Altivar® 21
Programming and Operation Guide

Instruction Bulletin

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HAZARD CATEGORIES AND SPECIAL SYMBOLS

The following symbols and special messages may appear in this manual or on the equipment to warn of potential hazards.

A lightning bolt or ANSI man symbol in a “Danger” or “Warning” safety label on the equipment indicates an electrical hazard which, as indicated below, can or will result in personal injury if the instructions are not followed.

An exclamation point symbol in a safety message in the manual indicates potential personal injury hazards. Obey all safety messages introduced by this symbol to avoid possible injury or death.

Symbol	Name
	Lightning Bolt
	ANSI Man
	Exclamation Point

⚠ DANGER

DANGER indicates an imminently hazardous situation which, if not avoided, **will result in** death or serious injury.

⚠ WARNING

WARNING indicates a potentially hazardous situation which, if not avoided, **can result in** death or serious injury.

⚠ CAUTION

CAUTION indicates a potentially hazardous situation which, if not avoided, **can result in** minor or moderate injury.

CAUTION

CAUTION, used without the safety alert symbol, indicates a potentially hazardous situation which, if not avoided, **can result in** property damage.

PRODUCT SUPPORT

For support and assistance, contact the Product Support Group. The Product Support Group is staffed from 8:00 am until 6:00 pm Eastern time to assist with product selection, start-up, and diagnosis of product or application problems. Emergency phone support is available 24 hours a day, 365 days a year.

Toll Free	888-Square D (888-778-2733)
E-mail	drive.products.support@us.schneider-electric.com
Fax	919-217-6508

SECTION 1— INTRODUCTION

PRODUCT RANGE

The Altivar 21 (ATV21) family of adjustable speed AC drive controllers is used for controlling three-phase asynchronous motors in variable torque applications. The controllers range from:

- 1 to 40 hp, 208/240 V, three-phase input
- 1 to 100 hp, 480 V, three-phase input
- 0.75 to 30 kW, 200 V, three-phase input
- 0.75 to 75 kW, 400 V, three-phase input

ABOUT THIS DOCUMENT

This manual contains programming instructions for ATV21 drive controllers. The following documentation is also provided with the controller:

- *Altivar® 21 Installation Guide,* 30072-451-61
- *Altivar® 21 Start-Up Guide,* 30072-451-90
- *Altivar® 21 Remote Keypad Display VW3A21101,* 30072-451-72

Refer to the *Altivar 21® Installation Guide*, 30072-451-61, for instructions on receiving, inspection, mounting, installation, and wiring. Refer to the *Altivar 21® Start-Up Guide* for instructions on bringing the drive controller into service with the factory configuration.

CONFIGURATION SETTINGS AND PARAMETER INDEX

This document contains an index of the configurable parameters beginning on page 141. Use the Configuration Settings Table to record customized parameter settings, to look up parameter default settings, and to look up sections of the manual that contain detailed parameter descriptions.

BEFORE YOU BEGIN

Read and follow these precautions before beginning any procedure with this drive controller.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Read and understand this manual before installing or operating the Altivar 21 (ATV21) drive controller. Installation, adjustment, repair, and maintenance must be performed by qualified personnel.
- The user is responsible for compliance with all international and national electrical code requirements with respect to grounding of all equipment.
- Many parts of this drive controller, including the printed circuit boards, operate at the line voltage. DO NOT TOUCH. Use only electrically insulated tools.
- DO NOT touch unshielded components or terminal strip screw connections with voltage present.
- DO NOT short across terminals PA/+ and PC/– or across the DC bus capacitors.
- Before servicing the drive controller:
  - — Disconnect all power.
  - — Place a “DO NOT TURN ON” label on all power disconnects.
  - — Lock all power disconnects in the open position.
  - — Disconnect all power, including external control power that may be present, before servicing the drive controller. WAIT 15 MINUTES to allow the DC bus capacitors to discharge. Then follow the “Bus Voltage Measurement Procedure” located in the *Altivar® 21 Installation Guide,* 30072-451-61, to verify that the DC voltage is less than 45 V. The drive LED is not an indicator of the absence of DC bus voltage.
- Install and close all covers before applying power or starting and stopping the drive controller.

Failure to follow these instructions will result in death or serious injury.

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION

Before turning on the drive controller or upon exiting the configuration menus, ensure that the inputs assigned to the Run command are in a state that will not cause the drive controller to run. Otherwise, the motor can start immediately.

Failure to follow these instructions will result in death, serious injury, or equipment damage.

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION

- Prevent accidental grounding of logic inputs configured for sink logic. Accidental grounding can result in unintended activation of drive controller functions.
- Protect the signal conductors against damage that could result in unintentional conductor grounding.
- Follow NFPA 79 and EN 60204 guidelines for proper control circuit grounding practices.

Failure to follow these instructions will result in death or serious injury.

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.[1]
- Each implementation of an Altivar 21 drive controller must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

[1] For additional information refer to NEMA ICS 1.1 (latest edition), “Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control” and to NEMA ICS 7.1 (latest edition), “Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems.”

⚠ WARNING

LOSS OF CONTROL

- Set the communication error trip time to stop the drive controller in case the remote keypad display is deactivated by an unusual event such as tripping, an operation error, or a power outage.
- Ensure that the communication error trip time is properly set before deactivating the remote keypad display.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

⚠ CAUTION

INCOMPATIBLE LINE VOLTAGE

Before turning on and configuring the drive controller, ensure that the line voltage is compatible with the line voltage range specified on the drive controller nameplate. The drive controller can be damaged if the line voltage is not compatible.

Failure to follow these instructions can result in injury or equipment damage.

SECTION 2— DRIVE CONTROLLER OPERATION

LOCAL AND REMOTE MODES OF OPERATION

OVERVIEW

The ATV21 drive controller has two modes of operation, local and remote.

In local mode, the ATV21 drive controller can be operated only from the keypad:

- Use the RUN and STOP keys for command control
- Use the UP and DOWN keys for speed control

In remote mode, the ATV21 drive controller is operated from a combination of the command and speed reference sources defined by programming parameters F M O d and C M O d.

COMMAND SOURCES

The command source (C M O d) choices are:

- External signals to the control terminal logic inputs F, R, RES and VIA
- Serial communication control (Modbus®, Metasys® N2, Apogee® FLN, BACnet, or LonWorks®)
- Keypad RUN and STOP keys

SPEED REFERENCE SOURCES

The speed reference source (F M O d) choices are:

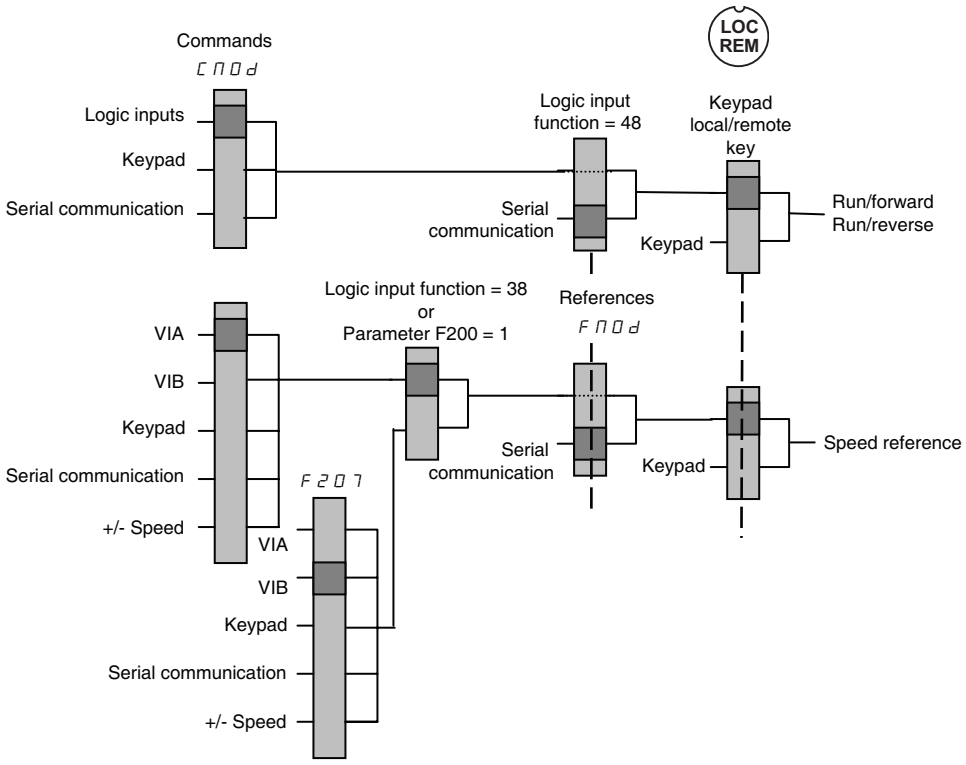
- External signals to the control terminal analog inputs VIA or VIB (4–20 mA, 0–10 Vdc),
- External signals to the control terminal logic inputs assigned to +/- Speed
- Serial communication control (Modbus®, Metasys® N2, Apogee® FLN, BACnet, or LonWorks®)
- Keypad UP and DOWN keys

Changes to parameters F M O d and C M O d can only be made when the drive controller is stopped.

COMMAND MODE SELECTION AND PRIORITIES

Figure 1 illustrates the control inputs and selection logic which determine the source of the drive controller's start/stop and speed reference commands.

Figure 1: Command and Reference Switching



Parameters CMd and FMd are the first layers of logic used by the drive controller to determine its command (CMd) and speed reference (FMd) source.

F207 is a secondary speed reference source that may override the source selected by FMd.

The speed reference source identified by F207 takes control if either

- A logic input assigned to function 38 (frequency reference source switching) is enabled, or
- Parameter F200 is set to 1 and the drive controller's output frequency is equal to or less than 1 Hz.

If a serial communication link is established, it can take control of the ATV21 drive controller, overriding inputs identified by CMd, FMd, and F207. Control is restored to CMd, FMd, and F207 only if:

- The serial communication link relinquishes control, or
- A logic input assigned to function 48 (forced local) is enabled.

The final layer of logic used by the drive controller to determine its command source is the LOC/REM key on the keypad.

When the drive controller is set to local mode (by pressing the LOC/REM key, lighting the local mode LED), the drive controller responds only to commands from the keypad.

SELECTING LOCAL OR REMOTE MODE

Selection between local and remote mode is made with the LOC/REM key on the drive controller's keypad.

The LOC/REM key can be disabled by setting parameter F732 to 1.

When parameter F295 is set to 1 (factory setting), a bumpless transfer of motor operation is achieved when switching from remote to local mode.

For example, if the bumpless transfer feature is active and if the motor is running at full speed with the drive controller in remote mode, the motor will still run at full speed after the drive controller is transferred to local mode.

Conversely, when switching from local to remote modes, a new run and speed command must be given to the ATV21 drive controller once it enters remote mode. Otherwise, the motor will coast to a stop.

LOCAL MODE

When the ATV21 drive controller is in local mode, the LED above the LOC/REM key is illuminated.

STARTING AND STOPPING THE MOTOR IN LOCAL MODE

Start and stop the motor with the RUN and STOP keys on the drive controller keypad.

The setting of parameter F721 determines how the motor stops when the drive controller is in local mode:

- If F721 is set to 0 (factory setting), the motor will stop on a ramp, based on the time value set in parameter dEC (deceleration time 1) or parameter F501 (deceleration time 2).
- If F721 is set to 1, power will be removed from the motor when the STOP key is pressed, allowing the motor to coast to a stop with the ramp-down time determined by inertia and friction.

Use of the RUN and STOP keys in local mode can be disabled using parameter F733.

ADJUSTING MOTOR SPEED IN LOCAL MODE

Set the motor speed using the UP and DOWN keys on the drive controller keypad. Motor speed can be adjusted while the drive controller is operating.

Normally, motor frequency changes by 0.1 Hz each time the UP or DOWN key is pressed. This rate of speed change can be altered by entering a new frequency step change into parameter F707.

If the ENT key is pressed after the motor speed has been adjusted, that speed setpoint value will be entered into parameter FC. The next time the drive controller is started in the local mode, it will accelerate the motor directly to the speed setpoint memorized by FC.

SELECTING MOTOR ROTATION DIRECTION IN LOCAL MODE

Motor rotation direction is set by parameter Fr. The four selections are:

- 0: Forward only (factory setting)
- 1: Reverse only
- 2: Forward, with reverse selectable from the keypad[1]
- 3: Reverse, with forward selectable from the keypad[1]

Motor rotation is indicated on the keypad as Fr-F for forward and as Ff-R for reverse.

The ability to run in the Forward or Reverse direction can be set with parameter F311.

[1] If Fr is set to either 2 or 3, motor rotation can be set to forward by pressing the UP key while holding the ENT key. Reverse can be set by pressing the DOWN key while holding the ENT key.

RESETTING DRIVE CONTROLLER FAULTS IN LOCAL MODE

It is not possible to clear a drive controller fault if the cause of the fault persists. Be sure to diagnose and rectify the cause of the fault before attempting a drive controller reset.

With the STOP Key

To clear a drive controller fault in local mode:

1. Press the STOP key. See Table 69 on page 85 for a list of faults that can be reset with the STOP key. If it is possible to reset the drive controller, the keypad will display CLr.
2. To clear the fault, press the STOP key a second time.
3. If the cause of the fault is still present, the CLr display will not appear. Diagnose and solve the problem before attempting to reset the drive controller.

Use of the STOP key as a fault reset can be set with parameter F735.

In the event of an OL1 or OL2 fault, the following time periods must pass before a fault reset is possible:

- OL1 (drive controller overload)—about 30 seconds after the occurrence of the fault
- OL2 (motor overload)—about 120 seconds after the occurrence of the fault

By Cycling Line Power

A drive controller fault can also be reset by removing and restoring line power. Ensure that the cause of the fault is no longer present and leave power removed long enough for all of the LEDs on the face of the drive controller to extinguish.

Cycling power to clear a fault can cause the fault history to be lost. Refer to parameter F602 on page 88 for drive fault memory options.

LOGIC INPUT FUNCTIONS ACTIVE IN LOCAL MODE

The logic input functions listed in Table 1 are active, even if CMOd is set to 1 (keypad control). See Table 2 on page 32 for logic input function settings.

Table 1: Logic Input Functions Active in Local Mode

Logic Input Function No.	Description
1	Run permissive
54	
10	Fault reset
55	
11	External Fault
45	
16	Combination of run permissive and fault reset
38	Frequency reference source switching
41	+/- Speed
42	
43	
44	
46	External overheating fault input
47	
51	Clear accumulated power consumption display
52	Forced-mode drive operation
53	Fire-mode drive operation
62	Holding of RY-RC relay output
64	Cancellation of last keypad command

REMOTE MODE

When the ATV21 drive controller is in the remote mode, the LOC/REM LED is off.

STARTING AND STOPPING THE MOTOR IN REMOTE MODE

Figure 1 on page 16 illustrates the start/stop command source when the drive controller is in remote mode.

With Logic Input Terminals

Use the logic input terminals F, R, RES, or VIA to start the drive controller if:

1. Parameter CMOd is set to 0 (factory setting), and
2. Serial communication control has not been established

With the Keypad

The drive controller responds to commands from the keypad, just as in local mode, if:

1. Parameter CMOd is set to 1, and
2. Serial communication control has not been established

With Serial Communication

The drive controller responds to commands sent over the serial communication link (Modbus®, Metasys® N2, Apogee® FLN, BACnet or LonWorks®) if parameter CMOd is set to 2.

With the Keypad STOP Key

The keypad STOP key is active when the drive controller is in remote mode. Pressing the STOP key causes the drive controller to stop according to the setting of parameters F603, F604, and F251. After the drive controller has come to a stop, the keypad displays E and the fault relay is activated.

ADJUSTING THE MOTOR SPEED IN REMOTE MODE

Figure 1 on page 16 illustrates the speed reference source when the drive controller is in remote mode.

By Analog Input VIA

A 0–10 Vdc or 4–20 mA signal connected to VIA and CC can be used to adjust the motor speed if:

1. Parameter FMOd is set to 1 (factory setting)
2. Alternate speed reference source parameter F207 has not been enabled
3. Serial communication control has not been established

The analog signal type depends on the setting of switch SW3 and parameters F109, F201–F204, and F470–F471.

By Analog Input VIB

A 0–10 Vdc signal connected to VIB and CC can be used to adjust the motor speed if:

1. Parameter FMOd is set to 2
2. Alternate speed reference source parameter F207 has not been enabled
3. Serial communication control has not been established

The control that VIB has over motor speed depends on the setting of parameters F210–F213, F472–F473, and F645.

By Keypad Control

Keypad control of the motor speed is enabled, if:

1. Parameter FMOd is set to 3
2. Alternate speed reference source parameter F207 has not been enabled
3. Serial communication control has not been established

By Serial Communication Control

Serial communication control (Modbus, Metasys N2, Apogee FLN, BACnet or LonWorks) of the motor speed is enabled, if:

1. Parameter FMOd is set to 4
2. Alternate speed reference source parameter F207 has not been enabled

By +/- Motor Speed Control

+/- Motor speed control is enabled, if:

1. Parameter FMOd is set to 5
2. Alternate speed reference source parameter F207 has not been enabled
3. Serial communication control has not been established

SELECTING MOTOR ROTATION DIRECTION IN REMOTE MODE

Figure 1 on page 16 illustrates the motor rotation command source when the drive controller is in remote mode.

With Logic Input Terminals

Use the logic input terminals F, R, RES, or VIA to select motor rotation direction if:

1. Parameter CMOd is set to 0 (factory setting)
2. Serial communication control has not been established

With the Keypad

Motor rotation direction can be set by pressing the keypad UP and ENT keys if:

1. Parameter CMOd is set to 1
2. Serial communication control has not been established
3. Parameter Fr is set to either 2 or 3

With Serial Communication

The drive controller responds to commands sent over the serial communication link (Modbus, Metasys N2, Apogee FLN, BACnet or LonWorks) if Parameter CMOd is set to 2.

RESETTING DRIVE CONTROLLER FAULTS IN REMOTE MODE

Figure 1 on page 16 illustrates the fault reset command source when the drive controller is in remote mode.

It is not possible to clear a drive controller fault if the cause of the fault persists. Be sure to diagnose and rectify the cause of the fault before attempting to reset the drive controller.

See Table 69 on page 85 for a list of faults that can be reset in remote mode.

With the Logic Input Terminals

Use the logic input terminals F, R, RES, or VIA to reset a drive controller fault if:

- Parameter CMOd is set to 0 (factory setting), and
- Serial communication control has not been established

With the Keypad

The STOP key can be used to clear a drive controller fault if:

- Parameter CMOd is set to 1, and
- Serial communication control has not been established

To clear a drive controller fault in keypad mode, press the STOP key. If it is possible to reset the drive controller, the keypad will display CLr. To clear the fault, press the STOP key a second time.

If the cause of the fault is still present, the CLr display will not appear. Diagnose and solve the problem before attempting to reset the drive controller.

The use of the STOP key as a fault reset can be disabled by setting parameter F735 to 1.

With Serial Communication

A drive controller fault can be reset over the serial communication link (Modbus, Metasys N2, Apogee FLN, BACnet or LonWorks) if parameter CMOd is set to 2

In the event of an OL1 or OL2 fault, the following time periods must pass before a fault reset is possible:

- OL1 (drive controller overload) - about 30 seconds after the occurrence of the fault
- OL2 (motor overload) - about 120 seconds after the occurrence of the fault

By Cycling Line Power

A drive controller fault can also be reset by removing and restoring line power. Ensure that the cause of the fault is no longer present and leave power removed long enough for all of the LEDs on the face of the drive controller to go out.

Cycling power to clear a fault can cause the fault history to be lost. Refer to parameter F602 on page 88 for drive fault memory options.

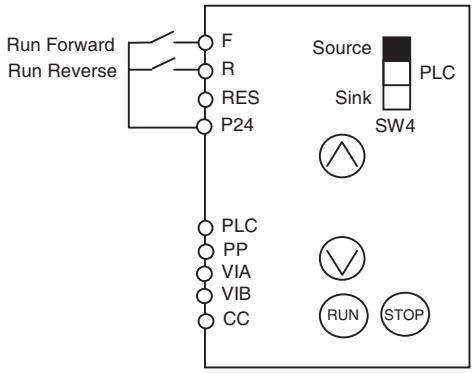
SECTION 3— COMMON CONTROL SCHEMES

2-WIRE CONTROL

For two-wire control:

1. Program the drive controller as indicated in Figure 2.
2. Set switch SW4 to source.
3. Wire the logic inputs as indicated in Figure 2.

Figure 2: 2-Wire Control



Programming:

Parameter	Setting
CtD	0

NOTE: The factory default function for logic input R is preset speed 1. To set logic input R for reversing operation, set parameter F112 to 3.

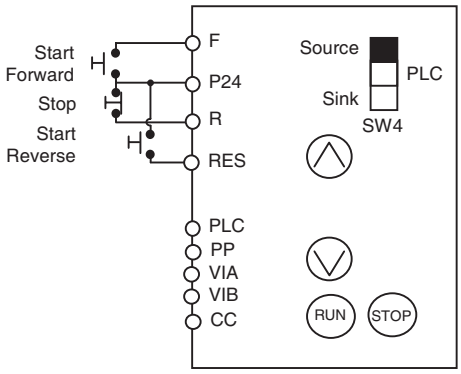
If the drive controller receives both a forward and reverse command simultaneously, it will stop based on the setting of parameter F721 (page 65) in local mode or the setting of parameter F603 (page 117) in remote mode.

3-WIRE CONTROL

For three-wire control:

1. Program the drive controller as indicated in Figure 3.
2. Set switch SW4 to source.
3. Wire the logic inputs as indicated in Figure 3.

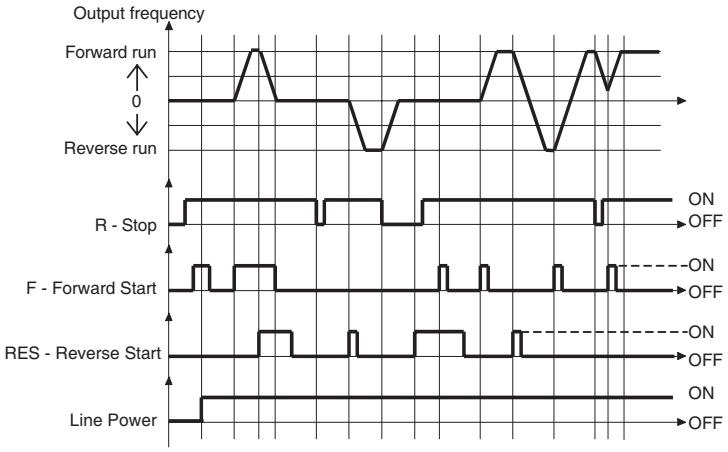
Figure 3: 3-Wire Control



Programming:

Parameter	Setting
CtrL	0
F111	2
F112	49
F113	3

Figure 4: 3-Wire Control Timing Diagram

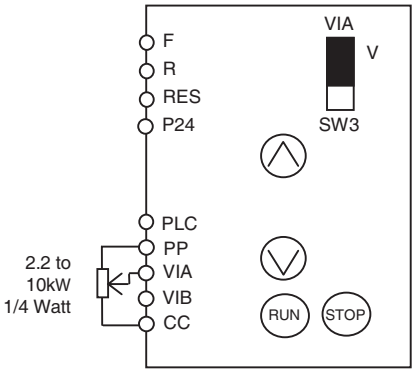


EXTERNAL SPEED CONTROL POTENTIOMETER

For external speed control:

1. Program the drive controller as indicated in Figure 5.
2. Set switch SW3 to V (voltage).
3. Wire analog input VIA as indicated in Figure 5.

Figure 5: External Speed Control Potentiometer



Programming:

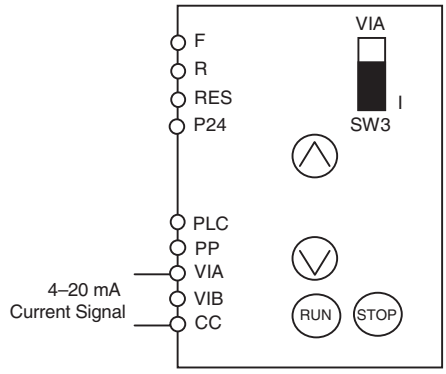
Parameter	Setting
FMOd	1
F109	0
F200	0

4–20 MA SPEED CONTROL

For 4–20 mA speed control:

1. Program the drive controller as indicated in Figure 6.
2. Set switch SW3 to I (current).
3. Wire analog input VIA as indicated in Figure 6.

Figure 6: 4–20 mA Speed Control



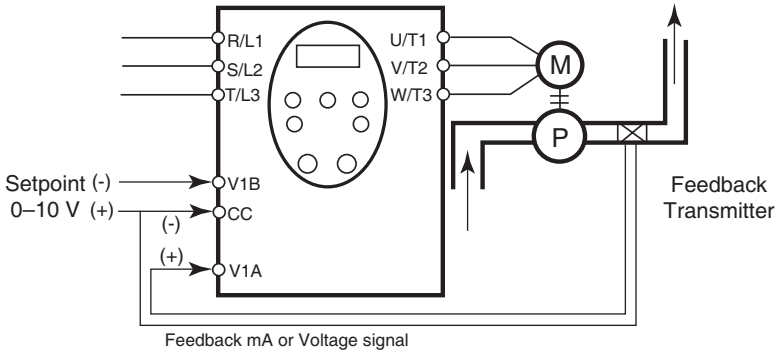
Programming:

Parameter	Setting
FMOd	1
F109	0
F200	0
F201	20

PID CONTROL

For PID control, wire analog inputs VIA and VIB as indicated in Figure 7 and set the parameters as indicated in the PID Control Parameter Settings table below.

Figure 7: PID Control



If the feedback is a milliamp signal, set switch SW3 to the I (current) position.

If the feedback is a voltage signal, set switch SW3 to the V (voltage) position.

PID Control Parameter Settings

FMOd	2
F109	0
F200	0
F360	1

Check parameters F167, F201 to F204, F210 to F213, F256, F359, F362, F363, F366, and F470 to F473 for proper settings. Related I/O functions are:

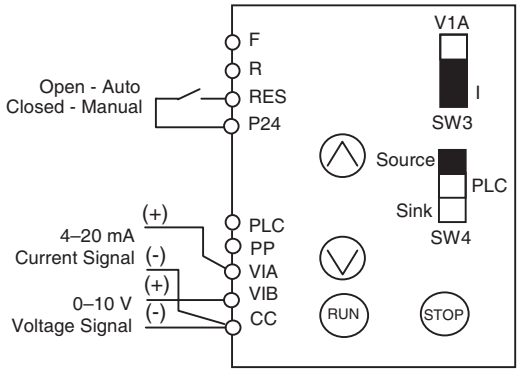
- Optional logic input functions: 14 and 65 (see Table 2 on page 32)
- Optional relay output functions: 52, 53, 60, and 61 (see Table 4 on page 37)

AUTO/MANUAL SPEED REFERENCE SWITCHING

For auto/manual speed reference switching:

1. Program the drive controller as indicated in Figure 8.
2. Set switch SW3 to I (current).
3. Set switch SW4 to source.
4. Wire analog inputs VIA and VIB, and logic input RES as indicated in Figure 8.

Figure 8: Auto/Manual Speed Reference Switching



Programming:

Parameter	Setting
FMOd	1
F109	0
F113	38
F200	0
F201	20
F207	2

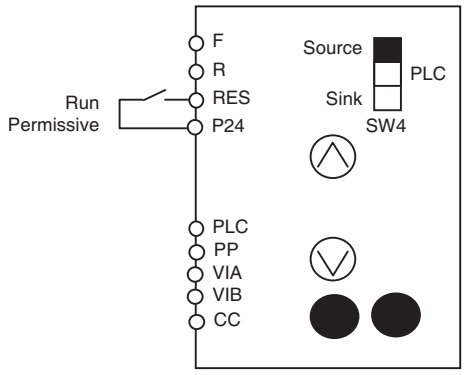
RUN PERMISSIVE

For run permissive:

1. Program the drive controller as indicated in Figure 9.
2. Set switch SW4 to source.
3. Wire the logic input RES as indicated in Figure 9.

Parameter F110, always active logic input function 2, is factory set to run permissive. Set parameter F110 to 0 or another function if run permissive will be used as a logic input. See page 112 for more information.

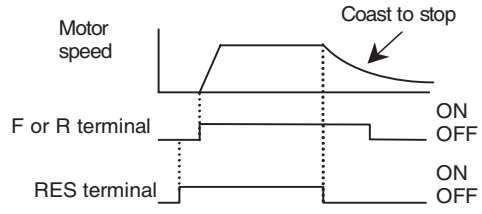
Figure 9: Run Permissive



Programming:

Parameter	Setting
F113	1

Figure 10: Run Permissive Timing Diagram



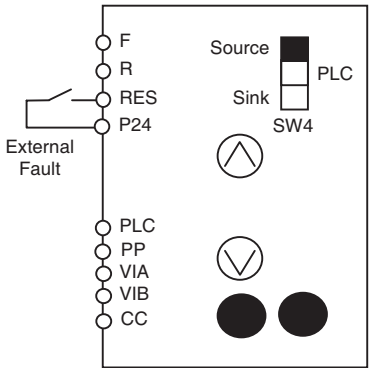
NOTE: When the Run Permissive is open, the keypad will display OFF.

EXTERNAL FAULT

For external fault:

1. Program the drive controller as indicated in Figure 11.
2. Set switch SW4 to source.
3. Wire the logic input RES as indicated in Figure 11.

Figure 11: External Fault



Programming:

Parameter	Setting
F113	11

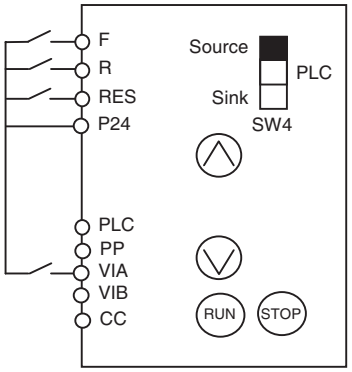
If the drive controller stops due to an external fault command, the keypad will display *E* and the fault relay will be activated.

PRESET SPEEDS (UP TO SEVEN)

For preset speeds:

1. Program the drive controller as indicated in Figure 12.
2. Set switch SW4 to source.
3. Wire the logic inputs as indicated in Figure 12.

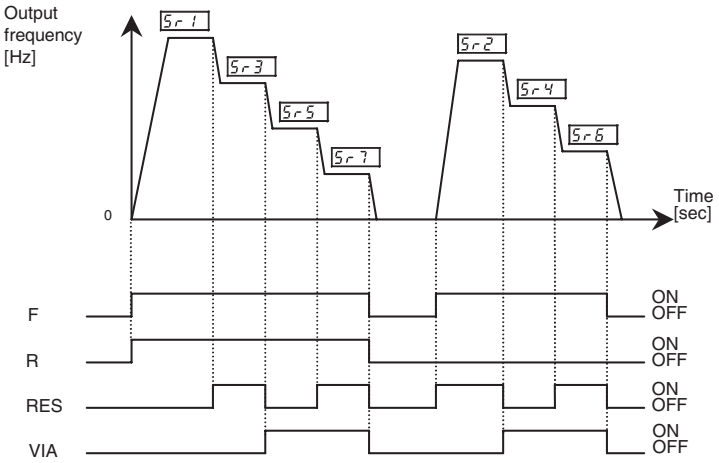
Figure 12: Preset Speeds



Programming:

Parameter	Setting
F109	2
F111	2
F112	6
F113	7
F118	8

Figure 13: Preset Speeds Timing Diagram



Example of 7-step preset speed operation

Speed reference commands coming from other sources such as the keypad, VIA, or VIB, can be valid when all preset-speed logic inputs are deactivated.

When speed reference commands from these other sources are present at the same time as a preset-speed command, the preset-speed command takes priority.

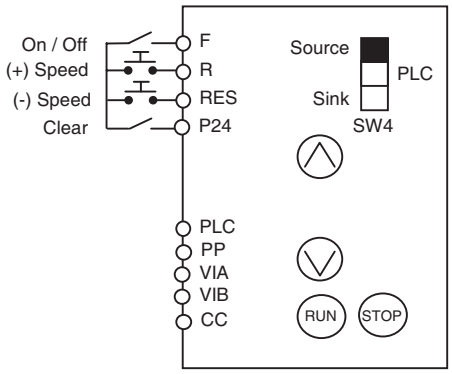
See logic input functions 6–8 on page 32 for more information regarding using preset speeds.

+/- SPEED (MOTORIZED POTENTIOMETER)

For +/- speed;

1. Program the drive controller as indicated in Figure 14.
2. Set switch SW4 to source.
3. Wire the logic inputs as indicated in Figure 14.

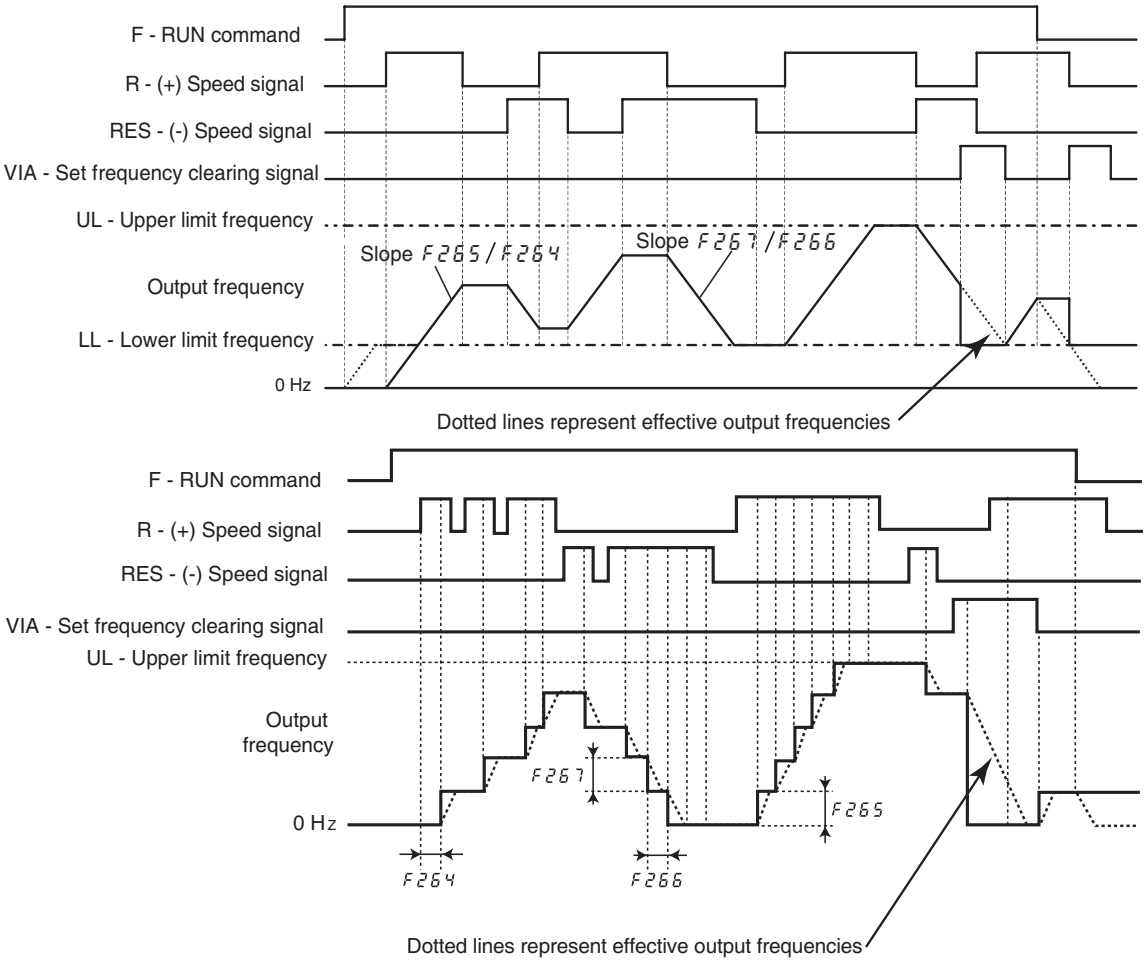
Figure 14: +/- Speed



Programming:

Parameter	Setting
FMOd	5
F109	2
F111	2
F112	41
F113	42
F118	43
F200	0

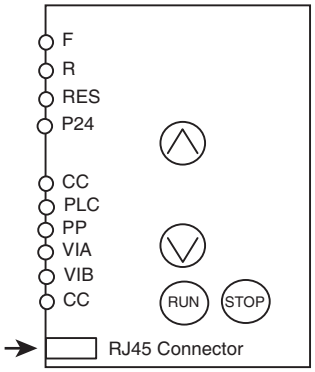
Figure 15: +/- Speed Timing Diagrams



SERIAL COMMUNICATION

For Modbus, Metasys N2, Apogee FLN, BACnet, and LonWorks serial communication, program the drive controller as indicated in Figure 16 and plug the network cable into the RJ45 connector on the main control board.

Figure 16: Serial Communication



Programming:

Parameter	Setting
CMOd	2
FMOd	4

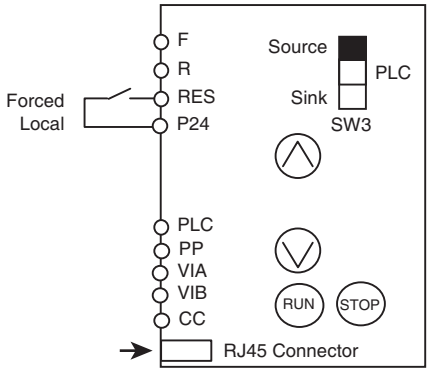
FORCED LOCAL

A logic input assigned to the forced local function can be used to temporarily disable serial communication control and put the drive controller in local keypad control.

For forced local:

1. Program the drive controller as indicated in Figure 17.
2. Set switch SW4 to source
3. Wire the logic input RES as indicated in Figure 17.
4. Plug the network cable into the RJ45 connector on the main control board.

Figure 17: Forced Local



Programming:

Parameter	Setting
F113	48

LOGIC INPUT FUNCTIONS

Logic inputs F, R, RES, and VIA (if parameter F109 is set to 1 or 2) can be set to the functions described in Table 2. See Table 3 on page 36 for logic input function compatibility.

Table 2: Logic Input Functions

Function No.	Function Description	Action
0	No function assigned	Logic input disabled
1	Run permissive (see also input function 54)	OFF: Drive controller motor output disabled, motor coasts to stop ON: Drive controller ready for operation
2	Forward run command (2-wire control: input function 49 NOT used) or (3-wire control: input function 49 USED)	**Mode** — **Logic Input Action** 2-wire control — OFF: Motor ramps down to a stop 2-wire control — ON: Motor runs forward **Mode** — **Stop Input State** — **Logic Input Action** 3-wire control — OFF — OFF: no function 3-wire control — OFF — ON: no function 3-wire control — ON — OFF to ON transition starts the drive controller, motor runs forward
3	Reverse run command (2-wire control: input function 49 NOT used) or (3-wire control: input function 49 USED)	**Mode** — **Logic Input Action** 2-wire control — OFF: Motor ramps down to a stop 2-wire control — ON: Motor runs in reverse **Mode** — **Stop Input State** — **Logic Input Action** 3-wire control — OFF — OFF: no function 3-wire control — OFF — ON: no function 3-wire control — ON — OFF to ON transition starts the drive controller, motor runs in reverse
4		DO NOT USE
5	Acceleration/deceleration pattern selection	OFF: Acceleration/deceleration pattern 1 ON: Acceleration/deceleration pattern 2
6 7 8	Preset speed command input 1 Preset speed command input 2 Preset speed command input 3	**Input 3** — **Input 2** — **Input 1** — **Motor Speed** 0 — 0 — 0 — minimum speed or speed reference per FrEd 0 — 0 — 1 — Sr1: preset speed 1 0 — 1 — 0 — Sr2: preset speed 2 0 — 1 — 1 — Sr3: preset speed 3 1 — 0 — 0 — Sr4: preset speed 4 1 — 0 — 1 — Sr5: preset speed 5 1 — 1 — 0 — Sr6: preset speed 6 1 — 1 — 1 — Sr7: preset speed 7
10	Fault reset (see also input function 55)	ON to OFF transition resets fault (if cause of fault has cleared)
11	External Fault (see also input function 45)	OFF: No external fault ON: Motor stops according to method set by parameter F603 Keypad displays E fault, fault relay activated
13	DC braking command	OFF: No DC braking command ON: DC braking applied to motor, Level and time set by parameters F251 and F252
14	PID control prohibited	OFF: PID control permitted ON: PID control prohibited
15	Programming parameter lock Functional only when parameter F700 = 1	OFF: Parameters locked (if parameter F700 = 1) ON: Programming changes permitted

Table 2: Logic Input Functions *(continued)*

Function No.	Function Description	Action
16	Combination of run permissive and fault reset	OFF: Drive controller motor output disabled, motor coasts to stop ON: Drive controller ready for operation ON to OFF transition resets fault (if cause of fault has cleared)
20	Combination of forward run command and acceleration/deceleration pattern 2 selection	OFF: Motor stops, ramping down per ACC/dEC pattern 2 ON: Motor runs forward, ramping up per ACC/dEC pattern 2
21	Combination of reverse run command and acceleration/deceleration pattern 2 selection	OFF: Motor stops, ramping down per ACC/dEC pattern 2 ON: Motor runs in reverse, ramping up per ACC/dEC pattern 2
22	Combination of forward run command and preset speed 1 command	OFF: Motor ramps down to a stop ON: Motor runs forward, at speed set by Sr1, preset speed 1
23	Combination of reverse run command and preset speed 1 command	OFF: Motor ramps down to a stop ON: Motor runs in reverse, at speed set by Sr1, preset speed 1
24	Combination of forward run command and preset speed 2 command	OFF: Motor ramps down to a stop ON: Motor runs forward, at speed set by Sr2, preset speed 2
25	Combination of reverse run command and preset speed 2 command	OFF: Motor ramps down to a stop ON: Motor runs in reverse, at speed set by Sr2, preset speed 2
26	Combination of forward run command and preset speed 3 command	OFF: Motor ramps down to a stop ON: Motor runs forward, at speed set by Sr3, preset speed 3
27	Combination of reverse run command and preset speed 3 command	OFF: Motor ramps down to a stop ON: Motor runs in reverse, at speed set by Sr3, preset speed 3
30	Combination of forward run command, preset speed 1 command, and acceleration/deceleration pattern 2 selection	OFF: Motor stops, ramping down per ACC/dEC pattern 2 ON: Motor runs forward, at speed set by Sr1, preset speed 1, ramping up per ACC/dEC pattern 2
31	Combination of reverse run command, preset speed 1 command, and acceleration/deceleration pattern 2 selection	OFF: Motor stops, ramping down per ACC/dEC pattern 2 ON: Motor runs in reverse, at speed set by Sr1, preset speed 1, ramping up per ACC/dEC pattern 2
32	Combination of forward run command, preset speed 2 command, and acceleration/deceleration pattern 2 selection	OFF: Motor stops, ramping down per ACC/dEC pattern 2 ON: Motor runs forward, at speed set by Sr2, preset speed 2, ramping up per ACC/dEC pattern 2
33	Combination of reverse run command, preset speed 2 command, and acceleration/deceleration pattern 2 selection	OFF: Motor stops, ramping down per ACC/dEC pattern 2 ON: Motor runs in reverse, at speed set by Sr2, preset speed 2, ramping up per ACC/dEC pattern 2
34	Combination of forward run command, preset speed 3 command, and acceleration/deceleration pattern 2 selection	OFF: Motor stops, ramping down per ACC/dEC pattern 2 ON: Motor runs forward, at speed set by Sr3, preset speed 3, ramping up per ACC/dEC pattern 2
35	Combination of reverse run command, preset speed 3 command, and acceleration/deceleration pattern 2 selection	OFF: Motor stops, ramping down per ACC/dEC pattern 2 ON: Motor runs in reverse, at speed set by Sr3, preset speed 3, ramping up per ACC/dEC pattern 2
38	Frequency reference source switching	OFF: Drive controller follows speed reference set by parameter FMOd ON: Drive controller follows speed reference set by parameter F207 (if F200 = 1)

Table 2: Logic Input Functions *(continued)*

Function No.	Function Description	Action
39	Motor V/Hz parameter switching	OFF: 1st motor V/Hz parameter set active: (Pt, uL, uLu, ub, tHr) ON: 2nd motor V/Hz parameter set active: (Pt = 0, F170, F171, F172, F173)
40	Motor control parameter switching V/Hz, current limit, acceleration/deceleration pattern	OFF: 1st motor control parameter set active: (Pt, uL, uLu, ub, tHr, ACC, dEC, F502, F601) ON: 2nd motor control parameter set active: (Pt = 0, F170, F171, F172, F173, F185, F500, F501, F503)
41	(+) speed input	OFF: No motor speed increase ON: Motor accelerates
42	(-) speed input	OFF: No motor speed reduction ON: Motor decelerates
43	+/- speed clear	OFF to ON transition clears frequency level set by +/- speed inputs
44	Combination of +/- speed clear and fault reset	OFF to ON transition clears frequency level set by +/- speed inputs ON to OFF transition resets fault (if cause of fault has cleared)
45	Inversion of external fault signal (see also input function 11)	OFF: Motor stops according to method set by parameter F603 Keypad displays E fault ON: No external fault
46	External overheating fault input (see also input function 47)	OFF: No external overheating fault ON: Motor stops, keypad displays OH2 fault
47	Inversion of external overheating fault input (see also input function 46)	OFF: Motor stops, keypad displays OH2 fault" ON: No external overheating fault
48	Forced local	OFF: No forced local function ON: Control of the drive controller is forced to mode set by FNOd, CNOd, and F207
49	3-wire control stop input	OFF: Motor ramps down to a stop ON: Drive controller ready for operation
51	Clear accumulated power consumption kWh display	OFF: No function ON: Clears kWh memory
52	Fire-mode drive operation Available only if F650 = 1 Set F294 to proper level **⚠ DANGER** **LOSS OF STOP FUNCTION** When the fire mode input function is used, the drive controller can not be stopped unless power is removed from the drive. **Failure to follow this instruction will result in death or serious injury.**	OFF: No function ON: Motor runs at speed set by F294 The following actions/events will NOT stop the drive controller and motor: • Setting the fire-mode input to OFF • Pressing the STOP key • The following drive controller faults: OC1, OC2, OC3, OC1P, OC2P, OC3P, OP1, OP2, OP3, OL1, OL2, OH, SOUT
53	Forced-mode drive operation Available only if F650 = 1 Set F294 to proper level	OFF: No function ON: Motor runs at speed set by F294 Setting the forced-mode input to OFF will NOT stop the drive controller Pressing the STOP key will stop the drive controller
54	Inversion of run permissive (see also input function 1)	OFF: Drive controller ready for operation ON: Drive controller motor output disabled, motor coasts to stop
55	Inversion of fault reset (see also input function 10)	OFF to ON transition resets fault (if cause of fault has cleared)
56	Combination of run permissive and run forward command (2-wire control only)	OFF: Drive controller motor output disabled, motor coasts to stop ON: Motor runs forward
57	Combination of run permissive and run reverse command (2-wire control only)	OFF: Drive controller motor output disabled, motor coasts to stop ON: Motor runs reverse
61	Current limit level selection	OFF: Current limit level 1 (F601) selected ON: Current limit level 2 (F185) selected

Table 2: Logic Input Functions *(continued)*

Function No.	Function Description	Action
62	Holding of RY-RC relay output	OFF: Normal real-time relay operation ON: RY-RC is held on once activated
64	Cancellation of last keypad command	OFF: Last keypad command cancelled ON: Last keypad command retained
65	Clear PID integral value	OFF: No action ON: PID integral value held at zero
66	Combination of run permissive, run forward command, and preset speed 1 command	OFF: Drive controller motor output disabled, motor coasts to stop ON: Motor runs forward at speed set by Sr1, preset speed 1
67	Combination of run permissive, run reverse command, and preset speed 1 command	OFF: Drive controller motor output disabled, motor coasts to stop ON: Motor runs reverse at speed set by Sr1, preset speed 1
68	Combination of run permissive, run forward command, and preset speed 2 command	OFF: Drive controller motor output disabled, motor coasts to stop ON: Motor runs forward at speed set by Sr2, preset speed 2
69	Combination of run permissive, run reverse command, and preset speed 2 command	OFF: Drive controller motor output disabled, motor coasts to stop ON: Motor runs reverse at speed set by Sr2, preset speed 2
70	Combination of run permissive, run forward command, and preset speed 4 command	OFF: Drive controller motor output disabled, motor coasts to stop ON: Motor runs forward at speed set by Sr4, preset speed 4
71	Combination of run permissive, run reverse command, and preset speed 4 command	OFF: Drive controller motor output disabled, motor coasts to stop ON: Motor runs reverse at speed set by Sr4, preset speed 4

LOGIC INPUT FUNCTION COMPATIBILITY

- O = Compatible
- X = Incompatible
- + = Compatible under some conditions
- @ = Priority

Table 3: Logic Input Compatibility Table

Function No. / Function		1/54	2	3	5	6-9	10/55	11/45	13	14	15	46/47	48	41-43	49	38	39	40	52/53
1/54	Run permissive		@	@	@	@	O	O	@	O	O	O	O	O	@	O	O	O	X
2	Forward run command	+		X	O	O	O	X	X	O	O	X	O	O	X	O	O	O	X
3	Reverse run command	+	+		O	O	O	X	X	O	O	X	O	O	X	O	O	O	X
5	Acceleration/deceleration pattern selection	+	O	O		O	O	X	X	O	O	X	O	O	O	O	O	X	O
6~9	Preset-speed commands 1 to 3	+	O	O	O		O	X	X	O	O	X	O	O	O	O	O	O	X
10/55	Fault reset	O	O	O	O	O		X	O	O	O	X	O	O	O	O	O	O	X
11/45	External fault	+	@	@	@	@	@		@	@	O	+	O	@	@	O	O	O	X
13	DC braking command	+	@	@	@	@	O	X		@	O	X	O	@	@	O	O	O	X
14	PID control prohibited	O	O	O	O	O	O	X	X		O	X	O	O	O	O	O	O	X
15	Programming parameter lock	O	O	O	O	O	O	O	O	O		O	O	O	O	O	O	O	O
46/47	External overheating fault	@	@	@	@	@	@	+	@	@	O		O	O	@	O	O	O	X
48	Forced local	O	O	O	O	O	O	O	O	O	O	O		O	O	O	O	O	X
41-43	+/- speed	O	O	O	O	O	O	O	O	O	O	O	O		O	O	O	O	X
49	3-wire control stop input	+	@	@	O	O	O	X	X	O	O	X	O	O		O	O	O	X
38	Frequency reference source switching	O	O	O	O	O	O	O	O	O	O	O	O	O	O		O	O	X
39	Motor V/Hz parameter switching	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O		X	O
40	Motor control parameter switching	O	O	O	@	O	O	O	O	O	O	O	O	O	O	O	@		O
52/53	Forced mode Fire-mode	@	@	@	O	@	@	@	@	@	O	@	@	@	@	@	O	O	

The following logic input functions are ALWAYS active, regardless of the FnOd and CnOd setting.

- (1) Run permissive
- (10) Fault reset
- (11) External fault

When determining function compatibility using Table 3, the function listed horizontally is activated first and the function listed vertically is activated second.

RELAY OUTPUT FUNCTIONS

The two relay outputs (FL and RY-RC) can be set to the functions described in Table 4.

Table 4: Relay Output Functions

Function No.	Function Description	Action
0	Low speed attained	OFF: output frequency is low speed setting (LL) ON: output frequency is > low speed setting (LL)
1	Inversion of low speed attained (function 0)	OFF: output frequency is > low speed setting (LL) ON: output frequency is low speed setting (LL)
2	High speed attained	OFF: output frequency is < high speed setting (UL) ON: output frequency is high speed setting (UL)
3	Inversion of high speed attained (function 2)	OFF: output frequency is high speed setting (UL) ON: output frequency is < high speed setting (UL)
4	F100 speed attained (drive running) (See page 116 for more detail on parameter F100.)	OFF: output frequency is < F100 speed setting ON: output frequency is F100 speed setting
5	Inversion of F100 speed attained (function 4)	OFF: output frequency is F100 speed setting ON: output frequency is < F100 speed setting
6	Commanded speed attained (up to speed)	OFF: output frequency is commanded speed +/- F102 hysteresis band ON: output frequency is > commanded speed +/- F102 hysteresis band
7	Inversion of commanded speed attained (function 6)	OFF: output frequency is > commanded speed +/- F102 hysteresis band ON: output frequency is commanded speed +/- F102 hysteresis band
8	F101 speed attained (See pages 116 and 116 for more detail on parameters F101 and F102.)	OFF: output frequency is F101 speed +/- F102 hysteresis band ON: output frequency is > F101 speed +/- F102 hysteresis band
9	Inversion of F101 speed attained (function 8)	OFF: output frequency is > F101 speed +/- F102 hysteresis band ON: output frequency is F101 speed +/- F102 hysteresis band
10	Fault relay (The drive controller is not in a fault state during auto fault reset attempts. See also function 36.)	OFF: No drive controller fault ON: Drive controller faulted
11	Inversion of fault relay (function 10)	OFF: Drive controller faulted ON: No drive controller fault
12	Overtorque fault (Overtorque fault detection is active only if parameter F615 = 1. See page 119 for more detail on an overtorque fault and parameters F616 and F618.)	OFF: Estimated motor torque has NOT been at F616 level for a time period longer than that set by F618 ON: Estimated motor torque has been at F616 level for a time period longer than that set by F618. Drive controller stopped, displaying Ot fault
13	Inversion of overtorque fault (function 12)	OFF: Estimated motor torque has been at F616 level for a time period longer than that set by F618. Drive controller stopped, displaying Ot fault ON: Estimated motor torque has NOT been at F616 level for a time period longer than that set by F618
14	Run relay	OFF: Drive controller is not powering the motor ON: Drive controller is powering the motor, accelerating, decelerating, at constant speed, or DC braking
15	Inversion of run relay (function 14)	OFF: Drive controller is powering the motor, accelerating, decelerating, at constant speed, or DC braking ON: Drive controller is not powering the motor
16	Motor overload alarm (Motor overload alarm detection is only active if parameter OLn is set to either 0, 1, 4, or 5. See page 61 for more detail on motor overload protection settings.)	OFF: motor thermal state is < 50% of motor overload fault level ON: motor thermal state is 50% of motor overload fault level
17	Inversion of motor overload alarm (function 16)	OFF: motor thermal state is 50% of motor overload fault level ON: motor thermal state is < 50% of motor overload fault level
20	Overtorque alarm (Overtorque alarm detection is active only if parameter F615 = 0. See pages 119 and 120 for more detail on the overtorque alarm and parameters F616 and F619.)	OFF: Estimated motor torque is < 70% of F616 level minus F619 hysteresis band ON: Estimated motor torque is 70% of F616 level
21	Inversion of overtorque alarm (function 20)	OFF: Estimated motor torque is 70% of F616 level ON: Estimated motor torque is < 70% of F616 level minus F619 hysteresis band

Table 4: Relay Output Functions *(continued)*

Function No.	Function Description	Action
22	General alarm	OFF: No alarm condition from the sources listed below exists ON: An alarm has been issued by one of the following sources: • Overtorque trip (output functions 12 and 13) • Motor overload alarm (output functions 16 and 17) • Overtorque alarm (output functions 20 and 21) • Loss of load detection (output functions 24 and 25) • Run time alarm (output functions 42 and 43) • Undervoltage alarm (output functions 54 and 55) • Drive controller in sleep mode (see page 66 for more detail on parameter F256) • Power failure stop (see page 89 for more detail on parameter F302) • Overcurrent alarm – motor current limit level (parameter F601) • Overvoltage alarm – DC bus voltage overvoltage stall level (parameter F626) • Drive controller overheating alarm
23	Inversion of general alarm (function 22)	OFF: An alarm has been issued by one of the following sources: • Overtorque trip (output functions 12 and 13) • Motor overload alarm (output functions 16 and 17) • Overtorque alarm (output functions 20 and 21) • Loss of load detection (output functions 24 and 25) • Run time alarm (output functions 42 and 43) • Undervoltage alarm (output functions 54 and 55) • Drive controller in sleep mode (see page 66 for more detail on parameter F256) • Power failure stop (see page 89 for more detail on parameter F302) • Overcurrent alarm – motor current limit level (parameter F601) • Overvoltage alarm – DC bus voltage overvoltage stall level (parameter F626) • Drive controller overheating alarm ON: No alarm condition from the sources listed above exists
24	Underload detection (See page 92 for more detail on parameters F609 – F612 and the underload function.)	OFF: Motor current is greater than F611 level + F609 hysteresis band ON: Motor current is less than F611 level for the time set by F612
25	Inversion of underload detection (function 24)	OFF: Motor current is less than F611 level for the time set by F612 ON: Motor current is greater than F611 level + F609 hysteresis band
26	Non-autoresettable fault	OFF: None of the fault conditions listed below exist ON: One (or more) of the following fault conditions exists and has stopped the drive controller: • E – external fault • E-18 – VIA analog input signal fault • E-19 – main control board CPU communication error • E-20 – excessive torque boost fault • E-21 – main control board CPU error 2 • EEP1 – main control board EEPROM error 1 • EEP2 – main control board EEPROM error 2 • EEP3 – main control board EEPROM error 3 • EF2 – ground fault • EPH0 – output phase failure fault • EPH1 – input phase failure fault • Err1 – speed reference error • Err2 – main control board RAM error • Err3 – main control board ROM error • Err4 – main control board CPU error 1 • Err5 – serial communication control error • Err7 – motor current sensor error • Err8 – serial communication network error • Etn1 – auto-tuning error • EtYP – drive controller ratings error • OCA – short-circuit detected in drive controller output inverter stage during motor startup • OCL – short-circuit detected in motor or output wiring during motor startup • OH2 - external overheating fault • Ot – overtorque fault • Uc – underload fault • UP1 - Undervoltage fault

Table 4: Relay Output Functions *(continued)*

Function No.	Function Description	Action
27	Inversion of non-autoresettable fault (function 26)	OFF: One (or more) of the following fault conditions exists and has stopped the drive controller: • E – external fault • E-18 – VIA analog input signal fault • E-19 – main control board CPU communication error • E-20 – excessive torque boost fault • E-21 – main control board CPU error 2 • EEP1 – main control board EEPROM error 1 • EEP2 – main control board EEPROM error 2 • EEP3 – main control board EEPROM error 3 • EF2 – ground fault • EPH0 – output phase failure fault • EPH1 – input phase failure fault • Err1 – speed reference error • Err2 – main control board RAM error • Err3 – main control board ROM error • Err4 – main control board CPU error 1 • Err5 – serial communication control error • Err7 – motor current sensor error • Err8 – serial communication network error • Etn1 – auto-tuning error • EtYP – drive controller ratings error • OCA – short-circuit detected in drive controller output inverter stage during motor startup • OCL – short-circuit detected in motor or output wiring during motor startup • OH2 - external overheating fault • Ot – overtorque fault • Uc – underload fault • UP1 - Undervoltage fault ON: None of the fault conditions listed above exist
28	Auto-resettable fault	OFF: None of the fault conditions listed below exist ON: One (or more) of the following fault conditions exists: • OC1 – overcurrent fault during acceleration • OC2 – overcurrent fault during deceleration • OC3 – overcurrent fault during constant speed operation • OC1P – overcurrent flowing in element during acceleration • OC2P – overcurrent flowing in element during deceleration • OC3P – overcurrent flowing in element during constant speed operation • OH – drive controller overheating fault • OL1 – drive controller overload fault • OL2 – motor overload fault • OP1 – overvoltage fault during acceleration • OP2 – overvoltage fault during deceleration • OP3 – overvoltage fault during constant speed operation • SOUt – permanent magnet motor step-out fault
29	Inversion of auto-resettable fault (function 28)	OFF: One (or more) of the following fault conditions exists: • OC1 – overcurrent fault during acceleration • OC2 – overcurrent fault during deceleration • OC3 – overcurrent fault during constant speed operation • OC1P – overcurrent flowing in element during acceleration • OC2P – overcurrent flowing in element during deceleration • OC3P – overcurrent flowing in element during constant speed operation • OH – drive controller overheating fault • OL1 – drive controller overload fault • OL2 – motor overload fault • OP1 – overvoltage fault during acceleration • OP2 – overvoltage fault during deceleration • OP3 – overvoltage fault during constant speed operation • SOUt – permanent magnet motor step-out fault ON: None of the fault conditions listed above exist
30	Drive controller ready condition 1	OFF: drive controller not ready for operation ON: drive controller ready for operation (ready includes active run permissive and active run command)
31	Inversion of drive controller ready condition 1 (function 30)	OFF: drive controller ready for operation (ready includes active run permissive and active run command) ON: drive controller not ready for operation
32	Drive controller ready condition 2	OFF: drive controller not ready for operation ON: drive controller ready for operation (ready does not include active run permissive or active run command)

Table 4: Relay Output Functions *(continued)*

Function No.	Function Description	Action
33	Inversion of drive controller ready condition 2 (function 32)	OFF: drive controller ready for operation (ready does not include active run permissive or active run command) ON: drive controller not ready for operation
34	VIB input reference source	OFF: analog input terminal VIB is NOT the active speed reference source ON: VIB is the active speed reference source
35	Inversion of VIB input reference source (function 34)	OFF: analog input terminal VIB is the active speed reference source ON: VIB is NOT the active speed reference source
36	Fault relay (The drive controller is not in a fault state during auto fault reset attempts. See also function 10.)	OFF: No drive controller fault ON: Drive controller faulted
37	Inversion of fault relay (function 36)	OFF: Drive controller faulted ON: No drive controller fault
38	Serial communication data	OFF: Serial communication word FA50 bit 0 = 0 ON: Serial communication word FA50 bit 0 = 1
39	Inversion of serial communication data (function 38)	OFF: Serial communication word FA50 bit 0 = 1 ON: Serial communication word FA50 bit 0 = 0
42	Drive controller operational run time alarm (See page 82 for more detail on parameter F621.)	OFF: Run time is < F621 time setting ON: Run time is F621 time setting
43	Inversion of run time alarm (function 42)	OFF: Run time is F621 time setting ON: Run time is < F621 time setting
44	Drive controller service alarm (See page 120 for more detail on parameter F634.)	OFF: Drive controller maintenance alarm not active ON: Drive controller maintenance alarm active
45	Inversion of drive controller maintenance alarm (function 44)	OFF: Drive controller maintenance alarm active ON: Drive controller maintenance alarm not active
48	Logic input F state	OFF: Logic input F is not active ON: Logic input F is active
49	Inversion of logic input F state (function 48)	OFF: Logic input F is active ON: Logic input F is not active
50	Logic input R state	OFF: Logic input R is not active ON: Logic input R is active
51	Inversion of logic input R state (function 50)	OFF: Logic input R is active ON: Logic input R is not active
52	Drive controller speed reference equals VIA signal	OFF: Speed reference from the source identified by FrD or the source identified by F207 ≠ VIA signal ON: Speed reference from the source identified by FrD or the source identified by F207 = VIA signal
53	Inversion of drive controller speed reference equals VIA signal (function 52)	OFF: Speed reference from the source identified by FrD or the source identified by F207 = VIA signal ON: Speed reference from the source identified by FrD or the source identified by F207 ≠ VIA signal
54	Undervoltage alarm	OFF: Undervoltage alarm is not active ON: Undervoltage alarm is active
55	Inversion of undervoltage alarm (function 54)	OFF: Undervoltage alarm is active ON: Undervoltage alarm is not active
56	Local/remote switching	OFF: Drive controller is in remote mode ON: Drive controller is in local mode
57	Inversion of local/remote switching (function 57)	OFF: Drive controller is in local mode ON: Drive controller is in remote mode
58	PTC thermal alarm	OFF: Motor temperature as indicated by PTC thermal probes is < 60% of the trip level ON: Motor temperature as indicated by PTC thermal probes is 60% of the trip level
59	Inversion of PTC thermal alarm (function 58)	OFF: Motor temperature as indicated by PTC thermal probes is 60% of the trip level ON: Motor temperature as indicated by PTC thermal probes is < 60% of the trip level

Table 4: Relay Output Functions *(continued)*

Function No.	Function Description	Action
60	Drive controller speed reference equals VIB signal	OFF: Speed reference from the source identified by FMOd or the source identified F207 ≠ VIB signal ON: Speed reference from source identified by FMOd or the source identified F207 = VIB signal
61	Inversion of drive controller speed reference equals VIB signal (function 60)	OFF: Speed reference from source identified by FMOd or the source identified F207 = VIB signal ON: Speed reference from the source identified by FMOd or the source identified F207 ≠ VIB signal
254	Relay output is always OFF	OFF
255	Relay output is always ON	ON

ANALOG INPUT FUNCTIONS

Two analog inputs are supplied with the ATV21 drive controller. The terminals are designated VIA and VIB.

ANALOG INPUT VIA

- VIA can accept the following signal types:
  - — Voltage (V): 0–10 V, voltage or potentiometer input
  - — Current (I): 0–20 mA or 4–20 mA
  - — The signal type (V or I) is selected by setting SW3 on the main control board.

  For more information on wiring, consult the *Altivar® 21 Installation Guide*, 30072-451-61.
- The slope and bias of the input signal are adjusted with parameters F201–204 and F470–F471. For more information, see page 75.
- VIA is configured as the speed reference input in the following macro-configurations:
  - — Run permissive
  - — 3-wire
  - — 4-20 mA.

  For more information, see pages 24–27.
- Relay output functions 34 and 35 can signal when VIA is being used as the speed reference source. For more information, see Table 4 on page 37 and consult “I/O Control Parameters” on page 73.
- Relay output functions 52 and 53 can be used to signal the results of a comparison between the signal at VIA and the speed reference commanded by FMOd or F207. This function can also be used to send out a signal indicating whether the amount of processing and the amount of feedback agree with each other. For more information, see Table 4 on page 37. Also, consult “I/O Control Parameters” on page 73 and review information about parameter F167 on page 117.
- The drive controller can enter a fault state if the VIA signal drops below a specified level for more than 300 mS. For more information, see parameter F633 on page 93 and error code E-18 on page 127.
- VIA can serve as an analog or a logic input, depending on setting of parameter F109 (set to 0 for analog input). Analog input is the factory setting. See page 74 for more information about parameter F109.

ANALOG INPUT VIB

- VIB can accept the following signal types:
  - — Voltage (V): 0–10V, voltage or potentiometer input
  - — PTC motor thermal sensor input. For more information, see parameters F645 and F646 on page 111.
- Adjust the slope and bias of the input signal with parameters F210-213 and F472-F473. For more information, see page 75.
- Relay output functions 52 and 53 can signal when VIA is being used as the speed reference source. For more information, see Table 4 on page 37 and consult “I/O Control Parameters” on page 73.
- Relay output functions 60 and 61 can be used to signal the results of a comparison between the signal at VIA and the speed reference commanded by FrPd or F207. This function can also be used to send out a signal indicating whether the amount of processing and the amount of feedback agree with each other. For more information, see Table 4 on page 37. Also, consult “I/O Control Parameters” on page 73 and review information about parameter F167 on page 117.

GENERAL

- The selection of VIA or VIB as the speed reference input in remote mode is made through parameters FrPd and F207. FrPd is the primary speed reference source, while F207 is the secondary source. Switching between the two is determined by the setting of parameter F200. For more information, see “Auto/Manual Speed Reference Switching (F200)” on page 77.
- Analog output terminal FN can be configured to provide a signal in proportion to the VIA or VIB signal levels. See parameter FrSL, selections 13 and 14, on page 77.
- When PID control is enabled, VIA or VIB can serve as the setpoint input. Either VIA or VIB must be selected as the feedback input. See page 79 for more information on parameter F360 and PID control.
- Information can be transferred between the serial communication network and the analog inputs via read and write functions F870, F871, and F875-879. For more information, see page 121.

ANALOG OUTPUT FUNCTIONS

One analog output is supplied with the ATV21 drive controller The terminal is designated FM.

FM is a multifunctional programmable analog output supplying an output frequency signal as the factory default.

The FM terminal can output a voltage or current signal.

- When switch SW2 is set to V (voltage), FM outputs a 0–10 Vdc signal at 1 mA.
- When switch SW2 is set to I (current), FM outputs a 0–20 mA signal up to 24 Vdc. For more detail on proper wiring, consult the *Altivar 21 Installation Guide*, 30072-451-61.

The drive controller value represented by the FM analog output signal is determined by the setting of parameter FrSL. See page 77 for more information.

Calibrating the FM signal output to provide full scale deflection on an analog meter is achieved by adjusting parameter FM. See page 78 for more information.

The slope and bias of the FM analog output signal can be adjusted using parameters F691 and F692. For more information, see pages 78 and 78.

SECTION 4— KEYPAD DESCRIPTION

This section describes the features of the integrated keypad display. An optional keypad display (VW3A21101) is also available. Refer to instruction bulletin 30072-451-72, *Altivar® 21 Remote Keypad Display VW3A21101*, for more information.

KEYPAD FEATURES

The Keypad LEDs and keys are illustrated in Figure 18.

Figure 18: Description of the Keypad

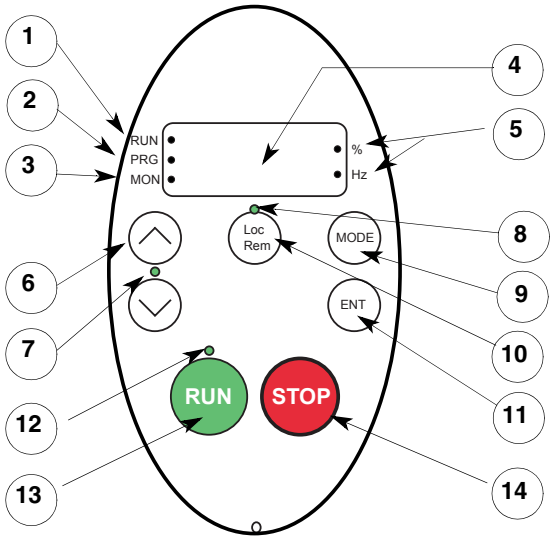


Table 5: Keypad Features

	LED/Key	Characteristics
1	Display RUN LED	• Illuminates when a run command is applied to the drive controller • Flashes when there is a speed reference present with a Run command
2	Display PRG LED	• Illuminates when Programming mode is active • Flashes in *AUF–Gru* modes
3	Display MON LED	• Illuminates when Monitoring mode is active • Flashes in fault history display mode
4	Display unit	4 digits, 7 segments
5	Display unit LED	• The % LED illuminates when a displayed numeric value is a percentage. • The Hz LED illuminates when a displayed numeric value is in hertz.
6	UP/DOWN keys	Depending on the mode, you can use the arrows to: • Navigate between the menus • Change a value • Change the speed reference when the UP/DOWN LED (7) is illuminated
7	UP/DOWN LED	Illuminates when the navigation arrows are controlling the speed reference
8	Loc/Rem LED	Illuminates when Local mode is selected
9	MODE	Press to select the Keypad mode. • Run mode (default on power-up) • Programming mode • Monitoring mode Can also be used to go back to the previous menu.
10	Loc/Rem	Switches between Local and Remote modes

Table 5: Keypad Features *(continued)*

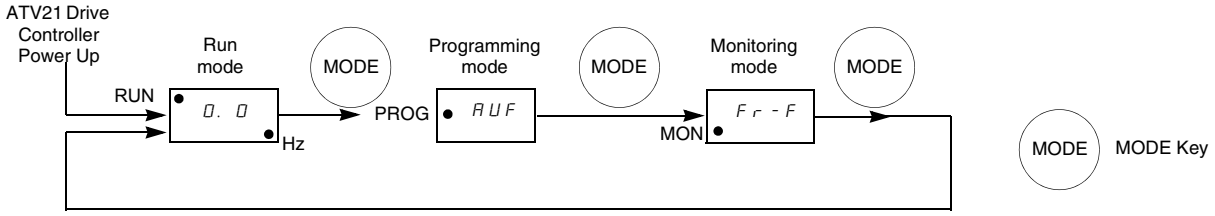
	LED/Key	Characteristics
11	ENT	Press to display a parameter's value or to save a changed value.
12	RUN LED	Illuminates when the Run key is enabled
13	RUN	Pressing this key when the RUN LED is illuminated starts the drive controller.
14	STOP	Stop/reset key. In Local mode, pressing the STOP key causes the drive controller to stop based on the setting of parameter F721. In Remote mode, pressing the STOP key causes the drive controller to stop based on the setting of parameter F603. The display will indicate a flashing "E". If F 7 3 5 is set to 0 (default setting), pressing the stop key twice will reset all resettable faults if the fault condition has been resolved.

KEYPAD MODES

The Altivar 21 keypad has three modes of operation: Run, Programming, and Monitoring.

The drive controller powers up in the Run mode. To select a different mode, use the MODE key as illustrated in Figure 19.

Figure 19: Mode Access



MONITORING MODE

The Monitoring mode displays drive controller operational data in real time. To access the Monitoring mode, press the MODE key until the MON LED is illuminated. Then use the UP and DOWN keys to view up to 30 different types of data.

Figure 20: Monitoring Mode

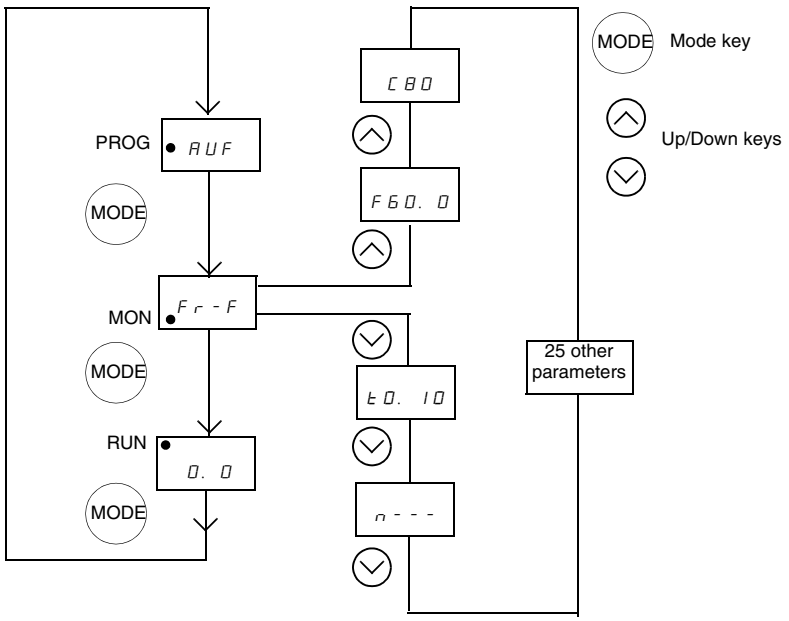


Table 6: Monitoring Mode Displays

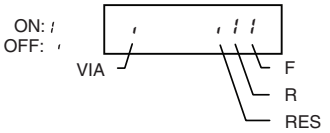
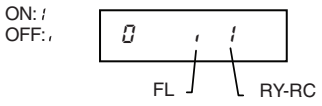
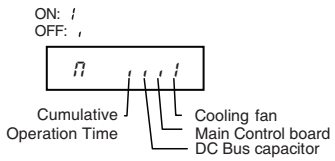
Display	Name	Description
Fr-F	Direction of rotation	Fr-F = forward direction Fr-R = reverse direction
F 60.0	Speed reference	Command frequency to drive controller, displayed either as Hz or in custom unit set by parameter F702
C 80	Motor current	The average of the 3 phases of motor current displayed either as amperes or as a percentage of the drive controller's nameplate-rated output current. Select % or A with parameter F701.
U 100	Line voltage	The average of the 3 phases of line to line input voltages displayed either in volts or as a percentage of the drive controller's rated input voltage (200 V for 208/240 V models - 400 V for 480 V models). Select % or volts with parameter F701.
P 100	Motor voltage	The average of the 3 phases of line to line output voltages displayed either in volts or as a percentage of the drive controller's rated output voltage (200 V for 208/240 V models - 400 V for 480 V models). Select % or volts with parameter F701.
9 60	Motor torque	Estimated motor torque as a percentage of the motor's rated torque
c 90	Torque current	The average of the 3 phases of torque-producing motor current displayed either as amperes or as a percentage of the motor's rated torque-producing current. Select % or A with parameter F701.
L 70	Drive controller load factor	The motor current as a percentage of the drive controller's rated output current, which may be reduced from the drive controller's nameplate current rating by adjustments in switching frequency.
h 80	Input power	Drive controller input power displayed in kilowatts (kW)
H 75	Output power	Drive controller output power displayed in kilowatts (kW)
o 60.0	Motor operating frequency	Motor operating frequency, displayed either as Hz or in custom unit set by parameter F702
. . 11	Logic input map	 The bar representing VIA is displayed only if F109 = 1 or 2
0. 1	Relay output map	
u 101	CPU 1 version	Version of CPU 1
u c01	CPU 2 version	Version of CPU 2
uE01	Memory version	Version of memory
d 50	PID feedback	Level of PID feedback, displayed either as Hz or in custom unit set by parameter F702
b 70	PID computed speed reference	Speed reference command to drive controller as computed by the PID function, displayed either as Hz or in custom unit set by parameter F702
h 85	Accumulated input power consumption	Accumulated input power consumed by the drive controller displayed in kWh
H 75	Accumulated output power consumption	Accumulated output power supplied by the drive controller displayed in kWh

Table 6: Monitoring Mode Displays *(continued)*

Display	Name	Description
A 16.5	Drive controller rated output current	Drive controller nameplate rated output current in amperes
1500	Motor speed	Motor speed in rpm
n 50	Communication counter	Displays the counter numbers of communication through the network
n 50	Normal state	Displays the counter numbers of communication only at normal state in all communication through the network
OC 3⇔1	Past fault 1	The most recent fault stored in the fault history. If the drive controller is in a fault state, this is not the active fault. A fault is stored in the fault history after it is cleared by fault reset action. Press ENT to review drive controller state at time of fault. See “Fault Display and History” on page 46 and “Troubleshooting” on page 127 for more detail.
OH⇔2	Past fault 2	Second most recent fault.
OP 3⇔3	Past fault 3	Third most recent fault.
nErr⇔4	Past fault 4	Fourth most recent fault.
n . . . 1	Drive service alarm	
t0.10	Drive controller run time	Cumulative drive controller run time. 0.01 = 1 hour. 1.00 = 100 hours

FAULT DISPLAY AND HISTORY

When the drive controller faults, the keypad displays a fault code. To review data about drive operation at the time of the fault, press the MODE key to enter the Monitoring mode. Then use the Up/Down keys to scroll through the data listed in Table 6.

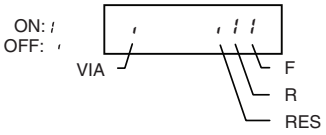
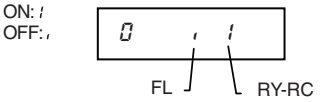
Up to five faults can be displayed on the keypad in Monitoring mode–the present fault (if the drive controller is in a fault state) and the previous four faults. To review drive operation data recorded at the time of fault for a previous fault, press ENT when the code for the fault is displayed. See Table 7 for the available information.

When a fault is reset or power is cycled to the drive controller, the present fault becomes Past Fault 1.

Table 7: Fault History

Display	Name	Description
n 2	Fault counter	Number of times in succession that this particular fault has occurred
o 60.0	Motor operating frequency	Motor operating frequency, displayed either as Hz or in custom unit set by parameter F702
Fr-F	Direction of rotation	Fr-F = forward direction Fr-R = reverse direction
F 60.0	Speed reference	Command frequency to drive controller, displayed either as Hz or in custom unit set by parameter F702
C 80	Motor current	The average of the 3 phases of motor current displayed either as A or as a percentage of the drive controller's nameplate-rated output current. Select % or A with parameter F701.

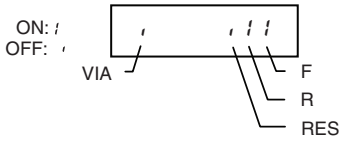
Table 7: Fault History *(continued)*

Display	Name	Description
U 100	Line voltage	The average of the 3 phases of line to line input voltages displayed either in volts or as a percentage of the drive controller's rated input voltage (200 V for 208/240 V models - 400 V for 480V models). Select % or volts with parameter F701.
P 100	Motor voltage	The average of the 3 phases of line to line output voltages displayed either in volts or as a percentage of the drive controller's rated output voltage (200 V for 208/240 V models - 400 V for 480 V models). Select % or volts with parameter F701.
. . 11	Logic input map	 The bar representing VIA is displayed only if F109 = 1 or 2
0. 1	Relay output map	
t0. 10	Drive controller run time	Cumulative drive controller run time. 0.01 = 1 hour. 1.00 = 100 hours

I/O MAP

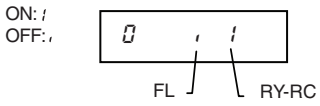
In both the Monitoring mode and the fault history, it is possible to view the state of the logic inputs and the relay outputs. See Tables 6 and 7 on pages 45 and 46.

Figure 21: Logic Input Map



The ON or OFF status of each logic input is displayed in bits. VIA is included in this display if parameter F109 is set to either 1 or 2.

Figure 22: Relay Output Map



The ON or OFF status of each relay output is displayed in bits.

RUN MODE

To access the Run mode, press the MODE key until the drive controller operating frequency, a fault code, or a pre-alarm code is displayed. See “Troubleshooting” beginning on page 127 for the fault and pre-alarm codes.

Changing the Display in Run Mode

Motor operating frequency is the default value displayed on the keypad in Run mode. This displayed value can be changed by setting parameter F710. See page 81 for a list of the display choices.

The displayed value can be expressed as a percentage of the drive controller rating, or in amperes or volts, as appropriate for the value displayed. The units can be changed by setting parameter F701. See page 82.

In addition, the resolution of the speed reference and output frequency displays can be adjusted by setting parameters F707 and F708. See pages 65 and 82.

PROGRAMMING MODE

Use this mode to program the drive controller. For more details, see “Programming” on page 49.

To access the Programming mode, use the MODE key until the PRG indicator LED on the display is illuminated. See Figure 18 on page 43.

SECTION 5— PROGRAMMING

MENU STRUCTURE

MENU NAVIGATION

Figures 23 and 24 (page 50) illustrate how to navigate through the programming menus and submenus.

Figure 23: Menu Navigation

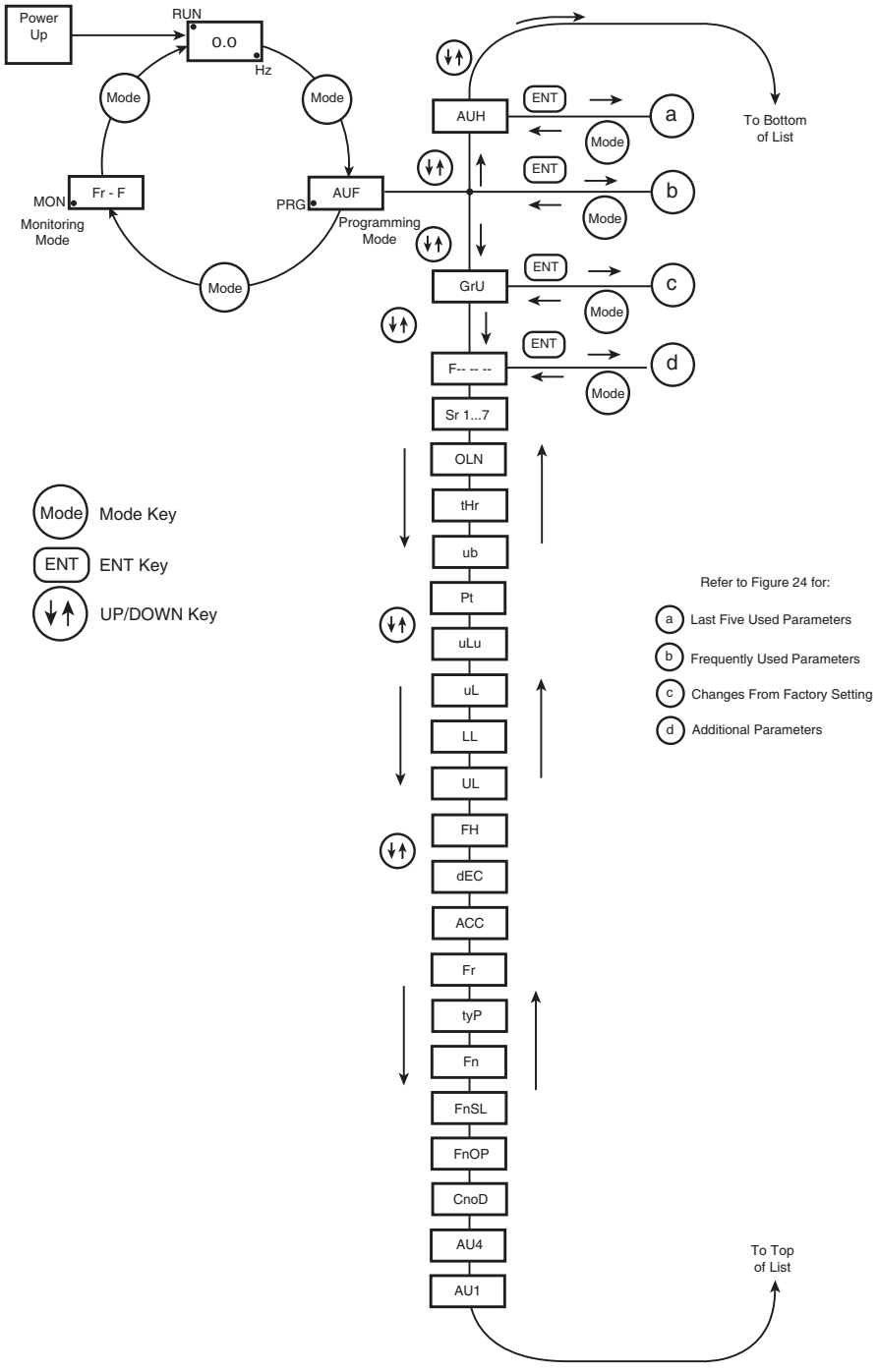
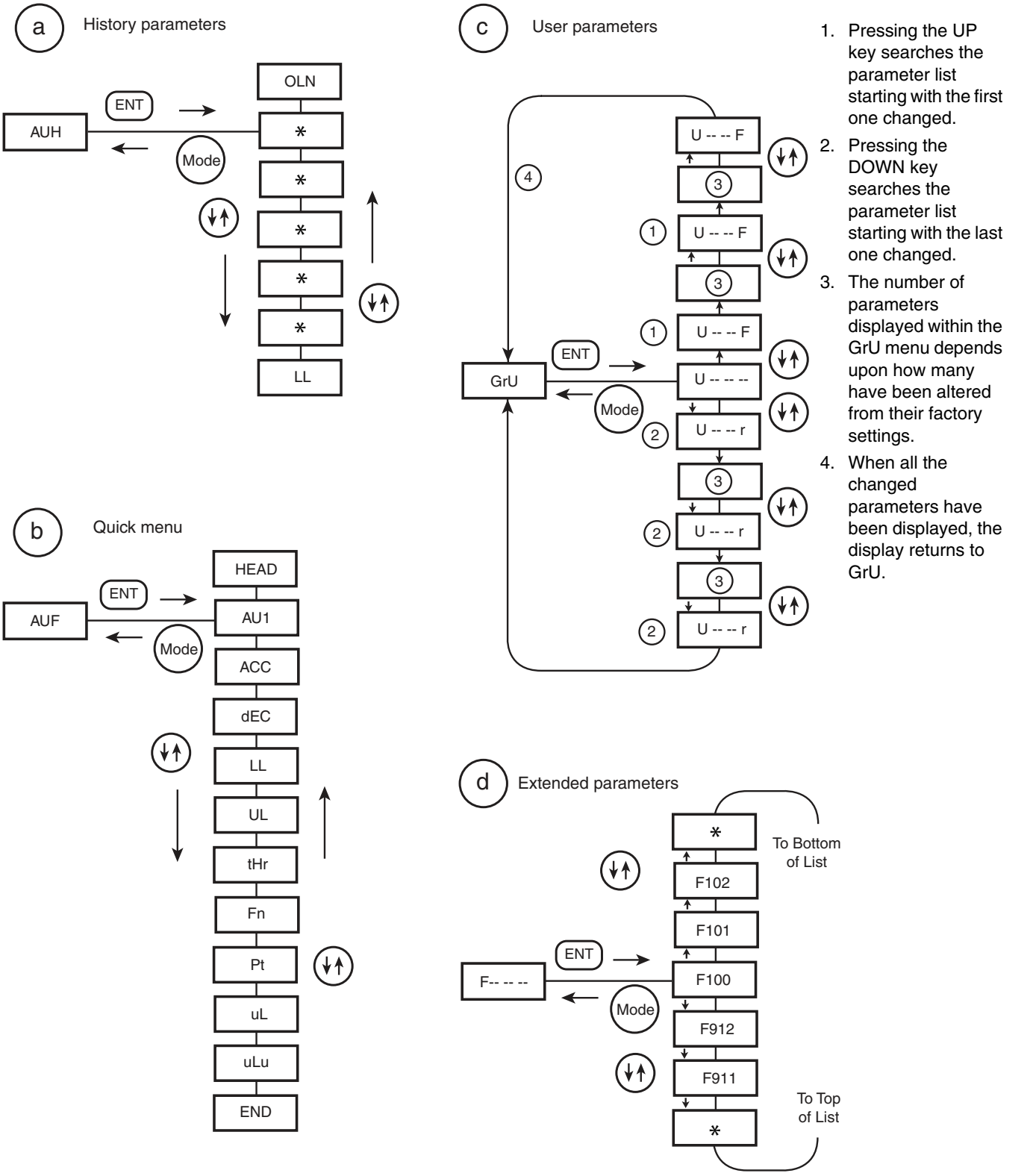


Figure 24: Menu Navigation *(continued)*



1. Pressing the UP key searches the parameter list starting with the first one changed.
2. Pressing the DOWN key searches the parameter list starting with the last one changed.
3. The number of parameters displayed within the GrU menu depends upon how many have been altered from their factory settings.
4. When all the changed parameters have been displayed, the display returns to GrU.

SUBMENUS

The ATV21 drive controller features 3 submenus (see Figure 24 on page 50) that are designed to reduce the time and effort required to program application parameters. Parameters can be modified within these submenus.

AUF: Quick Menu

The AUF submenu provides ready access to the ten basic parameters commonly used in programming the drive controller. In many cases, programming the ATV21 drive controller is complete when these 10 parameters have been properly set.

- Pt: motor control mode
- uLu: motor rated voltage
- uL: motor rated frequency
- tHr: motor rated current
- LL: low speed
- UL: high speed
- ACC: acceleration time
- dEC: deceleration time
- AU1: automatic accel/decel ramp adaptation
- Fn: analog output scaling

AUH: History Parameters

The AUH submenu displays, in reverse chronological order, the last 5 parameters that have been changed from their factory settings. Each time the AUH submenu is accessed, it searches for the latest parameters changed from their factory settings. If all parameters are at their factory settings, no display is generated.

Parameter F700 is not displayed in the AUH menu, even if its value has been changed.

GrU: User Parameters

The GrU submenu displays all parameters that have been changed from their factory settings. Each time the GrU submenu is accessed, its content is refreshed with the latest list of parameters changed from their factory settings. If all parameters are at their factory settings, no display is generated.

Parameters Fn and F470 – F473 are not displayed in the GrU menu, even if their values have been changed.

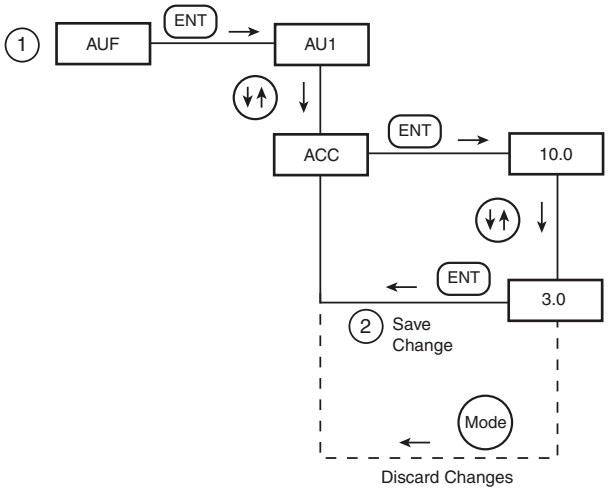
F– – –: Extended Parameters

The extended parameter submenu provides access to parameters used for special settings and applications.

ACCESSING AND CHANGING PARAMETERS

Figure 25 illustrates how to access and change parameter values.

Figure 25: Accessing and Changing Parameter Values



Parameters That Cannot be Changed While the Drive Controller is Running

Table 9 lists the parameters that cannot be changed unless the drive controller is stopped (displaying 0.0 or OFF on the keypad).

Table 8: Parameters that cannot be changed while the drive controller is running

Parameter	Description
AU1	Auto ramp adaptation
AU4	Macro programming
CMOd	Remote mode start/stop control source
FMOd	Remote mode primary speed reference source
tYp	Parameter reset
FH	Maximum frequency
uL	Motor rated frequency
uLu	Motor rated voltage
Pt	Motor control mode
F108	Always active logic function 1
F109	VIA input function (analog or logic selection)
F110	Always active logic function 2
F111	F logic input function
F112	R logic input function
F113	RES logic input function
F118	VIA logic input function
F130	RY-RC relay primary function
F132	FL relay function
F137	RY-RC relay secondary function
F139	RY-RC relay function logic selection
F170	Motor 2 rated frequency
F171	Motor 2 rated voltage
F300	Switching frequency level
F301	Catch on the fly
F303	Auto fault reset
F302	Coast to stop on loss of input power

Table 8: Parameters that cannot be changed while the drive controller is running *(continued)*

Parameter	Description
F305	Overvoltage fault protection
F307	Supply voltage correction and motor voltage limitation
F311	Motor rotation direction command
F316	Switching frequency control mode
F400	Auto tuning enable
F415	Motor rated full load current
F416	Motor no-load current
F417	Motor rated speed
F418	Speed control response coefficient
F419	Speed control stability coefficient
F480	Magnetizing current coefficient
F481	Line noise compensation filter
F482	Line noise inhibitor filter
F483	Line noise inhibitor gain
F485	Stall prevention control coefficient 1
F492	Stall prevention control coefficient 2
F494	Motor adjustment coefficient
F495	Maximum voltage adjustment coefficient
F496	Waveform switching adjustment coefficient
F601	Motor current limit
F603	External fault stop mode
F605	Output phase failure detection mode
F608	Input phase failure detection mode
F613	Output short-circuit detection mode
F626	Overvoltage fault operation level
F627	Undervoltage fault operation mode
F732	Disabling of keypad local/remote key
F910	Permanent magnet motor step-out detection current level
F911	Permanent magnet motor step-out detection time
F912	Permanent magnet motor high-speed torque adjustment coefficient

MACRO PROGRAMMING

The ATV21 drive controller can be configured for four common control schemes by setting parameter AU4:

- Run permissive: **Set parameter AU4 to 1.**
  - — Command inputs:
    F: run forward
    R: run permissive
    RES: fault reset
  - — Speed reference: VIA = 0–10 V or 0–20 mA
- 3-wire control: **Set parameter AU4 to 2.**
  - — Command inputs:
    F: start
    R: stop
    RES: fault reset
  - — Speed reference: VIA = 0–10 V or 0–20 mA
- +/- Speed: **Set parameter AU4 to 3.**
  - — Command inputs:
    F: run forward
    R: + Speed
    RES: - Speed
  - — Speed reference: +/- Speed
- 4-20 mA speed reference: **Set parameter AU4 to 4.**
  - — Command inputs:
    F: run forward
    R: preset speed 1
    RES: fault reset
  - — Speed reference: VIA = 4–20 mA

DEFAULT SETTINGS

PARAMETER RESET OPTIONS

The ATV21 drive controller offers three options to return parameters to their factory default settings:

- Factory reset: set parameter tYP to 3
- 50 Hz reset: set parameter tYP to 1
- 60 Hz reset: set parameter tYP to 2

Refer to Tables 189–193 on pages 133–140 for the settings of the parameters after a reset operation. The tables list:

- Parameters whose values after a reset DO NOT vary by reset type (Table 189 on page 133).
- Parameters whose values after a reset vary by reset type (Table 190 on page 137).
- Parameters whose values after a reset are drive controller model dependant but DO NOT vary reset type (Table 191 on page 138).
- Parameters whose values after a reset are drive controller model and reset type dependant (Table 192 on page 139).
- Parameters whose values do not change if a reset is performed (Table 193 on page 140).

CUSTOM SETTINGS

The drive controller parameter settings can be stored into memory and reloaded into the drive controller as a custom parameter set.

STORE AND RECALL CUSTOM SETTINGS

Set parameter tYP to 7 to save the drive controller parameter settings to memory.

Set parameter tYP to 8 to reload into the drive controller the parameter settings last saved by setting tYP to 7.

BASIC SETTINGS

This section provides information about basic drive controller parameters. The parameters in this section are organized according to the following categories:

- Programming parameters: parameters that affect how other parameters are programmed (page 56)
- Motor control parameters: parameters that affect how the drive controller applies power to the motor (page 58)
- Drive control parameters: parameters that affect how the drive controller interacts with the control system and the operator (page 64)
- Application parameters: parameters that customize drive controller operation for a specific application (page 67)
- I/O control parameters: parameters that change the function of the control inputs and outputs (page 73)
- Display parameters: parameters that affect what drive controller values are displayed and the display units (page 81)
- Fault Management parameters: parameters that determine drive controller action in the event of an internal or external fault (page 85)
- Serial communication parameters: parameters whose adjustments are needed only when communicating with the integrated Modbus or an optional serial communication card (page 93)

PROGRAMMING PARAMETERS

Parameter Reset (tYP)

60 Hz Parameter Reset (tYP = 2)

Setting parameter tYP to 2 sets specific parameters to values suitable for many 60 Hz (motor base frequency) applications. See Table 190 on page 137 and Table 191 on page 138 for a list of parameters that are affected by this reset action and their resultant values.

Factory Reset (tYP = 3)

Setting parameter tYP to 3 resets most parameters to their factory settings. See Tables 189–193 (pages 133–140) for a listing of the values that will be copied into the drive controller by this factory reset action:

- Parameters whose values after a reset DO NOT vary by reset type (Table 189 on page 133).
- Parameters whose values after a reset vary by reset type (Table 190 on page 137).
- Parameters whose values after a reset are drive controller model dependant but DO NOT vary reset type (Table 191 on page 138).
- Parameters whose values after a reset are drive controller model and reset type dependant (Table 192 on page 139).
- Parameters whose values do not change if a reset is performed (Table 193 on page 140).

A factory reset will also clear the fault history.

Save User-defined Settings (tYP = 7)

Set parameter tYP to 7 to save the current drive controller parameter settings to memory.

Recall User-defined Settings (tYP = 8)

Set parameter tYP to 8 to reload into the drive controller the parameter settings last saved by setting tYP to 7.

Macro Programming (AU4)

Parameter AU4 can be used to set the parameters specified in Table 9 to values that are compatible with one of four common control schemes.

Table 9: Setting Parameter AU4

Parameter	For more information see page	AU4 = 0 Factory Setting	AU4 = 1 Run Permissive	AU4 = 2 3-wire Control	AU4 = 3 +/- Speed	AU4 = 4 4-20 mA Control
CMOd	64	0	0	0	0	0
FMOd	64	1	1	1	5	1
F110	112	1	0	1	1	1
F111	73	2	2	2	2	2
F112	73	6	1	49	41	6
F113	73	10	10	10	42	10
F201	75	0	–	–	–	20

When programming parameter AU4, the keypad will display two numbers. The left number is the value last entered into AU4. The right number will always be 0. Use the UP/DOWN keys to change the right number to the desired value and press ENT.

Entering 0 into AU4 has no effect on the drive controller. Programming 0 into AU4 will not return the seven parameters to their factory default values.

Parameter Lock (F700)

Table 10: Parameter Lock

Parameter	Factory Setting	Value	Function
F700	0	0	All parameters are unlocked and can be changed. See Table 8 on page 52 for the parameters that cannot be changed while the drive controller is running.
		1	Only parameter F700 can be changed.

MOTOR CONTROL PARAMETERS

Motor Control Mode (Pt)

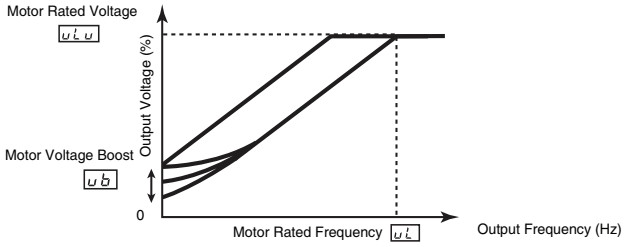
Table 11: Motor Control Mode

Parameter	Factory Setting	Value	Function
Pt	1	0	Constant V/Hz
		1	Variable torque
		2	Constant V/Hz with automatic torque boost
		3	Sensorless vector control
		4	Energy savings
		5	Reserved (DO NOT USE)
		6	Reserved (DO NOT USE)

Constant V/Hz Mode (Pt = 0)

Use constant V/Hz mode for loads that require the same torque at low speeds as at rated speeds. Low speed torque can be adjusted manually by setting parameter ub, motor voltage boost. See page 63 for more information.

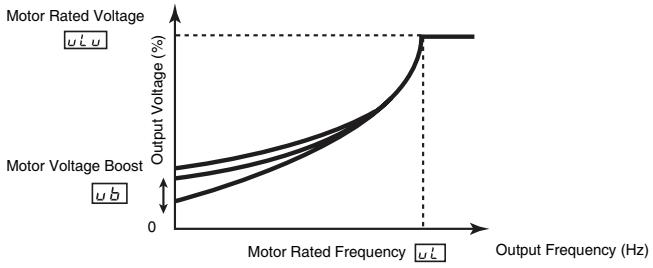
Figure 26: Constant V/Hz Mode



Variable Torque Mode (Pt = 1)

Use variable torque mode for loads such as centrifugal fans and pumps whose torque requirements increase as a square of the increase in motor speed. Low speed torque can be adjusted manually by setting parameter ub, motor voltage boost. See page 63 for more information.

Figure 27: Variable Torque Mode



Constant V/Hz Mode with Automatic Torque Boost (Pt = 2)

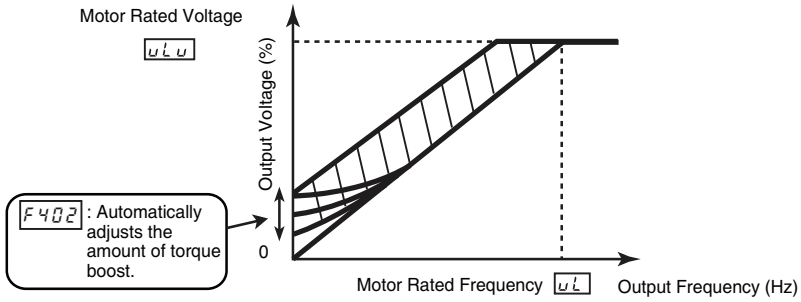
This mode is similar to the constant V/Hz mode (for loads that require the same torque at low speeds as at rated speeds), except it automatically increases motor voltage and torque to compensate for increases in load.

Use parameter F402 to adjust the amount of automatic torque boost.

If the ATV21 drive controller and the connected motor have the same power rating, and if the motor has a nominal 1800 rpm rating, no motor auto-tuning is required to use this motor control mode. Otherwise, follow the steps outlined in “Motor Tuning” on page 97.

Due to the feedback circuit used in this mode, it is possible for motor speed to oscillate. If this occurs, select the Constant V/Hz mode (Pt=0) and adjust torque boost manually with parameter ub.

Figure 28: Constant V/Hz Mode with Automatic Torque Boost



Sensorless Vector Control Mode (Pt = 3)

Use sensorless vector control mode to increase torque at motor speeds below 3 Hz or to improve speed regulation (0.5 to 1%).

If the ATV21 drive controller and the connected motor have the same power rating, and if the motor has a nominal 1800 rpm rating, no motor auto-tuning is required to use this motor control mode. Otherwise, follow the steps outlined in “Motor Tuning” on page 97.

Sensorless vector control mode is only for use in applications where:

- Each motor is powered by its own ATV21 drive controller (not for multi-motor applications).
- The motor has a power rating equal to that of the ATV21 drive controller, or no lower than one hp rating less.
- The motor has between two and eight poles (900 to 3600 rpm).

Sensorless vector control will not improve motor control above the motor’s rated speed.

Sensorless vector control is most effective if the motor leads are less than 100 feet in length. If motor leads longer than 100 feet are required, perform an auto-tuning with the long motor leads included in the circuit. Motor torque may not be maximized at the motor’s rated frequency due to voltage drop in the motor leads.

Connecting a load reactor or a motor protecting filter on the output of the ATV21 drive controller may reduce the torque generated by the motor in sensorless vector control mode. Auto-tuning will most likely not be possible with a reactor or filter attached to the drive controller. Manual tuning will be required.

Energy Savings Control Mode (Pt = 4)

In energy savings mode, the ATV21 drive controller monitors motor loading and automatically modulates the voltage applied to the motor to optimize energy consumption.

If the ATV21 drive controller and the connected motor have the same power rating, and if the motor has a nominal 1800 rpm rating, no motor auto-tuning is required to use this motor control mode. Otherwise, follow the steps outlined in “Motor Tuning” on page 97.

Other Motor Control Mode Parameters

Table 12 lists other parameters that may need to be adjusted, depending on the setting of parameter Pt.

Table 12: Relationship Between Pt setting and Other Motor Parameters

Parameter	Function	Parameter Pt setting				
		0	1	2	3	4
		Constant V/Hz Control	Variable Torque Control	Constant V/Hz with Automatic Torque Boost Control	Sensorless Vector Control	Energy Saving Control
uL	Motor rated frequency	⊗	⊗	⊗	⊗	⊗
uLu	Motor rated voltage	⊗	⊗	⊗	⊗	⊗
ub	Motor voltage boost	⊗	⊗	X	X	X
F170	Motor 2 rated frequency	O	X	X	X	X
F171	Motor 2 rated voltage	O	X	X	X	X
F172	Motor 2 voltage boost	O	X	X	X	X
F400	Auto-tuning	X	X	O	O	O
F401	Slip compensation	X	X	X	O	X
F402	Auto torque boost	X	X	⊗	⊗	⊗
F415	Motor rated full load current	O	O	⊗	⊗	⊗
F416	Motor no-load current	X	X	O	O	O
F417	Motor rated speed	O	O	⊗	⊗	⊗
F418	Speed control response coefficient	X	X	O	O	O
F419	Speed control stability coefficient	X	X	O	O	O
F480	Magnetizing current coefficient	X	X	O	O	X
F485	Stall prevention control coefficient 1	O	O	O	O	O
F492	Stall prevention control coefficient 2	O	O	O	O	O
F494	Motor adjustment coefficient	O	O	O	O	O
F495	Maximum voltage adjustment coefficient	O	O	O	O	O
F496	Waveform switching adjustment coefficient	O	O	O	O	O

X: Not applicable for the Motor Control Mode (Pt) setting

⊗ : Be sure to set and adjust this parameter.

O: Adjust this parameter if necessary.

Motor Rated Voltage (uLu)

Table 13: Motor Rated Voltage

Parameter	ATV21 Drive Controller Voltage	Factory Setting	Range
uLu	230 V	230 V	50 to 330 V
	460 V	400 V	50 to 660 V

Set parameter uLu to the motor’s rated voltage as indicated on the motor nameplate.

NOTE: Drive controller output voltage cannot be set to exceed the input line voltage level.

Motor Rated Frequency (uL)

Table 14: Motor Rated Frequency

Parameter	Factory Setting	Range
uL	50.0 Hz	25.0 to 200.0 Hz

Set parameter uL to the motor's rated frequency as indicated on the motor nameplate, typically 60 Hz.

NOTE: It is possible to set the drive controller's various motor control frequencies to 60 Hz by setting parameter tYP to 2, the 60 Hz reset. For more information, see page 56.

Motor Rated Current Overload Setting (tHr)

Table 15: Motor Rated Current Overload Setting

Parameter	Factory Setting	Range
tHr	100%	10 to 100% of the drive controller's output current rating

Set parameter tHr to the motor's rated current as indicated on the motor nameplate for the selected operating voltage.

If parameter F701 is set to 1, parameter tHr will be adjusted in amperes.

If parameter F701 is set to 0, parameter tHr will be adjusted in percentage. In this case, divide the motor rated current by the drive controller rated current (as listed on its nameplate) and set parameter tHr to the resulting percentage.

The setting of parameter F300 (switching frequency level) does not change the drive controller's rated current for the sake of this calculation.

Motor Overload Characteristics (OLN)

Table 16: Motor Overload Characteristics

Parameter	Factory Setting	Value	Motor type		Overload Protection	Overload Stall
			Self Cooled	Forced Cooled		
OLN	0	0	X	–	X	–
		1	X	–	X	X
		2	X	–	–	–
		3	X	–	–	X
		4	–	X	X	–
		5	–	X	X	X
		6	–	X	–	–
		7	–	X	–	X

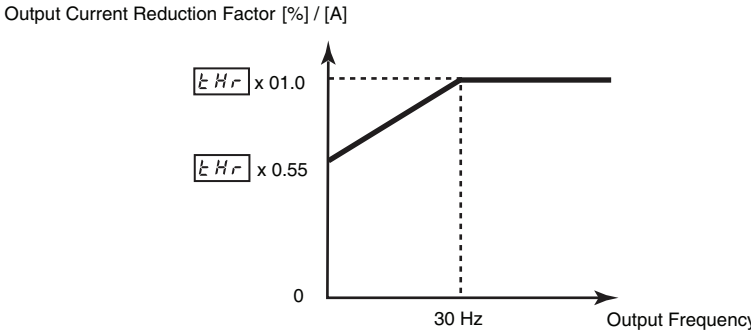
X = enabled

– = disabled

Motor Type

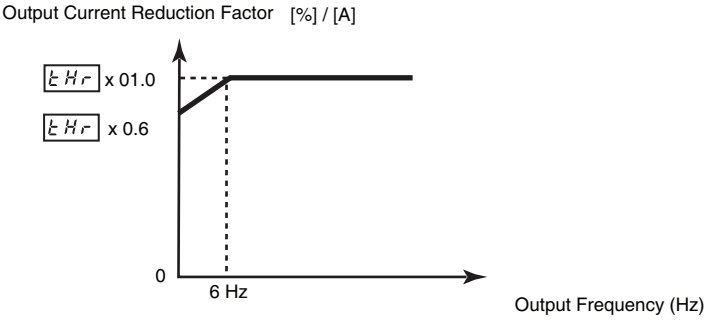
Set OLN to 0, 1, 2, or 3 if a self-cooled motor is being powered by the drive controller. Figure 29 illustrates the overload protection level for the self-cooled motor as a function of motor frequency.

Figure 29: Overload Protection for a Self-Cooled Motor



Set OLN to 4, 5, 6, or 7 if a forced-cooled motor is being powered by the drive controller. Figure 30 illustrates the overload protection level for the forced-cooled motor as a function of motor frequency.

Figure 30: Overload Protection for a Forced-Cooled Motor



Overload Protection

To enable motor overload protection, set OLN to 0, 1, 4, or 5.

⚠ WARNING

INADEQUATE MOTOR PROTECTION

When OLN is set to 2, 3, 6, or 7, a separate overload protective device, external to the drive controller, must be wired between the drive controller and the motor.

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

To disable motor overload protection, set OLN to 2, 3, 6, or 7. In this case, a separate overload protective device, external to the ATV21 drive controller, must be wired between the drive controller and the motor.

Overload Stall

The overload stall function is only compatible with variable torque loads where the load on the motor and drive controller is dependent on the operating frequency and where the load can be reduced by slowing the motor.

If overload stall is enabled, the drive controller will reduce its output frequency if it detects an impending overload fault. As the overload condition of the motor is dissipated, the drive controller will return its output frequency to the commanded value.

To enable overload stall, set OLN to 1, 3, 5, or 7.

To disable overload stall, set OLN to 0, 2, 4, or 6.

Motor Overload Time (F607)

Table 17: Motor Overload Time

Parameter	Factory Setting	Range
F607	300 seconds	10 to 2400 seconds

Parameter F607 determines how long the drive controller will support a 150% motor overload before a fault occurs.

Motor Voltage Boost (ub)

Table 18: Motor Voltage Boost

Parameter	Factory Setting	Range
ub	Dependent on drive controller model[1]	0 to 30%

[1] See Table 191 on page 138.

Low speed motor torque can be adjusted with parameter ub (Motor Voltage Boost) when parameter Pt is set to 0 (Constant V/Hz) or 1 (Variable Torque). See Figures 26 and 27 on page 58 for more information.

If nuisance overcurrent faults occur during starting, reducing the setting of parameter ub may help.

Motor Current Limit (F601)

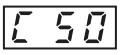
Table 19: Motor Current Limit

Parameter	Factory Setting	Range
F601	110%	10 to 110% of the drive controller's output current rating

Parameter F601 can be adjusted to limit current during motoring or braking. When the drive controller goes into current limit mode, it will:

- Adjust the output frequency to limit the flow of motor current (down when motoring, up when braking) and
- Display the letter C and the output frequency flashing. See Figure 31.

Figure 31: Display in Current Limit Mode



If parameter F701 is set to 1, parameter F601 will be adjusted in amperes. If parameter F701 is set to 0, parameter F601 will be adjusted as a percentage of the drive controller's output rated current as listed on its nameplate.

The setting of parameter F300 (switching frequency level) does not change the drive controller's rated current for the sake of this calculation.

Do not set parameter F601 below the no-load current rating of the motor. Otherwise, the drive controller will determine that motor braking is taking place and will increase the frequency applied to the motor.

DRIVE CONTROL PARAMETERS

Remote Mode Start/Stop Control (CMOd)

Table 20: Remote Mode Start/Stop Control

Parameter	Factory Setting	Value	Function
CMOd	0	0	Control terminal logic inputs
		1	Keypad
		2	Serial communication

The setting of parameter CMOd determines the source of start, stop, forward, and reverse operation commands when the drive controller is in remote mode.

The drive controller must be stopped to make changes to parameter CMOd.

See Figure 1 on page 16 for more information on the source of the drive controller's operation commands.

Remote Mode Primary Speed Reference Source (FMOd)

Table 21: Remote Mode Primary Speed Reference Source

Parameter	Factory Setting	Value	Function
FMOd	1	1	VIA
		2	VIB
		3	Keypad
		4	Serial communication
		5	+/- Speed

The setting of parameter FMOd determines the source of the drive controller's speed reference when the drive controller is in remote mode.

The drive controller must be stopped to make changes to parameter FMOd.

See Figure 1 on page 16 for more information on the source of the drive controller's speed reference.

Local Mode Speed Reference (FC)

Table 22: Local Mode Speed Reference

Parameter	Factory Setting	Range
FC	0.0	LL (low speed) to UL (high speed) Hz

The speed reference set by the UP/DOWN keys in local mode will be stored in parameter FC when the ENT key is pressed. The next time the drive controller is started in local mode, it will accelerate the motor directly to the speed setpoint memorized by FC.

Local Mode Motor Rotation Direction Command (FR)

Table 23: Local Mode Motor Rotation Direction Command

Parameter	Factory Setting	Value	Function
Fr	0	0	Run FORWARD Only
		1	Run REVERSE Only
		2	Run FORWARD with reverse selectable
		3	Run REVERSE with forward selectable

If Fr is set to 2 or 3:

- The motor direction can be changed in local mode to forward by pressing the UP key while holding the ENT key and to reverse by pressing the DOWN key while holding the ENT key. The new motor direction will be displayed (forward = Fr-F, reverse = Fr-R) before the motor direction is reversed.
- The motor's last operating direction in local mode will be stored before a power removal or loss. When power is restored to the drive controller, the local mode motor rotation direction will be the same as before the power loss.
- If bumpless transfer (parameter F295) is enabled and control is transferred from remote to local mode, the local mode operation will assume the same motor rotation direction as in remote mode, regardless of the setting of Fr.

Local Mode Speed Reference Step Changes (F707)

Table 24: Local Mode Speed Reference Step Changes

Parameter	Factory Setting	Setting	Function
F707	0.00	0.00	Disabled
		0.01 to FH (max. frequency) in Hz	Enabled

If parameter F707 is disabled in local mode, the drive controller's speed reference will change in steps of 0.1 Hz each time the UP or DOWN key is pressed.

If parameter F707 is enabled in local mode, the drive controller's speed reference will change in steps equal to the setting of F707 each time the UP or DOWN key is pressed.

Enabling parameter F707 only affects drive controller operation if parameter F702 is set to 0.00. See page 83.

If the display flashes "HI" or "LO", it indicates that repeated usage of the UP or DOWN keys has caused to drive controller's speed reference to reach either the low speed setting (LL) or the high speed setting (UL). This may happen if parameter F707 is set to a value larger than 0.00 Hz.

Local Mode Motor Stop Type (F721)

Table 25: Local Mode Motor Stop Type

Parameter	Factory Setting	Setting	Function
F721	0	0	Ramp stop
		1	Freewheel stop

The setting of parameter F721 determines the type of motor stop that will be executed when then keypad STOP key is pressed.

The RUN and STOP keys must be enabled be setting parameter F733 to 0 for the motor to stop when the keypad STOP key is pressed.

Bumpless Transfer From Remote To Local Control (F295)

Table 26: Bumpless Transfer From Remote To Local Control

Parameter	Factory Setting	Setting	Function
F295	1	0	Disabled
		1	Enabled

If parameter F295 is enabled, the speed reference, run and direction commands will be transferred from remote to local mode when the LOC/REM key is pressed. Operation of the drive controller is not affected by a remote to local control mode transition.

If parameter F295 is disabled, a remote to local control mode transition will cause the drive controller to remove power from the motor. A new run command and speed reference will need to be entered in the local mode.

Regardless of the setting of parameter F295, a local to remote transition will cause the drive controller to immediately respond to the remote commands present at the moment of the transition.

Sleep/Wake Operation (F256)

Table 27: Sleep/Wake Operation

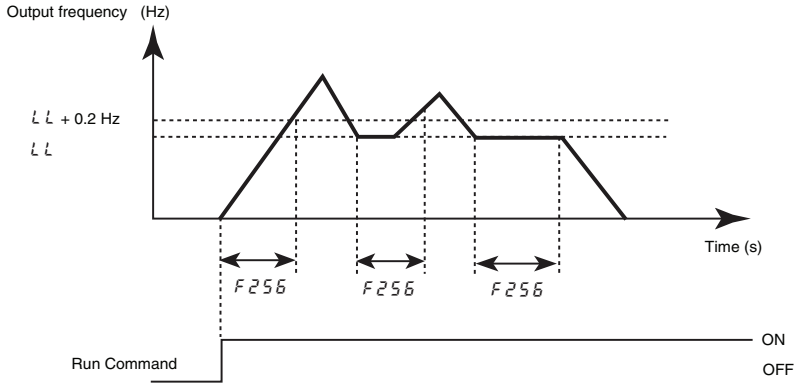
Parameter	Factory Setting	Setting	Function
F256	0.0	0.0	Disabled
		0.1 to 600 seconds	Enabled

If parameter F256 is enabled and if the drive controller operates continuously at low speed (LL) for a time period equal to the setting of F256, the drive controller will ramp the motor to a stop. While the motor is stopped, “LStP” will flash on the drive controller keypad.

When the speed reference to the drive controller exceeds the low speed level (LL) by at least 0.2 Hz, the drive controller will accelerate the motor to the new speed reference.

If parameter F256 is enabled, drive controller operation at or below the low speed level is also monitored during startup or during reversing of the motor. See Figure 32.

Figure 32: Sleep/Wake Operation Timing Diagram



APPLICATION PARAMETERS

Maximum Frequency (FH)

⚠ WARNING

OVERSPEED HAZARD

Do not operate the motor or driven equipment above its rated speed. Consult the equipment manufacturer for details

Failure to follow these instructions can result in death or equipment damage.

Table 28: Maximum Frequency

Parameter	Factory Setting	Range
FH	80.0 Hz	30.0 to 200.0 Hz

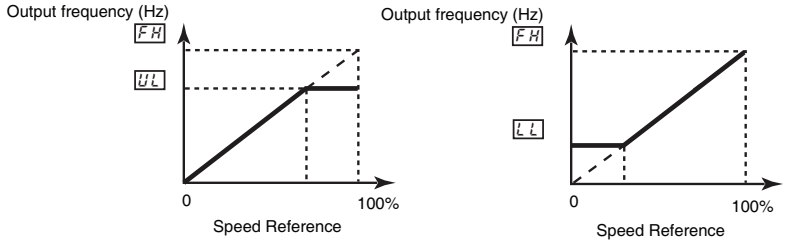
The setting of parameter FH determines the maximum output frequency of the drive controller.

FH limits the setting of parameter UL, high speed, which can be adjusted while the drive controller is operating.

Acceleration and deceleration rates are also affected by the setting of FH, as the definition of ACC or dEC is the time it takes for the drive controller to ramp the motor up or down between zero speed and the setting of FH.

FH can only be adjusted while the drive controller is stopped.

Figure 33: Maximum Output Frequency



High Speed (UL)

Table 29: High Speed

Parameter	Factory Setting	Range
UL	50.0 Hz	0.5 to FH (Hz)

Parameter UL sets the maximum frequency that can be commanded to the drive controller by the local or remote speed reference source.

The top end of its range is limited by the setting of FH (maximum frequency). See Figure 33.

Low Speed (LL)

Table 30: Low Speed

Parameter	Factory Setting	Range
LL	0.0 Hz	0. to UL Hz

Parameter LL sets the minimum frequency that can be commanded to the drive controller by the local or remote speed reference source.
See Figure 33.

Starting Frequency (F240)

Table 31: Starting Frequency

Parameter	Factory Setting	Range
F240	0.5 Hz	0.5 to 10.0 Hz

The setting of parameter F240 determines the drive controller's output frequency at the moment it receives a start command. There is no acceleration time to reach the F240 starting frequency level.

F240 is typically set for the rated slip frequency of the motor. This allows motor torque to be generated as soon as a start command is given. Adjust F240 when a delay in the motor's response to a start command adversely affects the application.

To determine the motor's slip frequency:

1. Subtract the motor's rated speed at full load from it's no-load speed (in rpm).
2. Divide the result by the no-load speed.
3. Multiply this result by the motor's rated frequency in Hz.

Example:

- Motor no-load speed = 1800 rpm
- Motor rated speed at full load = 1750 rpm
- Motor rated frequency = 60 Hz

1800 rpm – 1750 rpm = 50 rpm
50 rpm / 1800 rpm = 2.78%
60 Hz x 0.0278 = 1.7 Hz (motor slip frequency)

Acceleration Time 1 (ACC)

Table 32: Acceleration Time 1

Parameter	Factory Setting	Range
ACC	Dependent on drive controller model[1]	0.0 to 3200 seconds

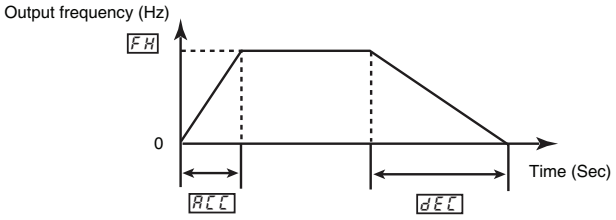
[1] See Table 191 on page 138.

The setting of parameter ACC determines the slope of the acceleration ramp and the time it takes for the output frequency of the drive controller to increase from 0 Hz to the setting of FH (maximum frequency).

If parameter AU1 (see page 69) is set to 1 or 2, the acceleration ramp may be increased or decreased from the setting of ACC, depending on the amount of load on the motor during ramp up.

If two different acceleration rates are needed, see parameter F500 on page 105.

Figure 34: Acceleration Ramp and Time



Deceleration Time 1 (dEC)

Table 33: Deceleration Time 1

Parameter	Factory Setting	Range
dEC	Dependent on drive controller model[1]	0.0 to 3200 seconds

[1] See Table 191 on page 138.

The setting of parameter dEC determines the slope of the deceleration ramp and the time it takes for the output frequency of the drive controller to decrease from the setting of FH (maximum frequency) to 0 Hz.

If parameter AU1 is set to 1 or 2, the deceleration ramp may be increased or decreased from the setting of dEC, depending on the amount of load on the motor during ramp down. See Figure 34.

If two different deceleration rates are needed, see parameter F501 on page 105.

Auto Ramp Adaptation (AU1)

Table 34: Auto Ramp Adaptation

Parameter	Factory Setting	Value	Function
AU1	1	0	Disabled
		1	Enabled (ACC and dEC)
		2	Enabled (ACC only)

If parameterAU1 is set to 1 or 2, the drive controller will monitor its own loading level and optimize the acceleration and deceleration ramps. The acceleration and deceleration (AU1 = 1 only) rates will be automatically adjusted between 1/8 to 8 times the settings of ACC and dEC, depending on the drive controller's current rating and the load level on the motor. ACC and dEC should be appropriately set for an average load in the application. If the load on the motor increases rapidly during ramp up or ramp down, the auto ramp adaptation feature may not prevent the drive controller from experiencing an overcurrent or overvoltage fault.

If the application requires a consistent acceleration and deceleration time, set AU1 to 0, and set ACC and dEC manually as needed. The manual acceleration and deceleration times can still be overridden by the motor current limit (F601) and overvoltage fault (F305, F626) functions.
See pages 63, 90, and 90.

Acc/Dec Pattern 1 (F502)

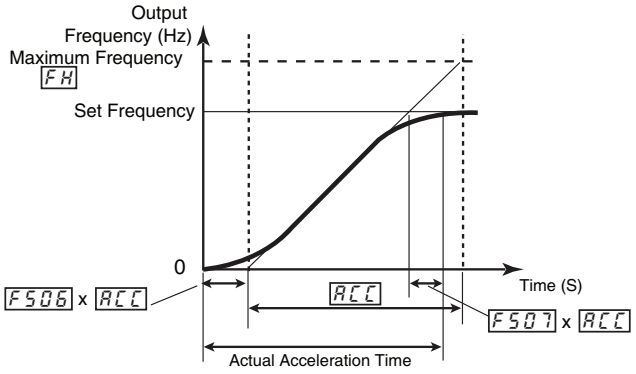
Table 35: Acc/Dec Pattern 1

Parameter	Factory Setting	Value	Function
F502	0	0	Linear
		1	S-pattern 1 (see Figure 35)
		2	S-pattern 2 (see Figure 36)

The linear acceleration and deceleration pattern is illustrated in Figure 34 on page 68 and is used in most applications.

S-pattern 1 (see Figure 35) is for use in applications that need the shortest ramp time possible while minimizing shock during speed changes. See pages 105 and 106 for more information about parameters F506 and F507.

Figure 35: S-pattern 1



Acc/Dec Pattern 2 (F503)

⚠ WARNING

OVERSPEED HAZARD

Do not operate the motor or driven equipment above its rated speed. Consult the equipment manufacturer for details

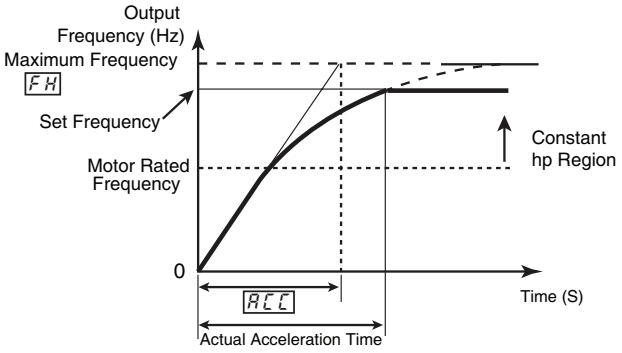
Failure to follow these instructions can result in death or equipment damage.

Table 36: Acc/Dec Pattern 2

Parameter	Factory Setting	Value	Function
F503	0	0	Linear
		1	S-pattern 1 (see Figure 35)
		2	S-pattern 2 (see Figure 36)

S-pattern 2 (see Figure 36) is for use in high-speed spindle applications where acceleration and deceleration rates need to be reduced as the motor operates above its rated operating frequency—a constant hp region where motor torque is reduced.

Figure 36: S-pattern 2



Switching Frequency Level (F300)

Table 37: Switching Frequency Level

Parameter	Factory Setting	Range
F300	Dependent on drive controller model[1]	6.0 to 16.0 kHz in 0.1 kHz steps

[1] See Table 191 on page 138.

Increasing the switching frequency may reduce audible motor noise.

Increasing the switching frequency will increase the heat dissipated by the drive controller. The capacity of the drive controller may need to be derated accordingly if the switching frequency is increased. See the derating curves in instruction bulletin 30072-451-61, *Altivar® 21 Installation Guide*.

Switching Frequency Random Mode (F312)

Table 38: Switching Frequency Random Mode

Parameter	Factory Setting	Setting	Function
F312	0	0	Disabled
		1	Enabled

Random control of the switching frequency may reduce audible motor noise.

Random control of the switching frequency will not be performed if the switching frequency is set above 7.1 kHz, regardless of the setting of F312.

Switching Frequency Control Mode (F316)

Table 39: Switching Frequency Control Mode

Parameter	Factory Setting	Value	Function
F316	1	0	All models: switching frequency NOT automatically reduced
		1	All models: switching frequency automatically reduced
		2	460 V models[1]: switching frequency NOT automatically reduced
		3	460 V models[1]: switching frequency automatically reduced

[1] For 460 V applications with motor leads longer than 100 feet.

If parameter F316 is set to 1 or 3, the switching frequency level will be automatically controlled to prevent a drive controller overheating fault. If the drive controller senses an impending overheating fault, it will reduce the switching frequency, thus reducing heat produced by the controller. As the temperature approaches normal, the switching frequency will return to the level selected by parameter F300.

If F316 is set to 2 or 3, motor control performance is optimized if parameter F300 is set to 6 kHz.

Skip Frequencies

Table 40: Skip Frequencies

Parameter	Factory Setting	Range	Function
F270	0.0	0.0 – FH (Hz)	Skip frequency 1 midpoint
F271	0.0	0.0 – 30.0 (Hz)	Skip frequency 1 bandwidth
F272	0.0	0.0 – FH (Hz)	Skip frequency 2 midpoint
F273	0.0	0.0 – 30.0 (Hz)	Skip frequency 2 bandwidth
F274	0.0	0.0 – FH (Hz)	Skip frequency 3 midpoint
F275	0.0	0.0 – 30.0 (Hz)	Skip frequency 3 bandwidth

Do not set the skip frequency bands so that they overlap.

While the drive controller will not operate within these skip frequency bands during steady state operation, skip frequency bands are ignored by the drive controller during motor acceleration and deceleration.

I/O CONTROL PARAMETERS

F Logic Input Function (F111)

Table 41: F Logic Input Function

Parameter	Factory Setting	Range
F111	2 (forward run command)	1 – 71

The setting of parameter F111 determines the control function of logic input terminal F.

See Table 2 on page 32 for a full list of F logic input assignments.

R Logic Input Function (F112)

Table 42: R Logic Input Function

Parameter	Factory Setting	Range
F112	6 (preset speed command input 1)	1 – 71

The setting of parameter F112 determines the control function of logic input terminal R.

See Table 2 on page 32 for a full list of R logic input assignments.

RES Logic Input Function (F113)

Table 43: RES Logic Input Function

Parameter	Factory Setting	Range
F113	10 (fault reset)	1 – 71

The setting of parameter F113 determines the control function of logic input terminal RES.

See Table 2 on page 32 for a full list of RES logic input assignments.

VIA Input Function (Analog or Logic Selection) (F109)

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION

- Prevent accidental grounding of logic inputs configured for sink logic. Accidental grounding can result in unintended activation of drive controller functions.
- Protect the signal conductors against damage that could result in unintentional conductor grounding.
- Follow NFPA 79 and EN 60204 guidelines for proper control circuit grounding practices.

Failure to follow these instructions will result in death or serious injury.

Table 44: VIA Input Function

Parameter	Factory Setting	Value	Function
F109	0	0	Analog input
		1	Logic input – sink (negative logic)
		2	Logic input – source (positive logic)

The setting of parameter F109 determines whether control input terminal VIA will serve as an analog input (0–10 Vdc or 0–20 mA) or as a logic input (either sink or source).

When configuring VIA as a logic input, be sure to slide switch SW3 on the main control board to the V (voltage) position.

When configuring VIA as a logic input using sink (negative) logic, be sure to connect a 4.7 kΩ (1/2 W) resistor between control terminals P24 and VIA.

For more information on the use of control input terminal VIA, see instruction bulletin 30072-451-61, *Altivar® 21 Installation Guide*.

VIA Logic Input Function (F118)

Table 45: VIA Logic Input Function

Parameter	Factory Setting	Range
F118	6 (preset speed command input 1)	1 – 71

The setting of parameter F118 determines the control function of logic input terminal VIA.

See Table 2 on page 32 for a full list of VIA logic input assignments.

Analog Input Adjustments (F201–F204; F210–F213; F470–F473)

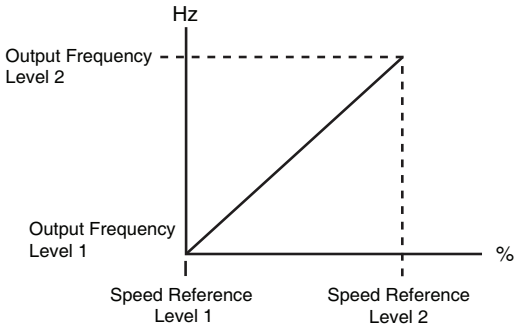
Table 46: Analog Input Speed Reference and Output Frequency

Parameter	Factory Setting	Range	Function
F201	0	0 – 100%	VIA speed reference level 1
F202	0.0	0.0 – 200.0 (Hz)	VIA output frequency level 1
F203	100	0 – 100%	VIA speed reference level 2
F204	50.0	0.0 – 200.0 (Hz)	VIA output frequency level 2
F210	0	0 – 100%	VIB speed reference level 1
F211	0.0	0.0 – 200.0 (Hz)	VIB output frequency level 1
F212	100	0 – 100%	VIB speed reference level 2
F213	50.0	0.0 – 200.0 (Hz)	VIB output frequency level 2

Do not set the same frequency values for both output frequency levels 1 and 2. This will cause an Err1 fault.

When using a 4–20 mA signal, set speed reference level 1 value to 20% (4 ÷ 20 = 20%).

Figure 37: Analog Input Speed Reference and Output Frequency

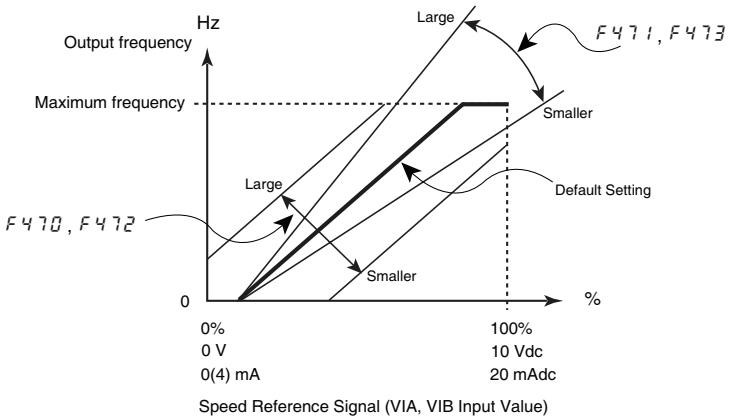


A further refinement of the bias and slope of the analog input signals can be made with parameters F470 – F473.

Table 47: Analog Input Bias and Gain Adjustments

Parameter	Factory Setting	Range	Function
F470	128	0 – 255	VIA analog input bias
F471	148	0 – 255	VIA analog input gain
F472	128	0 – 255	VIB analog input bias
F473	148	0 – 255	VIB analog input gain

Figure 38: Analog Input Bias and Gain Adjustments



Parameters F470 and F472 are factory set so that a minimal signal must be applied to VIA or VIB before the drive controller starts the motor.

- To increase the signal level required to start the motor, decrease the input bias level.
- To reduce the signal level required to start the motor, increase the input bias level.

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION

If the input bias level is set too high, the drive controller will start the motor without a signal present at VIA or VIB.

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

Parameters F471 and F473 are factory set so that the drive controller output reaches rated voltage and frequency just before the signal to VIA or VIB reaches its maximum level.

- To decrease the signal level required before the drive controller output reaches rated voltage and frequency, increase the input gain level.
- To increase the signal level required before the drive controller output reaches rated voltage and frequency, decrease the input gain level.

  NOTE: If the input gain level is set too low, the drive controller output may never reach rated voltage and frequency.

Auto/Manual Speed Reference Switching (F200)

Table 48: Auto/Manual Speed Reference Switching

Parameter	Factory Setting	Setting	Function
F200	0	0	Enabled
		1	Disabled

Switching between two speed reference sources by means of a logic input is enabled if parameter F200 is set to 0.

To use this function, you must assign a logic input to function 38, Auto/manual speed reference switching.

When the assigned logic input is off, the drive controller will follow the speed reference source defined by parameter FMOd (see page 64).

When the assigned logic input is on, the drive controller will follow the speed reference source defined by parameter F207 (see page 102).

When parameter F200 is set to 1, the drive controller will follow the FMOd speed reference source when it is operating above 1 Hz. Below 1 Hz, it will follow the F207 speed reference source.

Analog Output Function Selection (FMSL)

Table 49: Analog Output Function Selection

Parameter	Factory Setting	Value	Function	Maximum Signal
FMSL	0	0	Output frequency	Maximum frequency (FH)
		1	Output current	150% of drive controller's rated current
		2	Speed reference	Maximum frequency (FH)
		3	DC bus voltage	150% of drive controller's rated current
		4	Output motor voltage	150% of drive controller's rated current
		5	Input power	185% of drive controller's rated current
		6	Output power	185% of drive controller's rated current
		7	Estimated motor torque	250% of rated motor torque
		8	Motor torque current	Current at 250% of rated motor torque
		9	Motor thermal state	100% of motor's rating
		10	Drive controller thermal state	100%
		11	DO NOT USE	
		12	Internal speed reference (after PID)	Maximum frequency (FH)
		13	VIA input value	Maximum input value
		14	VIB input value	Maximum input value
		15	Fixed output – 100% signal (Selection 1 – output current)	
		16	Fixed output – 50% signal (Selection 1 – output current)	
		17	Fixed output – 100% signal (Selections 0, 2, 3, 4, 5, 6, 7, 8, 9,10, 12, 13, 14, 18)	
		18	Serial communication data	FA51 = 1000
		19	DO NOT USE	

Analog Output Scaling (FM)

Parameter FM is used to match the FM terminal output signal with the input requirements of the attached panel meter by adjusting the slope and bias of the analog output signal. Before adjusting FM, set FMSL to either 15 or 17. As you adjust the value of FM, monitor the display on the attached panel meter. When the meter display reaches 100%, press the ENT key on the drive controller keypad. The drive controller will flash between FM and the adjusted value, indicating that the adjustment has been saved.

Analog Output Slope (F691)

Table 50: Analog Output Slope

Parameter	Factory Setting	Setting	Function
F691	1	0	Negative slope
		1	Positive slope

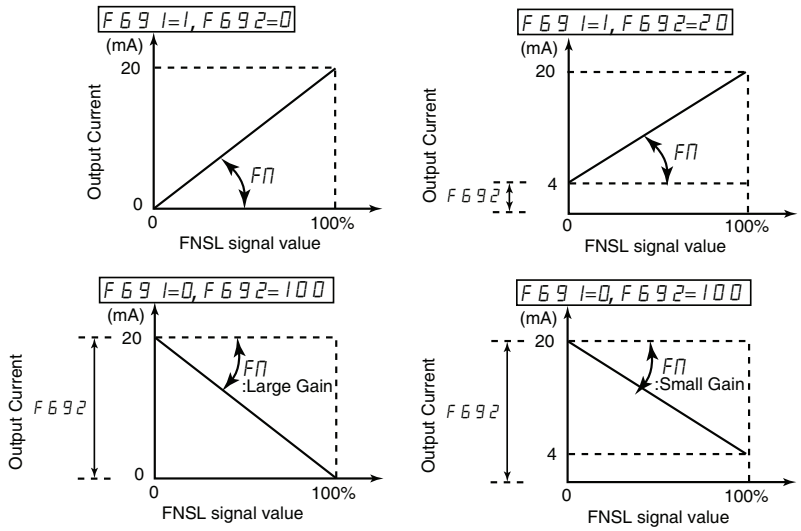
Analog Output Bias (F692)

Table 51: Analog Output Bias

Parameter	Factory Setting	Adjustment Range
F692	0	0 to 100%

Refer to Figure 39 for examples of adjusting parameters FM, F691, and F692.

Figure 39: Analog Output Bias



RY-RC Relay Function (F130)

Table 52: RY-RC Relay Function

Parameter	Factory Setting	Adjustment Range
F130	4: F100 speed attained (drive running)	0 to 61, 254, 255

For a full description of the various functions assignable to the RY-RC relay, see Table 4 on page 37.

The RY-RC relay can have a secondary assignment with programmed selection logic. See parameters F137 and F139 on page 115 for more detail.

FL Relay Function (F132)

Table 53: FL Relay Function

Parameter	Factory Setting	Adjustment Range
F132	11: Inversion of fault relay	0 to 61, 254, 255

For a full description of the various functions assignable to the FL relay, see Table 4 on page 37.

PID Control Enable (F360)

Table 54: PID Control Enable

Parameter	Factory Setting	Setting	Function
F360	0	0	PID disabled
		1	Enabled—feedback source is VIA
		2	Enabled—feedback source is VIB

Parameter F360 is used to enable PID control and define the source of the feedback signal.

The PID source is defined by the setting of parameter FPId. See page 64.

Parameter F167 can be adjusted to command a drive controller relay to signal when the PID setpoint and feedback are in agreement. See page 117 for more information.

PID Proportional Gain (F362)

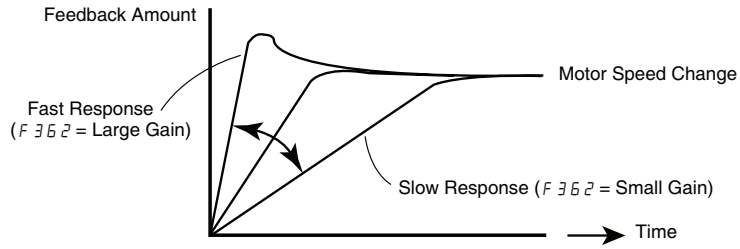
Table 55: PID Proportional Gain

Parameter	Factory Setting	Adjustment Range
F362	0.30	0.01 to 100.0

Parameter F362 adjusts the proportional gain applied during PID control. The speed change applied to the motor is a correctional value proportional to the product of this parameter's setting and the process error (deviation between the setpoint and the feedback value).

A higher setting of F362 provides a fast response to a process error but may also result in instability such as hunting. Figure 40 illustrates the effect produced by adjusting F362.

Figure 40: F362 Adjustment Effects



PID Integral Gain (F363)

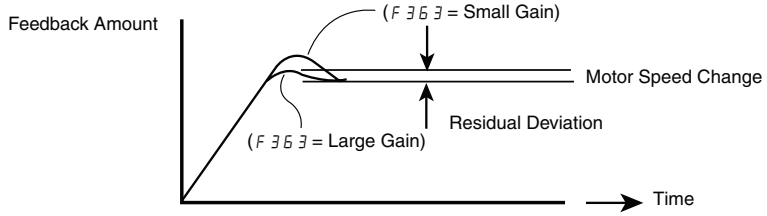
Table 56: PID Integral Gain

Parameter	Factory Setting	Adjustment Range
F363	0.20	0.01 to 100.0

Parameter F363 adjusts the integral gain applied during PID control. Any residual process errors that remain after correction by the proportional gain are cleared to zero over time by the integral gain function.

A higher setting of F363 provides a fast response to a process error but may also result in instability such as hunting. Figure 41 illustrates the effect produced by adjusting F363.

Figure 41: F363 Adjustment Effects



The integral gain value can be set to zero by setting a logic input to function 65. For more information, see Table 2 on page 32 and parameters F111, F112, F113, and F118 on pages 73–74.

PID Derivative Gain (F366)

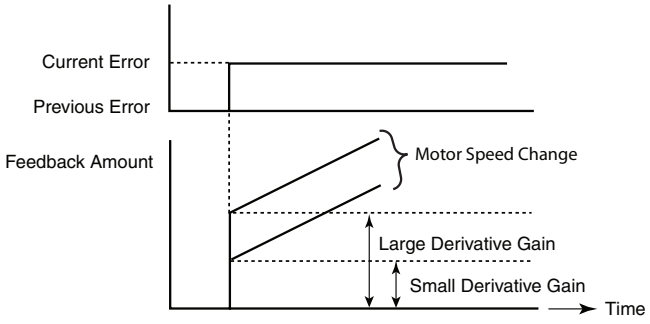
Table 57: PID Derivative Gain

Parameter	Factory Setting	Adjustment Range
F366	0.00	0.00 to 2.55

Parameter F366 adjusts the derivative gain applied during PID control. This gain adjusts the response time of the drive controller to rapid changes in the process.

Increasing the setting of F366 more than necessary may cause great fluctuations in motor speed resulting in system instability. Figure 42 illustrates the effect produced by adjusting F366.

Figure 42: F366 Adjustment Effects



PID Control Waiting Time (F359)

Table 58: PID Control Waiting Time

Parameter	Factory Setting	Adjustment Range
F359	0	0 to 2400 seconds

If parameter F359 is set to a value greater than 0 seconds, the drive controller will not immediately enter PID control upon startup. For the time set by F359, the drive controller will ignore the feedback signal, accelerating the motor to the speed set by the reference input. This function can be used to prevent the drive controller from entering PID control mode before the system approaches the final operating level.

DISPLAY PARAMETERS

Default Keypad Operational Display Value (F710)

Table 59: Default Keypad Operational Display Value

Parameter	Factory Setting	Setting	Function
F710	0	0	Motor operating frequency (Hz or custom display, see F702 on page 83)
		1	Speed reference (Hz or custom display, see F702 on page 83)
		2	Motor current (% or A, see F701)
		3	Drive controller rated current (A)
		4	Drive controller thermal state (%)
		5	Output power (kW)
		6	Internal speed reference (after PID function) (Hz or custom display, see F702 on page 83)
		7	Serial communication data
		8	Output speed (rpm, see F417 on page 97)
		9	Displays the total number of frames received by the communication card since the last power ON
		10	Displays the total number of valid frames received by the communication card since the last power ON

The setting of parameter F710 determines the default display on the drive controller's keypad upon power up.

Status alarms C, P, L, and H can only be displayed on the keypad if F710 is set to 0. See "Run Mode" on page 48 for more information.

Keypad Display: % or A/V Units (F701)

Table 60: % or A/V Units

Parameter	Factory Setting	Setting	Function
F701	1	0	%
		1	A (amperes) or V (volts)

The setting of parameter F701 determines how certain values will be displayed on the drive controller keypad, either as a percentage of the drive controller rating or as a value of amperes or volts as appropriate.

The setting of F701 will only affect parameters and display values that can be represented in amperes or volts. This includes the following parameters:

- tHr and F173: motor rated current
- F251: DC braking current level
- F185 and F601: motor current limit
- F611: underload detection level
- F910: permanent magnet motor step-out detection current level

Motor rated voltage (parameters ulu and F171) are always displayed in volts.

Keypad Frequency Display Resolution (F708)

Table 61: Keypad Frequency Display Resolution

Parameter	Factory Setting	Setting	Function
F708	0	0	Disabled – 0.1 Hz steps
		1 – 255	See the formula below

Parameter F708 works along with parameter F707 (page 65) to adjust the incremental steps of the drive controller keypad frequency display.

At its factory setting, parameter F708 is disabled and the keypad increments or decrements frequency displays in 0.1 Hz steps.

If parameter F708 is set to a value other than 0, then the keypad frequency display is determined as follows:

Keypad frequency display = Internal speed reference (after PID function) x F708 / F707

For example, if both F707 and F708 are equal to 1, the keypad frequency display will increase only in full 1 Hz steps.

Run Time Alarm Setting (F621)

Table 62: Run Time Alarm Setting

Parameter	Factory Setting	Adjustment Range
F621	610.0 (6100 hours)	0.0 to 999.9 (0.1 = 1 hour, 100 = 1000 hours)

Parameter F621 is used in conjunction with a relay output set to functions 42 or 43 (see page 40) to signal that the run time specified by the setting of F621 has accumulated.

Accumulated Power Consumption Memory (F748)

Table 63: Accumulated Power Consumption Memory

Parameter	Factory Setting	Setting	Function
F748	1	0	Disabled
		1	Enabled

The setting of parameter F748 determines whether the drive controller's accumulated power consumption memory, displayed in kilowatt-hours (kWh), is cleared when the line power is cycled. If F748 is set to 0, the memory is cleared. If set to 1, the kWh memory is retained.

Accumulated Power Consumption Display Unit (F749)

Table 64: Accumulated Power Consumption Display Unit

Parameter	Factory Setting	Setting	Unit of display
F748	Model dependant. See Table 191 on page 138.	0	1 kWh
		1	0.1 kWh
		2	0.01 kWh
		3	0.001 kWh

The setting of parameter F749 determines the scaling of the kWh display on the keypad.

Custom Frequency Display Conversion Factor (F702)

Parameters F702, F705, and F706 can be used to customize a speed display on the drive controller keypad to match the application's operational speed, for example, feet per minute or units per hour.

Table 65 lists the display value and parameters that are affected by the settings of this parameter:

Table 65: Custom Frequency Display Conversion Factor

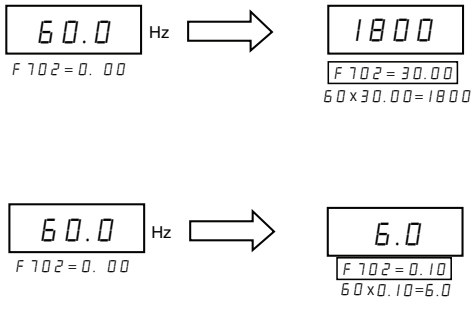
Parameter	Factory Setting	Setting	Function
F702	0.00	0.00	Frequency displayed in Hz
		0.01 to 200.0	Conversion factor

If parameter F702 is set to a value other than 0.00, the frequency value displayed will be calculated as follows:

Value displayed = display or parameter frequency x F702

See Figure 43 for an example.

Figure 43: Custom Frequency Display Conversion Factor Example



Custom Frequency Display Conversion Slope (F705)

Table 66: Custom Frequency Display Conversion Slope

Parameter	Factory Setting	Setting	Function
F705	1	0	Negative slope
		1	Positive slope

Parameter F705 sets the slope of the custom frequency display conversion. See Figure 44 for examples of the operation of this function.

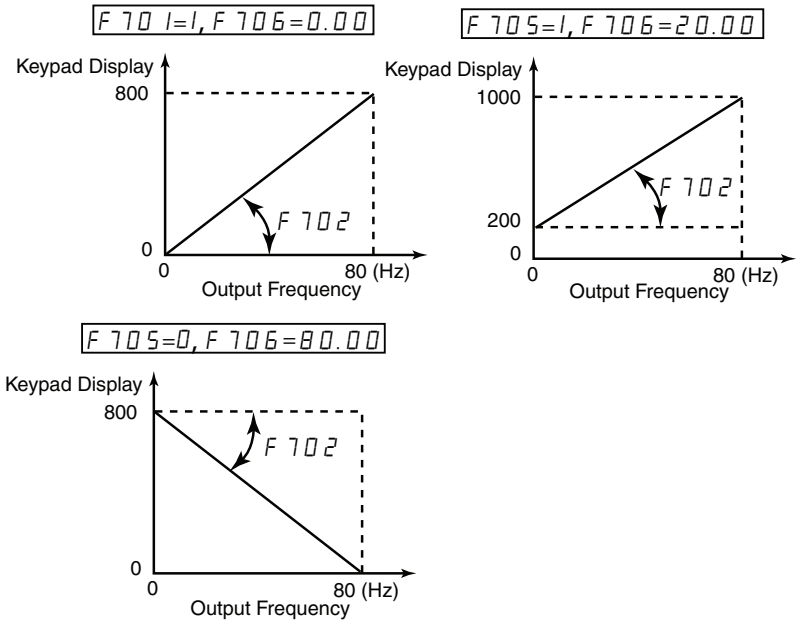
Custom Frequency Display Conversion Bias (F706)

Table 67: Custom Frequency Display Conversion Bias

Parameter	Factory Setting	Adjustment Range
F706	0.00	0.00 to FH

Parameter F706 adds a bias to the custom frequency display conversion process. See Figure 44.

Figure 44: Examples of the Operation of F705 and F706



FAULT MANAGEMENT PARAMETERS

Auto Fault Reset (F303)

Table 68: Auto Fault Reset

Parameter	Factory Setting	Setting	Function
F303	0	0	Disabled
		1 – 10	Number of fault reset attempts

Description

Table 71 lists the faults that can be cleared with Auto fault reset. If parameter F303 is set to a value greater than 0 and one of these faults occurs, the drive controller will attempt to automatically clear the fault, allowing it to be restarted:

Table 69: Automatically Resettable Faults

Code	Fault	Code	Fault
OC1	Overcurrent during acceleration	OL1	Drive controller overload
OC2	Overcurrent during deceleration	OL2	Motor overload
OC3	Overcurrent during constant speed operation	OP1	Overvoltage during acceleration
OC1P	Short-circuit or ground fault during acceleration	OP2	Overvoltage during deceleration
OC2P	Short-circuit or ground fault during deceleration	OP3	Overvoltage during constant state operation
OC3P	Short-circuit or ground fault during constant speed operation	SOUt	Permanent magnet motor pulls out of synchronism
OH	Drive controller overtemperature fault	–	–

Auto fault reset attempts will continue until the number of attempts set by parameter F303 has been exhausted.

If these attempts do not clear the fault condition, the drive controller will stop and a manual fault reset will be required.

If another type of fault (a type not listed in Table 69) occurs during the auto fault reset process, the drive controller will stop and a manual fault reset will be required.

A successful auto fault reset means that the drive controller accelerates the motor to the commanded speed without another fault occurring.

If an unspecified period of time elapses after a successful auto fault reset attempt without another fault occurring, the reset attempt counter will clear allowing another full set of reset attempts to be made during a future fault occurrence.

During the auto fault reset process, the drive controller keypad alternately displays $r\,t\,r\,\square$ and the display value selected by parameter F710.

Conditions permitting auto fault reset

An auto fault reset attempt will not be made if the cause of the fault persists.

In the case of an OL1 or OL2 fault, the drive controller will calculate the cooling time necessary to clear the fault.

In the event of an OH fault, the heatsink temperature probe will indicate when the fault can be cleared.

DC bus voltage measurements will indicate when an OP1, OP2, or OP3 fault can be cleared.

Time delay

The first fault reset is attempted 1 second after the fault occurs. Each subsequent fault reset attempt adds 1 second to the time interval, as illustrated in Table 70.

Table 70: Fault Reset Attempts

Attempt number	Time delay between fault reset attempt and most recent fault
1	1 second
2	2 seconds
3	3 seconds
4	4 seconds
5	5 seconds
6	6 seconds
7	7 seconds
8	8 seconds
9	9 seconds
10	10 seconds

Fault relay action

An output relay set to functions 10 and 11 (see Table 4 on page 37) will not indicate a fault until all fault reset attempts have been exhausted.

Output relay functions 28 and 29 can be used to indicate that an auto-resetable fault has occurred.

Output relay functions 36 and 37 can be used to signal any kind of drive controller fault, even during auto fault reset attempts.

Drive controller fault memory (F602)

If parameter F602 is set to 1 and power to the drive controller is cycled while an auto-resettable fault is active, the auto fault reset action will be cancelled.

Catch On The Fly (F301)

Table 71: Catch On The Fly

Parameter	Factory Setting	Setting	Function
F301	3[1]	0	Disabled
		1	After brief power loss
		2	After run permissive is restored
		3	After brief power loss or run permissive is restored
		4	During every startup

[1] Catch-on-the-fly motor starting after a drive fault is always active if auto fault reset is enabled (parameter F303 is not set to 0).

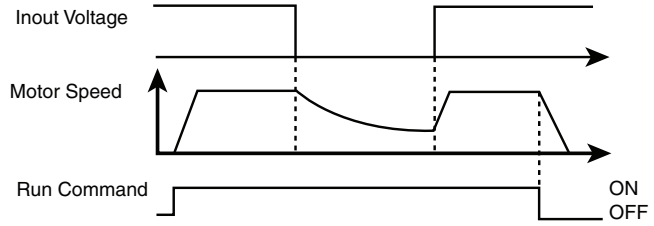
If catch-on-the-fly motor starting is enabled (parameter F301 is not set to 0), the drive controller will detect the motor's rotating direction and speed before applying power. This will result in a smooth reapplication of power to a coasting motor without high current or torque pulses.

If F301 is disabled and the drive controller is started into a spinning motor, it will apply a low starting frequency to the motor, operating in current limit until the motor almost stops. Then, the drive controller will accelerate the motor to the commanded speed.

Catch-on-the-fly motor starting will be applied if F301 is set to 1 or 3 and:

- There is a brief power loss (the keypad does not go blank) that results in the drive controller removing power from the motor, and
- There is a continuous run command to the drive controller (2-wire control)

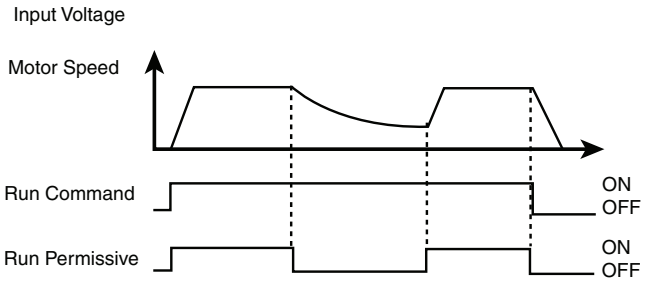
Figure 45: F301 Set to 1 or 3



Catch-on-the-fly motor starting will be applied if F301 is set to 2 or 3 and:

- The run permissive (logic input assigned to functions 1 or 54) is removed and restored, and
- There is a continuous run command to the drive controller (2-wire control)

Figure 46: F301 Set to 2 or 3



If F301 is set to 4, the drive controller will perform a motor speed and direction search each time it receives a run command.

NOTE: Enabling catch-on-the-fly adds about 300 milliseconds to implementation of each start command to the drive controller.

Do not use catch-on-the-fly if there is more than one motor supplied by the drive controller.

Motor Overload Memory (F632)

Table 72: Motor Overload Memory

Parameter	Factory Setting	Setting	Function
F632	0	0	Cleared
		1	Retained

If parameter F632 is set to 0, the drive controller's memory of the motor's thermal state (used for overload calculation) is cleared whenever the power is cycled.

If parameter F632 is set to 1, the drive controller's memory of the motor's thermal state is retained even when power is removed. If the drive controller is faulted on an OL2 (motor overload) fault, a cooling time (as calculated by the drive controller) must expire before the motor can be restarted.

Drive Fault Memory (F602)

Table 73: Drive Fault Memory

Parameter	Factory Setting	Setting	Function
F602	0	0	Cleared
		1	Retained

If parameter F602 is set to 0 and power to the drive controller is cycled after a fault:

- If the cause of the fault has been eliminated, the drive controller will reset and can be started. Information about the fault just cleared will be transferred to the fault history.
- If the cause of the fault has not been eliminated, the fault will be displayed again but the drive controller's memory of the operational information associated with the fault will be transferred to the fault history.
- Information about the 4th most recent fault will be eliminated from the fault history.

If parameter F602 is set to 1 and power to the drive controller is cycled after a fault:

- If the cause of the fault has been eliminated, the drive controller will reset and can be started. Information about the fault just cleared will be transferred to the fault history.
- If the cause of the fault has not been eliminated, the original fault code and all of its operational data will be available for viewing as the current fault in the monitoring mode.
- Information about the 4th most recent fault will be retained in the fault history.
- Auto fault reset will be disabled.

Input Phase Failure Detection Mode (F608)

Table 74: Input Phase Failure Detection Mode

Parameter	Factory Setting	Setting	Function
F608	1	0	Disabled
		1	Enabled

If parameter F608 is set to 0, input phase failure detection is disabled. Loss of one input phase will not cause the drive controller to fault.

If parameter F608 is set to 1, the loss of one input phase will cause an *EPHI* fault.

Coast To Stop On Momentary Loss Of Input Power (F302)

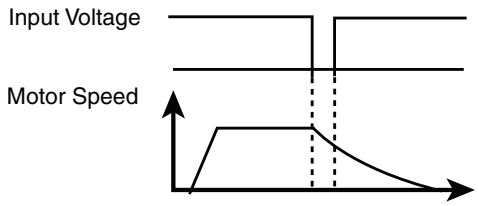
Table 75: Coast To Stop On Momentary Loss Of Input Power

Parameter	Factory Setting	Setting	Function
F302	0	0	Disabled
		1	DO NOT SELECT
		2	Coast to stop

If parameter F302 is set to 0 and the drive controller briefly loses input power, it may not fault but may instead experience a momentary reduction of motor voltage and/or current and then resume normal operation once full input power is restored.

If parameter F302 is set to 2 and the drive controller briefly loses input power, the drive controller will remove power from the motor and allow it to coast to a stop. The keypad will flash $5\,t\,0\,P$. The drive controller can only be restarted by providing a new run command.

Figure 47: Parameter F302



Undervoltage Fault Operation Mode (F627)

Table 76: Undervoltage Fault Operation Mode

Parameter	Factory Setting	Setting	Function
F627	0	0	Alarm only (detection level below 60%)
		1	Fault (detection below 60%)
		2	Alarm only (detection level below 50%)

If parameter F627 is set to 0 and the supply voltage drops below 60% of its rated value, the drive controller will stop and indicate a fault code on the keypad, but it will not activate a fault relay. If the supply voltage rises above 60% of its rated value, the fault code on the keypad will be cleared without a fault reset action and the drive controller will be ready to operate.

If parameter F627 is set to 1 and the supply voltage drops below 60% of its rated value, the drive controller will fault and will require a reset action to clear the fault before it can be restarted.

If parameter F627 is set to 2 and the supply voltage drops below 50% of its rated value, the drive controller will stop and indicate a fault code on the keypad, but it will not activate a fault relay. If the supply voltage rises above 50% of its rated value, the fault code on the keypad will be cleared without a fault reset action and the drive controller will be ready to operate.

The use of a line reactor is required if parameter F267 is set to 2.

Overvoltage Fault Protection (F305)

Table 77: Overvoltage Fault Protection

Parameter	Factory Setting	Setting	Function
F305	2	0	Enabled
		1	Disabled
		2	Enabled (quick deceleration mode)
		3	Enabled (dynamic quick deceleration mode)

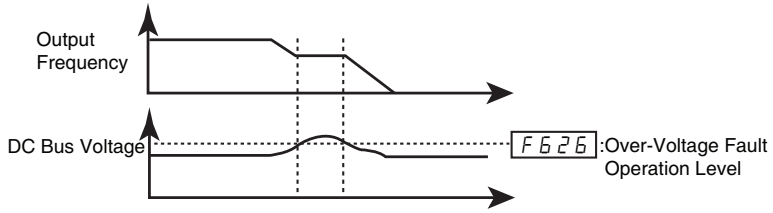
When motor speed is being reduced, a DC bus overvoltage fault can often be caused by regenerated energy being absorbed by the drive controller from the load and motor.

If parameter F305 is set to 0, and the drive controller detects an impending DC bus overvoltage fault, it will automatically take one of the following actions:

- Increase the deceleration time
- Keep the motor at a steady speed
- Increase the motor speed

See Figure 48 for more details.

Figure 48: Parameters F305 and F626



If parameter F305 is set to 1, the drive controller will take no action to avoid a DC bus overvoltage fault.

If parameter F305 is set to 2, and the drive controller detects an impending DC bus overvoltage fault, it will increase the V/Hz ratio of the power applied to the motor. Motor over-excitation is used to dissipate regenerative energy into the motor instead of the drive controller.

If parameter F305 is set to 3, the drive controller will increase the V/Hz ratio of the power applied to the motor as soon as slow down begins instead of waiting for the DC bus voltage to approach the fault level.

Overvoltage Fault Operation Level (F626)

Table 78: Overvoltage Fault Operation Level

Parameter	Factory Setting	Adjustment Range
F626	140	100 – 150% of nominal DC bus voltage

Parameter F626 sets the DC bus voltage level at which the actions defined by parameter F305 take place. See Figure 48 for more details.

Output Phase Failure Detection Mode (F605)

Table 79: Output Phase Failure Detection Mode

Parameter	Factory Setting	Setting	Function
F605	3	0	Disabled
		1	At first start-up
		2	At every start-up
		3	During operation
		4	At start-up and during operation
		5	Load side disconnect mode

If output phase failure detection is enabled and an output phase failure persists for more than 1 second, the drive controller will fault and display the *EPHD* fault code.

If parameter F605 is set to 0, output phase failure detection is disabled.

If parameter F605 is set to 1, an output phase failure check is made only during the first motor start-up after power is applied to the drive controller.

If parameter F605 is set to 2, an output phase failure check is made every time the motor is started.

If parameter F605 is set to 3, continuous output phase failure monitoring is performed while the motor is running.

If parameter F605 is set to 4, monitoring for an output phase failure is performed at motor start-up and continuously during operation.

Setting 5 for parameter F605 is for applications with a load side disconnect. The drive controller will automatically restart the motor if the following are true:

- An all-phase failure has been detected (an output contactor or a load side disconnect has opened)
- The drive controller detects that a 3-phase connection has been reestablished (the output contactor or load side disconnect has closed)
- A valid run command exists

An output phase failure detection sweep is made as part of the auto-tuning process, regardless of the setting of parameter F605. High-speed motors and other special motors may cause nuisance output phase failure faults.

Underload Fault/Alarm Selection (F610)

The drive controller's response to an underload condition is set by parameters F609, F610, F611, and F612.

The setting of parameter F610 determines whether an underload condition signals an alarm with an output relay or faults the drive controller.

Parameter F611 sets the underload detection level.

The sum of parameters F609 and F611 determines the drive controller loading level that will clear an underload alarm/fault.

Parameter F612 determines how long the drive controller can be under load before an alarm or fault is signaled.

See Figure 49 on page 92 for more details.

Table 80: Underload Fault/Alarm Selection

Parameter	Factory Setting	Setting	Function
F610	0	0	Alarm
		1	Fault

If parameter F610 is set to 0, relay output functions 24 or 25 (see page 38) can be used to signal an underload condition without the drive controller faulting.

If parameter F610 is set to 1 and the loading level drops below the setting of F611 for a period of time longer than that set by F612, the drive controller will fault, displaying fault code UC. The fault relay will be set if one has been defined (relay output functions 10 or 11, see page 37). A relay assigned to signal an underloaded condition (functions 24 or 25, see page 38) will also be set.

Underload Detection Level (F611)

Table 81: Underload Detection Level

Parameter	Factory Setting	Adjustment Range
F611	0	0 – 100%[1]

[1] Percentage of the drive controller's current rating. Display can also be in amperes, depending on setting of parameter F701 (see page 82).

Underload Detection Level Bandwidth (F609)

Table 82: Underload Detection Level Bandwidth

Parameter	Factory Setting	Adjustment Range
F609	10	1 – 20%[1]

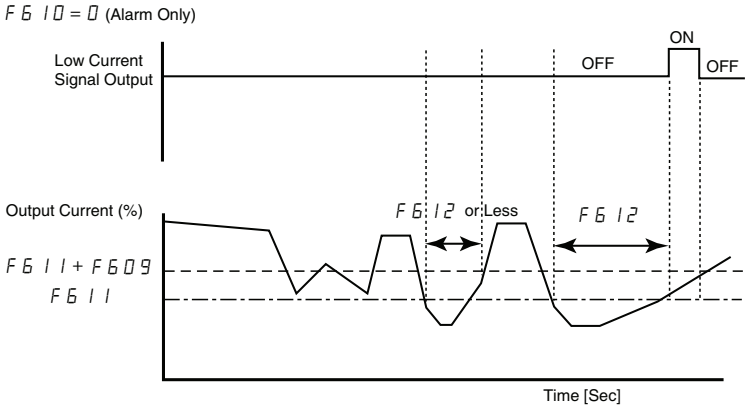
[1] Percentage of F611 setting

Underload Detection Time (F612)

Table 83: Underload Detection Time

Parameter	Factory Setting	Adjustment Range
F612	10	0 – 255 seconds

Figure 49: Parameters F609, F610, F611 and F612



Loss of VIA Analog Signal (F633)

Table 84: Loss of VIA Analog Signal

Parameter	Factory Setting	Setting	Function
F633	0	0	Disabled
		1 – 100% [1]	Fault detection level

[1] Percentage of maximum VIA signal level

If parameter F633 is set to 0, the drive controller will not monitor for loss of signal at analog input terminal VIA.

If parameter F633 is set to a value greater than 0 and:

- The signal at VIA drops below the fault detection level selected, and
- The low signal level persists for 300 milliseconds or longer

the drive controller will fault and the keypad will display the fault code *E - IB*.

SERIAL COMMUNICATION PARAMETERS

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure.
- Examples of critical control functions are Emergency Stop and Overtravel Stop.
- Separate or redundant control paths must be provided for critical control functions.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

Network communication between the ATV21 drive controller and a master controller is possible through five protocols selectable through the keypad:

- Modbus® RTU
- Metasys® N2
- Apogee® P1 FLN
- BACnet
- LonWorks®

Three types of data exchange are possible:

- Monitoring: monitoring values such as output frequency, voltage, and current
- Programming: reading, editing, and writing drive controller parameters
- Control: starting and stopping the drive controller and controlling the frequency reference

For operation on a network containing multiple drive controllers, each ATV21 drive controller must be assigned a unique address using parameter F802.

For operation on a network where all drive controllers are slaves responding to a central control system:

- Parameters CMD and FMD must be set correctly:
  - — Setting CMD to 2 enables start/stop control of the drive controller via network communication
  - — Setting FMD to 4 enables the frequency reference to be controlled by network communication
  - — Setting either CMD to 2 or FMD to 4 enables serial communication error detection. The setting of parameter F851 determines the drive controller's response in case of a loss of communication.

For operation on a network with one master ATV21 drive controlling a system of slave ATV21 drives, use parameter F806 to identify the master, to define the master/slave relationship, and to select the action of the slave if communication with the master is lost.

Control of the ATV21 drive controller can be established by a master controller over a serial communication network regardless of the setting of CMD or FMD (see Figure 1 on page 16). Control can be restored to the source defined by CMD and FMD if the serial communication network relinquishes control or a logic input assigned to function 48 (forced local) is enabled.

Baud Rate (F800)

Table 85: Baud rate

Parameter	Factory Setting	Setting	Function
F800	1	0	9,600 bps
		1	19,200 bps

Parity (F801)

Table 86: Parity

Parameter	Factory Setting	Setting	Function
F801	1	0	No parity
		1	Even parity
		2	Odd parity

Address (F802)

Table 87: Address

Parameter	Factory Setting	Adjustment Range
F802	1	0 – 247

Time-out (F803)

Table 88: Time-out

Parameter	Factory Setting	Setting	Function
F803	3	0	Communication error detection disabled
		1 – 100	Seconds

Communication Waiting Time (F805)

Table 89: Communication Waiting Time

Parameter	Factory Setting	Adjustment Range
F805	0.00	0.00 – 2.00 seconds

Communication Between Slave and Master Selection (F806)

Table 90: Communication Between Slave and Master

Parameter	Factory Setting	Setting	Function
F806	0	0	Slave – drive controller ramps to a stop if communication with master is lost
		1	Slave – last commanded operation continues if communication with master is lost
		2	Slave – drive controller faults if communication with master is lost
		3	Master – transmission of frequency commands
		4	Master – transmission of output frequency signals

Communication Fault Setting (F851)

Table 91: Communication Fault Setting

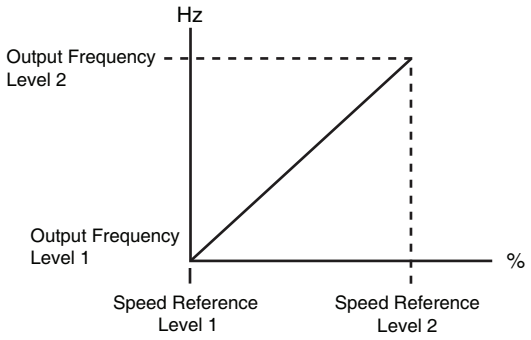
Parameter	Factory Setting	Setting	Function
F851	4	0	Drive controller ramps to a stop. Serial control is relinquished to the sources defined by FNOd and CNOd.
		1	Last commanded operation continues
		2	Drive controller ramps to a stop. Serial control is maintained.
		3	Drive controller removes power from the motor which coasts to a stop. Serial control is maintained.
		4	Drive controller faults with either a communication error Err5 or a network error Err8.

Communication Speed Reference Bias and Slope Adjustments (F811–F814)

Table 92: Communication Speed Reference Bias and Slope Adjustments

Parameter	Factory Setting	Range	Function
F811	0	0 – 100%	Communication speed reference level 1
F812	0.0	0.0 – 200.0 (Hz)	Communication output frequency level 1
F813	100	0 – 100%	Communication speed reference level 2
F814	50.0	0.0 – 200.0 (Hz)	Communication output frequency level 2

Figure 50: Communication Speed Reference and Output Frequency



ADVANCED SETTINGS

This section provides information about advanced drive controller parameters. The parameters in this section are organized according to the following categories:

- Programming parameters: parameters that affect how other parameters are programmed (page 96)
- Motor control parameters: parameters that affect how the drive controller applies power to the motor (page 97)
- Drive control parameters: parameters that affect how the drive controller interacts with the control system and the operator (page 102)
- Application parameters: parameters that customize drive controller operation for a specific application (page 105)
- I/O control parameters: parameters that change the function of the control inputs and outputs (page 111)
- Fault Management parameters: parameters that determine drive controller action in the event of an internal or external fault (page 118)
- Serial communication parameters: parameters whose adjustments are needed only when communicating with the integrated Modbus or an optional serial communication card (page 121)
- Option parameters: parameters used for optional equipment (page 124)

PROGRAMMING PARAMETERS

50 Hz Parameter Reset (tYP = 1)

Setting parameter tYP to a value of 1 will set specific parameters to values suitable for many 50 Hz (motor base frequency) applications.

See Table 190 on page 137 and Table 192 on page 139 for a list of parameters that are affected by this reset action and their resultant values.

Display of Submenu AUF (F738)

Table 93: Display of Submenu AUF

Parameter	Factory Setting	Setting	Function
F738	0	0	AUF displayed
		1	AUF not displayed

The setting of this parameter determines whether the AUF submenu, Quick Menu, will be displayed on the keypad.

See “AUF: Quick Menu” on page 51 for more information.

MOTOR CONTROL PARAMETERS

Motor Tuning

Tuning the drive controller to specific motor values will optimize motor performance if parameter Pt is set to:

- 2 (constant V/Hz with automatic boost),
- 3 (sensorless vector control), or
- 4 (energy savings)

At a minimum, manually set parameters uL, uLu (see page 60), F415, F416, and F417.

Parameters F401, F402, F418, and F419 can be set manually or they can be set automatically using the auto tuning function, parameter F400.

More precise motor control adjustments can be made with parameters F307, F480, F485, F492, and F494 – F496.

Motor Rated Full Load Current (F415)

Table 94: Motor Rated Full Load Current

Parameter	Factory Setting	Adjustment Range
F415	Model dependant (see Table 191 on page 138)	0.1 to 200.0 A

Set parameter F415 to the motor rated full load current in amperes as indicated on the motor’s nameplate.

Motor No-load Current (F416)

Table 95: Motor No-load Current

Parameter	Factory Setting	Adjustment Range
F416	Model dependant (see Table 191 on page 138)	0.0 to 30.0 %

Set parameter F416 to the ratio of the motor’s no load current to its rated full load current.

Motor Rated Speed (F417)

Table 96: Motor Rated Speed

Parameter	Factory Setting	Adjustment Range
F417	Model dependant (see Table 191 on page 138)	100 to 9,999 rpm

Set parameter F417 to the motor rated speed in rpm as indicated on the motor’s nameplate.

Auto Tuning Enable (F400)

Table 97: Auto Tuning Enable

Parameter	Factory Setting	Setting	Function
F400	1	0	Disabled
		1[1]	Enabled – parameter F402 may need adjustment
		2[1]	Enabled – complete auto tuning

[1] Parameter F400 is reset to “0” after the auto tuning is performed.

Before performing an auto-tune, verify that:

- A motor is connected and any load-side disconnect is closed.
- The motor is completely stopped and de-energized.
- The motor should be cool (room temperature).
- There is only one motor connected to the drive controller.
- All of the motor leads that will be used in the final installation are included in the output circuit during the auto-tuning process.
- Motor leads are no longer than 100 ft. Motor leads longer than 100 ft. may result in reduced motor torque and less than optimal motor control.
- No load reactors or filters are included in the motor circuit. Output reactors and filters may cause an auto-tuning error (Etn1) and reduce effectiveness of sensorless vector control.
- The motor is not more than 1 hp size smaller than the drive controller.
- The motor has at least 2 and not more than 8 poles (900 to 3600 rpm).
- The motor does not have a high slip rating.

Auto tuning is performed upon the first start command after parameter F400 is set to 1 or 2 and is normally completed within 3 seconds. During the auto-tuning process, the keypad displays $AtnI$.

During the auto-tuning process voltage is applied to the motor, although it barely rotates and produces very little torque.

During the auto-tuning process, the drive controller checks for an output phase loss regardless of the setting of parameter F605. An output phase loss fault ($EPHO$) will abort the auto-tuning process.

If the auto-tuning process fails, the drive controller will display fault code $EtnI$. In this event, no results of the aborted auto-tuning will be saved in the drive controller, and a manual tuning of parameters F401, F402, F418, and F419 will be required.

Slip Compensation (F401)

Table 98: Slip Compensation

Parameter	Factory Setting	Adjustment Range
F401	50	0 to 150%

Before adjusting parameter F401, verify that parameter F417 is set to the rated full-load speed of the motor in rpm. Parameter F401 can be used to fine tune the drive controller’s slip compensation feature. Increasing the value of parameter F401 increases the drive controller’s compensation of motor slip.

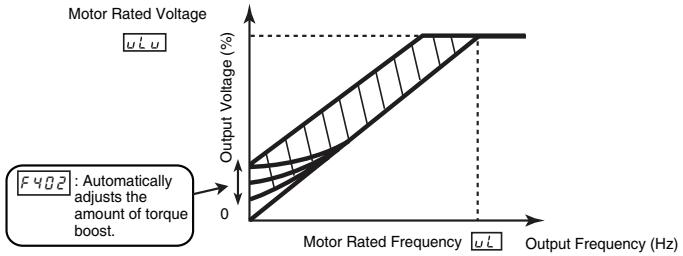
Auto Torque Boost (F402)

Table 99: Auto Torque Boost

Parameter	Factory Setting	Adjustment Range
F402	Model dependant (see Table 191 on page 138)	0.0 to 30.0%

Use parameter F402 to adjust the amount of automatic torque boost that is applied.

Figure 51: Auto Torque Boost



Speed Control Response Coefficient (F418)

Parameters F418 and F419 reduce the speed of the drive controller's response to a change in speed command. The factory setting of these two parameters assumes that the inertia of the load is three times as large as that of the motor shaft. Adjust these two parameters if the factory setting is not appropriate for the application.

NOTE: It is possible for the drive controller's output frequency to exceed its upper limit (parameter FH) if the acceleration parameter (ACC or F507) is set to its minimum value.

Table 100: Speed Control Response Coefficient

Parameter	Factory Setting	Adjustment Range
F418	40	1 to 150

Increasing the setting of parameter F418 reduces the drive controller's response time to changes in the speed reference.

Speed Control Stable Coefficient (F419)

Table 101: Speed Control Stable Coefficient

Parameter	Factory Setting	Adjustment Range
F419	20	1 to 100

Increasing the setting of parameter F419 further reduces the drive controller's response to changes in the speed reference.

Magnetizing Current Coefficient (F480)

Table 102: Magnetizing Current Coefficient

Parameter	Factory Setting	Adjustment Range
F480	100%	100 to 130%

Use parameter F480 to fine tune motor torque during low-speed operation. To increase motor torque in the low-speed operating range, increase the setting of parameter F480. However, only adjust parameter F480 if an auto tune does not yield sufficient low-speed torque. Increasing the setting of parameter F480 may increase the motor's no-load current during low-speed operation. Do not set this parameter so that the motor's no-load current exceeds its rated operating current.

Stall Prevention Control Coefficient 1 (F485)

Table 103: Stall Prevention Control Coefficient 1

Parameter	Factory Setting	Adjustment Range
F485	100	10 to 250

Use parameter F485 to adjust the drive controller's response to large, sudden changes in load when the motor is operated above its rated frequency. If a sudden change in load causes the motor to stall before the drive controller goes into current limit, gradually reduce the setting of F485.

Stall Prevention Control Coefficient 2 (F492)

Table 104: Stall Prevention Control Coefficient 2

Parameter	Factory Setting	Adjustment Range
F492	100	50 to 150

Use parameter F492 to adjust the drive controller's response to a drop in the line supply voltage when the motor is operated above its rated frequency. Such a drop in voltage often causes fluctuations in motor current or vibration in the motor. To eliminate these disturbances, set parameter F492 to a value between 80 and 90.

NOTE: Reducing the F492 setting increases the motor running current level.

Motor Adjustment Coefficient (F494)

DO NOT ADJUST.

Maximum Voltage Adjustment Coefficient (F495)

Table 105: Maximum Voltage Adjustment Coefficient

Parameter	Factory Setting	Adjustment Range
F495	104%	90 to 110%

Use parameter F495 to limit the drive controller's maximum output voltage. Increasing this setting increases torque when the motor is operated above its rated frequency, but may also cause motor vibration. Do not increase the value of F495 if motor vibrations occur.

Waveform Switching Adjustment Coefficient (F496)

Table 106: Waveform Switching Adjustment Coefficient

Parameter	Factory Setting	Adjustment Range
F496	14.0 kHz	0.1 to 14.0 kHz

Adjusting the value of parameter F496 may reduce motor noise and vibration during PWM waveform frequency shifts in the mid-speed operating range.

Supply Voltage Correction and Motor Voltage Limitation (F307)

Table 107: Supply Voltage Correction and Motor Voltage Limitation

Parameter	Factory Setting	Setting	Function
F307	3	0	Supply voltage uncorrected – motor voltage limited
		1	Supply voltage corrected – motor voltage limited
		2	Supply voltage uncorrected – motor voltage unlimited
		3	Supply voltage corrected – motor voltage unlimited

The setting of parameter F307 determines:

- If the drive controller's voltage output will be corrected for fluctuations in the line supply voltage, or
- If the drive controller's voltage output will be limited, despite increases in the line supply voltage.

The drive controller's output voltage will not exceed the input supply voltage.

If parameter F307 is set to 0 or 2, no corrections are made in the motor voltage gating process in response to fluctuations in supply voltage. As a result, the V/Hz value of the output waveform to the motor will change in proportion to the input voltage. Conversely, if F307 is set to 1 or 3, the V/Hz value of the output waveform will be held constant, despite changes in the supply voltage level.

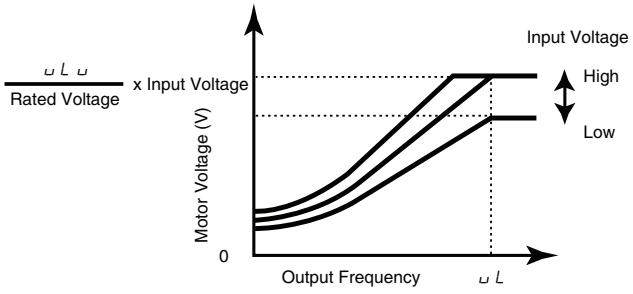
If parameter F307 is set to 0 or 1, output motor voltage will be limited to the value set by parameter uLu, even if the input supply voltage rises. If F307 is set to 2 or 3, output motor voltage can rise above the level set by uLu if the input supply voltage rises above the motor rated voltage.

If parameter Pt is set to a value of 2, 3, 4, 5, or 6, the supply voltage is corrected, regardless of the setting of parameter F307.

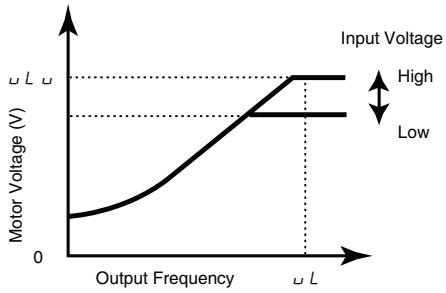
Figure 52 illustrates the impact of each setting of parameter F307.

Figure 52: Settings for parameter F307

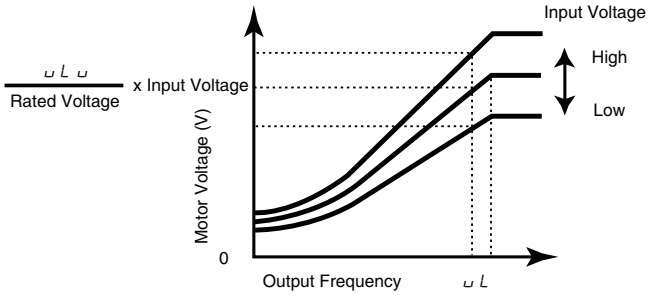
F307 = 0
Supply Voltage uncorrected, Motor Voltage Limited



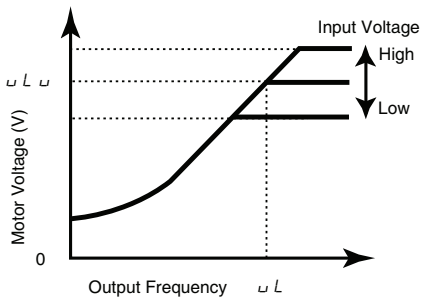
F307 = 1
Supply Voltage corrected, Motor Voltage Limited



F307 = 2
Supply Voltage uncorrected, Motor Voltage Unlimited



F307 = 3
Supply Voltage corrected, Motor Voltage Unlimited



DRIVE CONTROL PARAMETERS

Remote Mode Secondary Speed Reference Source (F207)

Table 108: Remote Mode Secondary Speed Reference Source

Parameter	Factory Setting	Setting	Function
F207	2	1	VIA
		2	VIB
		3	Keypad
		4	Serial communication
		5	+/- Speed

Parameter F207 defines the remote mode secondary speed reference source. The setting of parameter F200 (see page 77) determines whether this source is used for the speed reference.

If F200 is set to 0, a logic input terminal set to function 38 (see page 33) determines if F207 identifies the speed reference source.

If F200 is set to 1, F207 is the speed reference source when the drive controller's output frequency is 1 Hz or below.

See Figure 1 on page 16 for more detail.

Forced Speed Enable (F650)

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.[1]
- Each implementation of an Altivar 21 drive controller must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

[1] For additional information refer to NEMA ICS 1.1 (latest edition), "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control" and to NEMA ICS 7.1 (latest edition), "Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems."

Table 109: Forced Speed Enable

Parameter	Factory Setting	Setting	Function
F650	0	0	Disabled
		1	Enabled

To enable Forced speed mode, set parameter F650 to 1 and assign a logic input to function 52 or 53 (see Table 2 beginning on page 32). When parameter F650 is set to 1, the keypad will briefly flash the code F Ir E.

If parameter F650 is set to 1 and a logic input assigned to function 52 is activated, the drive controller will run at the frequency set by parameter F294 (see page 103).

- Deactivationg the logic input assigned to function 52 will not stop the drive controller!
- The following drive controller faults will not stop the drive controller: OC1, OC2, OC3, OC1P, OC2P, OC3P, OP1, OP2, OP3,OL1,OL2, OH, and SOUt
- Only removing power from the drive controller will stop it when it is in this mode of operation.

When parameter F650 is set to 1 and a logic input set to function 53 is activated, the drive controller will run at the frequency set by parameter F294 (see page 103).

- Deactivationg the logic input assigned to function 53 will not stop the drive controller!
- Only a fault or pressing the STOP key on the keypad will stop the drive controller.

Forced Speed Frequency (F294)

Table 110: Forced Speed Frequency

Parameter	Factory Setting	Adjustment Range
F294	50.0 Hz	LL - UL

Use parameter F204 to set the fixed frequency command for the drive controller when it is in Forced speed mode.

Motor Rotation Direction Command (F311)

Table 111: Motor Rotation Direction Command

Parameter	Factory Setting	Setting	Function
F311	1	0	Forward and Reverse operation PERMITTED
		1	Reverse operation PROHIBTED
		2	Forward operation PROHIBITED

Use parameter F311 to prevent forward or reverse operation when an improper operation signal is received.

Disabling of Keypad Speed Reference Change Keys (F730)

Table 112: Disabling of Keypad Speed Reference Change Keys

Parameter	Factory Setting	Setting	Function
F730	0	0	Enabled
		1	Disabled

The setting of parameter F730 determines whether it is possible to set the drive controller's speed by means of the keypad in local mode.

Disabling of Keypad Local/Remote Key (F732)

Table 113: Disabling of Keypad Local/Remote Key

Parameter	Factory Setting	Setting	Function
F732	0	0	Enabled
		1	Disabled

Use parameter F732 to enable or disable the LOC/REM key on the drive controller keypad.

If the LOC/REM key is disabled, switching between local and remote mode can be achieved with parameters FMOd and CMOd. See page 64.

Disabling of Keypad RUN and STOP Keys in Local Mode (F733)

⚠ WARNING

DISABLED STOP COMMAND

Disabling the stop key (733 or 734) on the drive keypad display or the remote keypad display will prevent the drive controller from stopping when the stop key is pressed. An external stop command must be installed to stop the motor.

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

Table 114: Disabling of Keypad RUN and STOP Keys

Parameter	Factory Setting	Setting	Function
F733	0	0	Enabled
		1	Disabled

The setting of parameter F733 determines whether it is possible to start and stop the drive controller by means of the keypad in local mode.

Disabling of Keypad STOP Key in Remote Mode (F734)

Table 115: Disabling of Keypad STOP Key in Remote Mode

Parameter	Factory Setting	Setting	Function
F734	0	0	Enabled
		1	Disabled

The setting of parameter F733 determines whether it is possible to stop the drive controller by means of the keypad in remote mode (see page 19 for more detail).

Disabling of Keypad Fault Reset Function (F735)

Table 116: Disabling of Keypad Fault Reset Function

Parameter	Factory Setting	Setting	Function
F735	0	0	Enabled
		1	Disabled

The setting of parameter F735 determines whether it is possible to reset a drive controller fault by means of the keypad STOP key (see page 20 for more detail).

APPLICATION PARAMETERS

Acceleration Time 2 (F500)

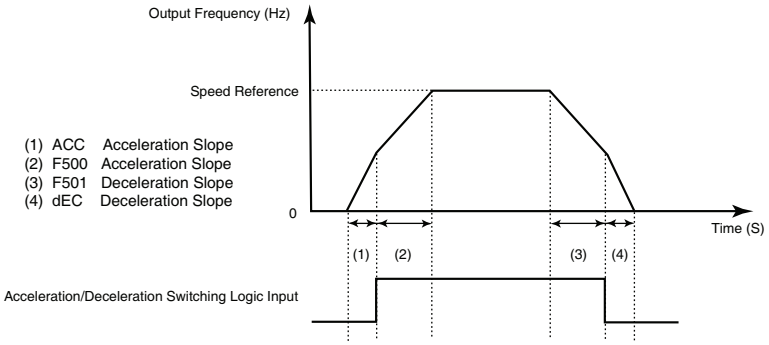
Table 117: Acceleration Time 2

Parameter	Factory Setting	Adjustment Range
F500	20.0 seconds	0.0 to 3200 seconds

Parameter F500 sets the second acceleration time. Switching between acceleration rates 1 and 2 is accomplished by means of:

- Parameter F504 (see page 106),
- A particular operating frequency (see parameter F505 on page 107), or
- A logic input assigned to functions 5, 20, 21, 30, 31 – 35, or 40 (see Table 2 beginning on page 32)

Figure 53: Parameter F500



Deceleration Time 2 (F501)

Table 118: Deceleration Time 2

Parameter	Factory Setting	Adjustment Range
F501	20.0 seconds	0.0 to 3200 seconds

Parameter F501 sets the second deceleration time. Switching between deceleration rates 1 and 2 is accomplished by means of:

- Parameter F504 (see page 106),
- A particular operating frequency (see parameter F505 on page 107), or
- A logic input assigned to functions 5, 20, 21, 30, 31 – 35, or 40 (see Table 2 beginning on page 32)

Acc/Dec S-pattern Lower Limit (F506)

Table 119: Acc/Dec S-pattern Lower Limit

Parameter	Factory Setting	Adjustment Range
F506	10%	0 to 50% of acceleration time

Use parameter F506 to adjust the lower portion of S-pattern 1. See Figure 35 on page 70.

Acc/Dec S-pattern Upper Limit (F507)

Table 120: Acc/Dec S-pattern Upper Limit

Parameter	Factory Setting	Adjustment Range
F507	10%	0 to 50% of acceleration time

Use parameter F507 to adjust the upper portion of the S-pattern 1. See Figure 35 on page 70.

Acc/Dec Pattern 2 (F503)

Table 121: Acc/Dec Pattern 2

Parameter	Factory Setting	Value	Function
F503	0	0	Linear
		1	S-pattern 1
		2	S-pattern 2

Use parameter F503 to select the second Acc/Dec pattern. Switching between Acc/Dec patterns 1 and 2 is accomplished by means of:

- Parameter F504 (see page 106),
- A particular operating frequency (see parameter F505 on page 107), or
- A logic input assigned to functions 5, 20, 21, 30, 31 – 35, or 40 (see Table 2 beginning on page 32)

For more information on Acc/Dec patterns, see parameter F502 on page 70.

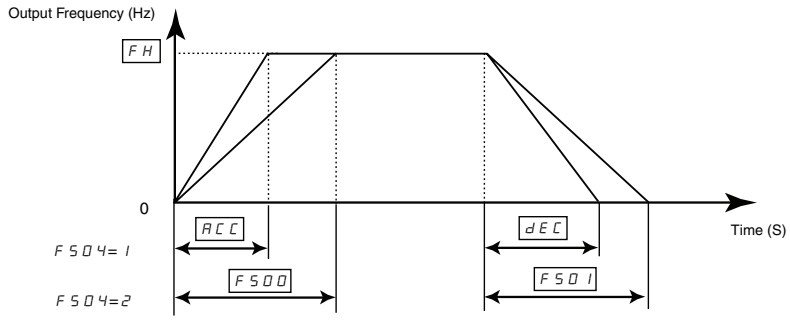
Acc/Dec Pattern Selection (Ramp Switching) (F504)

Table 122: Acc/Dec Pattern Selection (Ramp Switching)

Parameter	Factory Setting	Setting	Function
F504	1	1	Acc/Dec pattern 1
		2	Acc/Dec pattern 2

Parameter F504 determines the Acc/Dec pattern. See Figure 54.

Figure 54: Parameter F504



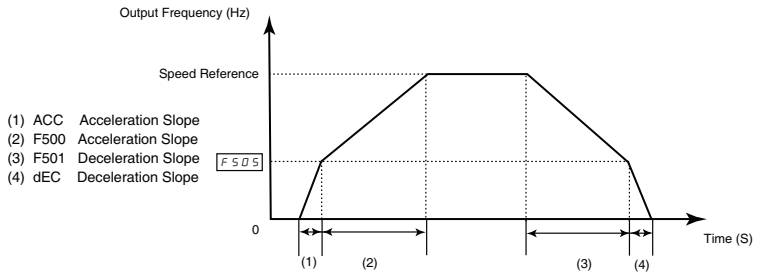
Acc/Dec Pattern Switching Frequency (F505)

Table 123: Acc/Dec Pattern Switching Frequency

Parameter	Factory Setting	Adjustment Range
F505	0.0	0.0 to UL

If parameter F505 is set to a frequency greater than 0.0, the drive controller will use Acc/Dec pattern 1 above that frequency and Acc/Dec pattern 2 above.

Figure 55: Parameter F505



DC Injection Braking Parameters

⚠ WARNING

NO HOLDING TORQUE

- DC injection braking does not provide holding torque at zero speed.
- DC injection braking does not function during a loss of power or during a drive controller fault.
- When required, use a separate brake for holding torque.

MOTOR OVERHEATING

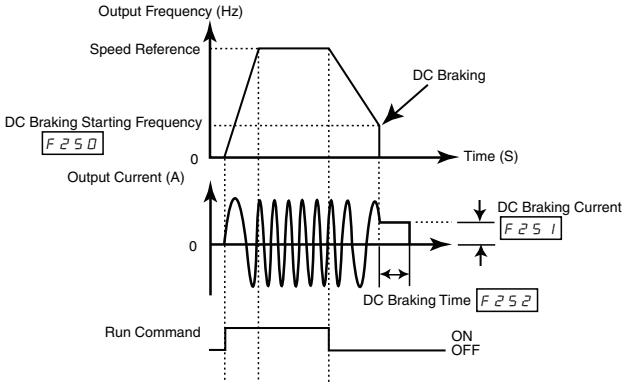
- Protect the motor from extended periods of DC injection braking. Application of DC injection braking for long periods of time can cause motor overheating and damage.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

The drive controller can inject DC current into the motor to apply braking torque to the load. Parameters F250, F251 and F252 determine the starting frequency, current level, and braking time.

During DC injection braking, the drive controller's switching frequency is 6 kHz regardless of the setting of parameter F300 (see page 71).

Figure 56: DC Injection Braking



DC Braking Starting Frequency (F250)

Table 124: DC Braking Starting Frequency

Parameter	Factory Setting	Adjustment Range
F250	0.0 Hz	0.0 to FH (Hz)

When stopping the motor, the drive controller will apply DC injection braking once the output frequency drops below the level set by parameter F250.

DC Braking Current Level (F251)

Table 125: DC Braking Current Level

Parameter	Factory Setting	Adjustment Range
F251	50 %[1]	0 to 100 %

[1] Percent of the drive controller's rated current. Ampere range will vary according to drive controller power rating.

Parameter F251 sets the level of current applied to the motor during DC injection braking. The displayed value, percent or amperes, is set by parameter F701 (see page 82).

During DC injection braking, the drive controller's overload protection sensitivity increases. The drive controller automatically lowers the applied DC current to avoid an overload fault.

DC Braking Time (F252)

Table 126: DC Braking Time

Parameter	Factory Setting	Adjustment Range
F252	1.0 seconds	0.0 to 20.0 seconds

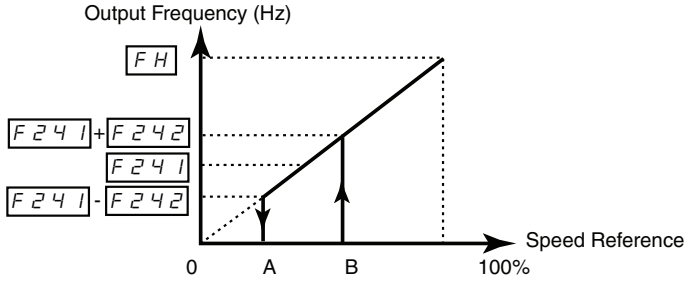
Parameter F252 determines how long DC injection braking is applied to the motor.

Start/Stop Control By Speed Reference Level

Use parameters F241 and F242 to enable start/stop control of the drive controller based on the speed reference level.

If the drive controller is not faulted and has a run permissive signal, the drive controller will start powering the motor as soon as the speed reference level exceeds the frequency set by F241 + F242 (point B in Figure 57). It will remove power from the motor as soon as the output frequency drops below the level set by F241 – F242 (point A in Figure 57).

Figure 57: Start/Stop Control



Operating Starting Frequency (F241)

Table 127: Operating Starting Frequency

Parameter	Factory Setting	Adjustment Range
F241	0.0 Hz	0.0 to FH (Hz)

Operating Starting Frequency Hysteresis (F242)

Table 128: Operating Starting Frequency Hysteresis

Parameter	Factory Setting	Adjustment Range
F242	0.0 Hz	0.0 to FH (Hz)

Droop Control

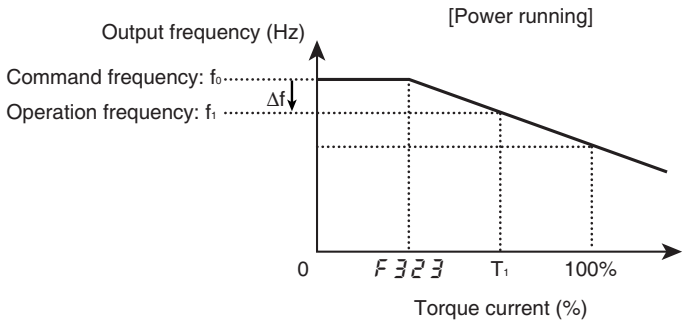
The use of droop control (or negative slip compensation) can help balance the load between multiple motors in a load sharing application. The amount of slip or speed droop allowed in the motor powering the load is determined by the load current level and the setting of parameters F320 and F323.

During motoring, droop control decreases the drive controller output frequency. During regenerative braking, droop control increases the drive controller output frequency,

When enabled, droop control is active when:

- The load current exceeds the level set by parameter F323.
- The drive controller output frequency is between the starting frequency (parameter F240, see page 68) and maximum frequency (parameter FH, see page 67).

Figure 58: Droop Control



The amount of speed droop allowed (f) can be calculated by this equation:

f = UL[1] (motor rated frequency) x F320 x (load current – F323) [2]

Example:

UL = 60 Hz
F320 = 10%
F323 = 30% (of drive controller's rated current)
Load current = 100% of drive controller's rating

f = 60 x 0.1 x (1 – 0.3)
f = 60 x 0.07
f = 4.2

Assuming the speed reference is set to 60 Hz, the output frequency will be: f1 = f0 – f = 60 – 4.2 = 55.8 (Hz).

Droop Gain (F320)

Table 129: Droop Gain

Parameter	Factory Setting	Adjustment Range
F320	0%	0 to 100%

Droop Insensitive Torque Band (F323)

Table 130: Droop Insensitive Torque Band

Parameter	Factory Setting	Adjustment Range
F323	0%[1]	0 to 100%[1]

[1] Percent of the drive controller's rated current.

[1] This is parameter UL (see page 61). The value entered for UL in this formula should not exceed 100, regardless of the actual setting of parameter UL.

[2] Speed droop is zero if (load current – F323 = 0).

Permanent Magnet Motor

NOTE: Consult the catalog before applying the drive controller to a permanent magnet motor.

If a permanent magnet motor steps out with a resultant increase in motor current, the drive controller will fault with a SOUt code if the motor current exceeds the level set by parameter F910 for a time greater than that set by parameter F912.

Permanent Motor Step-out Detection Current Level (F910)

Table 131: Permanent Motor Step-out Detection Current Level

Parameter	Factory Setting	Adjustment Range
F910	100 %[1]	10 to 150 %

[1] Percent of the drive controller's rated current. Ampere range will vary according to drive controller power rating.

Permanent Motor Step-out Detection Time (F911)

Table 132: Permanent Motor Step-out Detection Time

Parameter	Factory Setting	Setting	Function
F911	0.00 seconds	0.00	Disabled
		0.01 – 25	Enabled

Permanent Motor High-speed Torque Adjustment Coefficient (F912)

DO NOT ADJUST.

I/O CONTROL PARAMETERS

PTC Motor Thermal Protection Enable (F645)

Table 133: PTC Motor Thermal Protection Enable

Parameter	Factory Setting	Setting	Function
F645	0	0	Disabled
		1	Enabled (fault mode)
		2	Enabled (alarm mode)

Setting parameter F645 to 1 or 2 converts control terminal VIB into a PTC motor thermal probe input. See the *Altivar® 21 Installation Guide*, 30072-451-61, for wiring details.

If F911 is set to 1 and the PTC probe signals a problem, the drive controller will fault and display an OH2 code.

If F911 is set to 2 and the PTC probe signals a problem, the drive controller will signal a fault and continue operating.

PTC Resistor Value (F646)

Table 134: PTC Resistor Value

Parameter	Factory Setting	Adjustment Range
F646	3000 Ω	0 to 9999 Ω

Always Active Logic Function

⚠ WARNING

LOSS OF CONTROL

- The designer of any control scheme must consider the potential failure modes of control paths and, for certain critical control functions, provide a means to achieve a safe state during and after a path failure. Examples of critical control functions are emergency stop and overtravel stop.
- Separate or redundant control paths must be provided for critical control functions.
- System control paths may include communication links. Consideration must be given to the implications of unanticipated transmission delays or failures of the link.[1]
- Each implementation of an Altivar 21 drive controller must be individually and thoroughly tested for proper operation before being placed into service.

Failure to follow these instructions can result in death, serious injury, or equipment damage.

[1] For additional information refer to NEMA ICS 1.1 (latest edition), "Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control" and to NEMA ICS 7.1 (latest edition), "Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems."

Two logic input functions can be configured to be always active. The logic input functions assigned to parameters F108 and F110 will continuously affect drive controller operation. See Table 2 beginning on page 32 for a list of available logic input functions.

Always Active Logic Function 1 (F108)

Table 135: Always Active Logic Function 1

Parameter	Factory Setting	Adjustment Range
F108	0 (no function)	0 to 71

Always Active Logic Function 2 (F110)

Table 136: Always Active Logic Function 2

Parameter	Factory Setting	Adjustment Range
F110	1 (run permissive)	0 to 71

Preset Speeds (Sr1 – Sr7)

A maximum of seven preset speeds can be selected by 4 logic inputs (F, R, RES, or VIA). Preset speed control is only active when the drive controller is in logic input control (CMd = 0).

For one preset speed, assign a logic input to function 6.

For up to three preset speeds, use two logic inputs for functions 6 and 7.

For up to seven preset speeds, use three logic inputs for functions 6, 7, and 8.

Preset speed commands take priority over speed commands from any other source. For more information on preset speeds, see pages 29 and 32. See the *Altivar 21® Installation Guide*, 30072-451-61, for wiring instructions.

Table 137: Preset Speeds

Parameter	Function	Range	Factory Setting
Sr1	Preset speed 1	LL – UL Hz	15
Sr2	Preset speed 2	LL – UL Hz	20
Sr3	Preset speed 3	LL – UL Hz	25
Sr4	Preset speed 4	LL – UL Hz	30
Sr5	Preset speed 5	LL – UL Hz	35
Sr6	Preset speed 6	LL – UL Hz	40
Sr7	Preset speed 7	LL – UL Hz	50

Motor 2 Control Parameters

When logic inputs assigned to functions 39 or 40 are active, parameters F170 – F173 and F185 are the active set of motor control parameters.

When motor 2 control parameters are active, only constant V/Hz motor control mode (Pt = 0) is available (see page 58).

Motor 2 Rated Frequency (F170)

Table 138: Motor 2 Rated Frequency

Parameter	Factory Setting	Range
F170	50.0 Hz	25.0 to 200.0 Hz

Set parameter F170 to the motor's rated frequency as indicated on the motor nameplate, typically 60 Hz.

NOTE: it is possible to set the drive controller's various motor control frequencies to 60 Hz by setting parameter tYP to 2, the 60 Hz reset. For more information, see page 56.

Motor 2 Rated Voltage (F171)

Table 139: Motor 2 Rated Voltage

Parameter	ATV21 model	Factory Setting	Range
F171	230 V	230 V	50 to 330 V
	460 V	400 V	50 to 660 V

Set parameter F171 to the motor's rated voltage as indicated on the motor nameplate.

NOTE: drive controller output voltage cannot be set to exceed the input line voltage.

Motor 2 Voltage Boost (F172)

Table 140: Motor 2 Voltage Boost

Parameter	Factory Setting	Range
F172	Dependent on drive controller model[1]	0 to 30%

[1] See Table 191 on page 138

Motor 2 Rated Current Overload Setting (F173)

Table 141: Motor 2 Rated Current Overload Setting

Parameter	Factory Setting	Range
F173	100%	10 to 100% of the drive controller's output current rating

Set parameter F173 to the motor's rated current as listed on the motor nameplate for the selected operating voltage.

Motor 2 Current Limit (F185)

Table 142: Motor 2 Current Limit

Parameter	Factory Setting	Range
F185	110%	10 to 110% of the drive controller's output current rating

Adjust parameter F185 to limit current during motoring or braking.

Do not set parameter F185 below the no-load current rating of the motor; otherwise, the drive controller will determine that motor braking is taking place and will increase the frequency applied to the motor.

+/- Speed Control Parameters

+/- speed (motorized potentiometer) control is selected by setting parameter FIOd or F207 to 5 (see pages 64 and 102). Two logic inputs are required, one to increase the speed command (logic input function 41) and one to decrease the speed command (logic input function 42). Logic input function 43 clears the speed reference value accumulated by the +/- speed logic inputs.

Parameters F264 – F269 refine the operation of +/- speed control.

The ratio of parameter F265 to parameter F264 determines the (+) speed command slope:

(+) speed command slope = F265 / F264

The ratio of parameter F267 to parameter F266 determines the (-) speed command slope.

(-) speed command slope = F267 / F266

For more detail, see pages 30 and 34.

+Speed Logic Input Response Time (F264)

Table 143: +Speed Logic Input Response Time

Parameter	Factory Setting	Range
F264	0.1 seconds	0.0 to 10.0 seconds

Parameter F264 sets the maximum on-time of the logic input assigned to (+) speed, limiting the speed increase, as defined by parameter F 265, to only one step. Keeping the logic input active longer than the time set by parameter F264 will allow multiple step increases of the speed command.

+Speed Frequency Steps (F265)

Table 144: +Speed Frequency Steps

Parameter	Factory Setting	Range
F265	0.1 Hz	0.0 to FH (Hz)

Parameter F265 sets the frequency width in Hz of each (+) speed command step.

-Speed Logic Input Response Time (F266)

Table 145: -Speed Logic Input Response Time

Parameter	Factory Setting	Range
F266	0.1 seconds	0.0 to 10.0 seconds

Parameter F266 sets the maximum on-time of the logic input assigned to (-) speed, limiting the speed decrease, as defined by parameter F 267, to only one step. Keeping the logic input active longer than the time set by parameter F265 will allow multiple step decreases of the speed command.

-Speed Frequency Steps (F267)

Table 146: -Speed Frequency Steps

Parameter	Factory Setting	Range
F267	0.1 Hz	0.0 to FH (Hz)

Parameter F267 sets the frequency width in Hz of each (-) speed command step.

Initial +/- Speed Command (F268)

Table 147: Initial +/- Speed Command

Parameter	Factory Setting	Range
F268	0.0 Hz	0.0 to FH (Hz)

Parameter F268 sets the +/- speed command in Hz that is applied to the drive controller when it is first powered up. Leaving this parameter at its default value will result in the drive controller's output frequency starting at 0 Hz every time it is powered up.

Change of Initial +/- Speed Frequency (F269)

Table 148: Change of Initial +/- Speed Frequency

Parameter	Factory Setting	Setting	Function
F269	1	0	Disabled
		1	Enabled

The setting parameter F269 determines whether the value of parameter F268 will change every time power is cycled to the drive controller. If parameter F269 is set to 1, parameter F268 will be set to the last speed command received by the drive controller before power was removed.

RY-RC Relay Secondary Function (F137)

Table 149: RY-RC Relay Secondary Function

Parameter	Factory Setting	Adjustment Range
F137	255 – always on	0 to 61, 254, 255

The RY-RC relay can be set to signal a secondary condition. The primary RY-RC relay function is set by parameter F130 (see page 78). See Table 4 (pages 37 – 41) for a full description of the primary and secondary functions that can be assigned to the RY-RC relay.

RY-RC Relay Function Logic Selection (F139)

Table 150: RY-RC Relay Function Logic Selection

Parameter	Factory Setting	Setting	Function
F139	0	0	F130 (primary) and F137 (secondary)
		1	F130 (primary) or F137 (secondary)

The RY-RC relay can be configured to energize when either:

- Both the primary AND secondary conditions are met (true) (F139 = 0), or
- Only one OR the other is met (true) (F139 = 1)

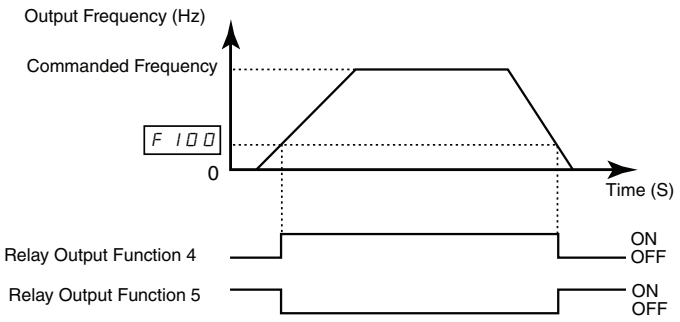
Relay Output – Frequency Level 1 Attained (F100)

Table 151: Relay Output – Frequency Level 1 Attained

Parameter	Factory Setting	Adjustment Range
F100	0.0 Hz	0.0 to FH (Hz)

The frequency set by parameter F100 is the threshold level for relay output functions 4 and 5 (see Table 4 on pages 37 – 41).

Figure 59: Relay Output Functions 4–5



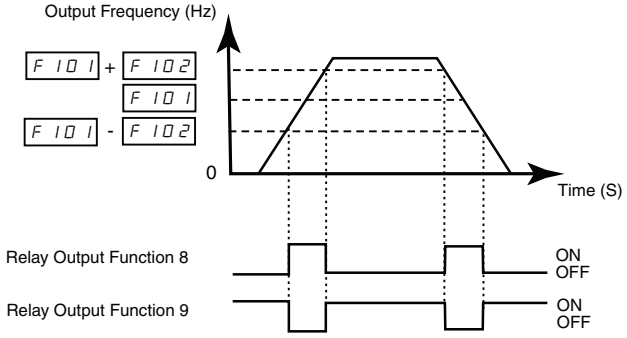
Relay Output – Frequency Level 2 Attained (F101)

Table 152: Relay Output – Frequency Level 2 Attained

Parameter	Factory Setting	Adjustment Range
F101	0.0 Hz	0.0 to FH (Hz)

The frequency set by parameter F101 +/- the F102 detection band is the threshold level for relay output functions 8 and 9 (see Table 4 on pages 37–41).

Figure 60: Relay Output Functions 8–9



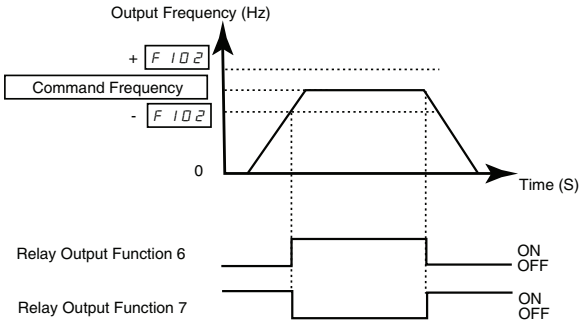
Frequency Attained Detection Band (F102)

Table 153: Frequency Attained Detection Band

Parameter	Factory Setting	Adjustment Range
F102	2.5 Hz	0.0 to FH (Hz)

Parameter F102 determines the bandwidth around the F101 frequency (see Figure 60) and the commanded frequency (see Figure 61) driving relay output functions 6 through 9 (see Table 4 on pages 37 – 41).

Figure 61: Relay Output Functions 6–7



Frequency Command Agreement Detection Range (F167)

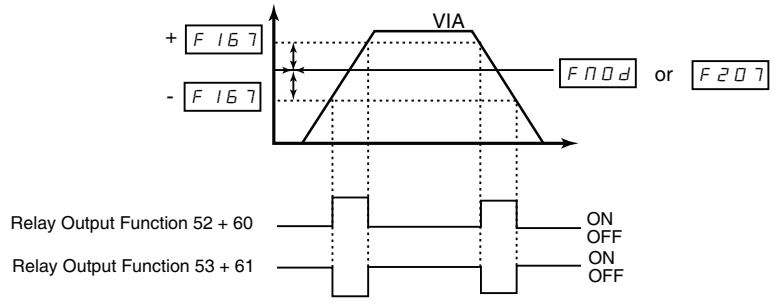
Table 154: Frequency Command Agreement Detection Range

Parameter	Factory Setting	Adjustment Range
F167	2.5 Hz	0.0 to FH (Hz)

Parameter F167 determines the bandwidth around the VIA or VIB speed reference (see Figure 62) driving relay output functions 52, 53, 60, and 61 (see Table 4 on pages 37 – 41).

This function can be used to signal whether the amount of processing and the amount of feedback agree when the PID function is in use.

Figure 62: Relay Output Functions 52, 53, 60, and 61



External Fault Stop Mode (F603)

Table 155: External Fault Stop Mode

Parameter	Factory Setting	Setting	Function
F603	0	0	Freewheel stop
		1	Ramp stop
		2	DC injection braking

The setting of parameter F603 determines how the drive controller will stop if a logic input assigned to function 11 or 46 is activated (see Table 2 on pages 32–35).

External Fault DC Braking Time (F604)

Table 156: External Fault DC Braking Time

Parameter	Factory Setting	Adjustment Range
F604	1.0 seconds	0.0 to 20 seconds

If parameter F603 is set to 2, parameter F604 will determine how long DC current will be injected into the motor while the external fault logic input is active.

FAULT MANAGEMENT

Fault History Reset (tYP = 4)

Setting parameter tYP to 4 resets the fault history. As soon as the fault history is reset, parameter tYP resumes its default value of 0.

Elapsed Motor Run Time Reset (tYP = 5)

Setting parameter tYP to 5 resets the elapsed motor run time clock. As soon as the elapsed motor run time clock is reset, parameter tYP resumes its default value of 0.

Elapsed Drive Run Time Reset (tYP = 9)

Setting parameter tYP to 6 resets the elapsed drive run time clock. As soon as the elapsed drive run time clock is reset, parameter tYP resumes its default value of 0.

Reset of EtYP Fault (tYP = 6)

Setting parameter tYP to 6 resets a EtYP fault. As soon as the EtYP fault is reset, parameter tYP resumes its default value of 0.

Output Short-Circuit Detection Mode (F613)

Table 157: Output Short-Circuit Detection Mode

Parameter	Factory Setting	Setting	Function
F613	0	0	Each time a RUN command is given (standard pulse)
		1	Only one time after power is turned on (standard pulse)
		2	Each time a RUN command is given (short-time pulse)
		3	Only one time after power is turned on (short-time pulse)

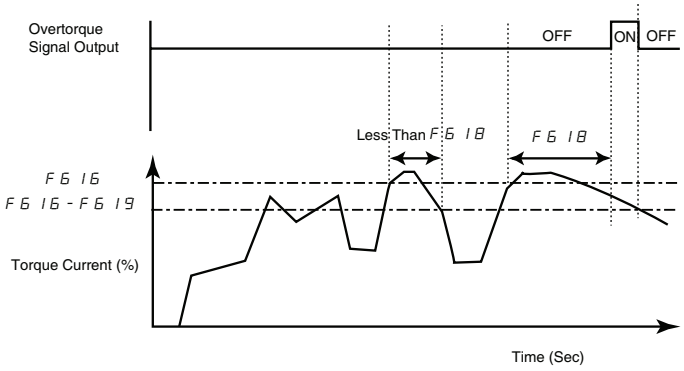
The setting of parameter F613 determines how the drive controller determines an output short-circuit during start-up.

Select the short-time pulse if the drive controller is powering a low impedance motor.

Overtorque Detection

The drive controller's response to a particular motor torque level is determined by the setting of parameters F615 – F619.

Figure 63: Overtorque Detection



Overtorque Fault/Alarm Selection (F615)

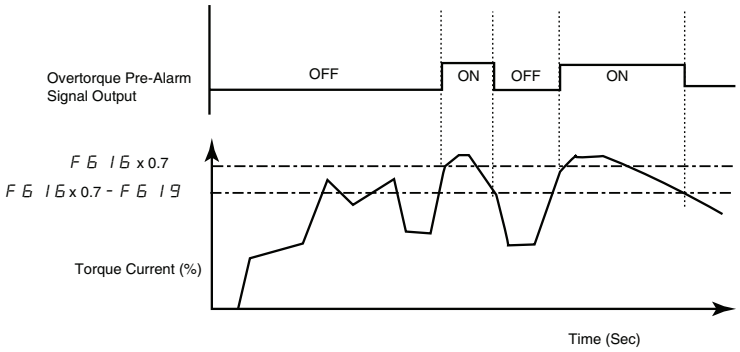
Table 158: Overtorque Fault/Alarm Selection

Parameter	Factory Setting	Setting	Function
F615	0	0	Alarm
		1	Fault

Depending on the setting of parameter F615, the drive controller can use output relay function 12 or 13 (see Table 4 on pages 37–41) to signal an overtorque alarm or fault (Ot fault code).

If parameter F615 is set to 1 and the drive controller faults, the overtorque signal output will remain latched on until the fault is reset.

Figure 64: Overtorque Detection Pre-alarm



Output relay functions 20 or 21 can be used to signal a overtorque pre-alarm when the calculated motor torque reaches 70% of the value set by parameter F616.

Overtorque Detection Level (F616)

Table 159: Overtorque Detection Level

Parameter	Factory Setting	Adjustment Range
F616	130 %	0 to 200 % of nominal rated motor torque

The setting of parameter F616 determines the level at which the drive controller will act upon a motor overtorque condition (see Figures 63 and 64).

Overtorque Detection Time (F618)

Table 160: Overtorque Detection Time

Parameter	Factory Setting	Adjustment Range
F618	0.5 seconds	0.0 to 10 seconds

The setting of parameter F618 determines how long the drive controller must detect a motor overtorque condition before it signals an alarm or fault (see Figure 63 on page 119).

Overtorque Detection Level Bandwidth (F619)

Table 161: Overtorque Detection Level Bandwidth

Parameter	Factory Setting	Adjustment Range
F619	10 %	0 to 100 % of F616 level

While the setting of parameter F616 determines the level at which a motor overtorque alarm or fault will be signaled, the setting of parameter F619 determines how far the calculated motor torque must drop before the alarm or fault is cancelled (see Figure 63 on page 119).

Ambient Temperature For Drive Controller Service Alarm (F634)

Table 162: Ambient Temperature For Drive Controller Service Alarm

Parameter	Factory Setting	Setting	Function
F634	3	1	-10 to 10 °C
		2	11 to 20 °C
		3	21 to 30 °C
		4	31 to 40 °C
		5	41 to 50 °C
		6	51 to 60 °C

The drive controller can be programmed to signal a service alarm using output relay functions 44 or 45 (see Table 4 on pages 37–41). The status of the service alarm can be displayed on the keypad (see page 46).

At initial start-up, set parameter F634 to the drive controller's average ambient operating temperature. Setting F634 to the highest annual temperature or changing the value after drive controller operation has begun may result in an early drive controller service alarm.

Nuisance Overvoltage And Input Phase Fault Avoidance

Parameters F481 – 483 can be used to avoid nuisance overvoltage and input phase faults caused by:

- High input impedance: line reactor
- Low input impedance: high kVA distribution network
- Voltage instability: generator power source

If nuisance faults occur, increase the value of parameter F481. If increasing the value of F481 over 1000 does not eliminate nuisance faults, increase the values of parameters F482 and F483 as needed.

Line Noise Compensation Filter (F481)

Table 163: Line Noise Compensation Filter

Parameter	Factory Setting	Adjustment Range
F481	0 microseconds	0 – 9999 microseconds

Line Noise Inhibitor Filter (F482)

Table 164: Line Noise Inhibitor Filter

Parameter	Factory Setting	Adjustment Range
F482	442 microseconds	0 – 9999 microseconds

Line Noise Inhibitor Gain (F483)

Table 165: Line Noise Inhibitor Gain

Parameter	Factory Setting	Adjustment Range
F483	100.0 %	0.0 to 300.0 %

SERIAL COMMUNICATION

Parameters F856–F880 define the structure of data transmitted between the drive controller and the data communication network.

Protocol (F829)

Table 166: Protocol

Parameter	Factory Setting	Setting	Function
F829	1	0	DO NOT USE
		1	Modbus RTU
		2	Metasys N2
		3	Apogee P1 FLN
		4	BACnet

Motor Poles For Communication (F856)

Table 167: Motor Poles For Communication

Parameter	Factory Setting	Setting	Function
F856	1 poles	1	2 poles
		2	4 poles
		3	6 poles
		4	8 poles
		5	10 poles
		6	12 poles
		7	14 poles
		8	16 poles

Block Write Data 1 (F870)

Table 168: Block Write Data 1

Parameter	Factory Setting	Setting	Function
F870	0	0	No selection
		1	Command 1
		2	Command 2
		3	Frequency command
		4	Output data on the terminal board
		5	Analog output for communications
		6	Motor speed command

Block Write Data 2 (F871)

Table 169: Block Write Data 2

Parameter	Factory Setting	Setting	Function
F871	0	0	No selection
		1	Command 1
		2	Command 2
		3	Frequency command
		4	Output data on the terminal board
		5	Analog output for communications
		6	Motor speed command

Block Read Data 1 (F875)

Table 170: Block Read Data 1

Parameter	Factory Setting	Setting	Function
F875	0	0	No selection
		1	Status information
		2	Output frequency
		3	Output current
		4	Output voltage
		5	Alarm information
		6	PID feedback value
		7	Input terminal board monitor
		8	Output terminal board monitor
		9	VIA terminal board monitor
		10	VIB terminal board monitor
		11	Output motor speed monitor

Block Read Data 2 (F876)

Table 171: Block Read Data 2

Parameter	Factory Setting	Setting	Function
F876	0	0	No selection
		1	Status information
		2	Output frequency
		3	Output current
		4	Output voltage
		5	Alarm information
		6	PID feedback value
		7	Input terminal board monitor
		8	Output terminal board monitor
		9	VIA terminal board monitor
		10	VIB terminal board monitor
		11	Output motor speed monitor

Block Read Data 3 (F877)

Table 172: Block Read Data 3

Parameter	Factory Setting	Setting	Function
F877	0	0	No selection
		1	Status information
		2	Output frequency
		3	Output current
		4	Output voltage
		5	Alarm information
		6	PID feedback value
		7	Input terminal board monitor
		8	Output terminal board monitor
		9	VIA terminal board monitor
		10	VIB terminal board monitor
		11	Output motor speed monitor

Block Read Data 4 (F878)

Table 173: Block Read Data 4

Parameter	Factory Setting	Setting	Function
F878	0	0	No selection
		1	Status information
		2	Output frequency
		3	Output current
		4	Output voltage
		5	Alarm information
		6	PID feedback value
		7	Input terminal board monitor
		8	Output terminal board monitor
		9	VIA terminal board monitor
		10	VIB terminal board monitor
		11	Output motor speed monitor

Block Read Data 5 (F879)

Table 174: Block Read Data 5

Parameter	Factory Setting	Setting	Function
F879	0	0	No selection
		1	Status information
		2	Output frequency
		3	Output current
		4	Output voltage
		5	Alarm information
		6	PID feedback value
		7	Input terminal board monitor
		8	Output terminal board monitor
		9	VIA terminal board monitor
		10	VIB terminal board monitor
		11	Output motor speed monitor

Free Notes (F880)

Table 175: Free Notes

Parameter	Factory Setting	Adjustment Range
F880	0	0 to 65535

The free notes parameter can be used to set a unique value to identify the drive controller on a network.

OPTIONS

Parameters F890 – F899 should be adjusted only if the corresponding optional equipment has been installed. See the *Altivar® 21 Catalog* for more detail.

Parameter for Option 1 (F890)

Table 176: Parameter for Option 1

Parameter	Factory Setting	Adjustment Range
F890	0	0 to 65535

Parameter for Option 2 (F891)

Table 177: Parameter for Option 2

Parameter	Factory Setting	Adjustment Range
F891	0	0 to 65535

Parameter for Option 3 (F892)

Table 178: Parameter for Option 3

Parameter	Factory Setting	Adjustment Range
F892	0	0 to 65535

Parameter for Option 4 (F893)

Table 179: Parameter for Option 4

Parameter	Factory Setting	Adjustment Range
F893	0	0 to 65535

Parameter for Option 5 (F894)

Table 180: Parameter for Option 5

Parameter	Factory Setting	Adjustment Range
F894	0	0 to 65535

Parameter for Option 6 (F895)

Table 181: Parameter for Option 6

Parameter	Factory Setting	Adjustment Range
F895	0	0 to 65535

Parameter for Option 7 (F896)

Table 182: Parameter for Option 7

Parameter	Factory Setting	Adjustment Range
F896	0	0 to 65535

Parameter for Option 8 (F897)

Table 183: Parameter for Option 8

Parameter	Factory Setting	Adjustment Range
F897	0	0 to 65535

Parameter for Option 9 (F898)

Table 184: Parameter for Option 9

Parameter	Factory Setting	Adjustment Range
F898	0	0 to 65535

Parameter for Option 10 (F899)

Table 185: Parameter for Option 10

Parameter	Factory Setting	Adjustment Range
F899	0	0 to 65535

SECTION 6— TROUBLESHOOTING

FAULT CONDITIONS

Refer to Tables 186, 187 (page 130), and 188 (page 131) to diagnose and resolve problems when a fault, alarm, or pre-alarm condition occurs.

If the problem cannot be resolved by the actions described in the tables, contact your Schneider Electric representative.

Table 186: Fault Codes

Fault code	Problem	Possible causes	Remedies
E - 18	Break in VIA signal cable	• The VIA analog signal is below the level set by parameter F633.	• Check the signal at VIA and rectify the cause of the signal loss. • Verify that parameter F633 is set correctly.
E - 19	CPU communications error	• Communication error between control CPUs	• Contact Schneider Electric to repair the drive controller.
E - 20	Excessive torque boost	• Torque boost parameter F402 is set too high. • The motor impedance is too low.	• Repeat the drive controller auto-tune and then adjust down parameter F402.
E - 21	CPU fault 2	• The control board CPU is inoperable.	• Contact Schneider Electric to repair the drive controller.
EEP1	EEPROM fault 1	• A data writing error has occurred.	• Cycle power to clear the fault. • If the fault does not clear, contact Schneider Electric to repair the drive controller.
EEP2	EEPROM fault 2	• Power was removed from the drive controller during a parameter reset operation resulting in a data writing error.	• Cycle power to clear the fault and try the parameter reset operation again. • If the fault does not clear, contact Schneider Electric to repair the drive controller.
EEP3	EEPROM fault 3	• A data reading error has occurred.	• Cycle power to clear the fault. • If the fault does not clear, contact Schneider Electric to repair the drive controller.
EF2	Ground fault	• Ground fault in motor or motor cables	• Using a 1000 V megger, check the motor and motor cables for ground faults.
EPH1	Input phase loss	• Loss of one input phase	• Determine the cause of the missing input phase and rectify. • Set parameter F608 to 0. • Contact Schneider Electric to repair the drive controller.
EPH0	Output phase loss	• Loss of one or more output phases	• Determine the cause of the missing output phase (such as a bad connection, an output disconnect, or an open winding in the motor) and rectify the problem. • Set parameter F605 to 0.
Err1	Frequency setting point error alarm	• Parameters F202, F203, F210, or F212 are set improperly.	• Set the parameters to the correct settings.
Err2	Control board RAM fault	• The control board RAM is inoperable.	• Contact Schneider Electric to repair the drive controller.
Err3	Control board ROM fault	• The control board ROM is inoperable.	• Contact Schneider Electric to repair the drive controller.
Err4	CPU fault 1	• The control board CPU is inoperable.	• Contact Schneider Electric to repair the drive controller.
Err5	Communication fault	• Serial communication error	• Check network control devices and cables. • Check the setting of the communication timeout parameter, F803. • Check the remote keypad cable.
Err7	Current sensor fault	• A motor current sensor is inoperable.	• Contact Schneider Electric to repair the drive controller.
Err8	Network error	• Network communication error	• Check the network control devices and cables.

Table 186: Fault Codes *(continued)*

Fault code	Problem	Possible causes	Remedies
EtnI	Auto-tuning error	• Parameters F401 to F494 are incorrectly set. • The motor is too large for the drive controller. • The motor cable gauge is too small. • The motor is still rotating at the start of the auto-tune. • The drive controller is not powering a 3-phase induction motor.	• Set parameters F401–F494 correctly. • Use a larger drive controller. • Use a larger gauge motor cable. • Verify that the motor is stopped before starting an auto-tune. • Use the drive controller to power only a 3-phase induction motor.
EtYP	Drive controller type fault	• The main control board is inoperable.	• Contact Schneider Electric to repair the drive controller.
h999	Accumulated input power error	• The accumulated input power value is more than 999.999 kWh.	• Clear the accumulated input power value using logic input function 51, or parameter F748.
H999	Accumulated output power error	• The accumulated output power value is more than 999.999 kWh.	• Clear the accumulated input power value using logic input function 51, or parameter F748.
OCI	Overcurrent during acceleration	• The acceleration time is too short. • The setting of parameter Pt is incorrect. • The drive controller is starting into a rotating load. • The drive controller is powering a low impedance motor. • Ground fault	• Increase the acceleration time parameters (ACC or F500). • Select the correct setting for parameter Pt. • Enable catch on the fly, parameter F301. • Adjust the switching frequency parameter F300. • Set parameter F316 to 1 or 3.
OCIP	Ground fault	• Short circuit or ground fault during acceleration	• Using a 1000 V megger, check the motor and motor cables for ground faults. • Contact Schneider Electric to repair the drive controller.
OC2	Overcurrent during deceleration	• The deceleration time is too short. • Ground fault	• Increase the deceleration time parameters (dEC or F501). • Set parameter F316 to 1 or 3.
OC2P	Ground fault	• Short circuit or ground fault during deceleration	• Using a 1000 V megger, check the motor and motor cables for ground faults. • Contact Schneider Electric to repair the drive controller.
OC3	Overcurrent during constant speed operation	• Abrupt fluctuations in load • Abnormal load condition	• Reduce the load fluctuations. • Check the load. • Set parameter F316 to 1 or 3.
OC3P	Ground fault	• Short circuit or ground fault during constant speed operation	• Using a 1000 V megger, check the motor and motor cables for ground faults. • Contact Schneider Electric to repair the drive controller.
OCA	Arm overcurrent during startup	• Ground fault	• Using a 1000 V megger, check the motor and motor cables for ground faults. • Contact Schneider Electric to repair the drive controller.
OCL	Short Circuit	• Phase to phase output short circuit • The motor impedance is too low.	• Using a 1000 V megger, check the motor and motor cables for ground faults. • Contact Schneider Electric to repair the drive controller.
OH	Drive controller overtemperature fault	• The drive controller cooling fan is not working. • The ambient temperature is too high. • An enclosure air vent is blocked. • A heat source is too close to the drive controller. • The drive controller heatsink temperature sensor is malfunctioning.	• Restart operation by resetting the drive controller fault after cool-off. • Decrease the ambient temperature by increasing the free space around the drive controller and removing any heat generating source from the proximity of the drive controller. • Contact Schneider Electric to repair the drive controller.
OH2	Motor PTC overtemperature fault	• The external PTC embedded in the motor windings indicates a motor overtemperature condition.	• Correct the motor overload condition. • Check the PTC for correct operation.

Table 186: Fault Codes *(continued)*

Fault code	Problem	Possible causes	Remedies
OL1	Drive controller overload	• The acceleration time is too short. • The DC injection current level is too high. • The setting of parameter Pt is incorrect. • The drive controller is starting into a rotating load. • The load is too large.	• Increase the acceleration time parameters (ACC or F500). • Reduce the setting of parameters F251 and/or F252. • Select the correct setting for parameter Pt. • Enable catch on the fly, parameter F301. • Set parameter F302 to 2. • Use a drive controller with a higher power rating.
OL2	Motor overload	• The setting of parameter Pt is incorrect. • The motor is jammed. • Low-speed operation is performed continuously • Excessive load is applied to the motor.	• Select the correct setting for parameter Pt. • Check the load. • Adjust parameter OLN to the overload level that the motor can withstand during low speed operation.
OP1	Overvoltage during acceleration	• The input voltage is fluctuating abnormally. • Power network is greater than 200 kVA. • Power factor capacitor switching • SCR switching on power network • The drive controller is starting into a rotating load. • Intermittent output phase fault	• Install a line reactor. • Enable catch on the fly, parameter F301. • Set parameter F302 to 2. • Determine the cause of the missing output phase (such as a bad connection, an output disconnect, or an open winding in the motor) and rectify the problem.
OP2	Overvoltage during deceleration	• The deceleration time is too short. • Overhauling load • The input voltage is fluctuating abnormally. • Power network is greater than 200 kVA • Power factor capacitor switching • SCR switching on power network • The drive controller is starting into a rotating load. • Intermittent output phase fault	• Increase the deceleration time parameters (DEC or F501). • Enable parameter F305. • Install a line reactor. • Check the input and output circuits for phase failure and rectify. • Enable catch on the fly, parameter F301.
OP3	Overvoltage during constant speed operation	• The input voltage is fluctuating abnormally. • Power network is greater than 200 kVA • Power factor capacitor switching • SCR switching on power network • The drive controller is regenerating—the load causes the motor to run at a frequency higher than drive controller output frequency. • Intermittent output phase fault	• Install a line reactor. • Check the input and output circuits for phase failure and rectify.
OT	Overtorque fault	• The calculated motor torque has reached the level set by parameter F616.	• Adjust the settings of parameters F615 and F616 as needed. • Verify machine operation.
SOUT	Permanent magnet motor pulls out of synchronism	• The motor is jammed. • Output phase loss • Impact load	• Check the load and correct the jammed condition. • Check the condition of the motor and load wiring.
UC	Underload fault	• The measured motor current has dropped below the level set by parameter F611.	• Check parameters F610–612 for the correct settings. • Contact Schneider Electric to repair the drive controller.
UP1	DC bus undervoltage fault	• The input voltage is too low.	• Check the input voltage and rectify the problem. • Select the correct setting for parameter F627. • Enable catch on the fly, parameter F301. • Set parameter F302 to 2.

ALARM CONDITIONS

Alarms do not cause the drive controller to enter a fault condition.

Table 187: Alarm Codes

Alarm code	Problem	Possible causes	Remedies
AtnI	Auto-tuning	• Auto-tuning in process	• Normal if it the message disappears after a few seconds.
CLr	Clear command acceptable	• This message is displayed after the STOP key is pressed while an error code is displayed.	• Press the STOP key again to clear the fault.
db	DC braking	• DC braking in process	• The alarm code goes off in several seconds if no problem occurs.
E-17	Keypad error	• A keypad key has been held down for more than 20 seconds. • A keypad key may not be operating properly.	• Release the keypad key. • If this does not clear the error, replace the drive controller.
EI	The number of digits that can be displayed has been exceeded	• The number of digits entered for values such as frequencies is more than 4. (The upper digits have priority.)	• Lower the frequency free-unit magnification F702.
EOFF	Emergency stop command acceptable	• The operation panel is used to stop the operation in automatic control or remote control mode.	• Press the STOP key for an emergency stop. To cancel the emergency stop, press any other key.
Err1	Frequency point setting error alarm	• The frequency setting signals at points 1 and 2 are set too close to each other.	• Set the frequency setting signals at points 1 and 2 apart from each other.
h999	Integral input power	• Integral input power is more than 999.99 kWh.	• Press and hold down the key for 3 s or more when power is off or when the input terminal function CKWH is turned on or displayed.
H999	Integral output power	• Integral output power is more than 999.99 kWh.	• Press and hold down the key for 3 s or more when power is off or when the input terminal function CKWH is turned on or displayed.
HEAd/ End	Display of first/last data items	• The first and last data item in the AUX data group is displayed.	• Press MODE key to exit the data group.
HI/ LO	Parameter adjustment error	• During programming, a value was entered that exceeds the maximum or minimum value of the parameter.	• Enter a value within the bounds of the parameter
InIt	Parameters in the process of initialization	• Parameters are being initialized to default values.	• Normal if the message disappears after several seconds.
LSTP	Auto-stop because of continuous operation at the lower-limit frequency	• The automatic stop function selected with F256 was activated.	• To deactivate the automatic stop function, increase the frequency command above the lower-limit frequency (LL) + 0.2 Hz or turn off the operation command.
nOFF	Line supply undervoltage fault	• The phase-to-phase input voltage is too low.	• Measure the main circuit supply voltage. If the voltage is at a normal level, the drive controller requires repair. • Contact your local Schneider Electric representative.
OFF	ST terminal OFF	• The ST-CC (run permissive) circuit is open.	• Close the ST-CC circuit.
rtry	Restart in process	• The drive controller is in the process of restart. • A momentary stop occurred.	• The drive controller is operating normally if it restarts after several seconds.
StOP	Momentary power failure slowdown stop prohibition function activated.	• The slowdown stop prohibition function set with F302 (momentary power failure ride-through operation) is activated.	• To restart operation, reset the drive controller or input an operation signal again.

PRE-ALARM CONDITIONS

Table 188: Pre-alarm Codes

Code	Pre-alarm	Description
CL	Current Limit	The drive controller is at current limit. For more information, refer to parameter F601 and F185.
OP	DC bus overvoltage	The drive controller is approaching an overvoltage fault due to a high supply line, regenerative motor braking, or a combination of these. For more information, refer to parameters F305 and F626.
OL	Motor overload alarm	The motor overload timer has reached or exceeded 50% of its fault level.
OH	Drive controller overheating alarm	The drive controller is approaching an overheating fault.

The pre-alarm codes are displayed, blinking, in the following order from left to right: CL, OP, OL, OH.

If two or more problems arise simultaneously, one of the following pre-alarm codes appears and blinks: CLOP, OPOL, CLOPOL.

RESETTING THE DRIVE CONTROLLER AFTER A FAULT CONDITION

Clear the cause of a fault trip condition before resetting the drive controller. Resetting the tripped drive controller before eliminating the problem causes it to fault again.

The drive controller can be reset after a fault with any of the following operations:

1. By turning off the power.
2. By means of an external signal.
3. With the Stop key on the display terminal:
   a. Press the STOP key and make sure that CLr is displayed.
   b. Eliminate the cause of the fault.
   c. Press the STOP key again to reset the drive controller.
4. By a fault clear signal from a remote communication device.

When any overload function (OLI1 or OLC2) is active, the drive controller cannot be reset by inputting a reset signal from an external device or with the Stop key on the display terminal if the calculated cooling time has not expired. Calculated cooling time:

- OLI1: 30 seconds after the fault has occurred
- OLC2: 120 seconds after the fault has occurred

CAUTION

MOTOR OVERHEATING

- Repeated reset of the thermal state after a thermal overload can result in thermal stress to the motor.
- When faults occur, promptly inspect the motor and driven equipment for problems (such as a locked shaft or mechanical overload) before restarting. Also check the power supplied to the motor for abnormal conditions (such as a phase loss or phase imbalance).

Failure to follow these instructions can result in equipment damage.

APPENDIX A— PARAMETER RESET TABLES

PARAMETER RESET

The Altivar 21 drive controller offers three parameter reset options:

- Factory reset (tYP = 3)
- 50 Hz reset (tYP = 1)
- 60 Hz reset (tYP = 2)

This appendix describes parameter values after these reset operations. Tables 189–193 identify:

- Parameters whose values after a reset DO NOT vary by reset type. See page 133.
- Parameters whose values after a reset vary by reset type. See page 137.
- Parameters whose values after a reset are drive controller model dependant but DO NOT vary by reset type. See page 138.
- Parameters whose values after a reset are drive controller model and reset type dependant. See page 139.
- Parameters whose values do not change if a reset is performed. See page 140.

PARAMETER VALUES THAT DO NOT VARY BY RESET TYPE

Table 189 lists the parameters whose values, after a reset, do not vary by the reset type.

To determine the value of a parameter after a reset, locate the parameter in the first column and read across the row to the default value column. The number that appears at the intersection of the parameter and the default value is the parameter's value after a reset of any type (tYP = 1, tYP = 2, or tYP = 3).

Table 189: Parameters whose values after a reset DO NOT vary by reset type

Parameter	Description	Unit	Default Value
AU1	Auto ramp adaptation	–	1
AU4	Macro programming	–	0
FOSL	Analog output function selection	–	0
FO	Analog output scaling	–	–
tYp	Parameter reset	–	0
Fr	Local mode motor rotation direction command	–	0
FC	Local mode speed reference	Hz	0.0
LL	Low speed	Hz	0.0
Pt	Motor control mode	–	1
OLN	Motor overload characteristics	–	0
Sr1	Preset speed 1	Hz	15
Sr2	Preset speed 2	Hz	20
Sr3	Preset speed 3	Hz	25
Sr4	Preset speed 4	Hz	30
Sr5	Preset speed 5	Hz	35
Sr6	Preset speed 6	Hz	40
Sr7	Preset speed 7	Hz	50
F100	Relay output – frequency level 1 attained	Hz	0.0

Table 189: Parameters whose values after a reset DO NOT vary by reset type *(continued)*

Parameter	Description	Unit	Default Value
F101	Relay output – frequency level 2 attained	Hz	0.0
F102	Frequency attained detection band	Hz	2.5
F108	Always active logic function 1	–	0
F109	VIA input function (analog or logic selection)	–	0
F110	Always active logic function 2	–	1
F111	F logic input function	–	2
F112	R logic input function	–	6
F113	RES logic input function	–	10
F118	VIA logic input function	–	7
F130	RY-RC relay primary function	–	4
F132	FL relay function	–	11
F137	RY-RC relay secondary function	–	255
F139	RY-RC relay function logic selection	–	0
F167	Frequency command agreement detection range	Hz	2.5
F200	Auto/manual speed reference switching	–	0
F201	VIA speed reference level 1	%	0
F202	VIA output frequency level 1	Hz	0.0
F203	VIA speed reference level 2	%	100
F207	Remote mode secondary speed reference source	–	2
F210	VIB speed reference level 1	%	0
F211	VIB output frequency level 1	Hz	0.0
F212	VIB speed reference level 2	%	100
F240	Starting frequency	Hz	0.5
F241	Operating starting frequency	Hz	0.0
F242	Operating starting frequency hysteresis	Hz	0.0
F250	DC braking starting frequency	Hz	0.0
F251	DC braking current level	A	50
F252	DC braking time	s	1.0
F256	Sleep/wake operation	s	0.0
F264	+ Speed logic input response time	s	0.1
F265	+ Speed frequency steps	Hz	0.1
F266	- Speed logic input response time	s	0.1
F267	- Speed frequency steps	Hz	0.1
F268	Initial +/- speed frequency	Hz	0.0
F269	Reset of initial +/- speed frequency	–	1
F270	Skip frequency 1 midpoint	Hz	0.0
F271	Skip frequency 1 bandwidth	Hz	0.0
F272	Skip frequency 2 midpoint	Hz	0.0
F273	Skip frequency 2 bandwidth	Hz	0.0
F274	Skip frequency 3 midpoint	Hz	0.0
F275	Skip frequency 3 bandwidth	Hz	0.0
F294	Forced speed frequency	Hz	50
F295	Bumpless transfer from remote to local control	–	1
F301	Catch on the fly	–	3
F302	Coast to stop on momentary loss of input power	–	0
F305	Overvoltage fault protection	–	2

Table 189: Parameters whose values after a reset DO NOT vary by reset type *(continued)*

Parameter	Description	Unit	Default Value
F307	Supply voltage correction and motor voltage limitation	–	3
F311	Motor rotation direction command	–	1
F312	Switching frequency random mode	–	0
F316	Switching frequency control mode	–	1
F320	Droop gain	%	0
F323	Droop insensitive torque band	%	10
F359	PID control waiting time	s	0
F360	PID control enable	–	0
F362	PID proportional gain	–	0.30
F363	PID integral gain	–	0.20
F366	PID derivative gain	–	0.00
F400	Auto tuning enable	–	0
F401	Slip compensation	%	50
F418	Speed control response coefficient	–	40
F419	Speed control stability coefficient	–	20
F470	VIA analog input bias	–	128
F471	VIA analog input gain	–	148
F472	VIB analog input bias	–	128
F473	VIB analog input gain	–	148
F482	Line noise inhibitor filter	micro-seconds	442
F483	Line noise inhibitor gain	–	100
F485	Stall prevention control coefficient 1	–	100
F492	Stall prevention control coefficient 2	–	100
F495	Maximum voltage adjustment coefficient	%	104
F496	Waveform switching adjustment coefficient	kHz	14.0
F502	Acc/Dec pattern 1	–	0
F503	Acc/Dec pattern 2	–	0
F504	Acc/Dec pattern selection (ramp switching)	–	1
F505	Acc/Dec pattern switching frequency	Hz	0.0
F506	Acc/Dec S–pattern lower limit	%	10
F507	Acc/Dec S–pattern upper limit	%	10
F602	Drive fault memory	–	0
F603	External fault stop mode	–	0
F604	External fault DC braking time	s	1.0
F605	Output phase failure detection mode	–	3
F607	Motor overload time	s	300
F608	Input phase failure detection mode	–	1
F609	Underload detection level bandwidth	%	10
F610	Underload fault/alarm selection	–	0
F611	Underload detection level	% / A	0
F612	Underload detection time	s	0
F613	Output short-circuit detection mode	–	0
F615	Overtorque fault/alarm selection	–	0
F616	Overtorque detection level	%	130
F618	Overtorque detection time	s	0.5
F619	Overtorque detection level bandwidth	%	10

Table 189: Parameters whose values after a reset DO NOT vary by reset type *(continued)*

Parameter	Description	Unit	Default Value
F621	Run time alarm setting	hours	610
F627	Undervoltage fault operation mode	–	0
F632	Motor overload memory	–	0
F633	Loss of VIA analog signal	%	0
F634	Ambient temperature for drive controller service alarm	–	3
F645	PTC motor thermal protection enable	–	0
F646	PTC resistor value	Ω	3000
F650	Forced speed enable	–	0
F691	Analog output slope	–	1
F692	Analog output bias	%	0
F700	Parameter lock	–	0
F701	Keypad display: % or A/V units	–	1
F702	Custom frequency display conversion factor	–	0
F705	Custom frequency display conversion slope	–	1
F706	Custom frequency display conversion bias	Hz	0.0
F707	Local mode speed reference step changes	Hz	0.0
F708	Keypad frequency display resolution	–	0
F710	Default keypad operational display value	–	0
F721	Local mode motor stop type	–	0
F730	Disabling of keypad speed reference change keys	–	0
F732	Disabling of keypad local/remote key	–	0
F733	Disabling of keypad RUN and STOP keys in local mode	–	0
F734	Disabling of keypad STOP key in remote mode	–	0
F735	Disabling of keypad fault reset function	–	1
F738	Display of submenu AUF	–	0
F748	Accumulated power consumption memory	–	1
F800	Baud rate	–	1
F801	Parity	–	1
F802	Address	–	1
F803	Time-out	s	3
F805	Communication waiting time	s	0.00
F806	Communication between slave and master selection	–	0
F811	Communication speed reference level 1	%	0
F812	Communication output frequency level 1	Hz	0.0
F813	Communication speed reference level 2	%	100
F829	Protocol	–	1
F851	Communication fault setting	–	4
F856	Motor poles for communication	–	2
F870	Block write data 1	–	0
F871	Block write data 2	–	0
F875	Block read data 1	–	0
F876	Block read data 2	–	0
F877	Block read data 3	–	0
F878	Block read data 4	–	0
F879	Block read data 5	–	0
F880	Free notes	–	0

Table 189: Parameters whose values after a reset DO NOT vary by reset type *(continued)*

Parameter	Description	Unit	Default Value
F890	Parameter for option 1	–	0
F891	Parameter for option 2	–	0
F892	Parameter for option 3	–	0
F893	Parameter for option 4	–	0
F894	Parameter for option 5	–	0
F895	Parameter for option 6	–	0
F896	Parameter for option 7	–	0
F897	Parameter for option 8	–	0
F898	Parameter for option 9	–	0
F899	Parameter for option 10	–	0
F910	Permanent magnet motor step-out detection current level	%/A	100
F911	Permanent magnet motor step-out detection time	s	0.00
F912	Permanent magnet motor high-speed torque adjustment coefficient	–	0

PARAMETER VALUES THAT VARY ACCORDING TO RESET TYPE

Table 190 lists the parameters whose values, after a reset, depend on the reset type (tYP = 1, tYP = 2, or tYP = 3).

To determine the value of a parameter after a reset, locate the parameter in the first column and read across the row to the column that corresponds to the reset type. The number that appears at the intersection of the parameter and the reset type is the parameter's value after a reset of the corresponding type.

Table 190: Parameters whose values after a reset vary by reset type

Parameter	Description	Unit	Factory Reset tYP = 3	50 Hz Reset tYP = 1	60 Hz Reset[1] tYP = 2
CMOd	Drive controller start/stop control source	–	0	1	1
FMOd	Drive controller primary speed reference source	–	0	1	1
FH	Maximum frequency	Hz	50	50	60
UL	High speed	Hz	50	50	60
uL	Motor rated frequency	Hz	50	50	60
F170	Motor 2 rated frequency	Hz	50	50	60
F204	VIA output frequency level 2	Hz	50	50	60
F213	VIB output frequency level 2	Hz	50	50	60
F303	Auto fault reset	–	0	0	0
F480	Magnetizing current coefficient	%	100	0	100
F481	Line noise compensation filter	micro-seconds	0	100	0
F814	Communication output frequency level 2	Hz	50	50	60

[1] A 60 Hz reset on a 460 V drive controller sets the motor rated voltage (uLu and F171) to 400 V.

PARAMETER VALUES THAT VARY ACCORDING TO DRIVE CONTROLLER MODEL, BUT NOT RESET TYPE

Table 191 lists the parameters whose values, after a reset, depend on the drive controller model.

To determine the value of a parameter after a reset, locate the drive controller model number in first column and read across the row to the column that corresponds to the parameter code.The number that appears at the intersection of the model number and the parameter code is the parameter's value after a reset. These values are the same for all reset types (tYP = 1, tYP = 2, or tYP = 3).

Table 191: Parameters whose values after a reset are drive controller model dependant but DO NOT vary by reset type

Model number	Parameter													
	ACC	dEC	uLu	ub	F171	F172	F300	F402	F494	F500	F501	F626	F740	F748
ATV21H075M3X	10	10	200	6	200	6	12	5.8	80	10	10	140	0	0
ATV21HU15M3X	10	10	200	6	200	6	12	4.3	70	10	10	140	0	0
ATV21HU22M3X	10	10	200	5	200	5	12	4.1	70	10	10	140	0	0
ATV21HU30M3X	10	10	200	5	200	5	12	3.4	70	10	10	140	0	0
ATV21HU40M3X	10	10	200	5	200	5	12	3.4	70	10	10	140	1	1
ATV21HU55M3X	10	10	200	4	200	4	12	3.0	70	10	10	140	1	1
ATV21HU75M3X	10	10	200	3	200	3	12	2.5	70	10	10	140	1	1
ATV21HD11M3X	10	10	200	2	200	2	12	2.3	60	10	10	140	1	1
ATV21HD15M3X	10	10	200	2	200	2	12	2.0	50	10	10	140	1	1
ATV21HD18M3X	30	30	200	2	200	2	8	2.0	50	30	30	140	1	1
ATV21HD22M3X	30	30	200	2	200	2	8	1.8	50	30	30	140	1	1
ATV21HD30M3X	30	30	200	2	200	2	8	1.8	50	30	30	140	1	1
ATV21H075N4	10	10	400	6	400	6	12	5.8	80	10	10	140	0	0
ATV21HU15N4	10	10	400	6	400	6	12	4.3	70	10	10	140	0	0
ATV21HU22N4	10	10	400	5	400	5	12	4.1	70	10	10	140	0	0
ATV21HU30N4	10	10	400	5	400	5	12	3.4	70	10	10	140	0	0
ATV21HU40N4	10	10	400	5	400	5	12	3.4	70	10	10	140	1	1
ATV21HU55N4	10	10	400	4	400	4	12	2.6	70	10	10	140	1	1
ATV21HU75N4	10	10	400	3	400	3	12	2.3	70	10	10	140	1	1
ATV21HD11N4	10	10	400	2	400	2	12	2.2	60	10	10	140	1	1
ATV21HD15N4	10	10	400	2	400	2	12	1.9	50	10	10	140	1	1
ATV21HD18N4	30	30	400	2	400	2	8	1.9	50	30	30	140	1	1
ATV21HD22N4	30	30	400	2	400	2	8	1.8	50	30	30	140	1	1
ATV21HD30N4	30	30	400	2	400	2	8	1.8	50	30	30	140	1	1

PARAMETER VALUES THAT VARY ACCORDING TO DRIVE CONTROLLER MODEL AND RESET TYPE

Table 192 lists the parameters whose values, after a reset, depend on the drive controller model and the reset type (tYP = 1, tYP = 2, or tYP = 3). To determine the value of a parameter after a reset:

1. Locate the drive controller model number in the first column.
2. Read across the row to the group of columns that corresponds to the reset type (tYP = 1, tYP = 2, or tYP = 3).
3. Locate the parameter code in the columns corresponding to the reset type.

The number that appears at the intersection of the drive controller model number and the parameter code is the parameter's value after a reset of the specified type.

Table 192: Parameters whose values after a reset are drive controller model and reset type dependant

Model number	Factory reset tYP = 3							50 Hz reset tYP = 1							60 Hz reset tYP = 2						
	tHr	F173	F185	F415	F416	F417	F601	tHr	F173	F185	F415	F416	F417	F601	tHr	F173	F185	F415	F416	F417	F601
ATV21H075M3X	100	100	110	-	-	-	110	4.6	4.6	5.1	3.5	3.2	1400	5.1	4.6	4.6	5.1	3.0	2.7	1700	5.1
ATV21HU15M3X	100	100	110	-	-	-	110	7.5	7.5	8.3	6.1	5.3	1420	8.3	7.5	7.5	8.3	5.8	5.0	1715	8.3
ATV21HU22M3X	100	100	110	-	-	-	110	10.6	10.6	11.7	8.8	7.3	1430	11.7	10.6	10.6	11.7	8.0	6.6	1715	11.7
ATV21HU30M3X	100	100	110	-	-	-	110	13.7	13.7	15.1	12.5	11.0	1420	15.1	13.7	13.7	15.1	12.4	10.9	1760	15.1
ATV21HU40M3X	100	100	110	-	-	-	110	17.5	17.5	19.3	15.8	13.7	1425	19.3	17.5	17.5	19.3	15.2	13.2	1769	19.3
ATV21HU55M3X	100	100	110	-	-	-	110	24.2	24.2	26.6	20.6	16.7	1430	26.6	24.2	24.2	26.6	22.0	17.8	1780	26.6
ATV21HU75M3X	100	100	110	-	-	-	110	32.0	32.0	35.2	26.3	20.3	1450	35.2	32.0	32.0	35.2	28.0	21.6	1780	35.2
ATV21HD11M3X	100	100	110	-	-	-	110	46.2	46.2	50.8	36.9	27.3	1450	50.8	46.2	46.2	50.8	36.0	26.6	1766	50.8
ATV21HD15M3X	100	100	110	-	-	-	110	61.0	61.0	67.1	49.5	36.6	1455	67.1	61.0	61.0	67.1	48.0	35.5	1771	67.1
ATV21HD18M3X	100	100	110	-	-	-	110	74.8	74.8	82.3	61.0	45.1	1455	82.3	74.8	74.8	82.3	61.0	45.1	1771	82.3
ATV21HD22M3X	100	100	110	-	-	-	110	88.0	88.0	96.8	68.0	50.3	1460	96.8	88.0	88.0	96.8	68.0	50.3	1771	96.8
ATV21HD30M3X	100	100	110	-	-	-	110	117	117	128.7	93.0	65.1	1460	128.7	117	117	128.7	93.0	65.1	1771	128.7
ATV21H075N4	100	100	110	-	-	-	110	2.2	2.2	2.4	2.0	1.8	1400	2.4	2.2	2.2	2.4	1.5	1.4	1700	2.4
ATV21HU15N4	100	100	110	-	-	-	110	3.7	3.7	4.1	3.5	3.0	1420	4.1	3.7	3.7	4.1	2.9	2.5	1715	4.1
ATV21HU22N4	100	100	110	-	-	-	110	5.1	5.1	5.6	5.1	4.2	1430	5.6	5.1	5.1	5.6	4.0	3.3	1715	5.6
ATV21HU30N4	100	100	110	-	-	-	110	7.2	7.2	7.9	7.2	6.3	1420	7.9	7.2	7.2	7.9	6.2	5.5	1760	7.9
ATV21HU40N4	100	100	110	-	-	-	110	9.1	9.1	10.0	9.1	7.9	1425	10.0	9.1	9.1	10.0	7.6	6.6	1769	10.0
ATV21HU55N4	100	100	110	-	-	-	110	12.0	12.0	13.2	11.9	9.6	1430	13.2	12.0	12.0	13.2	11.0	8.9	1780	13.2
ATV21HU75N4	100	100	110	-	-	-	110	16.0	16.0	17.6	15.2	11.7	1450	17.6	16.0	16.0	17.6	14.0	10.8	1780	17.6
ATV21HD11N4	100	100	110	-	-	-	110	22.5	22.5	24.8	21.3	15.8	1450	24.8	22.5	22.5	24.8	21.0	15.5	1766	24.8
ATV21HD15N4	100	100	110	-	-	-	110	30.5	30.5	33.6	28.6	21.2	1455	33.6	30.5	30.5	33.6	27.0	20.0	1771	33.6
ATV21HD18N4	100	100	110	-	-	-	110	37.0	37.0	40.7	35.1	26.0	1455	40.7	37.0	37.0	40.7	35.1	26.0	1771	40.7
ATV21HD22N4	100	100	110	-	-	-	110	43.5	43.5	47.9	41.7	30.9	1460	47.9	43.5	43.5	47.9	41.7	30.9	1771	47.9
ATV21HD30N4	100	100	110	-	-	-	110	58.5	58.5	64.4	55.0	38.5	1460	64.4	58.5	58.5	64.4	55.0	38.5	1771	64.4

PARAMETER VALUES THAT DO NOT CHANGE IF RESET

The parameters listed in Table 193 cannot be reset. Table 193 lists the default settings of these parameters.

Table 193: Parameters whose values do not change if a reset is performed

Parameter	Description	Unit	Default Value
FΠ	Analog output scaling	–	–
FΠ5L	Analog output selection function	–	0
F109	VIA input function (analog or logic selection)	–	0
F470	VIA analog input bias	–	128
F471	VIA analog input gain	–	148
F472	VIB analog input bias	–	128
F473	VIB analog input gain	–	148
F880	Free notes	–	0

APPENDIX B— CONFIGURATION SETTINGS AND PARAMETER INDEX

Use the Configuration Setting Table to look up parameter default settings, to record customized parameter settings, and to look up sections of the manual, by page number, that contain detailed parameter descriptions.

Table 194: Configuration Setting Table

Parameter	Page Number	Name	Unit	Keypad Minimum Setting	Serial Comm Min. Setting		Adjustment Range / Function	Factory Setting	User Setting
FC	**64**	Local mode speed reference	Hz	0.1	0.01	–	LL to UL	0.0	
AU1	**69**	Auto ramp adaptation	–	–	–	0	Disabled	1	
						1	Enabled (ACC and dEC)		
						2	Enabled (ACC only)		
AU4	**57**	Macro programming	–	–	–	0	Factory setting	0	
						1	Run permissive		
						2	3-wire control		
						3	+/- speed		
						4	4–20 mA control		
CMOd	**64**	Remote mode start/stop control source	–	–	–	0	Control terminal logic inputs	0	
						1	Keypad		
						2	Serial communication		
FMOd	**64**	Remote mode primary speed reference source	–	–	–	1	VIA	1	
						2	VIB		
						3	Keypad		
						4	Serial communication		
						5	+/- Speed		

Table 194: Configuration Setting Table *(continued)*

Parameter	Page Number	Name	Unit	Keypad Minimum Setting	Serial Comm Min. Setting		Adjustment Range / Function	Factory Setting	User Setting
FPSL	**77**	Analog output function selection	–	–	–	0	Output frequency	0	
						1	Output current		
						2	Speed reference		
						3	DC bus voltage		
						4	Output motor voltage		
						5	Input power		
						6	Output power		
						7	Estimated motor torque		
						8	Motor torque current		
						9	Motor thermal state		
						10	Drive controller thermal state		
						11	DO NOT USE		
						12	Internal speed reference (after PID)		
						13	VIA input value		
						14	VIB input value		
						15	Fixed output – 100% signal (Selection 1 – output current)		
						16	Fixed output – 50% signal (Selection 1 – output current)		
						17	Fixed output – 100% signal (Selections 0, 2, 3, 4, 5, 6, 7, 8, 9,10,12,13, 14, 18)		
						18	Serial communication data		
						19	DO NOT USE		
FP	**78**	Analog output scaling	–	–	–	–	–	–	
tYP	**56, 96, 118**	Parameter reset	–	–	–	0	No action	0	–
						1	50 Hz parameter reset		
						2	60 Hz parameter reset		
						3	Factory reset		
						4	Fault history reset		
						5	Elapsed motor run time reset		
						6	Reset of EtYP fault		
						7	Save user–defined settings		
						8	Recall used–defined settings		
						9	Elapsed drive run time reset		
Fr	**65**	Local mode motor rotation direction command	–	–	–	0	Run FORWARD Only	0	
						1	Run REVERSE Only		
						2	Run FORWARD with reverse selectable		
						3	Run REVERSE with forward selectable		
ACC	**68**	Acceleration time 1	seconds	0.1	0.1	–	0.0 – 3200	Model dependant	
dEC	**69**	Deceleration time 1	seconds	0.1	0.1	–	0.0 – 3200	Model dependant	

Table 194: Configuration Setting Table *(continued)*

Parameter	Page Number	Name	Unit	Keypad Minimum Setting	Serial Comm Min. Setting		Adjustment Range / Function	Factory Setting	User Setting
FH	**67**	Maximum frequency	Hz	0.1	0.01	–	30.0 – 200.0	80.0	
UL	**67**	High speed	Hz	0.1	0.01	–	0.5 – FH	50.0	
LL	**67**	Low speed	Hz	0.1	0.01	–	0.0 – UL	0.0	
uL	**61**	Motor rated frequency	Hz	0.1	0.01	–	25.0 – 200.00	50.0	
uLu	**60**	Motor rated voltage	V	1	0.1	230 V models	50 – 330	230	
						460 V models	50 – 660	400	
Pt	**58**	Motor control mode	–	–	–	0	Constant V/Hz	1	
						1	Variable torque		
						2	Constant V/Hz with automatic torque boost		
						3	Sensorless vector control		
						4	Energy savings		
						5	Reserved (DO NOT USE)		
						6	Reserved (DO NOT USE)		
ub	**63**	Motor voltage boost	%	0.1	0.1	–	0.0 – 30.0	Model dependant	
tHr	**61**	Motor rated current overload setting	% / A	1	1	–	10 – 100% of drive controller's output current rating	100%	
OLN	**61**	Motor overload characteristics	–	–	–	0	Self cooled, overload protection	0	
						1	Self cooled, overload protection and stall		
						2	Self cooled		
						3	Self cooled, overload stall		
						4	Forced cooled, overload protection		
						5	Forced cooled, overload protection and stall		
						6	Forced cooled		
						7	Forced cooled, overload stall		
Sr1	**113**	Preset speed 1	Hz	0.1	0.01	1	LL – UL	15	
Sr2	**113**	Preset speed 2	Hz	0.1	0.01	1	LL – UL	20	
Sr3	**113**	Preset speed 3	Hz	0.1	0.01	1	LL – UL	25	
Sr4	**113**	Preset speed 4	Hz	0.1	0.01	1	LL – UL	30	
Sr5	**113**	Preset speed 5	Hz	0.1	0.01	1	LL – UL	35	
Sr6	**113**	Preset speed 6	Hz	0.1	0.01	1	LL – UL	40	
Sr7	**113**	Preset speed 7	Hz	0.1	0.01	1	LL – UL	50	
F100	**116**	Relay output - frequency level 1 attained	Hz	0.1	0.01	–	0.0 – FH	0.0	
F101	**116**	Relay output - frequency level 2 attained	Hz	0.1	0.01	–	0.0 – FH	0.0	
F102	**117**	Frequency attained detection band	Hz	0.1	0.01	-	0.0 – FH	2.5	
F108	**112**	Always active logic function 1	–	–	–	0 – 71	See Table 2, pages 32–35	0	

Table 194: Configuration Setting Table *(continued)*

Parameter	Page Number	Name	Unit	Keypad Minimum Setting	Serial Comm Min. Setting		Adjustment Range / Function	Factory Setting	User Setting
F109	**74**	VIA input function (analog or logic selection)	–	–	–	0	Analog input	0	
						1	Logic input – sink (negative logic)		
						2	Logic input – source (positive logic)		
F110	**112**	Always Active logic function 2	–	–	–	0 – 71	See Table 2, pages 32–35	1	
F111	**73**	F logic input function	–	–	–	0 – 71	See Table 2, pages 32–35	2	
F112	**73**	R logic input function	–	–	–	0 – 71	See Table 2, pages 32–35	6	
F113	**73**	RES logic input function	–	–	–	0 – 71	See Table 2, pages 32–35	10	
F118	**74**	VIA logic input function	–	–	–	0 – 71	See Table 2, pages 32–35	7	
F130	**78**	RY-RC relay primary function	–	–	–	0 – 61, 254, 255	See Table 4, pages 37–41	4	
F132	**79**	FL relay function	–	–	–	0 – 61, 254, 255	See Table 4, pages 37–41	11	
F137	**115**	RY-RC relay secondary function	–	–	–	0 – 61, 254, 255	See Table 4, pages 37–41	255	
F139	**116**	RY-RC relay function logic selection	–	–	–	0	F130 (primary) and F137 (secondary)	0	
						1	F130 (primary) or F137 (secondary)		
F167	**117**	Frequency command agreement detection range	Hz	0.1	0.01	–	0.0 – FH	2.5	
F170	**113**	Motor 2 rated frequency	Hz	0.1	0.01	–	25.0 – 200.0	50.0	
F171	**113**	Motor 2 rated voltage	V	1	0.1	230V model	50 – 330	230	
						460V model	50 – 660	400	
F172	**113**	Motor 2 voltage boost	%	0.1	0.1	–	0 – 30	Model dependant	
F173	**114**	Motor 2 rated current overload setting	% / A	1	1	–	10 – 100% of drive controller rating	100	
F185	**114**	Motor 2 current limit	% / A	1	1	–	10 – 110%	110	
F200	**77**	Auto/manual speed reference switching	–	–	–	0	Enabled	0	
						1	Disabled		
F201	**75**	VIA speed reference level 1	%	1	1	–	0 – 100	0	
F202	**75**	VIA output frequency level 1	Hz	0.1	0.01	–	0.0 – 200.0	0.0	
F203	**75**	VIA speed reference level 2	%	1	1		0 – 100	100	
F204	**75**	VIA output frequency level 2	Hz	0.1	0.01		0.0 – 200.0	50.0	
F207	**102**	Remote mode secondary speed reference source	–	–	–	1	VIA	2	
						2	VIB		
						3	Keypad		
						4	Serial communication		
						5	+/– Speed		
F210	**75**	VIB speed reference level 1	%	1	1		0 – 100	0	
F211	**75**	VIB output frequency level 1	Hz	0.1	0.01		0.0 – 200.0	0.0	

Table 194: Configuration Setting Table *(continued)*

Parameter	Page Number	Name	Unit	Keypad Minimum Setting	Serial Comm Min. Setting		Adjustment Range / Function	Factory Setting	User Setting
F212	**75**	VIB speed reference level 2	%	1	1		0 – 100	100	
F213	**75**	VIB output frequency level 2	Hz	0.1	0.01		0.0 – 200.0	50.0	
F240	**68**	Starting frequency	Hz	0.1	0.01	–	0.5 – 10.0	0.5	
F241	**109**	Operating starting frequency	Hz	0.1	0.01	–	0.0 – FH	0.0	
F242	**109**	Operating starting frequency hysteresis	Hz	0.1	0.01	–	0.0 – FH	0.0	
F250	**108**	DC braking starting frequency	Hz	0.1	0.01	–	0.0 – FH	0.0	
F251	**108**	DC braking current level	% / A	1	1	–	0 – 100%	50	
F252	**108**	DC braking time	seconds	0.1	0.1	–	0.0 – 20.0	1.0	
F256	**66**	Sleep/wake Operation	seconds	0.1	0.1	Disabled	0.0	0.0	
						Enabled	0.1 – 600.0		
F264	**114**	+ speed logic input response time	seconds	0.1	0.1	–	0.0 – 10.0	0.1	
F265	**114**	+ speed frequency steps	Hz	0.1	0.01	–	0.0 – FH	0.1	
F266	**115**	- speed logic input response time	seconds	0.1	0.1	–	0.0 – 10.0	0.1	
F267	**115**	- speed frequency steps	Hz	0.1	0.01	–	0.0 – FH	0.1	
F268	**115**	Initial +/- speed frequency	Hz	0.1	0.01	–	0.0 – FH	0.0	
F269	**115**	Reset of initial +/- speed frequency	–	–	–	0	Disabled	1	
						1	Enabled		
F270	**72**	Skip frequency 1 midpoint	Hz	0.1	0.01	–	0.0 – FH	0.0	
F271	**72**	Skip frequency 1 bandwidth	Hz	0.1	0.01	–	0.0 – 30.0	0.0	
F272	**72**	Skip frequency 2 midpoint	Hz	0.1	0.01	–	0.0 – FH	0.0	
F273	**72**	Skip frequency 2 bandwidth	Hz	0.1	0.01	–	0.0 – 30.0	0.0	
F274	**72**	Skip frequency 3 midpoint	Hz	0.1	0.01	–	0.0 – FH	0.0	
F275	**72**	Skip frequency 3 bandwidth	Hz	0.1	0.01	–	0.0 – 30.0	0.0	
F294	**103**	Forced speed frequency	Hz	0.1	0.01	–	LL – UL	50.0	
F295	**66**	Bumpless transfer from remote to local control	–	–	–	0	Disabled	1	
						1	Enabled		
F300	**71**	Switching frequency level	kHz	0.1	0.1	–	6.0 – 16.0	Model dependant	
F301	**86**	Catch on the fly	–	–	–	0	Disabled	3	
						1	After brief power loss		
						2	After run permissive is restored		
						3	After brief power loss or run permissive is restored		
						4	During every startup		

Table 194: Configuration Setting Table *(continued)*

Parameter	Page Number	Name	Unit	Keypad Minimum Setting	Serial Comm Min. Setting		Adjustment Range / Function	Factory Setting	User Setting
F302	**89**	Cost to stop on momentary loss of input power	–	–	–	0	Disabled	0	
						1	DO NOT SELECT		
						2	Coast to stop		
F303	**85**	Auto fault reset	–	1	1	0	Disabled	3	
						1 – 10	Number of fault reset attempts		
F305	**90**	Overvoltage fault protection	–	–	–	0	Enabled	2	
						1	Disabled		
						2	Enabled (quick deceleration mode)		
						3	Enabled (dynamic quick deceleration mode)		
F307	**100**	Supply voltage correction and motor voltage limitation	–	–	–	0	Supply voltage uncorrected – motor voltage limited	3	
						1	Supply voltage corrected – motor voltage limited		
						2	Supply voltage uncorrected – motor voltage unlimited		
						3	Supply voltage corrected – motor voltage unlimited		
F311	**103**	Motor rotation direction command	–	–	–	0	Forward and Reverse operation PERMITTED	1	
						1	Reverse operation PROHIBTED		
						2	Forward operation PROHIBITED		
F312	**72**	Switching frequency random mode	–	–	–	0	Disabled	0	
						1	Enabled		
F316	**72**	Switching frequency control mode	–	–	–	0	All models: switching frequency NOT automatically reduced	1	
						1	All models: switching frequency automatically reduced		
						2	460 V models*: switching frequency NOT automatically reduced		
						3	460 V models*: switching frequency automatically reduced		
F320	**110**	Droop gain	%	1	1	–	0 – 100%	0	
F323	**110**	Droop insensitive torque band	%	1	1	–	0 – 100%	0	
F359	**81**	PID control waiting time	seconds	1	1	–	0 – 2400	0	
F360	**79**	PID control enable	–	–	–	0	PID disabled	0	
						1	Enabled – feedback source: VIA		
						2	Enabled – feedback source: VIB		
F362	**79**	PID proportional gain	–	0.01	0.01	–	0.01 – 100.0	0.30	
F363	**80**	PID Integral gain	–	0.01	0.01	–	0.01 – 100.0	0.20	
F366	**80**	PID derivative gain	–	0.01	0.01	–	0.00 – 2.55	0.00	

Table 194: Configuration Setting Table *(continued)*

Parameter	Page Number	Name	Unit	Keypad Minimum Setting	Serial Comm Min. Setting		Adjustment Range / Function	Factory Setting	User Setting
F400	**98**	Auto tuning enable	–	–	–	0	Disabled	0	
						1	Enabled – parameter F402 may need adjustment		
						2	Enabled – complete auto tuning		
F401	**98**	Slip compensation	%	1	1	–	0 – 150	50	
F402	**99**	Auto torque boost	%	0.1	0.1	–	0.0 – 30.0	Model dependant	
F415	**97**	Motor rated full load current	A	0.1	0.1	–	0.1 – 200.0	Model dependant	
F416	**97**	Motor no–load current	%	1	1	–	0.0 – 30.0	Model dependant	
F417	**97**	Motor rated speed	rpm	1	1	–	100 – 9,999	Model dependant	
F418	**99**	Speed control response coefficient	–	1	1	–	1 – 150	40	
F419	**99**	Speed control stability coefficient	–	1	1	–	1 – 100	20	
F470	**75**	VIA analog input bias	–	–	–	–	0 – 255	128	
F471	**75**	VIA analog input gain	–	–	–	–	0 – 255	148	
F472	**75**	VIB analog input bias	–	–	–	–	0 – 255	128	
F473	**75**	VIB analog input gain	–	–	–	–	0 – 255	148	
F480	**99**	Magnetizing current coefficient	–	1	1	–	100 – 130	100	
F481	**120**	Line noise compensation filter	micro–seconds	1	1	–	0 – 9999	0	
F482	**121**	Line noise inhibitor filter	micro–seconds	1	1	–	0 – 9999	442	
F483	**121**	Line noise inhibitor gain	–	0.1	0.1	–	0.0 – 300.0	100.0	
F485	**100**	Stall prevention control coefficient 1	–	1	1	–	10 – 250	100	
F492	**100**	Stall prevention control coefficient 2	–	1	1	–	50 – 150	100	
F494	**100**	Motor adjustment coefficient	–	1	1	–	DO NOT ADJUST	Model dependant	
F495	**100**	Maximum voltage adjustment coefficient	%	1	1	–	90 – 110	104	
F496	**100**	Waveform switching adjustment coefficient	kHz	0.1	0.1	–	0.1 – 14.0	14.0	
F500	**105**	Acceleration time 2	seconds	0.1	0.1	1	0.0 – 3200	20.0	
F501	**105**	Deceleration time 2	seconds	0.1	0.1	1	0.0 – 3200	20.0	
F502	**70**	Acc/Dec pattern 1	–	–	–	0	Linear	0	
						1	S-pattern 1		
						2	S-pattern 2		
F503	**71**	Acc/Dec pattern 2	–	–	–	0	Linear	0	
						1	S-pattern 1		
						2	S-pattern 2		
F504	**106**	Acc/Dec pattern selection (ramp switching)	–	–	–	1	Acc/Dec pattern 1	1	
						2	Acc/Dec pattern 2		
F505	**107**	Acc/Dec pattern switching frequency	Hz	0.1	0.01	–	0.0 – UL	0.0	
F506	**105**	Acc/Dec S-pattern lower limit	%	1	1	–	0 – 50	10	

Table 194: Configuration Setting Table *(continued)*

Parameter	Page Number	Name	Unit	Keypad Minimum Setting	Serial Comm Min. Setting		Adjustment Range / Function	Factory Setting	User Setting
F507	**106**	Acc/Dec S-pattern upper limit	%	1	1	–	0 – 50	10	
F601	**63**	Motor current limit	% / A	1	1	–	10 – 110%	110%	
F602	**88**	Drive fault memory	–	–	–	0	Cleared	0	
						1	Retained		
F603	**117**	External fault stop mode	–	–	–	0	Freewheel stop	0	
						1	Ramp stop		
						2	DC injection braking		
F604	**118**	External fault DC braking time	seconds	0.1	0.1	–	0.0 – 20.0	1.0	
F605	**91**	Output phase failure detection mode	–	–	–	0	Disabled	3	
						1	At first start-up		
						2	At every start-up		
						3	During operation		
						4	At start-up and during operation		
						5	Load side disconnect mode		
F607	**63**	Motor overload time	seconds	1	1	–	10 – 2400	300	
F608	**88**	Input phase failure detection mode	–	–	–	0	Disabled	1	
						1	Enabled		
F609	**92**	Underload detection level bandwidth	%	1	1	–	1 – 20	10	
F610	**91**	Underload fault/alarm selection	–	–	–	0	Alarm	0	
						1	Fault		
F611	**92**	Underload detection level	% / A	1	1	–	0 – 100%	0	
F612	**92**	Underload detection time	seconds	1	1	–	0 – 255	10	
F613	**118**	Output short-circuit detection mode	–	–	–	0	Each time (standard pulse)	0	
						1	Only one time after power is turned on (standard pulse)		
						2	Each time (short-time pulse)		
						3	Only one time after power is turned on (short-time pulse)		
F615	**119**	Overtorque fault/alarm selection	–	–	–	0	Alarm	0	
						1	Fault		
F616	**119**	Overtorque detection level	%	1	1	–	0 – 200	130	
F618	**120**	Overtorque detection time	seconds	0.1	0.1	–	0.0 – 10.0	0.5	
F619	**120**	Overtorque detection level bandwidth	%	1	1	–	0 – 100%	10	
F621	**82**	Run time alarm setting	hours	0.1	0.1	–	0.0 – 999.9 (0.1 = 1 hour, 100 = 1000 hours)	610	
F626	**90**	Overvoltage fault operation level	%	1	1	1	100 – 150% of nominal DC bus voltage	140	
F627	**89**	Undervoltage fault operation mode	–	–	–	0	Alarm only (detection level below 60%)	0	
						1	Fault (detection below 60%)		
						2	Alarm only (detection level below 50%)		
F632	**87**	Motor overload memory	–	–	–	0	Cleared	0	
						1	Retained		

Table 194: Configuration Setting Table *(continued)*

Parameter	Page Number	Name	Unit	Keypad Minimum Setting	Serial Comm Min. Setting		Adjustment Range / Function	Factory Setting	User Setting
F633	**93**	Loss of VIA analog signal	–%	–	–	0	Disabled	0	
						1 – 100	Fault detection level		
F634	**120**	Ambient temperature for drive controller service alarm	–	–	–	1	-10 – 10°C	3	
						2	11 – 20°C		
						3	21 – 30°C		
						4	31 – 40°C		
						5	41 – 50°C		
						6	51 – 60°C		
F645	**111**	PTC motor thermal protection enable	–			0	disabled	0	
						1	Enabled (fault mode)		
						2	Enabled (alarm mode)		
F646	**111**	PTC resistor value	ohms	1	1	–	0 – 9999	3000	
F650	**102**	Forced speed enable	–	–	–	0	Disabled	0	
						1	Enabled		
F691	**78**	Analog output slope	–	–	–	0	Negative slope	1	
						1	Positive slope		
F692	**78**	Analog output bias	%	1	1	–	0 – 100%	0	
F700	**57**	Parameter lock	–	–	–	0	All parameters are unlocked and can be changed. But see Table 8 on page 52 for those that cannot be changed while the drive controller is running	0	
						1	Only parameter F700 can be changed.		
F701	**82**	Keypad display: % or A/V unit	–	–	–	0	%	1	
						1	A (amperes) or V (volts)		
F702	**83**	Custom frequency display conversion factor	–	0.01	0.01	0	Frequency displayed in Hz	0	
						0.01 – 200.0	Conversion factor		
F705	**84**	Custom frequency display conversion slope	–	–	–	0	Negative slope	1	
						1	Positive slope		
F706	**84**	Custom frequency display conversion bias	Hz	0.01	0.01	–	0.00 – FH	0.00	
F707	**65**	Local mode speed reference step changes	Hz	0.01	0.01	Disabled	0.00	0.00	
						Enabled	0.01 – FH		
F708	**82**	Keypad frequency display resolution	–	1	1	0	Disabled – 0.1 Hz steps	0	
						1 – 255	See formula on page 82		

Table 194: Configuration Setting Table *(continued)*

Parameter	Page Number	Name	Unit	Keypad Minimum Setting	Serial Comm Min. Setting		Adjustment Range / Function	Factory Setting	User Setting
F710	**81**	Default keypad operational display value	–	–	–	0	Motor operating frequency, (Hz or custom display, see F702 on page 81)	0	
						1	Speed reference, (Hz or custom display, see F702 on page 83)		
						2	Motor current, (% or A, see F701 on page 82)		
						3	Drive controller rated current (A)		
						4	Drive controller thermal state (%)		
						5	Output power (kW)		
						6	Internal speed reference (after PID function), (Hz or custom display, see F702 on page 83)		
						7	Serial communication data		
						8	Output speed (rpm, see F417 page 97)		
						9	Displays the counter numbers of communication through the network		
						10	Displays the counter numbers of communication only at the normal state in all communication through the network.		
F721	**65**	Local mode motor stop type	–	–	–	0	Ramp stop	0	
						1	Freewheel stop		
F730	**103**	Disabling of keypad speed reference change keys	–	–	–	0	Enabled	0	
						1	Disabled		
F732	**104**	Disabling of keypad local/remote key	–	–	–	0	Enabled	0	
						1	Disabled		
F733	**104**	Disabling of keypad RUN and STOP keys in local mode	–	–	–	0	Enabled	0	
						1	Disabled		
F734	**104**	Disabling of keypad STOP key in remote mode	–	–	–	0	Enabled	0	
						1	Disabled		
F735	**104**	Disabling of keypad fault reset function	–	–	–	0	Enabled	0	
						1	Disabled		
F738	**97**	Display of submenu AUF	–	–	–	0	AUF displayed	0	
						1	AUF not displayed		
F748	**83**	Accumulated power consumption memory	–	–	–	0	Disabled	1	
						1	Enabled		
F749	**83**	Accumulated power consumption display unit	kWh	–	–	0	1 kWh	Model dependant	
						1	0.1 kWh		
						2	0.01 kWh		
						3	0.001 kWh		
F800	**94**	Baud rate	–	–	–	0	9,600 bps	1	
						1	19,200 bps		
F801	**94**	Parity	–	–	–	0	No parity	1	
						1	Even parity		
						2	Odd parity		
F802	**94**	Address	–	1	1	–	0 – 247	1	

Table 194: Configuration Setting Table *(continued)*

Parameter	Page Number	Name	Unit	Keypad Minimum Setting	Serial Comm Min. Setting		Adjustment Range / Function	Factory Setting	User Setting
F803	**94**	Time-out	seconds	1	1	0	Communication error detection disabled	3	
						1 – 100	Seconds		
F805	**94**	Communication waiting time	seconds	0.01	0.01	–	0.00 – 2.00	0.00	
F806	**95**	Communication between slave and master selection	–	–	–	0	Slave – drive controller ramps to a stop if communication with master is lost	0	
						1	Slave – last commanded operation continues if communication with master is lost		
						2	Slave – drive controller faults if communication with master is lost		
						3	Master – transmission of frequency commands		
						4	Master – transmission of output frequency signals		
F811	**96**	Communication speed reference level 1	%	1	1	–	0 – 100	0	
F812	**96**	Communication output frequency level 1	Hz	0.1	0.01	–	0.0 – 200.0	0.0	
F813	**96**	Communication speed reference level 2	%	1	1	–	0 – 100	100	
F814	**96**	Communication output frequency level 2	Hz	0.1	0.01	–	0.0 – 200.0	50.0	
F829	**121**	Protocol	–	–	–	0	DO NOT USE	1	
						1	Modbus RTU		
						2	Metasys N2		
						3	Apogee P1 FLN		
						4	BACnet		
F851	**95**	Communication fault setting	–	–	–	0	Drive controller ramps to a stop. Serial control is relinquished to the sources defined by FNOd and CNOd.	4	
						1	Last commanded operation continues		
						2	Drive controller ramps to a stop. Serial control is maintained.		
						3	Drive controller removes power from the motor which coasts to a stop. Serial control is maintained.		
						4	Drive controller faults with either a communication error Err5 or a network error Err8.		
F856	**121**	Motor poles for communication	–	–	–	1	2 poles	2	
						2	4 poles		
						3	6 poles		
						4	8 poles		
						5	10 poles		
						6	12 poles		
						7	14 poles		
						8	16 poles		

Table 194: Configuration Setting Table *(continued)*

Parameter	Page Number	Name	Unit	Keypad Minimum Setting	Serial Comm Min. Setting		Adjustment Range / Function	Factory Setting	User Setting
F870	**121**	Block write data 1	–	–	–	0	No selection	0	
						1	Command 1		
						2	Command 2		
						3	Frequency command		
						4	Output data on the terminal board		
						5	Analog output for communications		
						6	Motor speed command		
F871	**122**	Block write data 2	–	–	–	0	No selection	0	
						1	Command 1		
						2	Command 2		
						3	Frequency command		
						4	Output data on the terminal board		
						5	Analog output for communications		
						6	Motor speed command		
F875	**122**	Block read data 1	–	–	–	0	No selection	0	
						1	Status information		
						2	Output frequency		
						3	Output current		
						4	Output voltage		
						5	Alarm information		
						6	PID feedback value		
						7	Input terminal board monitor		
						8	Output terminal board monitor		
						9	VIA terminal board monitor		
						10	VIB terminal board monitor		
						11	Output motor speed monitor		
F876	**122**	Block read data 2	–	–	–	0	No selection	0	
						1	Status information		
						2	Output frequency		
						3	Output current		
						4	Output voltage		
						5	Alarm information		
						6	PID feedback value		
						7	Input terminal board monitor		
						8	Output terminal board monitor		
						9	VIA terminal board monitor		
						10	VIB terminal board monitor		
						11	Output motor speed monitor		

Table 194: Configuration Setting Table *(continued)*

Parameter	Page Number	Name	Unit	Keypad Minimum Setting	Serial Comm Min. Setting		Adjustment Range / Function	Factory Setting	User Setting
F877	**123**	Block read data 3	–	–	–	0	No selection	0	
						1	Status information		
						2	Output frequency		
						3	Output current		
						4	Output voltage		
						5	Alarm information		
						6	PID feedback value		
						7	Input terminal board monitor		
						8	Output terminal board monitor		
						9	VIA terminal board monitor		
						10	VIB terminal board monitor		
						11	Output motor speed monitor		
F878	**123**	Block read data 4	–	–	–	0	No selection	0	
						1	Status information		
						2	Output frequency		
						3	Output current		
						4	Output voltage		
						5	Alarm information		
						6	PID feedback value		
						7	Input terminal board monitor		
						8	Output terminal board monitor		
						9	VIA terminal board monitor		
						10	VIB terminal board monitor		
						11	Output motor speed monitor		
F879	**123**	Block read data 5	–	–	–	0	No selection	0	
						1	Status information		
						2	Output frequency		
						3	Output current		
						4	Output voltage		
						5	Alarm information		
						6	PID feedback value		
						7	Input terminal board monitor		
						8	Output terminal board monitor		
						9	VIA terminal board monitor		
						10	VIB terminal board monitor		
						11	Output motor speed monitor		
F880	**124**	Free notes	–	1	1	–	0 – 65535	0	
F890	**124**	Parameter for option 1	–	1	1	–	0 – 65535	0	
F891	**124**	Parameter for option 2	–	1	1	–	0 – 65535	0	
F892	**124**	Parameter for option 3	–	1	1	–	0 – 65535	0	
F893	**124**	Parameter for option 4	–	1	1	–	0 – 65535	0	
F894	**124**	Parameter for option 5	–	1	1	–	0 – 65535	0	
F895	**124**	Parameter for option 6	–	1	1	–	0 – 65535	0	
F896	**124**	Parameter for option 7	–	1	1	–	0 – 65535	0	
F897	**124**	Parameter for option 8	–	1	1	–	0 – 65535	0	
F898	**125**	Parameter for option 9	–	1	1	–	0 – 65535	0	

Table 194: Configuration Setting Table *(continued)*

Parameter	Page Number	Name	Unit	Keypad Minimum Setting	Serial Comm Min. Setting		Adjustment Range / Function	Factory Setting	User Setting
F899	**125**	Parameter for option 10	–	1	1	–	0 – 65535	0	
F910	**133**	Permanent magnet motor step-out detection current level	% / A	1	1	–	10 – 150%	100	
F911	**133**	Permanent magnet motor step-out detection time	seconds	0.1	0.1	0	Disabled	0.00	
						0.01 – 25	Enabled		
F912	**133**	Permanent magnet motor high–speed torque adjustment coefficient	–	0.01	0.01	–	DO NOT ADJUST	0.00	

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