Altivar 21

Variable speed drives for asynchronous motors

Programming Manual

Software V1.9

09/2009

AAV75193

www.schneider-electric.com

Schneider Electric

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Important information

PLEASE NOTE

Please read these instructions carefully and examine the equipment in order to familiarize yourself with the device before installing, operating or carrying out any maintenance work on it.

The following special messages that you will come across in this document or on the device are designed to warn you about potential risks or draw your attention to information that will clarify or simplify a procedure.

The addition of this symbol to a “Danger” or “Warning” safety label indicates that there is an electrical risk that will result in injury if the instructions are not followed.

This is a safety warning symbol. It warns you of the potential risk of injury. You must comply with all safety messages that follow this symbol in order to avoid the risk of injury or death.

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

PLEASE NOTE:

Only qualified personnel are authorized to carry out maintenance work on electrical equipment. Schneider Electric accepts no responsibility for the consequences of using this device. This document does not constitute an instruction manual for inexperienced personnel.

Before You Begin

Read and understand these instructions before performing any procedure with this drive.

⚠ DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Read and understand this manual before installing or operating the Altivar 21 drive. 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, 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:
  - — 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. WAIT 15 MINUTES to allow the DC bus capacitors to discharge. Then follow the “Bus Voltage Measurement Procedure” located in the Installation Manual, to verify that the DC voltage is less than 42 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.

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

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION

Before turning on the drive 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 to run. Otherwise, the motor can start immediately.

Failure to follow this instruction 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 functions.
- Protect the signal conductors against damage that could result in unintentional conductor grounding.

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.
- Each implementation of an Altivar 21 drive 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.

⚠ WARNING

LOSS OF CONTROL

- Set the communication error trip time to stop the drive in case the remote graphic display terminal 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 graphic display terminal display.

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

Documentation structure

The following Altivar 21 technical documents are available on the Telemecanique website (www.telemecanique.com) as well as on the CD-ROM supplied with the drive.

Installation Manual

This manual contains complete mounting and wiring instructions.

Programming Manual

This describes the functions, parameters and use of the drive terminal (integrated display terminal and graphic display terminal).
The communication functions are not described in this manual, but in the manual for the bus or network used.

Manuals for Modbus, Lonworks, BACnet, Metasys N2, Apogee FLN

These manuals describe the assembly, connection to the bus or network, signaling, diagnostics, and configuration of the communication-specific parameters via the integrated display terminal or the graphic display terminal.
They also describe the communication services of the protocols.

Software enhancements

Since the Altivar ATV21 was first launched, it has benefited from the addition of several new functions. The software version is now V1.9. The old versions can be replaced by this new one without any modifications.
Although this documentation relates to version V1.9, it can still be used with earlier versions, as the updates merely involve the addition of new values and parameters, and none of the parameters of the previous versions have been modified or removed.
The software version is indicated on the nameplate attached to the body of the drive.

Enhancements made to version V1.1 in comparison to V1.0

- New factory value for Supply Voltage Correction and Motor Voltage Limitation F307 = Supply Voltage Corrected - motor voltage unlimited (F307 = 3). See page 51.
- Modify factory value for Motor No-load Current F416 = According to drive model. See page 48.
- New factory value for FL Relay Function F132 = Inversion of fault relay (F132 = 11). See page 85.
- No detection of Ground Fault EF2 during Line supply undervoltage fault nOF over 22 kW product.

Enhancements made to version V1.2 in comparison to V1.1

- New factory value for Motor Current Limit F601 = 110 % of the drive's output current rating. See page 47.
- New factory value for Motor 2 Current Limit F185 = 110 % of the drive's output current rating. See page 52.
- In case of Supply Voltage Correction and Motor Voltage Limitation F307 = Supply voltage uncorrected (F307 = 0 or 2), auto-swap the Motor rated voltage uL1 as 200 V (200 V range) or 400 V (400 V range). See page 51 and page 40.

Enhancements made to version V1.3 in comparison to V1.2

- New factory value for Time-out F803 = 3 seconds of the drive's output current rating. See page 110.

Enhancements made to version V1.6 in comparison to V1.3

- New factory value for Auto Fault Reset F303 = Disabled (F303 = 0). See page 97.
- Overvoltage Fault OPx is automatically re-start when Auto Fault Reset F303 = Disabled (F303 = 0). See page 120and page 97.
- New factory value for Disabling of graphic display terminal Fault Reset Function F735 = Disabled (F735 = 1). See page 58.
- Improvement of speed search function.
- Modify external keypad interface (text on "Stop" button becomes "Stop / Reset").
- Stop key from optional graphic display terminal (VW3A21101).

Enhancements made to version V1.7 in comparison to V1.6

- New parameter Power supply adjustment gain F484. See page 106.
- Clear PID integral value (function 65) and PID Control Prohibited (function 14) are valid for all Remote Mode Start/Stop Control CnOd adjustment.

Enhancements made to version V1.8 in comparison to V1.7

- Improvement countermesure of vibration issue (F484). See page 106.

Enhancements made to version V1.9 in comparison to V1.8

New parameters:

- Delay for RY-RC Relay F146. See page 85.
- Delay for FL Relay F147. See page 85.
- Threshold logic for relay link to VIA F160. See page 81.
- Hysteresis threshold for logic relay link to VIA F161. See page 81.
- Threshold logic for relay link to VIB F162. See page 81.
- Hysteresis threshold for logic relay link to VIB F163. See page 81.
- PI regulator reversal direction correction F380. See page 87.
- Stop on LL hysteresis F391. See page 87.
- PI wake up threshold on PI error F392. See page 87.
- PI wake up threshold on PI feedback error F393. See page 87.
- Drive behaviour on 4-20 event F644. See page 104.
- Fallback speed F649. See page 104.
- Low frequency when analog output equal 0 V F694. See page 84.
- High frequency when analog output equal 0 V F695. See page 84.

INSTALLATION

☐ 1 Consult the Installation Manual

PROGRAMMING

■ 2 Configure the parameters

- ☐ Quick menu AUF
- ☐ Motor parameters
- ☐ Perform an auto-tuning operation

■ 3 Start

Tips:

- Before you start programming, complete the user setting tables, page 132.
- Perform an auto-tuning operation to optimize performance, page 48.
- If you get lost, return to the factory settings, page 123.

☞ *Note: Check that the wiring of the drive is compatible with its configuration.*

Factory configuration

Drive factory settings

The Altivar 21 is factory-set for the most common operating conditions:

- Motor Control Mode $P\,t$: Variable torque ($P\,t$ = 1). See page 45.
- High speed $U\,L$ = 50.0 Hz. See page 59.
- Low speed $L\,L$ = 0.0 Hz. See page 59.
- Switching Frequency Level $F\,3\,0\,0$: depending on drive rating (see page 64)
- Auto Ramp Adaptation $A\,U\,\_\,1$ = Enabled ($A\,U\,\_\,1$ = 1). See page 64.

Parameter which depends on Macro Programming $A\,U\,4$ = Factory setting 0 (see page 42):

- Command reference: logic inputs ($C\,N\,O\,d$ = 0). See Remote Mode Start/Stop Control page 54.
- Speed reference: analog input VIA = 0–10 V or 0–20 mA ($F\,N\,O\,d$ = 1, $F\,2\,0\,\_\,1$ = 0). See Remote Mode Primary Speed Reference Source $F\,N\,0\,0$ page 54 and Analog Input Speed Reference page 81.
- F: run forward ($F\,\_\,1\,1\,1$ = 2). See F Logic Input Function page 80.
- R: preset speed 1 ($F\,\_\,1\,1\,2$ = 6). See R Logic Input Function page 80.
- RES: fault reset ($F\,\_\,1\,1\,3$ = 10). See RES Logic Input Function page 80.
- Drive ready for operation ($F\,\_\,1\,1\,0$ = 1). See Always Active Logic Function 2 page 89.

If the above values are compatible with the application, the drive can be used without changing the settings.

Setup – Preliminary recommendations

⚠ CAUTION

INCOMPATIBLE LINE VOLTAGE

Before turning on and configuring the drive, ensure that the line voltage is compatible with the supply voltage range shown on the drive nameplate. The drive may be damaged if the line voltage is not compatible.

Failure to follow these instructions can result in equipment damage.

Power switching via line contactor

⚠ CAUTION

UNINTENDED EQUIPMENT OPERATION

- Avoid operating the contactor frequently (premature ageing of the filter capacitors).
- Cycle times < 60 s may result in damage to the pre-charge resistor.

Failure to follow these instructions can result in equipment damage.

User adjustment and extension of functions

- The display unit and buttons can be used to modify the settings and to extend the functions described in the following pages.
- **Return to factory settings** is made easy by the Parameter Reset ᴇ ᵧ ᴘ (see page 41).

DANGER

UNINTENDED EQUIPMENT OPERATION

- Check that changes made to the settings during operation do not present any danger.
- We recommend stopping the drive before making any changes.

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

Test on a low power motor or without a motor

- In factory settings mode, Output Phase Failure Detection Mode F605 (see page 102) is active (F605 = 3). To check the drive in a test or maintenance environment without having to switch to a motor with the same rating as the drive (particularly useful in the case of high power drives), deactivate F605 = 0.
- Set Motor Control Mode Pt = Constant V/Hz 0 (see page 45)

⚠ CAUTION

UNINTENDED EQUIPMENT OPERATION

Motor thermal protection will not be provided by the drive if the motor current is less than 0.2 times the rated drive current. Provide an alternative means of thermal protection.

Failure to follow these instructions can result in equipment damage.

Using motors in parallel

- Set Motor Control Mode Pt = Constant V/Hz 0 (see page 45).

⚠ CAUTION

UNINTENDED EQUIPMENT OPERATION

Motor thermal protection is no longer provided by the drive. Provide an alternative means of thermal protection on every motor.

Failure to follow these instructions can result in equipment damage.

Using in single phase supply

- Set Input Phase Failure Detection Mode F608 = Disabled 0 (see page 100).

⚠ CAUTION

UNINTENDED EQUIPMENT OPERATION

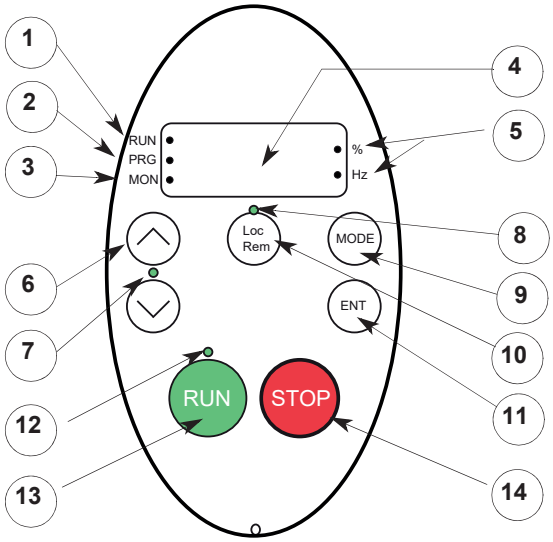
Using ATV21 in single phase supply is only allowed in training mode with motor and without load.

Failure to follow these instructions can result in equipment damage.

Graphic display terminal

This section describes the features of the integrated graphic display terminal display. An optional graphic display terminal (VW3A21101) is also available.

Graphic display terminal features

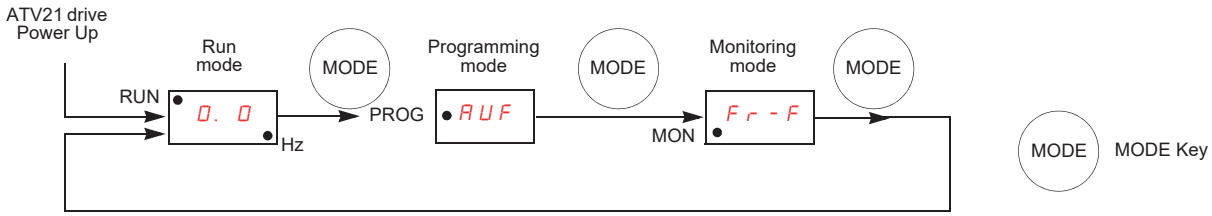


	LED/Key	Characteristics
1	Display RUN LED	• Illuminates when a run command is applied to the drive. • Flashes when there is a speed reference present with a Run command.
2	Display PRG LED	• Illuminates when Programming mode is active. • Flashes in AUF, GrU modes
3	Display MON LED	• Illuminates when Monitoring 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 graphic display terminal 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
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.
14	STOP	Stop/reset key. In Local mode, pressing the STOP key causes the drive to stop based on the setting of parameter F121. In Remote mode, pressing the STOP key causes the drive to stop based on the setting of parameter F603. The display will indicate a flashing "E". If F735 is set to 0 (default setting), pressing the stop key twice will reset all resettable faults if the fault condition has been resolved.

Graphic display terminal

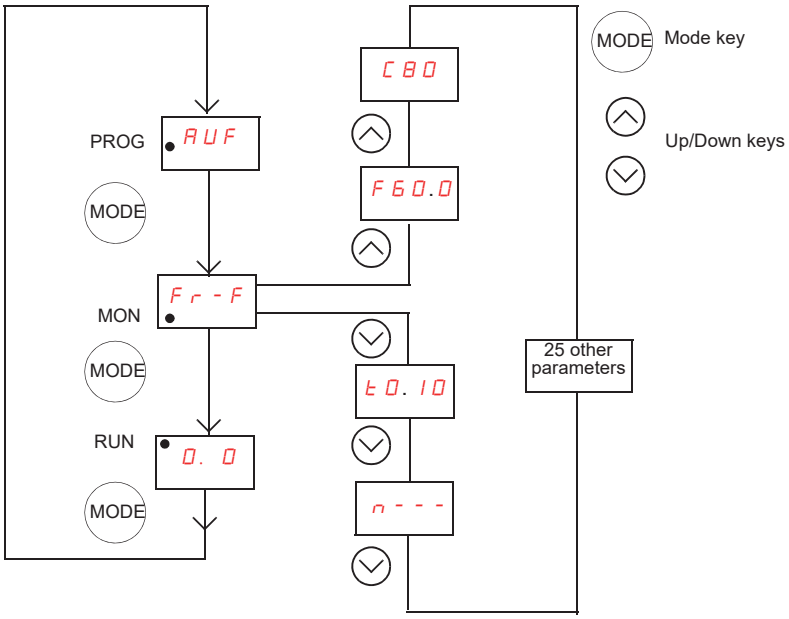
Graphic display terminal modes

The Altivar 21 graphic display terminal has three modes of operation: Monitoring, Run and Programming.
The drive powers up in the Run mode. To select a different mode, use the MODE key as illustrated below.



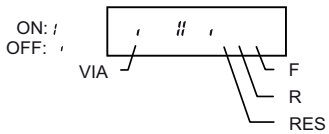
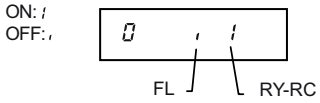
Monitoring Mode

The Monitoring mode displays drive 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.

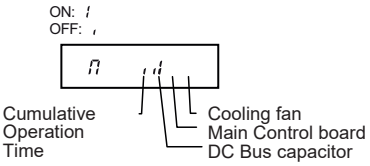


Graphic display terminal

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, displayed either as Hz or in custom unit set by parameter F 702
C 80	Motor current	The average of the 3 phases of motor current displayed either as amperes or as a percentage of the drive's nameplate-rated output current. Select % or A with parameter F 701.
y 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's rated input voltage (200 V for 208/240 V models - 400 V for 480 V models). Select % or volts with parameter F 701.
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's rated output voltage (200 V for 208/240 V models - 400 V for 480 V models). Select % or volts with parameter F 701.
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 F 701.
L 70	drive load factor	The motor current as a percentage of the drive's rated output current, which may be reduced from the drive's nameplate current rating by adjustments in switching frequency.
h 80	Input power	drive input power displayed in kilowatts (kW)
H 75	Output power	drive 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 F 702
. . 11	Logic input map	 The bar representing VIA is displayed only if F 109 = 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 F 702
b 70	PID computed speed reference	Speed reference command to drive as computed by the PID function, displayed either as Hz or in custom unit set by parameter F 702
h 85	Accumulated input power consumption	Accumulated input power consumed by the drive displayed in kWh
H 75	Accumulated output power consumption	Accumulated output power supplied by the drive displayed in kWh
A 16.5	Drive rated output current	Drive nameplate rated output current in amperes
1500	Motor speed	Motor speed in rpm

Monitoring Mode Displays (continued)

Display	Name	Description
n SO	Communication counter	Displays the counter numbers of communication through the network
n SO	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 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 state at time of fault. See “Fault Display and History” on page 18 and “Faults - Causes - Remedies” on page 118 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 run time	Cumulative drive run time. 0.01 = 1 hour. 1.00 = 100 hours

Graphic display terminal

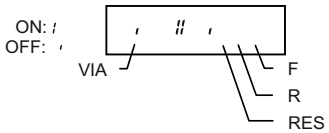
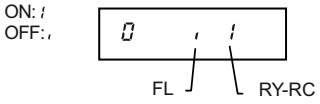
Fault Display and History

When the drive faults, the graphic terminal 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 page 16.

Up to five faults can be displayed on the graphic terminal in Monitoring mode: the present fault (if the drive 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 below for the available information.

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

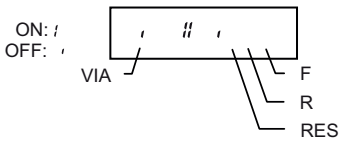
Fault History

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 F 702
Fr-F	Direction of rotation	Fr-F = forward direction Fr-r = reverse direction
F 60.0	Speed reference	Command frequency to drive, displayed either as Hz or in custom unit set by parameter F 702
C 80	Motor current	The average of the 3 phases of motor current displayed either as A or as a percentage of the drive's nameplate-rated output current. Select % or A with parameter F 701.
Y 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's rated input voltage (200 V for 208/240 V models - 400 V for 480V models). Select % or volts with parameter F 701.
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's rated output voltage (200 V for 208/240 V models - 400 V for 480 V models). Select % or volts with parameter F 701.
. . 11	Logic input map	 The bar representing VIA is displayed only if F 109 = 1 or 2
0. 1	Relay output map	
t0. 10	Drive run time	Cumulative drive run time. 0.01 = 1 hour. 1.00 = 100 hours

I/O Map

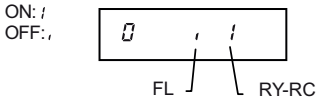
In both the monitoring mode and the fault history, it is possible to view the state of the logic inputs and the relay outputs. See previous tables on pages 16 and 18.

Logic Input Map



The ON or OFF status of each logic input is displayed in bits. VIA is included in this display if parameter F 109 is set to either 1 or 2.

Relay Output Map



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

Graphic display terminal

Run Mode

To access the Run mode, press the MODE key until the drive operating frequency, a fault code, or a pre-alarm code is displayed. See Faults - Causes - Remedies beginning on page 118 for the fault and pre-alarm codes.

Changing the Display in Run Mode

Motor operating frequency is the default value displayed on the graphic terminal in Run mode. This displayed value can be changed by setting parameter Default graphic display terminal Operational Value F 7 10. See page 94 for a list of the display choices.

The displayed value can be expressed as a percentage of the drive rating, or in amperes or volts, as appropriate for the value displayed. The units can be changed by setting parameter Graphic display terminal (% or A/V Units) F 70 1 (see page 94).

In addition, the resolution of the speed reference and output frequency displays can be adjusted by setting parameters Local Mode Speed Reference Step Changes F 70 7 and Graphic display terminal Frequency Resolution F 708 (see pages 55 and 94).

Programming Mode

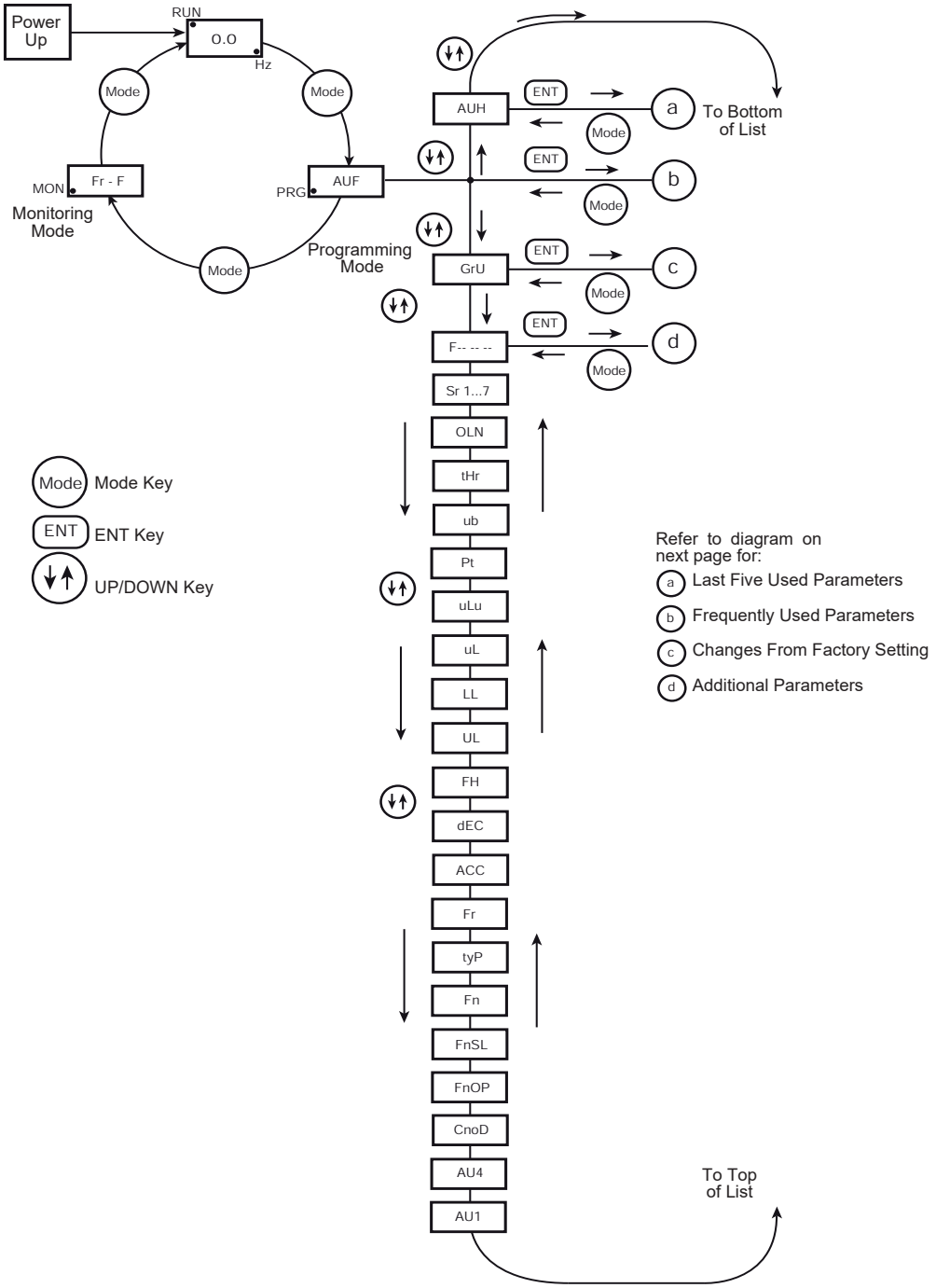
Use this mode to program the drive.

To access the Programming mode, use the MODE key until the PRG indicator LED on the display is illuminated.

Menu Structure

Menu Navigation

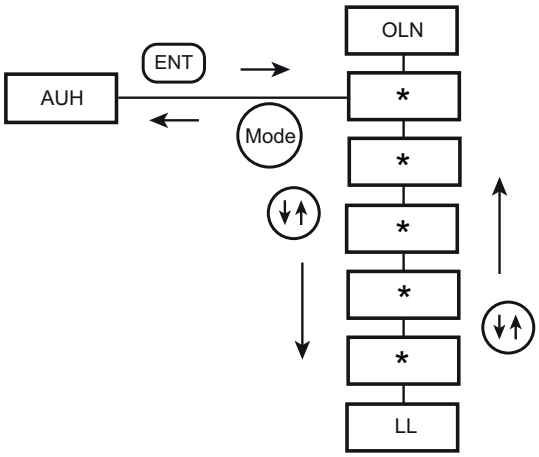
Menu navigation diagrams below and page 21 illustrate how to navigate through the programming menus and submenus.



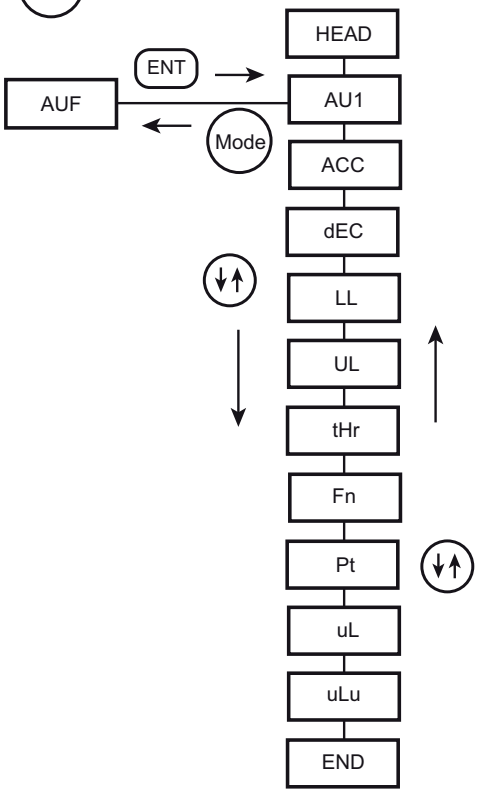
Menu Structure

Menu Navigation (continued)

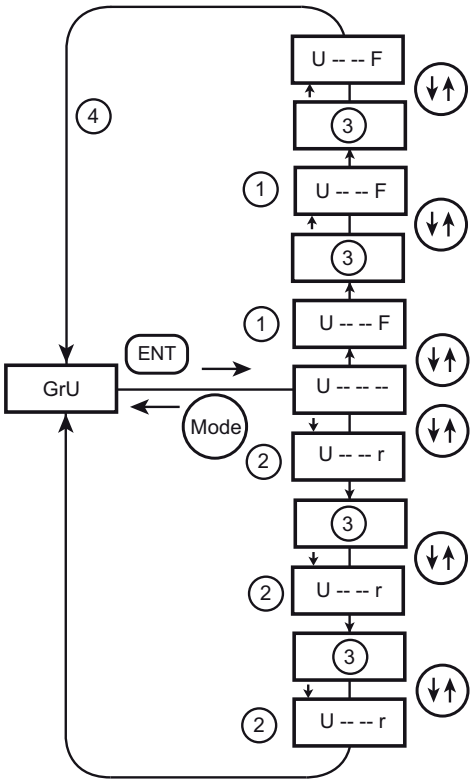
a History parameters



b Quick menu

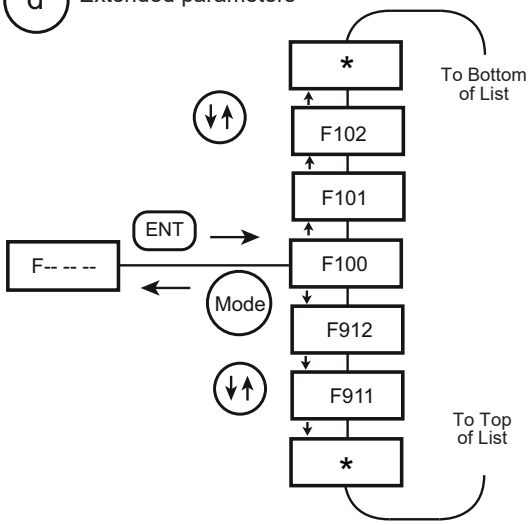


c User parameters



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.

d Extended parameters



Submenus

The ATV21 drive features 4 submenus (see diagram on page 21) that are designed to reduce the time and effort required to program application parameters. Parameters can be modified within these submenus.

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 Lock F700 is not displayed in the AUH menu, even if its value has been changed (see page 43).

AUF: Quick Menu

The AUF submenu provides ready access to the ten basic parameters commonly used in programming the drive. In many cases, programming the ATV21 drive is complete when these 10 parameters have been properly set (see chapter Quick Menu page 37).

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 setting, no display is generated.

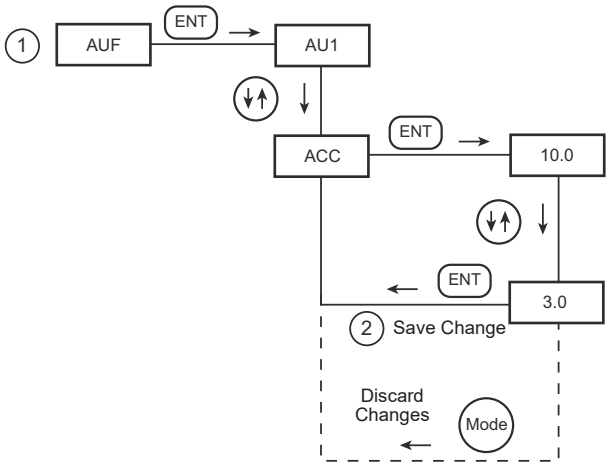
Parameters Fn and F470 – F473 are not displayed in the GrU menu, even if their values have been changed.

F---: Extended Parameters

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

Accessing and Changing Parameters

The diagram below illustrates how to access and change parameter values.



Menu Structure

Parameters that cannot be changed while the drive is running

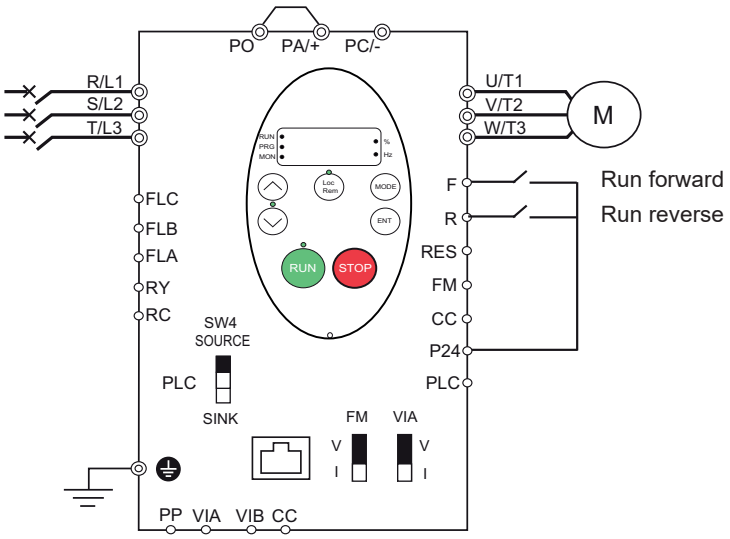
The table below lists the parameters that cannot be changed unless the drive is stopped (displaying 0.0 or OFF on the graphic display terminal).

Parameter	Description
AU1	Auto ramp adaptation
AU4	Macro programming
CNOd	Remote mode start/stop control source
FNOd	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
F305	Overvoltage fault protection
F307	Supply voltage correction and motor voltage limitation
F311	Motor rotation direction command

Parameter	Description
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	Frequency loop gain
F419	Frequency loop stability
F480	Magnetizing current coefficient
F481	Line noise compensation filter
F482	Line noise inhibitor filter
F483	Line noise inhibitor gain
F484	Power supply adjustment 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 graphic display terminal 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

Common control schemes

2-wire control



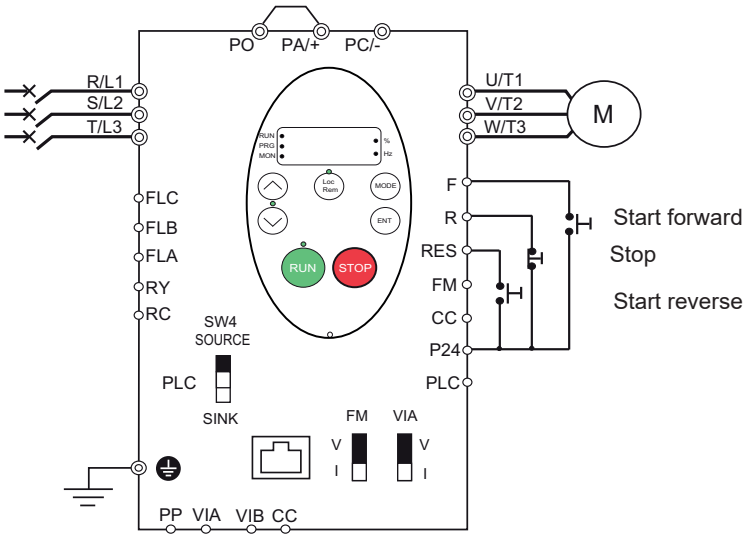
1. Wire the logic inputs as indicated in the above figure.
2. Set switch SW4 to source.
3. Program common parameters of ATV21 (see Quick Start page 37).
4. Program specific parameters for 2-wire control as indicated in the following table:

Parameter	Page	Setting	Factory value
CnOd (remote mode start/stop control)	54	0 (control terminal logic inputs)	0
F111 (F logic input function)	80	2 (forward run command)	2
F112 (R logic input function)	80	3 (reverse run command)	6

Note: F111 and F112 must not be switched simultaneously or the drive will go at 0 speed.

Common control schemes

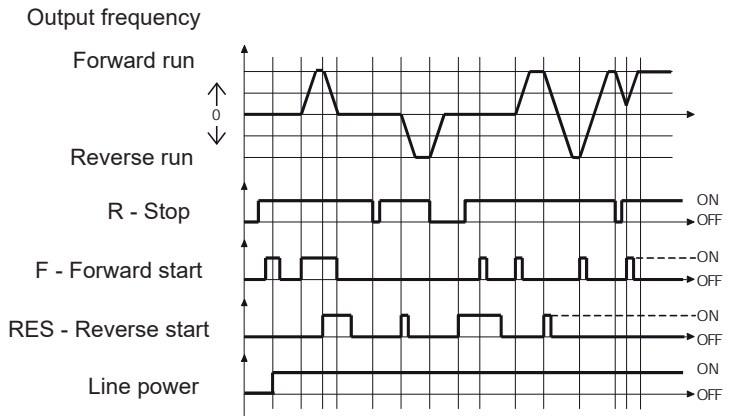
3-wire control



1. Wire the logic inputs as indicated in the above figure.
2. Set switch SW4 to source.
3. Program common parameters of ATV21 (see Quick Start page 37).
4. Program specific parameters for 3-wire control as indicated in the following table:

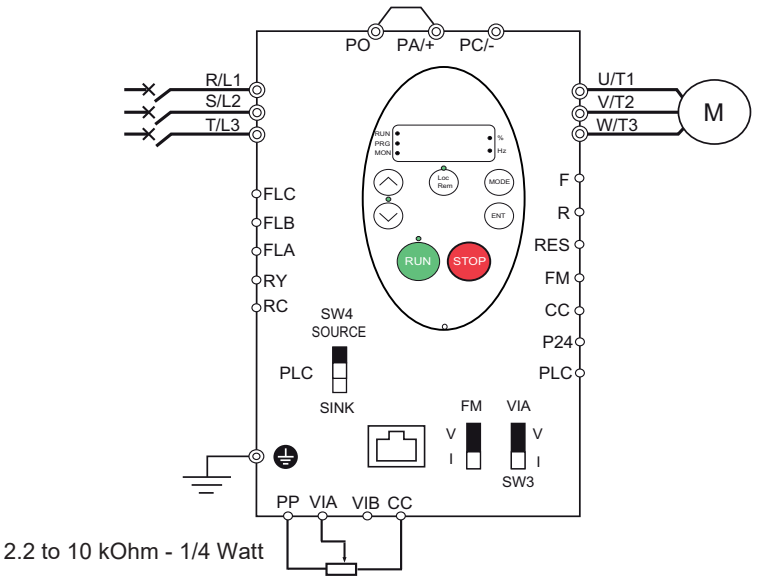
Parameter	Page	Setting	Factory value
CMOd (remote mode start/stop control)	54	**0** (control terminal logic inputs)	0
FII1 (F logic input function)	80	**2** (start forward - 3 wire control)	2
FII2 (R logic input function)	80	**49** (stop input - 3 wire control)	6
FII3 (RES logic input function)	80	**3** (start reverse - 3 wire control)	10

3 wire control timing diagram:



Common control schemes

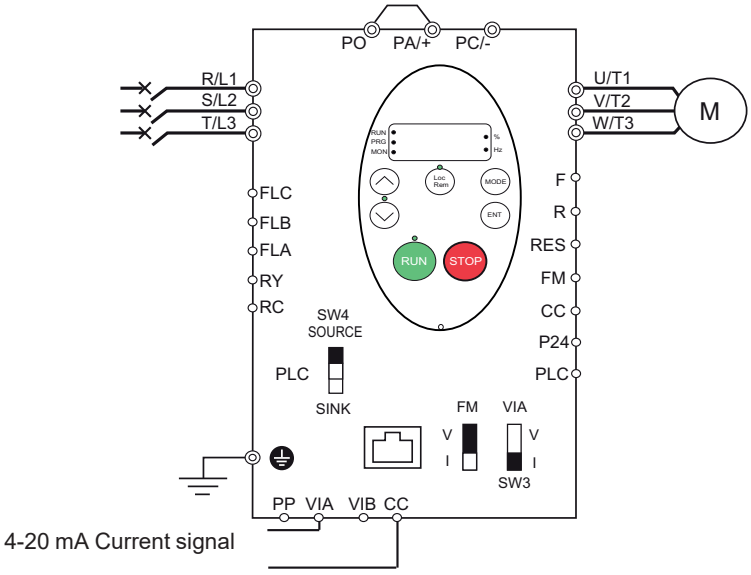
External speed control potentiometer



1. Wire the analog input as indicated in the above figure.
2. Set switch SW3 to V (voltage).
3. Program common parameters of ATV21 (see Quick Start page 37).
4. Program specific parameters for external speed control potentiometer as indicated in the following table:

Parameter	Page	Setting	Factory value
FMOd (remote mode primary speed reference source)	54	1 (VIA)	1
F109 (VIA input function - analog or logic selection)	80	0 (Analog input)	0
F200 (auto/manual speed reference switching)	83	0 (Enabled)	0

4-20 mA speed control

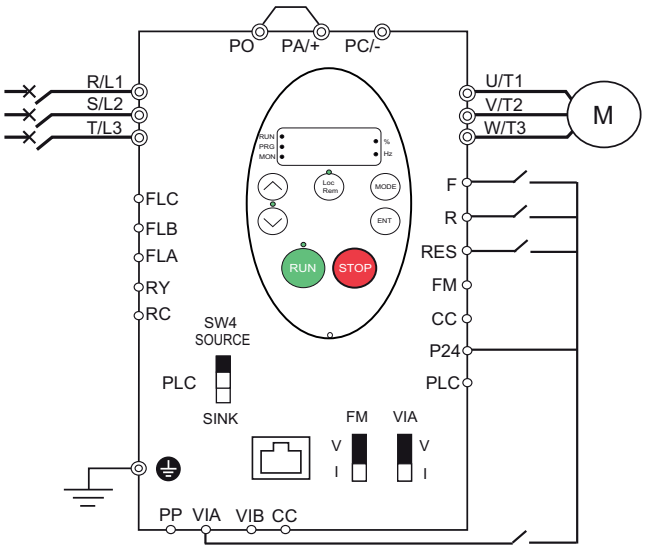


1. Wire the analog input as indicated in the above figure.
2. Set switch SW3 to I (current).
3. Program common parameters of ATV21 (see Quick Start page 37).
4. Program specific parameters for 4-20 mA speed control as indicated in the following table:

Parameter	Page	Setting	Factory value
FMOd (remote mode primary speed reference source)	54	1 (VIA)	1
F109 (VIA input function - analog or logic selection)	80	0 (Analog input)	0
F200 (auto/manual speed reference switching)	83	0 (Enabled)	0
F201 (VIA speed reference level 1)	81	20 %	0 %

Common control schemes

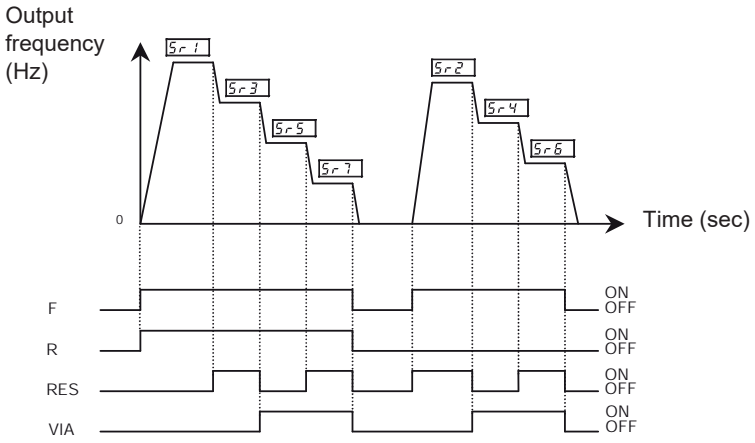
Preset speeds (up to seven)



1. Wire the logic and analog inputs as indicated in the above figure.
2. Set switch SW4 to source.
3. Program common parameters of ATV21 (see Quick Start page 37).
4. Program specific parameters for preset speed as indicated in the following table:

Parameter	Page	Setting	Factory value
F 109 (VIA input function - analog or logic selection)	80	2 (logic input - source)	0
F 111 (F logic input function)	80	2 (forward run command)	2
F 112 (R logic input function)	80	6 (preset speed command input 1)	6
F 113 (RES logic input function)	80	7 (preset speed command input 2)	10
F 118 (VIA logic input function)	80	8 (preset speed command input 3)	7

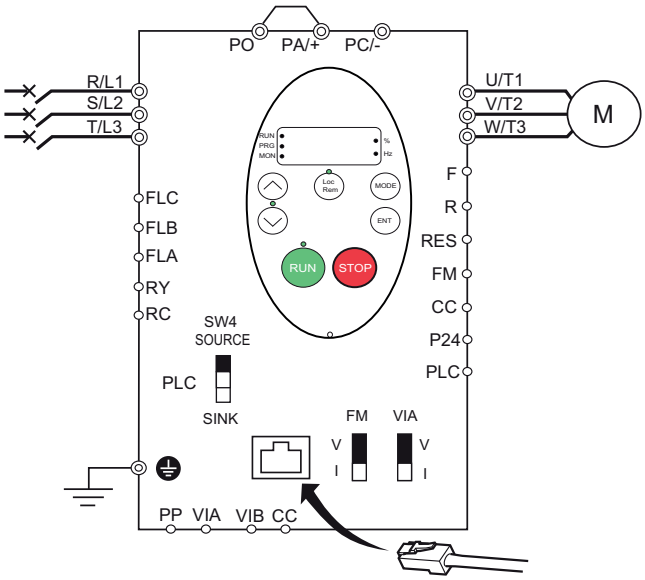
Example of 7-step preset speed operation:



See page 90 for additionnal information.

Common control schemes

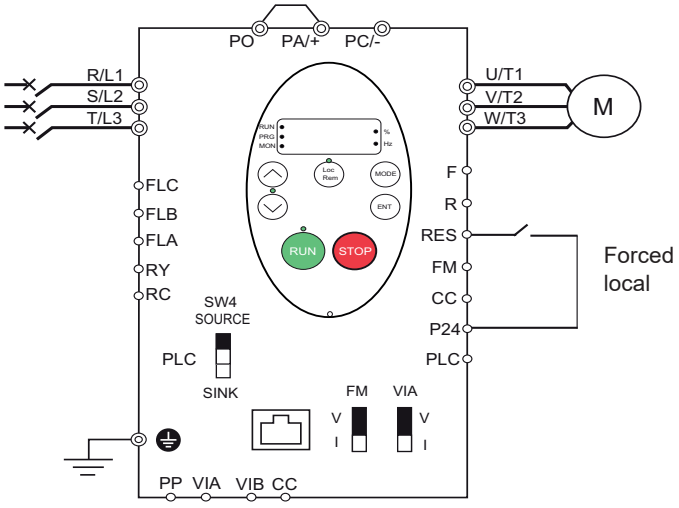
Serial communication



1. For Modbus serial communication, plug the network cable into RJ45 connector on the main control board.
2. Program common parameters of ATV21 (see Quick Start page 37).
3. Program specific parameters for serial communication as indicated in the following table:

Parameter	Page	Setting	Factory value
CMOd (remote mode start/stop control)	54	2 (serial communication)	0
FMOd (remote mode primary speed reference source)	54	4 (serial communication)	1

Forced local

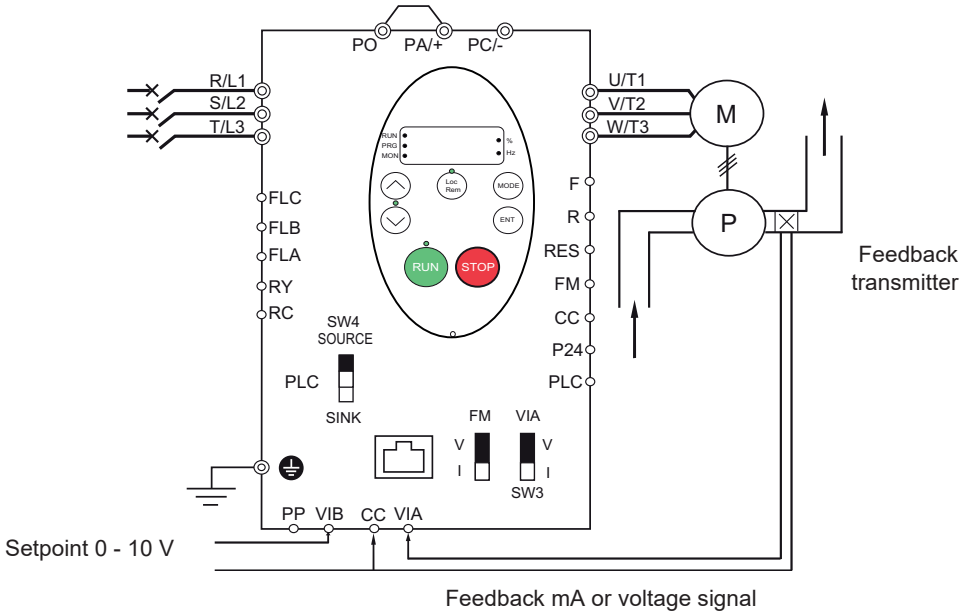


1. Wire the logic input as indicated in the above figure.
2. Set switch SW4 to source.
3. Program common parameters of ATV21 (see Quick Start page 37).
4. Program specific parameter for forced local as indicated in the following table:

Parameter	Page	Setting	Factory value
F113 (RES logic input function)	80	48 (forced local)	10

Common control schemes

PID control



1. Wire analog inputs as indicated in the above figure.
2. Set switch SW4 to source.
3. 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.
4. Program common parameters of ATV21 (see Quick Start page 37).
5. Program specific parameters for PID control as indicated in the following table:

Parameter	Page	Setting	Factory value
F M O d (remote mode primary speed reference source)	54	**2** (VIB)	1
F I O 9 (VIA input function - analog or logic selection)	80	**0** (Analog input)	0
F 2 O O (auto/manual speed reference switching)	83	**0** (Enabled)	0
F 3 6 O (PID control enable)	86	**1** (Enabled - feedback source is VIA)	0
F 3 5 9 (PID control waiting time)	87	In accordance with the application	0 s
F 3 6 2 (PID proportionnal gain)	86		0.30 %
F 3 6 3 (PID integral gain)	86		0.20
F 3 6 6 (PID derivative gain)	87		0.00
F 3 8 O (PI regulator reversal direction correction)	87		0
F 3 9 I (Stop on LL hysteresis)	87		0.2 Hz
F 3 9 2 (PI wake up threshold on PI error)	87		0.0 Hz
F 3 9 3 (PI wake up threshold on PI feedback error)	87		0.0 Hz

Drive Operation

Local and Remote Modes of Operation

Overview

The ATV21 drive has two modes of operation, local and remote.
In local mode, the ATV21 drive can be operated only from the graphic display terminal:

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

In remote mode, the ATV21 drive is operated from a combination of the command and speed reference sources defined by programming parameters Remote Mode Primary Speed Reference Source F M O d and Remote Mode Start/Stop Control C M O d (see page 54).

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®)
- Graphic display terminal RUN and STOP keys

Speed Reference Sources

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

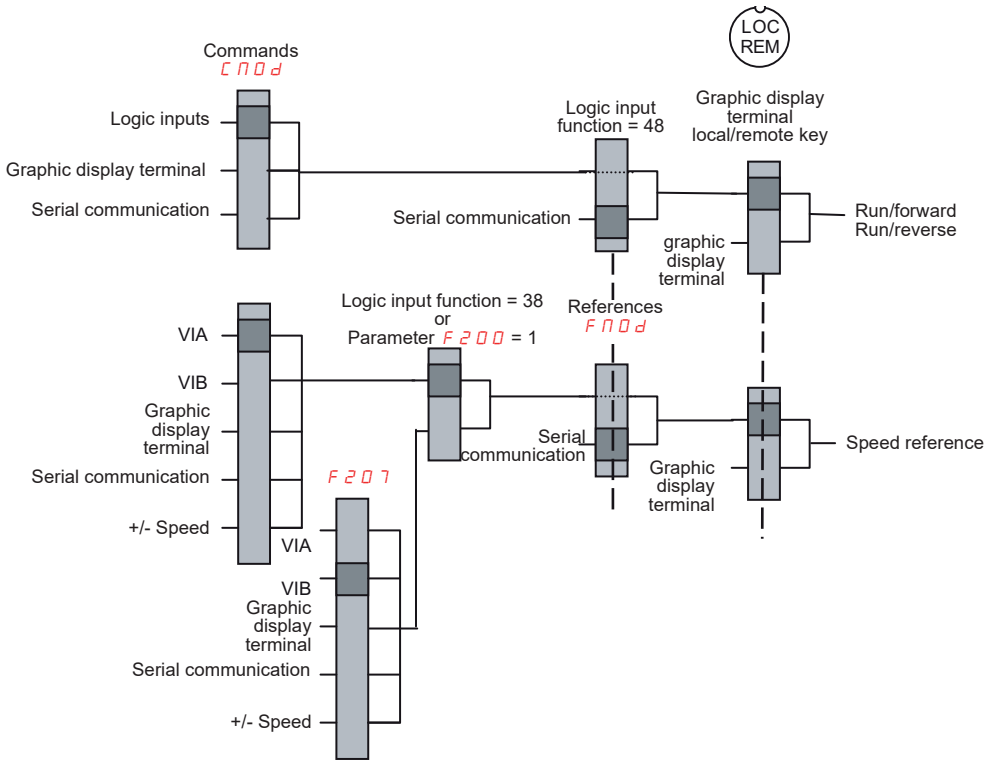
- External signals to the control terminal analog inputs VIA or VIB
- (4–20 mA, 0–10 Vdc),
- External signals to the control terminal logic inputs assigned to
- +/- Speed
- Serial communication control (Modbus®, Metasys® N2, Apogee® FLN, BACnet, or LonWorks®)
- graphic display terminal UP and DOWN keys

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

Command Mode Selection and Priorities

The diagram below illustrates the control inputs and selection logic which determine the source of the drive's start/stop and speed reference commands.

Command and Reference Switching



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

Remote Mode Secondary Speed Reference Source F207 is a secondary speed reference source that may override the source selected by FMd (see page 56).

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 Auto/Manual Speed Reference Switching F200 is set to 1 and the drive's output frequency is equal to or less than 1 Hz (see page 83).

If a serial communication link is established, it can take control of the ATV21 drive, 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 to determine its command source is the LOC/REM key on the graphic display terminal.

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

Selecting Local or Remote Mode

DANGER

UNINTENDED EQUIPMENT OPERATION

- Know the state of the frequency and run commands from the remote source before exiting the local mode.
- Uponentering the remote mode, the drive will respond to the most recent command from the remote source, even if it was received before entering or while in the local mode.

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

Switching between local and remote mode is achieved with the LOC/REM key in the drive's graphic display terminal.

The LOC/REM key can be disabled by setting parameter Disabling of graphic display terminal Local/Remote Key F732 to 1 (see page 58).

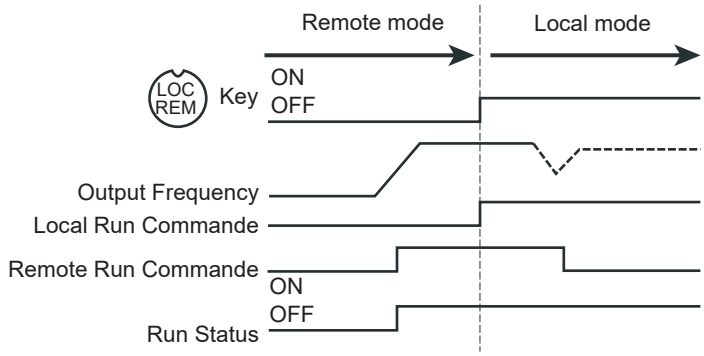
When parameter Bumpless Transfer From Remote To Local Control F295 is set to 1 (factory setting), a bumpless tranfer of motor operation is achieved when switching from remote to local mode (see page 55).

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

Conversely, when switching from local to remote mode, the run and speed command is not transferred to the remote mode. Upon entering the remote mode, the drive will operate on the run and speed command set by the remote source even if it was received before entering or while in the local mode.

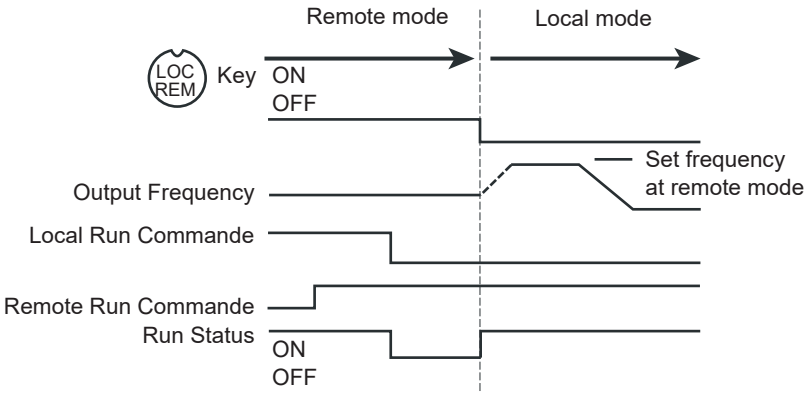
The diagram below is an example timing diagram.

Switching Between Local and Remote Mode



The remote run command and frequency command are transferred to the local mode when the LOC/REM key is pressed.

In this example, the run command and frequency command from the remote mode are copied to the local mode, and the motor continues to run.



When switching from the local mode to the remote mode, the run command and frequency command are determined by the setting in the remote mode.

In this example, when the LOC/REM button is pressed, the motor in started.
This is due to the application of a remote run command when the drive exits the local mode and enters the remote mode.

Local Mode

When the ATV21 drive 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 graphic display terminal.

The setting of parameter Local Mode Motor Stop Type F121 determines how the motor stops when the drive is in local mode (see page 55):

- If F121 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 F121 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 Disabling of graphic display terminal RUN and STOP Keys in Local Mode F133 (see page 58).

Adjusting Motor Speed in Local Mode

Set the motor speed using the UP and DOWN keys on the graphic display terminal. Motor speed can be adjusted while the drive 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 Local Mode Speed Reference Step Changes F107 (see page 55).

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 is started in the local mode, it will accelerate the motor directly to the speed setpoint memorized by Local Mode Speed Reference FC (see page 54).

Selecting Motor Rotation Direction in Local Mode

Motor rotation direction is set by parameter Local Mode Motor Rotation Direction Command Fr (see page 54). The four selections are:

- 0: Forward only (factory setting)
- 1: Reverse only
- 2: Forward, with reverse selectable from the graphic display terminal (1)
- 3: Reverse, with forward selectable from the graphic display terminal (1)

(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.

Motor rotation is indicated on the graphic display terminal as Fr-F for forward and as Fr-r for reverse.
The ability to run in the Forward or Reverse direction can be set with parameter Motor Rotation Direction Command F311 (see page 57).

Resetting drive Faults in Local Mode

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

With the STOP Key

To clear a drive fault in local mode:

1. Press the STOP key. See Automatically Resettable Faults on page 97 for a list of faults that can be reset with the STOP key. If it is possible to reset the drive, the graphic display terminal 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.

Use of the STOP key as a fault reset can be set with parameter Disabling of graphic display terminal Fault Reset Function F135 (see page 58).
In the event of an OL1 or OL2 fault, the following time periods must pass before a fault reset is possible:

- OL1 (drive 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 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 to extinguish.

Cycling power to clear a fault can cause the fault history to be lost. Refer to parameter F602 on page 100 for Drive Fault Memory options.

Logic Input Functions Active in Local Mode

The logic input functions listed in the table below are active, even if CMOd is set to 1 (graphic display terminal control). See table on page 67 for logic input function settings.

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	Fire-mode drive operation
53	Forced-mode drive operation
62	Holding of RY-RC relay output
64	Cancellation of last graphic display terminal command

Remote Mode

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

Starting and Stopping the Motor in Remote Mode

The diagram on page 31 illustrates the start/stop command source when the drive is in remote mode.

With Logic Input Terminals

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

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

With the graphic display terminal

The drive responds to commands from the graphic display terminal, just as in local mode, if:

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

With Serial Communication

The drive 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 graphic display terminal STOP Key

The graphic display terminal STOP key is active when the drive is in remote mode. Pressing the STOP key causes the drive to stop according to the setting of parameters F603, F604, and F251 (see page 93 and page 66) . After the drive has come to a stop, the graphic display terminal displays E and the fault relay is activated.

Adjusting the Motor Speed in Remote Mode

The diagram on page 31 illustrates the speed reference source when the drive 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:

- Parameter F M O d is set to 1 (factory setting).
- Alternate speed reference source parameter Remote Mode Secondary Speed Reference Source F 2 0 7 has not been enabled (see page 56).
- Serial communication control has not been established.

The analog signal type depends on the setting of switch SW3 and parameters F 1 0 9, F 2 0 1–F 2 0 4, and F 4 7 0–F 4 7 1.

By Analog Input VIB

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

- Parameter F M O d is set to 2.
- Alternate speed reference source parameter F 2 0 7 has not been enabled.
- Serial communication control has not been established.

The control that VIB has over motor speed depends on the setting of parameters F 2 1 0–F 2 1 3, F 4 7 2–F 4 7 3, and F 6 4 5.

By graphic display terminal Control

graphic display terminal control of the motor speed is enabled, if:

- Parameter F M O d is set to 3.
- Alternate speed reference source parameter F 2 0 7 has not been enabled.
- 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:

- Parameter F M O d is set to 4.
- Alternate speed reference source parameter F 2 0 7 has not been enabled.

By +/- Motor Speed Control

+/- Motor speed control is enabled, if:

- Parameter F M O d is set to 5.
- Alternate speed reference source parameter F 2 0 7 has not been enabled.
- Serial communication control has not been established.

Selecting Motor Rotation Direction in Remote Mode

The diagram on page 31 illustrates the motor rotation command source when the drive is in remote mode.

With Logic Input Terminals

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

- Parameter C M O d is set to 0 (factory setting).
- Serial communication control has not been established .

With the graphic display terminal

Motor rotation direction can be set by pressing the graphic display terminal UP and ENT keys if:

- Parameter C M O d is set to 1.
- Serial communication control has not been established.
- Parameter F r is set to either 2 or 3.

With Serial Communication

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

Resetting drive Faults in Remote Mode

The diagram on page 31 illustrates the fault reset command source when the drive is in remote mode.

It is not possible to clear a drive 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.
See Automatically Resettable Faults on page 97 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 fault if:

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

With the graphic display terminal

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

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

To clear a drive fault in graphic display terminal mode, press the STOP key. If it is possible to reset the drive, the graphic display terminal 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.

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

With Serial Communication

A drive 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 OL 1 or OL2 fault, the following time periods must pass before a fault reset is possible:

- OL 1 (drive overload) - about 30 seconds after the occurrence of the fault.
- OL2 (motor overload) - about 120 seconds after the occurrence of the fault.

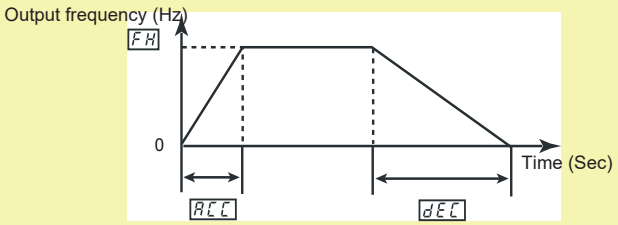
By Cycling Line Power

A drive 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 to go out.

Cycling power to clear a fault can cause the fault history to be lost. Refer to parameter F602 on page 100 for drive fault memory options.

Quick menu AUF

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

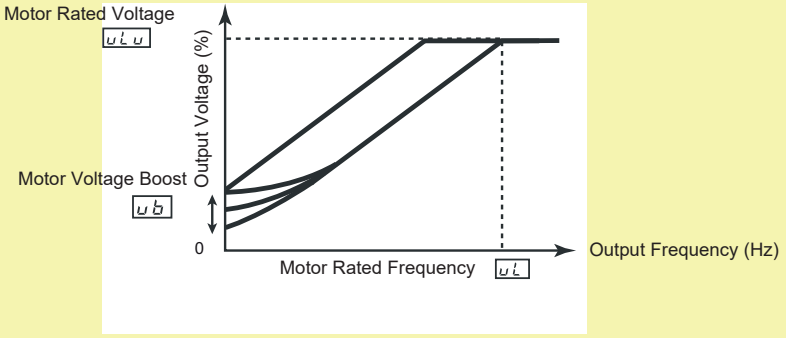
Code	Name/Description	Adjustment range	Factory setting
AU1	**Auto Ramp Adaptation**	-	1
0	**Disabled**		
1	**Enabled** - Acceleration Time 1 ACC and Deceleration Time 1 dEC (see page 60)		
2	**Enabled** (ACC only)		
	If parameter AU1 is set to 1 or 2, the drive will monitor its own loading level and 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'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 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 (see page 47) and Overvoltage Fault Protection F305 (see page 101) and Overvoltage Fault Operation Level F626 (see page 101) functions.		
ACC	**Acceleration Time 1**	0.0 to 3200 seconds	According to drive model (see table page 128).
	The setting of parameter ACC determines the slope of the acceleration ramp and the time it takes for the output frequency of the drive to increase from 0 Hz to the setting of Maximum Frequency FH (see page 59).		
	If parameter Auto Ramp Adaptation AU1 (see page 64) 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 Acceleration Time 2 F500 on page 61.		
			
dEC	**Deceleration Time 1**	0.0 to 3200 seconds	According to drive model (see table page 128).
	The setting of parameter dEC determines the slope of the deceleration ramp and the time it takes for the output frequency of the drive to decrease from the setting of Maximum Frequency FH to 0 Hz.		
	If parameter Auto Ramp Adaptation 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 diagram above.		
	If two different deceleration rates are needed, see parameter Deceleration Time 2 F501 on page 61.		

Code	Name/Description	Adjustment range	Factory setting
LL	❑ **Low Speed**	0.0 to UL Hz	0.0 Hz
	Parameter LL sets the minimum frequency that can be commanded to the drive by the local or remote speed reference source. See diagram above.		
UL	❑ **High Speed**	0.5 to FH Hz	50.0 Hz
	Parameter UL sets the maximum frequency that can be commanded to the drive by the local or remote speed reference source. The top end of its range is limited by the setting of Maximum frequency FH. See diagram above.		
tHr	❑ **Motor Rated Current Overload Setting**	10 to 100% of the drive's output current rating	100 %
	Set parameter tHr to the motor's rated current as indicated on the motor nameplate for the selected operating voltage. If parameter % or A/V Units F701 is set to 1 (see page 94), parameter tHr will be adjusted in amperes. If parameter % or A/V Units F701 is set to 0, parameter tHr will be adjusted in percentage. In this case, divide the motor rated current by the drive rated current (as listed on its nameplate) and set parameter tHr to the resulting percentage. The setting of parameter Switching Frequency Level F300 does not change the drive's rated current for the sake of this calculation (see page 64).		
FM	❑ **Analog Output Scaling**		-
	Parameter FM is used to match the FN 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 graphic display terminal. The drive will flash between FM and the adjusted value, indicating that the adjustment has been saved.		

Code	Name/Description	Factory setting
PE	**Motor Control Mode**	1

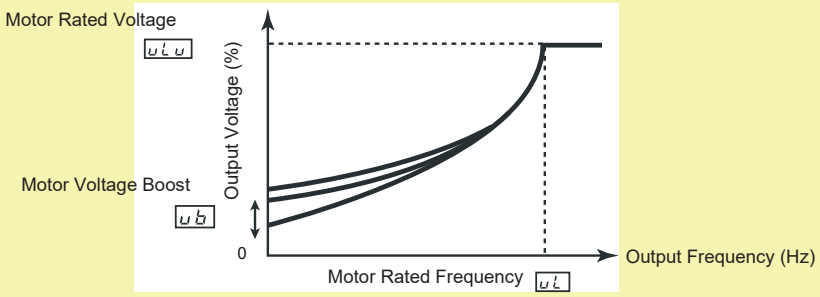
0 Constant V/Hz

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 Motor Voltage Boost ub (see page 47).



1 Variable torque

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 Motor Voltage Boost ub (see page 47).



2 Constant V/Hz with automatic torque boost (1)

See the diagram on page 44.

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.

3 Sensorless vector control (1)

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

4 Energy saving

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

If the ATV21 drive 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 48.

5 Reserved (DO NOT USE)

6 Reserved (DO NOT USE)

(1) See page 44 for more details.

Code	Name/Description	Adjustment range	Factory setting
uL	**❑ Motor Rated Frequency**	25.0 to 200.0 Hz	50.0 Hz
	Set parameter uL to the motor's rated frequency as indicated on the motor nameplate. ☞ It is possible to set the drive's various motor control frequencies to 50 Hz by setting Parameter Reset tYP to 1, the 50 Hz reset. For more information, see page 41.		
uLu	**❑ Motor Rated Voltage**	According to drive rating	According to drive rating
	Set parameter uLu to the motor's rated voltage as indicated on the motor nameplate. ATV21●●●M3X: 50 to 330 V. ATV21●●●N4: 50 to 660 V ☞ Drive output voltage cannot be set to exceed the input line voltage level.		

Motor parameters

Configure the motor parameters and perform an auto-tuning (Auto Tuning Enable F400 = 2, see page 49 for auto-tuning).

Code	Name/Description	Adjustment range	Factory setting
F415	**❑ Motor Rated Full Load Current**	0.1 to 200.0 A	According to drive model (1)
	Set parameter F415 to the motor rated full load current in amperes as indicated on the motor's nameplate.		
F417	**❑ Motor Rated Speed**	100 to 15,000 rpm	According to drive model (1)
	Set parameter F417 to the motor rated speed in rpm as indicated on the motor's nameplate.		

Code	Name/Description	Adjustment range	Factory setting
F400	**❑ Auto Tuning Enable**	-	0
0	□ **Disabled**		
1	□ **Enabled** (2): parameter Auto Torque Boost F402 may need adjustment		
2	□ **Enabled** (2): complete auto tuning		

(1) See table page 128
(2) Parameter Auto Tuning Enable F400 is reset to "0" after the auto tuning is performed.

Parameter Reset (tYP)

Parameter Reset Options

The ATV21 drive 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

Code	Name/Description	Factory setting
tYP	**Parameter Reset**	0
0	-	
1	**50 Hz Parameter Reset** Setting parameter tYP to a value of 1 will set specific parameters to values suitable for many 50 Hz (motor base frequency) applications. See Parameters whose values after a reset vary by reset type table on page 128 and table on page 130 for a list of parameters that are affected by this reset action and their resultant values.	
2	**60 Hz Parameter Reset** Setting parameter tYP to 2 sets specific parameters to values suitable for many 60 Hz (motor base frequency) applications. See table "Parameters whose values after a reset vary by reset type" on page 128 and table "Parameters whose values after a reset are drive model dependant but DO NOT vary by reset type" on page 129 for a list of parameters that are affected by this reset action and their resultant values.	
3	**Factory Reset** Setting parameter tYP to 3 resets most parameters to their factory settings. See tables on pages 123 to 131 for a listing of the values that will be copied into the drive by this factory reset action: - Parameters whose values after a reset DO NOT vary by reset type (on page 123). - Parameters whose values after a reset vary by reset type (on page 128). - Parameters whose values after a reset are drive model dependant but DO NOT vary reset type (on page 129). - Parameters whose values after a reset are drive model and reset type dependant (on page 130). - Parameters whose values do not change if a reset is performed (on page 131). A factory reset will also clear the fault history.	
4	**Fault History Reset** 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.	
5	**Elapsed Motor Run Time Reset** 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.	
6	**Reset of EtYP Fault** 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.	
7	**Save User-defined Settings** The drive parameter settings can be stored into memory into the drive as a custom parameter set. Set parameter tYP to 7 to save the current drive parameter settings to memory	
8	**Recall User-defined Settings** The drive parameter settings can be reloaded into the drive as a custom parameter set. Set parameter tYP to 8 to reload into the drive the parameter settings last saved by setting tYP to 7	
9	**Elapsed Drive Run Time Reset** Setting parameter tYP to 9 resets the elapsed drive run time clock. As soon as the elapsed motor run time clock is reset, parameter tYP resumes its default value of 0.	

Programming Parameters

Macro Programming (AU4)

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

Code	Name/Description	Factory setting
AU4	❑ **Macro Programming** (1)	0
0	◻ **Factory setting** - Command reference: logic inputs (CMOd = 0). See Remote Mode Start/Stop Control page 54. - Speed reference: analog input VIA = 0–10 V or 0–20 mA (FMOd = 1, F20 1 = 0). See Remote Mode Primary Speed Reference Source FMOd page 54 and Analog Input Speed Reference page 81. - F: run forward (FI11 = 2). See F Logic Input Function page 80. - R: preset speed 1 (FI12 = 6). See R Logic Input Function page 80. - RES: fault reset (FI13 = 10). See RES Logic Input Function page 80. - Drive ready for operation (FI10 = 1). See Always Active Logic Function 2 page 89.	
1	◻ **Run permissive** - Command reference: logic inputs (CMOd = 0). See Remote Mode Start/Stop Control page 54. - Speed reference: analog input VIA = 0–10 V or 0–20 mA (FMOd = 1). See Remote Mode Primary Speed Reference Source page 54. - F: run forward (FI11 = 2). See F Logic Input Function page 80. - R: run permissive (FI12 = 1). See R Logic Input Function page 80. - RES: fault reset (FI13 = 10). See RES Logic Input Function page 80.	
2	◻ **3-wire control:** - Command reference: logic inputs (CMOd = 0). See Remote Mode Start/Stop Control page 54. - Speed reference: analog input VIA = 0–10 V or 0–20 mA (FMOd = 1). See Remote Mode Primary Speed Reference Source page 54. - F: run forward (FI11 = 2). See F Logic Input Function page 80. - R: stop ramp (FI12 = 49). See R Logic Input Function page 80. - RES: fault reset (FI13 = 10). See RES Logic Input Function page 80.	
3	◻ **+/- Speed:** - Command reference: logic inputs (CMOd = 0). See Remote Mode Start/Stop Control page 54. - Speed reference: +/- Speed (FMOd = 5). See Remote Mode Primary Speed Reference Source page 54. - F: run forward (FI11 = 2). See F Logic Input Function page 80. - R: + Speed (FI12 = 41). See R Logic Input Function page 80. - RES: - Speed (FI13 = 42). See RES Logic Input Function page 80.	
4	◻ **4-20 mA speed reference:** - Command reference: logic inputs (CMOd = 0). See Remote Mode Start/Stop Control page 54. - Speed reference: analog input VIA = 4–20 mA (FMOd = 1, F20 1 = 20). See Remote Mode Primary Speed Reference Source page 54 and Analog Input Speed Reference page 81. - F: run forward (FI11 = 2). See F Logic Input Function page 80. - R: preset speed 1 (FI12 = 6). See R Logic Input Function page 80. - RES: fault reset (FI13 = 10). See RES Logic Input Function page 80.	

(1) When programming parameter AU4, the graphic display terminal 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. Programming 0 into AU4 will not return the seven parameters to their factory default values.

Parameter Lock (F 700)

Code	Name/Description	Factory setting
F 700	❑ **Parameter Lock**	0
0	All parameters are unlocked and can be changed. See table on page 23 for the parameters that cannot be changed while the drive is running.	
1	Only parameter F 700 can be changed.	

Display of Submenu AUF (F 738)

Code	Name/Description	Factory setting
F 738	❑ **Display of Submenu AUF**	0
	The setting of this parameter determines whether the AUF submenu, Quick Menu, will be displayed on the graphic terminal (see page 22).	
0	AUF displayed.	
1	AUF not displayed.	

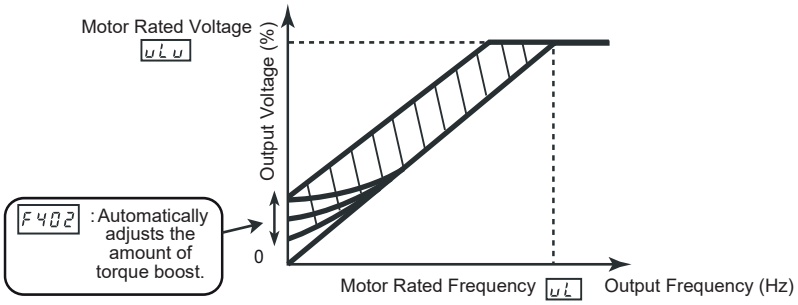
Motor Control Mode (PtC)

Constant V/Hz Mode with AutomaticTorque Boost (PtC = 2)

Use parameter Auto Torque Boost F402 to adjust the amount of automatic torque boost (see page 53).

If the ATV21 drive 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 48.

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 (PtC = 0) and adjust torque boost manually with parameter ub.



Sensorless Vector Control Mode (PtC = 3)

If the ATV21 drive 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 48.

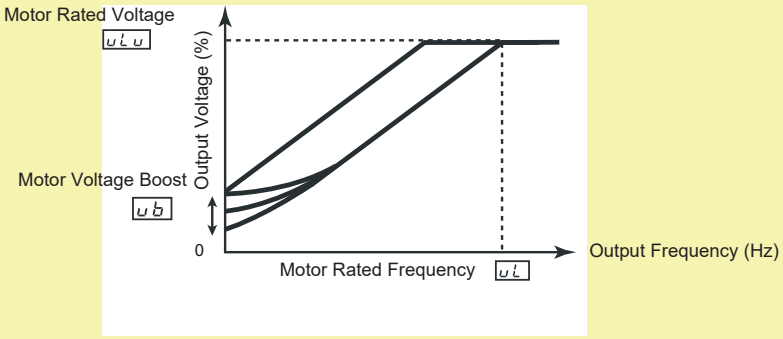
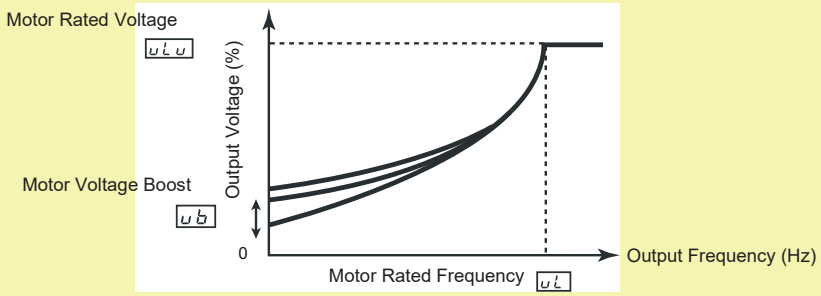
Sensorless vector control mode is only for use in applications where:

- Each motor is powered by its own ATV21 drive (not for multi-motor applications).
- The motor has a power rating equal to that of the ATV21 drive, 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 30 m (100 ft) in length. If motor leads longer than 30 m (100 ft) 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 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. Manual tuning will be required.

Code	Name/Description	Factory setting
PE	**Motor Control Mode**	1
0	**Constant V/Hz** 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 Motor Voltage Boost ub (see page 47).  	
1	**Variable torque** 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 Motor Voltage Boost ub (see page 47).  	
2	**Constant V/Hz with automatic torque boost** See the diagram on page 44. 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.	
3	**Sensorless vector control** Use sensorless vector control mode to increase torque at motor speeds below 3 Hz or to improve speed regulation (0.5 to 1%).	
4	**Energy saving** In energy savings mode, the ATV21 drive monitors motor loading and automatically modulates the voltage applied to the motor to optimize energy consumption. If the ATV21 drive 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 48.	
5	**Reserved (DO NOT USE)**	
6	**Reserved (DO NOT USE)**	

Motor Control Parameters

Other Motor Control Mode Parameters

The table below lists other parameters that may need to be adjusted, depending on the setting of parameter Motor Control Mode PtH.

Relationship Between PtH setting and Other Motor Parameters

Parameter	Function	Parameter PtH 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	Frequency loop gain	X	X	O	O	O
F419	Frequency loop stability	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 PtH setting
⊗ : Be sure to set and adjust this parameter.
O: Adjust this parameter if necessary.

Code	Name/Description	Adjustment range	Factory setting
ub	**❑ Motor Voltage Boost**	0.0 to 30.0 %	-
	Low speed motor torque can be adjusted with parameter Motor Voltage Boost ub (see page 47) when parameter Motor Control Mode Pt (see page 45) is set to 0 (Constant V/Hz) or 1 (Variable Torque). See curves on page 44 for more information. If nuisance overcurrent faults occur during starting, reducing the setting of parameter ub may help.		
F601	**❑ Motor Current Limit**	10 to 110% of the drive's output current rating	110 %
	Parameter F601 can be adjusted to limit current during motoring or braking. **Display in Current Limit Mode:** When the drive goes into current limit mode, it will: - Adjust the output frequency to limit the flow of motor current (down when motoring, up when braking). - Display the letter C and the output frequency flashing, ex : C 50 If parameter % or A/V Units F701 is set to 1 (see page 94), 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's output rated current as listed on its nameplate. The setting of parameter Switching Frequency Level F300 (see page 64) does not change the drive'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 will determine that motor braking is taking place and will increase the frequency applied to the motor.		

Motor Tuning

Tuning the drive to specific motor values will optimize motor performance if parameter Motor Control Mode PtC (see page 45) 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, 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.

Code	Name/Description	Adjustment range	Factory setting
uLu	❑ **Motor Rated Voltage** Set parameter uLu to the motor's rated voltage as indicated on the motor nameplate. ATV21●●●M3X: 50 to 330 V. ATV21●●●N4: 50 to 660 V ☞ Drive output voltage cannot be set to exceed the input line voltage level.	According to drive rating (1)	According to drive rating (1)
uL	❑ **Motor Rated Frequency** Set parameter uL to the motor's rated frequency as indicated on the motor nameplate. ☞ It is possible to set the drive's various motor control frequencies to 50 Hz by setting Parameter Reset tYP to 1, the 50 Hz reset. For more information, see page 41.	25.0 to 200.0 Hz	50.0 Hz
tHr	❑ **Motor Rated Current Overload Setting** Set parameter tHr to the motor's rated current as indicated on the motor nameplate for the selected operating voltage. If parameter % or A/V Units F701 is set to 1 (see page 94), parameter tHr will be adjusted in amperes. If parameter % or A/V Units F701 is set to 0, parameter tHr will be adjusted in percentage. In this case, divide the motor rated current by the drive rated current (as listed on its nameplate) and set parameter tHr to the resulting percentage. The setting of parameter Switching Frequency Level F300 does not change the drive's rated current for the sake of this calculation (see page 64).	10 to 100% of the drive's output current rating	100 %
F607	❑ **Motor Overload Time** Parameter F607 determines how long the drive will support a 150% motor overload before a fault occurs.	10 to 2400 seconds	300 seconds
F415	❑ **Motor Rated Full Load Current** Set parameter F415 to the motor rated full load current in amperes as indicated on the motor's nameplate.	0.1 to 200.0 A	According to drive model (1)
F416	❑ **Motor No-load Current** Set parameter F416 to the ratio of the motor's no load current to its rated full load current.	10.0 to 100.0 %	According to drive model (1)
F417	❑ **Motor Rated Speed** Set parameter F417 to the motor rated speed in rpm as indicated on the motor's nameplate.	100 to 15,000 rpm	According to drive model (1)

(1) See table page 128

Auto-tuning

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.
- 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 30 m (100 ft). Motor leads longer than 30 m (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 (Etn 1) and reduce effectiveness of sensorless vector control.
- The motor is not more than 1 hp size smaller than the drive.
- 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 Auto Tuning Enable F400 (see page 49) is set to 1 or 2 and is normally completed within 3 seconds. During the auto-tuning process, the graphic display terminal displays Atn 1.

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 checks for an output phase loss regardless of the setting of parameter F605. An output phase loss fault EPH0 will abort the auto-tuning process.

If the auto-tuning process fails, the drive will display fault code Etn 1. In this event, no results of the aborted auto-tuning will be saved in the drive, and a manual tuning of parameters F401, F402, F418, and F419 will be required.

Code	Name/Description	Adjustment range	Factory setting
F400	❑ **Auto Tuning Enable**	-	0
0	□ **Disabled**		
1	□ **Enabled** (1): parameter Auto Torque Boost F402 may need adjustment		
2	□ **Enabled** (1): complete auto tuning		

(1) Parameter Auto Tuning Enable F400 is reset to “0” after the auto tuning is performed.

Expert parameters:

Code	Name/Description	Adjustment range	Factory setting
F480	❑ **Magnetizing Current Coefficient**	100 to 130 %	100 %
	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.		
F485	❑ **Stall Prevention Control Coefficient 1**	10 to 250	100
	Use parameter F485 to adjust the drive'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 goes into current limit, gradually reduce the setting of F485.		
F492	❑ **Stall Prevention Control Coefficient 2**	50 to 150	100
	Use parameter F492 to adjust the drive'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.		
F494	❑ **Motor Adjustment Coefficient**	-	-
	DO NOT ADJUST.		
F495	❑ **Maximum Voltage Adjustment Coefficient**	90 to 120 %	104 %
	IUse parameter F495 to limit the drive'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.		
F496	❑ **Waveform Switching Adjustment Coefficient**	0.1 to 14.0 kHz	14.0 kHz
	IAdjusting 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)

The setting of parameter F307 determines:

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

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

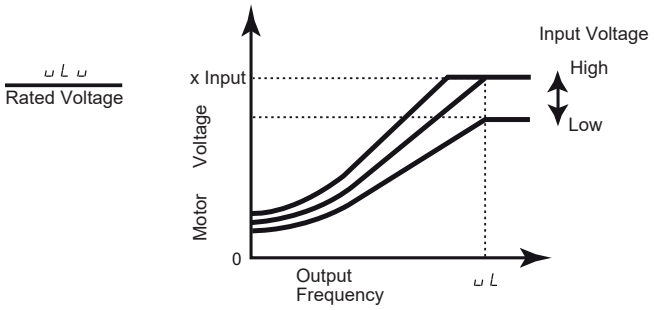
If parameter F307 is set to 0 or 2, no corrections are made in the motor voltage gating process in response to fluctuations in supply voltage. As a result, the V/Hz value of the output waveform to the motor will change in proportion to the input voltage. Conversely, if F307 is set to 1 or 3, the V/Hz 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 Motor Rated Voltage uLu (see page 40), 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.

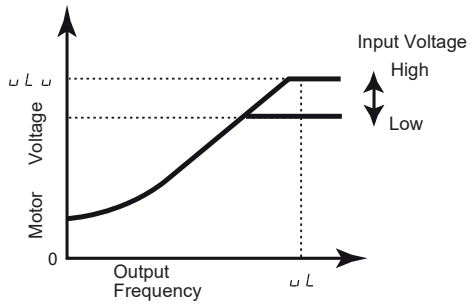
If parameter Pt is set to a value of 2, 3, 4, 5, or 6, the supply voltage is corrected, regardless of the setting of parameter F307.

The diagrams below illustrate the impact of each setting of parameter F307.

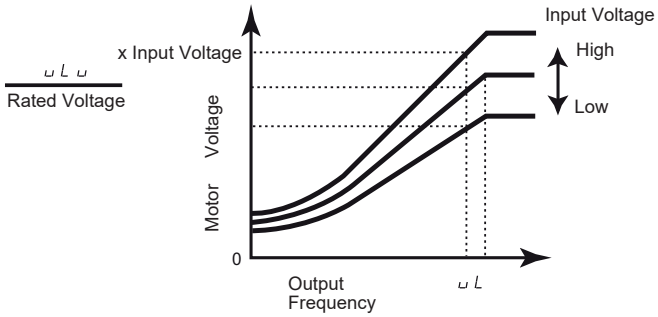
F307 = 0
Supply Voltage uncorrected, Motor Voltage Limited



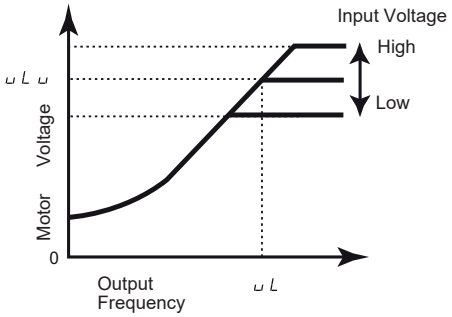
F307 = 1
Supply Voltage corrected, Motor Voltage Limited



F307 = 2
Supply Voltage uncorrected, Motor Voltage Unlimited



F307 = 3
Supply Voltage corrected, Motor Voltage Unlimited



Code	Name/Description	Factory setting
F307	**Supply Voltage Correction and Motor Voltage Limitation**	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	

Motor 2 Control Parameters

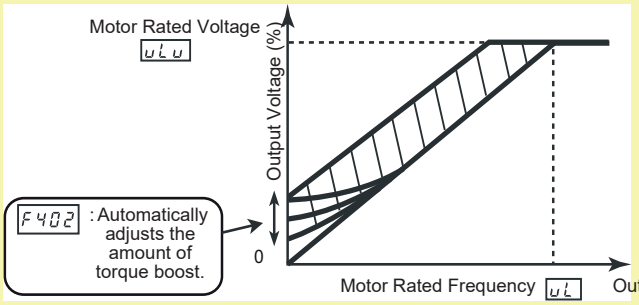
When logic inputs assigned to functions 39 or 40 are active, parameters F I 7 0 to F I 7 3 and F I 8 5 are the active set of motor control parameters.

When motor 2 control parameters are active, only constant V/Hz Motor Control Mode (P t = 0) is available (see page 45).

Code	Name/Description	Adjustment range	Factory setting
F I 7 0	❑ **Motor 2 Rated Frequency**	25.0 to 200.0 Hz	50.0 Hz
	Set parameter F I 7 0 to the motor's rated frequency as indicated on the motor nameplate. ☞ It is possible to set the drive's various motor control frequencies to 50 Hz by setting Parameter Reset t y P to 1, the 50 Hz reset. For more information, see page 41.		
F I 7 1	❑ **Motor 2 Rated Voltage**	According to drive model (1)	According to drive model (1)
	Set parameter F I 7 1 to the motor's rated voltage as indicated on the motor nameplate. ATV21●●●M3X: 50 to 330 V. ATV21●●●N4: 50 to 660 V ☞ Drive output voltage cannot be set to exceed the input line voltage.		
F I 7 2	❑ **Motor 2 Voltage Boost**	0 to 30 %	According to drive model (1)
F I 7 3	❑ **Motor 2 Rated Current Overload Setting**	10 to 100% of the drive's output current rating	100 %
	Set parameter F I 7 3 to the motor's rated current as listed on the motor nameplate for the selected operating voltage.		
F I 8 5	❑ **Motor 2 Current Limit**	10 to 110% of the drive's output current rating	110 %
	Adjust parameter F I 8 5 to limit current during motoring or braking. Do not set parameter F I 8 5 below the no-load current rating of the motor; otherwise, the drive will determine that motor braking is taking place and will increase the frequency applied to the motor.		

(1) See table page 128.

Code	Name/Description	Adjustment range	Factory setting
F401	**❑ Slip Compensation**	0 to 150 %	50 %
	Before adjusting parameter F401, verify that parameter Motor Rated Speed F417 (see page 48) is set to the rated full-load speed of the motor in rpm. Parameter F401 can be used to fine tune the drive's slip compensation feature. Increasing the value of parameter F401 increases the drive's compensation of motor slip.		
F402	**❑ Auto Torque Boost**	0.0 to 30.0%	According to drive model (see table page 128).
	Use parameter F402 to adjust the amount of automatic torque boost that is applied.		
F418	**❑ Frequency loop gain**	1 to 150	40
	Parameters Frequency loop gain F418 and Frequency loop stability F419 reduce the speed of the drive'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's output frequency to exceed its upper limit (parameter FH) if the acceleration parameter (ACC or F507) is set to its minimum value. Increasing the setting of parameter F418 reduces the drive's response time to changes in the speed reference.		
F419	**❑ Frequency loop stability**	1 to 100	20
	Increasing the setting of parameter F419 further reduces the drive's response to changes in the speed reference.		



Code	Name/Description	Adjustment range	Factory setting
CMOd	**Remote Mode Start/Stop Control**	-	0

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

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

See diagram on page 31 for more information on the source of the drive's operation commands.

0
1
2

- **Control terminal logic inputs.**
- **Graphic display terminal.**
- **Serial communication**

FMOd	**Remote Mode Primary Speed Reference Source**	-	1

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

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

See diagram on page 31 for more information on the source of the drive's speed reference.

1
2
3
4
5

- **VIA**
- **VIB**
- **Graphic display terminal**
- **Serial communication**
- **+/- Speed**

FC	**Local Mode Speed Reference**	LL (low speed) to UL (high speed) Hz	0.0 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 is started in local mode, it will accelerate the motor directly to the speed setpoint memorized by FC.

Fr	**Local Mode Motor Rotation Direction Command**	-	0

0
1
2
3

- **Run forward only.**
- **Run reverse only.**
- **Run forward with reverse selectable.**
- **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, the local mode motor rotation direction will be the same as before the power loss.

- If Bumpless Transfer From Remote To Local Control F295 (see page 55) 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.

Code	Name/Description	Adjustment range	Factory setting
F707	❑ **Local Mode Speed Reference Step Changes** □ **Disabled** (0.00). □ **Enabled** (0.01 to Maximum Frequency FH in Hz). If parameter F707 is disabled in local mode, the drive'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'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 operation if parameter F702 is set to 0.00. See page 96. If the display flashes "HI" or "LO", it indicates that repeated usage of the UP or DOWN keys has caused to drive's speed reference to reach either the Low Speed LL (see page 59) or the High Speed UL (see page 59). This may happen if parameter F707 is set to a value larger than 0.00 Hz.	-	0.00 Hz
F721 0 1	❑ **Local Mode Motor Stop Type** The setting of parameter F721 determines the type of motor stop that will be executed when then graphic display terminal STOP key is pressed. The RUN and STOP keys must be enabled be setting parameter Disabling of graphic display terminal RUN and STOP Keys in Local Mode F733 (see page 58) to 0 for the motor to stop when the graphic display terminal STOP key is pressed. □ **Ramp stop** □ **Freewheel stop**	-	0
F295 0 1	❑ **Bumpless Transfer From Remote To Local Control** 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 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 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 to immediately respond to the remote commands present at the moment of the transition. □ **Disabled** □ **Enabled**	-	1

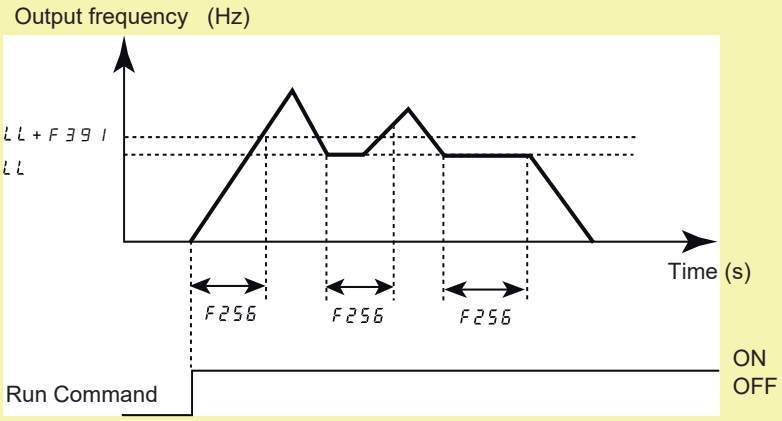
Code	Name/Description	Adjustment range	Factory setting
F256	❑ **Sleep/Wake Operation**	0.0 to 600 s	0.0 s

- **Disabled** (0.0).
- **Enabled** (0.01 to 600 seconds).

If parameter F256 is enabled and if the drive operates continuously at Low Speed LL (see page 59) for a time period equal to the setting of F256, the drive will ramp the motor to a stop. While the motor is stopped, "LSTP" will flash on the drive graphic display terminal.

When the speed reference to the drive exceeds the Low Speed level LL+F391, the drive will accelerate the motor to the new speed reference.

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



F207 1 2 3 4 5	❑ **Remote Mode Secondary Speed Reference Source**	-	2

- **VIA**
- **VIB**
- **Graphic Display terminal**
- **Serial communication**
- **+/- Speed**

Parameter F207 defines the remote mode secondary speed reference source. The setting of parameter Auto/Manual Speed Reference Switching F200 (see page 83) 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 68) determines if F207 identifies the speed reference source.

If F200 is set to 1, F207 is the speed reference source when the drive's output frequency is 1 Hz or below. See diagram on page 31 for more detail.

Code	Name/Description	Adjustment range	Factory setting
F650	**Forced Speed Enable**	-	0

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.
- Each implementation of an Altivar 21 drive 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.

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 page 68). When parameter F650 is set to 1, the graphic display terminal will briefly flash the code FIrE.

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

- Desactivating the logic input assigned to function 52 will not stop the drive!
- The following drive faults will not stop the drive: OC1, OC2, OC3, OC1P, OC2P, OC3P, OP1, OP2, OP3, OL1, OL2, OH, and SOUt
- Only removing power from the drive or a stop emergency 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 will run at the frequency set by parameter F294 (see below).

- Desactivating the logic input assigned to function 53 will not stop the drive.
- Only a fault, a pressing the STOP key on the graphic display terminal will stop the drive.

F294	**Forced Speed Frequency**	LL - UL	50.0 Hz

Use parameter VIA output frequency level 2 F204 (see page 81) to set the fixed frequency command for the drive when it is in Forced speed mode.

F311	**Motor Rotation Direction Command**	-	1

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

0 **Forward and reverse operation permitted**
1 **Reverse operation prohibited**
2 **Forward operation prohibited**

Code	Name/Description	Factory setting
F 7 3 0	❑ **Disabling of graphic display terminal Speed Reference Change Keys**	0
	The setting of parameter F 7 3 0 determines whether it is possible to set the drive's speed by means of the graphic display terminal in local mode.	
0	□ **Enabled**.	
1	□ **Disabled**.	
F 7 3 2	❑ **Disabling of graphic display terminal Local/Remote Key**	0
	Use parameter F 7 3 2 to enable or disable the LOC/REM key on the drive graphic display terminal.	
	If the LOC/REM key is disabled, switching between local and remote mode can be achieved with parameters Remote Mode Primary Speed Reference Source F N 0 d and Remote Mode Start/Stop Control C N 0 d. See page 54.	
0	□ **Permitted:** still retained with the power off.	
1	□ **Prohibited**	
2	□ **Permitted:** cancelled with the power off.	
F 7 3 3	❑ **Disabling of graphic display terminal RUN and STOP Keys in Local Mode**	0
	Use parameter Motor Rotation Direction Command F 3 1 1 (see page 57) to prevent forward or reverse operation when an improper operation signal is received.	
	⚠ WARNING **DISABLED STOP COMMAND** Disabling the stop key (7 3 3 or 7 3 4) on the drive graphic display terminal display or the remote graphic display terminal display will prevent the drive 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.**	
0	□ **Enabled**	
1	□ **Disabled**	
	The setting of parameter F 7 3 3 determines whether it is possible to start and stop the drive by means of the graphic display terminal in local mode.	
F 7 3 4	❑ **Enable / disable the local stop emergency function**	0
	The setting of parameter F 7 3 3 determines whether it is possible to stop the drive by means of the graphic display terminal in remote mode (see page 33 for more detail).	
0	□ **Enabled**	
1	□ **Disabled**	
F 7 3 5	❑ **Disabling of graphic display terminal Fault Reset Function**	1
	The setting of parameter F 7 3 5 determines whether it is possible to reset a drive fault by means of the graphic display terminal STOP key (see page 36 for more detail).	
0	□ **Enabled**	
1	□ **Disabled**	

Code	Name/Description	Adjustment range	Factory setting
F H	❑ **Maximum Frequency**	30.0 to 200.0 Hz	50.0 Hz

⚠ WARNING

OVERSPEED HAZARD

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

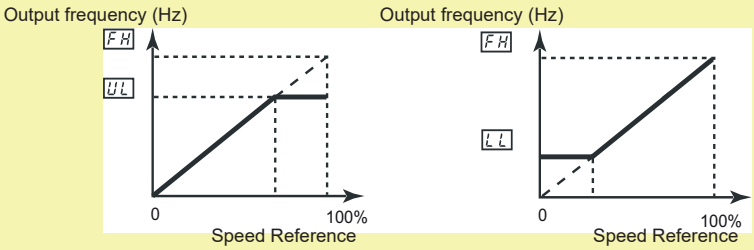
Failure to follow these instructions can result in death or equipment damage.

The setting of parameter F H determines the maximum output frequency of the drive.

FH limits the setting of parameter High Speed U L (see page 59), which can be adjusted while the drive is operating.

Acceleration and deceleration rates are also affected by the setting of F H, as the definition of Acceleration Time 1 A C C or Deceleration Time 1 d E C (see page 60) is the time it takes for the drive to ramp the motor up or down between zero speed and the setting of F H.

F H can only be adjusted while the drive is stopped.



U L	❑ **High Speed**	0.5 to F H Hz	50.0 Hz

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

The top end of its range is limited by the setting of Maximum frequency F H. See diagram above.

L L	❑ **Low Speed**	0.0 to U L Hz	0.0 Hz

Parameter L L sets the minimum frequency that can be commanded to the drive by the local or remote speed reference source.

See diagram above.

Code	Name/Description	Adjustment range	Factory setting
F240	❑ **Output Starting Frequency**	0.5 to 10.0 Hz	0.5 Hz

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

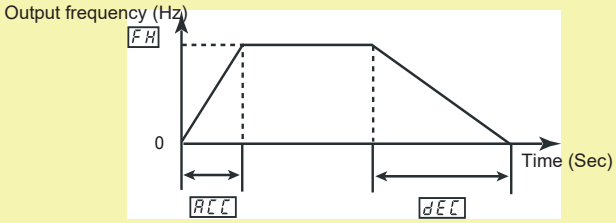
1800 rpm – 1750 rpm = 50 rpm
50 rpm / 1800 rpm = 2.78%
60 Hz x 0.0278 = 1.7 Hz (motor slip frequency)

Code	Name/Description	Adjustment range	Factory setting
ACC	❑ **Acceleration Time 1**	0.0 to 3200 seconds	According to drive model (see table page 128).

The setting of parameter ACC determines the slope of the acceleration ramp and the time it takes for the output frequency of the drive to increase from 0 Hz to the setting of Maximum Frequency FH (see page 59).

If parameter Auto Ramp Adaptation AUI (see page 64) 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 Acceleration Time 2 F500 on page 61.



Code	Name/Description	Adjustment range	Factory setting
dEC	❑ **Deceleration Time 1**	0.0 to 3200 seconds	According to drive model (see table page 128).

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

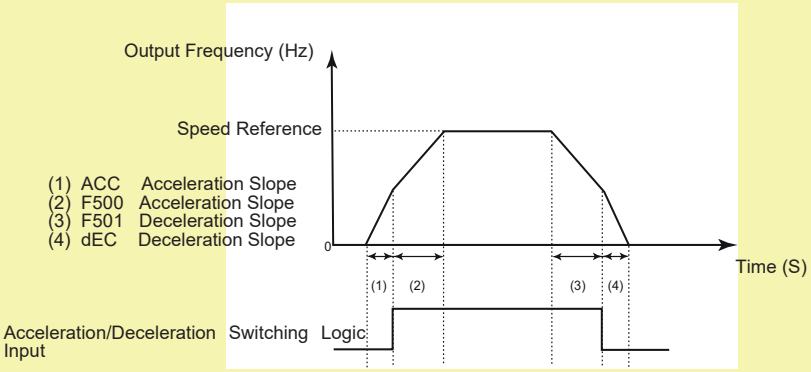
If parameter Auto Ramp Adaptation AUI is set to 1 or 2, the deceleration ramp may be increased or decreased from the setting of dEC, depending on the amount of load on the motor during ramp down. See diagram above.

If two different deceleration rates are needed, see parameter Deceleration Time 2 F501 on page 61.

Code	Name/Description	Adjustment range	Factory setting
F500	**Acceleration Time 2**	0.0 to 3200 seconds	20.0 seconds

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

- Parameter Acc/Dec Pattern Selection (Ramp Switching) F504 (see page 63),
- A particular operating frequency (see parameter Acc/Dec Pattern Switching Frequency F505 on page 63), or
- A logic input assigned to functions 5, 20, 21, 30, 31 – 35, or 40 (see table beginning on page 69)



F501	**Deceleration Time 2**	0.0 to 3200 seconds	20.0 seconds

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

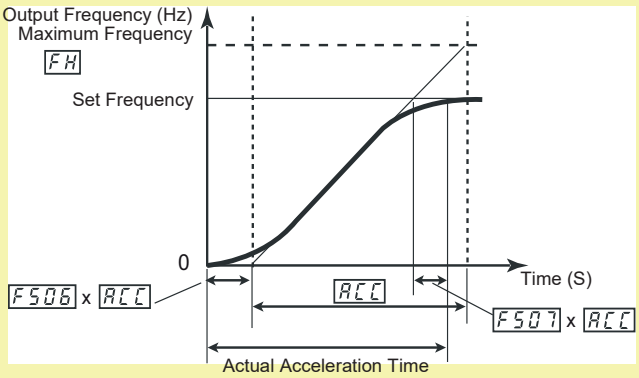
- Parameter F504 (see page 66),
- A particular operating frequency (see parameter F505 on page 66), or
- A logic input assigned to functions 5, 20, 21, 30, 31 – 35, or 40 (see table beginning on page 67)

F502	**Acc/Dec Pattern 1**	0

- 0 **Linear**
- 1 **S-pattern 1** (see diagram below)
- 2 **S-pattern 2** (see diagram below for Acc/Dec Pattern 2 F503 parameter).

The linear acceleration and deceleration pattern is illustrated in diagram on page 60 and is used in most applications.

S-pattern 1 (see diagram below) is for use in applications that need the shortest ramp time possible while minimizing shock during speed changes. See page 62 for more information about parameters Acc/Dec S-pattern Lower Limit F506 and Acc/Dec S-pattern Upper Limit F507.



Code	Name/Description		Factory setting
F503	❑ **Acc/Dec Pattern 2**		0

⚠ 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.

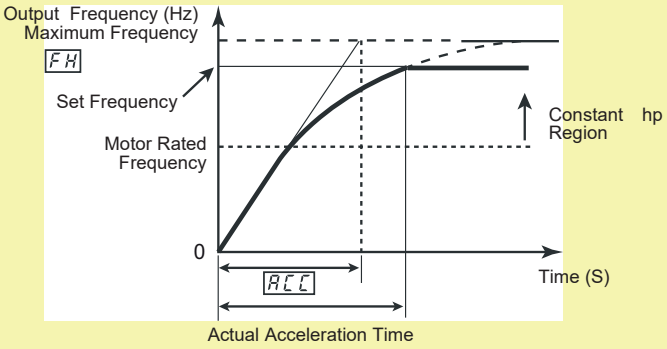
0 ◻ **Linear**
1 ◻ **S-pattern 1** (see diagram below)
2 ◻ **S-pattern 2** (see previous diagram for parameter Acc/Dec Pattern 1 F502).

S-pattern 2 (diagram below) 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.

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

- Parameter Acc/Dec Pattern Selection (Ramp Switching) F504 (see page 63),
- A particular operating frequency (see parameter Acc/Dec Pattern Switching Frequency F505 on page 63), or
- A logic input assigned to functions 5, 20, 21, 30, 31 – 35, or 40 (see table beginning on page 68)

For more information on Acc/Dec patterns, see parameter Acc/Dec Pattern 1 F502 on page 61.



F506	❑ **Acc/Dec S-pattern Lower Limit**	0 to 50% of acceleration time	10 %

Use parameter F506 to adjust the lower portion of S-pattern 1. See diagram on page 62.

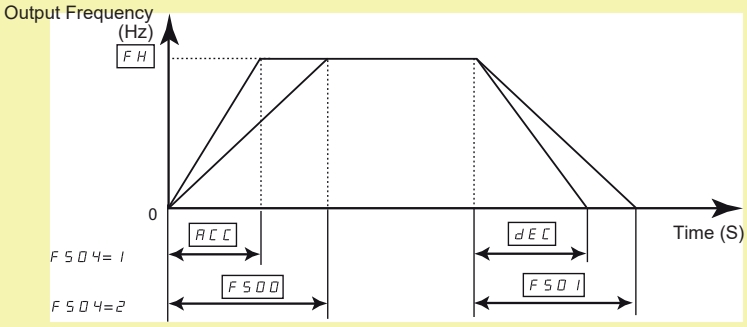
F507	❑ **Acc/Dec S-pattern Upper Limit**	0 to 50% of acceleration time	10 %

Use parameter F507 to adjust the upper portion of the S-pattern 1. See diagram on page 62.

Code	Name/Description	Adjustment range	Factory setting
F504	**❑ Acc/Dec Pattern Selection (Ramp Switching)**	-	1

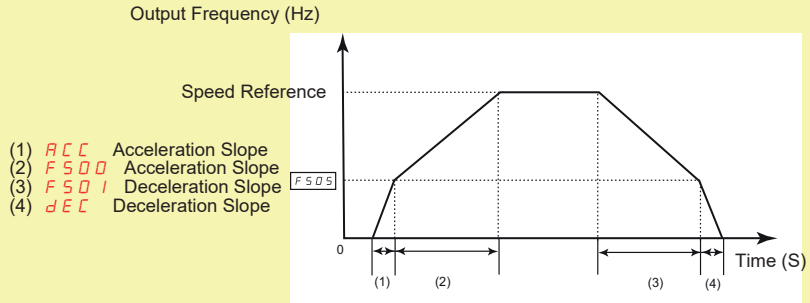
1 **□ Acc/Dec pattern 1**
2 **□ Acc/Dec pattern 2**

Parameter F504 determines the Acc/Dec pattern.



F505	**❑ Acc/Dec Pattern Switching Frequency**	0.0 to UL (Hz)	0.0 Hz

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



Code	Name/Description	Adjustment range	Factory setting
AU1	**Auto Ramp Adaptation**	-	1
0	☐ **Disabled**		
1	☐ **Enabled** - Acceleration Time 1 ACC and Deceleration Time 1 dEC (see page 60)		
2	☐ **Enabled** (ACC only)		
	If parameter AU1 is set to 1 or 2, the drive 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'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 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 (see page 47) and Overvoltage Fault Protection F305 (see page 101) and Overvoltage Fault Operation Level F626 (see page 101) functions.		
F300	**Switching Frequency Level**	6.0 to 16.0 kHz in 0.1 kHz steps	According to drive model (see table page 128).
	Increasing the switching frequency may reduce audible motor noise.		
	Increasing the switching frequency will increase the heat dissipated by the drive. The capacity of the drive may need to be derated accordingly if the switching frequency is increased. See the derating curves in the ATV21 Installation Manual.		
F312	**Switching Frequency Random Mode**	-	0
	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.		
0	☐ **Disabled**		
1	☐ **Enabled**		
F316	**Switching Frequency Control Mode**	-	1
0	☐ **ATV21●●●M3X and ATV21●●●N4:** switching frequency NOT automatically reduced		
1	☐ **ATV21●●●M3X and ATV21●●●N4:** switching frequency automatically reduced		
2	☐ **ATV21●●●N4** (1):switching frequency NOT automatically reduced		
3	☐ **ATV21●●●N4** (1):switching frequency automatically reduced		
	If parameter F316 is set to 1 or 3, the switching frequency level will be automatically controlled to prevent a drive overheating fault. If the drive 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.		

(1) For 400 V applications with motor leads longer than 30 m (100 ft).

Skip Frequencies

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

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

Code	Name/Description	Adjustment range	Factory setting
F270	❑ Skip frequency 1midpoint	0.0 – FH (Hz)	0.0 Hz
F271	❑ Skip frequency 1 bandwidth	0.0 – 30.0 (Hz)	0.0 Hz
F272	❑ Skip frequency 2 midpoint	0.0 – FH (Hz)	0.0 Hz
F273	❑ Skip frequency 2 bandwidth	0.0 – 30.0 (Hz)	0.0 Hz
F274	❑ Skip frequency 3 midpoint	0.0 – FH (Hz)	0.0 Hz
F275	❑ Skip frequency 3 bandwidth	0.0 – 30.0 (Hz)	0.0 Hz

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 fault.
- When required, use a separate brake for holding torque.

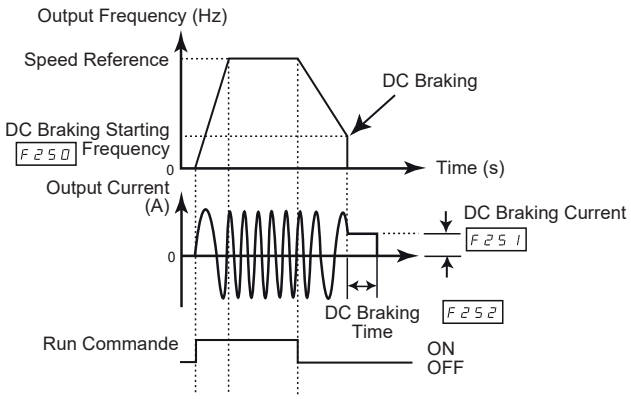
MOTOR OVERHEATING

- 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 can inject DC current into the motor to apply braking torque to the load. Parameters F250, F251 and F252 determine the Output Starting Frequency, current level, and braking time.

During DC injection braking, the drive's switching frequency is 6 kHz regardless of the setting of parameter F300 (see page 64).



Code	Name/Description	Adjustment range	Factory setting
F250	❑ **DC Braking Starting Frequency** When stopping the motor, the drive will apply DC injection braking once the output frequency drops below the level set by parameter F250.	0.0 to FH (Hz)	0.0 Hz
F251	❑ **DC Braking Current Level** 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 Graphic display terminal : % or A/V Units F701 (see page 94). During DC injection braking, the drive's overload protection sensitivity increases. The drive automatically lowers the applied DC current to avoid an overload fault.	0 to 100 %	50 % (1)
F252	❑ **DC Braking Time** Parameter F252 determines how long DC injection braking is applied to the motor.	0.0 to 20.0 seconds	1.0 second

(1) Percent of the drive's rated current. Ampere range will vary according to drive power rating.

I/O Control Parameters

Logic inputs F, R, RES, and VIA (if parameter F 109 is set to 1 or 2) can be set to the functions described in the table below. See table on page 71 for logic input function compatibility.

Function No.	Function Description	Action
0	No function assigned	Logic input disabled
1	Run permissive (see also input function 54)	OFF: drive motor output disabled, motor coasts to stop ON: drive 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 ON: Motor runs forward **Mode** / **Stop Input State** / **Logic Input Action** 3-wire control / OFF / OFF: no function ON: no function 3-wire control / ON / OFF to ON transition starts the drive, 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 ON: Motor runs in reverse **Mode** / **Stop Input State** / **Logic Input Action** 3-wire control / OFF / OFF: no function ON: no function 3-wire control / ON / OFF to ON transition starts the drive, motor runs in reverse
4		DO NOT USE
5	Acceleration/deceleration pattern selection	OFF: Acceleration/deceleration pattern 1 ON: Acceleration/deceleration pattern 2
6	Preset speed command input 1	Input 3 / Input 2 / Input 1 / Motor Speed 0 / 0 / 0 / minimum speed or speed reference per FNOd 0 / 0 / 1 / Sr 1: preset speed 1 0 / 1 / 0 / Sr 2: preset speed 2 0 / 1 / 1 / Sr 3: preset speed 3 1 / 0 / 0 / Sr 4: preset speed 4 1 / 0 / 1 / Sr 5: preset speed 5 1 / 1 / 0 / Sr 6: preset speed 6 1 / 1 / 1 / Sr 7: preset speed 7
7	Preset speed command input 2	
8	Preset speed command input 3	
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 graphic display terminal 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 (1)	PID control prohibited	OFF: PID control permitted ON: PID control prohibited PID control prohibited input terminal function is available to switch PID control and open-loop control. Also Clear PID integral value input terminal function (function 65) is available.

(1) For software version lower than V1.7IE04, when Clear PID integral value (function 65) and PID Control Prohibited (function 14) are used, it is necessary to set CNOd to terminal board (Remote Mode Start/Stop Control CNOd = Control terminal logic inputs = 0).

I/O Control Parameters

Function No.	Function Description	Action
15	Programming parameter lock Functional only when parameter F 700 = 1	OFF: Parameters locked (if parameter F 700 = 1) ON: Programming changes permitted
16	Combination of run permissive and fault reset	OFF: drive motor output disabled, motor coasts to stop ON: drive 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 Sr 1, 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 Sr 1, 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 Sr 2, 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 Sr 2, 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 Sr 3, 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 Sr 3, 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 Sr 1, 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 Sr 1, 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 Sr 2, 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 Sr 2, 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 Sr 3, 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 Sr 3, preset speed 3, ramping up per ACC/dEC pattern 2
38	Frequency reference source switching	OFF: drive follows speed reference set by parameter FNOd ON: drive follows speed reference set by parameter F207 > (if F200 = 1)
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)

I/O Control Parameters

Function No.	Function Description	Action
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 graphic display terminal 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, graphic display terminal displays OH2 fault
47	Inversion of external overheating fault input (see also input function 46)	OFF: Motor stops, graphic display terminal displays OH2 fault ON: No external overheating fault
48	Forced local	OFF: No forced local function ON: Control of the drive is forced to mode set by FMOd, CMOd, and F207
49	3-wire control stop input	OFF: Motor ramps down to a stop ON: drive 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 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 and motor: • Setting the fire-mode input to OFF • Pressing the STOP key • The following drive faults: OC1, OC2, OC3, OC1P, OC2P, OC3P, OP1, OP2, OP3, OL1, OL2, OH, SOU
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 The drive will stop after a press on the STOP key or when an emergency stop is activated by a logic input.
54	Inversion of run permissive (see also input function 1)	OFF: drive ready for operation ON: drive motor output disabled, motor coasts to stop This mode allows to have a freewheel stop using a terminal command.
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 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 motor output disabled, motor coasts to stop ON: Motor runs reverse

I/O Control Parameters

Function No.	Function Description	Action
61	Current limit level selection	OFF: Current limit level 1 F60 1 selected ON: Current limit level 2 F 185 selected
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 graphic display terminal command	OFF: Last graphic display terminal command cancelled ON: Last graphic display terminal command retained
65 (1)	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 motor output disabled, motor coasts to stop ON: Motor runs forward at speed set by Sr 1, preset speed 1
67	Combination of run permissive, run reverse command, and preset speed 1 command	OFF: drive motor output disabled, motor coasts to stop ON: Motor runs reverse at speed set by Sr 1, preset speed 1
68	Combination of run permissive, run forward command, and preset speed 2 command	OFF: drive motor output disabled, motor coasts to stop ON: Motor runs forward at speed set by Sr 2, preset speed 2
69	Combination of run permissive, run reverse command, and preset speed 2 command	OFF: drive motor output disabled, motor coasts to stop ON: Motor runs reverse at speed set by Sr 2, preset speed 2
70	Combination of run permissive, run forward command, and preset speed 4 command	OFF: drive motor output disabled, motor coasts to stop ON: Motor runs forward at speed set by Sr 4, preset speed 4
71	Combination of run permissive, run reverse command, and preset speed 4 command	OFF: drive motor output disabled, motor coasts to stop ON: Motor runs reverse at speed set by Sr 4, preset speed 4
72	PID error signal reversed	OFF: if F111 = 72 and F terminal is OFF, PI error input = reference - feedback ON: if F111 = 72 and F terminal is ON, PI error input = feedback - reference

(1) For software version lower than V1.7IE04, when Clear PID integral value (function 65) and PID Control Prohibited (function 14) are used, it is necessary to set CMOd to terminal board (Remote Mode Start/Stop Control CMOd = Control terminal logic inputs = 0).

I/O Control Parameters

Logic Input Function Compatibility

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

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	Fire-mode Forced mode	@	@	@	O	@	@	@	@	@	O	@	@	@	@	@	O	O	

The following logic input functions are ALWAYS active, regardless of the F n 0 4 and C n 0 4 setting

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

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

I/O Control Parameters

Relay Output Functions

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

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 93 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 page 93 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 is not in a fault state during auto fault reset attempts. See also function 36.)	OFF: No drive fault ON: drive faulted
11	Inversion of fault relay (function 10)	OFF: drive faulted ON: No drive fault
12	Overtorque fault (Overtorque fault detection is active only if parameter F615 = 1. See page 105 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 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 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 is not powering the motor ON: drive is powering the motor, accelerating, decelerating, at constant speed, or DC braking
15	Inversion of run relay (function 14)	OFF: drive is powering the motor, accelerating, decelerating, at constant speed, or DC braking ON: drive 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 108 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

Function No.	Function Description	Action
20	Overtorque alarm (Overtorque alarm detection is active only if parameter F615 = 0. See page 105 for more detail on the overtorque alarm and parameters F616, 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
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 in sleep mode (see for more detail on parameter F256) • Power failure stop (see 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 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 in sleep mode (see for more detail on parameter F256) • Power failure stop (see for more detail on parameter F302) • Overcurrent alarm – motor current limit level (parameter) • Overvoltage alarm – DC bus voltage overvoltage stall level (parameter F626) • drive overheating alarm ON: No alarm condition from the sources listed above exists
24	Underload detection (See 103 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

Function No.	Function Description	Action
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: • 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 • EPHO – 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 ratings error • OCA – short-circuit detected in drive 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
27	Inversion of non-autoresettable fault (function 26)	OFF: One (or more) of the following fault conditions exists and has stopped the drive: • 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 con8trol board EEPROM error 1 • EEP2 – main control board EEPROM error 2 • EEP3 – main control board EEPROM error 3 • EF2 – ground fault • EPHO – 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 ratings error • OCA – short-circuit detected in drive 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

I/O Control Parameters

Function No.	Function Description	Action
28	Auto-resettable fault	OFF: None of the fault conditions listed below exist ON: One (or more) of the following fault conditions exists: • oC 1 – overcurrent fault during acceleration • oC 2 – overcurrent fault during deceleration • oC 3 – overcurrent fault during constant speed operation • oC 1P – overcurrent flowing in element during acceleration • oC 2P – overcurrent flowing in element during deceleration • oC 3P – overcurrent flowing in element during constant speed operation • oH – drive overheating fault • oL 1 – drive overload fault • oL 2 – motor overload fault • oP 1 – overvoltage fault during acceleration • oP 2 – overvoltage fault during deceleration • oP 3 – 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: • oC 1 – overcurrent fault during acceleration • oC 2 – overcurrent fault during deceleration • oC 3 – overcurrent fault during constant speed operation • oC 1P – overcurrent flowing in element during acceleration • oC 2P – overcurrent flowing in element during deceleration • oC 3P – overcurrent flowing in element during constant speed operation • oH – drive overheating fault • oL 1 – drive overload fault • oL 2 – motor overload fault • oP 1 – overvoltage fault during acceleration • oP 2 – overvoltage fault during deceleration • oP 3 – overvoltage fault during constant speed operation • SOUt – permanent magnet motor step-out fault ON: None of the fault conditions listed above exist
30	drive ready condition 1	OFF: drive not ready for operation ON: drive ready for operation (ready includes active run permissive and active run command)
31	Inversion of drive ready condition 1 (function 30)	OFF: drive ready for operation (ready includes active run permissive and active run command) ON: drive not ready for operation
32	drive ready condition 2	OFF: drive not ready for operation ON: drive ready for operation (ready does not include active run permissive or active run command)
33	Inversion of drive ready condition 2 (function 32)	OFF: drive ready for operation (ready does not include active run permissive or active run command) ON: drive 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 is not in a fault state during auto fault reset attempts. See also function 10.)	OFF: No drive fault ON: drive faulted
37	Inversion of fault relay (function 36)	OFF: drive faulted ON: No drive 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

I/O Control Parameters

Function No.	Function Description	Action
42	drive operational run time alarm (See page 95 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 service alarm (See page 106 for more detail on parameter F634.)	OFF: drive maintenance alarm not active ON: drive maintenance alarm active
45	Inversion of drive maintenance alarm (function 44)	OFF: drive maintenance alarm active ON: drive 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 speed reference equals VIA signal	OFF: Speed reference from the source identified by FMOd or the source identified by F207 ≠ VIA signal ON: Speed reference from the source identified by FMOd or the source identified by F207 = VIA signal
53	Inversion of drive speed reference equals VIA signal (function 52)	OFF: Speed reference from the source identified by FMOd or the source identified by F207 = VIA signal ON: Speed reference from the source identified by FMOd 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 is in remote mode ON: drive is in local mode
57	Inversion of local/remote switching (function 57)	OFF: drive is in local mode ON: drive 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
60	drive 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 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

I/O Control Parameters

Function No.	Function Description	Action
62	Analog VIA detection	ON: The value of VIA is equal to or higher than F160 + F161 OFF: The value of VIA is equal to or lower than F160 - F161
63	Inversion of analog VIA detection	ON: The value of VIA is equal to or lower than F160 - F161 OFF: The value of VIA is equal to or higher than F160 + F161
64	Analog VIB detection	ON: The value of VIB is equal to or higher than F162 + F163 OFF: The value of VIB is equal to or lower than F162 - F163
65	Inversion of analog VIB detection	ON: The value of VIB is equal to or lower than F162 - F163 OFF: The value of VIB is equal to or higher than F162 + F163
66	Set frequency attainment signal with hysteresis	ON: The ouptput frequency is equal to or higher than F101 + F102 OFF: The ouptput frequency is equal to or lower than F101 - F102 (See page 93 for more detail on parameters F101 and F102.)
67	Inversion of set frequency attainment signal with hysteresis	ON: The ouptput frequency is equal to or lower than F101 - F102 OFF: The ouptput frequency is equal to or higher than F101 + F102 (See page 93 for more detail on parameters F101 and F102.)
254	Relay output is always OFF	OFF
255	Relay output is always ON	ON

I/O Control Parameters

Analog Input Functions

Two analog inputs are supplied with the ATV21 drive. 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 information on wiring, consult the ATV21 Installation manual.

- The slope and bias of the input signal are adjusted with parameters F201–F204 and F470–F471. For more information, see page 81.
- VIA is configured as the speed reference input in the following macro-configurations:
  - Run permissive
  - 3-wire
  - 4-20 mA.

- Relay output functions 34 and 35 can signal when VIA is being used as the speed reference source. For more information, see table on page 72 and consult “I/O Control Parameters” on page 80.
- 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 FNOd 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 on page 72. Also, consult “I/O Control Parameters” on page 80 and review information about parameter F167 on page 93.
- The drive 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 104 and error code E-18 on page 118.
- 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 80 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 88.
- Adjust the slope and bias of the input signal with parameters F210 - F213 and F472 - F473. For more information, see page 81.
- Relay output functions 52 and 53 can signal when VIA is being used as the speed reference source. For more information, see table on page 72 and consult “I/O Control Parameters” on page 80.
- 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 FNOd 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 on page 72. Also, consult “I/O Control Parameters” on page 80 and review information about parameter F167 on page 93.

General

- The selection of VIA or VIB as the speed reference input in remote mode is made through parameters FNOd and F207. FNOd 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 84.
- Analog output terminal FN can be configured to provide a signal in proportion to the VIA or VIB signal levels. See parameter FNSL, selections 13 and 14, on page 84.
- 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 86 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-F879. For more information, see page 111 to 113.

Analog Output Functions

One analog output is supplied with the ATV21 drive. 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 detail on proper wiring, consult the ATV21 Installation manual.

The drive value represented by the FM analog output signal is determined by the setting of parameter Analog Output Function Selection FMSL (see page 83).
Calibrating the FM signal output to provide full scale deflection on an analog meter is achieved by adjusting parameter Analog Output Scaling FM (see page 83).
The slope and bias of the FM analog output signal can be adjusted using parameters F691 and F692. For more information, see page 84.

Logic Inputs Function

See table on page 67 for a full list of F,R and RES logic inputs assignments.

Code	Name/Description	Adjustment range	Factory setting
F I I I	❑ F Logic Input Function	0 to 72	2 (forward run command)
	The setting of parameter F I I I determines the control function of logic input terminal F.		
F I I2	❑ R Logic Input Function	0 to 72	6 (preset speed command input 1)
	The setting of parameter F I I2 determines the control function of logic input terminal R.		
F I I3	❑ RES Logic Input Function	0 to 72	10 (fault reset)
	The setting of parameter F I I3 determines the control function of logic input terminal RES.		

Code	Name/Description	Adjustment range	Factory setting
F I09	❑ VIA Input Function (Analog or Logic Selection)	-	0

⚠ DANGER

UNINTENDED EQUIPMENT OPERATION

- Prevent accidental grounding of logic inputs configured for sink logic. Accidental grounding can result in unintended activation of drive functions.
- Protect the signal conductors against damage that could result in unintentional conductor grounding.

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

0 ◻ **Analog input**
1 ◻ **Logic input** - sink (negative logic)
2 ◻ **Logic input** - source (positive logic)

The setting of parameter F I09 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 ATV21 Installation manual.

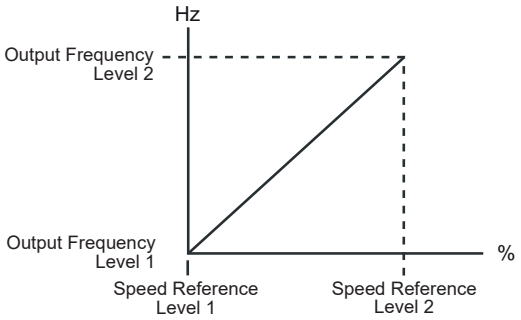
F I I8	❑ VIA Logic Input Function	0 to 72	7 (preset speed command input 2)
	The setting of parameter F I I8 determines the control function of logic input terminal VIA.		
	See table on page 67 for a full list of VIA logic input assignments.		

Analog Input Adjustments (F201–F204; F160 - F163; F210–F213; F470–F473)

Analog Input Speed Reference and Output Frequency

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

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

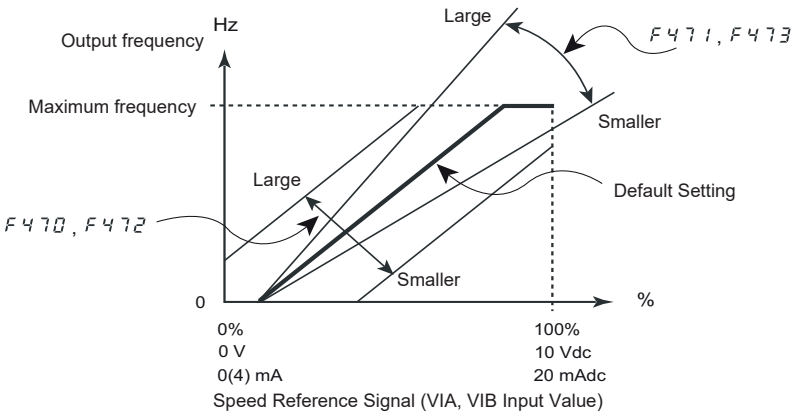


A further refinement of the bias and slope of the analog input signals can be made with parameters F470 – F473.

Code	Name/Description	Adjustment range	Factory setting
F201	❑ VIA speed reference level 1	0 to 100 %	0 %
F202	❑ VIA output frequency level 1	0.0 to 200.0 Hz	0.0 Hz
F203	❑ VIA speed reference level 2	0 to 100 %	100 %
F204	❑ VIA output frequency level 2	0.0 to 200.0 Hz	50.0 Hz
F160	❑ Threshold logic for relay link to VIA	0 to 100 %	0 %
F161	❑ Hysteresis threshold for logic relay link to VIA	0 to 20 %	3 %
F210	❑ VIB speed reference level 1	0 to 100 %	0 %
F211	❑ VIB output frequency level 1	0.0 to 200.0 Hz	0.0 Hz
F212	❑ VIB speed reference level 2	0 to 100 %	100 %
F213	❑ VIB output frequency level 2	0.0 to 200.0 Hz	50.0 Hz
F162	❑ Threshold logic for relay link to VIB	0 to 100 %	0 %
F163	❑ Hysteresis threshold for logic relay link to VIB	0 to 20 %	3 %

Analog Input Bias and Gain Adjustments

Code	Name/Description	Adjustment range	Factory setting
F470	❑ VIA analog input bias	0 to 255	128
F471	❑ VIA analog input gain	0 to 255	148
F472	❑ VIB analog input bias	0 to 255	128
F473	❑ VIB analog input gain	0 to 255	148



Parameters VIA analog input bias F470 and VIB analog input bias F472 are factory set so that a minimal signal must be applied to VIA or VIB before the drive 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 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 VIA analog input gain F471 and VIB analog input gain F473 are factory set so that the drive 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 output reaches rated voltage and frequency, increase the input gain level.
- To increase the signal level required before the drive output reaches rated voltage and frequency, decrease the input gain level.

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

Code	Name/Description	Factory setting
F200	**Auto/Manual Speed Reference Switching**	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 will follow the speed reference source defined by parameter Remote Mode Primary Speed Reference Source FNOd (see page 54).

When the assigned logic input is on, the drive will follow the speed reference source defined by parameter Remote Mode Secondary Speed Reference Source F207 (see page 56).

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

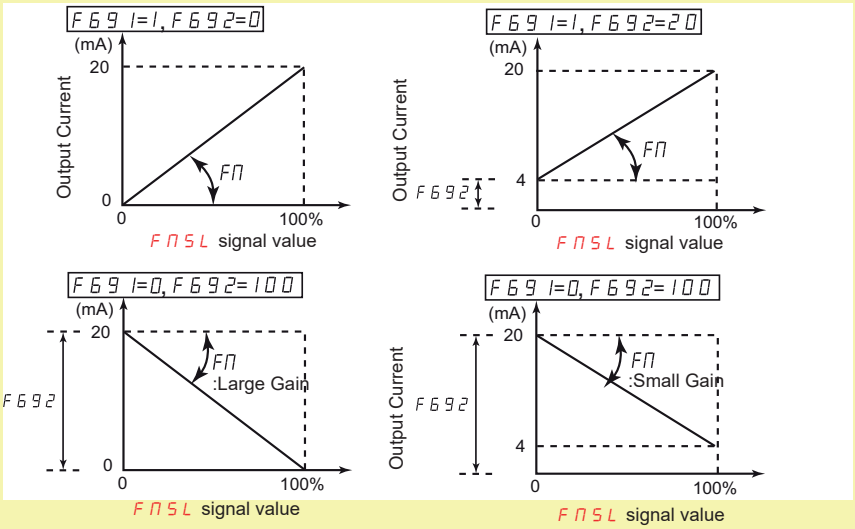
FNSL	**Analog Output Function Selection**	0

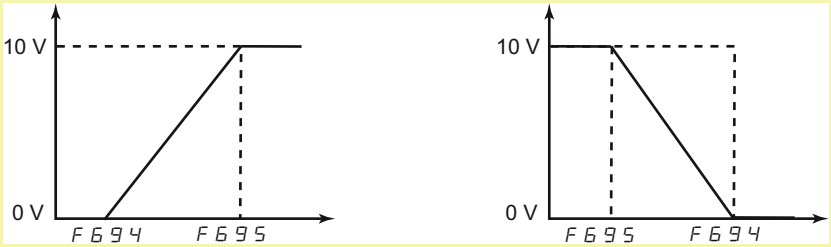
Value	Function	Maximum Signal
0	Output frequency	Maximum Frequency FH
1	Output current	150 % of drive's rated current
2	Speed reference	Maximum Frequency FH
3	DC bus voltage	150 % of drive's rated current
4	Output motor voltage	150 % of drive's rated current
5	Input power	185 % of drive's rated current
6	Output power	185 % of drive'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 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	FAS1 = 1000
19	DO NOT USE	-

FN	**Analog Output Scaling**	-

Parameter FN is used to match the FN 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 FN, set FNSL to either 15 or 17. As you adjust the value of FN, monitor the display on the attached panel meter. When the meter display reaches 100%, press the ENT key on the drive graphic display terminal. The drive will flash between FN and the adjusted value, indicating that the adjustment has been saved.

Code	Name/Description	Adjustment range	Factory setting
F691	❑ **Analog Output Slope** □ Negative slope □ Positive slope 0 1	-	1
F692	❑ **Analog Output Bias** Refer to the diagram below for examples of adjusting parameters FN, F691, and F692.	0 to 100 %	0 %
F694	❑ **Low frequency when analog output equal 0 V** Refer to the diagram below for adjusting parameters F694, and F695.	0 Hz to FH Hz	0 Hz
F695	❑ **High frequency when analog output equal 0 V** Refer to the diagram above for adjusting parameters F694, and F695.	0 Hz to FH Hz	0 Hz





Code	Name/Description	Adjustment range	Factory setting
F 130	❑ **RY-RC Relay Function**	0 to 61, 254, 255	4: F 100 speed attained (drive running)
	For a full description of the various functions assignable to the RY-RC relay, see page 72. The RY-RC relay can have a secondary assignment with programmed selection logic. See parameters RY-RC Relay Secondary Function F 137 and RY-RC Relay Function Logic Selection F 139 on page 92 for more detail.		
F 146	❑ **Delay for RY-RC Relay**	0.0 to 60.0 s	0.0 s
	This parameter introduce a delay on RY-RC output signal relay.		
F 132	❑ **FL Relay Function**	0 to 61, 254, 255	11: Inversion of fault relay
	For a full description of the various functions assignable to the FL relay, see page 72.		
F 147	❑ **Delay for FL Relay**	0.0 to 60.0 s	0.0 s
	This parameter introduce a delay on FL output signal relay.		

Code	Name/Description	Adjustment range	Factory setting
F360	**PID Control Enable**	-	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.

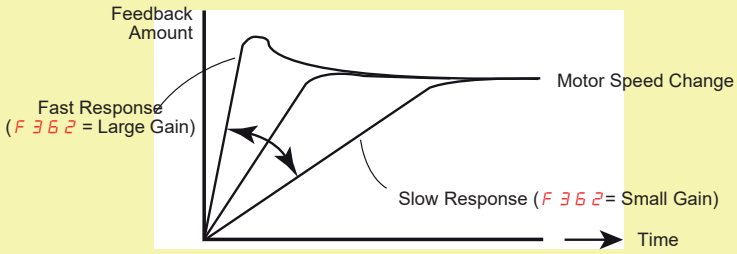
The PID source is defined by the setting of parameter Remote Mode Primary Speed Reference Source FNOd (see page 54).

Parameter Frequency Command Agreement Detection Range F167 can be adjusted to command a drive relay to signal when the PID setpoint and feedback are in agreement (see page 93).

F362	**PID Proportionnal Gain**	0.01 to 100.0 %	0.30 %

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).

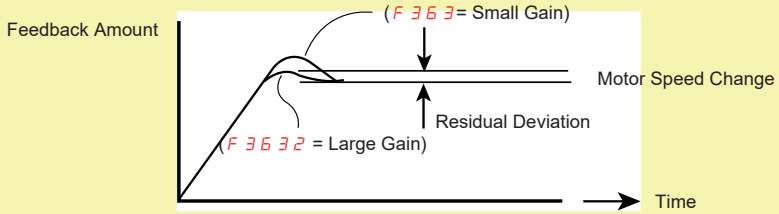
A higher setting of F362 provides a fast response to a process error but may also result in instability such as hunting. The diagram below illustrates the effect produced by adjusting F362.



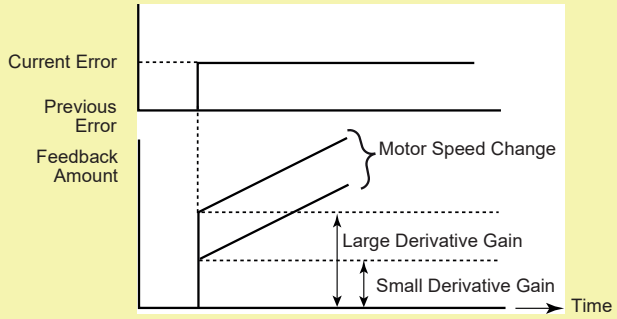
F363	**PID Integral Gain**	0.01 to 100.0	0.20

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. The diagram below illustrates the effect produced by adjusting F363.



The integral gain value can be set to zero by setting a logic input to function 65. For more information, see table on page 67 and parameters F111, F112, F113, page 80, and F118, page 80.

Code	Name/Description	Adjustment range	Factory setting
F366	❑ **PID Derivative Gain**	0.00 to 2.55	0.00
	Parameter F366 adjusts the derivative gain applied during PID control. This gain adjusts the response time of the drive 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. The diagram below illustrates the effect produced by adjusting F366.  		
F359	❑ **PID Control Waiting Time**	0 to 2400 seconds	0
	If parameter F359 is set to a value greater than 0 seconds, the drive will not immediately enter PID control upon startup. For the time set by F359, the drive 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 from entering PID control mode before the system approaches the final operating level.		
F380	❑ **PI regulator reversal direction correction**		0
0	◻ No		
1	◻ Yes		
F391	❑ **Stop on LL hysteresis**	0.0 to FH	0.2 Hz
F392	❑ **PI wake up threshold on PI error**	0.0 to FH	0.0 Hz
F393	❑ **PI wake up threshold on PI feedback error**	0.0 to FH	0.0 Hz

Code	Name/Description	Adjustment range	Factory setting
F645	❑ **PTC Motor Thermal Protection Enable**	-	0
0	◻ **Disabled**		
1	◻ **Enabled** (fault mode). If F911 is set to 1 and the PTC probe signals a problem, the drive will fault and display an OH2 code.		
2	◻ **Enabled** (alarm mode). If F911 is set to 2 and the PTC probe signals a problem, the drive will signal a fault and continue operating.		
	Setting parameter F645 to 1 or 2 converts control terminal VIB into a PTC motor thermal probe input. See the ATV21 Installation manual, for wiring details.		
F646	❑ **PTC Resistor Value**	100 to 9999 Ω	3000 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.
- Each implementation of an Altivar 21 drive 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.

Two logic input functions can be configured to be always active. The logic input functions assigned to parameters F I0B and F I I0 will continuously affect drive operation. See table beginning on page 67 for a list of available logic input functions.

Code	Name/Description	Adjustment range	Factory setting
F I0B	❑ Always Active Logic Function 1	0 to 72	0 (no function)
F I I0	❑ Always Active Logic Function 2	0 to 72	1 (run permissive)

Preset Speeds (SrI – 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 is in logic input control (CMOd = 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 page 67. See page 27, for wiring instructions and timing diagram.

Code	Name/Description	Adjustment range	Factory setting
SrI	❑ **Preset speed 1**	LL to UL Hz	15 Hz
Sr2	❑ **Preset speed 2**	LL to UL Hz	20 Hz
Sr3	❑ **Preset speed 3**	LL to UL Hz	25 Hz
Sr4	❑ **Preset speed 4**	LL to UL Hz	30 Hz
Sr5	❑ **Preset speed 5**	LL to UL Hz	35 Hz
Sr6	❑ **Preset speed 6**	LL to UL Hz	40 Hz
Sr7	❑ **Preset speed 7**	LL to UL Hz	45 Hz

I/O Control Parameters

+/- Speed Control Parameters

+/- speed (motorized potentiometer) control is selected by setting parameter F N O d or F 2 0 7 to 5 (see pages 54 and 56). 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 F 2 6 4 – F 2 6 9 refine the operation of +/- speed control.

The ratio of parameter F 2 6 5 to parameter F 2 6 4 determines the (+) speed command slope:

(+) speed command slope = F 2 6 5 / F 2 6 4

The ratio of parameter F 2 6 7 to parameter F 2 6 6 determines the (-) speed command slope.

(-) speed command slope = F 2 6 7 / F 2 6 6

For more detail, see page 69.

Code	Name/Description	Adjustment range	Factory setting
F 2 6 4	❑ **+Speed Logic Input Response Time** Parameter F 2 6 4 sets the maximum on-time of the logic input assigned to (+) speed, limiting the speed increase, as defined by parameter F 2 6 5, to only one step. Keeping the logic input active longer than the time set by parameter F 2 6 4 will allow multiple step increases of the speed command.	0.0 to 10.0 seconds	0.1 seconds
F 2 6 5	❑ **+Speed Frequency Steps** Parameter F 2 6 5 sets the frequency width in Hz of each (+) speed command step.	0.0 to F H Hz	0.1 Hz
F 2 6 6	❑ **-Speed Logic Input Response Time** Parameter F 2 6 6 sets the maximum on-time of the logic input assigned to (-) speed, limiting the speed decrease, as defined by parameter F 2 6 7, to only one step. Keeping the logic input active longer than the time set by parameter F 2 6 5 will allow multiple step decreases of the speed command.	0.0 to 10.0 seconds	0.1 seconds
F 2 6 7	❑ **-Speed Frequency Steps** Parameter F 2 6 7 sets the frequency width in Hz of each (-) speed command step.	0.0 to F H Hz	0.1 Hz
F 2 6 8	❑ **Initial +/- Speed Command** Parameter F 2 6 8 sets the +/- speed command in Hz that is applied to the drive when it is first powered up. Leaving this parameter at its default value will result in the drive's output frequency starting at 0 Hz every time it is powered up.	0.0 to F H Hz	0.0 Hz
F 2 6 9	❑ **Change of Initial +/- Speed Frequency** 0 ▫ **Disabled** 1 ▫ **Enabled** The setting parameter F 2 6 9 determines whether the value of parameter F 2 6 8 will change every time power is cycled to the drive. If parameter F 2 6 9 is set to 1, parameter F 2 6 8 will be set to the last speed command received by the drive before power was removed.	-	1

Code	Name/Description	Adjustment range	Factory setting
F137	❑ **RY-RC Relay Secondary Function**	0 to 61, 254, 255	255 (always on)

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 85). See table beginning on page 72 for a full description of the primary and secondary functions that can be assigned to the RY-RC relay.

F139	❑ **RY-RC Relay Function Logic Selection**	-	0

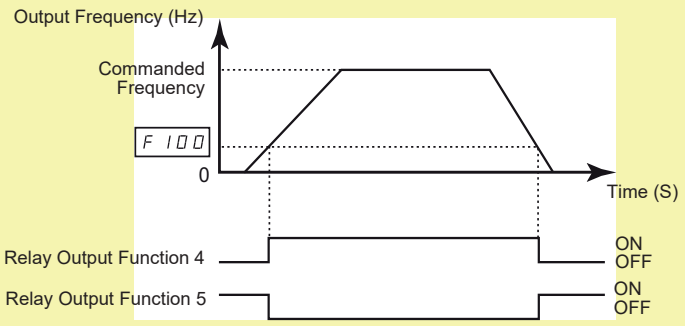
0 ▫ **F130 (primary) and F137 (secondary)**
1 ▫ **F130 (primary) or F137 (secondary)**

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)

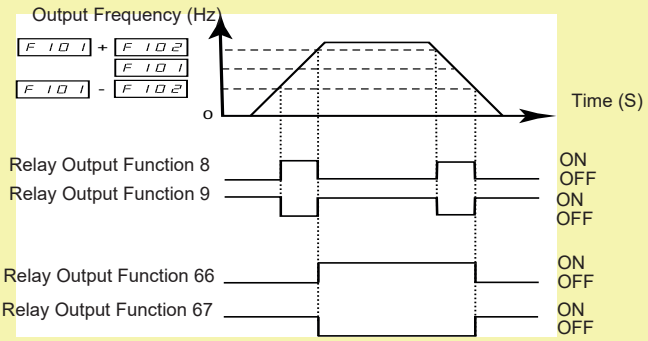
F100	❑ **Relay Output – Frequency Level 1 Attained**	0.0 to FH Hz	0.0 Hz

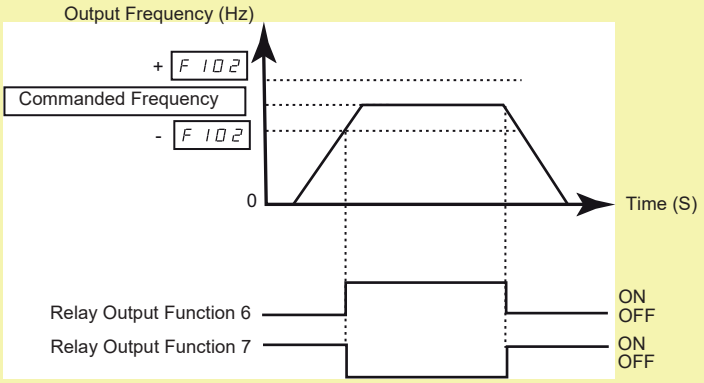
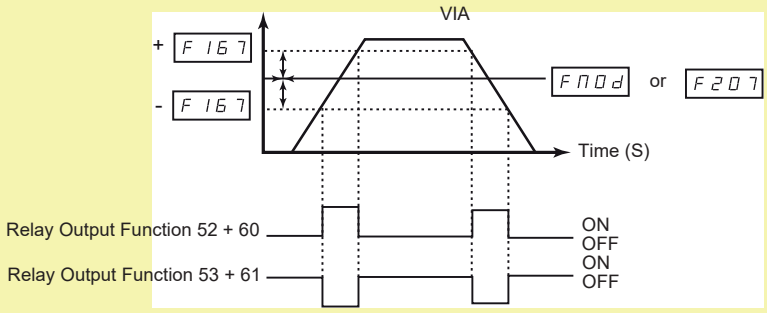
The frequency set by parameter F100 is the threshold level for relay output functions 4 and 5 (see page 72).



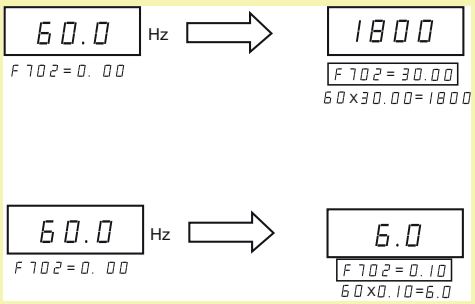
F101	❑ **Relay Output – Frequency Level 2 Attained**	0.0 to FH Hz	0.0 Hz

The frequency set by parameter F101 +/- the F102 detection band is the threshold level for relay output functions 8 and 9 and the hysteresis for relay output functions 66 and 67 (see page 72).

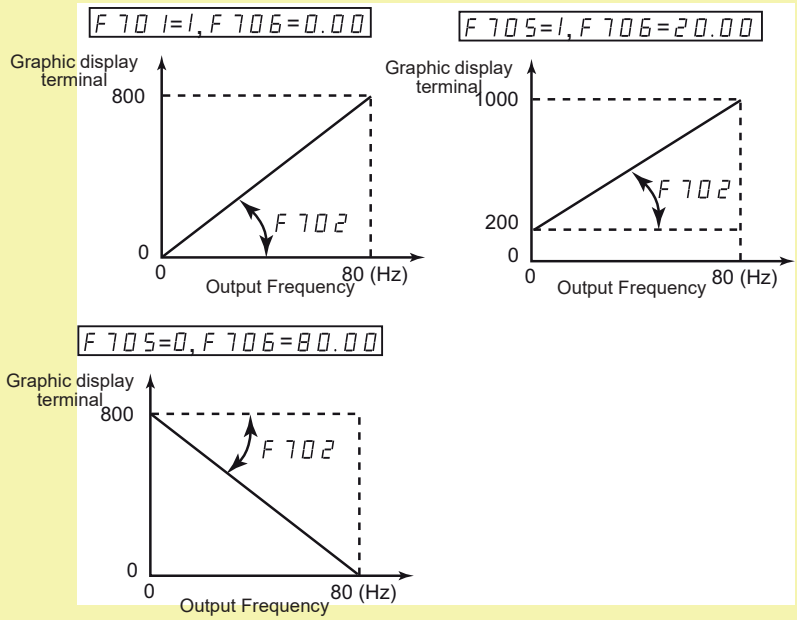


Code	Name/Description	Adjustment range	Factory setting
F102	**❑ Frequency Attained Detection Band** Parameter F102 determines the bandwidth around the F101 frequency (see diagram above) and the commanded frequency (see diagram below) driving relay output functions 6 through 9 (see page 72).  	0.0 to FH Hz	2.5 Hz
F167	**❑ Frequency Command Agreement Detection Range** Parameter F167 determines the bandwidth around the VIA or VIB speed reference (see below) driving relay output functions 52, 53, 60, and 61 (see page 76). 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.  	0.0 to FH Hz	2.5 Hz
F603 0 1 2	**❑ External Fault Stop Mode** □ **Freewheel stop** □ **Ramp stop** □ **DC injection braking** The setting of parameter F603 determines how the drive will stop if a logic input assigned to function 11 or 46 is activated (see table on pages 68 and 69).	-	0
F604	**❑ External Fault DC Braking Time** 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.	0.0 to 20 seconds	1.0 seconds

Code	Name/Description	Adjustment range	Factory setting
F 7 10	❑ **Default graphic display terminal Operational Value**	0 to 10	0
0	◘ **Motor operating frequency** (Hz or custom display, see Custom Frequency Display Conversion Factor F 7 0 2 on page 95)		
1	◘ **Speed reference** (Hz or custom display, see F 7 0 2 on page 95)		
2	◘ **Motor current** (% or A, see F 7 0 1 below)		
3	◘ **Drive rated current** (A)		
4	◘ **Drive thermal state** (%)		
5	◘ **Output power** (kW)		
6	◘ **Internal speed reference** (after PID function) (Hz or custom display, see F 7 0 2 on page 95)		
7	◘ **Serial communication data**		
8	◘ **Output speed** (rpm, see Motor Rated Speed F 4 1 7 on page 48)		
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 F 7 1 0 determines the default display on the drive's graphic display terminal upon power up.		
	Status alarms C, P, L, and H can only be displayed on the graphic display terminal if F 7 1 0 is set to 0. See "Run Mode" on page 19 for more information.		
F 7 0 1	❑ **Graphic display terminal : % or A/V Units**	-	1
0	◘ **%**		
1	◘ **A (amperes) or V (volts)**		
	The setting of parameter F 7 0 1 determines how certain values will be displayed on the drive graphic display terminal, either as a percentage of the drive rating or as a value of amperes or volts as appropriate.		
	The setting of F 7 0 1 will only affect parameters and display values that can be represented in amperes or volts. This includes the following parameters: - t H r and F 1 7 3: motor rated current - F 2 5 1: DC braking current level - F 1 8 5 and F 6 0 1: motor current limit - F 6 1 1: underload detection level - F 9 1 0: permanent magnet motor step-out detection current level		
	Motor rated voltage (parameters u 1 u and F 1 7 1) are always displayed in volts.		
F 7 0 8	❑ **Graphic display terminal Frequency Resolution**	-	0
0	◘ **Disabled** - 0.1 Hz steps		
1 to 2 5 5	◘ **See the formula below**		
	Parameter F 7 0 8 works along with parameter Local Mode Speed Reference Step Changes F 7 0 7 (see page 55) to adjust the incremental steps of the drive graphic display terminal frequency display. At its factory setting, parameter F 7 0 8 is disabled and the graphic display terminal increments or decrements frequency displays in 0.1 Hz steps.		
	If parameter F 7 0 8 is set to a value other than 0, then the graphic display terminal frequency display is determined as follows:		
	graphic display terminal frequency display = Internal speed reference (after PID function) x F 7 0 8 / F 7 0 7		
	For example, if both F 7 0 7 and F 7 0 8 are equal to 1, the graphic display terminal frequency display will increase only in full 1 Hz steps.		

Code	Name/Description	Adjustment range	Factory setting
F621	**Run Time Alarm Setting**	0.0 to 999.9	610.0 (6100 hours)
	Parameter F621 is used in conjunction with a relay output set to functions 42 or 43 (see page 75) to signal that the run time specified by the setting of F621 has accumulated. 0.1 = 1 hour, 100 = 1000 hours		
F748	**Accumulated Power Consumption Memory**	-	1
0	Disabled		
1	Enabled		
	The setting of parameter F748 determines whether the drive'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.		
F749	**Accumulated Power Consumption Display Unit**	According to drive model (see table page 128).	0
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 graphic display terminal.		
F702	**Custom Frequency Display Conversion Factor**	0.00 to 200.0	0.00
	Parameters F702, F705, and F706 can be used to customize a speed display on the drive graphic display terminal to match the application's operational speed, for example, feet per minute or units per hour. 0.00: Frequency displayed in Hz 0.0If 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 example below. 1 to 200.0: Conversion factor		
			
F703	**Frequency free unit conversion selection**		0
0	All frequencies display free unit		
1	PID frequencies free unit conversion		

Code	Name/Description	Adjustment range	Factory setting
F 705	❑ **Custom Frequency Display Conversion Slope**	-	1
0	◘ **Negative slope**		
1	◘ **Positive slope**		
	Parameter F 705 sets the slope of the custom frequency display conversion. See the diagrams below for examples of the operation of this function.		
F 706	❑ **Custom Frequency Display Conversion Bias**	0.00 to F H Hz	0.00 Hz
	Parameter F 706 adds a bias to the custom frequency display conversion process.		



Fault Management Parameters

Code	Name/Description	Factory setting
F303 0 1 to 10	❑ **Auto Fault Reset** □ **Disabled** □ **Number of fault reset attempts**	0

Description

The table below 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 will attempt to automatically clear the fault, allowing it to be restarted:

Automatically Resettable Faults

Code	Fault	Code	Fault
OC 1	Overcurrent during acceleration	OL 1	drive overload
OC 2	Overcurrent during deceleration	OL 2	Motor overload
OC 3	Overcurrent during constant speed operation	OP 1	Overvoltage during acceleration
OC 1P	Short-circuit or ground fault during acceleration	OP2	Overvoltage during deceleration
OC 2P	Short-circuit or ground fault during deceleration	OP3	Overvoltage during constant state operation
OC 3P	Short-circuit or ground fault during constant speed operation	SOUt	Permanent magnet motor pulls out of synchronism
OH	drive 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 will stop and a manual fault reset will be required.

If another type of fault (a type not listed in Automatically Resettable Faults table above) occurs during the auto fault reset process, the drive will stop and a manual fault reset will be required.

A successful auto fault reset means that the drive 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 graphic display terminal alternately displays rtry and the display value selected by parameter F710 (see page 94).

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 OL 1 or OL2 fault, the drive 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 OP 1, OP2, or OP3 fault can be cleared.

Fault Management Parameters

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 the table below.

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 on page 72) 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 fault, even during auto fault reset attempts.

Drive fault memory

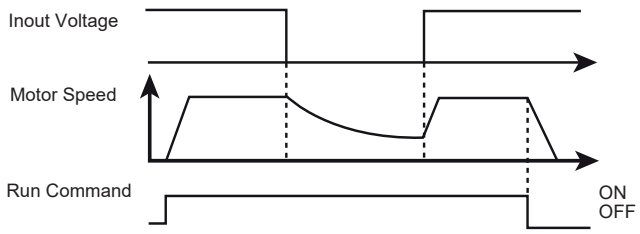
If parameter Drive Fault Memory F602 is set to 1 and power to the drive is cycled while an auto-resettable fault is active, the auto fault reset action will be cancelled (see page 100).

Catch On The Fly (F 3 0 1)

If catch-on-the-fly motor starting is enabled (parameter F 3 0 1 is not set to 0), the drive 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 F 3 0 1 is disabled and the drive 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 will accelerate the motor to the commanded speed.
Catch-on-the-fly motor starting will be applied if F 3 0 1 is set to 1 or 3 and:

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

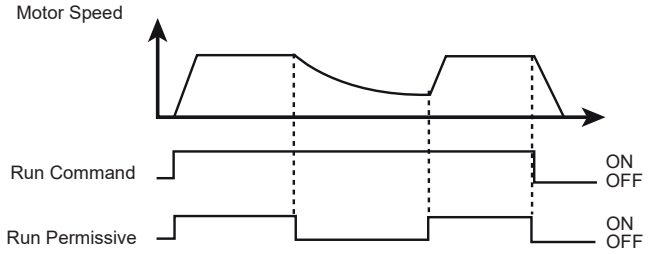
F 3 0 1 Set to 1 or 3



Catch-on-the-fly motor starting will be applied if F 3 0 1 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 (2-wire control)

F 3 0 1 Set to 2 or 3



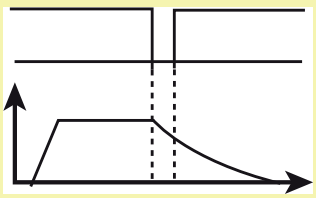
If F 3 0 1 is set to 4, the drive will perform a motor speed and direction search each time it receives a run command.

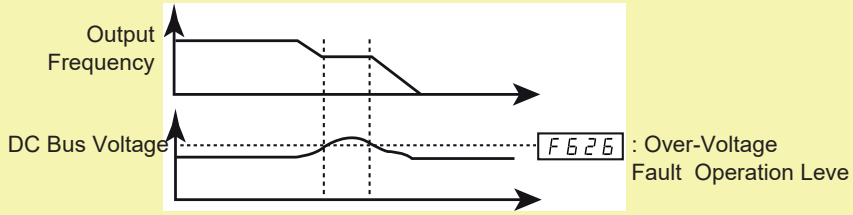
Note: Enabling catch-on-the-fly adds about 300 milliseconds to implementation of each start command to the drive.

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

Code	Name/Description	Factory setting
F 3 0 1	❑ **Catch On The Fly**	3 (1)
0	□ **Disable**	
1	□ **After brief power loss**	
2	□ **After run pemissive 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 Auto Fault Reset F 3 0 3 is not set to 0, see page 97).

Code	Name/Description	Factory setting
F632	❑ Motor Overload Memory	0
0	□ Cleared If parameter F632 is set to 0, the drive's memory of the motor's thermal state (used for overload calculation) is cleared whenever the power is cycled.	
1	□ Retained If parameter F632 is set to 1, the drive's memory of the motor's thermal state is retained even when power is removed. If the drive is faulted on an Motor Overload Fault OL2, a cooling time (as calculated by the drive) must expire before the motor can be restarted.	
F602	❑ Drive Fault Memory	0
0	□ Cleared If parameter F602 is set to 0 and power to the drive is cycled after a fault: - If the cause of the fault has been eliminated, the drive 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'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.	
1	□ Retained If parameter F602 is set to 1 and power to the drive is cycled after a fault: - If the cause of the fault has been eliminated, the drive 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.	
F608	❑ Input Phase Failure Detection Mode	1
0	□ Disabled If parameter F608 is set to 0, input phase failure detection is disabled. Loss of one input phase will not cause the drive to fault.	
1	□ Enabled If parameter F608 is set to 1, the loss of one input phase will cause an EPH1 fault.	
F302	❑ Input Phase Loss	0
0	□ Disabled If parameter F302 is set to 0 and the drive 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.	
1	□ DO NOT SELECT	
2	□ Freewheel If parameter F302 is set to 2 and the drive briefly loses input power, the drive will remove power from the motor and allow it to coast to a stop. The graphic display terminal will flash STOP. The drive can only be restarted by providing a new run command. Input Voltage Motor Speed 	

Code	Name/Description	Adjustment range	Factory setting
F627	**Undervoltage Fault Operation Mode**	-	0
0	**Alarm only** (detection level below 60 %) If parameter F627 is set to 0 and the supply voltage drops below 60% of its rated value, the drive will stop and indicate a fault code on the graphic display terminal, but it will not activate a fault relay. If the supply voltage rises above 60% of its rated value, the fault code on the graphic display terminal will be cleared without a fault reset action and the drive will be ready to operate.		
1	**Fault** (detection level below 60 %) If parameter F627 is set to 1 and the supply voltage drops below 60% of its rated value, the drive will fault and will require a reset action to clear the fault before it can be restarted.		
2	**Alarm only** (detection level below 50 %) If parameter F627 is set to 2 and the supply voltage drops below 50% of its rated value, the drive will stop and indicate a fault code on the graphic display terminal, but it will not activate a fault relay. If the supply voltage rises above 50% of its rated value, the fault code on the graphic display terminal will be cleared without a fault reset action and the drive will be ready to operate. The use of a line reactor is required if parameter F267 is set to 2.		
F305	**Overvoltage Fault Protection**	-	2
0	**Enabled** If parameter F305 is set to 0, and the drive 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  		
1	**Disabled** If parameter F305 is set to 1, the drive will take no action to avoid a DC bus overvoltage fault.		
2	**Enabled** (quick deceleration mode) If parameter F305 is set to 2, and the drive 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.		
3	**Enabled** (dynamic quick deceleration mode) If parameter F305 is set to 3, the drive 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. When motor speed is being reduced, a DC bus overvoltage fault can often be caused by regenerated energy being absorbed by the drive from the load and motor.		
F626	**Overvoltage Fault Operation Level**	100 to 150 % of nominal DC bus voltage	140 %
	Parameter F626 sets the DC bus voltage level at which the actions defined by parameter F305 take place. See diagram above for more details.		

Code	Name/Description	Factory setting
F605	**Output Phase Failure Detection Mode**	3

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

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

1 **At the first start-up.** 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.

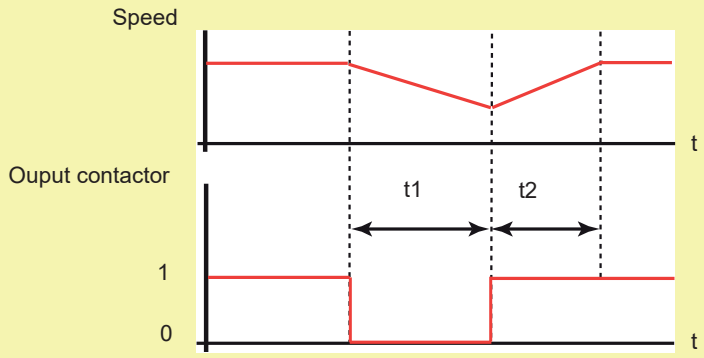
2 **At every start-up.** If parameter F605 is set to 2, an output phase failure check is made every time the motor is started.

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

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

5 **Load side disconnect mode.** Setting 5 for parameter F605 is for applications with a load side disconnect. The drive 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 detects that a 3-phase connection has been reestablished (the output contactor or load side disconnect has closed). It is necessary to wait 1 s between disconnection and connection. See following scheme to have an example of loss of output contactor.



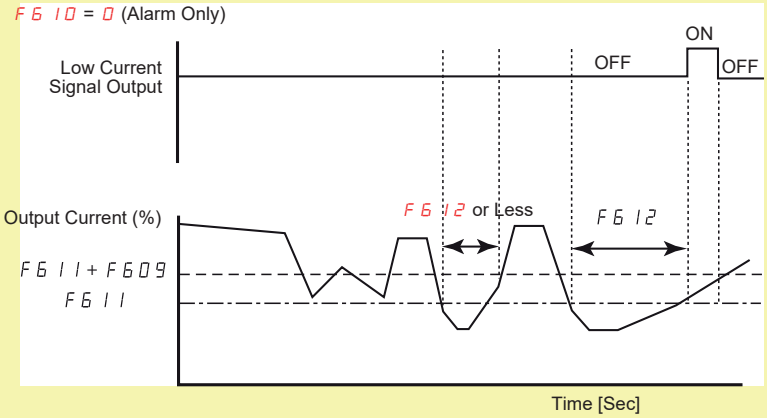
t1: deceleration without ramp (freewheel)

t2: acceleration with ramp

- 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.

Code	Name/Description	Adjustment range	Factory setting
F 6 10	❑ **Underload Fault/Alarm Selection**	-	0
0	◘ **Alarm.** If parameter F 6 10 is set to 0, relay output functions 24 or 25 (see page 73) can be used to signal an underload condition without the drive faulting.		
1	◘ **Fault.** If parameter F 6 10 is set to 1 and the loading level drops below the setting of F 6 11 for a period of time longer than that set by F 6 12, the drive will fault, displaying fault code U C. The fault relay will be set if one has been defined (relay output functions 10 or 11, see page 68). A relay assigned to signal an underloaded condition (functions 24 or 25, see page 68) will also be set.		
	The drive's response to an underload condition is set by parameters F 6 0 9, F 6 10, F 6 11, and F 6 12. The setting of parameter F 6 10 determines whether an underload condition signals an alarm with an output relay or faults the drive. The sum of parameters F 6 0 9 and F 6 11 determines the drive loading level that will clear an underload alarm/fault. Parameter F 6 12 determines how long the drive can be under load before an alarm or fault is signaled. See parameters F 6 0 9, F 6 10, F 6 11 and F 6 12 diagram below for more details.		
F 6 11	❑ **Underload Detection Level**	0 to 100 % (1)	0 %
	Parameter F 6 11 sets the underload detection level.		
F 6 0 9	❑ **Underload Detection Level Bandwith**	1 to 20 % (2)	10 %
F 6 12	❑ **Underload Detection Time**	0 to 255 s	0 s



(1) Percentage of the drive's current rating. Display can also be in amperes, depending on setting of parameter Graphic display terminal : % or A/V Units F 7 0 1 (see page 94).
(2) Percentage of Underload Detection Level F 6 11 setting

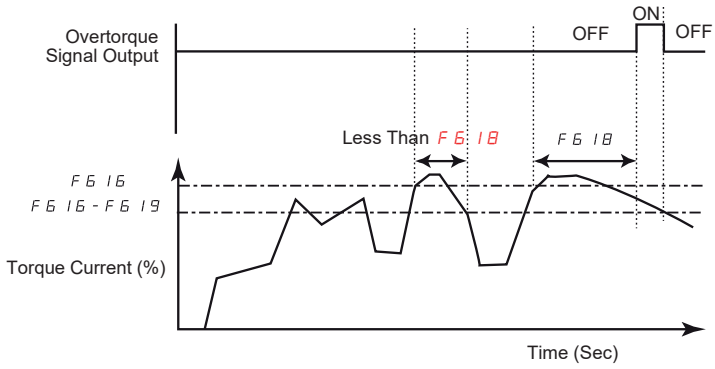
Fault Management Parameters

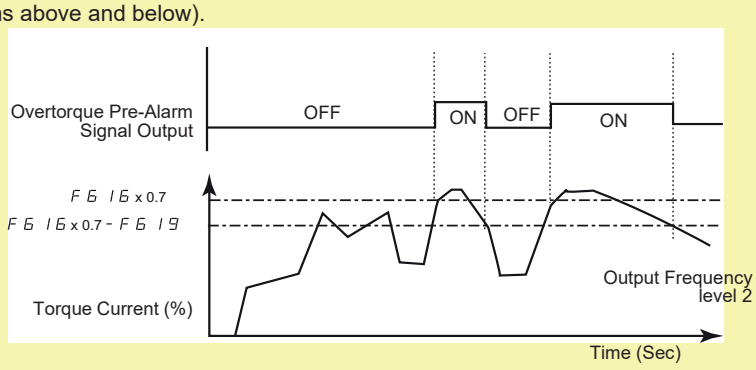
Code	Name/Description	Adjustment range	Factory setting
F633	❑ **Loss of VIA Analog Signal**	0 to 100 % (1)	0 %
0	◘ **Disabled.** If parameter F633 is set to 0, the drive will not monitor for loss of signal at analog input terminal VIA		
1 to 100	◘ **Fault detection level.** If parameter F633 is set to 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 will fault and the graphic display terminal will display the fault code E-18.		
F644	❑ **Drive behaviour on 4-20 event**		0
0	◘ **No**		
1	◘ **Freewheel:** freewheel stop and alarm		
2	◘ **Fallback speed:** switch to fallback speed. Maintained as long as the fault is present and the run command is not disabled. See parameter F649 for fallback speed.		
3	◘ **Speed maintain:** the drive maintains the speed being applied when the fault occured, as long as the fault is present and the run command is not disabled.		
4	◘ **Ramp stop**		
F649	❑ **Fallback speed**	0.0 to FH	0.0 Hz
	See parameter F644.		
F613	❑ **Output Short-Circuit Detection Mode**	-	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 determines an output short-circuit during start-up. Select the short-time pulse if the drive is powering a low impedance motor.		

(1) Percentage of maximum VIA signal level

Overtorque Detection

The drive's response to a particular motor torque level is determined by the setting of parameters F6 15 – F6 19.



Code	Name/Description	Adjustment range	Factory setting
F6 15	**Overtorque Fault/Alarm Selection**	-	0
0 1	▫ **Alarm**. f parameter F6 33 is set to 0, the drive will not monitor for loss of signal at analog input terminal VIA ▫ **Fault.** If parameter F6 15 is set to 1 and the drive faults, the overtorque signal output will remain latched on until the fault is reset. Depending on the setting of parameter F6 15, the drive can use output relay function 12 or 13 (see table on pages 72) to signal an overtorque alarm or fault (0L fault code).		
F6 16	**Overtorque Detection Level**	0 to 250 % of nominal rated motor torque	130 %
	The setting of parameter F6 16 determines the level at which the drive will act upon a motor overtorque condition (see diagrams above and below).		
			
	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 F6 16.		
F6 18	**Overtorque Detection Time**	0.0 to 10 seconds	0.5 seconds
	The setting of parameter F6 18 determines how long the drive must detect a motor overtorque condition before it signals an alarm or fault (see above diagram).		
F6 19	**Overtorque Detection Level Bandwith**	0 to 100 % of F6 16 level	10 %
	TWhile the setting of parameter F6 16 determines the level at which a motor overtorque alarm or fault will be signaled, the setting of parameter F6 19 determines how far the calculated motor torque must drop before the alarm or fault is cancelled (see above diagram).		

Code	Name/Description	Factory setting
F634	❑ **Ambient Temperature For drive Service Alarm**	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 can be programmed to signal a service alarm using output relay functions 44 or 45 (see page 75). The status of the service alarm can be displayed on the graphic display terminal (see page 18).	
	At initial start-up, set parameter F634 to the drive's average ambient operating temperature. Setting F634 to the highest annual temperature or changing the value after drive operation has begun may result in an early drive service alarm.	

Nuisance Overvoltage And Input Phase Fault Avoidance

Parameters F481 to F483 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.

Code	Name/Description	Adjustment range	Factory setting
F481	❑ **Line Noise Compensation Filter**	0 to 9999 microseconds	0 microsecond
F482	❑ **Line Noise Inhibitor Filter**	0 to 9999 microseconds	442 microseconds
F483	❑ **Line Noise Inhibitor Gain**	0.0 to 300.0 %	100 %
F484	❑ **Power supply adjustment gain**	0.0 to 2.0	0.0

When the using machine has specific resonance, the following phenomena are happened:
- the machine occurs vibration,
- unusual noise of machine or peripheral.

If these phenomena are occured, the following parameters should be adjusted:
- at first, set F484 to 0.5,
- next, set F484 as another value when no effect by setting F484 to 0.5,
- if Motor Rated Frequency uL = 50 Hz, set F481 to the following value 531,
- if Motor Rated Frequency uL = 60 Hz, set F481 to the following value 442.

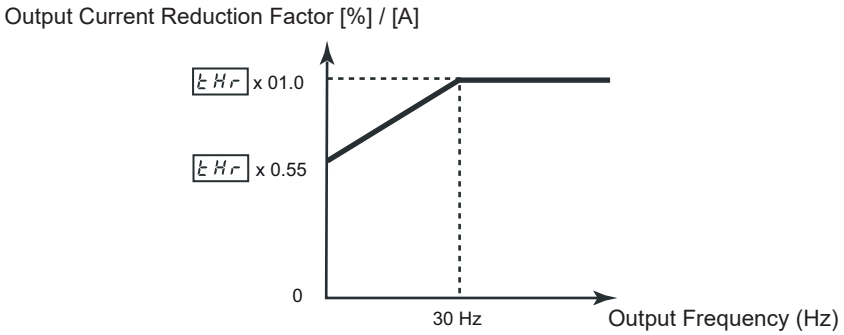
Note: F481 and F483 are invalid when F484 has a value excluding 0.0

Motor Overload Characteristics (OLn)

Motor Type

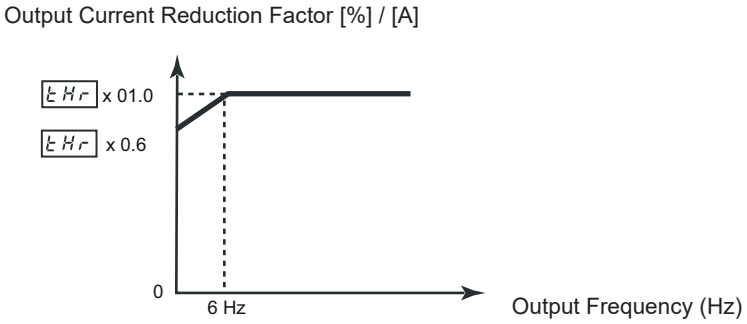
Set OLn to 0, 1, 2, or 3 if a self-cooled motor is being powered by the drive. The diagram below illustrates the overload protection level for the self-cooled motor as a function of motor frequency.

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. The diagram below illustrates the overload protection level for the forced-cooled motor as a function of motor frequency.

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, must be wired between the drive 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, must be wired between the drive and the motor.

Overload Stall

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

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

Code	Name/Description	Factory setting
OLn	❑ **Motor Overload Characteristics**	0

This parameter value depends on:

- the motor type (self cool or forced cooled),
- and the protection.

Motor type	Protection		OLn value	Behaviour
	Overload protection	Overload stall		
Self cooled	enabled	disabled	0	In case of overload defined by tHr parameter, the drive trips in OL2 fault and the letter L is blinking.
	enabled	enabled	1	In case of overload defined by tHr parameter, the drive reduces automatically the speed and follows a fallback speed (80 % of Motor rated frequency uL) (1). If the overload remains during the fallback speed, the drive trips in OL2 fault and the letter L is blinking.
	disabled	disabled	2	-
	disabled	enabled	3	In case of overload defined by tHr parameter, the drive reduces automatically the speed and follows a fallback speed (80 % of Motor rated frequency uL) (1). The drive will not trip in OL2 fault.
Forced cooled	enabled	disabled	4	In case of overload defined by tHr parameter, the drive trips in OL2 fault and the letter L is blinking.
	enabled	enabled	5	In case of overload defined by tHr parameter, the drive reduces automatically the speed and follows a fallback speed (80 % of Motor rated frequency uL) (1). If the overload remains during the fallback speed, the drive trips in OL2 fault and the letter L is blinking.
	disabled	disabled	6	-
	disabled	enabled	7	In case of overload defined by tHr parameter, the drive reduces automatically the speed and follows a fallback speed (80 % of Motor rated frequency uL) (1). The drive will not trip in OL2 fault.

(1) If the speed is lower than the fallback speed, the drive will keep the same speed.

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 and a master controller is possible through five protocols selectable through the graphic display terminal:

- 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 parameters
- Control: starting and stopping the drive and controlling the frequency reference

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

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

- Parameters Remote Mode Start/Stop Control CMOd (see page 54) and Remote Mode Primary Speed Reference Source FMOd (see page 54) must be set correctly:
  - Setting CMOd to 2 enables start/stop control of the drive via network communication
  - Setting FMOd to 4 enables the frequency reference to be controlled by network communication
  - Setting either CMOd to 2 or FMOd to 4 enables serial communication error detection. The setting of parameter F851 determines the drive'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 can be established by a master controller over a serial communication network regardless of the setting of CMOd or FMOd (see diagram on page 31). Control can be restored to the source defined by CMOd and FMOd if the serial communication network relinquishes control or a logic input assigned to function 48 (forced local) is enabled.

Serial Communication Parameters

Code	Name/Description	Adjustment range	Factory setting
F800	❑ **Baud Rate** □ 9600 bps (0) □ 19200 bps (1)	-	1
F801	❑ **Parity** □ No parity (0) □ Even parity (1) □ Odd parity (2)	-	1
F802	❑ **Address**	0 to 247	1
F803	❑ **Time-out** □ Communication error detection disabled (0) □ Seconds (1 to 100)	-	3
F851	❑ **Communication Fault Setting** □ **Drive ramps to a stop.** Serial control is relinquished to the sources defined by FNOd and CNOd. (0) □ **Last commanded operation continues** (1) □ **Drive ramps to a stop.** Serial control is maintained. (2) □ **Drive removes power from the motor which coasts to a stop.** Serial control is maintained. (3) □ **Drive faults with either a communication error ErrS or a network error ErrB.** (4)	-	4

Serial Communication Parameters

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

Code	Name/Description	Factory setting
F856	❑ **Motor Poles For Communication**	2
1	□ 2 poles	
2	□ 4 poles	
3	□ 6 poles	
4	□ 8 poles	
5	□ 10 poles	
6	□ 12 poles	
7	□ 14 poles	
8	□ 16 poles	
F870	❑ **Block Write Data 1**	0
0	□ No selection	
1	□ Command 1	
2	□ Command 2	
3	□ Frequency command	
4	□ Ouput data on the terminal board	
5	□ Analog output for communication	
6	□ Motor speed command	
F871	❑ **Block Write Data 2**	0
0	□ No selection	
1	□ Command 1	
2	□ Command 2	
3	□ Frequency command	
4	□ Ouput data on the terminal board	
5	□ Analog output for communication	
6	□ Motor speed command	
F875	❑ **Block Read Data 1**	0
0	□ No selection	
1	□ Status information	
2	□ Output frequency	
3	□ Ouput current	
4	□ Ouput 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	□ Ouput motor speed monitor	

Serial Communication Parameters

Code	Name/Description	Factory setting
F876	❑ Block Read Data 2	0
0	□ No selection	
1	□ Status information	
2	□ Output frequency	
3	□ Ouput current	
4	□ Ouput 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	□ Ouput motor speed monitor	
F877	❑ Block Read Data 9	0
0	□ No selection	
1	□ Status information	
2	□ Output frequency	
3	□ Ouput current	
4	□ Ouput 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	□ Ouput motor speed monitor	

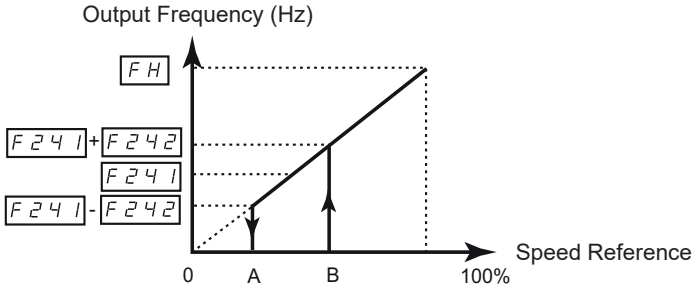
Serial Communication Parameters

Code	Name/Description	Adjustment Range	Factory setting
F878	❑ **Block Read Data 4**	-	0
	0 □ No selection 1 □ Status information 2 □ Output frequency 3 □ Ouput current 4 □ Ouput 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 □ Ouput motor speed monitor		
F879	❑ **Block Read Data 5**	-	0
	0 □ No selection 1 □ Status information 2 □ Output frequency 3 □ Ouput current 4 □ Ouput 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 □ Ouput motor speed monitor		
F880	❑ **Free Notes** The free notes parameter can be used to set a unique value to identify the drive on a network.	0 to 65535	0

Start/Stop Control By Speed Reference Level

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

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



Code	Name/Description	Adjustment Range	Factory setting
F241	❑ **Operating Starting Frequency**	0.0 to FH Hz	0.0 Hz
F242	❑ **Operating Starting Frequency Hysteresis**	0.0 to FH Hz	0.0 Hz

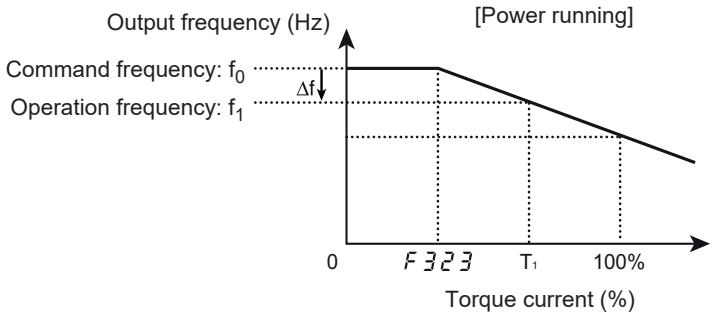
Droop Control

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

When enabled, droop control is active when:

- The load current exceeds the level set by parameter F323.
- The drive output frequency is between the Output Starting Frequency F240 (see page 60) and Maximum Frequency FH (see page 59).



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's rated current)
Load current = 100% of drive'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).

(1) This is parameter High Speed UL (see page 59). 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).

Code	Name/Description	Adjustment Range	Factory setting
F320	❑ **Droop Gain**	0 to 100 %	0 %
F323	❑ **Droop Insensitive Torque Band**	0 to 100 % (3)	10 %

(3) Percent of the drive's rated current.

Permanent Magnet Motor

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

If a permanent magnet motor steps out with a resultant increase in motor current, the drive 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.

Code	Name/Description	Adjustment Range	Factory setting
F910	❑ **Permanent Motor Step-out Detection Current Level**	10 to 150 % (1)	100 %
F911	❑ **Permanent Motor Step-out Detection Time**	0.00 to 25 seconds	0.00 second
0.00	□ **Disabled**		
0.01 to 25	□ **Enabled**		
F912	❑ **Permanent Motor High-speed Torque Adjustment Coefficient** DO NOT ADJUST	-	-

(1) Percent of the drive's rated current. Ampere range will vary according to drive power rating.

Options

Code	Name/Description	Adjustment range	Factory setting
F829	❑ **Protocol** □ Reserved □ Modbus RTU □ Metasys N2 □ Apogee P1 FLN □ BACnet 0 1 2 3 4	-	1

Parameters F890 – F896 should be adjusted only if the corresponding optional equipment has been installed. See the ATV21 catalog for more detail.

Code	Name/Description
F890	❑ **Parameter for Option 1**
F891	❑ **Parameter for Option 2**
F892	❑ **Parameter for Option 3**
F893	❑ **Parameter for Option 4**
F894	❑ **Parameter for Option 5**
F895	❑ **Parameter for Option 6**
F896	❑ **Parameter for Option 7**

When the value of F829 parameter is changed, the adjustment range and factory setting of F890 to F896 are automatically setted.

	Modbus		APOGEE FLN P1		METASYS N2		BACNET	
	Adjustment Range	Factory setting	Adjustment Range	Factory setting	Adjustment Range	Factory setting	Adjustment Range	Factory setting
F829	-	1	3	3	2	2	4	4
F890	0 to 65535	0	1 to 99	99	1 to 255	1	0 to 127	0
F891			0 to 6	0	1 to 5	5	1 to 5	5
F892			20 to 600	100	20 to 600	100	20 to 600	100
F893			0 to 4194	0	0 to 4194	0	0 to 4194	0
F894			0 to 999	0	0 to 999	0	0 to 999	0
F895			0 to 127	0	0 to 127	0	0 to 127	127
F896			0 to 100	0	0 to 100	0	1 to 100	1

Faults - Causes - Remedies

Fault Conditions

Refer to tables on pages 118, 121 and 122 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.

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.
E-20	Excessive torque boost	• Torque boost parameter F402 is set too high. • The motor impedance is too low.	• Repeat the drive 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.
EEP1	EEPROM fault 1	• A data writing error has occurred.	• Cycle power to clear the fault.
EEP2	EEPROM fault 2	• Power was removed from the drive 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.
EEP3	EEPROM fault 3	• A data reading error has occurred.	• Cycle power to clear the fault.
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.
EPHO	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.
Err3	Control board ROM fault	• The control board ROM is inoperable.	• Contact Schneider Electric to repair the drive.
Err4	CPU fault 1	• The control board CPU is inoperable.	• Contact Schneider Electric to repair the drive.
Err5	Communication fault	• Serial communication error	• Check network control devices and cables. • Check the setting of the communication timeout parameter, F803. • Check the remote graphic display terminal cable.
Err7	Current sensor fault	• A motor current sensor is inoperable.	• Replace the drive.
Err8	Network error	• Network communication error	• Check the network control devices and cables.

Faults - Causes - Remedies

Fault code	Problem	Possible causes	Remedies
Etn1	Auto-tuning error	• Parameters F401 to F494 are incorrectly set. • The motor is too large for the drive. • The motor cable gauge is too small. • The motor is still rotating at the start of the auto-tune. • The drive is not powering a 3-phase induction motor.	• Set parameters F401–F494 correctly. • Use a larger drive. • Use a larger gauge motor cable. • Verify that the motor is stopped before starting an auto-tune. • Use the drive to power only a 3-phase induction motor.
EtyP	drive type fault	• The main control board is inoperable.	• Set parameter tyP to 6. • If this does not clear the error, replace the drive.
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.
OC1	Overcurrent during acceleration	• The acceleration time is too short. • The setting of parameter Pt is incorrect. • The drive is starting into a rotating load. • The drive 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.
OC1P	Ground fault	• Short circuit or ground fault during acceleration	• Using a 1000 V testing tool megger, check the motor and motor cables for ground faults.
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..
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.
OCA	Arm overcurrent during startup	• Ground fault	• Using a 1000 V megger, check the motor and motor cables for ground faults.
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.
OH	drive overtemperature fault	• The drive 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. • The drive heatsink temperature sensor is malfunctioning.	• Restart operation by resetting the drive fault after cool-off. • Decrease the ambient temperature by increasing the free space around the drive and removing any heat generating source from the proximity of the drive.
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.

Faults - Causes - Remedies

Fault code	Problem	Possible causes	Remedies
OL 1	drive overload	• The acceleration time is too short. • The DC injection current level is too high. • The setting of parameter Pt is incorrect. • The drive 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 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 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 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 is regenerating - the load causes the motor to run at a frequency higher than drive 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.
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.

Faults - Causes - Remedies

Alarm Conditions

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

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	graphic display terminal error	• A graphic display terminal key has been held down for more than 20 seconds. • A graphic display terminal key may not be operating properly.	• Release the graphic display terminal key. • If this does not clear the error, replace the drive.
E1	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 auh 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+F391 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 requires repair.
OFF	ST terminal OFF	• The ST-CC (run permissive) circuit is open.	• Close the ST-CC circuit.
rtry	Restart in process	• The drive is in the process of restart. • A momentary stop occurred.	• The drive 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 or input an operation signal again.

Pre-alarm Conditions

Pre-alarm Codes

Code	Pre-alarm	Description
C	Current Limit	The drive is at current limit. For more information, refer to parameter F601 (see page 47) and F185 (see page 52).
P	DC bus overvoltage	The drive 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 (see page 101) and F626 (see page 101).
L	Motor overload alarm	The motor overload timer has reached or exceeded 50% of its fault level.
H	drive overheating alarm	The drive is approaching an overheating fault.

The pre-alarm codes are displayed, blinking, in the following order from left to right: C, P, L, H.

If two or more problems arise simultaneously, one of the following pre-alarm codes appears and blinks: CP, PL, CPL.

Resetting the drive after a Fault Condition

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

The drive 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:

    - Press the STOP key and make sure that CLr is displayed.
    - Eliminate the cause of the fault.
    - Press the STOP key again to reset the drive.

4. By a fault clear signal from a remote communication device.

When any overload function (OL1 or OL2) is active, the drive 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:

- OL1: 30 seconds after the fault has occurred
- OL2: 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). these instructions can result in equipment damage.

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

Parameters reset tables

Parameter Reset

Refer to Menu navigation diagram page 20 to know how to reach tYP parameter.
The Altivar 21 drive 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.
The following tables identify:

- Parameters whose values after a reset DO NOT vary by reset type, see below.
- Parameters whose values after a reset vary by reset type, see page 128.
- Parameters whose values after a reset are drive model dependant but DO NOT vary by reset type, see page 128.
- Parameters whose values after a reset are drive model and reset type dependant, see page 130.
- Parameters whose values do not change if a reset is performed, see page 131.

Parameter values that do not vary by reset type

The table below 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).

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
FNSL	Analog output function selection	–	0
FN	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	45
F100	Relay output – frequency level 1 attained	Hz	0.0
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

Parameters reset tables

Parameter	Description	Unit	Default Value
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	Output 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	Input Phase Loss	–	0
F305	Overvoltage fault protection	–	2
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

Parameters reset tables

Parameter	Description	Unit	Default Value
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	Frequency loop gain	–	40
F419	Frequency loop stability	–	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
F484	Power supply adjustment gain	–	0.0
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
F621	Run time alarm setting	hours	610.0 (6100 h)
F627	Undervoltage fault operation mode	–	0
F632	Motor overload memory	–	0
F633	Loss of VIA analog signal	%	0

Parameters reset tables

Parameter	Description	Unit	Default Value
F634	Ambient temperature for drive 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	Graphic display terminal display: % or A/V units	–	1
F702	Custom frequency display conversion factor	–	0
F703	Frequency free unit conversion selection	–	0
F706	Custom frequency display conversion bias	Hz	0.0
F707	Local mode speed reference step changes	Hz	0.0
F708	Graphic display terminal frequency display resolution	–	0
F710	Default graphic display terminal operational display value	–	0
F721	Local mode motor stop type	–	0
F730	Disabling of graphic display terminal speed reference change keys	–	0
F732	Disabling of graphic display terminal local/remote key	–	0
F733	Disabling of graphic display terminal RUN and STOP keys in local mode	–	0
F734	Enable / disable the local stop emergency function	–	0
F735	Disabling of graphic display terminal 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
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

Parameters reset tables

Parameter	Description	Unit	Default Value
F890	Parameter for option 1	–	(1)
F891	Parameter for option 2	–	(1)
F892	Parameter for option 3	–	(1)
F893	Parameter for option 4	–	(1)
F894	Parameter for option 5	–	(1)
F895	Parameter for option 6	–	(1)
F896	Parameter for option 7	–	(1)
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

(1) See table page 117.

Parameters reset tables

Parameter values that vary according to reset type

The table below 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.

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 tYP = 2
CMOd	drive start/stop control source	–	0	1	1
FMOd	drive 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

Parameter values that vary according to drive model, but not reset type

The table below lists the parameters whose values, after a reset, depend on the drive model.

To determine the value of a parameter after a reset, locate the drive 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).

Parameters reset tables

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

Reference	Parameter												
	ACC	dEC	uLu	ub	F171	F172	F300	F402	F494	F500	F501	F626	F748
ATV21H075M3X	10	10	200	6	200	6	12	5.8	80	10	10	140	0
ATV21HU15M3X	10	10	200	6	200	6	12	4.3	70	10	10	140	0
ATV21HU22M3X	10	10	200	5	200	5	12	4.1	70	10	10	140	0
ATV21HU30M3X	10	10	200	5	200	5	12	3.4	70	10	10	140	0
ATV21HU40M3X	10	10	200	5	200	5	12	3.4	70	10	10	140	1
ATV21HU55M3X	10	10	200	4	200	4	12	3.0	70	10	10	140	1
ATV21HU75M3X	10	10	200	3	200	3	12	2.5	70	10	10	140	1
ATV21HD11M3X	10	10	200	2	200	2	12	2.3	60	10	10	140	1
ATV21HD15M3X	10	10	200	2	200	2	12	2.0	50	10	10	140	1
ATV21HD18M3X	30	30	200	2	200	2	8	2.0	50	30	30	140	1
ATV21HD22M3X	30	30	200	2	200	2	8	1.8	50	30	30	140	1
ATV21HD30M3X	30	30	200	2	200	2	8	1.8	50	30	30	140	1
ATV21H075N4	10	10	400	6	400	6	12	5.8	80	10	10	140	0
ATV21HU15N4	10	10	400	6	400	6	12	4.3	70	10	10	140	0
ATV21HU22N4	10	10	400	5	400	5	12	4.1	70	10	10	140	0
ATV21HU30N4	10	10	400	5	400	5	12	3.4	70	10	10	140	0
ATV21HU40N4	10	10	400	5	400	5	12	3.4	70	10	10	140	1
ATV21HU55N4	10	10	400	4	400	4	12	2.6	70	10	10	140	1
ATV21HU75N4	10	10	400	3	400	3	12	2.3	70	10	10	140	1
ATV21HD11N4	10	10	400	2	400	2	12	2.2	60	10	10	140	1
ATV21HD15N4	10	10	400	2	400	2	12	1.9	50	10	10	140	1
ATV21HD18N4	30	30	400	2	400	2	8	1.9	50	30	30	140	1
ATV21HD22N4	30	30	400	2	400	2	8	1.8	50	30	30	140	1
ATV21HD30N4	30	30	400	2	400	2	8	1.8	50	30	30	140	1
ATV21HD37N4	30	30	400	2	400	2	8	1.8	50	20	20	140	1
ATV21HD45N4	30	30	400	2	400	2	8	1.7	50	20	20	140	1
ATV21HD55N4	30	30	400	2	400	2	8	1.6	40	20	20	140	1
ATV21HD75N4	30	30	400	2	400	2	8	1.5	40	20	20	140	1

Parameters reset tables

Parameter values that vary according to drive model and reset type

The table below lists lists the parameters whose values, after a reset, depend on the drive 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 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 model number and the parameter code is the parameter's value after a reset of the specified type.

Parameters whose values after a reset are drive model and reset type dependant

Reference	Factory reset tYP = 3				50 Hz reset tYP = 1							60 Hz reset tYP = 2						
	tHr	F173	F185	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
ATV21HD37N4	100	100	110	110	-	-	-	67	-	1475	-	-	-	-	67	-	1771	-
ATV21HD45N4	100	100	110	110	-	-	-	81	-	1475	-	-	-	-	71	-	1771	-
ATV21HD55N4	100	100	110	110	-	-	-	99	-	1480	-	-	-	-	86	-	1771	-
ATV21HD75N4	100	100	110	100	-	-	-	135	-	1480	-	-	-	-	114	-	1771	-

Parameters reset tables

Parameter values that do not change if reset

The parameters listed in the table below cannot be reset. The table lists the default settings of these parameters.

Parameters whose values do not change if a reset is performed

Parameter	Description	Default Value
FN	Analog output scaling	–
FNSL	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

User settings tables

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

Configuration Setting Table

Code	Page	Name	Unit	Adjustment Range / Function		Factory Setting	User Setting
FC	54	Local mode speed reference	Hz	–	LL to UL	0.0	
AUI	37	Auto ramp adaptation	-	0	Disabled	1	
				1	Enabled (ACC and dEC)		
				2	Enabled (ACC only)		
AU4	42	Macro programming	-	0	Factory setting	0	
				1	Run permissive		
				2	3-wire control		
				3	+/- speed		
				4	4–20 mA control		
CNOd	54	Remote mode start/stop control source	-	0	Control terminal logic inputs	0	
				1	graphic display terminal		
				2	Serial communication		
FNOd	54	Remote mode primary speed reference source	-	1	VIA	1	
				2	VIB		
				3	graphic display terminal		
				4	Serial communication		
				5	+/- Speed		
FNSL	83	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 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		
FN	38	Analog output scaling	-	–	–	–	

User settings tables

Code	Page	Name	Unit	Adjustment Range / Function		Factory Setting	User Setting
EYP	41	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	54	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	37	Acceleration time 1	s	–	0.0 – 3200	Model dependant	
dEC	37	Deceleration time 1	s	–	0.0 – 3200	Model dependant	
FH	59	Maximum frequency	Hz	–	30.0 – 200.0	80.0	
UL	59	High speed	Hz	–	0.5 – FH	50.0	
LL	59	Low speed	Hz	–	0.0 – UL	0.0	
uL	40	Motor rated frequency	Hz	–	25.0 – 200.00	50.0	
uLu	40	Motor rated voltage	V	230 V models	50 – 330	230	
				460 V models	50 – 660	400	
Pt	45	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	47	Motor voltage boost	%	–	0.0 – 30.0	Model dependant	
tHr	48	Motor rated current overload setting	%/A	–	10 – 100% of drive's output current rating	100%	
OLn	108	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		

User settings tables

Code	Page	Name	Unit	Adjustment Range / Function		Factory Setting	User Setting
Sr 1	90	Preset speed 1	Hz	1	LL to UL	15	
Sr2	90	Preset speed 2	Hz	1	LL to UL	20	
Sr3	90	Preset speed 3	Hz	1	LL to UL	25	
Sr4	90	Preset speed 4	Hz	1	LL to UL	30	
Sr5	90	Preset speed 5	Hz	1	LL to UL	35	
Sr6	90	Preset speed 6	Hz	1	LL to UL	40	
Sr7	90	Preset speed 7	Hz	1	LL to UL	45	
F100	92	Relay output - frequency level 1 attained	Hz	-	0.0 to FH	0.0	
F101	92	Relay output - frequency level 2 attained	Hz	-	0.0 to FH	0.0	
F102	93	Frequency attained detection band	Hz	-	0.0 to FH	2.5	
F108	89	Always active logic function 1	-	0 – 71	See table on pages 67 to 69	0	
F109	80	VIA input function (analog or logic selection)	-	0	Analog input	0	
				1	Logic input – sink (negative logic)		
				2	Logic input – source (positive logic)		
F110	89	Always Active logic function 2	-	0 – 72	See table on pages 67 to 69	1	
F111	80	F logic input function	-	0 – 72	See table on pages 67 to 69	2	
F112	80	R logic input function	-	0 – 72	See table on pages 67 to 69	6	
F113	80	RES logic input function	-	0 – 72	See table on pages 67 to 69	10	
F118	80	VIA logic input function	-	0 – 72	See table on pages 67 to 69	7	
F130	85	RY-RC relay primary function	-	0 – 61, 254, 255	See table on pages 72 to 76	4	
F132	85	FL relay function	-	0 – 61, 254, 255	See table on pages 72 to 76	11	
F137	92	RY-RC relay secondary function	-	0 – 61, 254, 255	See table on pages 72 to 76	255	
F139	92	RY-RC relay function logic selection	-	0	F130 (primary) and F137 (secondary)	0	
				1	F130 (primary) or F137 (secondary)		
F146	85	Delay for RY-RC Relay	s	-	0.0 – 60.0 s	0.0	
F147	85	Delay for FL Relay	s	-	0.0 – 60.0 s	0.0	
F160	81	Threshold logic for relay link to VIA	%	-	0 – 100	0	
F161	81	Hysteresis threshold for logic relay link to VIA	%	-	0 – 20	3	
F162	81	Threshold logic for relay link to VIB	%	-	0 – 100	0	
F163	81	Hysteresis threshold for logic relay link to VIB	%	-	0 – 20	3	
F167	93	Frequency command agreement detection range	Hz	-	0.0 to FH	2.5	
F170	52	Motor 2 rated frequency	Hz	-	25.0 to 200.0	50.0	

User settings tables

Code	Page	Name	Unit	Adjustment Range / Function		Factory Setting	User Setting
F171	52	Motor 2 rated voltage	V	230V model	50 to 330	230	
				460V model	50 to 660	400	
F172	52	Motor 2 voltage boost	%	-	0 – 30	Model dependant	
F173	52	Motor 2 rated current overload setting	%/A	-	10 – 100% of drive rating	100	
F185	52	Motor 2 current limit	%/A	-	10 – 110%	110	
F200	83	Auto/manual speed reference switching	-	0	Enabled	0	
				1	Disabled		
F201	81	VIA speed reference level 1	%	-	0 – 100	0	
F202	81	VIA output frequency level 1	Hz	-	0.0 – 200.0	0.0	
F203	81	VIA speed reference level 2	%		0 – 100	100	
F204	81	VIA output frequency level 2	Hz		0.0 – 200.0	50.0	
F207	56	Remote mode secondary speed reference source	-	1	VIA	2	
				2	VIB		
				3	graphic display terminal		
				4	Serial communication		
				5	+/– Speed		
F210	81	VIB speed reference level 1	%		0 – 100	0	
F211	81	VIB output frequency level 1	Hz		0.0 – 200.0	0.0	
F212	81	VIB speed reference level 2	%		0 – 100	100	
F213	81	VIB output frequency level 2	Hz		0.0 – 200.0	50.0	
F240	60	Output starting frequency	Hz	-	0.5 – 10.0	0.5	
F241	114	Operating starting frequency	Hz	-	0.0 – FH	0.0	
F242	114	Operating starting frequency hysteresis	Hz	-	0.0 – FH	0.0	
F250	66	DC braking starting frequency	Hz	-	0.0 – FH	0.0	
F251	66	DC braking current level	%/A	-	0 – 100%	50	
F252	66	DC braking time	s	-	0.0 – 20.0	1.0	
F256	56	Sleep/wake Operation	s	Disabled	0.0	0.0	
				Enabled	0.1 – 600.0		
F264	91	+ speed logic input response time	s	-	0.0 – 10.0	0.1	
F265	91	+ speed frequency steps	Hz	-	0.0 – FH	0.1	
F266	91	- speed logic input response time	s	-	0.0 – 10.0	0.1	
F267	91	- speed frequency steps	Hz	-	0.0 – FH	0.1	
F268	91	Initial +/- speed frequency	Hz	-	0.0 – FH	0.0	
F269	91	Reset of initial +/- speed frequency	-	0	Disabled	1	
				1	Enabled		
F270	65	Skip frequency 1 midpoint	Hz	-	0.0 – FH	0.0	
F271	65	Skip frequency 1 bandwidth	Hz	-	0.0 – 30.0	0.0	
F272	65	Skip frequency 2 midpoint	Hz	-	0.0 – FH	0.0	
F273	65	Skip frequency 2 bandwidth	Hz	-	0.0 – 30.0	0.0	

User settings tables

Code	Page	Name	Unit	Adjustment Range / Function		Factory Setting	User Setting
F274	65	Skip frequency 3 midpoint	Hz	-	0.0 – FH	0.0	
F275	65	Skip frequency 3 bandwidth	Hz	-	0.0 – 30.0	0.0	
F294	57	Forced speed frequency	Hz	-	LL – UL	50.0	
F295	55	Bumpless transfer from remote to local control	-	0	Disabled	1	
				1	Enabled		
F300	64	Switching frequency level	kHz	-	6.0 – 16.0	Model dependant	
F301	99	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		
F302	100	Cost to stop on momentary loss of input power	-	0	Disabled	0	
				1	DO NOT SELECT		
				2	Coast to stop		
F303	97	Auto fault reset	-	0	Disabled	3	
				1-10	Number of fault reset attempts		
F305	101	Overvoltage fault protection	-	0	Enabled	2	
				1	Disabled		
				2	Enabled (quick deceleration mode)		
				3	Enabled (dynamic quick deceleration mode)		
F307	51	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	57	Motor rotation direction command	-	0	Forward and Reverse operation PERMITTED	1	
				1	Reverse operation PROHIBTED		
				2	Forward operation PROHIBITED		
F312	64	Switching frequency random mode	-	0	Disabled	0	
				1	Enabled		
F316	64	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	115	Droop gain	%	-	0 – 100%	0	
F323	115	Droop insensitive torque band	%	-	0 – 100%	10	

User settings tables

Code	Page	Name	Unit	Adjustment Range / Function		Factory Setting	User Setting
F359	87	PID control waiting time	s	-	0 – 2400	0	
F360	86	PID control enable	-	0	PID disabled	0	
				1	Enabled – feedback source: VIA		
				2	Enabled – feedback source: VIB		
F362	86	PID proportional gain	-	-	0.01 – 100.0	0.30	
F363	86	PID Integral gain	-	-	0.01 – 100.0	0.20	
F366	87	PID derivative gain	-	-	0.00 – 2.55	0.00	
F380	87	PI regulator reversal direction correction	-	0	No	0	
				1	Yes		
F391	87	Stop on LL hysteresis	Hz	-	0.0 – FH	0.2	
F392	87	PI wake up threshold on PI error	Hz	-	0.0 – FH	0.0	
F393	87	PI wake up threshold on PI feedback error	Hz	-	0.0 – FH	0.0	
F400	49	Auto tuning enable	-	0	Disabled	0	
				1	Enabled – parameter F402 may need adjustment		
				2	Enabled – complete auto tuning		
F401	53	Slip compensation	%	-	0 – 150	50	
F402	53	Auto torque boost	%	-	0.0 – 30.0	Model dependant	
F415	48	Motor rated full load current	A	-	0.1 – 200.0	Model dependant	
F416	48	Motor no–load current	%	-	10.0 – 100.0	Model dependant	
F417	48	Motor rated speed	rpm	-	100 – 15,000	Model dependant	
F418	53	Frequency loop gain	-	-	1 – 150	40	
F419	53	Frequency loop stability	-	-	1 – 100	20	
F470	82	VIA analog input bias	-	-	0 – 255	128	
F471	82	VIA analog input gain	-	-	0 – 255	148	
F472	82	VIB analog input bias	-	-	0 – 255	128	
F473	82	VIB analog input gain	-	-	0 – 255	148	
F480	50	Magnetizing current coefficient	-	-	100 – 130	100	
F481	106	Line noise compensation filter	µs	-	0 – 9999	0	
F482	106	Line noise inhibitor filter	µs	-	0 – 9999	442	
F483	106	Line noise inhibitor gain	-	-	0.0 – 300.0	100.0	
F484	106	Power supply adjustment gain	-	-	0.0 to 2.0	0.0	
F485	50	Stall prevention control coefficient 1	-	-	10 – 250	100	
F492	50	Stall prevention control coefficient 2	-	-	50 – 150	100	
F494	50	Motor adjustment coefficient	-	-	DO NOT ADJUST	Model dependant	
F495	50	Maximum voltage adjustment coefficient	%	-	90 – 120	104	
F496	50	Waveform switching adjustment coefficient	kHz	-	0.1 – 14.0	14.0	
F500	61	Acceleration time 2	s	1	0.0 – 3200	20.0	
F501	61	Deceleration time 2	s	1	0.0 – 3200	20.0	

User settings tables

Code	Page	Name	Unit	Adjustment Range / Function		Factory Setting	User Setting
F502	61	Acc/Dec pattern 1	-	0	Linear	0	
				1	S-pattern 1		
				2	S-pattern 2		
F503	62	Acc/Dec pattern 2	-	0	Linear	0	
				1	S-pattern 1		
				2	S-pattern 2		
F504	63	Acc/Dec pattern selection (ramp switching)	-	1	Acc/Dec pattern 1	1	
				2	Acc/Dec pattern 2		
F505	63	Acc/Dec pattern switching frequency	Hz	-	0.0 – UL	0.0	
F506	62	Acc/Dec S-pattern lower limit	%	-	0 – 50	10	
F507	62	Acc/Dec S-pattern upper limit	-	-	0 – 50	10	
F601	47	Motor current limit	%/A	-	10 – 110%	110%	
F602	100	Drive fault memory	-	0	Cleared	0	
				1	Retained		
F603	93	External fault stop mode	-	0	Freewheel stop	0	
				1	Ramp stop		
				2	DC injection braking		
F604	93	External fault DC braking time	s	-	0.0 – 20.0	1.0	
F605	102	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	48	Motor overload time	s	-	10 – 2400	300	
F608	100	Input phase failure detection mode	-	0	Disabled	1	
				1	Enabled		
F609	103	Underload detection level bandwidth	%	-	1 – 20	10	
F610	103	Underload fault/alarm selection	-	0	Alarm	0	
				1	Fault		
F611	103	Underload detection level	%/A	-	0 – 100%	0	
F612	103	Underload detection time	s	-	0 – 255	0	
F613	104	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	105	Overtorque fault/alarm selection	-	0	Alarm	0	
				1	Fault		
F616	105	Overtorque detection level	%	-	0 – 250	130	
F618	105	Overtorque detection time	s	-	0.0 – 10.0	0.5	

User settings tables

Code	Page	Name	Unit	Adjustment Range / Function		Factory Setting	User Setting
F619	105	Overtorque detection level bandwidth	%	-	0 – 100%	10	
F621	95	Run time alarm setting	h	-	0.0 – 999.9 (0.1 = 1 hour, 100 = 1000 hours)	610.0	
F626	101	Overvoltage fault operation level	%	1	100 – 150% of nominal DC bus voltage	140	
F627	101	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	100	Motor overload memory	-	0	Cleared	0	
				1	Retained		
F633	104	Loss of VIA analog signal	%	0	Disabled	0	
				1 – 100	Fault detection level		
F634	106	Ambient temperature for drive 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		
F644	104	Drive behaviour on 4-20 event	-	0	No	0	
				1	Freewheel		
				2	Fallback speed		
				3	Speed maintain		
				4	Ramp stop		
F645	88	PTC motor thermal protection enable	-	0	disabled	0	
				1	Enabled (fault mode)		
				2	Enabled (alarm mode)		
F646	88	PTC resistor value	Ω	-	100 – 9999	3000	
F649	104	Fallback speed	Hz	-	0 – FH Hz	0	
F650	57	Forced speed enable	-	0	Disabled	0	
				1	Enabled		
F691	84	Analog output slope	-	0	Negative slope	1	
				1	Positive slope		
F692	84	Analog output bias	%	-	0 – 100%	0	
F694	84	Low frequency when analog output equal 0 V	Hz	-	0 – FH Hz	0	
F695	84	High frequency when analog output equal 0 V	Hz	-	0 – FH Hz	0	
F700	43	Parameter lock	-	0	All parameters are unlocked and can be changed. But see table on page 23 for those that cannot be changed while the drive is running	0	
				1	Only parameter F700 can be changed.		
F701	94	Graphic display terminal display: % or A/V unit	-	0	%	1	
				1	A (amperes) or V (volts)		

User settings tables

Code	Page	Name	Unit	Adjustment Range / Function		Factory Setting	User Setting
F702	95	Custom frequency display conversion factor	-	0	Frequency displayed in Hz	0	
				0.01 – 200.0	Conversion factor		
F703	95	Frequency free unit conversion selection	-	0	All frequencies display free unit	0	
				1	PID frequencies free unit conversion		
F705	96	Custom frequency display conversion slope	-	0	Negative slope	1	
				1	Positive slope		
F706	96	Custom frequency display conversion bias	Hz	-	0.00 – FH	0.00	
F707	55	Local mode speed reference step changes	Hz	Disabled	0.00	0.00	
				Enabled	0.01 – FH		
F708	94	Graphic display terminal frequency display resolution	-	0	Disabled – 0.1 Hz steps	0	
				1 – 255	See formula on page 95		
F710	94	Default graphic display terminal operational display value	-	0	Motor operating frequency, (Hz or custom display, see F702 page 95)	0	
				1	Speed reference, (Hz or custom display, see F702 page 95)		
				2	Motor current, (% or A, see F701 page 94)		
				3	drive rated current (A)		
				4	drive thermal state (%)		
				5	Output power (kW)		
				6	Internal speed reference (after PID function), (Hz or custom display, see F702 page 95)		
				7	Serial communication data		
				8	Output speed (rpm, see F417 page 48)		
				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	55	Local mode motor stop type	-	0	Ramp stop	0	
				1	Freewheel stop		
F730	58	Disabling of graphic display terminal speed reference change keys	-	0	Enabled	0	
				1	Disabled		
F732	58	Disabling of graphic display terminal local/remote key	-	0	Permitted (still retained with the power off)	0	
				1	Prohibited		
				2	Permitted (cancelled with the power off)		

User settings tables

Code	Page	Name	Unit	Adjustment Range / Function		Factory Setting	User Setting
F733	58	Disabling of graphic display terminal RUN and STOP keys in local mode	-	0	Enabled	0	
				1	Disabled		
F734	58	Enable / disable the local stop emergency function	-	0	Enabled	0	
				1	Disabled		
F735	58	Disabling of graphic display terminal fault reset function	-	0	Enabled	1	
				1	Disabled		
F738	43	Display of submenu AUF	-	0	AUF displayed	0	
				1	AUF not displayed		
F748	95	Accumulated power consumption memory	-	0	Disabled	1	
				1	Enabled		
F749	95	Accumulated power consumption display unit	kWh	0	1 kWh	Model dependant	
				1	0.1 kWh		
				2	0.01 kWh		
				3	0.001 kWh		
F800	110	Baud rate	-	0	9600 bps	1	
				1	19200 bps		
F801	110	Parity	-	0	No parity	1	
				1	Even parity		
				2	Odd parity		
F802	110	Address	-	-	0 – 247	1	
F803	110	Time-out	s	0	Communication error detection disabled	3	
				1-100	Seconds		
F829	117	Protocol	-	0	DO NOT USE	1	
				1	Modbus RTU		
				2	Metasys N2		
				3	Apogee P1 FLN		
				4	BACnet		
F851	110	Communication fault setting	-	0	drive ramps to a stop. Serial control is relinquished to the sources defined by FNOd and CNOd.	4	
				1	Last commanded operation continues		
				2	drive ramps to a stop. Serial control is maintained.		
				3	drive removes power from the motor which coasts to a stop. Serial control is maintained.		
				4	drive faults with either a communication error ErrS or a network error ErrB.		

User settings tables

Code	Page	Name	Unit	Adjustment Range / Function		Factory Setting	User Setting
F856	111	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		
F870	111	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	111	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	111	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		

User settings tables

Code	Page	Name	Unit	Adjustment Range / Function		Factory Setting	User Setting
F876	112	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		
F877	112	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	113	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		

User settings tables

Code	Page	Name	Unit	Adjustment Range / Function		Factory Setting	User Setting
F879	113	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	113	Free notes	-	-	0 – 65535	0	
F890	117	Parameter for option 1	-	-	0 – 65535	(1)	
F891	117	Parameter for option 2	-	-	0 – 65535	(1)	
F892	117	Parameter for option 3	-	-	0 – 65535	(1)	
F893	117	Parameter for option 4	-	-	0 – 65535	(1)	
F894	117	Parameter for option 5	-	-	0 – 65535	(1)	
F895	117	Parameter for option 6	-	-	0 – 65535	(1)	
F896	117	Parameter for option 7	-	-	0 – 65535	(1)	
F910	116	Permanent magnet motor step-out detection current level	%/A	-	10 – 150%	100	
F911	116	Permanent magnet motor step-out detection time	s	0	Disabled	0.00	
				0.01-25	Enabled		
F912	116	Permanent magnet motor high-speed torque adjustment coefficient	-	-	DO NOT ADJUST	0.00	

(1) See table page 117.

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