FUELMASTER

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K&K 3-Line-Display Installation Manual for FMPlus

08/28/2025

FMPlus Software Version: >= 5.21.3.0

FMPlus FMU Firmware Version >= 4.13

Document Version: 3.0

Contents

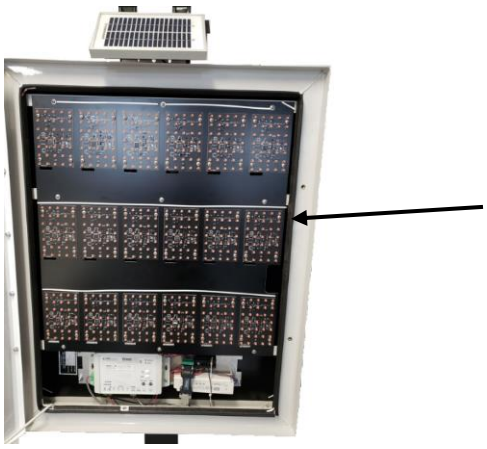
3-Line Display Overview

This K&K 3-Line Display Installation Manual guides the FuelMaster® installer through the installation, configuration and troubleshooting of the **K&K Systems 3-Line Display** for **FMPlus** systems.

Syntech Kit part ID: 191F0280-30 includes all the necessary components for a complete FMPlus installation.

3-Line Display Differences

Gen 1 Release – The LED Panel Assembly is secured to the main housing.



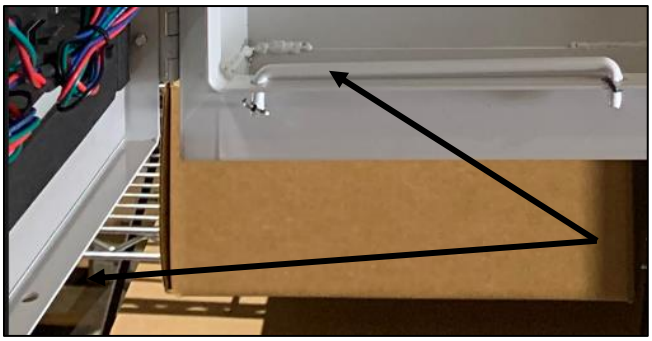
Gen 2 Release – The LED Panel Assembly is secured to the door.

Both production releases are functionally equivalent. The only difference is where the LED Panel Assembly is mounted inside the unit.

Additional Gen 2 Release Changes

- Changed colored Syntech logo to monochrome Fuelmaster logo on the door.

- The Door Prop Rod holds the door securely open at a 120-degree angle providing plenty of clearance while working inside the display.



- The door is now closed and locked with T-Handle.

- Mounting brackets changed from U-bolt, L-brackets, to 'V' shape bolt-on brackets, since new housing no longer contains the track for mounting with L-Bracket.

3-Line Display Product Identification and Compatibility

Product identification is located inside the unit and affixed to the back of the housing. Important data includes:

- Date of Manufacture
- Model Number
- Serial Number.

3-Line Display Compatibility (FMPlus - Gen 1, Gen 2)

Scenario	Supported
Adding a K&K 3-Line Display to a New or existing FMU.	
Replacing a Tekinno 3-Line Display with a K&K 3-Line Display. See Considerations when replacing a Tekinno 3-Line Display:	
Adding a K&K 3-Line Display to an existing FMPlus FMU that already supports a Tekinno 3-Line Display. • The FMU can only support a Tekinno 3-Line Display or a K&K 3-Line Display, *not both*. • This information should have been explained prior to purchasing the K&K 3-Line Display. If that is not the case, please contact your FuelMaster distributor or service provider immediately.	

Considerations when replacing a Tekinno 3-Line Display:

- First, determine the I/O Silver Board configuration housed in the lower FMU pedestal and note what devices the I/O Silver Board is interfacing with.
- The I/O Silver Board and associated hardware must be removed. If the I/O Silver Board is only interfacing with the Tekinno 3-Line Display, then there will only be one I/O Silver Board installed. The I/O Silver Board part ID that shipped with the Tekinno kit is 264736.
- If the FMU is interfacing with a Tank Monitor Unit (TMU) *and* the Tekinno 3-Line Display, then there will be two I/O Silver Boards, one stacked on top of the other. Again, the part ID that shipped with the Tekinno kit is 264736 and is usually the top I/O Silver Board. The board and associated hardware must be removed.

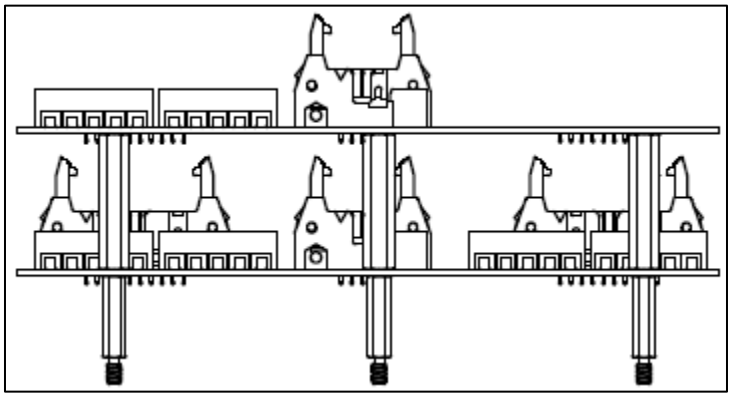


Image of Stacked I/O Silver Boards, 264736 is on top.

I/O Silver Board Assembly Removal

NOTE	Label all cables prior to removal.

1. Shut off AC power to FMU, all connected dispensers, connected Tank Monitor Unit, and, if applicable, all connected FMUs.
2. Unlock and open Pedestal door.
3. Remove lower electrical access cover.
4. Disconnect all ribbon cables and plugs from the 1/0 Silver Board.
5. Remove the 1/0 Silver Board mounted over the Pedestal 1/0 Board on six standoffs.

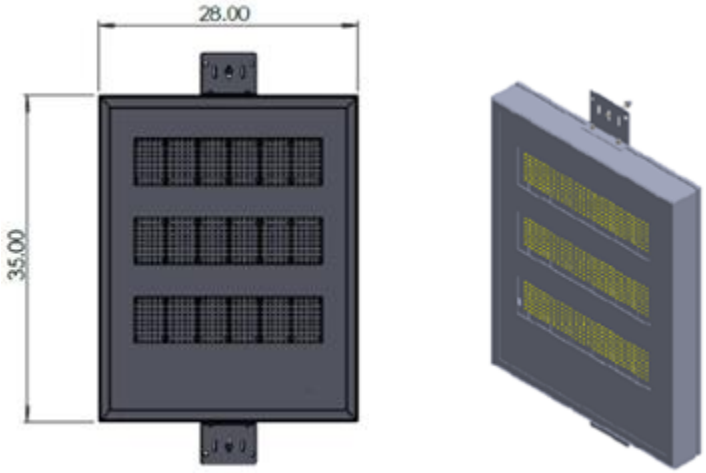
3-Line Display General Details (Gen 1 Release)

Display Dimensions

Height: 35.00 inches

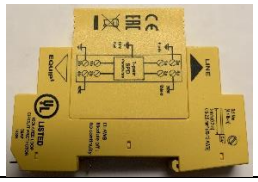
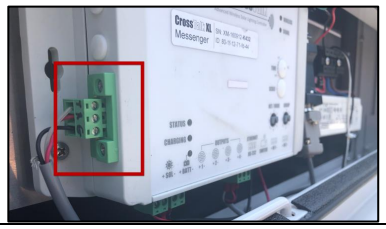
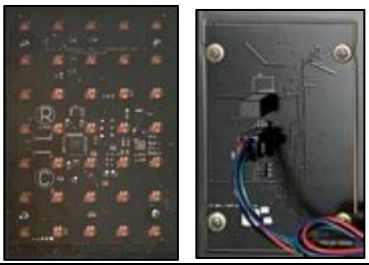
Width: 28.00 inches

Depth: 4.83 inches



Display Components

Part	Image
Solar Panel with Mounting Bracket STS Part ID: 266810	
K&K 3-Line Display STS Part ID: 266552	

3-Line Display Mounting Hardware Kit The brackets can be used for both wall mount and pole mount. Refer to the installation section below. ▪ Bracket part ID: 266808 ▪ MFR Part ID: MES651218A ▪ Description: BRACKET, MOUNTING, UNIVERSAL, 3LD, K&K	
Surge Protector, RS232/RS485 STS Part ID: 266734	
QUAD UART to Surge Protector Cable STS Part ID: 191F0234-30	
Quad UART Board STS Part ID: 941B0107C (-20)	
3-Line Display / CrossTalk Controller Connections ▪ Wire, 3-Conductor, Shielded, 22AWG, 300V (Cable) - STS Part ID: 255114 ▪ 3-Pin Connector - STS Part ID: 265926	**Image n/a** 
LED Panels (Replacement Part) STS Part ID: 267355	

Mounting the 3-Line Display (Gen 1)

IMPORTANT	The 3-Line Display will require at least three people to safely mount the display.

Assumptions

Mounting procedures assume the following:

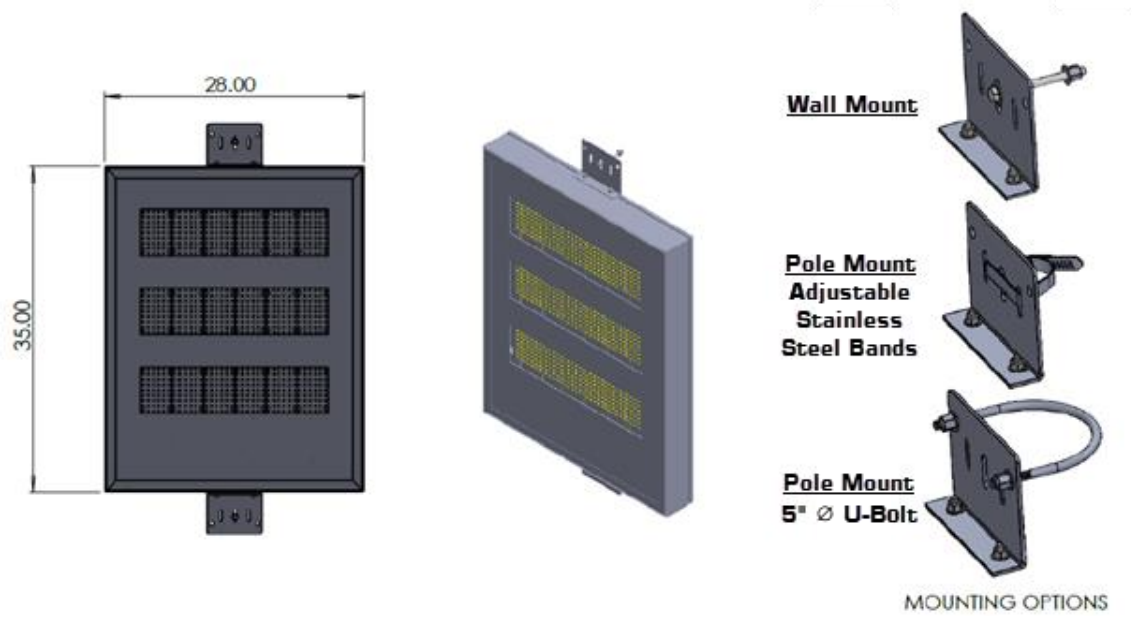
- A 3-Line Display is not currently installed (see Compatibility scenarios).
- You are working with an FMPlus Unit
- You have a Citel Surge Protector (STS Part ID: 266734)

Mounting Options

- The 3-Line Display can be mounted to a wall or on a pole.
- Syntech does not stock or sell a mount, as the display can be attached to either.
- Syntech does not stipulate strict guidelines for mounting, as factors are different from site to site. Instead, Syntech relies on the knowledge and experience of the distributor/installer performing the installation, and that they will ensure the installation and mounting are completed to code, with safety as the highest priority.

Mounting Kit Hardware

- The K&K 3-Line Display comes with two universal mounting brackets (Syntech part ID: 266808).
- The brackets can be positioned at the top, bottom, or on the sides.
- Additional brackets can be ordered for extra stability.
- The mounts can be attached to a wall or pole in following manner:
    a. Wall Mount
        i. Using wedge anchors, lag bolt, etc.
    b. Pole Mount
        ii. Using adjustable stainless-steel bands
        iii. Using a 5” diameter U-Bolt. (Shown below as: 5” ⌀ U-Bolt)



NOTE	Mounting locations and options vary from site to site. The mounting examples below serve only as guidelines.

Wall Mount Example

6. Find a mounting location within range of the FMU.
7. Measure and mark the four holes needed to mount the 3-Line Display to the wall.
8. Drill out the holes.
9. Secure the 3-Line Display to the wall.
10. Next, refer to the Solar Panel Mounting and Connection steps below.

Mounting Base (Anchored) or Pole Mount Example

1. Find a mounting location within range of the FMU.
2. Using one of the mounting options mentioned above, secure the top and bottom of the 3-Line Display to the base/pole at the desired height.
3. Next, refer to the Solar Panel Mounting and Connection steps below.

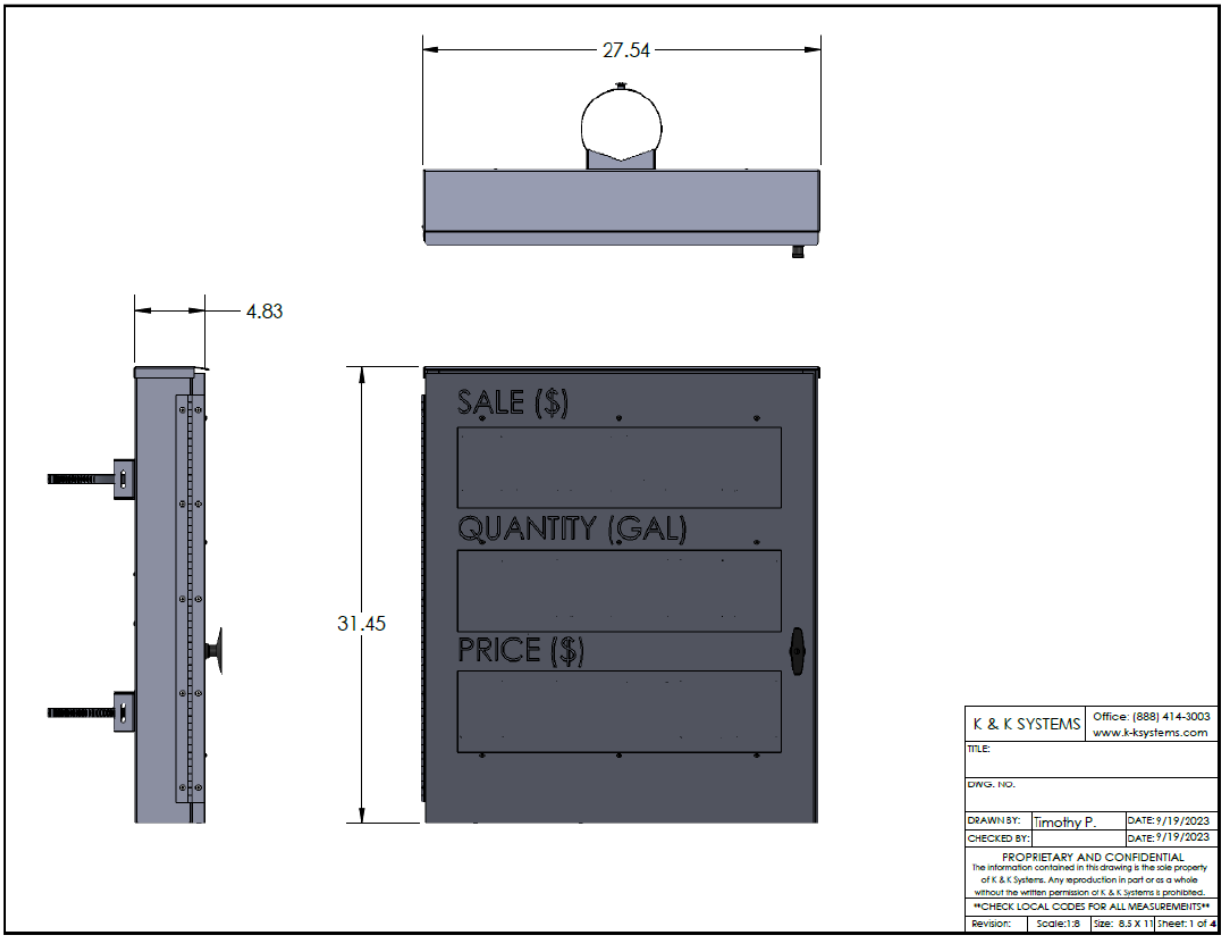
3-Line Display General Details (Gen 2 Release)

Display Dimensions

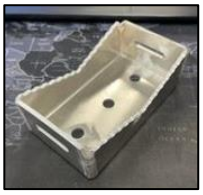
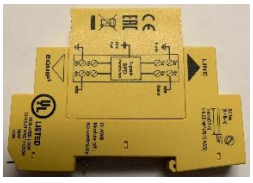
Height: 31.45 inches

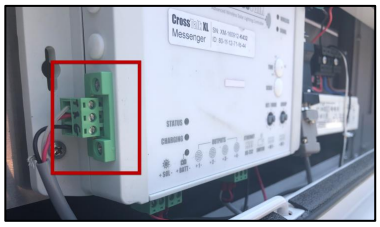
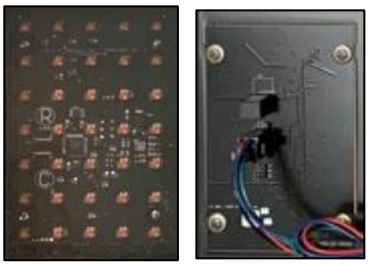
Width: 27.54 inches

Depth: 4.83 inches



Display Components

Part	Image
Solar Panel with Mounting Bracket STS Part ID: 266810	
K&K 3-Line Display STS Part ID: 266552	
3-Line Display Mounting Hardware Kit includes V-bracket, hex screws, and stainless-steel adjustable bands. Maximum pole diameter is 6 inches. Longer bands can be purchased at your local hardware store. ▪ Bracket part ID: 267413 ▪ MFR Part ID: MES71261418A ▪ Description: BRACKET, MOUNTING, V-SHAPE, 3LD, K&K, GEN 2 ▪ Hex Screw part ID: 267414	 
Surge Protector, RS232/RS485 STS Part ID: 266734	
USB to RS232 Cable STS Part ID: 191F0224-60	

3-Line Display / CrossTalk Controller Connections ▪ Wire, 3-Conductor, Shielded, 22AWG, 300V (Cable) - STS Part ID: 255114 ▪ 3-Pin Connector - STS Part ID: 265926	**Image n/a** 
LED Panels (Replacement Part) STS Part ID: 267355	

Mounting the 3-Line Display (Gen 2)

IMPORTANT	The 3-Line Display will require at least three people to safely mount the display.

Assumptions

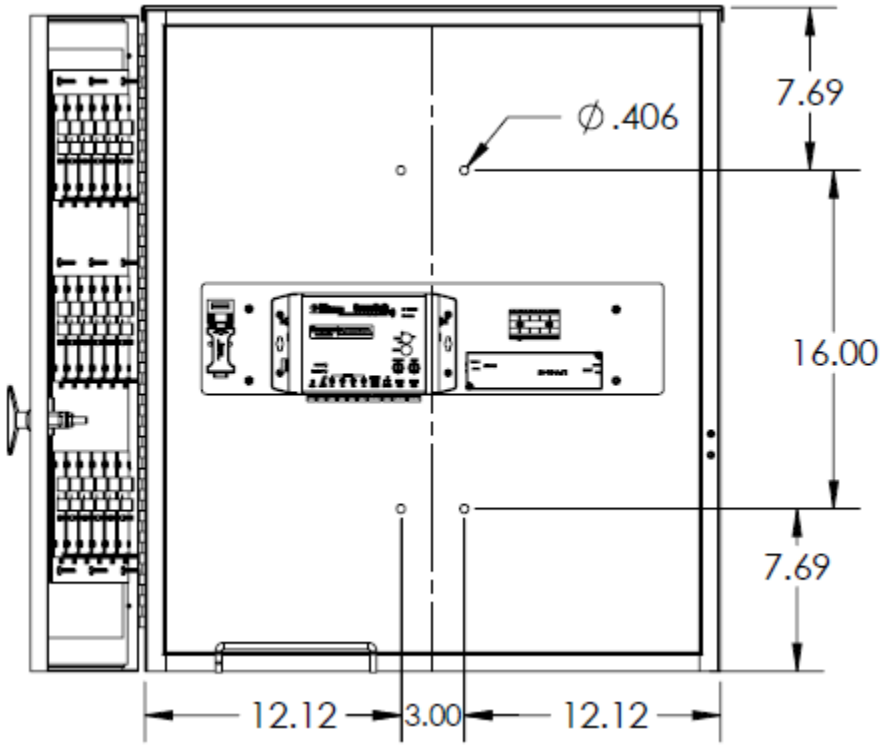
This tutorial assumes:

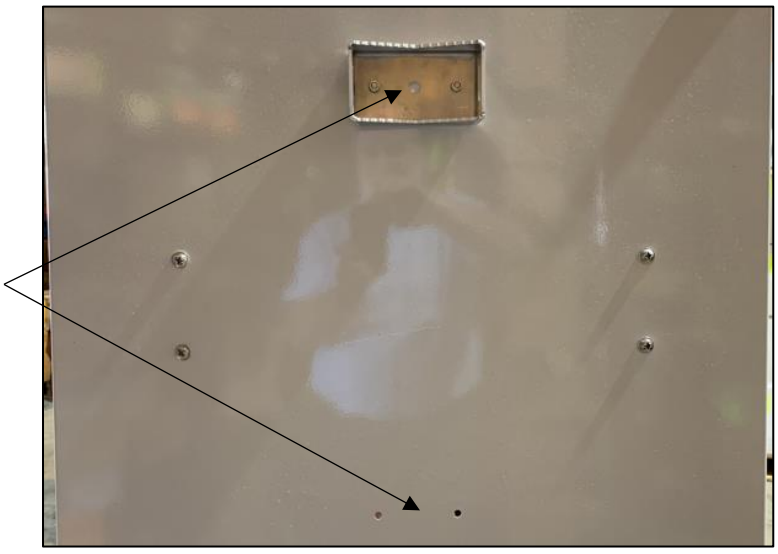
- A K&K 3LD is not currently installed

Mounting Options

- The 3-Line Display can be mounted to a wall or on a pole.
- Syntech does not stock or sell a mount, as the display can be attached to either.
- Syntech does not stipulate strict guidelines for mounting as factors are different from site to site. Instead, Syntech relies on the knowledge and experience of the distributor/installer performing the installation, and that they will ensure the installation and mounting are completed to code, with safety as the highest priority.

- The back of the enclosure includes two sets of 0.406” diameter drill holes positioned in the location shown below for positioning of the mounting.





The back of the 3-Line Display showing holes for brackets or wall mount.

Mounting Kit Hardware

- The K&K 3-Line Display and comes with the following hardware:
  - Two V-shaped mounting brackets (Syntech part ID: 267413)
  - Two hex screws (part ID: 267414)
  - Two 5-5/8" – 6-1/2" size adjustable stainless steel hex clamp bands.
- The mounting kit hardware is designed to support round and square poles, as well as Unistrut channel.
- The provided stainless steel adjustable bands can be installed on a pole with a maximum diameter of 6 inches. Longer bands can be obtained at your local hardware store.

Wall Mount Option

- As mentioned above, the back of the 3-Line Display enclosure includes two sets of 0.406" diameter drill holes for mounting, and can accommodate wedge anchors, lag bolts, etc. of that size.
- Care must be taken if the holes are drilled wider than the width provided, as electronic components, such as the CrossTalk Controller and power connections, are also located in the housing.
- If you must drill, cover and protect sensitive electronic components. Clean up all metal debris after drilling.

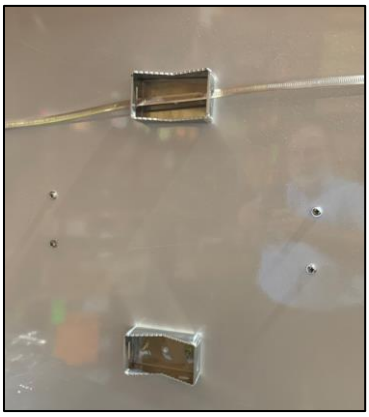
NOTE	Mounting locations and options vary from site to site. The mounting examples below serve only as guidelines.

Wall Mount Example

4. Find a mounting location within range of the FMU.
5. Measure and mark the four holes needed to mount 3-Line Display to the wall.
6. If the bolts being used exceed the diameter of the pre-drilled holes, drill out the holes to the required diameter.
7. Secure the 3-Line Display to the wall.
8. Next, refer to the Solar Panel Mount steps below.
9. Complete the final mounting steps by ensuring the display is secure.

Mounting Base (Anchored) or Pole Mount Example

1. Find a mounting location within range of the FMU and determine the height of the installation.
2. Secure the top and bottom brackets to the housing using the bolts and washers provided. Bolts and washers will feed from the inside of the housing, through the housing wall, and into the bracket nutserts.
3. Insert the stainless steel bands through the slotted openings in the brackets.



4. Install the top band.
    a. With someone holding the display at either end, have a third person place the top band around the pole, join the band together, and tighten the band.
    b. It is quicker to use a powered or cordless drill with the appropriate size nut driver to quickly tighten the band.
5. Install the bottom band.

Top and bottom bands installed.

6. Next, refer to the Solar Panel Mount steps below.
7. Complete the final mounting steps by ensuring the display is secure.

Solar Panel Mounting and Connection

Solar Panel

The solar panel is only used for controlling the brightness of the LEDs and not for 3-Line Display power. The solar panel automatically controls the LED brightness depending on ambient conditions – such as sunlight intensity at different times of the day and/or weather conditions – while maintaining viewing distance requirements.

When it is bright outside the solar panel will make the LEDs brighter (increase its luminous intensity) so it can be seen better. When it is dark outside it will dim the LED's (reduce its luminous intensity) for better readability.

Refer to the Troubleshooting section for solar panel configuration and testing options.

IMPORTANT	The Solar Panel converts sunlight into usable energy in the form of voltage and current; therefore, the panel should receive a fair amount of direct sunlight throughout the day. If you install the 3-Line Display and Solar Panel under a covering, the energy captured and the voltage required for proper functionality may be insufficient. For steps on how to test solar panel voltage, see Display Voltage for Solar Panel.

Solar Panel Part ID and Components

Syntech provides a mounting bracket and hardware to mount the solar panel.

Solar Panel (Front)

Solar Panel (Rear)

Mounting Bracket

Correct orientation when installed

The solar panel comes with a cable that is 9-ft in length. Mounting is not limited to attachment to the 3-Line Display only, but can be any place within range of the cable length that can be mounted securely, in the proper orientation, and receive direct sunlight.

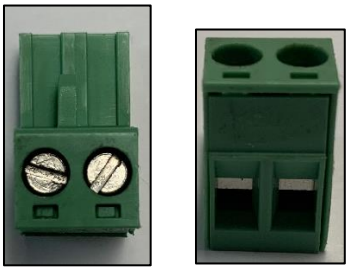
Mounting the Solar Panel

1. Locate the solar panel mounting bracket and ensure the orientation is correct.
2. Align and secure the solar panel to the solar panel mounting bracket with self-tapping screws (1/2").
3. Verify the Solar Panel can be mounted securely and placed so it receives direct sunlight.

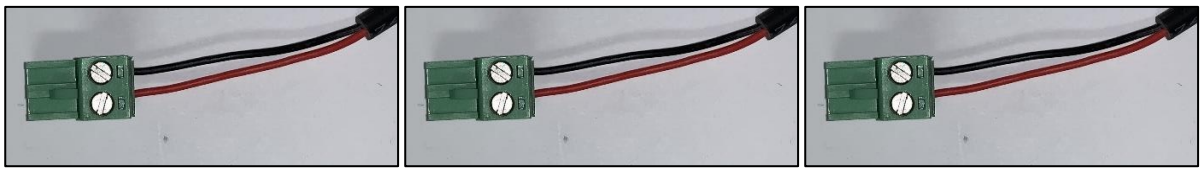
Connecting the Solar Panel to the 3-Line Display

The solar panel contains a 9 foot long two conductor cable. The two conductors will attach to the CrossTalk Controller's (+SOL-) connector inside the 3-Line Display.

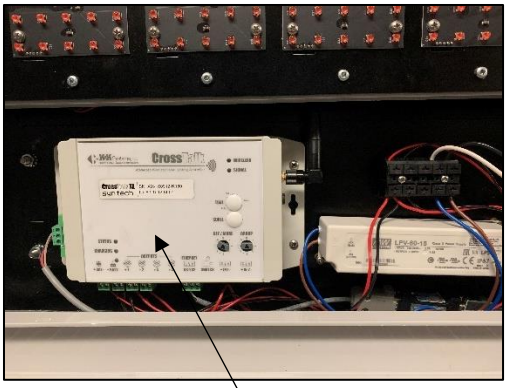
1. Open the door panel of the 3-Line Display. Use the prop rod to hold it open securely.
2. Run the two-conductor cable end from the solar panel through the access panel at the bottom of the 3-Line Display.
3. Locate the 2-pin Terminal Block and turn each screw fully counter-clockwise. The wires will be inserted into each hole.



4. With the terminal block oriented as shown above, insert the red wire (+) on the left and the black wire (-) on the right. Tighten each screw.



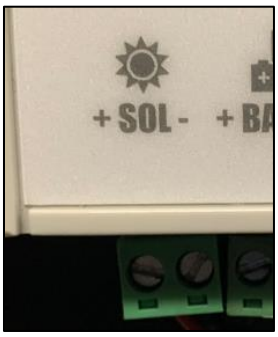
5. Locate the CrossTalk Controller inside the 3-Line Display.



CrossTalk Controller

6. On the bottom left corner locate the (+SOL-) icon. The connector is below the icon.

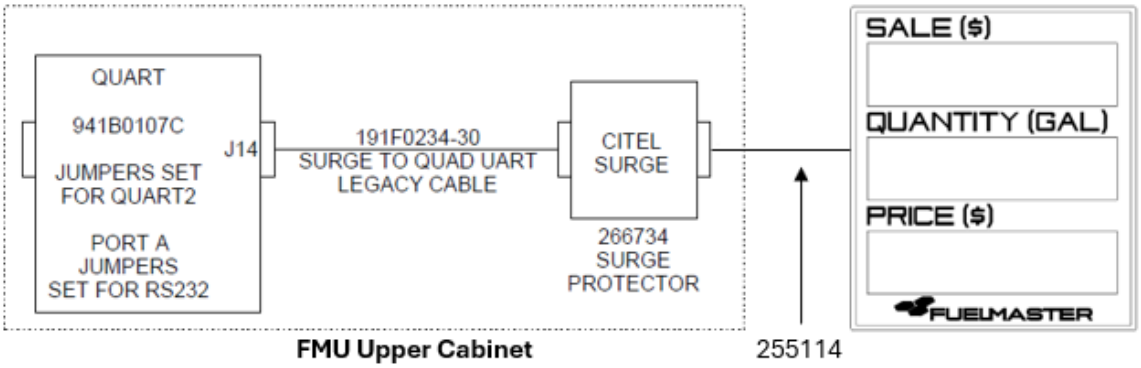
7. Insert the 2-pin terminal block into the connector. Note that the block is keyed to only be inserted one-way into the CrossTalk Controller connector.



FMU to 3-Line Display Connections Overview

Connecting the FMU to the 3-Line Display is a two-phase process:

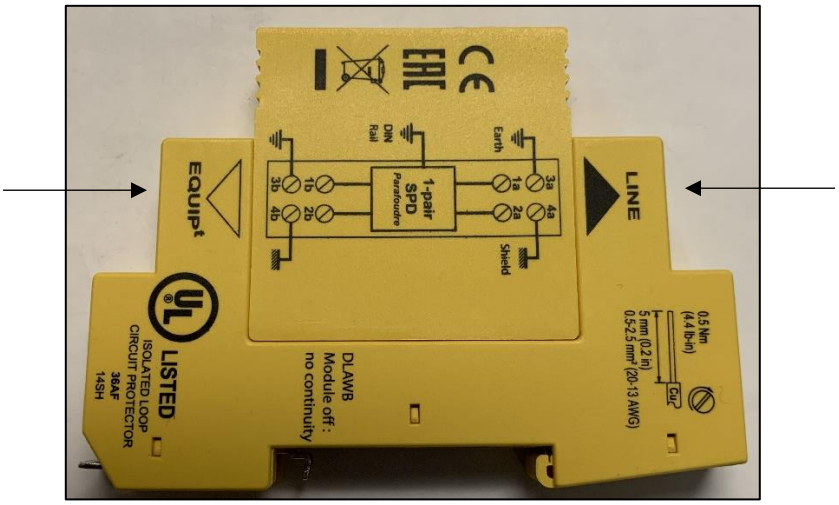
1. Install and connect the FMU Upper Cabinet component:
   a. Install the Quad UART Board and Citel Surge Protection Device (SPD).
   b. Connect the Quad UART Board to the Citel SPD 'EQUIPt' side.
2. Connect the Citel SPD 'LINE' side to the 3-Line Display.



Citel SPD Overview

The Citel SPD is installed between the FMU and the 3-Line Display.

- The EQUIPt of the SPD side connects to the FMU.
- The LINE side connects to the 3-Line Display.



EQUIPt side **LINE side**

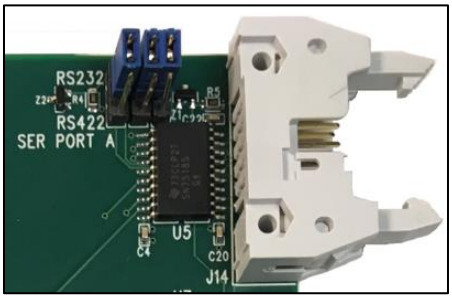
- Connection details are noted in the installation sections below.

FMU Upper Cabinet Connections

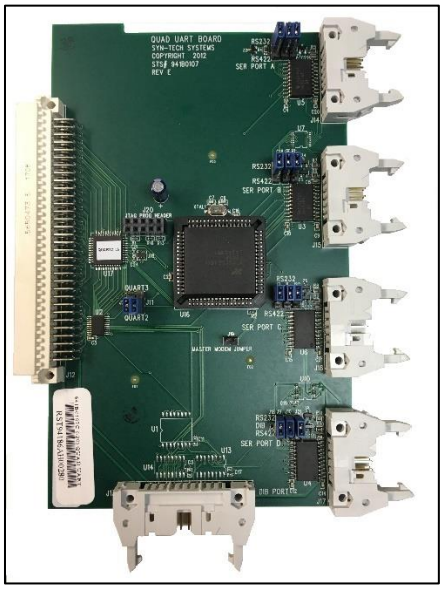
NOTE	This section covers wiring the FMU Quad UART Board to the Citel SPD.

Quad UART Board Installation

1. Turn off the FMU power.
2. On the Quad UART Board, ensure the following:
   c. Jumpers (J23, J11) are set for QUART2.
   d. SER PORT A (J14 connector) jumpers are set for RS-232.



3. Loosen the small restraint that secures add-on adapters to the mainboard.
4. Install the Quad UART board into an empty expansion slot of the FMU mainboard. The connector is keyed to only be inserted correctly one way.
5. Tighten the restraint.



Quad UART Board

Installed in the mainboard slot

IMPORTANT	Currently, there are two K&K cable/wiring configurations for the 3-Line Display. The difference is that the red and white wires are swapped on cable 191F0234-30 on the FMU/Quad UART Board connection side. Determine your configuration below.

Cable Configuration 1: 191F0234-30 (Cable Configuration Shipped Before 01/01/2024)

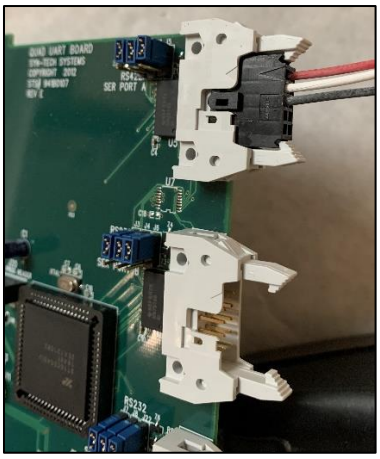
1. Determine if your kit includes cable 191F0234-30 shipped prior to 01/01/2025.
   a. If so, refer to the pinout table below and proceed to step 2.
   b. If not, see section Cable Connection 2: 191F0234-30 shipped after 01/01/2025.

Wire Color	Signal Ref	Pin
Red	FMU TX	2
White	FMU RX	3
Black	FMU GND	5

Cable 191F0234-30: FMU-Quad UART Board Quad-to-Surge Protector Cable Pinout (Ref Drawing: 191F0234 Rev B)

NOTE	This section covers connecting the Quad UART Board to the Citel Surge Protection Device (SPD) EQUIPt-side using the **Configuration 1** cable.

2. Plug the connector end of the *QUAD-to-Surge Protector Cable* (Syntech part ID 191F0234-30) into Ser Port A (J14) of the Quad UART Board (the top connector).

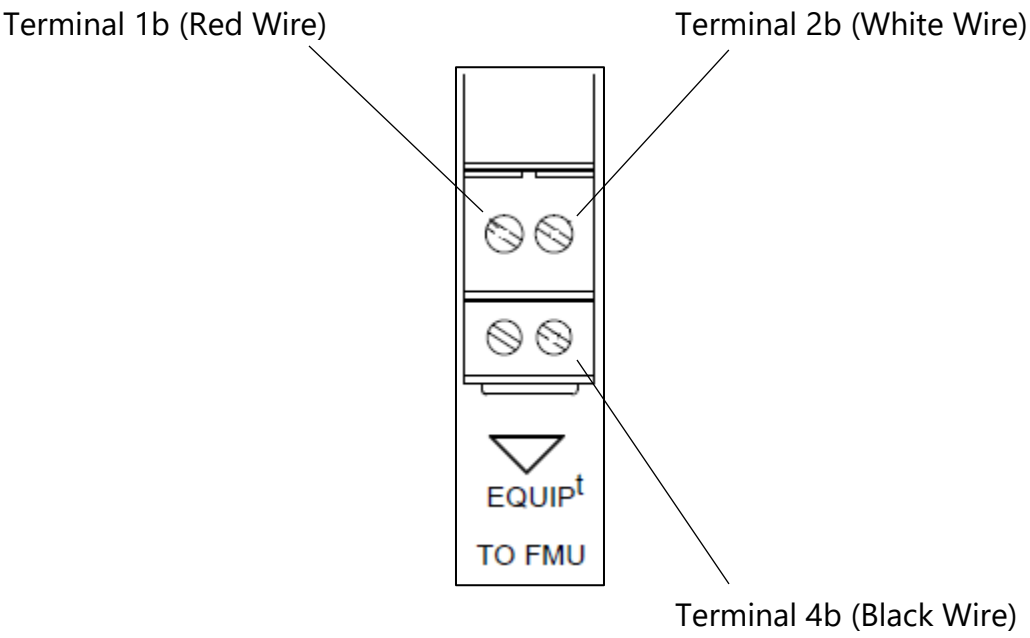


Ser Port A (J14) Top Connector

Wire Color	Signal Ref	Terminal
Red	FMU TX	1b
White	FMU RX	2b
Black	FMU GND	4b

Cable 191F0234-30: Citel SPD EQUIPt Side Pinout (Ref Drawing: 191F0280 Rev C)

3. Connect the pigtailed end of the cable to the Citel Surge Protector EQUIPt-side (Syntech part ID 266734).
   a. Connect the Red wire to terminal 1b.
   b. Connect the White wire to terminal 2b.
   c. Connect the Black wire to terminal 4b.



Cable Configuration 2: 191F0234-30 (Cable Configuration Shipped After 01/01/2024)

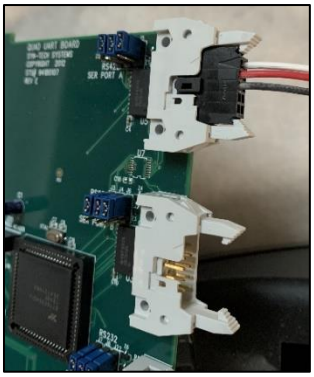
1. Determine if your kit includes cable 191F0234-30 shipped after 01/01/2025.
   d. If so, refer to the pinout table below and proceed to step 2.
   e. If not, see section Cable Connection 1: 191F0234-30 shipped prior to 01/01/2025.

Wire Color	Signal Ref	Pin
White	FMU RX	2
Red	FMU TX	3
Black	FMU GND	5

Cable 191F0234-30: FMU-Quad UART Board Quad-to-Surge Protector Cable Pinout (Ref Drawing: 191F0234 Rev D)

NOTE	This section covers connecting the Quad UART Board to the Citel Surge Protection Device (SPD) EQUIPt-side using the **Configuration 2** cable.

2. Plug the connector end of the *QUAD-to-Surge Protector Cable* (Syntech part ID 191F0234-30) into Ser Port A (J14) of the Quad UART Board (the top connector).

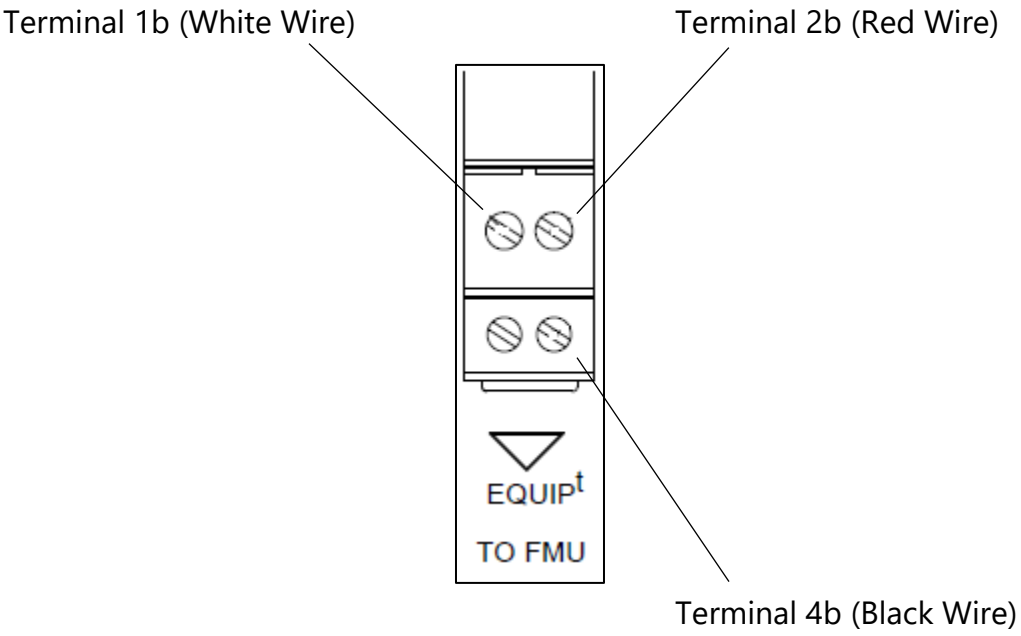


Ser Port A (J14) Top Connector

Wire Color	Signal Ref	Terminal
White	FMU RX	1b
Red	FMU TX	2b
Black	FMU GND	4b

Cable 191F0234-30: Citel SPD EQUIPt Side Pinout (Ref Drawing: 191F0280 Rev D)

3. Connect the pigtailed end of the cable to the Citel Surge Protector EQUIPt-side (Syntech part ID 266734).
   a. Connect the White wire to terminal 1b.
   b. Connect the Red wire to terminal 2b.
   c. Connect the Black wire to terminal 4b.

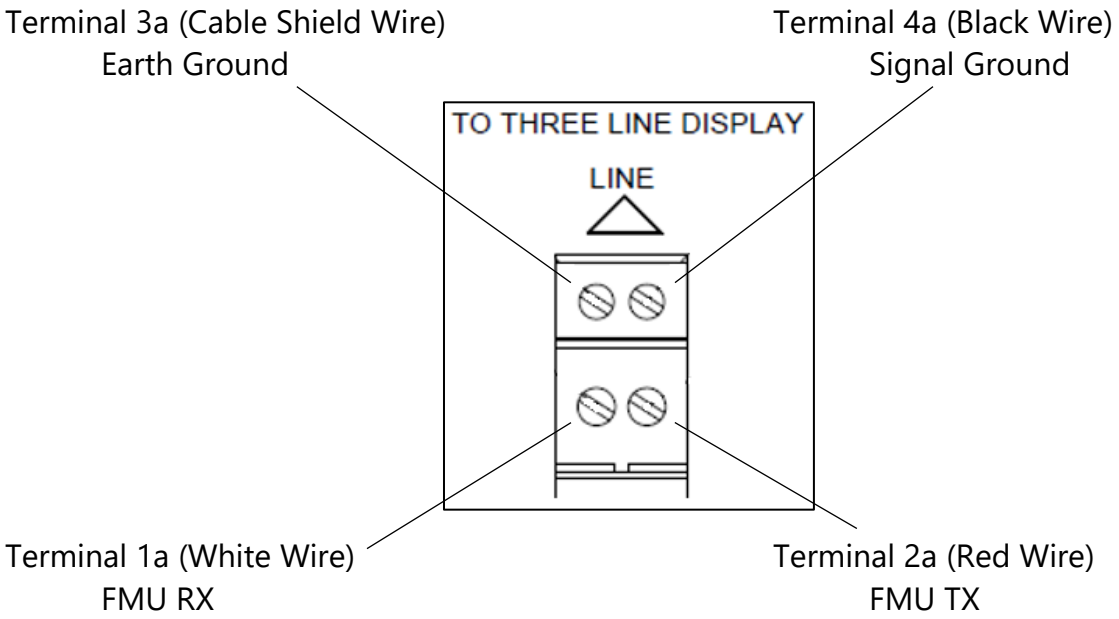

Terminal 1b (White Wire)
Terminal 2b (Red Wire)
EQUIPt
TO FMU
Terminal 4b (Black Wire)

Citel SPD LINE-side Connections

NOTE	The length of the 3-conductor cable shipped with the 3-Line Display kit is 75 feet. Installers can cut the cable to their desired length.

Connect the pigtail end of the 3-Line Display serial cable (STS# 255114) to the LINE- side of the Citel SPD.

1. Connect the White wire to terminal 1a.
2. Connect the Red wire to terminal 2a.
3. Connect the cable shield to terminal 3a.
4. Connect the Black wire to the terminal 4a.

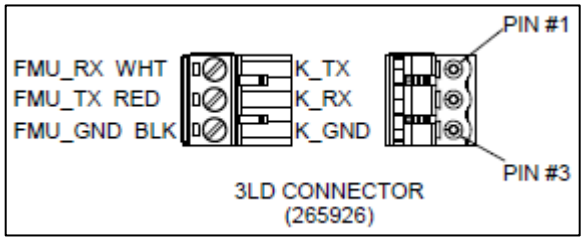


3-Line Display/Crosstalk Controller Connection

3-Pin Connector

Connect the 3-pin connector side of the three-conductor cable into the CrossTalk Controller inside of the 3LD housing. The wire order is:

1. Connect the White wire to PIN 1 (FMU_Receive (RX)_WHT)
    a. Connects with the 3-Line Display CrossTalk Controller transmit (TX) pin.
2. Connect the Red wire to Pin 2 (FMU_Transmit (TX)_RED)
    a. Connects with the 3-Line Display CrossTalk Controller receive (RX) pin.
3. Connect the Black wire to Pin 3 (FMU_Signal Ground (GND)_BLK
    a. Connects with the 3-Line Display CrossTalk Controller signal ground (GND) pin.



Ref Drawing: 191F0280_Rev D (2023-11-03)

CrossTalk Controller showing 3-pin Connector Installed

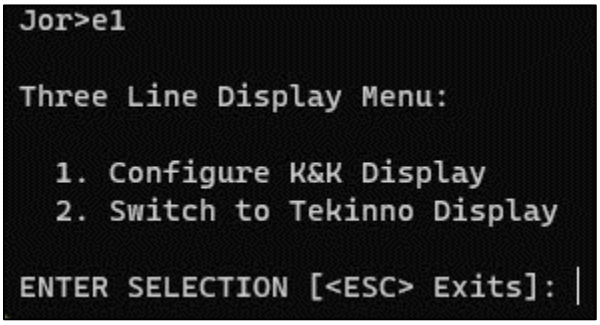
Configure 3-Line Display on FMPlus Unit

Assumptions

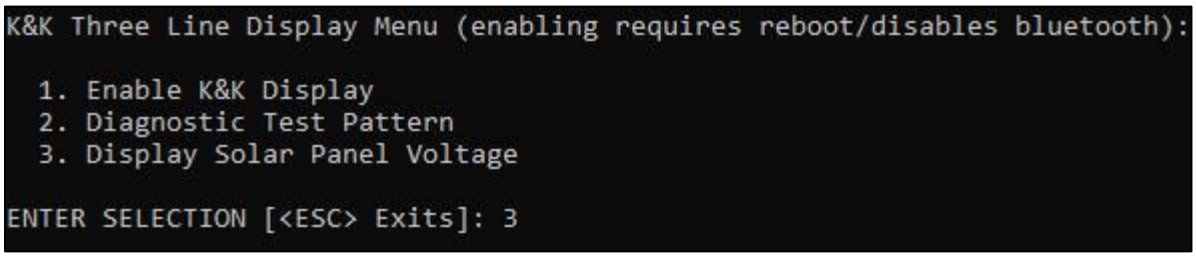
The tutorials below assume:

- A K&K 3-Line Display is installed and you are connected to the FMU.
- The unit is configured with FW v4.13 or newer.
- The Central Controller software which downloads transactions from this unit is FMPlus v5.8.3.0 or newer.

1. Enter command "**E1**". The 3-Line Display Menu should display: "IN TEST MODE" message should display on the 3-Line Display.
2. Enter '**1**' to configure a K&K display.



3. Enter '**1**' to enable the K&K 3-Line Display.



4. Reboot the FMU.

FMU and 3-Line Display Power On

Power the display using an input power source of 100-240 VAC 50-60 Hz.

1. Power on the FMU.
2. Power on the 3-Line Display.
3. Proceed to the Troubleshooting steps below to ensure everything is functional.

Troubleshooting

Users can troubleshoot their 3-Line Display following installation by accessing the 3-Line Display menu.

Users with access to the 3-Line Display menu will have the option to:

- View the current voltage coming from the solar panel.
- Test the performance of the 3-Line Display LEDs.

Assumptions

The tutorials below assume:

- A K&K 3-Line Display is currently installed, you are connected to the FMU, and have navigated to the K&K 3LD Menu.
- The unit is configured with FW v4.13.
- The Central Controller software which downloads transactions from this unit is FMPlus v5.8.3.0 or newer.
- You have added the configuration for a 3LD to your unit.

View Current Solar Voltage

1. Enter *3* to Display the current solar voltage coming through the solar panel on the 3-Line Display.

```
K&K Three Line Display Menu (enabling requires reboot/disables bluetooth):

  1. Enable K&K Display
  2. Diagnostic Test Pattern
  3. Display Solar Panel Voltage

ENTER SELECTION [<ESC> Exits]: 3

Display Shows Solar Panel Voltage:

     Voltage Value Changes with Light Intensity as Loop Executes

<ESC> Exits

SOLAR =  9.7 V
```

TIP Test the solar voltage decreases by covering the solar panel or test the solar voltage increases by shining a light on the solar panel.

2. Press *ESC* key to exit 3-Line Display Menu.

Test Performance of LEDs

1. Enter *2* to display the LED test pattern on the 3-Line Display.

```
K&K Three Line Display Menu (enabling requires reboot/disables bluetooth):

  1. Enable K&K Display
  2. Diagnostic Test Pattern
  3. Display Solar Panel Voltage

ENTER SELECTION [<ESC> Exits]: 2

Display Cycles This Pattern:
     All LEDs On -> Alphabet -> All LEDs OFF
<ESC> Exits
```

NOTE	The TEST pattern follows the following cadence: 2. All LEDS on 3. Alphabet 4. All LEDS off

2. Press *ESC* key to exit 3-Line Display Menu.

Document Version History

Version	Date	Description
1.0	8/17/2023	Initial draft Added Mounting Example Added cable configuration section for FMPlus Units, including Citel SPD wiring. Added Section for configuring FMPlus Unit to add K&K 3-Line Display. Added section for troubleshooting 3-Line Display after SW and HW configuration.
2.0	10/10/2023	Added Part # for LED Panels to 3LD Components.
2.1	02/02/2024	Revised to include Two Cable Configurations and cable connection information (pages 4-8). The wrong PB number was being referenced (PB-271) in the header on pages 2-9, corrected to PB-272 throughout the document.
2.2	05/15/2024	Major revisions now cover pages 1-34
3.0	08/28/2025	Updated to styling standards.