HITACHI WJ-C1 BASIC INSTRUCTION MANUAL
DETROIT HOIST PROGRAM **V30**

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Stop Read First!

IMPORTANT! – This manual was created based on Detroit Hoist program version 30. Please verify the program number before using this manual by navigating to VFD parameter db-02.

Step	Instruction
1	Power up the VFD.
2	Press the ESC button one time and the screen will change to dA-01.
3	Scroll to db-02 by turning the jog rotary dial clockwise until you get to db-02.
4	Press the button located in the center of the jog rotary dial to enter the parameter.
5	Verify the program number value is 30.
6	To return to the main screen press and hold the ESC button until the screen returns to 0.00 or simply power cycle.

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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 use an input line noise filter and derate VFD to 65% 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 C1-*****-HFU2). Nominal voltage 460-480V | maximum rated voltage 480V
- 208-240Vac (200v class models C1-*****-LFU2). Nominal voltage 210-230V | maximum rated voltage 240V
- Digital I/O's are 24vdc (27vdc max).
- Voltage fluctuation must be ±5% or less but not over maximum rated voltage.
- Frequency variation and voltage imbalance must be ±3% or less.
- Total harmonic distortion (THD) of voltage must be ±10% or less.
- Ambient temperature-10 to 50℃ | 14 to 122 ℉.
- Humidity: 20 to 90 %RH (non-condensing)
- Vibration: 10 to 57 Hz: amplitude 0.075 mm 57 to 150 Hz: 9.8 m/s2 (1.0 G)
- 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 free from corrosive gases and dust.
- Overload Current Rating 150% 60sec / 200% 3sec.
- 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 3.
- Built-in dynamic braking chopper circuit.
- Built-in electronic motor thermal protection.

- **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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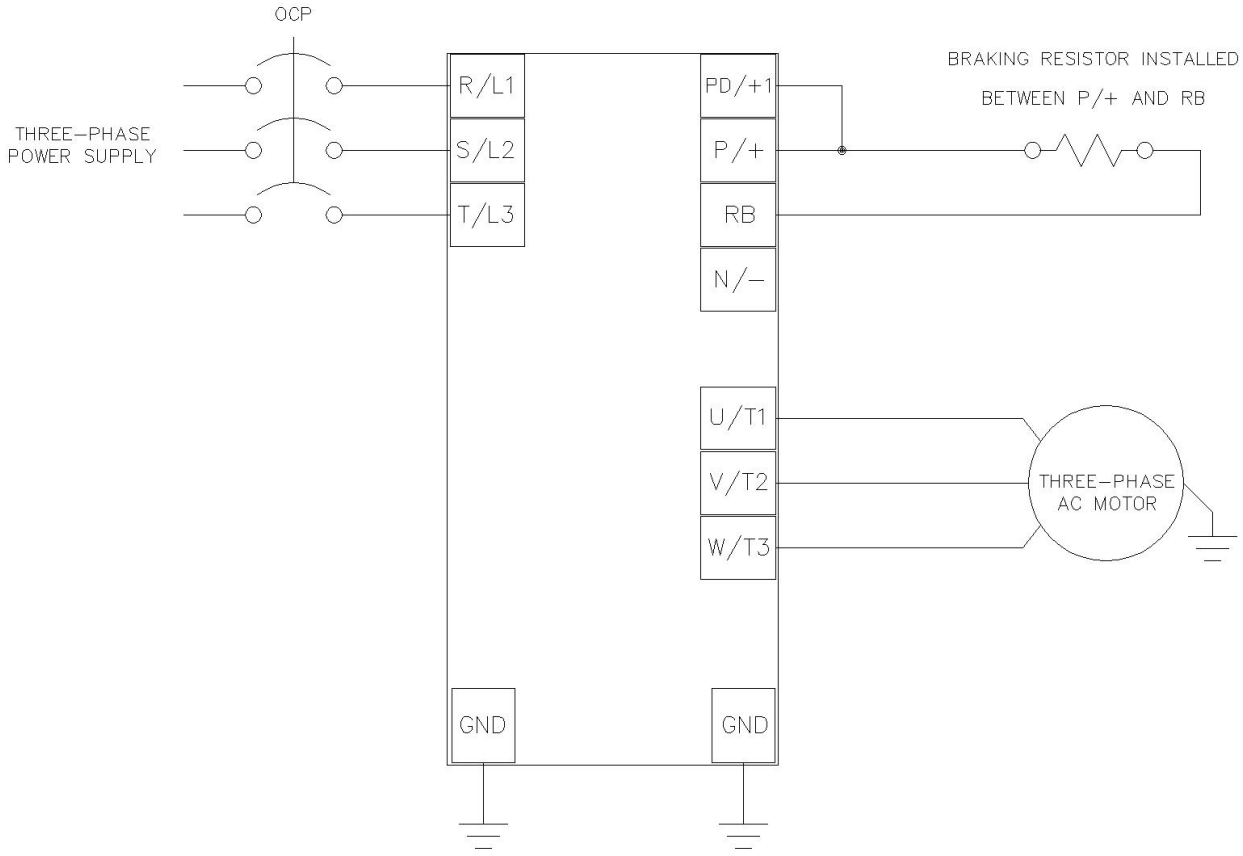
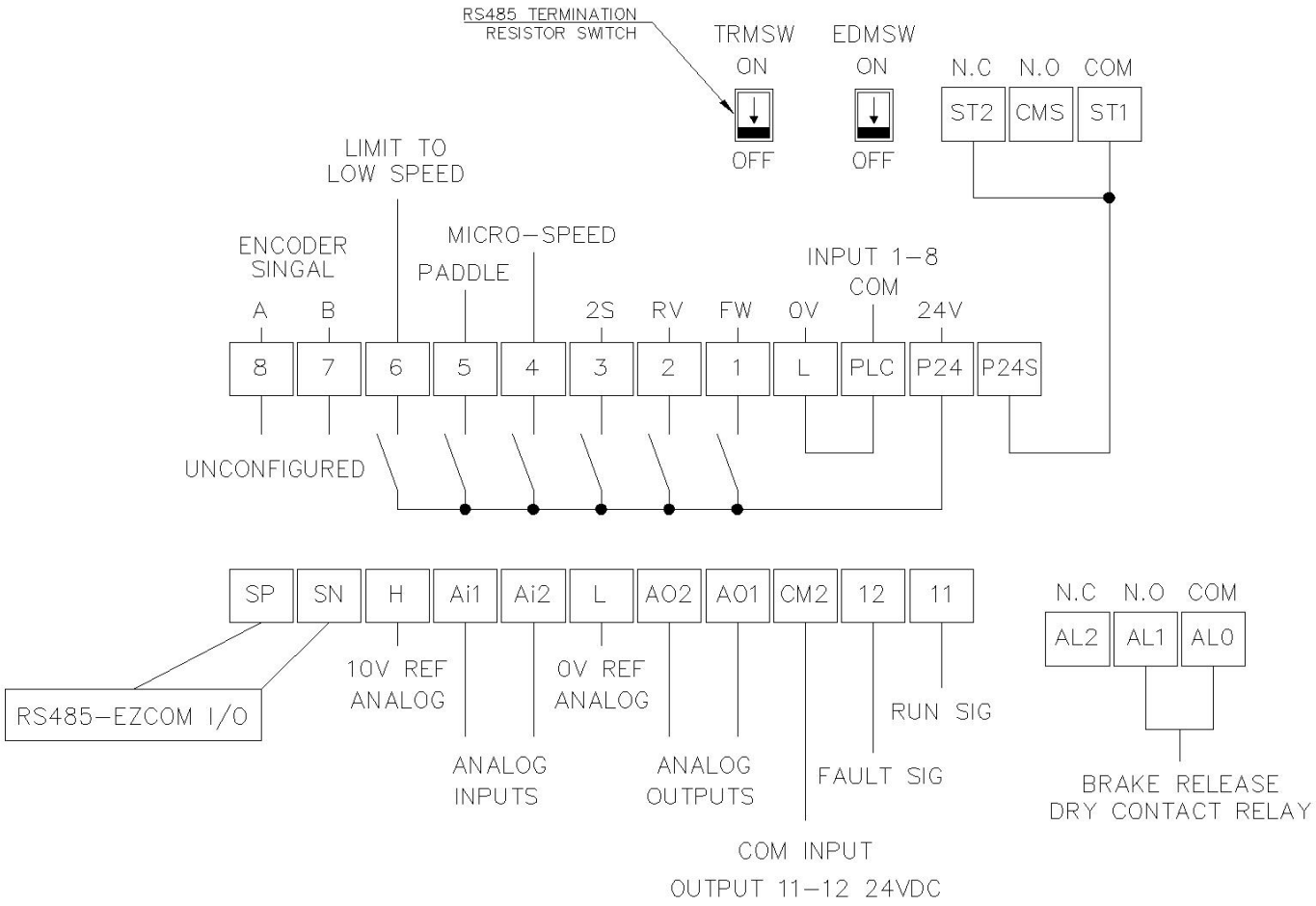


Terminal Symbol	Basic Description	Extended Description
R, S, T (L1, L2, L3)	Main power input (3-ph 50/60hz)	Connect to the AC power supply. Leave these terminals unconnected when using a front-end regenerative converter.
U, V, W (T1, T2, T3)	Inverter motor output	Connect three-phase motor or load reactor.
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-C1 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. Maximum current 100mA
L	Common for inputs 1 – 8.
PLC	Sink / Source logic switch. Sink logic: short-circuit to [P24] terminal Source logic: short-circuit to [L] terminal
1 - 8	24v digital inputs for command functions. 5mA Terminal 4, 5, 6, 7, 8 can be configured for allowed functions. Terminals 1, 2 are permanently assigned to forward(1) and reverse(2) and cannot be changed. Digital input 5 is typically reserved for hoisting paddle limit / maximum upper limit signal.
Encoder Signals Signal A (Terminal 8) Singal B (Terminal 7)	24v Encoder input for control main body. CA-90 = 02 speed feedback. When "Pulse input target function selection [CA-90]" is set to other than "Disable (00)", the input terminal [7] is a terminal for B phase pulse input or direction signal in single-phase pulse input. The input terminal [8] is a terminal for A phase pulse input. When [CA-90] is set to "Disable (00)", it becomes an intelligent input terminal.
CM2	Common for 24v digital outputs 11 - 12
11 – 15	24v digital outputs. 27VDC 50mA max. Voltage drop when turned on: 4 VDC or less.
AL0 (COM), AL1 (N.O), AL2 (N.C)	Brake release relay SPDT | 250vac 5A(resistive) \ 250vac 1A(inductive). The AL relay is permanently assigned to LOG1 logic operator.
Ao2, Ao1	Analog output Ao1 can be configured for 0-10v or 4-20mA and A02 can be configured for 0-10V or PWM using parameters. Ao1 [Cb-26 = 01:Voltage | 02:Current] Ao2 [Cb-36 = 01:Voltage | 03:Pulse]
H	Analog Internal 10v reference.
L	Analog 0v / ground reference.
Ai1, Ai2	Analog inputs, Ai1 and Ai2 can be configured for 0-10v or 4-20mA using parameters below. Ai1 [Cb-08 = 01:Voltage | 02:Current] Ai2 [Cb-18 = 01:Voltage | 02:Current]
SN, SP	RS485 / Ezcom communication terminals. Used for Modbus or Ezcom communication. Shielded twisted wire required and grounding of shield.

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.

If additional inputs are required for the desired speed control method, you will need to add the appropriate circuit if one is not present on the panel. Please consult Detroit Hoist for a wiring diagram to modify the control circuit and provide you with the required components.

Speed Control Method	Standard Speed Control Parameter	Alternative Speed Control Parameter	Parameter Values
2-Step *(factory default)*	UE-18	UE-17	0
2-Step Infinitely Variable	UE-18	UE-17	1
3-Step *Note – Digital Input 7 will be Intermediate Speed / 2nd speed*	UE-18	UE-17	2
	CA-07		92
	UE-24		1
3-Step Infinitely Variable *Note – Digital Input 7 will be Freq-Hold*	UE-18	UE-17	3
	CA-07		92
	UE-24		1
0-10V | 4-20mA *Note – Set analog input mode selection parameters for 0-10v or 4-20mA*	UE-18	UE-17	4 (when using Ai1) 5 (when using Ai2)
4 – 16 Step	UE-18	N/A	6

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.

***NOTE** – If operating at low frequencies 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	UE-11	1000 (10.00 Hz)
	2nd speed | high speed	UE-12	6000 (60.00 Hz)
2-Step Infinitely Variable	1st speed | low speed	UE-11	1000 (10.00 Hz)
	2nd speed | high speed	UE-12	6000 (60.00 Hz)
3-Step	1st speed | low speed	UE-11	1000 (10.00 Hz)
	2nd speed | Intermediate Speed	UE-13	3000 (30.00 Hz)
	3rd speed | high speed	UE-12	6000 (60.00 Hz)
3-Step Infinitely Variable	1st speed | low speed	UE-11	1000 (10.00 Hz)
	Freq-Hold	UE-13	n/a
	3rd speed | high speed	UE-12	6000 (60.00 Hz)
0-10V | 4-20mA	1st speed | low speed | 0v	UE-11	1000 (10.00 Hz)
	2nd speed | high speed | 10v	UE-12	6000 (60.00 Hz)
4 – 16-Step	See Multi-Step Speed Command on next page.		

MULTI-STEP SPEED COMMAND

Multi-Step speed command can be configured up to 16 speeds. Only use multi-step speed command when speed control greater than 3-steps is required. In the multi-step speed command, 4 inputs as a binary combination of 0 (OFF) and 1 (ON) will determine the command frequency, reference the chart below for configuring the steps and speeds. Use the chart below to configure the use of the multi-step speed command.

NOTE *– The multi-step speed command steps outside of the internal program to determine the speeds during normal operation. Please make sure that Ab110 & UE-11 match for the low frequency value. Also make sure to set UE-12 to match the high-speed frequency determined by the multi-speed binary operation.*

Speed Control Method	Parameters	Values
Multi-Step Speed Command	UE-18	6
Input Speed Source	AA101	7 = Keypad
Multi-Step Input Determination Time	CA-55	0-2000 ms
Multi-Step Digital Inputs	Digital Input 3 | CA-03	03 = CF1
	Digital Input 6 | CA-06	04 = CF2
	Digital Input 7 | CA-07	05 = CF3
	Digital Input 8 | CA-08	06 = CF4

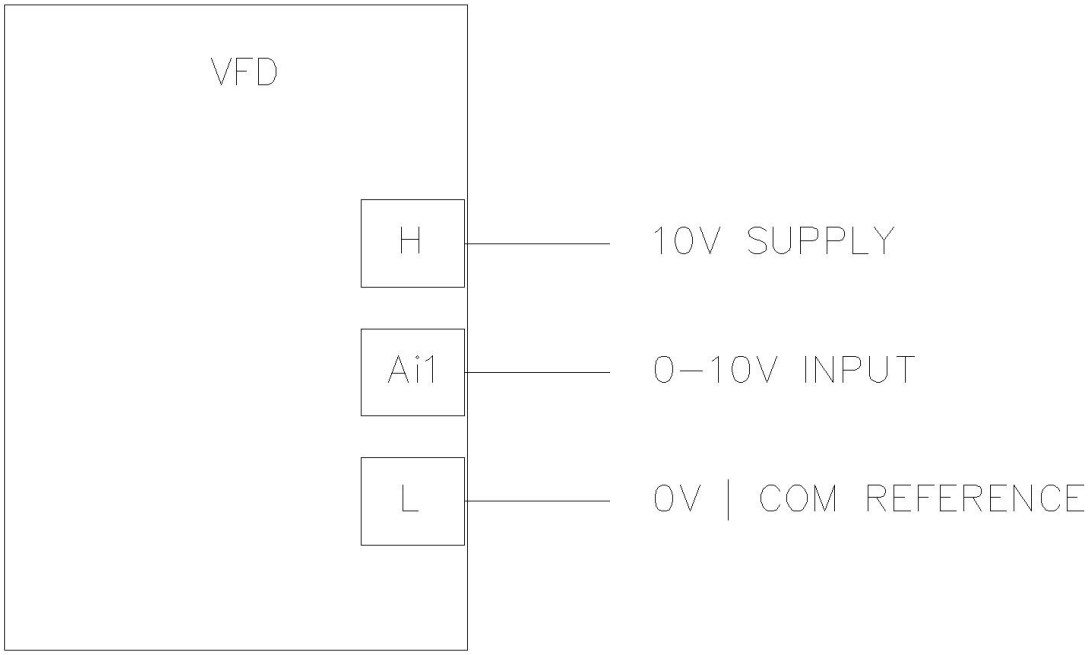
Muti-Step Speed	CF4	CF3	CF2	CF1	Frequency Parameter	NOTE
1st speed	OFF	OFF	OFF	OFF	Ab110	Set UE-11 to match Ab110 Set UE-12 to match the highest frequency set in the multi-step that will be used
2nd speed	OFF	OFF	OFF	ON	Ab-11	
3rd speed	OFF	OFF	ON	OFF	Ab-12	
4th speed	OFF	OFF	ON	ON	Ab-13	
5th speed	OFF	ON	OFF	OFF	Ab-14	
6th speed	OFF	ON	OFF	ON	Ab-15	
7th speed	OFF	ON	ON	OFF	Ab-16	
8th speed	OFF	ON	ON	ON	Ab-17	
9th speed	ON	OFF	OFF	OFF	Ab-18	
10th speed	ON	OFF	OFF	ON	Ab-19	
11th speed	ON	OFF	ON	OFF	Ab-20	
12th speed	ON	OFF	ON	ON	Ab-21	
13th speed	ON	ON	OFF	OFF	Ab-22	
14th speed	ON	ON	OFF	ON	Ab-23	
15th speed	ON	ON	ON	OFF	Ab-24	
16th speed	ON	ON	ON	ON	Ab-25	

0-10V ANALOG SPEED CONTROL

When using 0-10V or 4-20mA the low-speed frequency will be 0V or 4mA. If the 0-10V is supplied from a radio that has its own 10V supply, then you will only need to connect the radio's 0V / COM reference to terminal L and the radio's 0-10V output signal to Ai1 terminal. Terminal H is the 10V supply if you are using an adjustable resistor / potentiometer.

Use the chart below to configure the standard speed control for 0-10V using analog input Ai1.

Function	Parameter	Parameter Value
0-10V Speed Control *Note – Make sure Ai1 is set for 10v Cb-08 = 01:Voltage*	UE-18	4
1st speed | low speed | 0v / 4mA	UE-11	1000 (10.00 Hz)
2nd speed | high speed | 10v / 20mA	UE-12	6000 (60.00 Hz)



ALTERNATE SPEED CONTROL METHOD SWITCHING

It is possible to switch between two different speed control methods using a digital input on the VFD. The Alternate Speed Control Method does not support Multi-Step Speed Control and can only be assigned to the Standard Speed Control Method. In the table below we assign the speed control method switching to digital input 7 (CA-07 = 23:F-OP). When digital input 7 is commanded on the speed control method will operate based on the value in UE-17.

Function	Parameter	Parameter Value
Enable Alternate Speed Control Method	CA-07	023: F-OP
Standard Speed Control	UE-18	0: 2-Step
		1: 2-Step Infinitely Variable
		2: 3-Step
		3: 3-Step Infinitely Variable
		4: Analog Ai1
		5: Analog Ai2
		6: Multi-Step Speed
Alternate Speed Control Method	UE-17	0: 2-Step
		1: 2-Step Infinitely Variable
		2: 3-Step
		3: 3-Step Infinitely Variable
		4: Analog Ai1
		5: Analog Ai2

ACCELERATION / DECELERATION TIMES

When adjusting the deceleration times be sure to check the hook block limit for over travel. If over travel occurs either lower the deceleration time or adjust the limit zones.

Changing the acceleration time to a shorter time can cause an E01 over-current 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 an 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	AC120	3.50 seconds
Deceleration Time	AC122	3.50 seconds
Acceleration Curve	AC-03	00 = liner-curve
		01 = S-curve *(default)*
		02 = U-curve
		03 = Reverse U-curve
Deceleration Curve	AC-04	00 = liner-curve
		01 = S-curve *(default)*
		02 = U-curve
		03 = Reverse 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 the alternate acceleration deceleration switching by input [2CH] you will need to configure an available digital input function for 31:[2CH] (example CA-08 = 31:2CH) and add the 24vdc circuit for that input.

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

Function	Parameters	Example Value
ALT Acceleration Time	AC124	2.50 seconds
ALT Deceleration Time	AC126	1.00 seconds
Method to switch to ALT Accel / Decel	AC115	00 = Switching by input [2CH] (Configure available digital input function to 31: 2CH) Digital Input 8 | CA-08 = 31:2CH
		01 = Switching by frequency break point
		02 = Switching by direction reversal
Accel to ALT Accel break point	AC116	15.00 Hz
Decel to ALT Decel break point	AC117	15.00 Hz

DIGITAL INPUT CONFIGURABLE EXTENSIONS

Due to the limited available digital inputs the general-purpose inputs can be configured for different internal program core functions. You need to set the general-purpose input function and then assign the general-purpose function to a digital input.

Function	Parameter	Example Value
Mi6 Function	UE-23	0 = None 1 = 3-Step Input 2 = Limit to Low Speed 3 = Auto-Speed Enable 4 = Ezcom Sync Enable
Mi7 Function	UE-24	
Mi8 Function	UE-25	
Digital Input 6 Function	CA-06	91:Mi6 92:Mi7 93:Mi8
Digital Input 7 Function	CA-07	
Digital Input 8 Function	CA-08	

MICRO-SPEED FUNCTION

Micro-speed is designed to temporarily restrict or lower the speed set until the function is released. The micro-speed function can be configured for two different modes. This function is factory configured using digital input 4.

Min-Max Mode – This mode will limit the low speed and high-speed frequency range to the values supplied in UE-10 for low-speed and UE-15 for high-speed. In 3-Step maintained the intermediate speed will be the mid-point frequency of the range supplied (Intermediate Speed = (UE-15 - UE-10) + UE-10).

Percentage Mode – This mode will reduce the commanded frequency to the value from UE-16 as a percentage of the standard speed set. Values in UE-10 and UE-15 are ignored. Setting UE-16 to a value of 30 will provide a speed that is 30% of the standard speed sets for the configured speed control method. The maximum value allowed in UE-16 is 90 and the minimum value is 10.

Input Mode – The input for micro-speed can be configured for maintained or momentary input. The maintained selection requires the signal to be constant on/off for micro-speed activation. The momentary selection allows for the activation signal to be toggled on and off using a momentary signal. The momentary selection is useful when there are no additional radio or pushbutton signals available, and the horn signal can be dual purposed as the momentary toggle signal. The status of the momentary activation will be reset on power cycle.

Function	Parameters	Value
Digital Input 4 Micro-Speed Activation Input	CA-04	89:MI4
Input Mode	UE-19	0 = Maintained
		1 = Momentary
Micro-Speed Low-Speed	UE-10	500 (5.00 Hz)
Micro-Speed High-Speed	UE-15	1000 (10.00 Hz)
Micro-Speed Mode	UE-16	Value = 0 (Min-Max Mode) UE-10 and UE-15
		Value >= 10 (Percentage Mode) 10% min value 90% max value

Example Percentage Mode Frequency = 30.00hz when UE-16 = 50 and commanded frequency = 60.00hz.

LIMIT TO LOW-SPEED FUNCTION

For applications where it is required to limit the VFD to low-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. This function, when enabled, will prevent high speed operations and force the VFD to the configured low speed frequency. If micro-speed is active, then the low speed will be the low speed configured for micro-speed.

The parameter chart below references digital input 6 but any available inputs can be used. See the Digital Input Configurable Extensions section for using other digital inputs for this function if required. This function is factory configured using digital input 6.

Function	Parameter	Value
Digital Input 6 Function	CA-06	91: MI6
Mi6 Function	UE-23	2 = Limit To Low Speed
Digital Input 6 Contact Status	CA-26	00 = N.O 01 = N.C

AUTOMATIC ADAPTIVE AUTO-SPEED FUNCTION (AAAS)

The automatic adaptive auto-speed (AAAS) function will automatically increase the frequency to the fastest possible frequency while keeping the output motor current 10% below the overload / over-weight high speed current settings CE107 to prevent trips and false over-weight detections. The auto-speed functions are available when using 0-10V/4-20mA speed control methods, when micro-speed is active, and or when in tandem mode sync mode.

HOW IT WORKS – AAAS works by monitoring the motor current against the high-speed overload value and will continuously increment the output speed until the motor current is in the to 90% - 92% zone of the high-speed overload value.

The speed that is achieved during a lift will be logged and will be the maximum speed that can be achieved in the lowering direction.

If loading changes during the lift the VFD will start de-incrementing the frequency back to the standard high-speed frequency until the motor current becomes in the 90% - 92% zone of the high-speed overload value or until the speed reaches the standard high-speed frequency.

The automatic adaptive auto-speed function can be restricted to activate only if the output current is below the output current value specified in UE-21 and while operating at the base frequency (standard high speed). If the value in UE-21 is set to 0 then the automatic adaptive auto-speed function will be unrestricted. UE-21 uses whole numbers to represent the output current. Example UE-21 = 625 (6.25Amps)

The automatic adaptive auto-speed function can be restricted to enable or disable with a digital input. You can use both the auto-speed activation value and activation method in unison.

Use the charts below to properly configure the auto-speed function. In the chart below the digital input 8 is shown as the auto-speed input activation, this is not required unless you want an input to allow the function to activate.

Function	Parameter	Example Value
Auto-Speed Activation Value	UE-21	0 = Unrestricted > 0 = Restricted *(UE-21 = 625) 6.25Amp*
Auto-Speed Activation Method	UE-22	0 = Function Disabled
		1 = Function Enabled Always
		2 = Function Enabled with Input Activation
Auto-Speed Max Frequency	UE-14	9000 (90.00 Hz) Max
Digital Input 8 Function	CA-08	93: MI8
Mi8 Function	UE-25	3 = Auto-Speed Enable
Digital Input 8 Contact Status	CA-28	00 = N.O

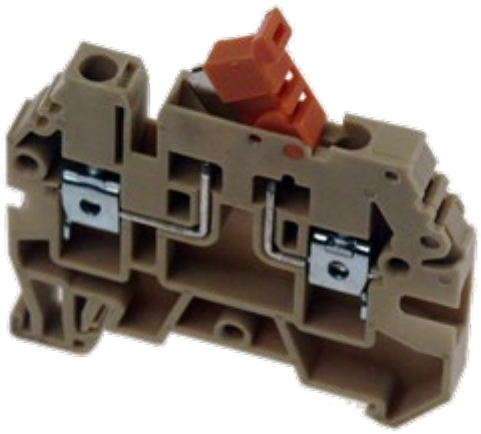
HOIST 125% FIELD LOAD TESTING / OVER-WEIGHT BYPASS

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.

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.*



Over-Weight Bypass Knife Disconnect

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. Using (2) over-weights greatly increases over-weight accuracy and decreases the likelihood of a false over-weight condition. The default setting for the output signal is configured for digital output 11.

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.

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 or internally restrict the hoist up direction. 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	UE-54	0 = External Momentary
		1 = External Maintained
		2 = Internal
Over-Weight Detection Delay Time	UE-55	150 = (1.5 seconds)
Over-Weight Reset Time	UE-56	200 = (2.0 seconds)
Over-Weight (2) Switch Over Frequency	UE-57	1200 (12.00Hz)
Standard Over-Weight		
Standard Over-Weight (1) Value *Output Frequency <= UE-57*	CE106	14.0 Amps
Standard Over-Weight (2) Value *Output Frequency > UE-57*	CE107	15.0 Amps
Digital Output 11 Function	CC-01	69:MO1
Digital Output 11 Status	CC-11	00: N.O 01: N.C

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.
2	Attach the 100% rated load to the hook block.
3	Navigate to the VFD's output current monitor dA-02.
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 CE106 to that value.
7	Take the value from step 5 and multiply it by 1.05 and set over-weight (2) parameter CE107 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.

OUTUT SIGNAL FOR FAULT SIGNAL

The VFD will come from Detroit Hoist with output 12 already configured for fault alarm signal. If you need to switch the fault alarm signal to a different output.

Function	Parameters	Value
Fault Alarm Signal	CC-01 CC-02 (24vdc digital i/o)	017 = AL (Alarm)

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.

Function	Parameters	Value
Fault reset	CA-04, CA-06, CA-07, CA-08	028 = RS

TRIGGER EXTERNAL TRIP / FAULT

In some applications an external trip point may be required to stop all VFD operations in cases like a safety light curtain trip. You can assign one of the available digital inputs for external fault.

Function	Parameters	Value
External Fault / Trip	CA-04, CA-06, CA-07, CA-08	033 = EXT

OUTPUT 0-10V / 4-20mA

The output analog can be configured for multiple functions. Listed below are the most common functions used for hoist and crane applications. If the function is not present, please contact Detroit Hoist for further assistance.

Function	Parameters	Value	Description
Ao1 – Analog output 1 function	Cd-04	dA-01 = Output Frequency dA-02 = Output Current dA-17 = Output Torque	
Ao2 – Analog output 2 function	Cd-05		
Analog monitor adjust mode	Cd-10	0 = disabled 1 = enabled	1 = Outputs to terminals output levels in the adjustment mode.
Ao1 filter time constant	Cd-21	1 – 500 ms	Filters and outputs the selected data.
Ao1 data type	Cd-22	00 = Absolute data	Outputs the absolute value of data
		01 = Signed data	Outputs data with a symbol as is.
Ao1 monitor bias adjustment	Cd-23	-100.0 – 100.0%	Biases data to adjust Point 0 of data.
Ao1 monitor gain adjustment	Cd-24	-1000.0 – 1000.0%	Apply a gain to data to adjust an inclination in data.
Ao1 output level setting at Ao1 monitor adjust mode	Cd-25	-100.0 – 100.0%	Sets output in the adjustment mode. It selects the maximum output (at 100.0%), the minimum output (at 0.0%) ([Cd-22]=00), or the minimum output (at -100.0%) ([Cd-22]=01).
Ao1 Output Type	Cd-26	01:Voltage 02:Current	
Ao2 filter time constant	Cd-31	1 – 500 ms	Filters and outputs the selected data.
Ao2 data type	Cd-32	00 = Absolute data 01 = Signed data	Outputs the absolute value of data
			Outputs data with a symbol as is.
Ao2 monitor bias adjustment	Cd-33	-100.0 – 100.0%	Biases data to adjust Point 0 of data.
Ao2 monitor gain adjustment	Cd-34	-1000.0 – 1000.0%	Apply a gain to data to adjust an inclination in data.
Ao2 output level setting at Ao2 monitor adjust mode	Cd-35	-100.0 – 100.0%	Sets output in the adjustment mode. It selects the maximum output (at 100.0%), the minimum output (at 0.0%) ([Cd-32]=00), or the minimum output (at -100.0%) ([Cd-32]=01).
A02 Output Type	Cd-36	01: Voltage 03: Pulse PWM	

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 bC110 for a calculated time based on frequency, time and a reduction ratio. The electronic thermal protection function also can save the current data and calculate it based on output current and time.

Function	Parameters	Value
Electronic thermal level	bC110	Motor FLA * 1.25
Electronic thermal subtraction function	bC112	0 = disabled
		1 = enabled (Linear Decrease) 2 = enabled (Time Constant Decrease)
Electronic thermal subtraction time	bC113	600 sec
Electronic thermal counter memory function	bC-14	0 = disabled
		1 = enabled

MOTOR BRAKE PARAMETERS

Brake Release Max Wait Time – The brake release max wait time UE-28 is used to compensate for delayed brakes to help prevent driving through the motor brake. This is the maximum amount of time the VFD will wait before accelerating to the commanded frequency.

Motion Type	Function	Parameter	Value
Trolley / Bridge	FA2 Brake Release Frequency	CE-10	N/A
	FA2 Brake Set Frequency	CE-11	N/A
	Brake Release AL Relay Output Function	CC-07	062:LOG1 (default)
	LOG1 Operand 1	CC-40	007: Inverter Ready
	LOG1 Operand 2	CC-41	001: Running
	Brake Release Max Wait Time	UE-28	0
Hoist Load-Brake	FA2 Brake Release Frequency	CE-10	2.50
	FA2 Brake Set Frequency	CE-11	3.50
	Brake Release AL Relay Output Function	CC-07	062:LOG1 (default)
	LOG1 Operand 1	CC-40	007: Inverter Ready
	LOG1 Operand 2	CC-41	003: FA2 Frequency
	Brake Release Max Wait Time	UE-28	0
Hoist No-Load Brake	FA2 Brake Release Frequency	CE-10	2.50
	FA2 Brake Set Frequency	CE-11	4.50
	Brake Release AL Relay Output Function	CC-07	062:LOG1 (default)
	LOG1 Operand 1	CC-40	007: Inverter Ready
	LOG1 Operand 2	CC-41	003: FA2 Frequency
	Brake Release Max Wait Time	UE-28	45 ms

ENCODER PARAMETERS

The VFD can use encoder feedback for speed compensation and absolute position control. When CA-90 is set to 02: Feedback digital inputs 7 and 8 will be configured for encoder signal inputs [7]: Sig B, [8]: Sig A and cannot be configured for any functions.

The VFD can use encoder feedback for travel limits and position control with the encoder mounted to the output shaft of the gearbox, but speed compensation will need to be disabled. If using the encoder for speed compensation the encoder must be mounted to the motor shaft for accurate speed detection.

The Speed Feedback Monitor dA-08 will show the detected frequency coming from the encoder. Verify the shown frequency matches the direction of the motion (Forward/Hoist up positive frequency | Reverse/Hoist down negative frequency).

The Current Position Monitor dA-20 will show the current position in pulses from the forward/upper limit 0 pulse. This value typically is shown as a negative value since the upper limit is 0 (zero).

The Absolute Position Monitor FA-20 will show the current commanded position in pulses when in Absolute Position Control AA123 = 02.

Function	Parameter	Example Value
Main Body Encoder PPR	CA-81	XXX ppr
Main Body Encoder Phase Position	CA-82	00: Phase A-Lead
		01: Phase B-Lead
Encoder Disconnection Time	CA-85	0.0 – 10.0 sec 0.0 = Disabled
Speed Feedback Filter Time	CA-86	0 – 1000 ms 20ms Typical
Main Body Encoder Input Function	CA-90	02: Feedback
Control Mode Selection	AA121	03: Automatic Torque Boost 08: Sensorless Vector Control
Vector Control Mode	AA123	00: Speed/Torque Control 02: Absolute Position Control
Speed compensation With Encoder Feedback	AA124	00: Disable 01: Enable
Encoder Speed Feedback Monitor (signed)	dA-08	x.xx Hz
Current Position Monitor	dA-20	xxxx pulses
Absolute Position Control Commanded Position Monitor	FA-20	Xxxx pulses

GEARBOX MOUNTED ENCODER

In some applications the encoder may be mounted to the output shaft of a gearbox and will need to be electronically compensated to detect the correct speed of the motor. This function should NOT be used when using AA124 = 01 speed compensation with encoder feedback. This function is to be used to electrically compensate for the encoder signal so the over-speed and speed deviation functions work correctly.

Function	Parameter	Value
Motor Gear Ratio Numerator	CA-83	1
Motor Gear Ratio Denominator	CA-84	Gearbox Ratio

USING AN ENCODER FEEDBACK FOR SPEED COMPENSATION

The VFD has the capability to utilize a motor encoder for speed compensation. This is in no way a closed-loop flux vector. The VFD can operate in sensorless vector and automatic torque boost with encoder feedback for speed compensation but lacks torque proving, brake slip detection and load floating capabilities. The over-speed and speed deviation will function correctly.

The VFD's encoder input can only support 24vdc PNP type encoders and max pulse frequency of 32kHz. For applications that will have the motor operate at a frequency greater than 60hz should use an encoder with a PPR of 512 in order to keep the pulse frequency within the 32kHz range.

Pulse Freq-kHz = (PPR * Max RPM) / 60

15.36kHz = (512 * 1800 @ 60hz) / 60

23.04kHz = (512 * 2700 @ 90hz) / 60

Function	Parameters	Value
Encoder Pulse Per Revolution *Maximum Input Frequency 32kHz*	CA-81	XXX PPR
Encoder Phase Sequence	CA-82	01: Phase-B Lead
Motor Gear Ratio Numerator	CA-83	1
Motor Gear Ratio Denominator	CA-84	1
Encoder Disconnection Time	CA-85	1.5 sec
Speed Feedback Filter Time	CA-86	20ms
Encoder Pulse Input Target	CA-90	02: Speed Feedback
Speed compensation With Encoder Feedback	AA124	01: Enable
Control Mode Selection	AA121	03: Automatic Torque Boost 08: Sensorless Vector Control
Vector Control Mode	AA123	00: Speed/Torque Control

USING ENCODER-BASED OPERATIONAL TRAVEL LIMITS

The VFD has the capability to utilize the motor encoder to create digital forward/upper and reverse/lower operational travel limits. The VFD will store the pulse data on power cycle. If power is removed during operation or the motor is rotated without power on the VFD, the encoder limit areas may shift and will need to be reset. If an encoder fault occurs, then encoder-based limits may need to be reset.

Adjustments to the approach zone or stopping pulse count should be used with caution in which to prevent over travel. When adjusting the deceleration time longer than the factory settings the approach zone pulse count and stopping pulse count may need to be increased to prevent over travel. If using the motor gear ratio denominator parameter to compensate for an encoder mounted to the output of the gearbox the approach zone pulse count will automatically be scaled based on the value in CA-84. The pulse count for stopping UE-65 will need to be set manually or can be calculated by (encoder ppr * 1.5 / CA-84). Example where the encoder is 1024ppr and the gearbox ratio is 156:1 then the value for UE-65 = (1024 * 1.5) / 156 which is 9.8 rounded to 10.

Function	Parameters	Value
Encoder Pulse Per Revolution *Maximum Input Pulse Frequency 32kHz*	CA-81	xxx PPR
Encoder Pulse Input Target	CA-90	02: Speed Feedback
Encoder-Based Limits Mode	UE-33	0 = Disabled
		2 = Enabled Using Parameters
Limits Program Mode	UE-66	0 = Program Mode OFF
		1 = Program Mode
		2 = Program Mode with Position Reset
Upper & Lower Approach Zone Rotation Count	UE-64	20 rotations
Pulse Count for Stopping	UE-65	1.5 x encoder PPR when mounted to motor.

SETTING ENCODER-BASED LIMITS

Use the step chart below to set the encoder-based limits.

Step	Instruction
1	Navigate to VFD parameter UE-66 and set the value to 1 and save it.
2	Run the hook block to the desired upper limit position and wait for the motor brake to set.
3	Navigate to VFD parameter UE-66 and set the value to 2 and save it, wait 2 seconds, and change it back to 1. This will clear the current position pulse count.
4	Run the hook block to the desired lower limit position and wait for the motor brake to set.
5	Navigate to VFD parameter UE-66 and set the value to 0 and save it.
6	Verify operation of the upper and lower limits.

USING ENCODER FOR ABSOULTE POSITION CONTROL

Please contact Detroit Hoist for more information regarding this information.

MULTIPOSITION ABSOULTE POSITION CONTROL

Please contact Detroit Hoist for more information regarding this information.

EZCOM RS485 SYNC (SPEED & COMMAND SYNCING)

EZCOM can be used when 2 VFD's are used in tandem operation and require synced operation of the frequency, command status, and fault status. The VFD's will need to be configured to allow peer to peer communication between each other. 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 sync function when in tandem mode, digital input 7 is typically used but others can be configured.

HOW IT WORKS – The VFD's use the SN/SP RS485 terminals to send frequency, drive status, and command status Modbus registers values back and forth between each other. While in sync mode the VFD's compare the directional commands based on conditional internal logic, commanded frequency values and operational status.

Troubleshooting Ezcom Communication Disconnection (db-08 = 9999) – Use the VFD monitor parameter db-08 to monitor the EZCOM communication disconnection. If the value shown in db-08 = 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 098:ECOM if power cannot be synchronized at the same time. Verify EZCOM parameters are configured correctly using the EZCOM parameter chart on the next page.

EZCOM SETUP GUIDE

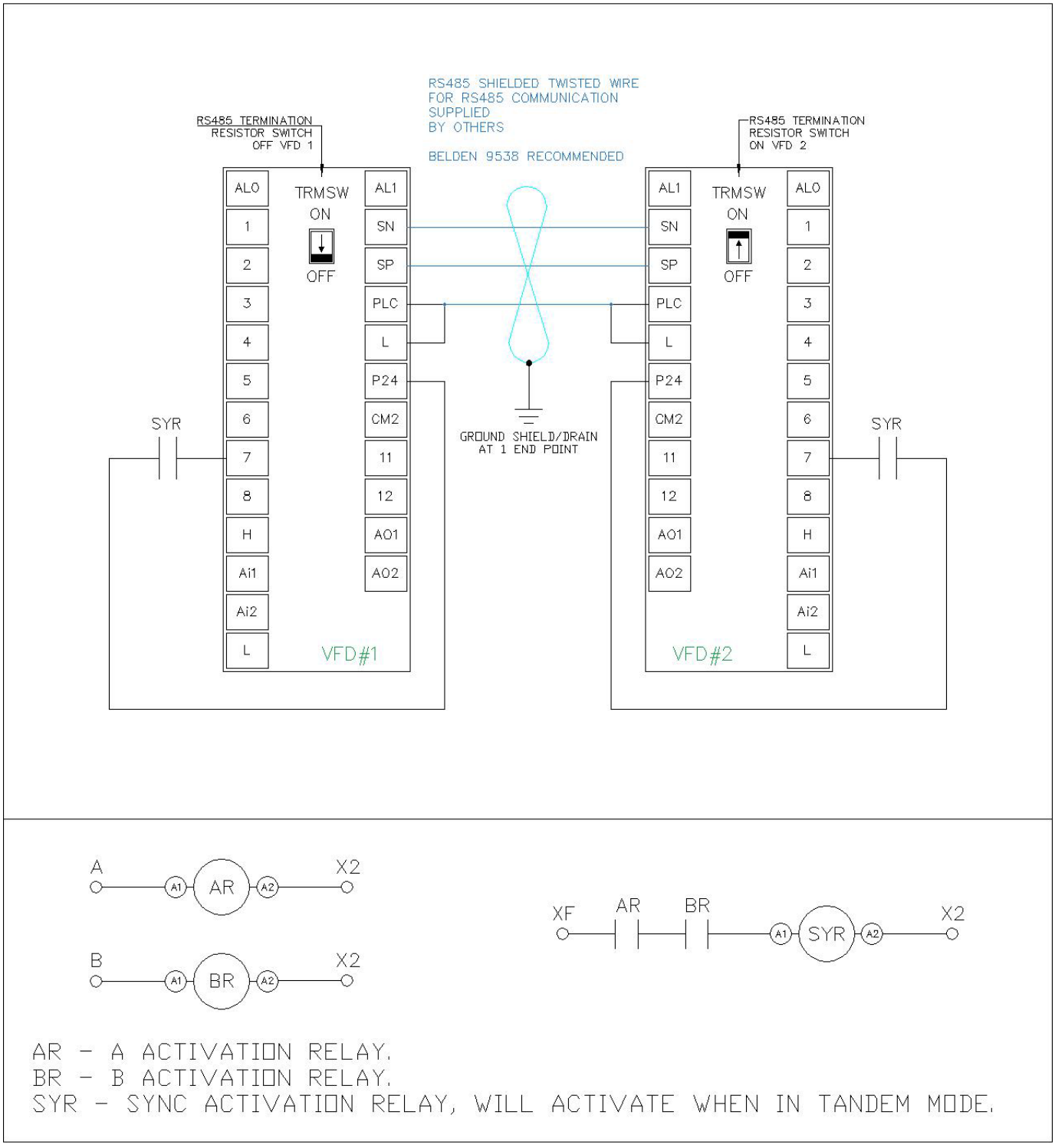
Step	Instruction
1	Configure the VFD's parameters using the EZCOM parameter chart. Most of the parameters should already be configured and only the ones highlighted in yellow need to be changed.
2	Power down both VFD's and connect the 2-wire shielded cable to the corresponding SN & SP terminals as shown in the EZCOM circuit wiring example on the next page. Be sure to switch on the RS485 termination switch on B VFD as shown on the EZCOM circuit wiring example.
3	Add the tandem activation circuit to digital input 7 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 db-08. If The value in db-08 = 9999 then troubleshooting is required.
5	Operate the hoists in tandem and individually and verify correct operation.

EZCOM PARAMETERS

Function	Parameter	Hoist A	Hoist B
Digital Input 7 Function	CA-07	92:MI7	92:MI7
MI7 Function	UE-24	4: Ezcom Sync Enable	4: Ezcom Sync Enable
Sync Mode Function	UE-42	2 = sync speed + command	2 = sync speed + command
EZCOM node ID	CF-02	1	2
EZCOM communication error select	CF-05	0 = trip with error	0 = trip with error
		02 = prevent run / without error	02 = prevent run / without error
EZCOM communication time out	CF-06	1.00 seconds	1.00 seconds
EZCOM communication wait time	CF-07	2 ms	2 ms
EZCOM communication mode	CF-08	03 = EZCOM Administrator	02 = EZCOM
EZCOM start node ID	CF-20	1	1
EZCOM end node ID	CF-21	2	2
EZCOM communication start method	CF-22	00 = digital input 098:ECOM	00 = digital input 098:ECOM
		01 = always start on power up	01 = always start on power up
EZCOM data size	CF-23	2	2
EZCOM destination address 1	CF-24	2	1
EZCOM destination register 1	CF-25	480A	480A
EZCOM source register 1	CF-26	480D	480D
EZCOM destination address 2	CF-27	2	1
EZCOM destination register 2	CF-28	480B	480B
EZCOM source register 2	CF-29	480E	480E

EZCOM CIRCUIT WIRING

EZCOM wiring example circuit. Make sure that VFD#2 has the RS485 termination switched to the on position shown below. Make sure to bond terminals L & PLC as shown below. Ground the shield of the communication cable only at one end. If L & PLC are terminated at the panels 24v power supply 0V reference, then bond the 0V references instead.



EZCOM WJ200 TO WJ-C1 TRANSLATION

If using Ezcom with an existing WJ200 then you will need to modify the Ezcom destination parameters on both VFD's. See the chart below.

VFD		Parameter	Hex Value	Decimal Value
WJ200	Ezcom Dest. Register 1	P142	480B	18443
WJ200	Ezcom Dest. Register 2	P145	480A	18442
WJ-C1	Ezcom Dest. Register 1	CF-25	1677	5751
WJ-C1	Ezcom Dest. Register 2	CF-28	1676	5750

VFD CONTROL MODES

Function	Parameters	Value
VFD Control Mode	AA121	00: V/F Control Constant Torque
		03: V/F Control Automatic Torque Boost
		08: Sensorless Vector Control

MANUAL TORQUE BOOST / AUTOMATIC TORQUE BOOST PARAMETERS

The manual and automatic torque boost parameters are only valid for VFD control modes 00 CT and 03 ATB.

Function	Parameter	Example Value
Manual Torque Boost Operation	Hb140	00: Disabled
		01: Always
		02: Forward Direction (default)
		03: Reverse Direction
Manual Torque Boost Value	Hb141	0 – 20 (4.0 default)
Manual Torque Boost Peak Speed Boost to % of base frequency	Hb142	0 – 50 (4.0 default)
Automatic Torque Boost Voltage Comp Gain	HC101	0 – 255 (100 default)
Automatic Torque Boost Slip Comp Gain	HC102	0 – 255 (100 default)

AUTO-TUNING

Field auto-tuning is generally not required. The VFD will be configured from the factory for the connected motor. If field auto-tuning is required, please use the step chart below.

NOTE – The E-stop / maximum upper limit will retain function to prevent over-travel into the frame. The VFD will automatically control the brake release command during auto-tuning.

IMPORTANT NOTE – If the VFD is for a hoist then make sure no loads are suspended from the hook during auto-tuning.

Step	Instruction
1	Remove all attached loads from the hook. If you plan to do a rotational auto-tune remove the wire rope from the drum.
2	Navigate to VFD parameter HA-01 and select 01: No Rotation for a static tune or 02: Rotation for a rotational tune. Save the selection
3	On the VFD press the GREEN RUN button once and the auto-tune process will start. If there is an issue or you wish to stop the auto-tune process, then press the RED STOP/RESET button.
4	Once the auto-tune process is complete the display with show _ _ _ _ O. The auto-tune data will automatically be applied to the motor constant parameters. Press the red stop reset button to clear the screen.
5	The auto-tune process is now complete.

MOTOR CONSTANTS

Function	Parameter	Example Value
Motor Capacity	Hb102	Motor in kW (7.50) kW
Motor Poles	Hb103	01: 4 pole motor
Motor Voltage	Hb106	230V / 460V
Motor FLA	Hb108	14.0 A
Motor R1 Constant	Hb110	0.459108 ohms
Motor R2 Constant	Hb112	0.502048 ohms
Motor L Constant	Hb114	8.316144 mH
Motor Io Constant	Hb116	6.11 A
Motor J Constant	Hb118	0.03176 kgm2

SPEED DEVIATION

The speed deviation error detection function judges that the deviation is excessive if the deviation between the frequency command and the feedback speed becomes large. Speed deviation is the difference between [dA-12] Output frequency monitor and [dA-08] detected frequency monitor.

When the absolute value of speed deviation has exceeded [bb-83] Speed deviation error detection level and [bb-84] Speed deviation error detection time has elapsed, it is judged as a speed deviation error.

The speed deviation error mode can be configured for the internal program to generate the fault (E52) or set for the standard VFD fault E105. The internal program has an added loop logic in which the speed deviation needs to be confirmed for a preset amount of program cycles which helps prevent nuisance trips.

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 / E105).

NOTE – The speed deviation function will work when CA-90 = 02: Feedback.

Function	Parameter	Example Value
Speed deviation error mode	bb-82	0 = E52 error (UE-58 must be set to greater than 0)
		1 = E105 error (UE-58 must be set to 0)
Speed deviation error level	bb-83	7.5 %
Speed deviation error detection time	bb-84	0.1 sec
Speed deviation program cycles * Valid when bb-82 = 0	UE-58	5 cycles 0 = Disabled

DYNAMIC BRAKING

Dynamic braking is used to electronically brake the motor during deceleration. Dynamic braking requires the use of a braking resistor or a regenerative converter. The parameters below only apply when using a resistor.

Load-Brake – The internal load-brake absorbs 99% of the dynamic braking. The dynamic braking usage ratio should be set to 3% to detect when the load-brake becomes worn, and maintenance is required. Setting the dynamic braking usage ratio greater than 3% will result in the resistor becoming hot and damaging the VFD.

Non-Load-Brake –The dynamic braking usage ratio should be set to 100%.

Dynamic braking mode – By default this is set to 01: enabled during run condition only. 02:enabed all the time helps suppress the DC BUS voltage from causing an E07 fault during idle if power spikes occur randomly. If the power becomes high for a long period of time this will cause an E06 fault to occur.

Dynamic braking voltage activation level – This is the DC BUS voltage level in which the braking chopper circuit will activate. In some cases, with high input power, you may need to adjust the level or an E06 will occur.

Function	Parameter	Values	Factory Default
Dynamic braking allowable usage ratio	bA-60	Load-Brake 3%	3%
		Non-Load-Brake = 100%	100%
Dynamic braking Mode	bA-61	0 = disabled	1 = enabled during RUN
		1 = enabled during RUN	
		2 = enabled all the time	
Dynamic braking DC BUS voltage activation level	bA-62	200V Class – (330 – 400V)	380V
		400V Class (660 – 800V)	780V

OVER-SPEED

The over-speed error detection function judges that the speed is excessive if the feedback speed exceeds the over-speed level. Whether the speed is excessive is determined according to the feedback frequency displayed on [dA-08] Detected frequency monitor. When the speed has exceeded [bb-80] Over-speed error detection level and [bb-81] Over-speed error detection time has elapsed, it is judged as an over-speed error. When an over-speed error occurs, the inverter trips with [E107] Over-speed error. NOTE – The over-speed function will work when CA-90 = 02: Feedback.

Function	Parameter	Example Value
Over-speed error detection level setting	bb-80	135%
Over-speed error detection time	bb-81	0.5 sec

CARRIER FREQUENCY

The carrier frequency is the frequency at which the element that controls the inverter output changes. The carrier frequency can be changed using the [bb101] setting. It is also effective in avoiding resonance of mechanical systems and motors.

If the [AA121] control mode selection is automatic torque boost (03), sensorless vector control (08), zero speed area sensorless vector control (09), or vector control with encoder (10) set the carrier frequency to 2.1 kHz or higher.

NOTE – Increasing the carrier frequency higher than 5.0 kHz will require the VFD to be de-rated due to thermal increase on the output transistors. Increasing the carrier frequency will increase the leakage current and appropriate measures should be taken to correct for the leakage current.

Function	Parameter	Example Value
Carrier frequency	bb101	5.0 kHz

GROUND FAULT PROTECTION

This is a function to protect the inverter by the detection of ground faults between the inverter output and the motor at power-on. The function doesn't work when there is a voltage induced in the motor due to idling or when the inverter trips.

Function	Parameter	Example Value
Ground fault protection	bb-64	0 = disabled
		1 = enabled

INPUT PHASE LOSS PROTECTION

When [bb-65] input phase loss selection is set to 01, when a missing phase is detected in input line, the inverter turns OFF its output. This protection function is used to prevent system failure due to unstable motor operation when a phase loss occurs by breakage of the input power cable.

When the input phase loss protection function has been enabled, an input phase loss error [E024] will occur if a phase loss state due to disconnection or breakage of the input power cable continues for 1 second or more.

When 3-phase AC is not supplied to power supply terminals R, S, and T, such as in cases where DC voltage is supplied to R and T or between P and N of the inverter, this function is disabled regardless of the setting for [bb-65].

Function	Parameter	Example Value
Input phase loss protection	bb-65	0 = disabled
		1 = enabled
Input phase loss detection level	bb-77	0.0 - 200

OUTPUT PHASE LOSS PROTECTION

While operating in closed loop mode (AA121 = 10) this protection function should be disabled due to 0hz load floating. The motor torque proving, and speed deviation protection functions will provide the protection function.

When the output phase loss selection [bb-66] is set to 01, when a loose connection or disconnection of output line, disconnection inside the motor, etc. is detected, the inverter turns OFF its output. Detection of phase loss state is executed in the section between 5Hz to 100Hz.

When the output phase loss protection function has been enabled, an output phase loss error [E034] will occur if a phase loss caused by disconnection or breakage of the motor cable continues.

If the capacity of the drive motor is smaller than that of the inverter, the inverter may detect an output phase loss erroneously. In this case, decrease the value of [bb-67] or set [bb-66] to 00.

If the carrier frequency [bb101] is low, the inverter may detect an output phase loss mistakenly. It may improve by increasing the value of the carrier frequency [bb101].

Function	Parameter	Example Value
Output phase loss protection	bb-66	0 = disabled
		1 = enabled
Output phase loss detection sensitivity	bb-67	1 ~ 100%

INPUT POWER SUPPLY OVER-VOLTAGE PROTECTION

This function will output an error [E015] when the P-N voltage exceeds the voltage level set in the incoming overvoltage level selection [bb-62] for 100 seconds continuously due to incoming voltage.

Function	Parameter	Example Value
Power supply over-voltage error selection	bb-61	0 = warning
		1 = error [E015]
Power supply over-voltage level	bb-62	600v – 820v (400v models) 300v – 410v (200v models)

OVER-TORQUE DETECTION

The over-torque detection function is used while operating in control modes (AA121) sensorless vector control (08). If the output torque exceeds the conditional quadrant set value an over-torque error will occur [E053].

Function	Parameter	Example Value
Over torque level (forward driving torque)	CE120	0 ~ 500%
Over torque level (reverse regen torque)	CE121	0 ~ 500%
Over torque level (reverse driving torque)	CE122	0 ~ 500%
Over torque level (forward regen torque)	CE123	0 ~ 500%

TORQUE LIMIT

The torque limit function is used while operating in control modes (AA121) sensorless vector control (08). This function can be used to limit the forward and reverse driving torques to help with load swing. The motor will stall if the torque becomes greater than this value.

Torque Limit Function	Parameter	Example Value
Forward Driving Torque Limit	bA112	0.0 – 500%
Reverse Regen Torque Limit	bA113	0.0 – 500%
Reverse Driving Torque Limit	bA114	0.0 – 500%
Forward regen Torque Limit	bA115	0.0 – 500%

MONITOR DIGITAL INPUTS

The Hitachi VFD's have a monitor function that will display the status of the 24vdc digital inputs 1 through 8. Navigate to dA-51 To view the digital input status monitor.

The WJ-C1's digital input monitor will display each input using a line that represents LOW or HIGH. The inputs on the monitor read right to left corresponding with digital inputs 1 through 8.

The image below is a reference image to the WJ-C1 digital input monitor. This example shows digital input 5 and 6 is the only active digital input. Again, the screen reads right to left, digital input 1 is the 1st line from the right.

dA-51 Digital Input Monitors

MONITOR PARAMETERS

Monitor	Parameter	Brief Description
Output Frequency	dA-01	The commanded output frequency.
Output Current	dA-02	Displays the output current to the motor.
Actual Rotation Direction	dA-03	Output rotation direction (f = forward / r = reverse)
Encoder Detected Speed	dA-08	Displays the detected speed from the encoder
Output Torque	dA-17	Displays the output torque to the motor.
Current Position	dA-20	Displays the current position in pulses based on the encoder and position of 0 being the upper limit when encoder limits are in use.
Accumulated Output Power kWh	dA-36	Displays the accumulated output in kilowatt hours.
DC-BUS Voltage	dA-40	DC-BUS voltage.
Dynamic Braking Usage %	dA-41	Displays the current dynamic braking usages in percentage.
Digital Inputs	dA-51	Displays the digital input terminal status. Terminals 1 thru 8 right to left on display
Digital Outputs and Relays	dA-54	Displays the digital outputs and relays status.
Analog Input Monitor Ai1	dA-61	Displays the value of the analog input.
Analog Input Monitor Ai2	dA-62	Displays the value of the analog input.
DH Program #	db-02	Displays the internal program version number.
EZCOM Communication Status	db-08	9999 = disconnected
Local VFD Command Instruction	db-10	Displays the local VFD's internal program command instruction number.
n/a	db-12	n/a
Auto-Speed Load Monitor	db-14	Displays the load value for the auto-speed function.
Cooling Fin Temp	dC-15	Displays the temperature of the cooling fins in Celsius.
Accumulation Number of Starts	dC-20	1-65535 cycles
Accumulated RUN Time	dC-22	1-1000000 hours
Accumulated Power-ON Time	dC-24	1-1000000 hours

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 encoder speed feedback (CA-90 = 02) the VFD is constantly comparing the detected frequency from the encoder to the commanded frequency while running. If the detected frequency from the encoder deviates outside of the allowable value bb-83 for the allowable time bb-84, 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.
- 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 dA-20 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 dA-08 and rotate the encoder shaft and see if there is any frequency being detected. The detected frequency should be a positive number when rotating in the forward/up direction and have a negative sign when rotating in the down/reverse direction.
- If a load is stuck in the air, you can disable the encoder speed feedback CA-90 = 00 for the purpose of lowering the load.
- If this fault is occurring at random check to make sure the motor brake circuit is not dropping out randomly. Check to see if the encoder signal in unstable by using dA-08 detected speed monitor, this value while run should be close to the set-frequency value. The allowable tolerance for dA-08 is + /- 1.5hz from the commanded frequency.
- Contact Detroit Hoist for further assistance.
- If there is reason to believe there is induced interference, try adding a cable on ferrite core magnet double wrapped at each end of the encoder wire (see image below).

Encoder Clamp on Ferrite Core Magnet

TROUBLESHOOTING E53 FAULT

WHAT IS AN E53 FAULT - An E53 fault is a over-torque fault.

HOW IS AN E53 FAULT DETERMINED – When the VFD is operating in a control mode of (AA121 = 8) the VFD will use the torque monitor to determine if the output torque becomes greater than the values in over-torque level parameters CE120 – CE123. If the output torque becomes greater than the over-torque levels, then an E53 over-torque fault is determined to occur.

- Check the encoder shaft collar is tight on the shaft and the encoder tether is secure.
- Check output torque monitor dA-17 without weight suspended from the hook and see if the torque is abnormally high, this might point to an issue with the output of the VFD or the motor.
- Check to see if the motor brake is releasing correctly.
- Check the over-torque levels in parameters CE120 – CE123, make sure they are not set lower than the required torque during driving (be sure to include the torque spike during acceleration).
- Contact Detroit Hoist for further assistance.

TROUBLESHOOTING E001 / E005 / E039 FAULTS

WHAT IS E001, E005, and E039 FAULT – The 3 faults are all over-current type faults.

- If operating in closed loop AA121 = 10 then check the encoder shaft collar is tight on the shaft and the encoder tether is secure.
- When the thermal protection begins, [E005] motor electronic thermal error occurs.
- Irrespective of the thermal setting of the motor, the inverter electronic thermal protection works independently to protect the inverter.
- When the current grows rapidly, [E001] excessive current error could occur before [E005] motor electronic thermal error.
- Even if the electronic thermal level is set high, the electronic thermal for inverter works separately at frequency decreased from 5Hz and 80% at 0Hz.
- Check to see if the motor brake is releasing correctly.
- Check if parameter bC110 value is set to lower than the over-weight value or less than 125% of the motor FLA.
- Check for binding or obstructions preventing the drive train from rotating.
- If a load brake is present, check to see if the load brake is releasing and operating correctly.
- Check motor wiring.
- Contact Detroit Hoist for further assistance.

TROUBLESHOOTING E006 FAULT

WHAT IS AN E006 FAULT – An E006 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.
- If the status of the fault was during RUN and the hoist is operating in closed loop AA121 = 10 then the dynamic braking allowable usage ratio may not be set properly, contact Detroit Hoist for assistance in correcting this issue.
- Contact Detroit Hoist for further assistance.

TROUBLESHOOTING E007 FAULT

WHAT IS AN E007 FAULT – An E007 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.
- If 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 E014 / E030 FAULT

WHAT IS AN E014 and E030 FAULT – An E014 and E030 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 breakdown or for corona discharge insulation damage.
- Check the motor for high moisture contamination.
- Contact Detroit Hoist for further assistance.

FAULT / ERROR CODES DESCRIPTION

Fault / Error Code	Description
E001	Over-current error
E005 / E039	Electronic thermal overload error (motor current > bC110)
E006	Dynamic braking resistor over used error
E007	DC-Bus over-voltage error
E008 / E011	Memory error / CPU error
E009	Undervoltage error
E010	Built-in current detector error
E012	External trip error (digital input configured for Ext)
E013	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.)
E014	Ground fault error
E015	Incoming voltage error (input power supply is too high)
E016	Instantaneous power failure error
E019	Temperature detector error
E020	Temperature error Cooling fan rotation speed reduction error
E021	Temperature error
E024	Input open-phase error When [bb-65] input phase loss selection is set to 01, and when a missing phase is detected in input line, the inverter turns OFF its output.
E030	IGBT error (ground fault to motor or on output of VFD)
E034	Output open-phase error When the output phase loss selection [bb-66] is set to 01, when a loose connection or disconnection of output line, disconnection inside the motor, etc. is detected, the inverter turns OFF its output. Detection of phase loss state is executed in the section between 5Hz to 100Hz.
E035	Thermistor error
E036	Brake error
E038	Low-speed range overload error
E039	Electronic thermal overload error (motor current > bC110)
E040	Operator keypad communication error
E041	RS485 / EZCOM communication error When CF-05 = 0 or 1
E042	RTC error

E043 / E044 / E045	Internal Program illegal instruction error
E052	Speed Deviation error
E053	Over-Torque error
E090 – E096	STO path error / FS option error
E100	Encoder disconnection error when using P1-FB option card
E104	Position control range error The encoder position data exceeded (268435455 | -268435455) pulses
E105	Speed deviation error
E106	Position deviation error When using the hook position syncing the follower VFD's position deviated over the value in parameter bb-86 for the amount of time in parameter bb-87
E107	Over-speed error

MANUAL REVISIONS

Manual Version#	*Date*	*What Changed*	Firmware Version#
1.0	6/25/2024	• Initial release for firmware version 30 for new WJ-C1. Used version 30 as a starting point since the WJ200 left off at V29 in beta.	30