HITACHI WJ BASIC INSTRUCTION MANUAL DH PROGRAM #27 - #28

Detroit Hoist & Crane LLC, Co.
6650 Sterling Drive North, Sterling Height Michigan 48312
+1 586-268-2600

Manual Revision V1.3

Stop Read First!

Important! – This manual is for program number #27 - #28 from Detroit Hoist. Please verify the program number before using this manual by navigating to VFD parameter d024. To navigate to d024 and check your VFD's program number follow the steps chart below.

NOTE – Includes updates for program number #28.

Step	Instruction
1	Power up the VFD.
2	Press the ESC button on the display one time and the screen will change to d001.
3	Use the UP arrow button to navigate to d024.
4	Press the SET button to view the value of d024. This value should be 27 or 28. If the value is lower please contact Detroit Hoist for further assistance.
5	To return to the main screen press and hold the ESC button until the display returns to 0.00 or you can simply cycle power.

Contents

BASIC SPECIFICATIONS

For specifications that are not listed please contact Detroit Hoist for further information.

- Input power 3-phase 50/60hz (recommended).
- Single phase applications must derate VFD to 70% and may require a larger VFD to supply the required motor current. Please contact Detroit Hoist for further information on single phase applications.
- 380-480Vac (400v class models WJ-*****-HF).
- 208-240Vac (200v class models WJ-*****-LF).
- Digital I/O's are 24vdc (27vdc max).
- Voltage fluctuation must be -15% to +10% or less.
- Voltage imbalance must be ±3% or less.
- Frequency variation must be ±4% or less.
- Total harmonic distortion (THD) of voltage must be ±10% or less.
- Ambient temperature -10 to 50℃ | 14 to 122 °f.
- In case of utilization at an altitude of 1000m or more, consider that the atmospheric pressure is reduced by 1% for every 100m up. Apply 1% derating from the rated current by increasing every 100m and conduct an evaluation test.
- IP20 – UL Open Type.
- Overload Current Rating 150% 60sec / 200% 3sec.
- All Digital I/O is 24vdc.
- Suitable for use on a circuit capable of delivering not more than 5,000 rms symmetrical amperes.
- Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.
- Pollution degree 2 environment and Overvoltage category III.
- Built-in dynamic braking chopper circuit.

POWER CIRCUIT WIRING

- **Risk of electric shock!**
- Before inspecting the inverter, be sure to turn off the power supply and wait for more than 10 or 15 minutes depending on the invertor model*1. (Before inspection, confirm that the Charge lamp on the inverter is off and the DC bus voltage between terminals P and N is 45 V or less.)

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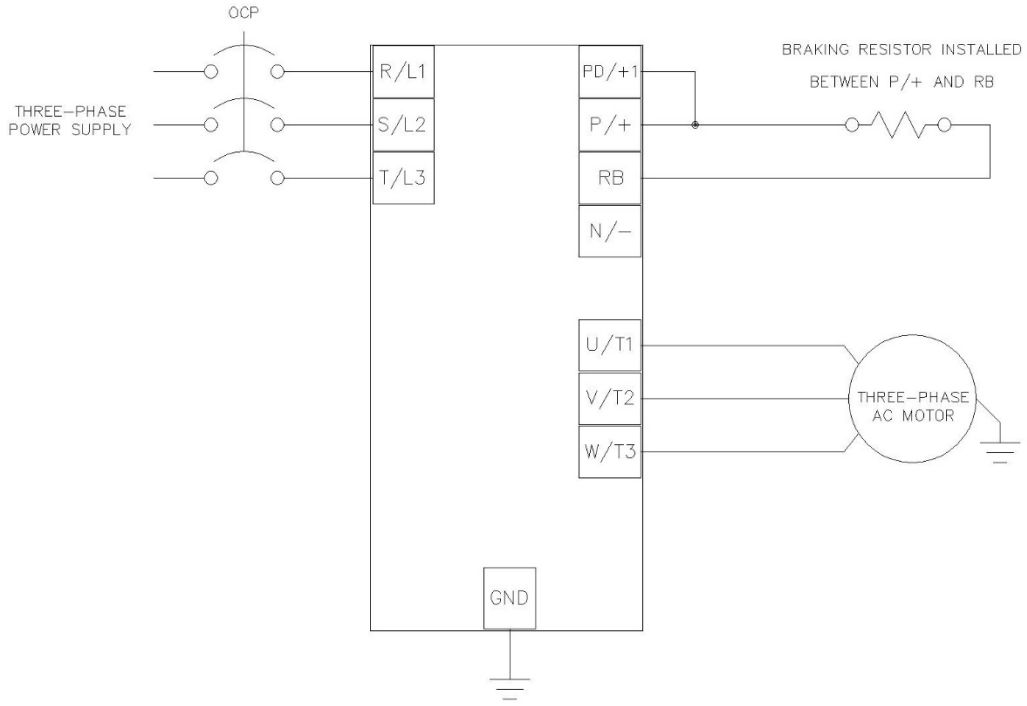
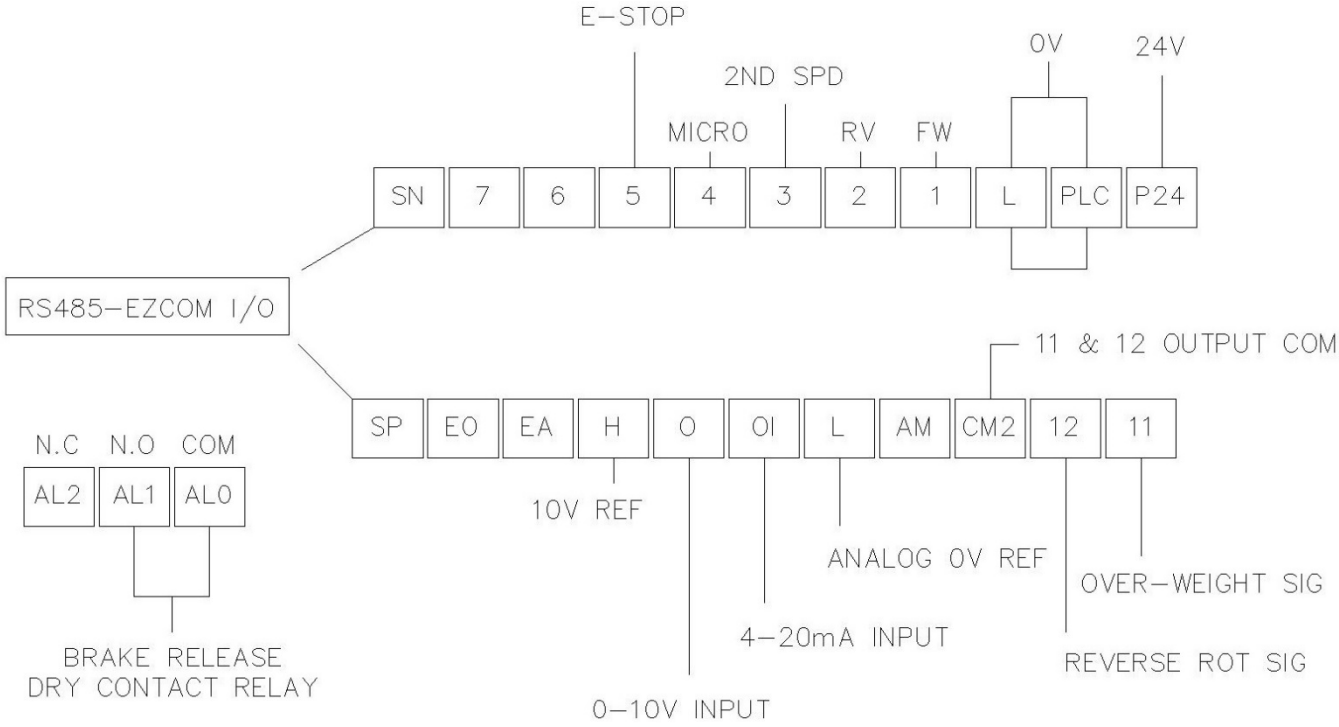


Terminal Symbol	Basic Description	Extended Description
R, S, T (L1, L2, L3)	Main power input (3-ph 50/60hz)	Connect to the AC power supply. Leave these terminals unconnected when using a front end regenerative converter.
U, V, W (T1, T2, T3)	Inverter motor output	Connect three-phase motor or load reactor.
PD, P (+1, +)	DC link choke connection terminal	Remove the PD-P jumper from terminals, and connect the optional DC link choke for power factor improvement.
P, N (+, -)	DC bus positive and negative terminals.	Connection of a back end regenerative converter or external braking unit.
P, RB (+, RB)	Dynamic braking chopper circuit	Connect braking resistor.

CONTROL CIRCUIT WIRING

Below is a basic example of the control circuit for the Hitachi WJ with the DH firmware and may differ from the actual configuration please reference the provided electrical drawing. Please consult Detroit Hoist if you plan to make changes to the control circuit for specific functions to ensure compatibility with the DH firmware. Please note that not all functions provided by standard Hitachi manual are compatible with the DH firmware and the use of them may cause the VFD to become unusable or unsafe.



Terminal Symbol	Description
P24	Internal 24V power supply.
1 – 6	24v digital inputs for command functions. 5.6mA Terminal 4, 5, and 6 can be configured for allowed functions.
7 (EB)	Digital Input 7(EB) can be used for an encoder signal B. or for allowed functions. NOTE – digital input 7 is limited to 2kHz for encoder signal B.
EA	EA terminal can be used for encoder signal A or extended for command functions. NOTE – EA is limited to 32kHz for encoder signal A.
CM2	COM for 24v digital outputs 11 & 12
11 & 12	24v digital outputs. 60mA max
AL0 (COM), AL1 (N.O), AL2 (N.C) (not configurable)	Brake release relay SPDT | 250vac 5A(resistive) \ 250vac 1A(inductive)
L	0v / ground reference for all analog I/O's
O	Analog input 0-10V
OI	Analog input 4-20mA
H	Internal 10v reference.
SN, SP	RS485 / Ezcom communication terminals. Used for Modbus or Ezcom communication. Shielded twisted wire required and grounding of shield.
L / PLC	0V reference for internal 24V power supply and ground reference for I/O return.

CONFIGURING SPEED CONTROL METHOD

Detroit Hoist VFD controls come factory pre-configured for 2-Step speed control unless otherwise specified during the ordering process.

Use the chart below to configure the speed control method that is required.

Speed Control Method	Parameters	Values
2-Step	P108	0
2-Step Infinitely Variable	P108	1
3-Step	P108	2
	P113	1
	C006	61
3-Step Infinitely Variable ***Note - 3-step infinitely variable uses the 2nd step as a frequency hold.***	P108	3
	P113	1
	C006	61
0-10V Analog	P108	4
4-20mA	P108	5

CONFIGURING SPEEDS / FREQUENCIES

Speed / frequency values are stored as whole numbers (*example is 15.25 Hz = 1525*).

Use the chart below to configure the speeds / frequencies for the configured speed control method.

If operating at frequencies below or at 5hz for an extended amount of time an external motor cooling device may be required to prevent motor overheating.

Speed Control Method	Speeds	Speed Parameters	Example Values
2-Step (factory default)	1st speed / low speed	P101	1000 (10.00 Hz)
	2nd speed / high speed	P102	6000 (60.00 Hz)
2-Step Infinitely Variable	1st speed / low speed	P101	1000 (10.00 Hz)
	2nd speed / high speed	P102	6000 (60.00 Hz)
3-Step	1st speed / low speed	P101	1000 (10.00 Hz)
	2nd speed	P102	3500 (35.00 Hz)
	3rd speed / high speed	P103	6000 (60.00 Hz)
3-Step Infinitely Variable	1st speed / low speed	P101	1000 (10.00 Hz)
	n/a	n/a	n/a
	3rd speed / high speed	P103	6000 (60.00 Hz)
0-10V / 4-20mA	1st speed / low speed	P101	1000 (10.00 Hz)
	2nd speed / high speed	P102	6000 (60.00 Hz)
Auto-Speed	Auto-Speed	P104	9000 (90.00 Hz)

ACCELERATION / DECELERATION TIMES

Changing the acceleration time to a shorter time can cause a E01, E02, or E03 over-current and or E05 over-load fault /trip, if this occurs due to a short acceleration time increase the acceleration time and test again.

Changing the deceleration time to a shorter time can cause a E07 over-voltage fault/trip, if this occurs due to a short deceleration time increase the deceleration time and test again.

Use the chart below to configure the standard acceleration and deceleration times.

Function	Parameters	Example Value
Acceleration Time	F002	2.50 seconds
Deceleration Time	F003	1.00 seconds
Acceleration Curve	A097	00 = liner-curve
		01 = S-curve (default)
		02 = U-curve
		03 = Inverse U-curve
Deceleration Curve	A098	00 = liner-curve
		01 = S-curve (default)
		02 = U-curve
		03 = Inverse U-curve

ALTERNATE ACCELERATION / DECELERATION TIMES

The alternate acceleration and deceleration function can be used to switch from the standard acceleration and deceleration times to an alternate acceleration and deceleration time based on a digital input, frequency break point, or reversal of direction command (aka reverse plugging). If you plan to use switch by input [2CH] you will need to configure an available digital input function for 09:[2CH] (example C006 = 09) and add the 24v circuit for that input.

Use the chart below to configure the standard acceleration and deceleration times.

Function	Parameters	Example Value
ALT Acceleration Time	A092	2.50 seconds
ALT Deceleration Time	A093	1.00 seconds
Method to switch to ALT Accel / Decel	A094	00 = Switching by input [2CH] (configure available digital input function to 09: 2CH)
		01 = Switching by frequency break point
		02 = Switching by direction reversal
Accel to ALT Accel break point	A095	15.00 Hz
Decel to ALT Decel break point	A096	15.00 Hz

MICRO-SPEED FUNCTION

Micro-speed is designed to temporarily restrict the speed of the hoist to a lower speed and to prevent high speed operations until the function is released. The micro-speed function can be configured two ways.

2-STEP MAINTAINED MODE – This mode will switch to a 2-Step maintained speed set. This is helpful where the micro-speeds need to be specific. This mode can also be used to provide a single speed by setting the low and high micro speed values the same value. To use this mode P106 must have a value of 0.

PERCENTAGE MODE – This mode will take the value from P106 as a percentage of the standard speed set. Setting P106 to a value of 50 will provide a 50% reduction in speed to the standard speed sets for the configured speed control method.

Micro-Speed Retain Var-Freq – This was introduced in V28. This parameter allows you to retain the infinity variable speed control when micro-speed is active when the standard speed control method is of infinity variable or analog type. You can disable this option by setting parameter P109 = 0 and when micro-speed is activated the speed control method will be maintained speeds.

In the chart below the digital input 4 is configured from the factory for micro-speed.

Function	Parameters	Value
Digital Input 4 Mirco-Speed Activation Input	C004	59:MI4
Mirco-Speed Low-Speed	P100	500 (5.00 Hz)
Mirco-Speed High-Speed	P105	1000 (10.00 Hz)
Micro-Speed Mode	P106	Value = 0 (*2-STEP MAINTAINED*)
		Value > 0 (*PERCENTAGE MODE*)
Micro-Speed Retain Var-Freq	P109	0 = Disabled | 1 = Enabled

LIMIT TO 1ST SPEED FUNCTION

For applications where it is required to limit the VFD to 1st speed frequency you can configure an available digital input for that function. This is typically used for travel limits or when approaching an upper / lower hook limit. The parameter chart below references setting either digital input 6 or digital input 7.

Function	Parameter	Value
Input 6 Configuration	P113	2
Digital Input 6 Function	C006	61
Digital Input 6 Contact Status	C016	00 = N.O 01 = N.C
Input 7 Configuration	P114	2
Digital Input 7 Function	C007	62
Digital Input 7 Contact Status	C017	00 = N.O 01 = N.C

AUTO-SPEED 90HZ FUNCTION

The auto-speed function will allow the VFD to increase the high speed to up to 90Hz when there is an empty hook or a light load. You can set this function for automatic or for input activation. The auto-speed function is not available when using 0-10V/4-20mA speed control methods, when micro-speed is active, and or when in tandem mode.

HOW IT WORKS – When the hoist is commanded in the forward/up direction and the frequency reaches the set high speed frequency, the VFD will check to see if the load monitor value is less than the auto-speed activation value and allow the frequency to increase to the auto-speed frequency.

Use the charts below to properly configure the auto-speed function. If you don't want Auto-Speed to activate unless there is an input, you can configure digital input 6 or digital input 7 for the Auto-Speed enable command.

Function	Parameter	Example Value
Auto-Speed Activation Value	P111	50
Auto-Speed Activation Method	P110	0 = Automatic 1 = With Input Enable
Auto-Speed Frequency	P104	9000 (90.00 Hz)
Input 6 Configuration	P113	3
Digital Input 6 Function	C006	61
Digital Input 6 Contact Status	C016	00 = N.O 01 = N.C
Input 7 Configuration	P114	3
Digital Input 7 Function	C007	62
Digital Input 7 Contact Status	C017	00 = N.O 01 = N.C

SETTING THE AUTO-SPEED ACTIVATION VALUE

Step	Instruction
1	Attached 30% rated load to the hook block and lift the load just off the ground. **NOTE – 30% should be the max load for 90 Hz & 60% should be the max load for 75 Hz*
2	Navigate to VFD parameter d027. This will display the load value that will be used to set the auto-speed activation level.
3	Using the pushbutton or radio, command the hoist in the up/forward direction with high speed and record the value of VFD parameter d027 while the load is operating at the high-speed frequency.
4	Navigate to VFD parameter P111 and set the value to the value recorded from d027 + 3%. (example d027 = 37, set P111 = 40)
5	Verify the auto-speed function works by lifting the same load at high speed. If the auto-speed function is configured for automatic then you should see the speed increase to 90hz, if you are using the input activation function then make sure the input is active and you should see the speed increase to 90hz

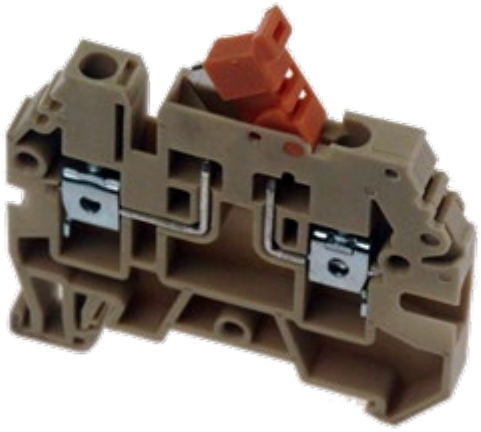
125% FIELD LOAD TESTING / OVER-WEIGHT BYPASS

Each hoist is factory load tested prior to shipment. If a field load test is required, you will need to bypass the over-weight signal.

To bypass the over-weight signal, locate the bypass terminal knife disconnect it should be labeled “BPS” (use images below as reference) and pull the yellow/orange tab to open. If the VFD is configured for internal over-weight, then you will need to adjust the over-weight values in C041 and C111 to a higher value and restore the original values after the load test.

IMPORTANT - Be sure to close the over-weight bypass terminal knife disconnect “BPS” after the load test is complete, failure to do so may result in damage to the hoist in the case of an overload.

NOTE – Detroit Hoist recommends that 125% load tests should only be conducted by operating the hoist in low speed when the 125% load is suspended or the VFD may fault.



HOIST OVER-WEIGHT FUNCTION

The VFD is setup to use the output current to the motor as the over-weight function. The VFD uses (2) over-weight current parameters. Over-weight (1) is when operating less than or equal to the low-speed frequency and over-weight (2) is when operating above low-speed frequency. The VFD automatically switches between over-weight (1) and over-weight (2) based on the frequency. Having (2) over-weights greatly increases over-weight accuracy and decreases the likelihood of a false over-weight condition.

The VFD has (3) configurations for the over-weight signal, external momentary, external maintained, Internal.

External momentary - will output a signal when the condition is met but will not maintain the output after the condition is no longer met. This configuration also uses digital output 12 assigned to 52:Reverse DIR with a N.C contact status which is used to latch a relay.

External maintained - will output a signal when the condition is met and maintain the signal until the reset condition is met or power is cycled.

Internal - does not require any external circuits to function. Internal works the same way as the external maintained but will internally prevent the hoist up function until the reset condition is met or power is cycled.

HOW IT WORKS – When the output current to the motor exceeds the value in the conditional over-weight current parameter for an amount of time that exceeds the detection delay time, the conditional digital output will turn on and activate a 24v relay to interrupt the hoist E-Stop circuit. The signal is turn off once the hoist has lowered for 2.0 seconds.

HOIST OVER-WEIGHT PARAMETERS

Function	Parameters	Example Value
Over-Weight Signal Output Type	P122	0 = External Momentary
		1 = External Maintained
		2 = Internal
Over-Weight Detection Delay Time	P123	180 = (1.80 seconds)
Over-Weight Reset Time	P124	200 = (2.0 seconds)
Standard Over-Weight (1) Value *Low Speed	C041	14.0 Amps
Standard Over-Weight (2) Value *High Speed	C111	15.0 Amps
Digital Output 11 Function	C021	44:MO1
Digital Output 11 Status	C031	00: N.O
Required For External Momentary		
Digital Output 12 Function	C022	52:Reverse Dir
Digital Output 12 Status	C032	01: N.C
Digital Output 12 On Delay	C132	2.0 s

SETTING HOIST OVER-WEIGHT

Each hoist's over-weight settings will be set at the factory prior to shipment. In some cases, field adjustments may be required. Use the step chart below to set the hoist's over-weight settings.

Step	Instruction
1	Locate the terminal knife disconnect labeled "BPS" and pull the top of the yellow/orange tab outwards, this will bypass the over-weight circuit. If no bypass switch is present, then increase the values in C041 and C111 to prevent tripping.
2	Attach the 100% rated load to the hook block.
3	On the VFD navigate to the output current monitor d002 by pressing the ESC button once and using the UP button to navigate to d002 and press the SET button to view the current monitor.
4	Proceed to lift the 100% rated load off the ground in low speed. Monitor the output current to the motor and write it down. Be sure to wait for the output current to normalize
5	Proceed to lift the 100% rated load off the ground in high speed. Monitor the output current to the motor and write it down. Be sure to wait for the output current to normalize.
6	Take the value from step 4 and multiply it by 1.05 and set over-weight (1) parameter C041 to that value.
7	Take the value from step 5 and multiply it by 1.05 and set over-weight (2) parameter C111 to that value.
8	Locate the terminal knife disconnect labeled "BPS" and close the tab.
9	Operate the hoist in low and high speed with the 100% rated load. If the over-weight circuit trips in low speed, then increase the value of over-weight (1) parameter until it no longer trips. If the over-weight circuit trips in high speed, then increase the value of over-weight (2) parameter until it no longer trips.

SETTING ENCODER-BASED LIMITS

Use the step chart below to set the encoder-based limits. This process is used for setting the encoder limits on hoist units that have an encoder mounted to the drum or gearbox output shaft.

Function	Parameters	Value
EA Terminal Function	P003	01 : Encoder Feedback
Encoder Signal Type	P004	01: 2-phase pulse 90-degree diff Term[EA] – Sig A | Term[DI7 (EB)] – Sig B
Simple Position Selection	P012	02 : Enabled
Approach zone pulse ratio	P014	250.0%
Position Complete Pulse Range	P017	5 pls
Internal Program Configuration	P128	0 : Disabled 1 : Enabled 2 : Enabled + Program Mode 3 : Enabled + Program Mode + Pos Clear
Simple Position Store Position	P129	0 : None 2 : Position 1 P061
Bind CP1	P131	1 : Reverse Dir
Store Position at power off	P081	01:Store

Step	Instruction
1	Navigate to VFD parameter P128 and set the value to 2 and save it. This will put the VFD into program mode.
2	Run the hook block to the desired upper limit position and wait for the motor brake to set.
3	Navigate to VFD parameter P128 and set the value to 3 and save it, wait 2 seconds, this will clear the current position pulse count. The value will automatically be changed back to 2.
4	Run the hook block to the desired lower limit position and wait for the motor brake to set.
5	Navigate to VFD parameter P129 and set the value to 2 and save it. This will store the position into P061.
6	Navigate to VFD parameter P128 and set the value to 1 and save it. This will take the VFD out of program mode.
7	Verify operation of hook block limits.

SIMPLE POSITION CONTROL

The VFD with program V28 supports setting up simple position control with ease. Simple position control can be used for automation to move up to 8 programmed positions. The DH software creates a simple way of setting the 8 available positions. For assistance in setting up the functions please contact Detroit Hoist.

Up to 8 position data are commanded by combination of 3 input terminals configured as CP1 to CP3. Due to the limited number of inputs on the VFD you can bind CP1 to the reverse command or to the forward command by setting parameter P131. The CP1 command will not be release unless the opposite direction is commanded if CP1 is bound to forward or reverse without release.

Function	Parameters	Value
EA Terminal Function	P003	01 : Encoder Feedback
Encoder Signal Type	P004	01: 2-phase pulse 90-degree diff Term[EA] – Sig A | Term[DI7 (EB)] – Sig B
		03: 1-phase pulse Term[EA] – Sig A | Term[DI7 (EB)] – Direction
Digital Input 7 (EB)	C007	85: EB
Encoder PPR	P011	32 – 1024 PPR
Simple Position Selection	P012	02 : Enabled
Approach Zone Pulse Ratio *Percentage Multiplied of PPR to restrict to Approach speed P015*	P014	0 – 400%
Approach Speed *Max Speed allowed when in approach zone*	P015	1.00 – 10.00 hz
Position Complete Pulse Range *Pulse range to complete positioning and to stop*	P017	0 – 1000 pls
Internal Program Configuration	P128	0 : Disabled 1 : Enabled 2 : Enabled + Program Mode 3 : Enabled + Program Mode + Pos Clear
Simple Position Store Position	P129	0 : No Position 1 : Position 0 P060 2 : Position 1 P061 3 : Position 2 P062 4 : Position 3 P063 5 : Position 4 P064 6 : Position 5 P065 7 : Position 6 P066 8 : Position 7 P067
Bind CP1	P131	0 : Disabled 1 : Reverse Direction Without Release 2 : Forward Direction Without Release 3: Reverse Direction With Release 4: Forward Direction With Release
Store Position at power off	P081	01:Store
Digital Input Function	Digital Input 4 - C004 Digital Input 5 - C005 Digital Input 6 - C006	66 : CP1 Multi-Position (1) 67 : CP2 Multi-Position (2) 68 : CP3 Multi-Position (3)
Brake Release Function	C143	02: FA2

SIMPLE POSITION CONTROL ENCODER REFERENCE

The VFD's encoder connection can be set up for (2) configurations.

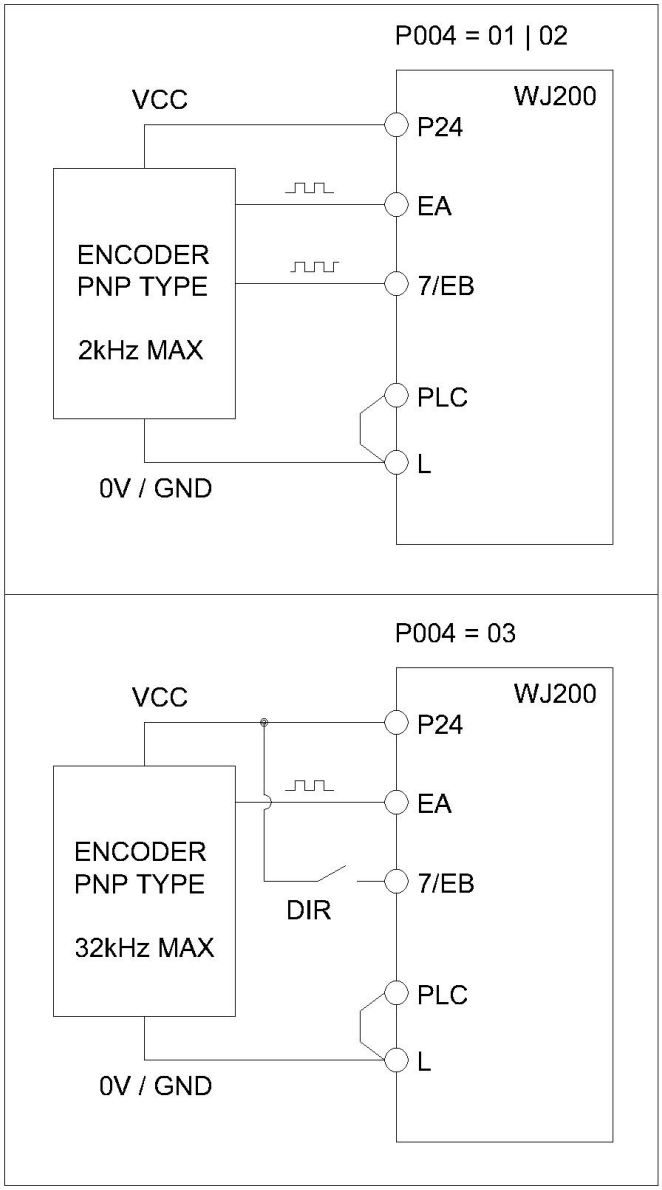
2-phase pulse input

Wire phase-A to EA terminal and phase-B to EB terminal, in some cases the phasing may need to be reversed.
Assign 85:EB to C007 input terminal 7. The max pulse frequency of terminal 7(EB) is 2kHz max. Use the formula below to check that the encoder pulse frequency does NOT exceed 2kHz.

Pulse Hz = (Encoder PPR * 1800) / 60
1000 Hz = 1kHz
Example – (1024ppr * 1800) / 60 = 30,720Hz = 30.72kHz

Single phase pulse input

Wire phase-A to EA terminal and direction signal to EB terminal. Assign 85:EB to C007 input terminal 7. ON input is forward and OFF input is reverse direction. When input 7(EB) is ON the encoder pulses will count in the positive direction. When input 7(EB) is OFF the encoder pulses will count in the negative direction.



SIMPLE POSITION CONTROL POSITION STAGE REFERENCE

Multistage Position	CP1	CP2	CP3
Position 0 (P060)	OFF	OFF	OFF
Position 1 (P061)	ON	OFF	OFF
Position 2 (P062)	OFF	ON	OFF
Position 3 (P063)	ON	ON	OFF
Position 4 (P064)	OFF	OFF	ON
Position 5 (P065)	ON	OFF	ON
Position 6 (P066)	OFF	ON	ON
Position 7 (P067)	ON	ON	ON

To avoid misinput due to time lag of each input, you can adjust the determination time in (C169). The input status is taken the preset time (C169) after the last change of input status. (Note that a long determination time deteriorates the input response.)

Function	Parameters	Value
Multistage Determination Time	C169	0 - 200

POSITION COMPLETE SIGNAL

If an output signal is required to indicate position is complete, please assign the value of 23: POK complete to digital output 11 or digital output 12 (24VDC 20mA Max).

Function	Parameters	Value
Position Complete Signal	C021 C022	23: POK Complete
Digital Output 11 ON Delay	C130	0.0 – 100.0
Digital Output 11 OFF Delay	C131	0.0 – 100.0
Digital Output 12 ON Delay	C132	0.0 – 100.0
Digital Output 12 OFF Delay	C133	0.0 – 100.0

SETTING / PROGRAMMING POSITIONS

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<table>
<tr><th>Step</th><th>Instruction</th></tr>
<tr><td>1</td><td>Navigate to VFD parameter P128 and set the value to 2 and save it. This will put the VFD into program mode.</td></tr>
<tr><td>2</td><td>Run the motor to the desired starting position and wait for the motor brake to set.</td></tr>
<tr><td>3</td><td>Navigate to VFD parameter P128 and set the value to 3 and save it, wait 2 seconds, this will clear the current position pulse counter. The value will automatically be changed back to 2.</td></tr>
<tr><td>4</td><td>Navigate to VFD parameter P129 and set the value to 1 and save it. This will store the position into P060 for position 0 which should be zero as the starting position.</td></tr>
<tr><td>5</td><td>Run the motor to the desired position for position 1 and wait for the motor brake to set.</td></tr>
<tr><td>6</td><td>Navigate to VFD parameter P129 and set the value to 2 and save it. This will store the position into P061 for position 1.</td></tr>
<tr><td>7</td><td>Repeat steps 5 & 6 for the number of positions required using the value for P129 from the chart below based on the position.
<table>
<tr><th>P129 Value</th><th>Position</th><th>Position Parameter</th></tr>
<tr><td>1</td><td>Position 0</td><td>P060</td></tr>
<tr><td>2</td><td>Position 1</td><td>P061</td></tr>
<tr><td>3</td><td>Position 2</td><td>P062</td></tr>
<tr><td>4</td><td>Position 3</td><td>P063</td></tr>
<tr><td>5</td><td>Position 4</td><td>P064</td></tr>
<tr><td>6</td><td>Position 5</td><td>P065</td></tr>
<tr><td>7</td><td>Position 6</td><td>P066</td></tr>
<tr><td>8</td><td>Position 7</td><td>P067</td></tr>
</table></td></tr>
<tr><td>8</td><td>Verify operation.</td></tr>
</table>

POSITION COMMAND MONITOR

The commanded position can be monitored using the Positioning Command Monitor d029. This monitor will display the commanded position in pulses.

CURRENT POSITION MONITOR

The current position can be monitored using the Current Position Monitor d030. This monitor will display the current position in pulses.

CARRIER FREQUENCY

The carrier frequency is adjustable from 2.0kHz to 15kHz. The audible sound decreases at the higher frequencies, but RFI noise and leakage current may be increased. It is recommended that the carrier frequency is 2.3kHz or greater when operating in sensorless vector A044 = 03.

Function	Parameters	Value
Carrier Frequency	b083	2.0 – 15.0 kHz

AUTOMATIC CARRIER FREQUENCY REDUCTION

The automatic carrier frequency reduction automatically reduces the carrier frequency according to the increase in output current. To enable this function, specify “01” for automatic carrier frequency reduction selection (b089).

When the output current increases to 60%, 72%, 84%, or 96% of the rated current, this function reduces the carrier frequency to 12, 9, 6, or 3 kHz, respectively. This function restores the original carrier frequency when the output decreases to 5% lower than each reduction start level.

The rate of carrier frequency reduction is 2kHz per second. The maximum limit of carrier frequency change by this function is the value specified for the carrier frequency setting (b083); the minimum limit is 3 kHz. Note: If 3 kHz or less freq. has been specified for b083, this function is disabled regardless of the setting of b089.

Function	Parameters	Value
Automatic Carrier Frequency Reduction	b089	00 = Disabled 01 = Enabled, depending on the output current 02 = Enabled, depending on the heat-sink temperature

RESET FAULT USING INPUT

Resetting a fault remotely using an input to the VFD can be done by configuring one of the available digital inputs for reset. Use the chart below.

Function	Parameters	Value
Fault reset	C006 – C007	18 = RS

OUTPUT SIGNAL WHEN FAULT OCCURS

You can configure a 24v digital output to turn on when a fault occurs. If the VFD is configured for hoisting, then you will need to configure the over-weight logic for either maintained or internal in order to free up digital output 12. If you need to change the over-weight logic, please reference the hoist over-weight function section to change the logic to maintained or internal.

Function	Parameters	Value
Output 12 Function	C022	05 = Faut / Alarm
Output 12 Contact Status	C032	00 = N.O 01 = N.C
Output 12 On-Delay Time	C132	0.0 – 100.0 s
Output 12 Off-Delay Time	C133	0.0 – 100.0 s

ELECTRONIC MOTOR THERMAL PROTECTION

The VFD has a built-in electronic motor thermal protection function and is configured for constant torque loading. When the output current exceeds the value in b012 for a calculated time based on frequency and time the VFD will trip with an E05 fault.

Function	Parameters	Value
Electronic thermal level	b012	Motor FLA * 1.25

MOTOR BRAKE PARAMETERS

These brake parameters are for program V27. If you have program V28 go to the next page for Motor Brake Parameters.

The motor brake parameters can be adjusted based on the application needs.

Brake wait time for release – After the Brake Release Frequency Setting is reached, the inverter waits for the braking wait time (b121)

Brake wait time for acceleration – The inverter waits for the Brake Wait Time for Acceleration (b122), and then starts accelerating the motor up to the set acceleration frequency.

Brake wait time for stopping – Once the brake release signal is turned off, the inverter waits for the Brake Wait Time for Stopping (b123), and then starts decelerating the motor down to 0Hz.

Function	Parameter	Value
Brake release frequency	b125	2.50 Hz
Brake set frequency	b127	2.50 Hz
Brake wait time for release	b121	0.00 s
Brake wait time for acceleration	b122	0.00 s
Brake wait time for stopping	b123	0.00 s
AL output relay output function	C026	19: BRK

MOTOR BRAKE PARAMETERS

These are the motor brake parameters for program V28. When using trolley or hoist with load brake use brake function #1. If the hoist is using sensorless vector A044 = 03 without load brake, then use Brake Parameters #2. If using simple position control use brake function #2 You can verify what brake function is set-up by checking the value in parameter C143. If C143 = 02 then use brake function #2. If C143 = 19 then use brake function #1.

Brake Function #1

Function	Parameter	Value
Brake release frequency	b125	2.50 Hz
Brake set frequency	b127	2.50 Hz
Brake wait time for release	b121	0.00 s
Brake wait time for acceleration	b122	0.00 s
Brake wait time for stopping	b123	0.00 s
Logic output 1 operand B	C143	19:BRK
AL output relay output function	C026	33:LOG1
FA2 Brake wait time for acceleration	P112	0

Brake Function #2

Function	Parameter	Value
Brake release frequency	C042	2.50 Hz
Brake set frequency	C043	2.50 Hz
Logic output 1 operand B	C143	02:FA2
AL output relay output function	C026	33:LOG1
FA2 Brake wait time for acceleration	P112	25ms – when using it for hoist *without* load brake 0 – when using it for trolley or hoist with load brake

VFD CONTROL MODES

The VFD control mode is pre-set from Detroit Hoist and should not be changed unless directed to by a Detroit Hoist employee.

Constant torque is typically used for all bridge motions and load brake hoist motions. Constant torque can be configured for manual torque boost or automatic torque boost. The default from Detroit Hoist is manual torque boost. Automatic torque boost uses the manual torque boost parameters as a start value and then adjusts based on the voltage compensation gain and slip compensation gain.

Sensorless vector is typically used for trolleys to provide higher torque but can also be used for all motions if configured correctly. This mode will also allow you to use the torque monitor and torque limitation functions.

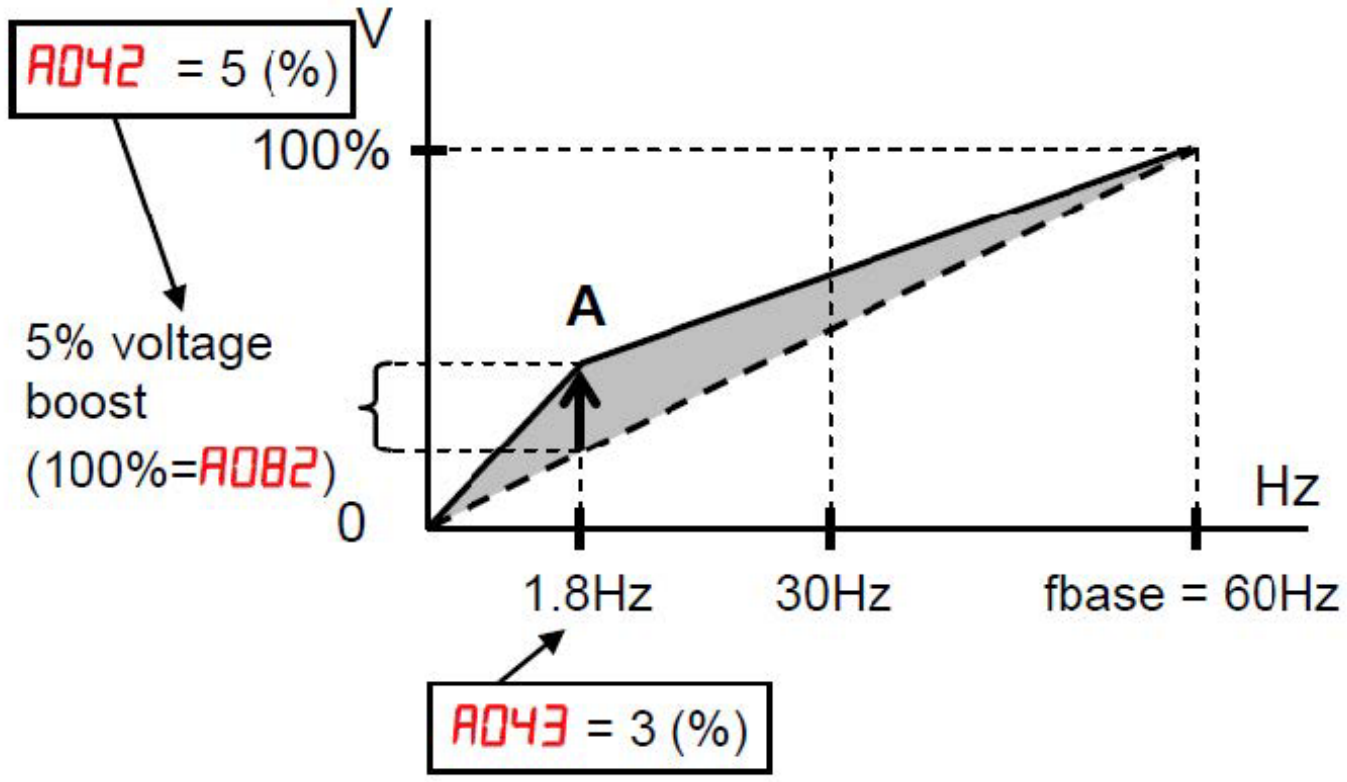
Simple Position Note – If the encoder used for simple position is mounted on the drum or gearbox output shaft you will need to use sensorless vector control A044 = 03. If the encoder is mounted directly to the motor shaft you can use either control method.

Function	Parameter	Value
Supported VFD Control Modes	A044	00 = Constant Torque 03 = Sensorless Vector

CONSTANT TORQUE CONTROL MODE / MANUAL TORQUE BOOST

Manual Torque Boost – 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 below). 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.

Function	Parameter	Value
Torque Boost Function	A041	00 = Manual
Torque Boost Value	A042	0.0 – 20.0
Torque Boost Break Point	A043	0.0 – 50.0
VFD Torque Control Mode	A044	00: Constant Torque



CONSTANT TORQUE CONTROL MODE / AUTOMATIC TORQUE BOOST

In constant torque using automatic torque boost the starting torque boost value and frequency break point are used as starting points for automatic torque boost. Voltage compensation gain and slip compensation gain are used for fine tuning adjustments. Using parameters A046 and A047, you can obtain better performance under automatic torque boost mode (A041=01). See following table for the concept of adjustment, including other parameters.

Function	Parameter	Value
Torque Boost Function	A041	01 = Automatic
Torque Boost Value	A042	0.0 – 20.0
Torque Boost Break Point	A043	0.0 – 50.0
VFD Torque Control Mode	A044	00: Constant Torque
Voltage Compensation Gain	A046	0 – 255
Slip Compensation Gain	A047	0 – 255

FINE TUNING AUTOMATIC TORQUE BOOST

Symptom	Adjustment	Parameter
Motor torque is not enough at low speed (The motor does not rotate at low speed)	Increase the voltage setting for manual torque boost, step by step	A042
	Increase the voltage compensation gain for automatic torque boost, step by step	A046
	Increase the slip compensation gain for automatic torque boost, step by step	A047
	Reduce carrier frequency	b083
Motor speed decreases (stalls) when a load is given to the motor	Increase the slip compensation gain for automatic torque boost, step by step	A047
Motor speed increases when a load is given to the motor	Decrease the slip compensation gain for automatic torque boost, step by step	A047
The inverter trips due to overcurrent when a load is given to the motor	Decrease the voltage setting for manual torque boost, step by step	A042
	Decrease the voltage compensation gain for automatic torque boost, step by step	A046
	Decrease the slip compensation gain for automatic torque boost, step by step	A047

SENSORLESS VECTOR CONTROL MODE

Sensorless vector control can achieve high torque performance (200% torque at 0.5Hz of output frequency) without motor speed feedback (encoder feedback). Sensorless vector control enables the inverter to accurately operate the motor with a high starting torque, even at low speed. It estimates and controls the motor speed and output torque based on the inverter output voltage, output current, and the set motor constants on the inverter.

When using the sensorless vector function all parameters related to manual torque boost and automatic torque boost are disregarded.

To use sensorless vector function, set parameter A044 to the value of "3" and set parameter H003 to the closest value of the combined connected motors in kW's. In some cases, the value for H003 might need to be set (1) size larger or smaller to obtain good performance.

Function	Parameter	Value
VFD Torque Control Mode	A044	03: Sensorless Vector
Carrier Frequency	b083	2.3 kHz or greater
Combined Connected Motor's kW Constant	H003	0.1 – 18.5 kW

In sensorless vector you gain the ability to use the torque limit functions and torque monitor. The torque limit function can be used in traverse motions to help reduce load swing by setting the value of the forward and reverse driving torque limits to a value just over the required torque to move a 100% load. Reference the reduced load swing section for more information and setup instructions.

SPEED DEVIATION

The speed deviation error detection function judges that the deviation is excessive if the deviation between the scaled frequency command and the feedback speed becomes large. Speed deviation is the difference between [d007] scaled frequency monitor and [d008] detected frequency monitor.

When the absolute value of speed deviation has exceeded [P027] Speed deviation error detection level for 2.0 seconds it is judged as a speed deviation error (E52).

Adjustments typically not required. Please consult Detroit Hoist before changing any speed deviation related parameters.

NOTE – A sudden increase in load like shock loading can cause a speed deviation error (E52).

If using an encoder mounted to the hoist drum or gearbox output shaft you will need to set the scaled frequency value to correct for the difference.

Function	Parameter	Example Value
Speed deviation error mode	P126	0 = disabled
		1 = enabled
Speed deviation error level	P027	2.50 Hz
Scaled Frequency Value	B086	0.01 – 99.99
B086 Special Note – DR2 = 0.18 / DR4 & DR6 = 0.21		

FINE TUNING SENSORLESS VECTOR

In most cases fine tuning is not required with the standard motor constants that are supplied when selecting the correct motor constant profile in parameter H003. Before adjusting, try selecting a motor constant profile (1) smaller or larger than the combined connected motors in kW's in parameter H003.

Status	Symptom	Adjustment Method	Adjustment Parameter
Powering	Momentary speed variation is negative	Increase the motor constant R2 step by step from the set value up to 1.2 times of the set value	H021
	Momentary speed variation is positive	Decrease the motor constant R2 step by step from the set value up to 0.8 times of the set value	H021
Regeneration	Torque is insufficient at low speed (~ few Hz)	Increase the motor constant R1 step by step from the set value up to 1.2 times of the set value	H020
		Increase the motor constant Io step by step from the set value up to 1.2 times of the set value	H023
Starting	Motor generates an impact at start	Reduce the motor constant J from the set value	H024
		Decrease the speed response factor	H005
	Motor runs backward for short moment at start	Set 01 (enable) on reverse run protection function (b046)	b046
Decelerating	Motor runs unsteadily	Decrease the speed response factor	H005
		Decrease the motor constant J from the set value	H024
Low Frequency Operation	Motor rotation is unstable	Increase the motor constant J from the set value	H024
		Increase the speed response factor	H005

AUTO-TUNING

In some cases, performing an auto-tune to get the proper motor constant will help in providing optimal performance when operating in sensorless vector control mode A044 = 03. Before auto-tuning make sure that parameter H003 is set to a value of the combined connected motors in kW's, in some cases this value might be (1) size larger or smaller.

Simple Position Note – In order to perform an auto-tune you will need to change P128 = 0 before performing an auto-tune. Note the current position will be cleared once the auto-tune is complete. You will need to change P128 = 2 and return the motor back to the starting position / 0 position. Then change P128 = 3 store it and wait 2 seconds. Then change P128 back to 1.

Use the step chart below to perform an auto-tune and to get / set the values.

Step	Instruction
1	Navigate to parameter H001 and change the value to (1) for static no rotation or (2) for rotational tune and press the SET button to save the change. NOTE – In most cases a static tune will produce the best outcome compared to a rotational tune.
2	IMPORTANT! – All limits are ignored during the auto-tune process. Be sure to make sure you have enough travel if using the (2) rotational tune.
3	Using the pushbutton press the desired directional command to start the auto-tune. If rotational tune is selected the motor will operate in the direction commanded.
4	Once the auto-tune is complete the display will show (_ _ _ O). If the display doesn't show an "O" that means the auto-tune failed and you will need to restart the test.
5	Once the tune is complete, parameters H030, H031, H032 will contain the obtained R1, R2, L motor constants.
6	Set parameter H020 to the value found in H030.
7	Set parameter H021 to the value found in H031.
8	Set parameter H022 to the value found in H032.
9	Operate the VFD and verify if the changed motor constants have improved the performance. If the performance is worse then change parameter H003 to a difference value and save it, then then change it back to the original set value to restore the default motor constants.

REDUCED LOAD SWING

In traverse applications it is possible to reduce the chance of load swing by configuring the VFD for sensorless vector control and using the torque limits to help reduce starting load swing. Also, you will use the alternate acceleration and deceleration functions to reduce load swing when accelerating and decelerating to and from high speeds.

In order to configure the torque limits correctly you will need to suspend 100% of the rated load.

Torque Limit Configuration

Step	Instruction
1	Lift 100% of the rated load off the ground.
2	Navigate to parameter d012 on the traverse VFD that you are configuring. This is the output torque monitor.
3	Operate the traverse motion in low speed in any direction and wait for the torque monitor to stabilize. Write down that value.
4	Operate the traverse motion in high speed in any direction and wait for the torque monitor to stabilize. Write down that value.
5	Using the largest value that was monitored in either step 3 or step 4, set parameters b041, b043 to that value.
6	The Torque limits have now been set to the required amount of torque to move 100% load. Verify operation to make sure the traverse motion can still properly move the load. If the load fails to move increment the values by 1 in parameters b041, b043 until the load moves properly.

Accel / Decel with ALT Accel & Decel Configuration

The acceleration and deceleration times are examples and can be modified to the specific application. The values in parameters F002 and F003 should be double then what is in parameters A092 and A093.

Step	Instruction
1	Navigate to parameter F002 and set it to 9.00 seconds. This is acceleration time (1) and will be used when accelerating from 0hz to 1st / low-speed.
2	Navigate to parameter F003 and set it to 9.00 seconds. This is deceleration time (1) and will be used when decelerating to 0hz from 1st / low-speed.
3	Navigate to parameter A092 and set it to 4.50 seconds. This is acceleration time (2) and will be used when accelerating from 1st / low-speed to high-speed or anything greater low-speed.
4	Navigate to parameter A093 and set it to 4.50 seconds. This is deceleration time (2) and will be used when decelerating to 1st / low-speed from high-speed or anything greater that low-speed.
5	Navigate to parameter A094 and set it to “01” : transition frequency. This will enable the alternate acceleration and deceleration change over based on transition frequency A095/A096.
6	Navigate to parameter A095 and set it to 1.00 Hz over the low-speed frequency. This is the frequency in which the acceleration will switch from acceleration time (1) to acceleration time (2). *Example: If 1st / low-speed frequency = 15.00hz then set A095 = 16.00hz*
7	Navigate to parameter A096 and set it to 1.00 Hz over the low-speed frequency. This is the frequency in which the deceleration will switch from deceleration time (1) to deceleration time (2). *Example: If 1st / low-speed frequency = 15.00hz then set A096 = 16.00hz*

Once everything is configured correctly test the traverse motion for proper operation. If the acceleration or decelerations times are too long for the application, then reduce the required times.

TANDEM HOIST / TROLLEY EZCOM (SPEED / COMMAND SYNCING)

Tandem hoist / trolley EZCOM can be used when 2 hoists / trolleys are used in tandem operation and require the frequency, command status, and run status to sync between each hoist.

The VFD's will need to be configured to communicate between each other and the internal logic activated. A 2-wire shielded cable is required to connect between the VFD's SN/SP RS485 terminals (Belden 9538 type cable is recommended). Typically, A/B relays will be used to supply an input to the VFD to activate the syncing logic when in tandem mode, digital input EA is used.

HOW IT WORKS – The VFD's use the SN/SP RS485 terminals to send frequency, drive status, and command status Modbus registers values between each other. While in sync mode the VFD's compare the directional commands based on conditional internal logic, which ensures if a hoist / trolley reaches a limit, or loses a command signal the opposite hoist will follow the command. While in tandem mode the VFD's also compare frequency values and always sync to which VFD has the lowest frequency value, this ensures the set frequencies always match.

NOTE – If the VFD's are configured for EZCOM tandem sync (P116 > 0) and the EZCOM communication is disconnected (d025 = 9999) the hoist / trolley will ignore all directional commands even when in individual mode and the communication disconnection must be addressed.

TROUBLESHOOTING EZCOM COMMUNICATION DISCONNECTION (d025 = 9999) – Use the VFD monitor parameter d025 to monitor the EZCOM communication disconnection. If the value shown in d024 = 9999 then the communication is disconnected or timed out or not configured correctly. Check the wiring between the VFD's SN & SP terminals. Also make sure the VFD's power up at the exact same time or use a digital input to active the EZCOM communication by configuring one of the available digital inputs to 81:485 Start if power cannot be verified at the same time. Verify EZCOM parameters are configured correctly using the EZCOM parameter chart.

EZCOM SETUP GUIDE

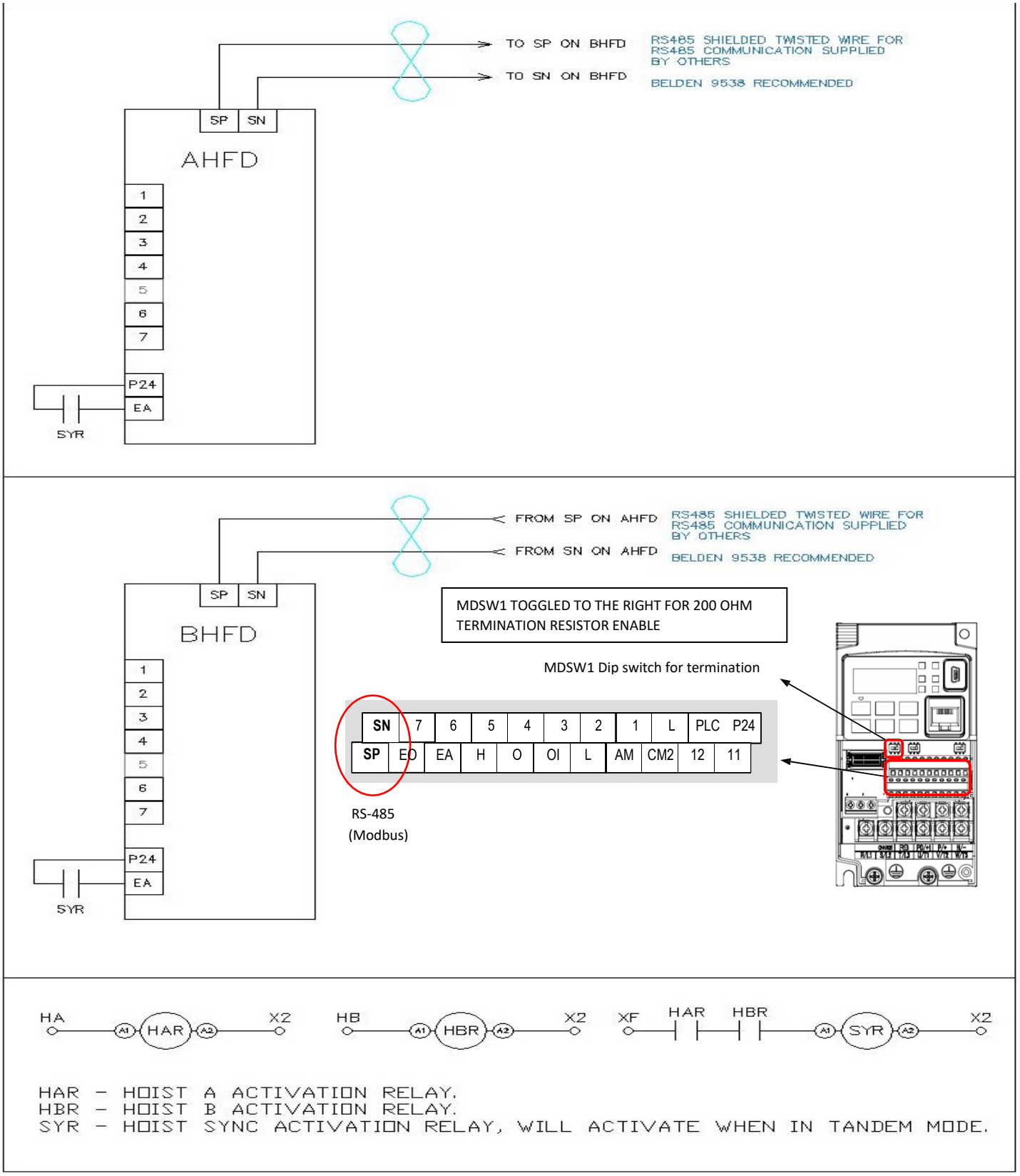
Step	Instruction
1	Configure the VFD's parameters using the EZCOM parameter chart. Most of the parameters should already be configured and only the ones highlighted in yellow should need to be changed. Digital Inputs 6, 7, and EA can be configured for Tandem Activation enable, the configuration for digital input EA is highlighted in the chart below but you can choose to use digital input 6 or 7 by configuring the required parameters for the corresponding terminal.
2	Power down both VFD's and connect the 2-wire shielded cable to the corresponding SN & SP terminals as shown in the EZCOM circuit wiring example on the next page. Be sure to enable the RS485 termination resistor on B hoist VFD as shown on the EZCOM circuit wiring example.
3	Add the tandem activation circuit to digital input EA on each VFD as shown in the EZCOM circuit wiring example on the next page.
4	Power up the VFD's together at the same time and verify the communication is not disconnected by using the monitor parameter d025. If The value in d025 = 9999 then troubleshooting is required.
5	Operate the hoists / trolley in tandem and individually and verify correct operation.

EZCOM PARAMETERS

Function	Parameter	Hoist A	Hoist B
Digital Input 6 = Tandem Activation	P113	4	4
	C006	61	61
Digital Input 7 = Tandem Activation	P114	4	4
	C007	62	62
Digital Input EA = Tandem Activation	P003	02	02
EZCOM sync mode	P116	1 = enabled speed + command	1 = enabled speed + command
EZCOM node ID	C072	1	2
EZCOM communication error select	C076	0 = trip with error	0 = trip with error
		2 = prevent run / without error	2 = prevent run / without error
EZCOM communication time out	C077	1.00 seconds	1.00 seconds
EZCOM communication wait time	C078	2 ms	2 ms
EZCOM communication mode	C096	02 = EZCOM Administrator	01 = EZCOM
EZCOM start node ID	C098	1	1
EZCOM end node ID	C099	2	2
EZCOM communication start method	C100	00 = digital input 81:ECOM	00 = digital input 81:ECOM
		01 = always start on power up	01 = always start on power up
EZCOM data size	P140	2	2
EZCOM destination address 1	P141	2	1
EZCOM destination register 1	P142	1676	1676
EZCOM source register 1	P143	1030	1030
EZCOM destination address 2	P144	2	1
EZCOM destination register 2	P145	1677	1677
EZCOM source register 2	P146	1678	1678

EZCOM CIRCUIT WIRING

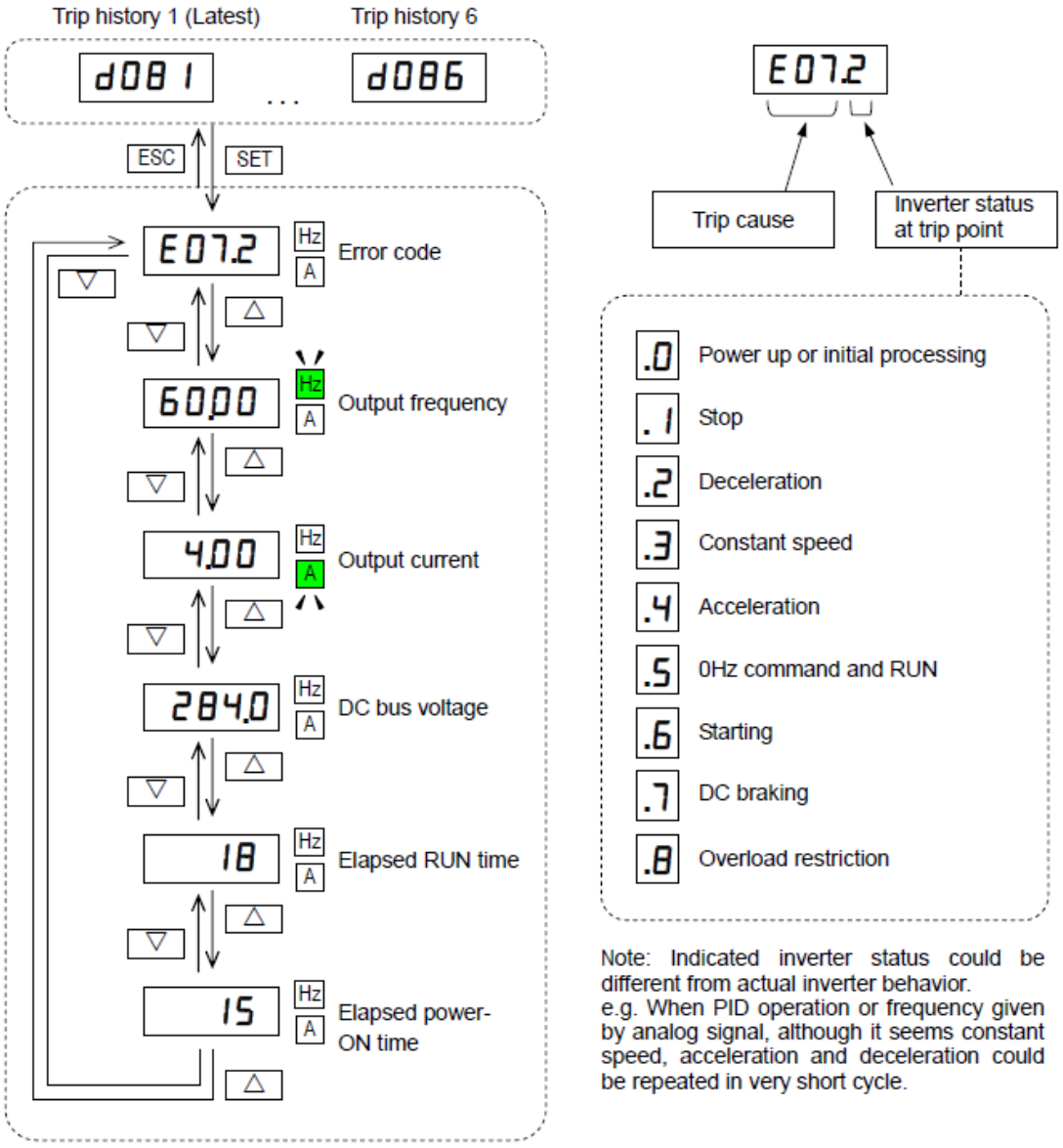
EZCOM wiring example circuit. Make sure the BVFD has the RS485 termination resistor dip switch toggled to the right.



VIEW FAULT HISTORY

To view the fault history, use the step chart below.

Step	Instruction
1	Power on the VFD.
2	Press ESC button and use the arrow buttons to navigate to d081 – d086.
3	Press the SET button to view the fault.
NOTE	d081 will always be the most recent fault.



Note: Indicated inverter status could be different from actual inverter behavior.
e.g. When PID operation or frequency given by analog signal, although it seems constant speed, acceleration and deceleration could be repeated in very short cycle.

MONITOR PARAMETERS

Monitor	Parameter	Brief Description
Output Frequency	d001	The commanded output frequency.
Output Current	d002	Displays the output current to the motor.
Actual Rotation Direction	d003	Output rotation direction (f = forward / r = reverse)
Digital Inputs	d005	Displays the digital input terminal status. Terminals 1 thru 7, read right to left on display
Scaled Output Frequency	d007	The output frequency after b086 scale factor
Encoder Detected Speed	d008	Displays the detected speed from the encoder
Output Torque	d012	Displays the output torque to the motor.
Output Voltage	d013	Displays the output voltage to the motor.
DH Program #	d024	Displays the internal program version number.
EZCOM Communication Status	d025	9999 = disconnected
Local VFD Command Instruction	d026	Displays the local VFD's internal program command instruction number.
Auto-Speed Load Monitor	d027	Displays the load value for the auto-speed function. Iout / 10
Position Command	d029	Displays the commanded position in pulses.
Current Position	d030	Displays the current position in pulses based on the encoder and position of 0 being the upper limit when encoder limits are in use.
Fault Counter	d080	Accumulated number of faults that have occurred.
Fault History 1 thru 6	d081 thru d086	Displays the most recent 6 faults. The most recent will be d081.
DC-BUS Voltage	d102	DC-BUS voltage.
Dynamic Braking Usage %	d103	Displays the current dynamic braking usages in percentage.

TROUBLESHOOTING E52 FAULT

WHAT IS AN E52 FAULT - An E52 fault is a speed deviation fault. The encoder detected speed deviated from the output commanded set-frequency.

HOW IS AN E52 FAULT DETERMINED – When the VFD is operating with an encoder and P126 = 1 the VFD is constantly comparing the d008 detected frequency from the encoder to the d007 scaled frequency while running. If the detected frequency from the encoder deviates outside of the allowable value P027 for the time of 2.0 seconds, then a speed deviation is determined to have occurred.

- Check the encoder shaft collar is tight on the shaft and the encoder tether is secure.
- Check for proper brake operation.
- If the encoder is mounted to the drum or output shaft of a gearbox, make sure the parameter b086 scaled frequency value is set correctly. *B086 Special Note – DR2 = 0.18 / DR4 & DR6 = 0.21*
- If the encoder was replaced in the field be sure to check for correct encoder signal phasing. Try switching sig A with sig B.
- If the fault is occurring at start you will need to determine if the encoder is working. To do this remove the encoder from the motor shaft and navigate to VFD parameter d030 the current position monitor. With the encoder in your hand rotate the encoder shaft and see if the pulse count is changing either counting up or counting down. You can also navigate to VFD parameter d008 and rotate the encoder shaft and see if there is any frequency being detected.
- If a load is stuck in the air, you can disable the Speed Deviation function by changing P126 = 0 for the purpose of lowering the load and to correct the problem.
- If this fault is occurring at random check to make sure the motor brake circuit is not dropping out randomly.
- Contact Detroit Hoist for further assistance.

TROUBLESHOOTING E01 / E02 / E03 FAULTS

WHAT IS AN E01 FAULT – The E01 fault is an over-current during constant speed.

WHAT IS AN E02 FAULT – The E02 fault is an over-current during deceleration.

WHAT IS AN E03 FAULT – The E03 fault is an over-current during acceleration.

- Check motor brake operation, try releasing the motor brake manually to check operation.
- Check for binding or flanging.
- Try decreasing the brake release frequency. See motor brake parameters.
- If the load is heavy check to see if torque is sufficient.
- Check to make sure all motors are wired correctly. In the case of multiple motors make sure all motors are phased correctly.
- Contact Detroit Hoist for further assistance.

TROUBLESHOOTING E05 FAULTS

WHAT IS AN E05 FAULT – The E05 fault is an electronic thermal overload protection fault.

- When the thermal protection begins, [E05] motor electronic thermal error occurs. Check parameter b012 is set correctly. B012 = Total connected motors FLA * 1.25
- Use the output current monitor d002 to monitor the output current while running to see if the output current is greater than the value in parameter b012.
- Check to make sure all motors are wired correctly. In the case of multiple motors make sure all motors are phased correctly.
- Contact Detroit Hoist for further assistance.

TROUBLESHOOTING E06 FAULT

WHAT IS AN E06 FAULT – An E06 fault is a dynamic braking overuse fault. This means the dynamic braking usage ratio was exceeded or met.

- If the status of the fault was while at STOP then this typically points to the input power to the VFD increased for a long enough period of time and the braking chopper was trying to reduce the dc-bus voltage level. Check the incoming power for spikes or if large machinery is starting up causing sags and spikes. If this is the case, then try adding a line reactor in front of the main power of the crane.
- If the status of the fault was during RUN and the hoist has a load brake, then the load brake needs to be serviced. The VFD's dynamic braking allowable usage will be set to 3% to detect when the load brake has excess wear and needs to be serviced.
- Try increasing the dynamic braking activation level parameter b096.
- Contact Detroit Hoist for further assistance.

TROUBLESHOOTING E07 FAULT

WHAT IS AN E07 FAULT – An E07 fault is a dc-bus over-voltage fault.

- Check the dynamic braking resistor circuit. Check that the resistor is connected to the correct terminals RB & P+. Check if the resistor is open using a multimeter.
- If the deceleration time is too short, try increasing the deceleration time.
- The resistor ohm value might be the incorrect value and a new resistor with a lower ohm value may be required.
- If a regenerative unit is used, then check that the regenerative unit is online and functioning correctly and not in a fault status. Also check if the regenerative is going offline due to power imbalance or noise.
- If the status of the fault was while at STOP then this typically points to the input power spiking. Check the incoming power for spikes or if large machinery is starting up causing sags and spikes. If this is the case, then try adding a line reactor in front of the main power of the crane.
- Contact Detroit Hoist for further assistance.

TROUBLESHOOTING E09 FAULTS

WHAT IS AN E09 FAULT – The E09 fault is an under-voltage fault.

- When the DC voltage falls below the threshold due to the incoming power brown out or power sag. Check incoming power when fault occurs.
- If the fault history contains [E07] and [E09] faults this will indicate an incoming power issue. This can occur if large machinery on the same power is starting it might be creating a power sag [E09] and once running or stopping creating a power spike [E07]. Adding a line reactor may improve performance.
- If recently replacing a dynamic braking resistor, make sure the resistor is connected to terminals RB & P+. If the resistor is connected to P+ & N- it will create a high resistive short across the DC BUS and will result in damage to the VFD.
- Contact Detroit Hoist for further assistance.

TROUBLESHOOTING E14 / E30 FAULT

WHAT IS AN E14 and E30 FAULT – An E14 and E30 fault are both referenced as ground faults.

- Check the output conductors for short to ground. Try disconnecting the motor leads from the VFD side and see if the fault no longer persists.
- Test the motor with a megger for insulation break down or for corona discharge insulation damage.
- Check the motor for high moisture contamination.
- Contact Detroit Hoist for further assistance.

CLEARING FAULT HISTORY

To clear the fault history, use the step chart below.

Step	Instruction
1	Power on the VFD.
2	Press the ESC button 4 times or until the screen displays b001.
3	Use the arrow buttons to navigate to parameter b084.
4	Press the SET button to enter the parameter, use the UP arrow to set the value to 01 and press the SET button to save the change.
5	Use the UP arrow to navigate to parameter b180.
6	Press the SET button to enter the parameter, use the UP arrow to set the value to 01 and press the SET button to save the change and the clearing process will begin. Once the process is complete the screen will return to d001.
7	You can use press and hold the ESC button until the screen returns to the frequency monitor or just cycle power.

FAULT / ERROR CODES DESCRIPTION

Fault / Error Code	Description
E01	Over-current event while at constant speed
E02	Over-current event during deceleration
E03	Over-current event during acceleration
E04	Over-current event during other conditions
E05	Electronic thermal overload protection (motor current > b012)
E06	Dynamic braking resistor over used error. Check incoming voltage for spikes.
E07	DC-Bus over-voltage error. Check incoming voltage for spikes.
E08	Memory error / CPU error
E09	Undervoltage error. Check incoming voltage for low power / brown / sags.
E10	Built-in current detector error
E12	External trip error (digital input configured for Ext)
E13	USP error This error occurs if an operation command has been input to the inverter when the power supply is turned ON. Operation command detection is carried out for 1 second after the power supply is turned ON. (When USP function is selected.)
E14	Ground fault error
E15	Incoming voltage error (input power supply is too high)
E021	Inverter thermal trip inverter internal temperature is above the threshold
E030	IGBT error (ground fault to motor or on output of VFD) check motor leads or motor is shorted.
E35	Thermistor error
E36	Brake error
E038	Low-speed range overload error
E040	Operator keypad communication error
E041	RS485 / EZCOM communication error When C076 = 0
E043 / E044 / E045	Internal Program illegal instruction error Typically indicated the internal program has been deleted using a factory default or the internal program memory is corrupted. Contact Detroit Hoist.
E52	Speed deviation. The detected encoder speed and the commanded frequency deviated.
E80	Encoder disconnection
E81	Excessive speed / Over-speed

REVISIONS

Version	*Date*	*Changes / Updates*
1.0	1/7/2022	Initial release
1.1	3/3/2022	Updated to include addition information for Program V28. • Added simple position control logic for hook block limits using an encoder, or travel limits for traverse motions when using an encoder. • Added speed deviation when using encoder. • Added logic for sensor less vector control with hoist using encoder mounted to drum. • Added troubling shooting faults. • Added list of monitors. • Simple position for multistage position control.
1.3	7/18/2022	Updated to include the update to micro-speed retain infinity variable P109.