Detroit Hoist
Since 1905

Hitachi P1 Closed Loop Hoist

Basic Instruction Manual

DH Firmware V.18 -V24

DETROIT HOIST AND CRANE LLC, CO.

6650 STERLING DRIVE NORTH
STERLING HEIGHTS MICHIGAN 48312

Introduction

This manual only applies to Hitachi P1 VFD's programmed with firmware version 18 - 24. Please verify the version by checking parameter db-02

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 0Hz frequency and floats then sets motor brake	Decelerates to 0Hz frequency and floats then sets motor brake	Decelerates to 0Hz frequency and floats then sets motor brake	Decelerates to 0Hz frequency and floats then sets motor brake	Decelerates to 0Hz frequency and floats then 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
Micro Speed	Break HIC Input 4 (hoist interface card) or input 4 on hoist VFD.

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 Ai1 on Hoist VFD
Cb-05	Start Rate Of Terminal Ai1
Cb-06	End Rate Of Terminal Ai1

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) Set VFD Parameter UE-18 = 00 (2) Set VFD Parameter CA-06 = NO / 000 (3) Set VFD Parameter UE-12 = 2nd Speed Frequency *(see note)*
2-Step Infinitely Variable	(1) Set VFD Parameter UE-18 = 01
3-Step	(1) Change VFD Parameter CA-06 = 91 (2) Set Paramter UF-02 = 91 (3) Set VFD Parameter UE-12 = 2nd Speed Frequency *(see note)* (4) Set VFD Parameter UE-13 = 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 UE-18 = 01 (3) Set VFD Parameter CA-06 = 91 (4) Set VFD Parameter UE-13 = 3rd Speed Frequency *(see note)*
Analog 0-10V	(1) Change VFD Parameter UE-16 = 01 0V = Low Speed VFD Parameter UE-11 *(see note)* 10V = High Speed VFD Parameter UE-12 *(see note)*

Note – Speed frequency parameters UE-10 thru UE-14 are represented as a whole number. See example below to understand how to set the speed parameters.

Example: 10.00 Hz / UE-10 = 1000

Example: 15.00 Hz / UE-11 = 1500

Example: 39.99 Hz / UE-12 = 3999

Configuring Speed Parameters

Speeds	VFD Parameters
Micro 1st Speed	UE-10
Micro 2nd Speed	UE-15
1st Step / 1st Speed	UE-11
2nd Step / 2nd Speed	UE-12
3rd Step / 3 Speed	UE-13
Auto Speed	UE-14

Micro 1st Speed – This is the 1st speed / low speed frequency setting. This will be the 1st speed frequency as long as input 4 is off. *Note* – To use micro speed use a relay or switch to break the input 4 connection to the HIC (Hoist Interface Card) or the input 4 wire on the VFD.

Micro 2nd Speed – This is the 2nd speed / high speed frequency setting. This will be the 2nd speed frequency as long as input 4 is off.

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 UE-10 thru UE-14 are represented as a whole number. See example below to understand how to set the speed parameters.

Example: 10.00 Hz / UE-10 = 1000

Example: 15.00 Hz / UE-11 = 1500

Example: 39.99 Hz / UE-12 = 3999

125% Load Testing

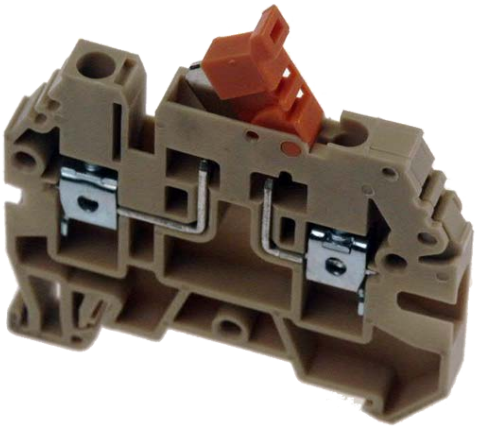
Each hoist is live load tested at 125% at the Detroit Hoist factory prior to shipment, to pass inspection. If additional field testing is required, please use the provided instructions to do so.

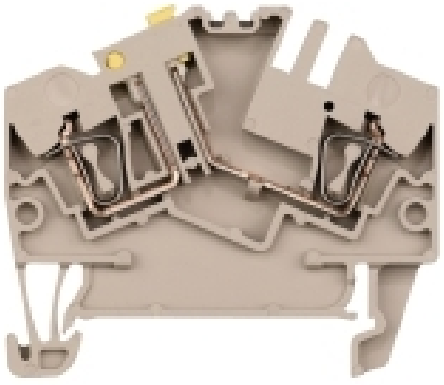
(Step 1) Locate over-weight bypass switch and open it (see images below for BPS switch example).

(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.





Setting Hoist Over-weight

(Step 1)	- On the Hoist VFD home screen 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 CE106 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 CE107 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 CC-20 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).

Over-Weight VFD Parameters	
Low Speed Over-Weight	CE106
High Speed Over-Weight	CE107

Setting Upper & Lower Operational Encoder Limits

The Hitachi P1 can use the encoder pulses for electronic upper and lower hook block limits. Detroit Hoist has made this a simple process by using knife disconnect switches. To set the upper and lower limits follow the steps below in order. Note: The process cannot be reversed or limits will not work properly.

Note: To disable the use of the electronic limits simply change parameter UE-33 = 0 and be sure to wire in a limit circuit. For assistance please contact Detroit Hoist for an updated electrical drawing.

1.) Simply open the PP knife disconnect to enter program mode. (Program Position Switch).

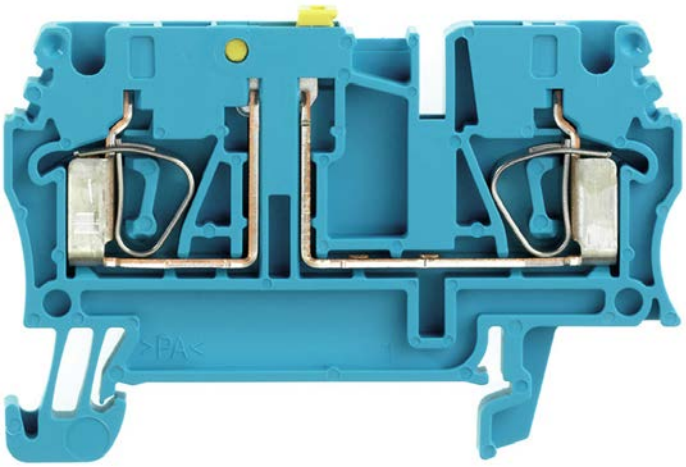
2.) Run hook block to desired upper limit.

3.) Simply open and then close the PR knife disconnect to clear the position counter memory. (Position Reset Switch) This is used as a momentary switch. (DO NOT LEAVE OPEN)

4.) Run hook block to desired lower limit.

5.) Simply close the PP knife disconnect once the motor brake has set to store the position data.

Use image below for reference of PP & PR switch.



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. This is not the over-weight protection parameter.

Hoisting applications – bC110 = 125% hoist Motor FLA

Encoder Inputs & Parameters

The Hitachi P1 VFD's have a built in high speed encoder input located under the front cover. The supply voltage for the encoder is 24vdc. Please ensure that your encoder is rated for 24vdc. Be sure to terminate the encoder shield with 0vdc to act as a noise drain.

Terminal A = Encoder Signal A

Terminal B = Encoder Signal B

Terminal COM = Encoder 24vdc

Terminal CM1 = Encoder 0vdc & Shield

Speeds	VFD Parameters
Encoder PPR	CA-81 (1024 Normal)
Encoder Position Selection	CA-82 00 = Phase A Lead 01 = Phase B Lead

Acceleration & Deceleration Parameters

Standard Accel & Decel Functions	VFD Parameter
Acceleration Time (1)	AC120
Deceleration Time (1)	AC122

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 (AC120) or deceleration (AC122) changes to the second acceleration (AC124) or deceleration (AC126).

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

2-Stage Accel & Decel Function	VFD Parameter
Acceleration Time (2)	AC124
Deceleration Time (2)	AC126
Select method to switch to accel / decel (2) profile	AC115 = 00 will require the use of CA-06 = 031 AC115 = 01 will use transition frequency AC115 = 02 will change when direction is reversed
Accel (1) to Accel (2) frequency transition	AC115
Decel (1) to Decel (2) frequency transition	AC116

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 UE-29. 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 / UE-29 = 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 UE-28 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 / UE-28 = 30

Start of Run Motor Check

* Closed Loop Hoist Only *

The Start of Run Motor Check is designed to check the motor torque at the beginning of each lift. On a power up cycle the VFD will test the motor at the default torque test value. Once the first check has successfully completed the VFD will check the motor at the torque required for the suspended load. If no load is suspended the VFD will check the motor torque at the minimum torque check value.

During the Start of Run Motor Check the VFD will check to make sure the motor has produced sufficient torque before releasing the motor brake.

If the motor fails to generate sufficient torque during the Start of Run Motor Check the VFD will trip with an E51 error. Please contact Detroit Hoist technical department 1 (800) 521-9126.

Note – Once the Start of Run Motor Check is complete the motor brake will release and if there is a light load or no load suspended the hoist may rotate slightly in the up direction due to a buildup of torque, this is normal.

Function	VFD Parameter
Enable Feature	UE-30 (0 = disabled / 1 = enabled)
Default Torque Check Value	UE-31
Motor Torque Check Time	UE-32

Example: 1.00 seconds / UE-32 = 100

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 relay 16A. 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 relay 16A.

Function	VFD Parameter
Enable Feature	UE-34 (0 = disabled / 1 = enabled)
Motor Brake Slip Max Allowable Pulse Count	UE-35 (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 UE-14 when the forward driving torque % at the high speed frequency is less than the Auto Speed output torque % threshold set in UE-21. 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 UE-21 is 40

Use the table below to configure the Auto Speed feature.

Function	VFD Parameter
Enable Feature / Auto Speed Output Torque Threshold	UE-21 (0 = disabled) UE-21 > 0 = The Auto Speed torque threshold %
Auto Speed Frequency	UE-14

Note – UE-14 & UE-21 are represented as a whole number, see example below to understand how to set the parameters.

Example1: 40% Torque / UE-21 = 40 (Do not set this value above 50)

Example2: 90.00 Hz / UE-14 = 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
dA-01	Output frequency
dA-02	Output current
dA-03	Rotation direction
dA-51	Digital input terminal status
dA-54	Digital output terminal status
dA-08	Actual output frequency from Encoder
dA-17	Output torque
dA-18	Output voltage
dA-20	Current Position
dA-30	Input power (kW)
dA-32	Accumulation Input Power (kWh)
dA-34	Output Power (kW)
dA-36	Accumulation Output Power (kWh)
dA-40	DC Buss Voltage
dA-41	Dynamic braking usage %
db-02	Firmware Version
db-14	Calculated Speed Deviation Monitor
db-16	End Of Run Brake Slip Pulse Count Monitor

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
E001	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.
E005	Overload Protection	The VFD has detected a motor overload on the internal electronic thermal protection circuit (bC110) which is set for 125% of the FLA on the motor.
E006	Braking Resistor Overload Protection	The allowable dynamic braking usage ratio bA-60 has been reached. Check load brake for slip, or decrease high speed.
E007	Over voltage	When the DC bus voltage exceeds a threshold, due to regenerative energy from the motor. Check to see if DB resistor is connected and is not shorted open.
E009	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.
E014	Ground Fault	The VFD detected a ground fault between the motor and VFD output circuit on power up.
E016	Instantaneous power failure	If an instantaneous power failure lasts 15 ms or more, the inverter will shut off its output.
E030	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.
E038	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
E043	Program Error	(Consult Detroit Hoist)
E045	Program Error	(Consult Detroit Hoist)
E051	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 to current. Check motor or contact Detroit Hoist.
E052 / E105	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. Check operation of encoder.
E053	Over-Torque	Over-Torque detected. Check to make sure motor brake is releasing and encoder is phased and operating correctly. Also check to make sure motor phasing is correct.
E060 (E070)	Encoder Line Break	The VFD has detected a line break from the encoder or disconnection of encoder line or encoder failure. Check electrical connection from encoder to SJ-FB encoder card.
E107	Over-speed	Detect when the motor rotation speed exceeds the maximum frequency times the over-speed detection error level P026

Clearing Trip Data

Parameter	Value
Ub-01	01
Ub-05	01

** Do Not Set UB-01 to anything other than 01 or load may fall and VFD may need to be sent to Detroit Hoist **

Temporarily Switching Closed Loop Vector to Sensorless Vector

Switching a closed loop vector to sensorless vector should only be done for temporary purposes if the motor encoder has failed. All safety features will be disabled when operating in sensorless vector all motor and motor brake safety checks will be disabled.

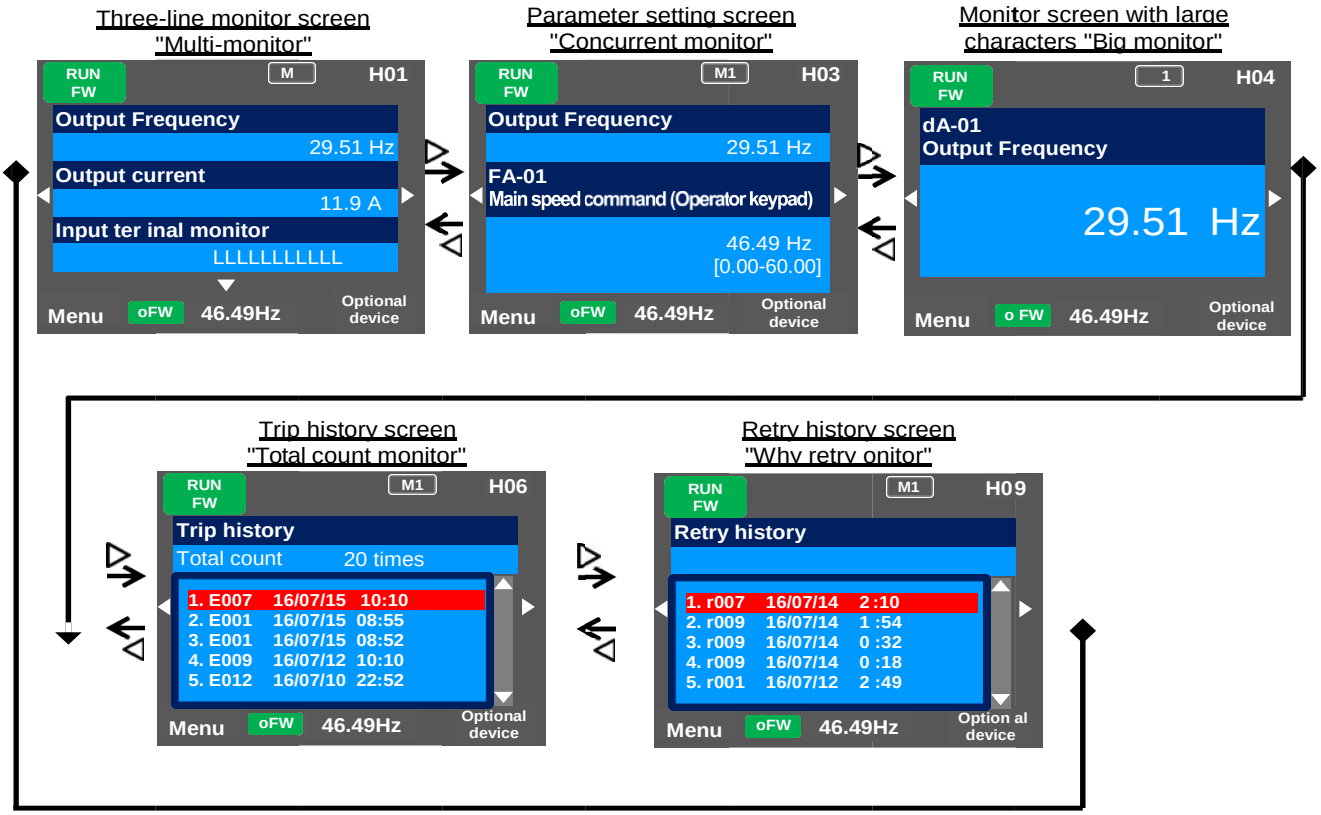
To switch to sensorless vector change parameter AA121 = 08 and cycle power to the VFD.

To switch back to closed loop vector change parameter AA121 = 10 and cycle power to the VFD.

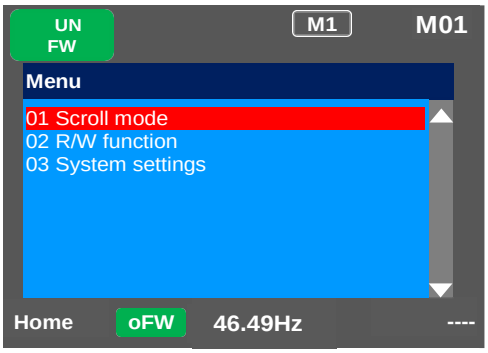
Detroit Hoist does not endorse the decision to switch from closed loop vector to sensorless vector.

Operator Keypad Screen

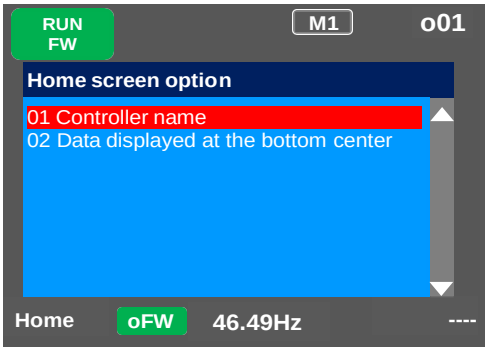
- Types of main monitor screen



- Menu screen



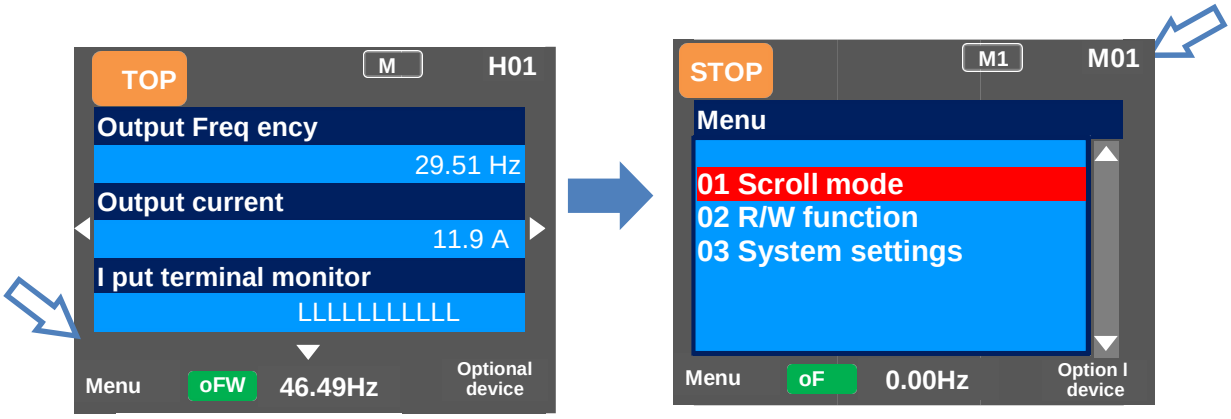
- Home screen option



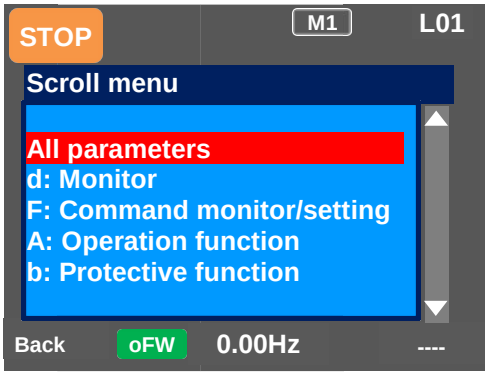
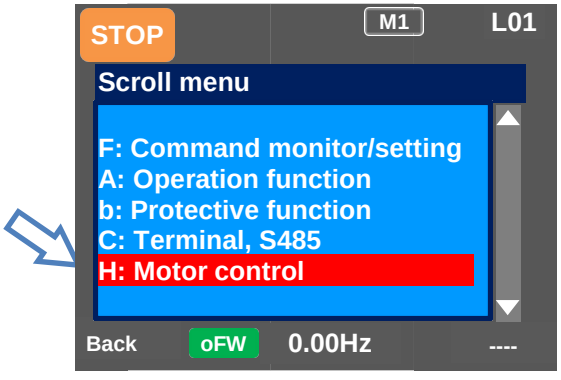
- You can switch between the main screen and menu screen using the F1(1) key.

- You can navigate to the home screen option from the main screen by using the F2(2) key. To return to the home screen, press F1(1) key.

Scroll Mode



Scroll menu - Parameter selection screen

Set-up procedure	Action
	3.1 Choose the croll mode on the system settings screen (M01) and press the SEL(O) key to show the scroll menu (L01). To 3.2.
	3.2 Choose a group you want to browse using the up and down ΔΔ) keys, and then press the SEL(O) key to move to the parameter list dis lay. For example, select "H: Motor control". Example: In the example shown below, the Hb group, which is a basic parameter of induction motor, is checked, and a parameter is changed. To 3.3.