Detroit Hoist
Since 1905

Hitachi Hoist & Traverse

Basic Instruction Manual

Firmware V.14+

DETROIT HOIST AND CRANE LLC, CO.

6650 STERLING DRIVE NORTH
STERLING HEIGHTS MICHIGAN 48312

Introduction

This manual only applies to Hitachi VFD's programmed with firmware version 14 or higher. Please verify the version by checking parameter D024

Each Detroit Hoist comes equipped with Hitachi variable frequency drives to control each supplied motion and in most cases will not require any field adjustment. If adjustments or different configurations are required, use this manual to make those changes or contact *Detroit Hoist technical department 1 (800) 521-9126*.

Pushbutton VFD Operation Explanation

Pushbutton Action	VFD Action				
	2-Speed	2-Speed Inf.Var	3-Speed	3-Speed Inf.Var	0-10V POT
Press to 1st step	Accelerates to 1st speed frequency.	Accelerates to 1st speed frequency.	Accelerates to 1st speed frequency.	Accelerates to 1st speed frequency.	Accelerates to 1st speed frequency or frequency determined by 0-10V reference
Press to 2nd step	Accelerates to 2nd speed frequency.	Accelerates to 2nd speed frequency.	Accelerates to 2nd speed frequency.	Maintains the speed frequency before the button was pushed to the 2nd step.	N/A
Press to 3rd step	N/A	N/A	Accelerates to 3rd speed frequency.	Accelerates to 3rd speed frequency.	N/A
Release to 2nd step	N/A	N/A	Decelerates 2nd speed frequency.	Maintains speed before the button was released to the 2nd step.	N/A
Release to 1st step	Decelerates to 1st speed frequency.	Maintains speed frequency before the button was released to the 1st Step.	Decelerates to 1st speed frequency.	Decelerates to 1st speed frequency.	N/A
Complete release from any step	Decelerates to braking frequency and sets motor brake	Decelerates to braking frequency and sets motor brake	Decelerates to braking frequency and sets motor brake	Decelerates to braking frequency and sets motor brake	Decelerates to braking frequency and sets motor brake

Wiring in Pushbutton Controls

Please use the chart as a reference for connecting the pushbutton wires to the corresponding control terminals. Please refer to supplied electrical schematic for proper installation. Terminals may vary based on model.

2-Step & 3-Step Control Wiring

Pushbutton Wires	Control Terminals On Control Panel
Hoist Up Direction	HU
Hoist Down Direction	HD
Hoist 2nd Speed / 2nd Step	H2
Hoist 3rd Speed / 3rd Step	110vac to input 6 on interface card 24vdc to input 6 on VFD if no interface card
Traverse Forward Direction	TF / BF
Traverse Reverse Direction	TR / BR
Traverse 2nd Speed / 2nd Step	T2 / B2
Traverse 3rd Speed / 3rd Step	110vac to input 6 on interface card 24vdc to input 6 on VFD if no interface card

Analog 0-10V Potentiometer

Controller	Control Terminals On Control Panel
Hoist Up Direction	HU
Hoist Down Direction	HD
Hoist Analog 10V Reference	Terminal H on Hoist VFD
Hoist Analog Ground Reference	Terminal L bottom row on Hoist VFD
Hoist Analog Input Reference	Terminal O on Hoist VFD
Traverse Forward Direction	TF / BF
Traverse Reverse Direction	TR / BR
Traverse Analog 10V Reference	Terminal H on Traverse VFD
Traverse Analog Ground Reference	Terminal L bottom row on Traverse VFD
Traverse Analog Input Reference	Terminal O on Traverse VFD

Configuring Speed Control Methods

All Detroit Hoist controls come pre-configured for 2-Step speed control unless otherwise specified. Detroit Hoist controls are designed to be easily configured for 2-Step, 2-Step Infinitely Variable, 3-Step, 3-Step Infinitely Variable, and an External Potentiometer speed control methods. The following will guide you in changing the speed control methods.

Speed Control Methods	Changes To Make
2-Step	**Default From Factory** (1) Turn switch located on the side of the enclosure from INF VAR to TWO SPEED (2) If no switch is available Set VFD Parameter C017 = 00 (3) Set VFD Parameter C006 = NO / 255 (4) Set VFD Parameter P102 = 2nd Speed Frequency *(see note)*
2-Step Infinitely Variable	(1) Turn switch located on the side of the enclosure from TWO SPEED to INF VAR. (2) If no switch is available Set VFD Parameter C017 = 01
3-Step	(1) Change VFD Parameter C006 = 61 (2) Set VFD Parameter P102 = 2nd Speed Frequency *(see note)* (3) Set VFD Parameter P103 = 3rd Speed Frequency *(see note)*
3-Step Infinitely Variable	(1) Turn switch located on the side of the enclosure from TWO SPEED to INF VAR (2) If no switch is available Set VFD Parameter C017 = 01 (3) Set VFD Parameter C006 = 61 (4) Set VFD Parameter P103 = 3rd Speed Frequency *(see note)*
Analog 0-10V	0V = Low Speed VFD Parameter P101 *(see note)* 10V = High Speed VFD Parameter P102 *(see note)*

Note – Speed frequency parameters P100 thru P104 are represented as a whole number. See example below to understand how to set the speed parameters.

Example: 10.00 Hz – P100 = 1000

Example: 15.00 Hz – P101 = 1500

Example: 39.99 Hz – P102 = 3999

Configuring Speed Parameters

Speeds	VFD Parameters
Limit Area Speed	P100
1st Step / 1st Speed	P101
2nd Step / 2nd Speed	P102
3rd Step / 3 Speed	P103
Auto Speed	P104

Limit Area Speed – This frequency speed setting is used in hoisting and traverse modes. This is the frequency speed the VFD will force to when input 4 is off on the VFD. This is used in hoisting when approaching the upper and lower limits as well as can be used for travel limits in traverse mode to force to slow speed.

1st Step / 1st Speed – This is the 1st speed / low speed frequency setting. This will be the 1st speed frequency as long as input 4 is on.

2nd Step / 2nd Speed – This is the 2nd speed / 2nd step frequency setting. This is also the high speed setting for 0-10V external POT

3rd Step / 3 Speed – This is the 3rd speed / 3rd step frequency setting.

Auto Speed – This is the Auto speed frequency setting. This is used in hoisting only. This is the speed in which the hoist VFD will allow when lifting a light load or empty hook. (Do not exceed 90HZ)

Note – Speed frequency parameters P100 thru P104 are represented as a whole number. See example below to understand how to set the speed parameters.

Example: 10.00 Hz – P100 = 1000

Example: 15.00 Hz – P101 = 1500

Example: 39.99 Hz – P102 = 3999

125% Load Testing

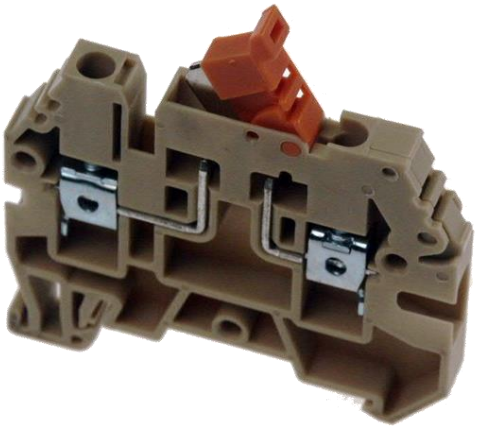
Each hoist is live load tested at 125% at the Detroit Hoist factory prior to shipment, to pass inspection. If additional field testing is required, please use the provided instructions to do so.

(Step 1) Locate over-weight bypass switch and open it (see images below for BPS switch example).

(Step 2) Proceed to lift 125% of rated capacity. Once the 125% load is off the ground test all motions to ensure proper movement.

(Step 3) If all motions had proper movement then go to step 4. If any of the motions did not move properly, please use the Manual Torque Boost parameters on the next page to increase the torque to attempt to move the load. If this is a closed loop application please contact Detroit Hoist for further assistance. If after adjusting the Manual Torque Boost parameters the load will still not move please contact Detroit Hoist for further assistance.

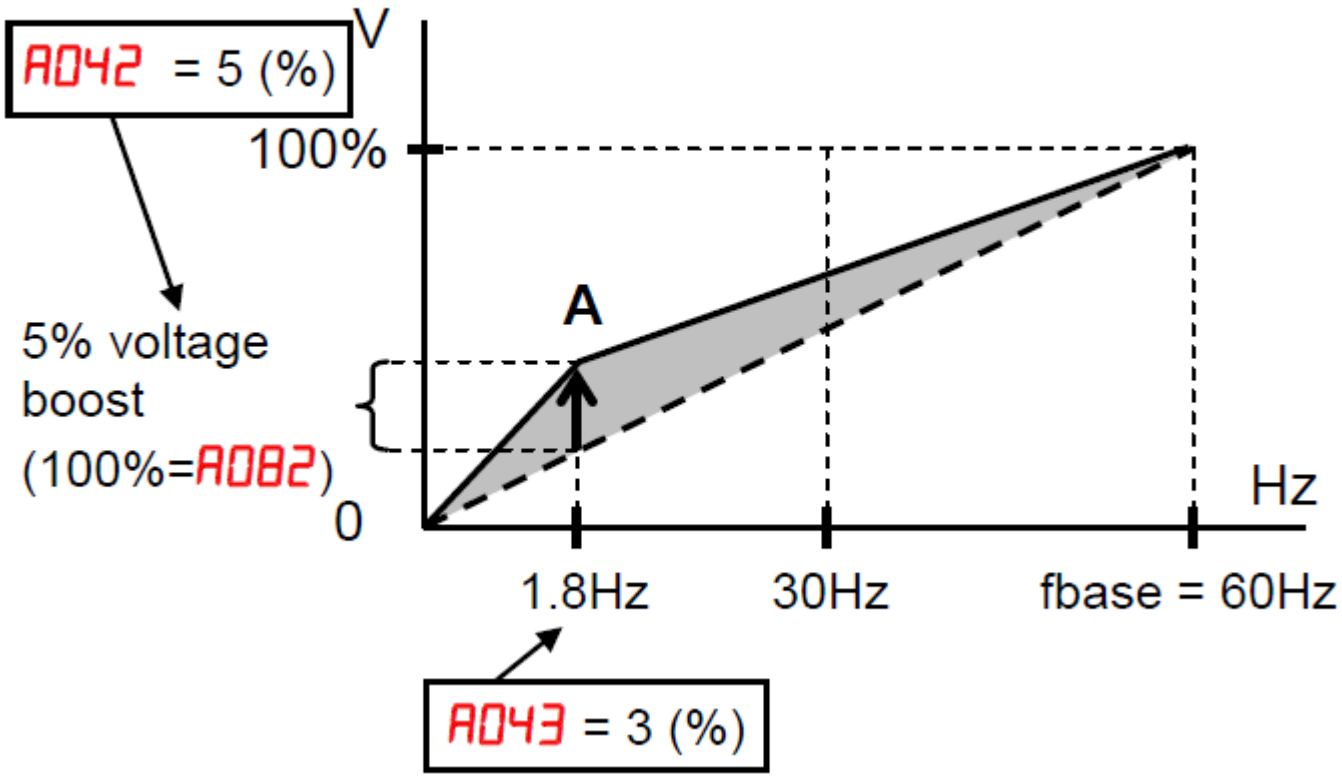
(Step 4) Remove the 125% load and close the over-weight bypass switch.



Manual Torque Boost

* Open Loop Only *

The Constant and Variable Torque algorithms feature an adjustable torque boost curve. When the motor load has a lot of inertia or starting friction, you may need to increase the low frequency starting torque characteristics by boosting the voltage above the normal V/f ratio (shown at right). The function attempts to compensate for voltage drop in the motor primary winding in the low speed range. The boost is applied from zero to the base frequency. You set the breakpoint of the boost (point A on the graph) by using parameters A042 and A043. The manual boost is calculated as an addition to the standard V/f curve.



Setting Hoist Over-weight

(Step 1)	- On the Hoist VFD navigate to parameter d002 – which displays the output current to the motor.
(Step 2)	- Locate the over-weight bypass switch located on the control panel (BPS) and open it. This will ignore any over-weight signal given by the hoist VFD to the over-weight circuit.
(Step 3)	- Lift 100% of the rated capacity in 1st speed and wait for the output current to become stable, note that value and add 2%.
(Step 4)	- Lift 100% of the rated load in 2nd speed and wait for the output current to become stable, note that value and add 2%.
(Step 5)	- On the Hoist VFD navigate to parameter C041 which is the over-weight current setting for low speed and set the value to the value determined in step 3.
(Step 6)	- On the Hoist VFD navigate to parameter C111 which is the over-weight current setting for high speed and set the value to the value determined in step 4.
(Step 7)	- Verify lifting 100% of the rated capacity in 1st and 2nd speed does not create an over-weight condition.
(Step 8)	- If the over-weight trips you will need to determine if the trip is in low or high speed and increment the value in the corresponding over-weight setting parameters. If the over-weight trips due to inrush current increment parameter C130 to delay the over-weight output signal.
(Step 9)	- After the over-weight setting have been successfully set close the over-weight bypass switch located on the control panel (BPS).

Motor Overload Protection

The Hitachi VFD's have built in solid state motor overload protection which reacts up to 150% of max output current of the VFD. Please ensure that this parameter is set correctly to the application provided by the VFD.

Hoisting applications – B012 = 125% hoist Motor FLA

Traverse applications – B012 = 125% of the sum all connected motors FLA.

Motor Brake Release & Set Frequency

* Open Loop Only *

Brake release frequency setting = B125

Braking frequency setting = B127

Acceleration & Deceleration Parameters

Standard Accel & Decel Functions	VFD Parameter
Acceleration Time (1)	F002
Deceleration Time (1)	F003

The Hitachi VFD's features two-stage acceleration and deceleration ramps. This gives flexibility in the profile shape while running in the infinite variable method. This feature allows you to have more control in the accel and decel while transitioning your frequency. You can specify the frequency transition point, the point at which the standard acceleration (F002) or deceleration (F003) changes to the second acceleration (A092) or deceleration (A093).

Use the table below to configure the 2-Stage Accel & Decel feature.

2-Stage Accel & Decel Function	VFD Parameter
Acceleration Time (2)	A092
Deceleration Time (2)	A093
Select method to switch to accel / decel (2) profile	A094 A094 = 00 will require the use of C006 = 09 A094 = 01 will use transition frequency
Accel (1) to Accel (2) frequency transition	A095
Decel (1) to Decel (2) frequency transition	A096

Note – 2-Stage Accel & Decel settings will be disabled when Reverse Plugging Alternate Decel is enabled.

Reverse Plugging Alternate Deceleration

Reverse plugging alternate deceleration feature gives the ability to switch to a separate decel profile during reverse plugging until the motor direction equals the command direction.

When the Reverse Plugging Alternate Deceleration feature is enabled the 2-Stage accel and decel option is ignored.

Use the table below to configure the reverse plugging alternate deceleration feature.

Function	VFD Parameter
Enable Feature	P109 (0 = disabled / 1 = enabled)
Reverse Plug Decel Time	P110 (*see note*)

Note – P110 are represented as a whole number. See example below to understand how to set the parameters.

Example: 3.50 seconds – P110 = 350

Brakeless Reverse Plugging

* Open Loop Only *

Brakeless reverse plugging feature gives the ability to reverse direction without having the motor brake set and release during a reversal as long as the directional command is held.

Use the table below to configure the reverse plugging alternate deceleration feature.

Function	VFD Parameter
Enable Feature	P108 (0 = disabled / 1 = enabled)

Load Float

* Closed Loop Hoist Only *

Load float makes use of the encoder feedback to hold the load at zero speed without setting the motor brake. This allows for extremely precise movement of a load as well as eliminating motor brake wear by always setting the motor brake at zero speed.

Once the motor brake has been released and directional commands have been completely released the VFD will decelerate to zero speed and float the load for the set amount time in parameter P119. If a directional command is given before the load float timer has expired the load float timer will reset once the directional commands are released again.

Once the timer has expired the VFD will close the motor brake and start the End of Run Motor Brake Check. The load float timer is adjustable please use the example below to set the desired float time.

Example: 2.00 seconds - P119 = 200

Motor Brake Wait Delay

* Closed Loop Hoist Only *

In some cases a motor brake may react faster or slower when given the release or set command. To ensure the motor doesn't not run through the brake or prematurely slip during the End of Run Brake check the Motor Brake Delay parameter P118 has been introduced.

This delay will allow for the motor brake to fully release before accepting a frequency command as well as allowing the motor brake to fully set before starting the End of Run Motor Brake Check. Please use the example below to adjust the motor brake delay time.

Example: 0.3 seconds – P118 = 30

Start of Run Motor Check

* Closed Loop Hoist Only *

Motor & Brake Torque Proving

The Start of Run Motor Check is designed to check the motor brake and the motor torque at the beginning of each lift. The VFD will apply the required amount of output torque to reach the motor brake test toque in parameter P121. Once the VFD has reached the motor brake test torque, the VFD will hold torque for the amount time determined in parameter P122. After the time has expired the VFD will release the motor brake wait until the Motor Brake Delay timer has expired before setting the frequency command.

During the entire Start of Run Motor Check the VFD will check for movement from the motor encoder as well as check to make sure the motor has produced sufficient torque.

If movement is detected the VFD will cancel the run command and lock out directional commands for 2 seconds and will also increment the brake slip counter parameter P129 by 1. If the brake slip counter exceeds 2 counts the VFD will trip with an E50 error and turn on the fault condition signal output terminal 13.

If the motor fails to generate sufficient torque during the Start of Run Motor Check the VFD will trip with an E51 error code and turn on the fault condition signal output terminal 13.

Function	VFD Parameter
Enable Feature	P120 (0 = disabled / 1 = enabled)
Motor Brake Test Torque	P121 (*see note*)
Motor Brake Test Time	P122 (*see note*)
Motor Brake Slip Detection Level	P123 (Please Contact Detroit Hoist)
Motor FLA	P108 (*see note*)

Note – P121 & P122 are represented as a whole number. See example below to understand how to set the parameters.

Example P121: 125% Torque = 125

Example P122: 0.3 seconds = 30 (Do not set the test time lower than 20 or motor brake slip may not be detected.)

Example P108: 14.61amps = 146

End of Run Motor Brake Check

* Closed Loop Hoist Only *

Brake Torque Proving

The End of Run Motor Check will check for motor brake slip at the end of each lift cycle. Once the load float timer has expired the VFD will lockout the directional commands. The VFD will then set the motor brake and wait until the Motor Brake Delay timer has expired. Once the Motor Brake Delay timer has expired the VFD will start controllably reducing the motor torque to 0%. While the VFD is controllably reducing the motor torque the VFD is checking for movement from the motor encoder.

If movement is detected during the End of Run Motor Brake Check the VFD will restore full torque to the motor and will turn on the fault condition signal from output terminal 13. The forward direction and high speed commands will be locked out, and only the reverse direction will be enabled. The VFD will wait until a reverse command is given and then will proceed to lower the load in low speed while the reverse command is on. If the reverse command is removed the VFD will start the End of Run Motor Brake Check again.

Once the load is safely on the ground and the End of Run Motor Brake Check passes then the VFD will restore all directional and speed commands and turn off the fault condition signal output terminal 13.

Function	VFD Parameter
Enable Feature	P124 (0 = disabled / 1 = enabled)
Motor Brake Slip Detection Level	P125 (Please Contact Detroit Hoist)

Auto Speed

* Closed Loop Hoist *

The Auto Speed feature will automatically increase the high speed frequency to the frequency value of P104 when the forward driving torque % at the high speed frequency is less than the Auto Speed output torque % threshold set in P111. The output current must not exceed the motor FLA and or the VFD FLA while in Auto Speed and the output torque must not exceed 150%. (Warning do not set the Auto Speed frequency above 90.0 Hz) Normal setting for P111 is 40

Use the table below to configure the Auto Speed feature.

Function	VFD Parameter
Enable Feature / Auto Speed Output Torque Threshold	P111 (0 = disabled) P111 > 0 = The Auto Speed torque threshold %
Auto Speed Frequency	P104

Note – P104 & P111 are represented as a whole number, see example below to understand how to set the parameters.

Example1: 40% Torque – P111 = 40 (Do not set this value above 50)

Example2: 90.00 Hz – P104 = 9000 (Do not set this value above 9000)

Auto Speed

* Open Loop Hoist *

The Auto Speed feature will automatically increase the high speed frequency to the frequency value of P104 when the forward driving output current % at the high speed frequency is less than the Auto Speed output current % threshold set in P111. The output current must not exceed the motor FLA and or the VFD FLA while in Auto Speed (Warning do not set the Auto Speed frequency above 90.0 Hz) Normal setting for P111 is 500

Use the table below to configure the Auto Speed feature.

Function	VFD Parameter
Enable Feature / Auto Speed Output Current Threshold	P111 (0 = disabled) P111 > 0 = The Auto Speed Current threshold %
Auto Speed Frequency	P104

Note – P104 & P111 are represented as a whole number, see example below to understand how to set the parameters.

Example1: 50% of the rated FLA output of the VFD – P111 = 500 (Do not set this value above 600)

Example2: 90.00 Hz – P104 = 9000 (Do not set this value above 9000)

VFD Monitor Parameters

This is a listing of the most common monitor parameters. To see all monitor parameters please use the Hitachi reference manual provided with the VFD.

Monitor Parameter	Monitor Description
d001	Output frequency
d002	Output current
d003	Rotation direction
d005	Digital input terminal status
d006	Digital output terminal status
d008	Actual output frequency from Encoder
d012	Output torque
d013	Output voltage
d014	Input power kW
d015	Watt-hour monitor
d016	RUN time
d017	Power on time
d024	Firmware Version
d027	Zero Speed Indication
d080-d086	Trip history
d102	DC buss voltage
d103	Dynamic braking usage %

Troubleshooting Common VFD Error Codes

This is a listing of the most common error codes. For a complete listing of all error codes please refer to the Hitachi reference manual provided with the VFD.

Error Code	Error Name	Causes
E01	Overcurrent During Constant Speed	The VFD has detected excessive current so the inverter output is turned off, caused by the motor being constrained or suddenly accelerated or decelerated.
E02	Overcurrent During Decel	
E03	Overcurrent During Accel	
E04	Overcurrent During Other	
E05	Overload Protection	The VFD has detected a motor overload on the internal electronic thermal protection circuit (B012) which is set for 125% of the FLA on the motor.
E06	Braking Resistor Overload Protection	The allowable dynamic braking usage ratio B090 has been reached.
E07	Over voltage	When the DC bus voltage exceeds a threshold, due to regenerative energy from the motor.
E09	Under Voltage	If the input voltage drops, the VFD cannot function normally. It will trip when the DC bus voltage drops below a specified voltage.
E14	Ground Fault	The VFD detected a ground fault between the motor and VFD output circuit on power up.
E16	Instantaneous power failure	If an instantaneous power failure lasts 15 ms or more, the inverter will shut off its output.
E23	Communication Error	A communication error between the CPU and gate array. Check ribbon cable between top and bottom boards.
E30	IGBT Error	The VFD detects an instantaneous overcurrent, main circuit temperature is abnormal or the main circuit element drive power drops, it will trip. Check motor and VFD for shorts to ground.
E38	Low Speed Overload Protection	If overload occurs during the motor operation at a very low speed at 0.2 Hz or less, the electronic thermal protection circuit in the inverter will detect the overload and shut off the inverter output

Troubleshooting Common VFD Error Codes Cont.1

Error Code	Error Name	Causes
E43	Program Error	(Consult Detroit Hoist)
E45	Program Error	(Consult Detroit Hoist)
E50	Start of Run Brake Slip Detected	During the Start of Run Motor Check the VFD has detected movement from the encoder. Check motor brake immediately!
E51	Start of Run Motor Torque Proving Failed	During the Start of Run Motor Check the VFD has detected the motor did not generate sufficient torque.
E52	Speed Deviation Error	The VFD has detected a speed deviation error. This is caused when the commanded frequency does not match the actual frequency. Check to see if encoder has come loose from motor shaft. Check to see if motor is locked up. Check to see if motor brake is releasing.
E60 (E70)	Encoder Line Break	The VFD has detected a line break from the encoder or disconnection of encoder line or encoder failure.
E61 (E71)	Over-speed	Detect when the motor rotation speed exceeds the maximum frequency times the over-speed detection error level P026
E69 (E79)	Connection error	Detect connection issue with SJ-FB encoder card to the VFD main body.

Clearing Trip Data

Parameter	Value
B084	01
B180	01

** Do Not Set B084 > 01 **