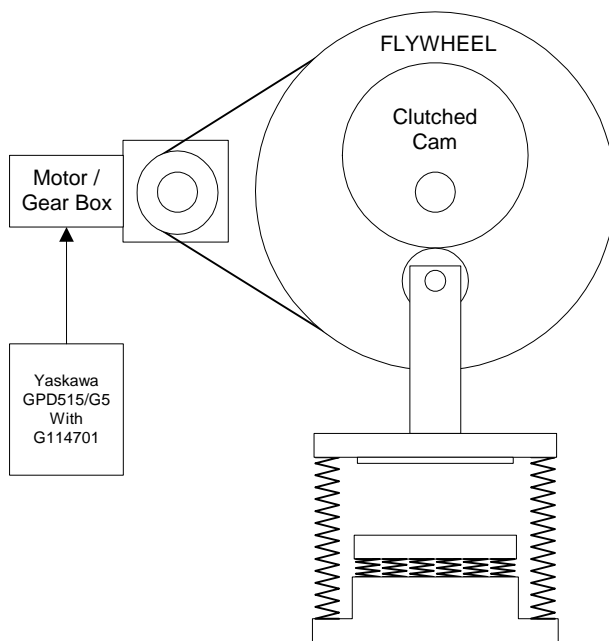


GPD515/G5 Software Option (VSG114701)
Part Number: CIMR-G5MXXXXXF-017⁽¹⁾

A Yaskawa GPD515/G5 inverter with this software can control rotating loads where the motor is overhauled by stored energy during part of the machine's cycle. The following example illustrates the type of application that will require this software.

Example Application



This example demonstrates two ways that the motor may be forced into regeneration. The first is when the cam clutch is not engaged. The motor can accelerate and drive the flywheel. There is no problem until the speed of the motor is reduced. The inertia from the flywheel will

overhaul the motor forcing regeneration into the GPD515/G5. The second is when the cam clutch is engaged. The motor in the example will drive the flywheel for one-half of a revolution compressing the springs. After the highest point of the cam moves past the center of the cam follower the springs will begin to release their energy into the flywheel for the next half of a revolution. This can overhaul the motor forcing regeneration into the GPD515/G5.

This software monitors and regulates the DC bus voltage by making adjustments to the deceleration rate and accelerating the motor to control regeneration. During periods when the speed has been reduced the deceleration rate is controlled. When the speed reference is constant and regeneration is detected the drive accelerates the motor to remove the condition. The necessary parameters are provided to enable control and limit these features.

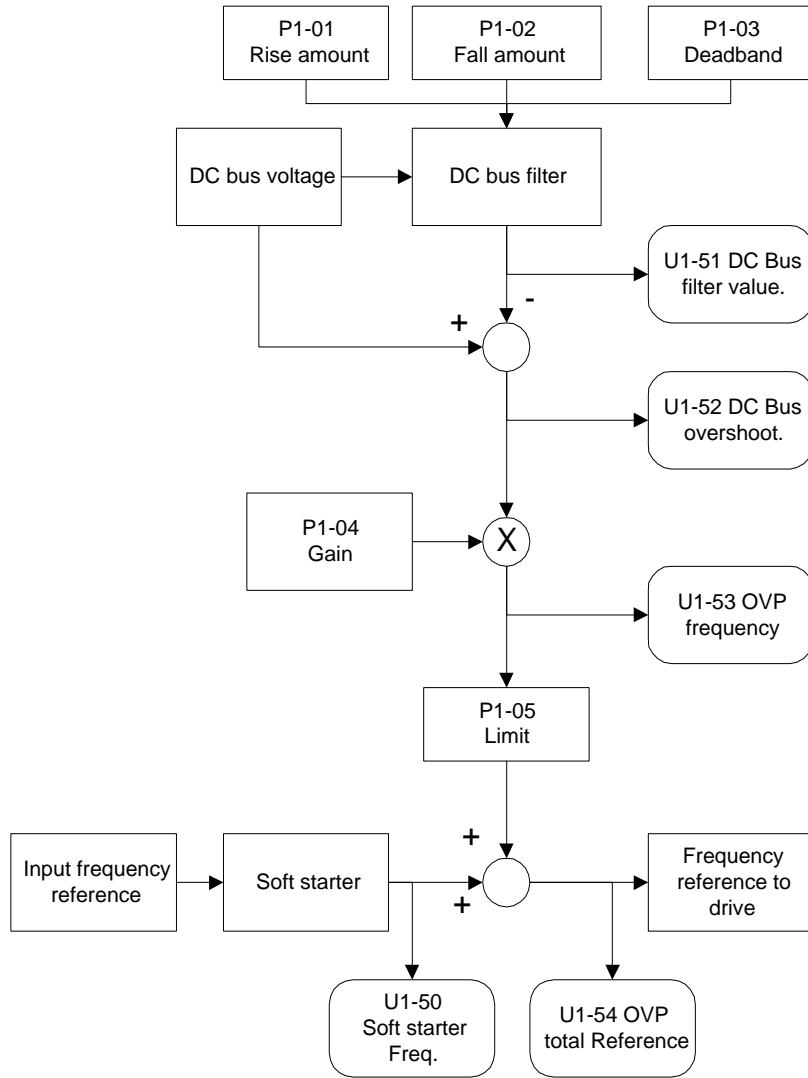
This software does not support ramp to stop. It defaults to coast to stop.

This document is an addendum to Technical Manual TM 4515. It contains the effect of this software on the parameters in the drive and function descriptions in the manual.

This software can be setup to operate in 230 – 575 VAC GPD515/G5 units. The default settings are for 480 VAC units.

⁽¹⁾ ZZZZ refers to the base Model Number of drive to be flashed with the software.

Flowchart

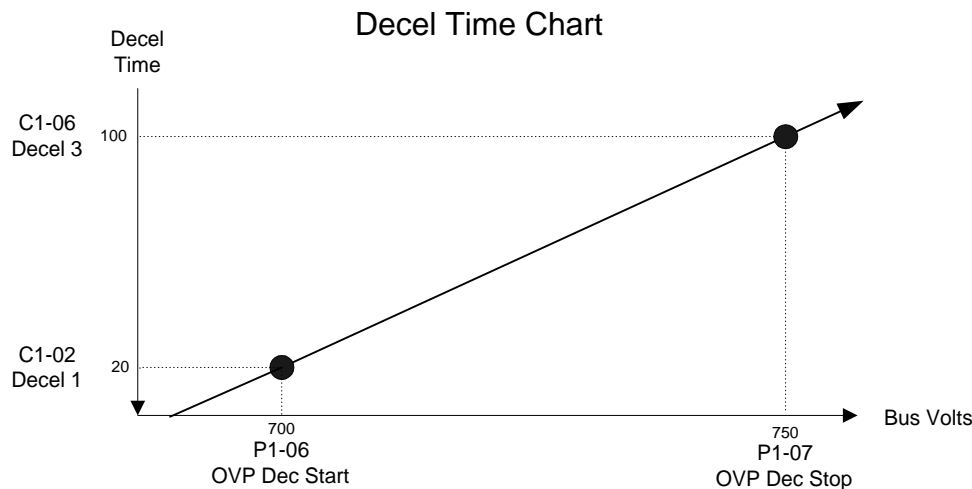


Acceleration OVP

The DC bus filter is used to provide a stable bus reference needed to determine sudden changes in the DC bus. It should not fluctuate with short periods of regeneration. It also provides a floating threshold that will adjust to normal AC line fluctuations. The filter buildup rate is controlled by P1-01: DC Filter Rise. When the DC bus is above the filter + P1-03: Filter Deadband it will rise. The filter decrement rate is controlled by P1-02: DC Filter Fall. When the DC bus is below the filter minus P1-03 the filter will fall. The filter may be monitored via U1-51: DC Bus Filter. This filter should be setup to fall much faster than it rises.

When the drive is running and the speed reference is constant the software monitors for DC Bus Overshoot. The DC Bus Overshoot is the rise of the DC Bus that exceeds the sum of the DC Bus Filter + P1-03: Filter Deadband. If this value is negative it is set to zero. U1-52: DC Bus Overshoot may be used to monitor this value. The DC bus overshoot is multiplied by P1-04: OVP Fref gain and is converted into a frequency reference. This reference may be monitored via U1-53: OVP Frequency and will be added to the existing frequency reference. The result of this may be monitored via U1-54: Total Ref. Acceleration will occur controlling regeneration into the inverter when there is a U1-52: DC Bus Overshoot value. The rate of acceleration is controlled by C1-01: Accel Time 1. The inverter will return to the input speed reference as the overshoot decreases. The rate of deceleration is determined based on the DC bus voltage and typically will range from C1-02: Decel Time 1 to C1-06: Decel Time 3. This is covered in the Deceleration OVP section.

Deceleration OVP



The deceleration OVP only functions when the speed reference is lowered. When the drive is stopped the deceleration rate is set to C1-04: Decel Time 2. When the drive must decelerate after an overshoot correction it will use the deceleration OVP value. C1-03: Accel Time 2 and C1-04: Decel Time 2 are used by the drive for normal speed regulation. Above is a graphical representation of the deceleration OVP portion of this software. At the DC voltage in P1-06: OVP Dec Start the deceleration rate will be the value in C1-02: Decel Time 1. When the DC bus voltage rises above this level the deceleration time will increase as indicated. The deceleration time will be at the value of C1-06: Decel Time 3 when the DC bus voltage is equal to P1-07: OVP Dec Stop. The decel rate will change linearly along the slope defined by the starting point C1-02: Decel Time 1, P1-06: OVP Dec Start and the second point C1-06: Decel Time 3, P1-07: OVP Dec Stop.

Startup Procedure

There are no special procedures beyond setting parameters P1-06 and P1-07 to the correct voltage range. The default settings are for 480-volt drives.

Changed Factory Parameters

New Defaults.

B1-03 = 1	Coast to Stop	– Recommended setting
C1-01 = 5.0	Accel Time 1	– Controls the acceleration rate when the speed reference is increased
C1-02 = 25.0	Decel time 1	– Lower set point of the deceleration OVP rate
C1-03 = 0.5	Accel time 2	– Used as the acceleration rate during speed regulation
C1-04 = 0.5	Decel time 2	– Used as the deceleration rate during speed regulation and stopping
C1-06 = 100.0	Decel time 3	– Upper set point of the deceleration OVP rate
C2-01 = 0.0	S Curve at start of accel	– S curve should be off in this software
C2-02 = 0.0	S Curve at end of accel	– S curve should be off in this software
C2-03 = 0.0	S Curve at start of decel	– S curve should be off in this software

Custom software Parameters

New Program Group

Group P OV Prevention

New Program Function

Function P1 OV Parameters

New Program Parameters

P1-01 DC Filter Rise amount per scan

B	B	B	B
---	---	---	---

DC Filter Rise P1-01= 0.01 Vdc

Setting Range: 0.00 to 1.00 Vdc
 Factory Default: 0.01
 Modbus Address: 0x580

The DC Filter Rise amount will be added to the DC bus filter when the DC bus voltage exceeds the value of the DC bus filter + P1-03: Deadband. This value will be added at a rate of 20 times a second. Using the default value results in a rate of 0.20 Vdc per second.

P1-02 DC Filter Fall amount per scan

B	B	B	B
---	---	---	---

DC Filter Fall P1-02= 0.50 Vdc

Setting Range: 0.00 to 1.00 Vdc
 Factory Default: 0.50
 Modbus Address: 0x581

The DC Filter Fall will be subtracted from the DC bus filter when the DC bus voltage is below the value of the DC bus filter - P1-03: Deadband. This value will be subtracted at a rate of 20 times a second. Using the default value results in a rate of 1.00 Vdc per second.

P1-03 DC Filter Deadband amount

B	B	B	B
---	---	---	---

Filter Deadband P1-03= 10.0 Vdc
--

Setting Range: 0.0 to 99.0 Vdc
 Factory Default: 10.0
 Modbus Address: 0x582

The dead band is the +/- amount that the DC bus must change before the DC bus filter will be changed. This parameter provides a means of preventing OVP corrections for normal DC bus fluctuations.

P1-04 Over Voltage Prevention Frequency Reference Gain

B	B	B	B
---	---	---	---

OVP Fref Gain P1-04= 0.050

Setting Range: 0.000 to 1.000
 Factory Default: 0.050
 Modbus Address: 0x583

The Over Voltage prevention frequency reference gain value is used to convert the DC bus overshoot into the frequency added to accelerate the drive preventing regeneration. The added frequency may be monitored using U1-53: OVP Frequency. The DC bus overshoot is equal to the DC bus voltage – (DC bus filter + P1-03: Deadband). This value may be monitored using U1-51: DC Bus Overshoot. The DC bus overshoot is multiplied by P1-04: Fref gain which yields the frequency to be added to the frequency reference and may be monitored using U1-53: OVP Frequency. The sum of the references may be monitored using U1-54: Total Ref. The drive follows this reference.

Example:

If the DC bus overshoot is 20 volts, the drive would add 1.0 hertz to it's output. (20 volts x 0.050 gain = 1.0 Hz)

P1-05 Over Voltage Prevention Frequency Limit

B	B	B	B
---	---	---	---

OVP Freq. Limit P1-05= 5.00 Hz

Setting Range: 0.00 to 10.00 Hz
 Factory Default: 5.00
 Modbus Address: 0x584

The OVP frequency limit is the maximum OVP frequency that may be added to the frequency reference accelerating the drive to prevent regeneration. The actual frequency being added may be monitored using U1-53: OVP Frequency.

P1-06 Over Voltage Prevention Deceleration Start Voltage

B	B	B	B
---	---	---	---

OVP Dec Start P1-06= 700 Vdc

Setting Range: 200 to 810 Vdc
 Factory Default: 700
 Modbus Address: 0x585

The OVP Deceleration Start voltage parameter is the DC bus voltage level where the deceleration rate starts increasing to prevent the DC bus voltage from climbing higher.

Recommended settings for different voltage units:

230 VAC – P1-06 = 300 VDC

480 VAC – P1-06 = 700 VDC

575 VAC – P1-06 = 950 VDC

P1-07 Over Voltage Prevention Decel Stop Voltage

B	B	B	B
---	---	---	---

OVP Dec Stop P1-07= 750 Vdc
--

Setting Range: 200 to 1200 Vdc
 Factory Default: 750
 Modbus Address: 0x586

The OVP Deceleration Stop is the DC bus level where the deceleration rate will be set to C1-06. It may be used to control the rate of the deceleration rate's change.

Recommended settings for different voltage units:

- 230 VAC – P1-07 = 350 VDC
- 480 VAC – P1-07 = 750 VDC
- 575 VAC – P1-07 = 1000 VDC

New Monitors

U1-50 Soft Starter Frequency

B	B	B	B
---	---	---	---

Soft Start Freq. 0.00 Hz

Range: 0 to 400.00 Hz
 Modbus Address: 0x00d0

Displays the value of frequency coming out of the soft starter algorithm.

U1-51 DC Bus Filter Value

B	B	B	B
---	---	---	---

DC Bus Filter 620.0 Vdc
--

Range: 0 to 1200.0 Vdc
 Modbus Address: 0x00d1

Displays the value of the DC bus filter.

U1-52 DC Bus Overshoot Voltage

B	B	B	B
---	---	---	---

DC Bus Overshoot 0.0 Vdc

Range: 0 to 1200.0 Vdc
 Modbus Address: 0x00d2

Displays the difference between the value of the DC bus filter and actual DC bus voltage.

U1-53 Over Voltage Prevention Frequency

B	B	B	B
---	---	---	---

OVP Frequency 0.00 Hz

Range: 0 to 10.00 Hz
 Modbus Address: 0x00d3

Displays the amount of frequency added to the frequency reference accelerating the motor to prevent regeneration. This is limited by P1-05.

U1-54 Over Voltage Prevention Total Frequency Reference

B	B	B	B
---	---	---	---

OVP Total Ref. 0.00 Hz

Range: 0 to 327.67 Hz
 Modbus Address: 0x00d4

Displays the value of frequency reference controlling the drive output. This is the OVP frequency + the frequency reference.