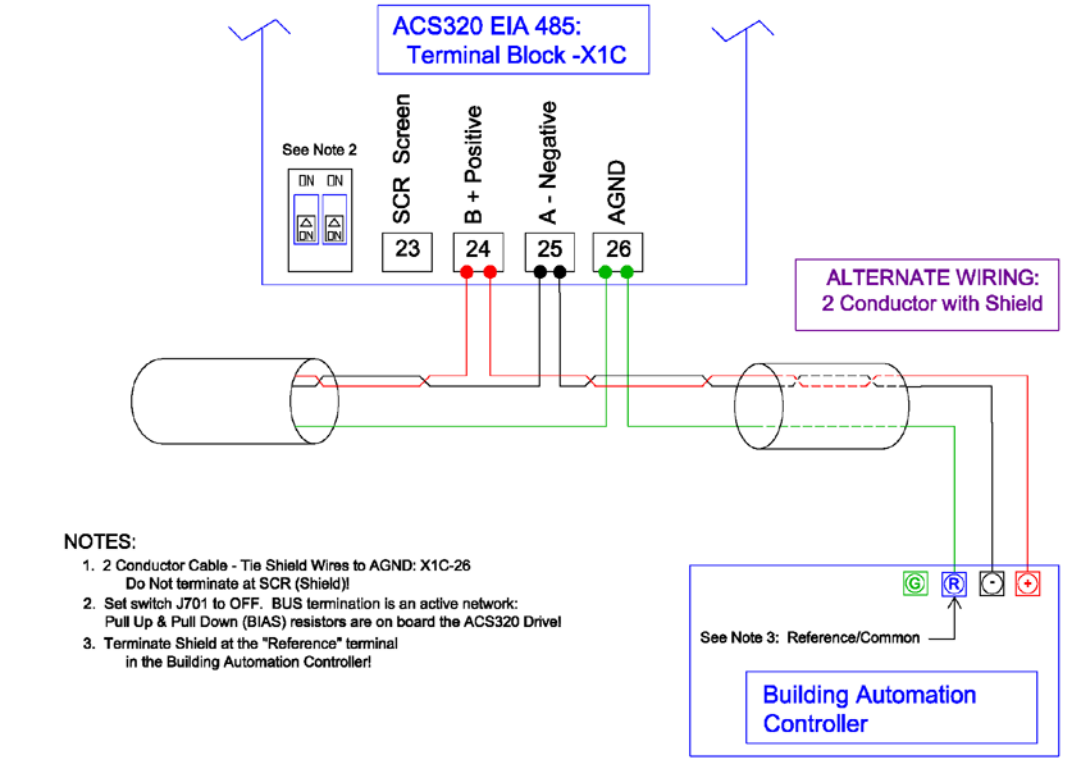


Figure 26: Alternate Wiring Diagram



Communication Set-up – EFB

Serial Communication Selection

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

- 1 (STD MODBUS). The MD4 must be set here with MicroTech III control.
- 2 (N2)
- 3 (FLN)
- 5 (BACNET)

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 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.

Table 49: Serial Communications Configuration Protocol Reference

Code	Description	EFB Protocol Reference			
		Modbus	N2	FLN	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** Defines the node address of the RS485 link.	Set each drive on the network with a unique value for this parameter. When this protocol is selected, the default value for this parameter is: 1 Note: For a new address to take affect, the drive power must be cycled OR 5302 must first be set to 0 before selecting a new address. Leaving 5302 = 0 places the RS485 channel in reset, disabling communication..			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	When this protocol is selected, the default value for this parameter is			When this protocol is selected, the default value for this parameter is: 38400
		9.6	9.6	4.8.	
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: 1	When this protocol is selected, the default value for this parameter is: 0		
					Sets MS/TP character format.
5305	**EFB CTRL PROFILE** Selects the communication profile used by the EFB protocol. 0 = ABB DRV LIM – Operation of Control/Status Words conform to ABB Drives 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 Drives Profile, as used in ACH600/800.	When this protocol is selected, the default value for this parameter is: 0	N/A. When this protocol is selected, the default value for this parameter is: 0. Changing the value for this parameter has no affect on this protocol's behavior.		

Code	Description (continuation of Table 49)	EFB Protocol Reference			
		Modbus	N2	FLN	BACnet
5310	**EFB PAR10**.	Not used for Comm setup	Sets them response turnaround time in milliseconds. When this protocol is selected, the default value is:		
			3 msec.	0 msec.	5 msec.
5311	**EFB PAR11**	Not used for Comm setup.			This parameter, together with parameter 5317, EFB PAR 17, 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**	Not used for Comm setup.			This parameter sets the BACnet Device Object Max Info Frames Property.
5313	**EFB PAR13**	Not used for Comm setup.			This parameter sets the BACnet Device Object Max Master Property.
5314	**EFB PAR14**	Not used for Comm setup.			
5315	**EFB PAR15**	Not used for Comm setup.			
5316	**EFB PAR 16**	Not used for Comm setup.			This parameter indicates the count of MS/TP tokens passed to this drive.
5317	**EFB PAR17**				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. (The location is defined by the Protocol Reference, which is protocol dependent.)

Table 50: Start/Stop Direction Control Protocol Reference

Drive Parameter		Value	Description	Protocol Reference				
				Modbus[1]		N2	FLN	BACnet
				abb drv	dcu profile			
1001	EXT1 COMMANDS	10 (COMM)	Start/Stop by fieldbus with Ext1 selected.	40001 bits 0…3	40031 bits 0, 1	BO1	24	BV10
1002	EXT2 COMMANDS	10 (COMM)	Start/Stop by fieldbus with Ext2 selected.	40001 bits 0…3	40031 bits 0, 1	BO1	24	BV10
1003	DIRECTION	3 (REQUEST)	Direction by fieldbus.	4002/40032	40031 bit 3	BO2	22	BV11

- 1.Daikin MicroTech II controls communicate with the MD4 over Modbus and all parameters are factory set. No field adjustments are recommended.
- 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 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.)

Table 51: Input Reference Select Protocol Reference

Drive Parameter		Value	Setting	Protocol Reference				
				Modbus		N2	FLN	BACnet
				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:

Daikin MicroTech II controls communicate with the MD4 over Modbus and all parameters are factory set.

No field adjustments are recommended.

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 and 1103 need to be changed to comm.

Using the fieldbus for miscellaneous drive control requires:

- Drive 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.)

Table 52: Miscellaneous Drive Control Protocol Reference

Drive Parameter		Value	Setting	Protocol Reference				
				Modbus[1]		N2	FLN	BACnet
				abb drv	dcu profile			
1601	RUN ENABLE	7 (COMM)	Run enable by fieldbus. (Not recommended1)	40001 bit 3	40031 bit 6 (inverted)	BO4	35	BV12
1604	FAULT RESET SEL	8 (COMM)	Fault reset by fieldbus.	40001 bit 7	40031 bit 4	BO6	94	BV14
1606	LOCAL LOCK	8 (COMM)	Source for local lock selection is the fieldbus.	Does not apply	40031 bit 14			
1607	PARAM SAVE	1 (SAVE)	Saves altered parameters to memory (then value returns to 0).	41607	40032 bit 2	BO18	N/A[1]	
1608	START ENABLE 1	7 (COMM)	Source for start enable 1 is the fieldbus Command word. (Not recommended)[1]	Does not apply.	40032 bit 2			BV20
1609	START ENABLE 2	7 (COMM)	Source for start enable 2 is the fieldbus Command word. (Not recommended)[1]		40032 bit 3			BV21
2013	MIN TORQUE SEL	7 (COMM)	Source for minimum torque selection is the fieldbus.		40031 bit 15			
2014	MAX TORQUE SEL	7 (COMM)	Source for maximum torque selection is the fieldbus.					
2201	ACC/DEC 1/2 SEL	7 (COMM)	Source for ramp pair selection is the fieldbus.		40031 bit 10			

- [1]Daikin 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.
- Fieldbus controller supplied reference word(s) in the appropriate location. (The location is defined by the Protocol Reference, which is protocol dependent.)

Table 53: Relay Output Control Protocol Reference

Drive Parameter		Value	Setting	Protocol Reference				
				Modbus[1]		N2	FLN	BACnet
				abb drv	dcu profile			
1401	RELAY OUTPUT 1	35 (COMM)	Relay Output 1 controlled by fieldbus.	40134 bit 0 or 00033		BO7	40	BO0
1402[1]	RELAY OUTPUT 2	35 (COMM)	Relay Output 2 controlled by fieldbus.	40134 bit 1 or 00034		BO8	41	BO1
1403[1]	RELAY OUTPUT 3	35 (COMM)	Relay Output 3 controlled by fieldbus.	40134 bit 2 or 00035		BO9	42	BO2
1410[1]	RELAY OUTPUT 4	35 (COMM)	Relay Output 4 controlled by fieldbus.	40134 bit 3 or 00036		BO10	43	BO3

- [1] More than 1 relay requires the addition of a relay extension module

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

Set 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.

NOTE: Relay status feedback occurs without configuration as defined below.

Table 54: Relay Status Feedback Protocol Reference

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 STATUS	Relay 4 status.	40123	0123		BI7	79	BI3

Analog Output Control

Using the fieldbus for analog output control requires:

- Drive 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.)

Table 55: Analog Output Control Protocol Reference

Drive Parameter		Value	Setting	Protocol Reference				
				Modbus		N2	FLN	BACnet
				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

PID Control Setpoint Source

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

Table 56: PID Control Setpoint Source Protocol Reference

Drive Parameter		Value	Setting	Protocol Reference				
				Modbus		N2	FLN	BACnet
				abb drv	dcu profile			
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.	40003		AO2	61	AV17
4110	SET POINT SEL (Set 2)							
4210	SET POINT SEL (Ext/ Trim)							

Communication Fault

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

Table 57: Communication Fault Reference

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.

Table 58: Pre-defined Feedback Protocol Reference

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	BI10, BI11, BI12,	70, 71, 72	BI6, BI7, BI8
0122	RO1-3 STATUS	40122	BI4, BI5, BI6	76, 77, 78	BI0, BI1, BI2
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

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

Mailbox Read/Write

The ACS320 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.

Table 59: Mailbox Protocol Reference

Name	Drive Parameter	Protocol Reference			
		Modbus[1]	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

- [1]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 starting on page 30 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%	1800 rpm1	10 * 0.1% * 1800 RPM / 100% = 18 rpm
100	0.1%	600 Hz2	100 * 0.1% * 600 Hz / 100% = 60 Hz

1. Assuming, for the sake of this example, that the Actual Value uses parameter 9908 MOT NOM SPEED as the 100% reference, and that 9908 = 1800 rpm.

2. Assuming, for the sake of this example, that the Actual Value uses parameter 9907 MOT NOM FREQ as the 100% reference, and that 9907 = 6.00 Hz.

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

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

Scaling does not apply for the BACnet protocol.

Diagnostics – EFB

Fault Queue for Drive Diagnostics

The three most recent MD4 faults are reported to the fieldbus as defined below.

Table 60: Fault Queue Protocol Reference

Drive Parameter		Protocol Reference			
		Modbus	N2	FLN	BACnet
0401	Last Fault	40401	17	90	AV18
0412	Previous Fault 1	40402	18	91	AV19
0413	Previous Fault 2	40403	19	92	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

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.

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 MD4 behavior, if communication is lost, was configured in Communication Fault. The parameters are 3018 COMM FAULT FUNC and 3019 COMM FAULT TIME. The “Parameter Descriptions” section in the ACH550 User’s Manual 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 code 28 "SERIAL 1 ERR", check for either of the following:

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

To correct:

Increase the time set by parameter 3019 COMM FAULT TIME, page 53.

Fault 31 – EFB1

For BACnet: If the drive's control panel shows fault code 31 "EFB1", the drive has aninvalid 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 (listed for the drive in "Diagnostics" in the ACH550 User's Manual, fault codes 31…33) are not used.

Intermittent Off-line Occurrences

The problems described above are the most common problems encountered with MD4 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:

Table 61: Binary Input Object Instance Summary

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

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:

Table 62: Binary Output Object Instance Summary

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 (also requires MREL-01 option).	ON/OFF	C
BO2	RO3 COMMAND	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	RO4 COMMAND	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

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

Binary ValueObject Instance Summary

The following table summarizes the Binary Output Objects supported:

Table 63: Binary Value Object Instance Summary

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
BV9	RUN ENA ACT	This object indicates the Run Enable command status, regardless of the control source.	ENABLE/DISABLE	R
BV10	RUN/STOP CMD	This object commands a drive start. Control requires either: Parameter 1001 value = COMM for control by EXT1 or Parameter 1002 value = COMM for control by EXT2.	RUN/STOP	C
BV11	FWD/REV CMD	This object commands a motor rotation direction change. Control requires 1003 = REQUEST and either: Parameter 1001 value = COMM for control by EXT1 or Parameter 1002 value = COMM for control by EXT2.	REV/FWD	C
BV12	RUN ENA CMD	This object commands Run Enable. Control requires parameter 1601 value = COMM.	ENABLE/DISABLE	C
BV13	EXT 1/2 CMD	This object selects ext1 or ext2 as the active control source. Control requires parameter 1102 value = COMM.	EXT2/EXT1	C
BV14	FAULT RESET	This object resets a faulted drive. The command is rising-edge triggered. Control requires parameter 1604 value = COMM.	RESET/NO	C
BV15	MBOX READ	This object reads a parameter (defined by AV25 MBOX PARAM) and returns it in AV26 MBOX DATA.	READ/RESET	W
BV16	MBOX WRITE	This object writes the data value specified by AV26, MBOX DATA, to a parameter (defined by AV25, MBOX PARAM).	WRITE/RESET	W
BV17	LOCK PANEL	This object locks the panel and prevents parameter changes. The corresponding drive parameter is 1602.	LOCK/UNLOCK	W
BV18	CTL OVERRIDE CMD	This object commands the drive into BACnet Control Override. In this mode, BACnet takes drive control from the normal source. However, the control panel's HAND mode has priority over BACnet Control Override.	ON/OFF	C
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 param 1608 value = COMM.	ENABLE/DISABLE	C
BV21	START ENABLE 2	This object commands start enable1. Control requires param 1609 value = COMM.	ENABLE/DISABLE	C

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

Analog Input Object Instance Summary

The following table summarizes the Analog Input Objects supported:

Table 64: Analog Input Object Instance Summary

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
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:

Table 65: Analog Value Object Instance Summary

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	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 parameter Group 35. The corresponding drive parameter is 0145.	°C	R
AV16	INPUT REF 1	This object sets Input Reference 1. Control requires parameter 1103 value = COMM.	Percent	C
AV17	INPUT REF 2	This object sets either: Input Reference 2. Control requires parameter 1106 value = COMM. Process PID setpoint. Control requires parameter 1106 value = PID1 OUT and parameter 4010 value = COMM.	Percent	C
AV18	LAST FLT	This object indicates the most recent fault entered in the drive's fault log. The corresponding drive parameter is 0401.	None	R
AV19	PREV FLT 1	This object indicates the second most recent fault entered in the drive's fault log. The corresponding drive parameter is 0412.	None	R
AV20	PREV FLT 2	This object indicates the third most recent fault entered in the drive's fault log. The corresponding drive parameter is 0413.	None	R
AV21	AO 1 ACT	This object indicates Analog Output 1's level. The corresponding drive parameter is 0124.	Milliamps	R
AV23	ACCEL1 TIME	This object sets the Ramp1 acceleration time. The corresponding drive parameter is 2202.	Seconds	W
AV24	DECEL1 TIME	This object sets the Ramp1 deceleration time. The corresponding drive parameter is 2203.	Seconds	W
AV25	MBOX PARAM	This object defines the parameter to be read or written to by the mailbox function. See BV15 and BV16.	None	W
AV26	MBOX DATA	This object holds the mailbox function's parameter value – a value that was read, or is to be written. See BV15 and BV16.	None	W
AV27	EXT PID STPT	This object sets the External PID controller setpoint. The corresponding drive parameter is 4211. Control requires parameter 4210, PID SETPOINT SEL, value = 19 (INTERNAL).	Percent	C

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

BACnet Quick-Start Sequence

The following steps summarize the process for enabling and configuring BACnet on the MD4:

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

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

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

2. Place the BACnet channel in "reset": Set drive parameter 5302, EFB STATION ID = 0.
   - This setting holds the BACnet communication channel in reset while remaining settings are completed.
3. Define the MS/TP baud rate.
   - Set drive parameter 5303, EFB BAUD RATE = appropriate value.
4. Define the Device Object Instance 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, UART ERRORS, should be stable.

Protocol Implementation Conformance Statement (PICS)

PICS Summary

BACnet Standard Device Profile

This version of MD4 BACnet fully conforms to the 'Application-Specific Controller' standard device profile (B-ASC).

Services Supported

The following services are supported by the MD4:

- 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 MD4 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 MD4 supports separate MAC ID and Device Object Instance parameters:

- Set the MAC ID using drive parameter 5302. Default: 5302 = 12?.
- 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

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

Table 66: BACnet Protocol Implementation Conformance Statement

Date	TBD
Vendor Name	Daikin
Product Name	Low Voltage AC Motor Drive
Product Model Number	MD4
Applications Software Version	TBD
Firmware Revision	TBD
BACnet Protocol Revision	2
Product Description	The MD4 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, DMDCC-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 89
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): ___ ☐ Point-To-Point, EIA 232 (Clause 10), baud rate(s): ___ ☐ Point-To-Point, modem, (Clause 10), baud rate(s): ___ ☐ LonTalk, (Clause 11), medium: _____ ☐ Other: _____
Device Address Binding Is static device binding supported? (This is currently necessary for two-way communication with MS/TP slaves and certain other devices.)	☐ Yes ☐ No
Networking Options	☐ Router, Clause 6 - List all routing configurations, e.g., ARCNET-Ethernet, Ethernet-MS/TP, etc. ☐ Annex H, BACnet Tunneling Router over IP ☐ BACnet/IP Broadcast Management Device (BBMD)
Does the BBMD support registrations by Foreign Devices?	☐ Yes ☐ No
Character Sets Supported Indicating support for multiple character sets does not imply that they can all be supported simultaneously.	☐ ANSI X3.4 ☐ IBM™/Microsoft™ DBCS ☐ ISO 8859-1 ☐ ISO 10646 (UCS-2) ☐ ISO 10646 (UCS-4) ☐ JIS C 6226
If this product is a communication gateway, describe the types of non- BACnet equipment/network(s) that the gateway supports:	

BACnet Object Definitions

Object/Property Support Matrix

The following table summarizes the Object Types/Properties Supported:

Table 67: Object/Property Support Matrix

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.

What This Chapter Contains

The chapter tells how to reset faults and view fault history. It also lists all alarm and fault messages including the possible cause and corrective actions.

Safety

⚠ WARNING

Only qualified electricians are allowed to maintain the drive. Read the safety instructions in chapter Safety on page 4 before you work on the drive.

Alarm and Fault Indications

Fault is indicated with a red LED. See section LEDs on page 101.

An alarm or fault message on the panel display indicates abnormal drive status. Using the information given in this chapter most alarm and fault causes can be identified and corrected. If not, contact an Daikin representative.

The four digit code number in parenthesis after the fault is for the fieldbus communication. (See chapter Fieldbus control with embedded fieldbus on page 90.)

How to Reset

The drive can be reset either by pressing the keypad key (Basic Control Panel) or (Assistant Control Panel), through digital input or fieldbus, or by switching the supply voltage off for a while. The source for the fault reset signal is selected by parameter 1604 FAULT RESET SEL. When the fault has been removed, the motor can be restarted.

Fault History

When a fault is detected, it is stored in the Fault History. The latest faults are stored together with the time stamp.

Parameters 0401 LAST FAULT, 0412 PREVIOUS FAULT 1 and 0413 PREVIOUS FAULT 2 store the most recent faults. Parameters 0404…0409 show drive operation data at the time the latest fault occurred. The Assistant Control Panel provides additional information about the fault history.

Alarm Messages Generated by the Drive

Table 68: Alarm Messages Generated by the Drive

CODE	ALARM	CAUSE	WHAT TO DO
2001	OVERCURRENT 0308 bit 0 (programmable fault function 1610)	Output current limit controller is active.	Check motor load. Check acceleration time (2202 and 2205). Check motor and motor cable (including phasing). Check ambient conditions. Load capacity decreases if installation site ambient temperature exceeds 40 °C. See section Derating on page 103.
2002	OVERVOLTAGE 0308 bit 1 (programmable fault function 1610)	DC overvoltage controller is active.	Check deceleration time (2203 and 2206). Check input power line for static or transient overvoltage.
2003	UNDERVOLTAGE 0308 bit 2 (programmable fault function 1610)	DC undervoltage controller is active.	Check input power supply.
2004	DIR LOCK 0308 bit 3	Change of direction is not allowed.	Check parameter 1003 DIRECTION settings.
2005	IO COMM 0308 bit 4 (programmable fault function 3018, 3019)	Fieldbus communication break	Check status of fieldbus communication. See chapter Fieldbus control with embedded fieldbus on page 70. Check fault function parameter settings. Check connections. Check if master can communicate.
2006	AI1 LOSS 0308 bit 5 (programmable fault function 3001, 3021)	Analog input AI1 signal has fallen below limit defined by parameter 3021 AI1 FAULT LIMIT.	Check fault function parameter settings. Check for proper analog control signal levels. Check connections.
2007	AI2 LOSS 0308 bit 6 (programmable fault function 3001, 3021)	Analog input AI2 signal has fallen below limit defined by parameter 3022 AI2 FAULT LIMIT.	Check fault function parameter settings. Check for proper analog control signal levels. Check connections.
2008	PANEL LOSS 0308 bit 7 (programmable fault function 3002)	Control panel selected as active control location for drive has ceased communicating.	Check panel connection. Check fault function parameters. Check control panel connector. Refit control panel in mounting platform. If drive is in external control mode (REM) and is set to accept start/stop, direction commands or references via control panel: Check Group 10: AcStart/Stop/Dir and Group 11: Reference Select settings.
2009	DEVICE OVERTEMP 0308 bit 8	Drive IGBT temperature is excessive. Alarm limit is 120°C.	Check ambient conditions. See also section Derating on page 103. Check air flow and fan operation. Check motor power against unit power.
2010	MOTOR TEMP 0305 bit 9 (programmable fault function 3005…3009 / 3503)	Motor temperature is too high (or appears to be too high) due to excessive load, insufficient motor power, inadequate cooling or incorrect start-up data.	Check motor ratings, load and cooling. Check start-up data. Check fault function parameters.
		Measured motor temperature has exceeded alarm limit set by parameter 3503 ALARM LIMIT.	Check value of alarm limit. Check that actual number of sensors corresponds to value set by parameter (2501 SENSOR TYPE). Let motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc.
2012	MOTOR STALL 0308 bit 11 (programmable fault function 3010…3012)	Motor is operating in stall region due to e.g. excessive load or insufficient motor power.	Check motor load and drive ratings. Check fault function parameters.
2013[1]	AUTORESET 0308 bit 12	Automatic reset alarm	Check parameter Group 31: Automatic Reset settings.
2014[1]	AUTOCHANGE 0308 bit 13	PFC Autochange function is active.	
2015	PFC I LOCK 0308 bit 14	PFC interlocks are active.	Drive cannot start • any motor (when Autochange is used) • the speed regulated motor (when Autochange is not used).

(continuation of Table 68)

CODE	ALARM	CAUSE	WHAT TO DO
2018 1)	PID SLEEP 3009 bit 1	Sleep function has entered sleeping mode.	See parameter Group 40: Process PID Set 1 (page 62)… Group 41: Process PID Set 2 (page 66).
2021	START ENABLE 1 MISSING 3009 bit 4	No Start Enable 1 signal received	Check parameter 1608 START ENABLE 1 settings. Check digital input connections. Check fieldbus communication settings.
2022	START ENABLE 2 MISSING 3009 bit 5	No Start Enable 2 signal received	Check parameter 1609 START ENABLE 2 settings. Check digital input connections. Check fieldbus communication settings.
2023	EMERGENCY STOP 3009 bit 6	Drive has received emergency stop command and ramps to stop according to ramp time defined by parameter 2208 EMERG DEC TIME.	Check that it is safe to continue operation. Return emergency stop push button to normal position.
2025	FIRST START 3009 bit 8	Motor identification magnetization is on. This alarm belongs to normal start-up procedure.	Wait until drive indicates that motor identification is completed.
2027	USER LOAD CURVE 3009 bit 10	Condition defined by 3701 USER LOAD C MODE has been valid longer than half of the time set by 3703 USER LOAD C TIME.	See parameter Group 37: User Load Curve, page 61.
2028	START DELAY 3009 bit 11	Start delay in progress	See parameter 2113 START DELAY, page 42.
2030	INLET LOW 3009 bit 13	Pressure at pump/fan inlet too low	Check for a closed valve on the inlet side of the pump/fan. Check piping for leaks. See parameter Group 44: Pump Protection, page 66.
2031	OUTLET HIGH 3009 bit 14	Pressure at pump/fan outlet too high	Check piping for blocks. See parameter Group 44: Pump Protection, page 66.
2032	PIPE FILL 3009 bit 15	Pipe fill in progress	See parameters 4421…4426, page 66.
2033	INLET VERY LOW 0310 bit 0	Pressure at pump/fan inlet too low	Check for a closed valve on the inlet side of the pump/fan. Check piping for leaks. See parameter Group 44: Pump Protection, page 66.
2034	OUTLET VERY HIGH 0310 bit 1	Pressure at pump/fan outlet too high	Check piping for blocks. See parameter Group 44: Pump Protection, page 66.

1) Even when the relay output is configured to indicate alarm conditions (e.g. parameter 1401 RELAY OUTPUT 1 = 5 (ALARM) or 16 (FLT/ALARM)), this alarm is not indicated by a relay output.

Alarms Generated by the Basic Control Panel

Table 69: Alarms Generated by the Basic Control Panel

The Basic Control Panel indicates Control Panel alarms with a code, A5xxx.

ALARM CODE	CAUSE	WHAT TO DO
5001	Drive is not responding.	Check panel connection.
5002	Incompatible communication profile	Contact your local Daikin representative.
5010	Corrupted panel parameter backup file	Retry parameter upload. Retry parameter download.
5011	Drive is controlled from another source.	Change drive control to local control mode.
5012	Direction of rotation is locked.	Enable change of direction. See parameter 1003 DIRECTION, page 38.
5013	Panel control is disabled because start inhibit is active.	Start from the panel is not possible. Reset the emergency stop command or remove the 3-wire stop command before starting from the panel. See parameters 1001 EXT1 COMMANDS, 1002 EXT2 COMMANDS and 2109 EMERG STOP SEL.
5014	Panel control is disabled because of drive fault.	Reset drive fault and retry.
5015	Panel control is disabled because local control mode lock is active.	Deactivate local control mode lock and retry. See parameter 1606 LOCAL LOCK, page 46.
5018	Parameter default value is not found.	Contact your local Daikin representative.
5019	Writing non-zero parameter value is prohibited.	Only parameter reset is allowed.
5020	Parameter or parameter group does not exist or parameter value is inconsistent.	Contact your local Daikin representative.
5021	Parameter or parameter group is hidden.	Contact your local Daikin representative.
5022	Parameter is write protected.	Parameter value is read-only and cannot be changed.
5023	Parameter change is not allowed, when drive is running.	Stop drive and change parameter value.
5024	Drive is executing task.	Wait until task is completed.
5025	Software is being uploaded or downloaded.	Wait until upload/download is complete.
5026	Value is at or below minimum limit.	Contact your local Daikin representative.
5027	Value is at or above maximum limit.	Contact your local Daikin representative.
5028	Invalid value	Contact your local Daikin representative.
5029	Memory is not ready.	Retry.
5030	Invalid request	Contact your local Daikin representative.
5031	Drive is not ready for operation, eg due to low DC voltage.	Check input power supply.
5032	Parameter error	Contact your local Daikin representative.
5040	Parameter download error. Selected parameter set is not in current parameter backup file.	Perform upload function before download.
5041	Parameter backup file does not fit into memory.	Contact your local Daikin representative.
5042	Parameter download error. Selected parameter set is not in current parameter backup file.	Perform upload function before download.
5043	No start inhibit	—
5044	Parameter backup file restoring error	Check that file is compatible with drive.
5050	Parameter upload aborted	Retry parameter upload.
5051	File error	Contact your local Daikin representative.
5052	Parameter upload has failed.	Retry parameter upload.
5060	Parameter download aborted	Retry parameter download.
5062	Parameter download has failed.	Retry parameter download.
5070	Panel backup memory write error	Contact your local Daikin representative.
5071	Panel backup memory read error	Contact your local Daikin representative.
5080	Operation is not allowed because drive is not in local control mode.	Switch to local control mode.
5081	Operation is not allowed because of active fault.	Check cause of fault and reset fault.
5083	Operation is not allowed because parameter lock is on.	Check parameter 1602 PARAMETER LOCK setting.
5084	Operation is not allowed because drive is performing task.	Wait until task is completed and retry.
5085	Parameter download from source to destination drive has failed.	Check that source and destination drive types are same, i.e. ACS320. See the type designation label of the drive.
5086	Parameter download from source to destination drive has failed.	Check that source and destination drive type designations are the same. See type designation labels of the drives.
5087	Parameter download from source to destination drive has failed because parameter sets are incompatible.	Check that source and destination drive information are same. See parameters in Group 33: Information, page 56.
5088	Operation has failed because of drive memory error.	Contact your local Daikin representative.
5089	Download has failed because of CRC error.	Contact your local Daikin representative.
5090	Download has failed because of data processing error.	Contact your local Daikin representative.
5091	Operation has failed because of parameter error.	Contact your local Daikin representative.
5092	Parameter download from source to destination drive has failed because parameter sets are incompatible.	Check that source and destination drive information are same. See parameters in Group 33: Information, page 56.

Fault Messages Generated by the Drive

Table 70: Fault Messages Generated by the Drive

CODE	FAULT	CAUSE	WHAT TO DO
0001	OVERCURRENT (2310) 0305 bit 0	Output current has exceeded trip level.	Check motor load. Check acceleration time (2202 and 2505). Check motor and motor cable (including phasing). Check ambient conditions. Load capacity decreases if installation site ambient temperature exceeds 40 °C. See section Derating on page 350.
0002	DC OVERVOLT (3210) 0305 bit 1	Excessive intermediate circuit DC voltage. DC overvoltage trip limit is 420 V for 200 V drives and 840 V for 400 V drives.	Check that overvoltage controller is on (parameter 2505 OVERVOLT CTRL). Check input power line for static or transient overvoltage. Check deceleration time (2203, 2206).
0003	DEV OVERTEMP (4210) 0305 bit 2	Drive IGBT temperature is excessive. Fault trip limit is 135 °C.	Check ambient conditions. See also section Derating on page 103. Check air flow and fan operation. Check motor power against unit power.
0004	SHORT CIRC (2340) 0305 bit 3	Short circuit in motor cable(s) or motor	Check motor and motor cable.
0006	DC UNDERVOLT (3220) 0305 bit 5	Intermediate circuit DC voltage is not sufficient due to missing input power line phase, blown fuse, rectifier bridge internal fault or too low input power.	Check that undervoltage controller is on (parameter 2006 UNDERVOLT CTRL). Check input power supply and fuses.
0007	AI1 LOSS (8110) 0305 bit 6 (programmable fault function 3001, 3021)	Analog input AI1 signal has fallen below limit defined by parameter 3021 AI1 FAULT LIMIT.	Check fault function parameter settings. Check for proper analog control signal levels. Check connections.
0008	AI2 LOSS (8110) 0305 bit 7 (programmable fault function 3001, 3022)	Analog input AI2 signal has fallen below limit defined by parameter 3022 AI2 FAULT LIMIT.	Check fault function parameter settings. Check for proper analog control signal levels. Check connections.
0009	MOT OVERTEMP (4310) 0305 bit 8 (programmable fault function 0305…3009 / 3504)	Motor temperature is too high (or appears to be too high) due to excessive load, insufficient motor power, inadequate cooling or incorrect start-up data.	Check motor ratings, load and cooling. Check start-up data. Check fault function parameters.
		Measured motor temperature has exceeded fault limit set by parameter 3504 FAULT LIMIT.	Check value of fault limit. Check that actual number of sensors corresponds to value set by parameter (3501 SENSOR TYPE). Let motor cool down. Ensure proper motor cooling: Check cooling fan, clean cooling surfaces, etc.
0010	PANEL LOSS (5300) 0305 bit 9 (programmable fault function 3002)	Control panel selected as active control location for drive has ceased communicating.	Check panel connection. Check fault function parameters. Check control panel connector. Refit control panel in mounting platform. If drive is in external control mode (REM) and is set to accept start/stop, direction commands or references via control panel: Check Group 10: AcStart/Stop/Dir and Group 11: Reference Select settings. 0012
0012	MOTOR STALL (7121) 0305 bit 11 (programmable fault function 3010…3012)	Motor is operating in stall region due to e.g. excessive load or insufficient motor power.	Check motor load and drive ratings. Check fault function parameters.
0014	EXT FAULT 1 (9000) 0305 bit 13 (programmable fault function 3003)	External fault 1 Check external devices for faults.	Check parameter 3003 EXTERNAL FAULT 1 setting.
0015	EXT FAULT 2 (9001) 0305 bit 14 (programmable fault function 3004)	External fault 2 Check external devices for faults.	Check parameter 3004 EXTERNAL FAULT 2 setting.
0016	EARTH FAULT (2330) 0305 bit 15 (programmable fault function 3017)	Drive has detected earth (ground) fault in motor or motor cable.	Check motor. Check fault function parameters. Check motor cable. Motor cable length must not exceed maximum specifications. See section Motor connection data on page 104.

(continuation of Table 70)

CODE	FAULT	CAUSE	WHAT TO DO
0018	THERM FAIL (5210) 0306 bit 1	Drive internal fault. Thermistor used for drive internal temperature measurement is open or short-circuited.	Contact your local Daikin representative.
0021	CURR MEAS (2211) 0306 bit 4	Drive internal fault. Current measurement is out of range.	Contact your local Daikin representative.
0022	SUPPLY PHASE (3130) 0306 bit 5	Intermediate circuit DC voltage is oscillating due to missing input power line phase or blown fuse. Trip occurs when DC voltage ripple exceeds 14% of nominal DC voltage.	Check input power line fuses. Check for input power supply imbalance. Check fault function parameters.
0024	OVERSPEED (7310) 0306 bit 7	Motor is turning faster than highest allowed speed due to incorrectly set minimum/maximum speed. Operating range limits are set by parameters 2007 MINIMUM FREQ and 2008 MAXIMUM FREQ.	Check minimum/maximum frequency settings. Check adequacy of motor braking torque.
0026	DRIVE ID (5400) 0306 bit 9	Internal drive ID fault	Contact your local Daikin representative.
0027	CONFIG FILE (630F) 0306 bit 10	Internal configuration file error	Contact your local Daikin representative.
0028	SERIAL 1 ERR (7510) 0306 bit 11 (programmable fault function 3018, 3019)	Fieldbus communication break	Check status of fieldbus communication. See chapter Fieldbus control with embedded fieldbus, page 70. Check fault function parameter settings. Check connections. Check if master can communicate.
0029	EFB CON FILE (6306) 0306 bit 12	Configuration file reading error	Contact your local Daikin representative.
0030	FORCE TRIP (FF90) 0306 bit 13	Trip command received from fieldbus	See appropriate communication module manual.
0031	EFB 1 (FF92) 0307 bit 0	Error from the embedded fieldbus (EFB) protocol application. The meaning is protocol dependent.	See chapter Fieldbus control with embedded fieldbus, page 70.
0032	EFB 2 (FF93) 0307 bit 1		
0033	EFB 3(FF94) 0307 bit 2		
0034	MOTOR PHASE (FF56) 0306 bit 14	Motor circuit fault due to missing motor phase or motor thermistor relay (used in motor temperature measurement) fault.	Check motor and motor cable. Check motor thermistor relay (if used).
0035	OUTP WIRING (FF95) 0306 bit 15 (programmable fault function 3023)	Incorrect input power and motor cable connection (i.e. input power cable is connected to drive motor connection). The fault can be erroneously declared if the input power is a delta grounded system and the motor cable capacitance is large. This fault can be disabled using parameter 3023 WIRING FAULT.	Check input power connections. Check fault function parameters.
0036	INCOMPATIBLE SW (630F) 0307 bit 3	Loaded software is not compatible.	Contact your local Daikin representative.
0038	USER LOAD CURVE (FF6B) 0307 bit 4	Condition defined by 3701 USER LOAD C MODE has been valid longer than the time set by 3703 USER LOAD C TIME.	See parameter Group 37: User Load Curve, page 61.
0039	UNKNOWN EXTENSION (7086) 0307 bit 5	Option module not supported by the drive firmware is connected to the drive.	Check connections.
0040	INLET VERY LOW (8A81) 0307 bit 6	Pressure at pump/fan inlet too low	Check for a closed valve on the inlet side of the pump/fan. Check piping for leaks. See parameter Group 44: Pump Protection.
0041	OUTLET VERY HIGH (8A83) 0307 bit 7	Pressure at pump/fan outlet too high	Check piping for blocks. See parameter Group 44: Pump Protection
0042	INLET LOW (8A80) 0307 bit 8	Pressure at pump/fan inlet too low	Check for a closed valve on the inlet side of the pump/fan. Check piping for leaks. See parameter Group 44: Pump Protection.
0043	OUTLET HIGH (8A82) 0307 bit 9	Pressure at pump/fan outlet too high	Check piping for blocks. See parameter Group 44: Pump Protection.

(continuation of Table 70)

CODE	FAULT	CAUSE	WHAT TO DO
0101	SERF CORRUPT (FF55) 0307 bit 14	Drive internal error	Write down fault code and contact your local Daikin representative.
0103	SERF MACRO (FF55) 0307 bit 14		
0201	DSP T1 OVERLOAD (6100) 0307 bit 13		
0202	DSP T2 OVERLOAD (6100) 0307 bit 13		
0203	DSP T3 OVERLOAD (6100) 0307 bit 13		
0204	DSP STACK ERROR (6100) 0307 bit 12		
0206	CB ID ERROR (5000) 0307 bit 11		
1000	PAR HZRPM (6320) 0307 bit 15	Incorrect frequency limit parameter setting	Check parameter settings. Check that following applies: • 2007 MINIMUM FREQ < 2008 MAXIMUM FREQ • 2007 MINIMUM FREQ / 9907 MOTOR NOM FREQ and 2008 MAXIMUM FREQ / 9907 MOTOR NOM FREQ are within range.
1001	PAR PFC REF NEG (6320) 0307 bit 15	Incorrect PFC parameters	Check parameter Group 81: PFA settings. Check that following applies: • 2007 MINIMUM FREQ > 0 when 8123 is ACTIVE or SPFC ACTIVE.
1003	PAR AI SCALE (6320) 0307 bit 15	Incorrect analog input AI signal scaling	Check parameter Group 13: Analog Inputs settings. Check that following applies: • 1301 MINIMUM AI1 < 1302 MAXIMUM AI1 • 1304 MINIMUM AI2 < 1305 MAXIMUM AI2.
1004	PAR AO SCALE (6320) 0307 bit 15	Incorrect analog output AO signal scaling	Check parameter Group 15: Analog Outputs settings. Check that following applies: • 1504 MINIMUM AO1 < 1505 MAXIMUM AO1.
1005	PAR PCU 2 (6320) 0307 bit 15	Incorrect motor nominal power setting	Check parameter 9009 setting. Following must apply: • 1.1 < (9906 MOTOR NOM CURR * 9905 MOTOR NOM VOLT * 1.73 / PN) < 3.0 where PN = 1000 * 9909 MOTOR NOM POWER (if units are in kW) or PN = 746 * 9909 MOTOR NOM POWER (if units are in hp).
1006	PAR EXT RO (6320) 0307 bit 15	Incorrect extension relay output parameters.	Check parameter settings. Check that following applies: • Relay Output Extension Module MREL-0 is connected to the drive. • 1402…1403 RELAY OUTPUT 2…3 and 1410 RELAY OUTPUT 4 have non-zero values. See MREL-01 Relay Output Extension Module User's Manual (3AUA0000035974 [English]).
1007	PAR FBUSMISS (6320) 0307 bit 15	Fieldbus control has not been activated.	Check fieldbus parameter settings.
1009	PAR PCU 1 (6320) 0307 bit 15	Incorrect motor nominal speed/ frequency setting	Check parameter settings. Following must apply: • 1 < (60 * 9907 MOTOR NOM FREQ / 9908 MOTOR NOM SPEED) < 16 • 0.8 < 9908 MOTOR NOM SPEED / (120 * 9907 MOTOR NOM FREQ / Motor poles) < 0.992
1012	PAR PFC IO 1 (6320) 0307 bit 15	I/O configuration for PFC not complete	Check parameter settings. Following must apply: • There are enough relays parameterized for PFC. • No conflict exists between parameter Group 14: Relay Outputs, parameter 8117 NR OF AUX MOT and parameter 8118 AUTOCHNG INTERV.
1013	PAR PFC IO 2 (6320) 0307 bit 15	I/O configuration for PFC not complete	Check parameter settings. Following must apply: • The actual number of PFC motors (parameter 8127 MOTORS) matches the PFC motors in parameter Group 14: Relay Outputs and parameter 8118 AUTOCHNG INTERV.
1014	PAR PFC IO 3 (6320) 0307 bit 15	I/O configuration for PFC not complete. The drive is unable to allocate a digital input (interlock) for each PFC motor.	See parameters 8120 INTERLOCKS and 8127 MOTORS, page 93.

(continuation of Table 70)

CODE	FAULT	CAUSE	WHAT TO DO
1015	PAR CUSTOM U/F (6320) 0307 bit 15	Incorrect voltage to frequency (U/f) ratio voltage setting.	Check parameter 2610 USER DEFINED U1…2617 USER DEFINED F4 settings.
1017	PAR SETUP 1 (6320) 0307 bit 15	It is not allowed to use frequency input signal and frequency output signal simultaneously.	Disable frequency output or frequency input: • change transistor output to digital mode (value of parameter 1804 TO MODE = DIGITAL), or • change frequency input selection to other value in parameters Group 11: Reference Select, Group 40: Process PID Set 1, Group 41: Process PID Set 2 and Group 42: External PID.
1026	PAR USER LOAD C (6320) 0307 bit 15	Incorrect user load curve parameter setting	Check parameter settings. Following must apply: • 3704 LOAD FREQ 1 ≤ 3707 LOAD FREQ 2 ≤ 3710 LOAD FREQ 3 ≤ 3713 LOAD FREQ 4 ≤ 3716 LOAD FREQ 5 • 3705 LOAD TORQ LOW 1 < 3706 LOAD TORQ HIGH 1 • 3708 LOAD TORQ LOW 2 < 3709 LOAD TORQ HIGH 2 • 3711 LOAD TORQ LOW 3 < 3712 LOAD TORQ HIGH 3 • 3714 LOAD TORQ LOW 4 < 3715 LOAD TORQ HIGH 4 • 3717 LOAD TORQ LOW 5 < 3718 LOAD TORQ HIGH 5.

Embedded Fieldbus Faults

Embedded fieldbus faults can be traced by monitoring group Group 53: EFB Protocol parameters. See also fault/alarm SERIAL 1 ERR.

No Master Device

If there is no master device on line, parameter 5306 EFB OK MESSAGES and 5307 EFB CRC ERRORS values remain unchanged.

What to do:

- Check that the network master is connected and properly configured.
- Check the cable connection.

Same Device Address

If two or more devices have the same address, parameter 5307 EFB CRC ERRORS value increases with every read/write command.

What to do:

- Check the device addresses. No two devices on line may have the same address.

Incorrect Wiring

If the communication wires are swapped (terminal A on one device is connected to terminal B on another device), parameter 5306 EFB OK MESSAGES value remains unchanged and parameter 5307 EFB CRC ERRORS increases.

What to do:

- Check the RS-232/485 interface connection.

What This Chapter Contains

The chapter contains preventive maintenance instructions and LED indicator descriptions.

Maintenance Intervals

If installed in an appropriate environment, the drive requires very little maintenance. The table lists the routine maintenance intervals recommended by Daikin McQuay.

Table 71: Maintenance Interval Instructions

Maintenance	Interval	Instructions
Reforming of capacitors	Every year when stored	See Capacitors on page 100.
Check of dustiness, corrosion and temperature	Every year	—
Replacement of the cooling fan (frame sizes R1…R4)	Every three years	See Cooling fan on page 99.
Check and tightening of the power terminals	Every six years	
Replacement of the battery in the Assistant Control Panel	Every ten years	See Changing the battery in the Assistant Control Panel on page 101.

Consult your local Daikin McQuay representative for more details on the maintenance. On the Internet, go to http://www.abb.com/drives and select Drive Services – Maintenance and Field Services.

Cooling Fan

The drive's cooling fan has a life span of minimum 25 000 operating hours. The actual life span depends on the drive usage and ambient temperature.

When the Assistant Control Panel is in use, the Notice Handler Assistant informs when the definable value of the operating hour counter is reached (see parameter 2901 COOLING FAN TRIG). This information can also be passed to the relay output (see parameter 1401 RELAY OUTPUT 1) regardless of the used panel type.

Fan failure can be predicted by the increasing noise from the fan bearings. If the drive is operated in a critical part of a process, fan replacement is recommended once these symptoms start appearing. Replacement fans are available from ABB. Do not use other than Daikin specified spare parts.

Replacing the Cooling Fan (frame sizes R1…R4)

Only frame sizes R1…R4 include a fan; frame size R0 has natural cooling.

⚠ WARNING

Read and follow the instructions in chapter Safety on page 15. Ignoring the instructions can cause physical injury or death, or damage to the equipment.

1. Stop the drive and disconnect it from the power line. Wait for five minutes to let the drive DC capacitors discharge. Ensure by measuring with a multimeter (impedance at least 1 Mohm) that there is no voltage present.
2. Remove the hood if the drive has the NEMA 1 option.
3. Lever the fan holder off the drive frame with eg a screwdriver and lift the hinged fan holder slightly upward from its front edge.
4. Free the fan cable from the clip in the fan holder.
5. Disconnect the fan cable. Use long-nose pliers if needed.

Figure 28: Disconnecting Fan Cable

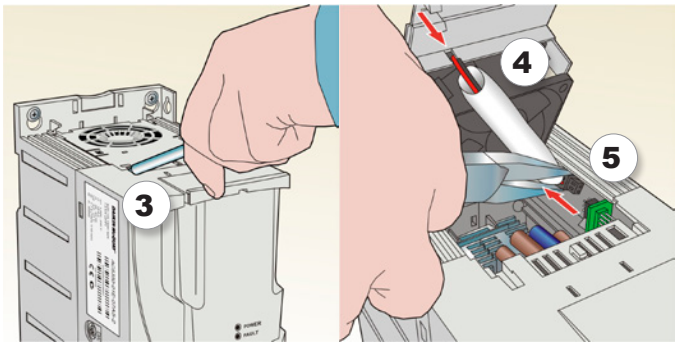
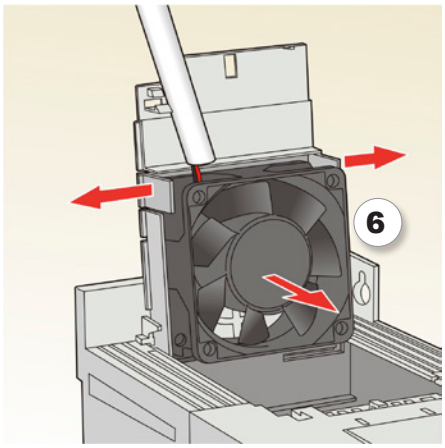


Figure 29: Removing the Fan



6. Remove the fan from the holder.
7. Install the new fan in reverse order.
8. Restore power.

Capacitors

Reforming the Capacitors

The capacitors must be reformed if the drive has been stored for a year. For information on reforming the capacitors, refer to Guide for Capacitor Reforming (3AFE68735190 [English]), available on the Internet (go to http://www.abb.com and enter the code in the Search field).

Power Connections

⚠ WARNING

Read and follow the instructions in chapter Safety on page 15. Ignoring the instructions can cause physical injury or death, or damage to the equipment.

1. Stop the drive and disconnect it from the power line. Wait for five minutes to let the drive DC capacitors discharge. Ensure by measuring with a multimeter (impedance at least 1 Mohm) that there is no voltage present.
2. Check the tightness of the power cable connections.
3. Restore power.

Control Panel

Cleaning the Control Panel

Use a soft damp cloth to clean the control panel. Avoid harsh cleaners which could scratch the display window.

Changing the Battery in the Assistant Control Panel

A battery is only used in Assistant Control Panels that have the clock function available and enabled. The battery keeps the clock operating in memory during power interruptions.

The expected life for the battery is greater than ten years. To remove the battery, use a coin to rotate the battery holder on the back of the control panel. Replace the battery with type CR2032.

NOTE: The battery is NOT required for any control panel or drive functions, except the clock.

LEDs

There is a green and a red LED on the front of the drive. They are visible through the panel cover but invisible if a control panel is attached to the drive. The Assistant Control Panel has one LED. The table below describes the LED indications.

Table 72: LED Indications

Where	LED off	LED lit and steady			LED blinking		
On the front of the drive. If a control panel is attached to the drive, switch to remote control (otherwise a fault will be generated), and then remove the panel to be able to see the LEDs.	No power	Green	●	Power supply on the board OK	Green	☀	Drive in an alarm state
		Red	●	Drive in a fault state. To reset the fault, press RESET from the control panel or switch off the drive power.	Red	☀	Drive in a fault state. To reset the fault, switch off the drive power.
At the top left corner of the Assistant Control Panel	Panel has no power or no drive connection.	Green	●	Drive in a normal state	Green	☀	Drive in an alarm state
		Red	●	Drive in a fault state. To reset the fault, press RESET from the control panel or switch off the drive power.	Red	☀	—

What This Chapter Contains

The chapter contains the technical specifications of the drive, eg ratings, sizes and technical requirements as well as provisions for fulfilling the requirements for CE and other marks.

Table 73: Ratings, Types and Voltages

HP	Ratings					Frame Size
	Input		Output			
	Nominal without Reactor A	Nominal with 5% Reactor A	Continous @ 50C, 10% Overload[1] A	Continous @ 40C, 0% Overload A	Instantaneous Peak[2] A	
1-phase supply voltage 200 - 240 V units (Confirm output ratings meet motor requirements)						
0.5	11.4	N/A	4.5	4.7	7.9	R1
1.0	16.1	N/A	6.5	6.7	11.4	R1
2.0	16.8	N/A	7.2	7.5	12.6	R2
3.0	21.0	N/A	9.4	9.8	16.5	R2
3-phase supply voltage 200 - 240 V units						
0.5	8.4	5.2	4.7	5.2	8.2	R1
2.0	13.2	8.3	7.5	8.3	13.1	R1
3.0	15.7	10.8	9.8	10.8	17.2	R2
5.0	27.3	19.4	17.6	19.4	30.8	R2
7.5	45.0	26.8	24.4	26.8	42.7	R3
10.0	55.0	34.1	31.0	34.1	54.3	R4
15.0	76.0	50.8	46.2	50.8	80.9	R4
3-phase supply voltage 380 - 480 V units						
0.5	2.2	1.2	1.1	1.2	2.1	R0
1.0	4.1	2.4	2.2	2.4	4.2	R1
2.0	6.9	4.1	3.7	4.1	7.2	R1
3.0	9.6	5.6	5.1	5.6	9.8	R1
4.0	11.6	7.3	6.6	7.3	12.8	R1
5.0	13.6	8.8	8.0	8.8	15.4	R1
7.5	18.8	12.5	11.4	12.5	21.9	R3
10.0	22.1	15.6	14.2	15.6	27.3	R3
15.0	30.9	23.1	21.0	23.1	40.4	R3
20.0	52.0	31.0	28.2	31.0	54.3	R4
25.0	61.0	38.0	34.5	38.0	66.5	R4
30.0	67.0	44.0	40.0	44.0	77.0	R4

1) Overloadability for one minute every ten minutes.
2) Instantaneous peak current for two seconds every ten minutes.

Definition

R0…R4 ACS320 is manufactured in frame sizes R0…R4. Some instructions and other information that only concern certain frame sizes are marked with the symbol of the frame size (R0…R4)

Sizing

The current ratings are the same regardless of the supply voltage within one voltage range. To achieve typical motor power, the rated current of the drive must be higher than or equal to the rated motor current.

NOTE: 1) The maximum allowed motor shaft power is limited to $1.5 \cdot P_N$ (where P_N = typical motor power). If the limit is exceeded, motor torque and current are automatically restricted. The function protects the input bridge of the drive against overload.

2) The ratings apply at ambient temperature of 40°C (104°F).

Derating

The load capacity decreases if the installation site ambient temperature exceeds 40 °C (104 °F) or if the altitude exceeds 1000 meters (3300 ft).

Temperature Derating

In the temperature range +40 °C…+50 °C (+104 °F…+122 °F), the rated output current is decreased by 1% for every additional 1 °C (1.8 °F). The output current is calculated by multiplying the current given in the rating table by the derating factor.

Example: If the ambient temperature is 50°C (+122°F), the derating factor is 100% - 1 $\frac{\%}{°C}$ · 10°C = 90% or 0.90. The output current is then $0.90 \cdot I_{2N}$ (where I_{2N} = continuous output at 40°C, 0% overload)

Altitude Derating

In altitudes 1000…2000 m (3300…6600 ft) above sea level, the derating is 1% for every 100 m (330 ft).

Switching Frequency Derating

Derate according to the switching frequency used (see parameter 2606 SWITCHING FREQ) as follows:

Switching Frequency	Drive Voltage Rating	
	UN = 200…240 V	UN = 380…480 V
4 kHz	No derating	No derating
8 kHz	Derate I_{2N} to 90%.	Derate I_{2N} to 75% for R0 or to 80% for R1…R4.
12 kHz	Derate I_{2N} to 80%.	Derate I_{2N} to 50% for R0 or to 65% for R1…R4 and derate maximum ambient temperature to 30 °C (86 °F).
16 kHz	Derate I_{2N} to 75%.	Derate I_{2N} to 50% and derate maximum ambient temperature to 30°C (86°F)

I_{2N} = continuous output at 40°C, 0% overload.

Electric Power Network Specification

Voltage (U_1)	200/208/220/230/240 V AC 1-phase for 200 V AC drives
	200/208/220/230/240 V AC 3-phase for 200 V AC drives
	380/400/415/440/460/480 V AC 3-phase for 400 V AC drives
	±10% variation from converter nominal voltage is allowed as default.
Short-circuit capacity	Maximum allowed prospective short-circuit current at the input power connection as defined in IEC 60439-1 is 100 kA. The drive is suitable for use in a circuit capable of delivering not more than 100 kA rms symmetrical amperes at the drive maximum rated voltage.
Frequency	50/60 Hz ± 5%, maximum rate of change 17%/s
Imbalance	Max. ±3% of nominal phase to phase input voltage

Motor Connection Data

Voltage (U_2)	0 to U_1, 3-phase symmetrical, Umax at the field weakening point
Short-circuit protection (IEC 61800-5-1, UL 508C)	The motor output is short-circuit proof by IEC 61800-5-1 and UL 508C.
Frequency	0…500 Hz
Frequency resolution	0.01 Hz
Current	See section Ratings, types and voltages on page 349.
Power limit	1.5 · PN
Field weakening point	10…500 Hz
Switching frequency	4, 8, 12 or 16 kHz
Maximum recommended motor cable length	R0: 30 m (100 ft), R1…R4: 50 m (165 ft) With output chokes the motor cable length may be extended to 60 m (195 ft) for R0 and 100 m (330 ft) for R1…R4. To comply with the European EMC Directive, use the cable lengths specified in the table below for 4 kHz switching frequency. The lengths are given for using the drive with the internal EMC filter or an optional external EMC filter.

4 kHz switching frequency	Internal EMC filter	Optional external EMC filter
Second environment (category C3[1])	30 m (100 ft)	30 m (100 ft) minimum
First environment (category C2[1])	—	30 m (100 ft)

Control Connection Data

Analog inputs X1A: 2 and 5	Voltage signal, unipolar	0 (2)…10 V, Rin > 312 kohm
	bipolar	-10…10 V, Rin > 312 kohm
	Current signal, unipolar	0 (4)…20 mA, Rin = 100 ohm
	bipolar	-20…20 mA, Rin = 100 ohm
	Potentiometer reference value (X1A: 4)	10 V ± 1%, max. 10 mA, R < 10 kohm
	Resolution	0.1%
	Accuracy	±1%
Analog output X1A: 7		0 (4)…20 mA, load < 500 ohm
Auxiliary voltage X1A: 9		24 V DC ± 10%, max. 200 mA
Digital inputs X1A: 12…16 (frequency input X1A: 16)	Voltage	12…24 V DC with internal or external supply
	Type	PNP and NPN
	Frequency input	Pulse train 0…16 kHz (X1A: 16 only)
	Input impedance	2.4 kohm
Relay output X1B: 17…19	Type	NO + NC
	Max. switching voltage	250 V AC / 30 V DC
	Max. switching current	0.5 A / 30 V DC; 5 A / 230 V AC
	Max. continuous current	2 A rms
Digital output X1B: 20…21	Type	Transistor output PNP
	Max. switching voltage	30 V DC
	Max. switching current	100 mA / 30 V DC, short-circuit protected
	Frequency	10Hz …16 kHz
	Resolution	1Hz
	Accuracy	0.2%
RS-485 interface X1C: 23…26	Cable	Shielded twisted pair, impedance 100…150 ohm
	Termination	Daisy chained bus without drop out lines
	Isolation	Bus interface isolated from the drive
	Transfer rate	1.2…76.8 kbit/s
	Communication type	Serial, asynchronous, half duplex
	Protocol	Modbus

Efficiency

Approximately 95 to 98% at nominal power level, depending on the drive size and options

Degrees of Protection

IP20 (cabinet installation) / UL open: Standard enclosure. The drive must be installed in a cabinet to fulfil the requirements for shielding from contact.

IP20 / NEMA 1: Achieved with an option kit including a hood and a connection box.

Ambient Conditions

Environmental limits for the drive are given below. The drive is to be used in a heated indoor controlled environment.

	Operation installed for stationary use	Storage in the protective package	Transportation in the protective package
Installation site altitude	0 to 2000 m (6600 ft) above sea level (above 1000 m [3300 ft], see section Derating on page 350)	—	—
Air temperature	-10 to +50 °C (14 to 122 °F). No frost allowed. See section Derating on page 350.	-40 to +70 °C (-40 to +158 °F)	-40 to +70 °C (-40 to +158 °F)
Relative humidity	0 to 95%	Max. 95%	Max. 95%
	No condensation allowed. Maximum allowed relative humidity is 60% in the presence of corrosive gases.		
Contamination levels (IEC 60721-3-3, IEC 60721-3-2, IEC 60721-3-1)	No conductive dust allowed.		
	According to IEC 60721-3-3, chemical gases: Class 3C2 solid particles: Class 3S2. The drive must be installed in clean air according to enclosure classification. Cooling air must be clean, free from corrosive materials and electrically conductive dust.	According to IEC 60721-3-1, chemical gases: Class 1C2 solid particles: Class 1S2	According to IEC 60721-3-2, chemical gases: Class 2C2 solid particles: Class 2S2
Sinusoidal vibration (IEC 60721-3-3)	Tested according to IEC 60721-3-3, mechanical conditions: Class 3M4 2…9 Hz, 3.0 mm (0.12 in) 9…200 Hz, 10 m/s2 (33 ft/s2)	—	—
Shock (IEC 60068-2-27, ISTA 1A)	—	According to ISTA 1A. Max. 100 m/s2 (330 ft/s2), 11 ms.	According to ISTA 1A. Max. 100 m/s2 (330 ft/s2), 11 ms.
Free fall	Not allowed	76 cm (30 in)	76 cm (30 in)

Materials

Drive enclosure	• PC/ABS 2 mm, PC+10%GF 2.5…3 mm and PA66+25%GF 1.5 mm, all in color NCS 1502-Y (RAL 9002 / PMS 420 C)
	• hot-dip zinc coated steel sheet 1.5 mm, thickness of coating 20 micrometers
	• extruded aluminium AlSi.
Package	Corrugated cardboard.
Disposal	The drive contains raw materials that should be recycled to preserve energy and natural resources. The package materials are environmentally compatible and recyclable. All metal parts can be recycled. The plastic parts can either be recycled or burned under controlled circumstances, according to local regulations. Most recyclable parts are marked with recycling marks. If recycling is not feasible, all parts excluding electrolytic capacitors and printed circuit boards can be landfilled. The DC capacitors contain electrolyte, which is classified as hazardous waste within the EU. They must be removed and handled according to local regulations.
	For further information on environmental aspects and more detailed recycling instructions, please contact your local Daikin distributor.

Applicable standards

	The drive complies with the following standards:
• IEC/EN 61800-5-1: 2003	Electrical, thermal and functional safety requirements for adjustable frequency a.c. power drives
• IEC/EN 60204-1: 2006	Safety of machinery. Electrical equipment of machines. Part 1: General requirements. Provisions for compliance: The final assembler of the machine is responsible for installing - an emergency-stop device - a supply disconnecting device.
• IEC/EN 61800-3: 2004	Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods
• UL 508C	UL Standard for Safety, Power Conversion Equipment, third edition

UL Marking

See the type designation label for the valid markings of your drive.

The UL mark is attached to the drive to verify that it meets UL requirements.

UL Checklist

Ambient Conditions – The drives are to be used in a heated indoor controlled environment. See section Ambient conditions on page 106 for specific limits.

Input Cable Fuses – For installation in the United States, branch circuit protection must be provided in accordance with the National Electrical Code (NEC) and any applicable local codes. To fulfil this requirement, use the UL classified fuses given in section Power cable sizes and fuses on page 104.

For installation in Canada, branch circuit protection must be provided in accordance with Canadian Electrical Code and any applicable provincial codes. To fulfil this requirement, use the UL classified fuses given in section Power cable sizes and fuses on page 104.

Overload Protection – The drive provides overload protection in accordance with the National Electrical Code (US).

NOTE: Input power connection, disconnecting device, power cable selection and connection are all done at the factory.

Daikin Applications

Parameter Settings:

The MD4 VFD has been made to Daikin specifications. All factory installed MD4 VFDs with MicroTech III controls are also factory configured and started. Table 74 lists the parameters that have been specifically configured for Daikin or may need owner adjustment as described in this manual.

- "HVAC Default" settings mentioned in the Table 74 note is the vendor default if Parameter 9902 is set as shown.
- "Daikin Settings" are the recommended settings for Daikin units.
- No other parameters should be needed or adjusted.

⚠ WARNING

Unintended Equipment Operation

• Modifying or changing parameters whose function is not described in this manual will affect drive controller operation. Some register changes will take effect as soon as they are entered.

• Do not modify or change parameters whose function is not described in this instruction bulletin.

Failure to follow this instruction can result in death, serious injury, or equipment damage.

Table 74: Parameter Settings

MD4 Parameters		Unit	RoofPak & Self C	Maverick II	Maverick II	RPS / RDT / RCS	RPE / RDE	RoofPak	Maverick II & Rebel
#	Name		SAF, RAF & EAF	SAF	EAF	Condenser Fan	Condenser Fan	Energy Rec Wheel	Energy Rec Wheel
9802	COMM PROT SEL		STD MODBUS	STD MODBUS	STD MODBUS	Not Selected	STD MODBUS	STD MODBUS	STD MODBUS
9901	LANGUAGE		ENGLISH	ENGLISH	ENGLISH	ENGLISH	ENGLISH	ENGLISH	ENGLISH
9902	APPLIC MARCO		HVAC DEFAULT	HVAC DEFAULT	HVAC DEFAULT	HVAC DEFAULT	HVAC DEFAULT	HVAC DEFAULT	HVAC DEFAULT
9905	MOTOR NOM VOLT	V	460	460	460	460	460	460	460
9906	MOTOR NOM CURR	A	35	24	4	2.6	11.2	1.1	0.5
9907	MOTOR NOM FREQ	Hz	60	60	60	60	60	60	60
9908	MOTOR NOM SPEED	rpm	1775	1775	1140	1142	1775	1775	1775
9909	MOTOR NOM POWER	hp	30	20	3	1.5	5	1	0.2
1001	EXT1 COMMANDS		COMM	COMM	COMM	DI1	COMM	COMM	COMM
1102	EXT1/EXT2 SEL		EXT1	EXT1	EXT1	EXT1	EXT1	EXT1	EXT1
1103	REF1 SELECT		COMM	COMM	COMM	AI 1	COMM	COMM	COMM
1104	REF1 MIN	Hz	0	0	0	24	0	0	0
1105	REF1 MAX	Hz	60	60	60	60	60	60	60
1106	REF2 SELECT		KEYPAD	KEYPAD	KEYPAD	KEYPAD	KEYPAD	KEYPAD	KEYPAD
1201	CONST SPEED SEL		NOT SEL	NOT SEL	NOT SEL	DI 3	NOT SEL	NOT SEL	NOT SEL
1601	RUN ENABLE		COMM	COMM	COMM	DI 2	COMM	COMM	COMM
1604	FAULT RESET SEL		COMM	COMM	COMM	KEYPAD	COMM	COMM	COMM
1607	PARAM SAVE		DONE	DONE	DONE	DONE	DONE	DONE	DONE
1608	START ENABLE 1		COMM	COMM	COMM	DI 4	NOT SEL	COMM	COMM
1611	PARAMETER VIEW		LONG VIEW	LONG VIEW	LONG VIEW	LONG VIEW	LONG VIEW	LONG VIEW	LONG VIEW
2101	START FUNCTION		SCAN START	SCAN START	SCAN START	SCAN START	SCAN START	SCAN START	SCAN START
2202	ACCELER TIME 1	s	60	60	60	10	5	60	60
2203	DECELER TIME 1	s	60	60	60	10	30	60	60
2605	U/F RATIO		LINEAR	LINEAR	LINEAR	LINEAR	LINEAR	LINEAR	LINEAR
3003	EXTERNAL FAULT 1		DI 2(INV)	NOT SEL	NOT SEL	NOT SEL	NOT SEL	NOT SEL	NOT SEL
3009	BREAK POINT FREQ	Hz	45	45	45	45	45	45	45
3101	NUMBER TRIALS		5	5	5	5	5	5	5
3103	DELAY TIME	s	3	3	3	3	3	3	3
3104	AR OVERCURRENT		ENABLE	ENABLE	ENABLE	DISABLE	ENABLE	ENABLE	ENABLE
3404	OUTPUT1 DSP FORM		DIRECT	DIRECT	DIRECT	+0.0	+0.0	DIRECT	DIRECT
3405	OUTPUT1 UNIT		%	Hz	Hz	% SP	Hz	Hz	Hz
3415	SIGNAL3 PARAM		AI 1	SPEED	SPEED	AI 1	SPEED	SPEED	SPEED
3418	OUTPUT3 DSP FORM		+0.0	DIRECT	DIRECT	+0.0	DIRECT	DIRECT	DIRECT
3421	OUTPUT3 MAX		44ma	1800 rpm	1800 rpm	10v	1800rpm	1800 rpm	1800 rpm
4201	GAIN		The Daikin software version [will grow over time]						
4202	INTEGRATION TIME	s	279	252	228	106	103	202	204
5302	EFB STATION ID		SAF=1,R/EAF=2	1	2	1	4	3	3
5303	EFB BAUD RATE		192	192	192	96	192	192	192
5304	EFP PARITY		8 NONE 2	8 NONE 2	8 NONE 2	Values Vary	8 NONE 2	8 NONE 2	8 NONE 2
5306	EFB OK MESSAGES			Usually a big number that continues to grow					
5307	EFB CRC ERRORS		0	0	0	0	0	0	0
5308	EFB UART ERRORS		Should be a small number that rarely grows unless a MicroTech III communication problem occurred						
5309	EFB STATUS		ON-LINE	ON-LINE	ON-LINE	ON-LINE	ON-LINE	ON-LINE	ON-LINE
8120	INTERLOCKS		NOT SEL	NOT SEL	NOT SEL	DI 4	NOT SEL	NOT SEL	NOT SEL
1002	EXT2 COMMANDS		NOT SEL	NOT SEL	NOT SEL	DI 1	NOT SEL	NOT SEL	NOT SEL
1301	MINIMUM AI1	%	MicroTech III limits minimum speed to 20 hz			10	MicroTech III limits minimum speed to 20 hz		
1302	MAXIMUM AI1	%	MicroTech III limits maximum speed to 60 hz			50	MicroTech III limits maximum speed to 60 hz		
1303	FILTER AI1	s				0.1			
3502	INPUT SELECTION					AI 1			
4210	SET POINT SEL					AI 1			
1202	CONST SPEED 1	Hz				60			
1401	RELAY OUTPUT 1					FAULT			

Vary depending on motor nameplate voltage and hp
These values vary depending on the application
Not important, will be HVAC default values

MicroTech III Control Parameters:

The MD4 will be factory configured to work with MicroTech III Controls and factory tested. The downloaded parameters have a high probability of being fully correct if the following parameters are set.

- Parameter 9802 states: “STD MODBUS”.
- Parameter 1001, 1103, 1601, 1604 and 1608 state: “COMM”.
- Parameter 5302 = address 1, 2 or 3 as required by the application.
- Parameter 5303 = “192” buad rate (19.2 K Bytes/second).
- Parameter 5304 = “8 NONE 2”.
- Parameter 5306 “EFB OK MESSAGES” will count up for every correct message received and continue to do so.
- Parameter “EFB STATUS” shows “ON-LINE”.
- Parameter 8120 states “NOT SEL”. If “DI4” is seen. This must be changed to = “NOT SEL”.
- Parameter 1020 states “NOT SEL”. Change to = “NOT SEL” if needed.

Factory Communications Troubleshooting Instructions

Reference: Diagnostics – EFB on page 81.

Possible Faults

- Loose wires. Difficult to discover, check mechanical tightness of all terminal connection points. Other faults specifically described below may be observed.
- Incorrect connections (including swapped wires).
- Bad grounding. Check for excessive EFB errors; improve communications cable installation as required.
- MicroTech III does not properly recognize the difference between the SAF, RAF and EAF condenser fan or energy recovery VFDs if the values for both 5307 and 5308 increase for each error transmission attempt.
- MicroTech III communications is not working if parameters 5306, 5307 or 5308 do not continually increment their count.
- The Modbus communication port is not working (broken or controller is OFF) if ALARM 2021 is flashing on the kepad screen, parameter 5306 is not increasing its count, or parameter 5309 “EFB STATUS” shows on the keypad as “IDLE”.
- The Daikin Factory Test Operator will change any Group 99 values to match the installed motor nameplates as required for Rooftop and Self-Contained units. Maverick units have specific allowed motor amp values that are entered into the VFD matching the design specification. Generic ACS320 Parameter Subset example that has never been loaded into a VFD.

Figure 30: MD4 Maverick II — Supply Fan, Exhaust Fan and Energy Recovery Wheel

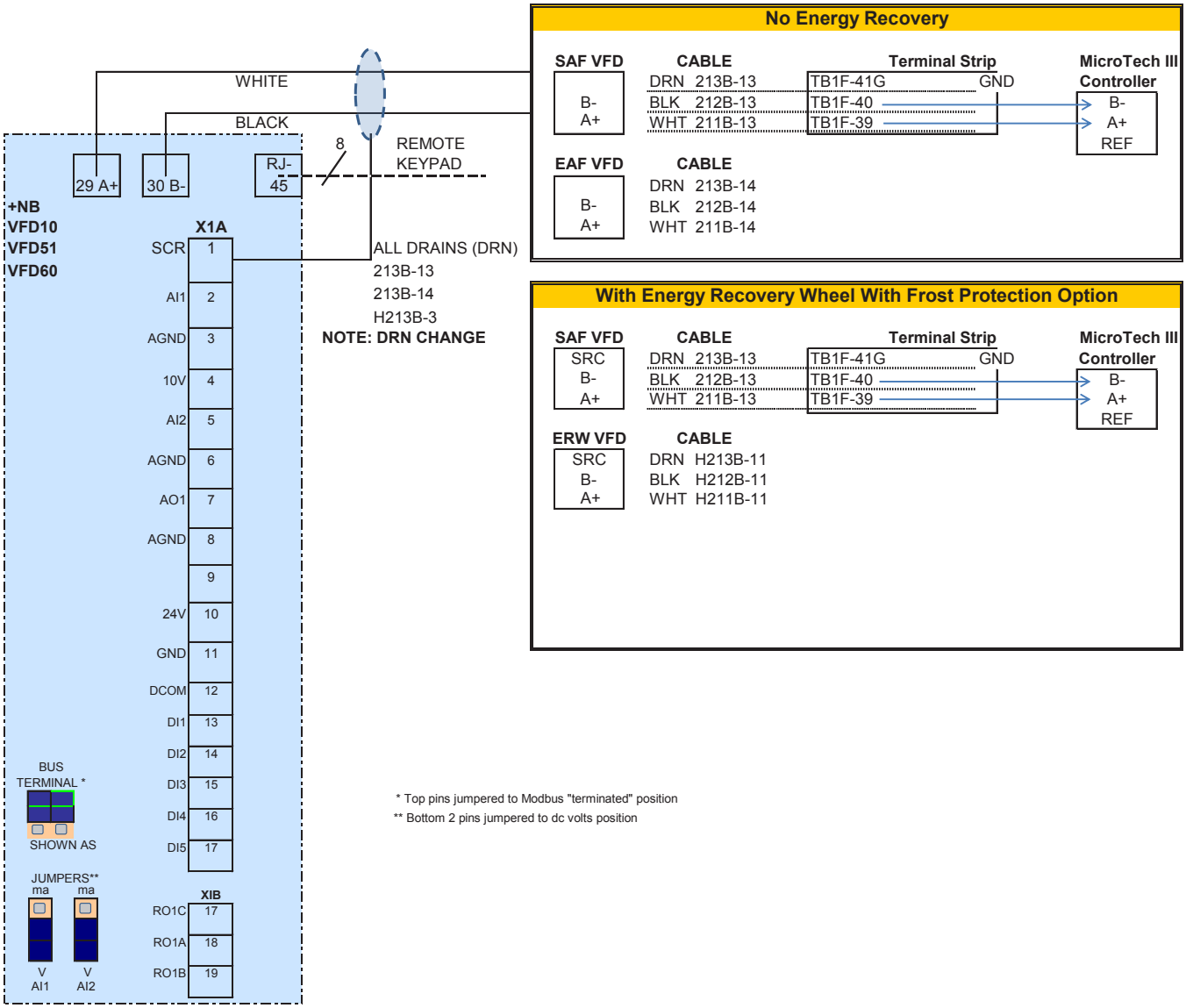


Figure 31: MD4 RoofPak and Self-Contained Air Conditioner Supply Air Fan

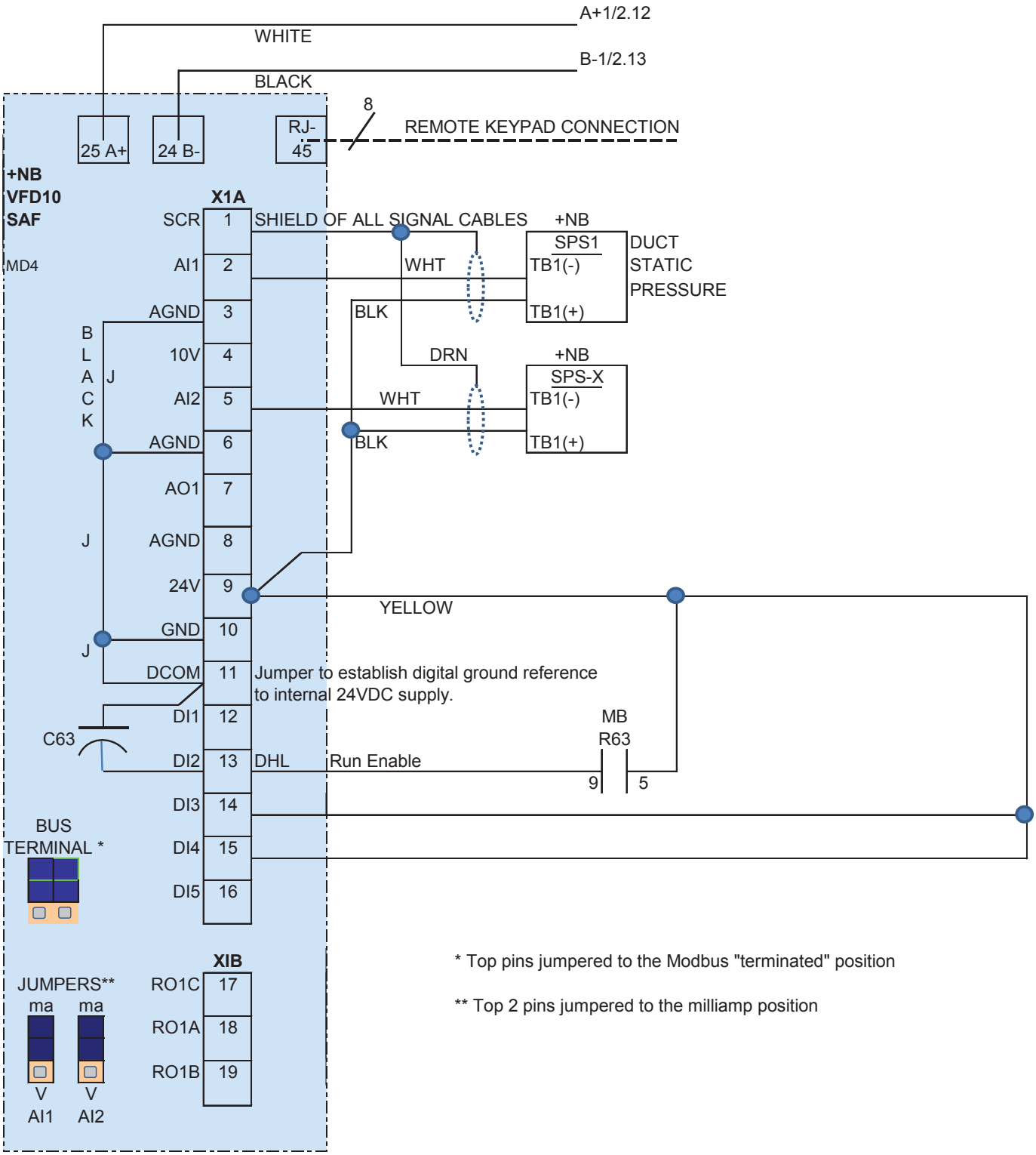


Figure 32: MD4 RoofPak Condenser Fan Speed Control

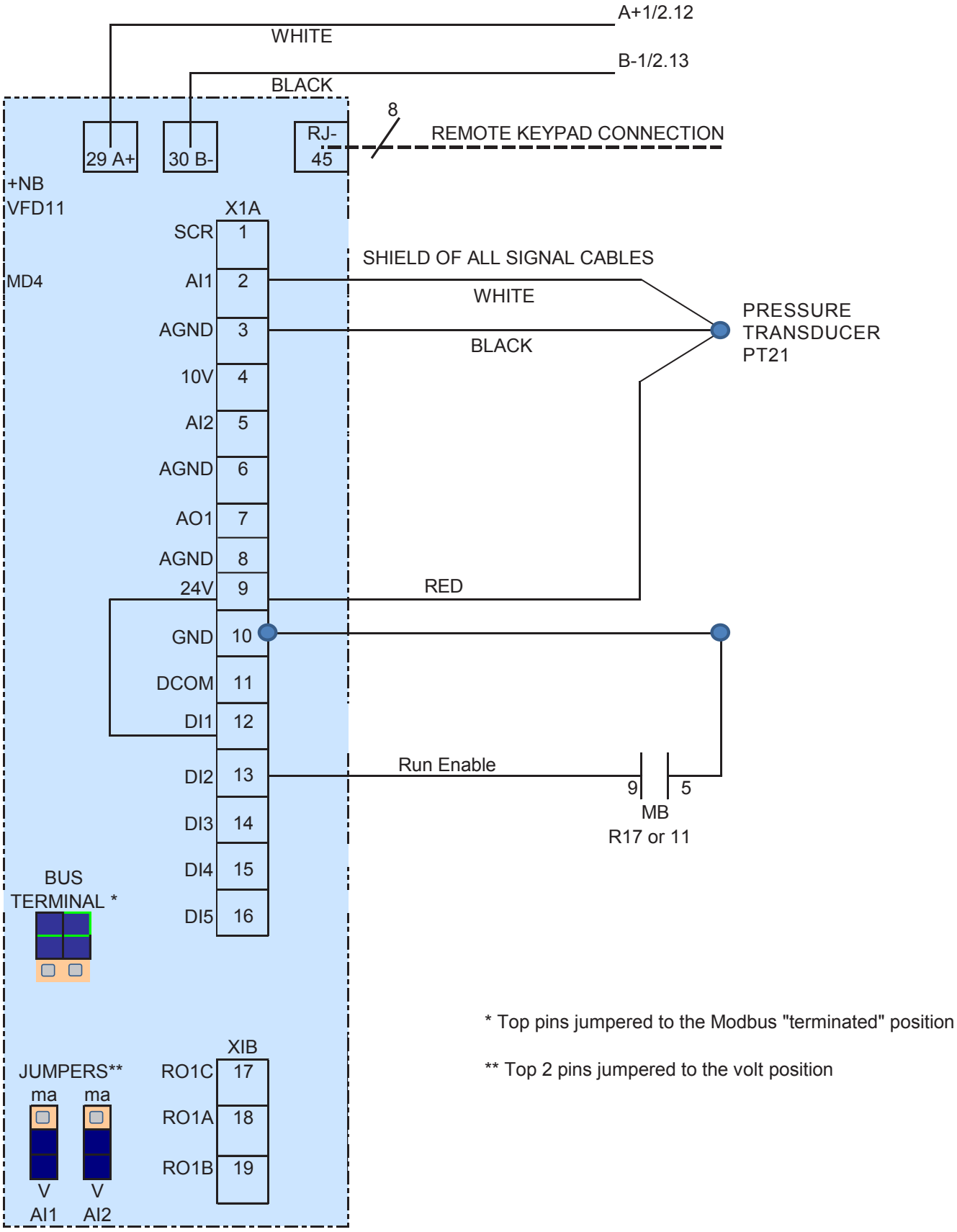
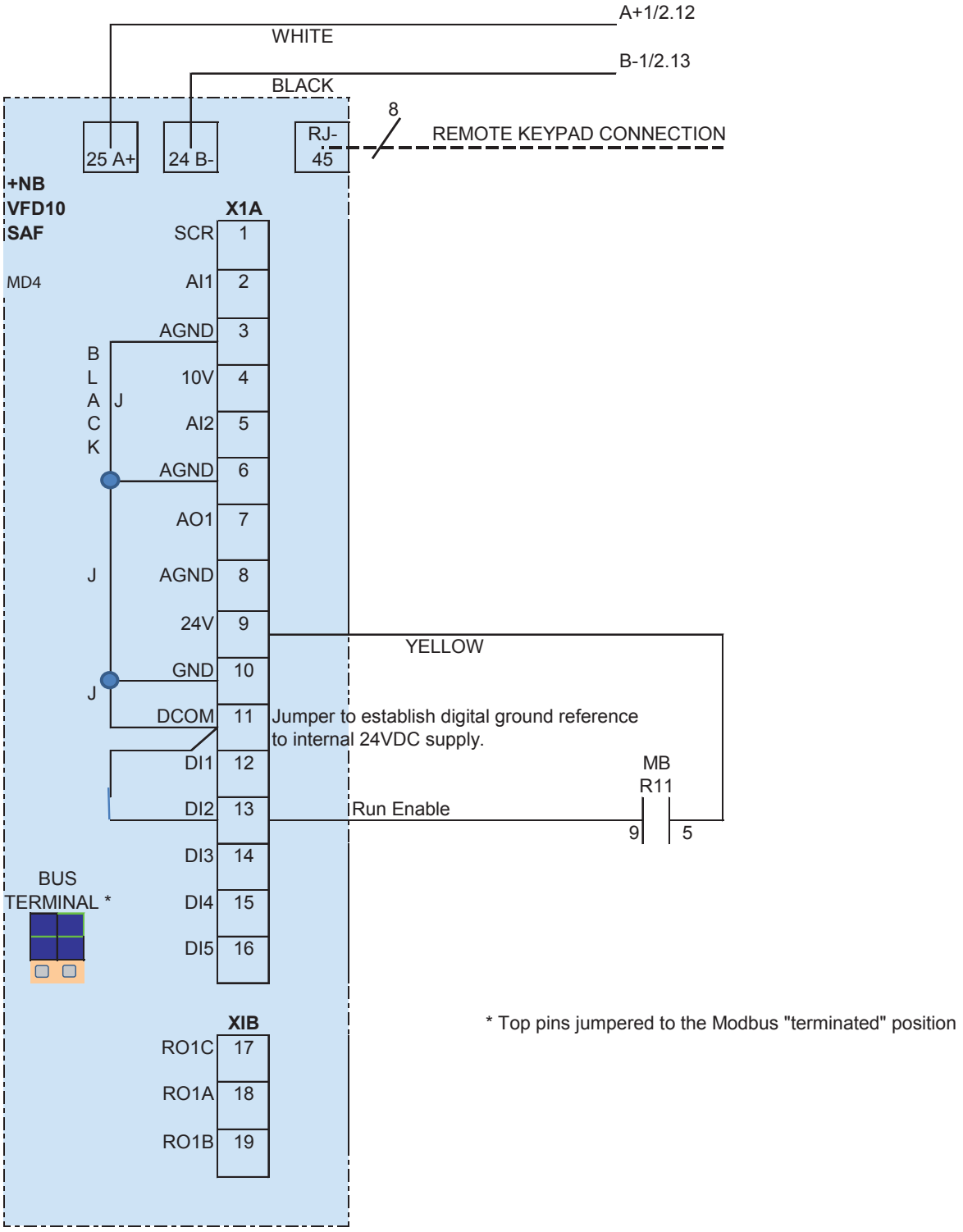


Figure 33: MD4 RoofPak — Energy Recovery Wheel, Frost Control Option



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