V2

DRIVE STARTUP MANUAL
KEB-PM

VERSION 2.1

SMARTRISE

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Document History

Date	Version	Summary of Changes
June 28, 2021	2.1	Updated Motor / Encoder wiring
December 17, 2019	2.0	Changed cover page New document format Deleted Encoder Pole Position Learn – (Optional) Expanded on step by step procedures Replaced Construction section to include wiring to the CXN board Deleted Encoder Pole Position Learn
October 23,2018	1.0	Initial Submittal

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KEB Drive

The KEB drive is a permanent magnet AC drive.

Figure 1: KEB PM Drive

Equipment/Settings Verification

Set and verify the equipment matches the job specific parameters for proper operation. See *V2 Controller* sheet *01 Getting Started* Parameter Table for more information.
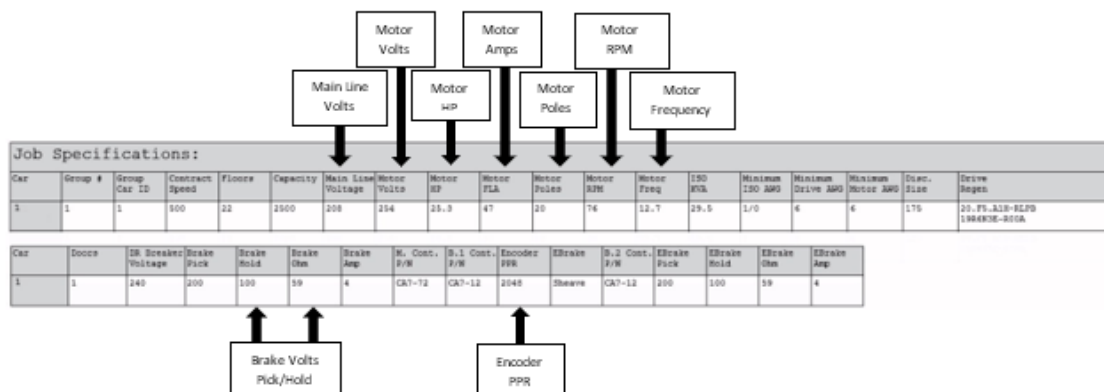

Figure 2: Example of Parameter Table

Scroll through the motor parameters and verify that they are set to the motor nameplate values prior to performing the Motor Learn procedure.

Grounding Requirements

NOTE: A proper and effective building ground connection is required for the safe and successful operation of the controller.

Examples of a proper building-to-controller ground is as follows:

1. Attach the ground wire to the street side of a water main.
2. Attach the ground wire to a grounding rod in the pit.

The controller has a common ground bus terminal connection.

Figure 3: Ground Bus Terminal

- The building, motor, transformer, and filter(s) must all share a common ground. This removes ground loops, limits impedance, and routes noise into the ground.

Wiring

A checklist must be completed during the drive wiring process. See Appendix 1 for terminal location.

Power

Perform the following to connect power. See *V2 Controller* sheet *03 Machine Room* for job specific information.

- Connect main line power to terminal blocks L1/L2/L3.
- Connect the ground wire to the yellow/green terminal block next to L1-L3.

Brake

Perform the following to connect the brakes. See *V2 Controller* sheet *05 Brakes* for job specific information.

- Connect the main brake wiring to terminal K1/K2 and the secondary brake wiring (if equipped) to terminals J1/J2 located on the terminal block next to the M Contactor.
- Jump EB to the terminal on Construction Box and connect either the rope gripper or sheave brake to EBR (if installed). See *V2 Controller* sheet *01 Getting Started* for more information.

Motor / Encoder

Perform the following to connect the drive to the motor and encoder cable. See *V2 Controller* sheet *04 Drive and Motor* for job specific information.

- Connect motor leads to the M contactor at T1/T2/T3.
- Connect the encoder cable to the EnDat card mounted on the drive.

The table below lists the Wiring References for Common Encoders.

Table 1: Wiring References for Common Encoders

Encoder	Heidenhain	Ziehl	Torin ECN413	Hollister Whitney
PWR	Green/Blue and Brown	Gray/Green	Red/Pink	Brown
COM	Green/White and White	Pink/Yellow	Black and Red/White	White
SIN	Green/Black	Gray/Pink	Green and Black	Green
/SIN	Yellow/Black	Red/Blue	Yellow and Black	Yellow
COS	Blue/Black	Blue	Blue and Black	Blue
/COS	Red/Black	Red	Red and Black	Red
Z				
/Z				
CLK+	Gray	White	Gray	Black
CLK-	Pink	Brown	Silver	Violet
DAT+	Violet	Violet	Purple	Gray
DAT-	Yellow	Black	White	Pink
SHIELD	Shield	Shield	Shield	Shield

Construction

Perform the following to wire the construction box. See *V2 Controller* sheet *01 Getting Started* for job specific information.

1. Install jumpers between M24 and the Inputs/Outputs (IOs).
2. Is an external run box being used?

    a. If an external run box is being used, go to step 3.
    b. If an external run box is not being used, go to step 5.

3. Remove factory wires on inputs 521 and 522.
4. Install the Run Bug UP/DOWN switch to IOs 521 and 522.
5. Install the Run Bug UP/DOWN TIME switch to M24.
6. Install the Temporary Run switch between 120 and SFIN on the CXN Board and 120 to THL, MHL, and BHL on the CXN Board.
7. Are there two sheave brakes and no rope gripper?

    a. If there are two sheave brakes and no rope gripper, go to step 8.
    b. If there is a rope gripper or single sheave brake, the process end.

8. Install a jumper between EB and SOUT.
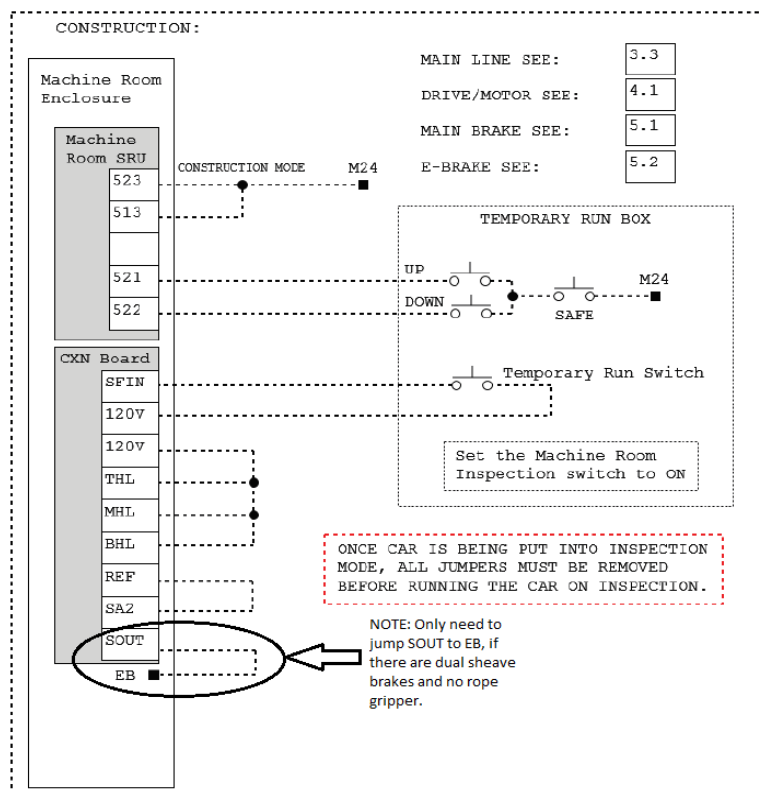

Figure 4: Example of Construction Wiring

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Powering Up

Perform the following to power up the drive.

1. Apply external power by closing the main disconnect.
2. Close the two-pole breaker and all pushbutton breakers.
3. Verify the LCD on the Smartrise board and the KEB Drive powers up.
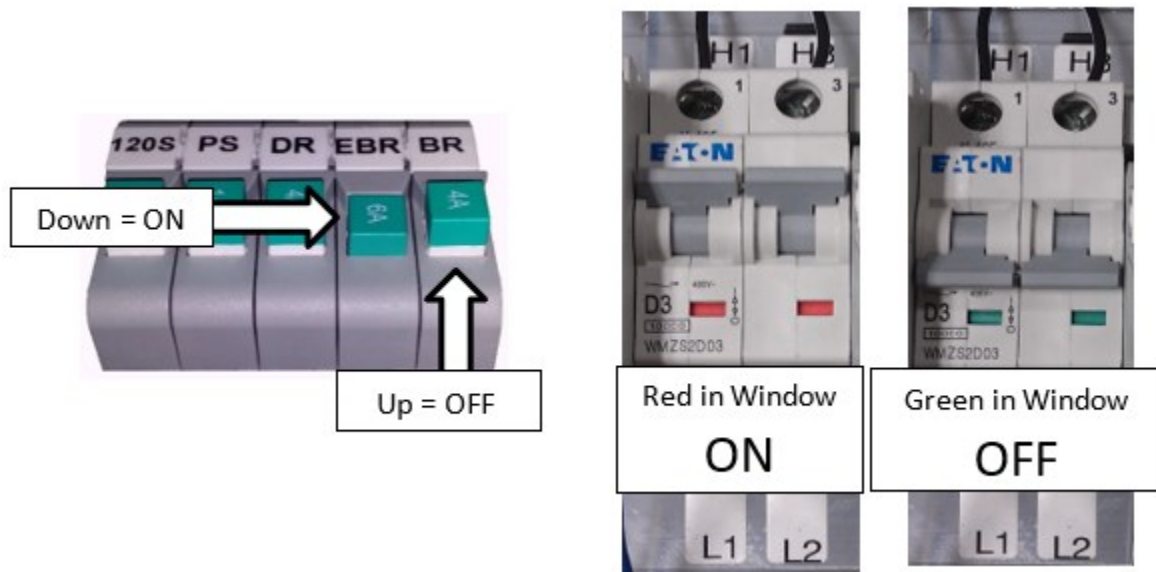
Figure 5: Breakers

Final Setup

Perform the following to set the Bypass Term Limit.

NOTE: The selected menu within the menu options is shown with a *.

1. Toggle the Inspection/Normal switch to Inspection.
2. On the Smartrise Machine Room board, press the left arrow (ESC) button several times to get to the MAIN SCREEN.
3. Press the right button to access the Main Menu.
4. From the MAIN MENU, scroll and select Setup.

Figure 6: MAIN MENU – Setup

5. From the SETUP menu, scroll and select Misc.

Figure 7: SETUP Menu – Misc

6. From the MISC menu, scroll and select Bypass Term Limits.

Figure 8: MISC Menu – Bypass Term Limits
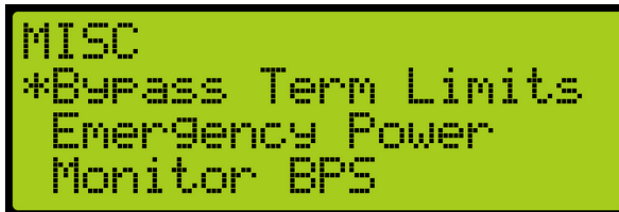
7. From the BYPASS TERM LIMITS menu, set the bypass term limits from NO to YES.

Figure 9: Bypass Term Limits Menu – NO

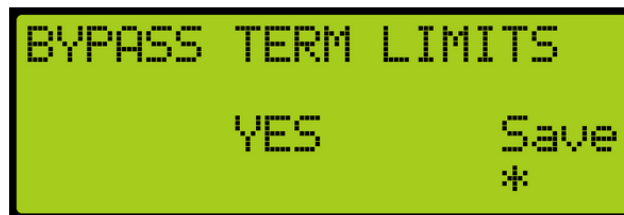8. Scroll and change NO to YES.

Figure 10: Bypass Term Limits Menu – YES

9. Scroll right and press Enter to save.
10. Press the left button several times to get to the MAIN SCREEN.
11. Verify the LCD displays Construction Mode on the MAIN SCREEN.

Encoder Cable

Proper connection of the encoder cable to the drive is key to a proper running elevator. Many drive issues can be attributed to a defective encoder, encoder cable, or the encoder (or cable) not installed properly.

The cable shall be kept a minimum of 8 inches (20 cm) away from all wires having greater than 24 VDC on them. For best results, run the encoder cable in a separate conduit from the controller to the motor.

It is absolutely necessary to ensure these signals are well shielded! Noise on the analog signals resulting from breaks in the shield or improper shield termination will result in vibration in the motor and poor ride quality.

KEB Motor Learn

Smartrise programs the KEB drive with factory defaults to properly communicate with the controller. After factory testing, customer motor data (from customer's EDF) is programmed into the drive to provide an easier "out of box" installation.

Initial Setup

[1]The complete motor data must be learned with the automated learn function.

The Motor Learn function can be found under the Tune Parameters group from the Programming menu (Home > Prog > Tune Parameters > LL01).

Perform the following to set the inspection speed on the Machine Room board to zero.

1. Set Motor Tuning LL01 to Start.
2. Disable the brake by turning off the BR and EBR breakers on the controller.
3. From the MAIN MENU, scroll and select Setup. See Figure 6.
4. From the SETUP menu, scroll and select Speeds & Slowdowns.

Figure 11: SETUP Menu – Speeds & Slowdowns

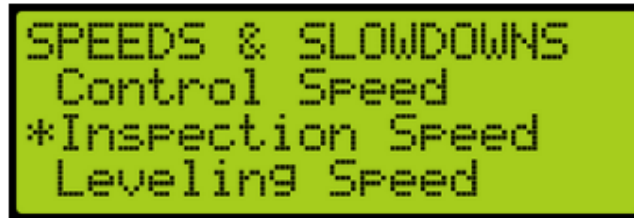5. From the SPEEDS & SLOWDOWNS menu, scroll and select Inspection Speed.

```
SPEEDS & SLOWDOWNS
 Control Speed
*Inspection Speed
 Leveling Speed
```

Figure 12: SPEEDS & SLOWDOWNS Menu – Inspection Speed

6. From the Inspection Speed menu, Scroll and set inspection speed to zero.

```
Inspection Speed

   00000 fpm
   *
```

Figure 13: Inspection Speed Menu

7. Scroll and press Enter to save.
8. Press and hold inspection (speed + direction + enable inputs) until completed.
   NOTE: The process should take 2-5 minutes and emits a high-pitched noise while the drive measures various motor parameters.
9. Is encoder learn function being performed?

   a. If encoder learn function is being performed, go to KEB Encoder Learn.
   b. If encoder learn function is not being performed, go to step 10.

10. Turn on the BR and EBR breakers and return the inspection speed to factory setting on the controller.

SETUP OF THE MOTOR LEARN IS NOW COMPLETE.

KEB Encoder Learn

For absolute encoders on PM motors, if at any time the physical relation between the motor shaft and encoder changes (for example, encoder replaced, encoder slippage, etc.) the encoder position must be relearned.

SPI Encoder Learn - Stationary

SPI can be done with the ropes on and the brake set. To start the SPI functionality, go to LL05 and follow the instructions on the LCD.

Perform the following to set the inspection speed on the Machine Room board to zero.

1. Set Motor Tuning LL05 to Start.
2. Disable the brake by turning off the BR and EBR breakers on the controller.
3. From the MAIN MENU, scroll and select Setup. See Figure 6.
4. From the SETUP menu, scroll and select Speeds & Slowdowns. See Figure 11.
5. From the SPEEDS & SLOWDOWNS menu, scroll and select Inspection Control. See Figure 12.
6. From the Inspection Speed menu, scroll and set inspection speed to zero. See Figure 13.
7. Scroll and press Enter to save.
8. On the controller, press and hold inspection (speed + direction + enable inputs) until completed.
   NOTE: During the SPI process, the motor makes a series of chirps and the LCD display shows the encoder position samples. See Encoder Synchronization for more information.

9. Go to Encoder Synchronization.

Encoder Synchronization

The Encoder Synchronization process determines the correct A/B encoder channel phasing and direction of rotation for PM motors and immediately follows either method of learning the encoder pole position.

Perform the following for encoder synchronization.

1. Set Encoder Synchronization LL07 to Start.
2. Follow the directions on the drive keypad.
   NOTE: The drive runs the elevator and swaps the phasing and direction of the A/B channels as needed.

3. Turn on the BR and EBR breakers and return the inspection speed to factory setting on the controller.

SETUP OF THE ENCODER LEARN IS NOW COMPLETE.

Operation

Run the car and complete the checklist during the verification process.

No Faults

Make sure the car is moving without triggering a fault either on the Smartrise SRU board or the drive. If the SRU board displays a drive fault, look at the drive to see what the fault is. See Drive Fault/Encoder Fault for troubleshooting drive fault.

Proper Direction

Make sure the car is moving in the same direction as the control switch on the Run Bug. See Wrong Direction for troubleshooting proper direction faults.

At Speed

Make sure the car is moving at the proper inspection speed (approximately 50 fpm). See Car Moving to Slow or Rough for troubleshooting at speed faults.

Under Control

Make sure that the car is moving under full control. The car should stop when commanded from the Run Bug. Verify that the car runs with no faults for 10 seconds or more. See Brake Not Lifting for troubleshooting under control faults.

Troubleshooting

The following sections list troubleshooting procedures. See Appendix 3 for advanced troubleshooting procedures.

Drive Fault/Encoder Fault

The most common fault at drive startup is the Encoder fault.

Perform the following checks to correct this fault:

- Check for a solid shield-to-ground connection at the motor and drive.
- Check for correct colored encoder wires to the terminals.
- Swap wires A with /A or swap A and /A with B and /B.
- Perform the SPI Encoder Learn - Stationary process after swapping any encoder wires or phasing.

Brake Not Lifting

If the brake is not picking, make sure that the brake is wired according to *V2 Controller* sheet *05 Brake Connection* and verify that the EB terminal is jumpered to the terminal. See *V2 Controller* sheet *01 Getting Started* for more information.

If the brake has the proper voltage check the following:

- During a run command, check the DC voltage between points K1/K2 and J1/J2 if secondary brake is installed. Verify the voltages are also at the brake coil(s) when commanded to pick.
- Verify that the actual brake voltage matches the brake coil voltage shown on the *V2 Controller* sheet *01 Getting Started* Parameter table.

Wrong Direction

If the car is moving in the wrong direction check the following:

- On the Smartrise controller board make sure that IO 521 comes on when commanding the UP direction and IO 522 comes on when commanding the DOWN direction.
- Swap two of the motor leads (T1 with T2).

Car Moving to Slow or Rough

If the car is moving to slow or rough perform the following:

- Swap encoder wires A and /A- on the drive.
- Verify the brakes are lifting fully.

Appendix 1 Main Line and Encoder Terminal Locations

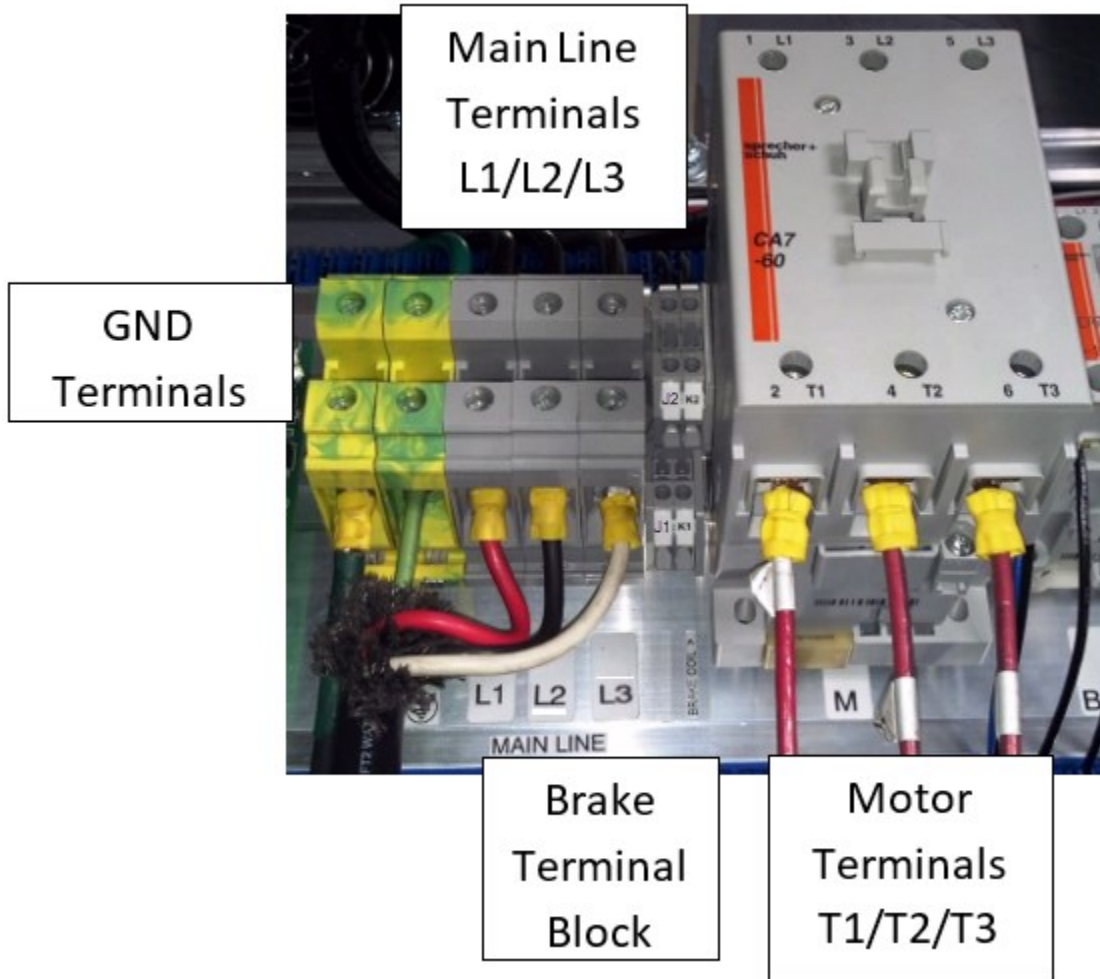The figures below show the Main Line and Encoder terminal locations.

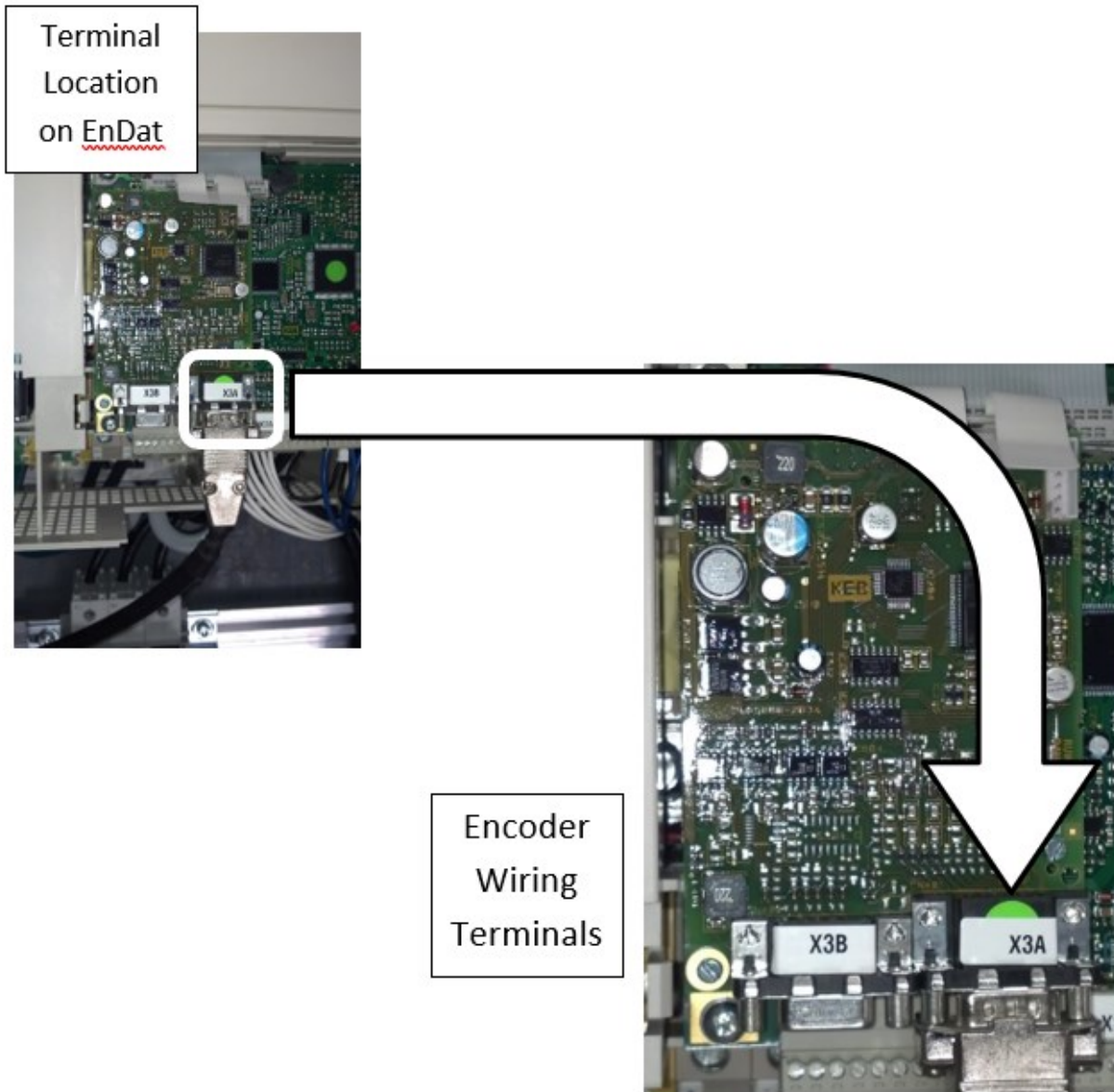*Figure 14: Main Line Terminal Locations*

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Figure 15: Encoder Terminal Location

Appendix 2 KEB Programming Menu

The programming menu is where all manual parameter adjustments are made and can be accessed at Home > Prog (F3).

The table below lists the Parameter Groups.

Table 2: Parameter Groups

Parameter	Parameter Group	Description
OS00 - OS22	Operator System	Provide general information about the operator and drive hardware and software. Additionally, the operator password level is set here which allows for different access levels.
US02 - US06	Basic Setup	Provides the very basic information needed to configure the drive, including motor type, control type, and contract speed.
LI01 - LI20	Inputs	Defines the logic of the inputs and assigns control functionality to the digital inputs.
LM01 - LM33	Motor Data	Defines and displays all relevant motor values and motor protection settings.
LE01 - LE36	Encoder Data	Defines the settings and scaling of the drive encoders.
LN01 - LN05	Machine Data	Defines the machine data, including sheave diameter, roping ratio, and rated load values.
LS01 - LS55	Speed Profile	Adjusts the speed, acceleration, and jerk values across the elevator run profile.
LL01 - LL17	Tune Parameters	Contains the automatic tuning parameters. The user can program the system inertia, motor data, and motor pole positions.
LC01 - LC44	Control Setting	Contains advanced adjustment parameters which affects the motor gains, system inertia gains, pre-torque, etc.
LT01 - LT13	Timer Parameters	Adjusts brake and drive signaling timers.
LP01 - LP08	Positioning Parameters	Contains the adjustments needed for the drive.
LX01 - LX18	Special Functions	Allows advanced adjustment of the drive and facilitates function tests of drive components.
CH01 - CH03	Configuration Handling	Allows a user to save parameters and default to OEM settings.
LA01 - LA40	Analog I/O	Defines and adjusts the analog inputs and outputs.
LO01 - LO20	Outputs	Defines the functionality of the relay and solid-state drive outputs.

Appendix 3 Advanced Troubleshooting

The following list of troubleshooting steps are to help with the startup and smooth running of the drive.

Starting Over (Defaulting Drive)

Sometimes parameters get changed, or certain functions that should work are not working for no apparent reason. In this case, starting over with factory defaults may solve these issues.

Perform the following to default the drive to factory settings.

1. Navigate to US03 and load the opposite configuration of what is shown.
2. To load opposite configuration:

    a. If the original configuration is Gearless, navigate to PM | Induction | Gearless and load (Induction) Geared and Save. Go to step 3.
    b. If the original configuration is Geared, navigate to PM | Induction | Geared and load (Induction) Gearless and Save. Go to step 3.

3. After this value is saved, go back and load the correct type. This does a complete background default on the drive.
4. Navigate to US05 and select Write Configuration to Drive.

Perform the following to re-load OEM values (Programmed by Smartrise).

- Go to US05 and select Restore OEM Defaults to reload Smartrise settings.

Vibration

If any vibration occurs:

- Cut the KP (LC03, LC04) and KI (LC08, LC09) gains in half.

Motor Noise

If the motor sounds noisy:

- Change LE.05 to 8 (PM)

Motor Not Running When Given Command

Perform the following when a motor is not running with given command. See *V2 Controller* sheet *04 Motor and Drive Connections* for job specific information.

1. Verify parameterLI.01 is set to NPN in order for the drive to receive signals from the controller.
2. Verify parameters LF.41 through LF.43 are set to the correct value See *V2 Controller* sheet *04 Drive and Motor* Parameter table.