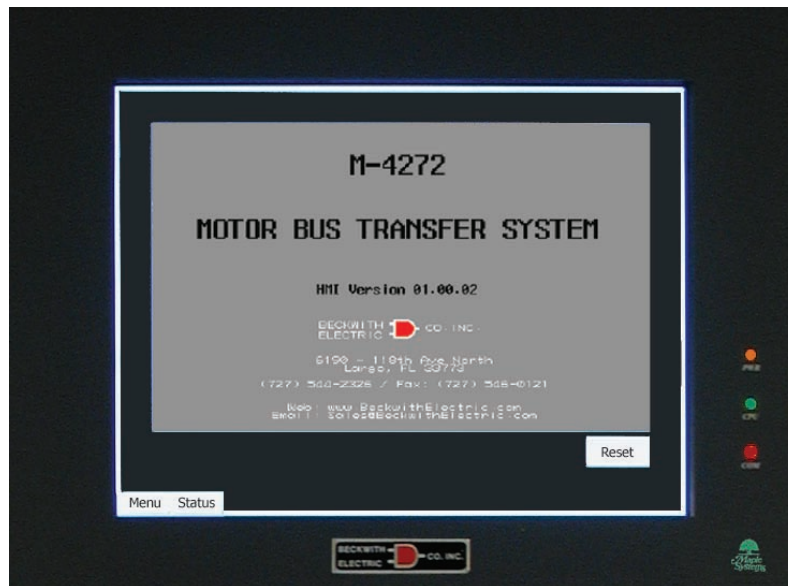


# Graphic Display Unit/ Human Machine Interface M-3909

**Graphic Display Unit (GDU) and Touch Screen Human Machine Interface (HMI) for communicating with one or two M-4272 Digital Motor Bus Transfer Systems**



- **Available in Two-breaker or Three-breaker Bus Transfer Configurations**
- **256-Color TFT Display**
- **10 Inch Touch Screen Human Machine Interface (HMI)**
- **Includes a separate power supply, nominal 120 V ac (50/60 Hz) or 125 V dc (250 V dc optional)**
- **Remote Manual Transfer Capability**

## Features

The M-3909 includes the following features and functions:

- Display & Touch Screen
  - Liquid Crystal Display (LCD)
  - 10.4" TFT 256 color
  - Size 8.5" x 6.0" [216 mm x 152 mm]
  - Brightness 400 cd/m<sup>2</sup>
  - Contrast 100:1
  - Resolution 640 x 480 pixels
  - Backlight – CCFL with up to 40,000 hour life span
  - Touch Screen type – 8-wire Analog Resistive
  - Adjustable contrast
  
- Microprocessor – 200 MHz 32-bit RISC
- Flash Memory – 4 MB
- DRAM – 4 MB
- Non-volatile Recipe RAM – 128 KB
- Material – Plastic ABS
  
- Serial Ports
  - The M-3909 includes two serial ports, which provide the connections to one or two M-4272 Digital Motor Bus Transfer Systems using RS-232 (standard) or RS-485 (optional) communications and an RS-232 connection to a computer for programming. The RS-485 serial port also provides the ability to connect multiple M-4272s in series to a single HMI. The M-3909 serial communication ports include the following capabilities:
    - One RS-232/RS-485 serial port (DE9P) (optional) used for Operator Interface Terminal (OIT) (PC) configuration and RS-485 M-4272 communications
    - One RS-232 serial port (DE9S) used for RS-232 M-4272 communications
    - Baud rates from 9,600 to 115,200
    - Point-to-point serial communications for all protocols
  
- One 4 foot RS-232 Y Cable, Beco Part Number 440-00889
- Compact Flash Slot
- PWR (yellow) LED indicates if power is applied to the unit
- CPU (green) LED indicates if the unit is operating correctly
- COM (red) LED indicates communications activity on PLC port
- RESET Switch to reinitialize the unit if an operational failure occurs

## Optional Features

- 250 V dc Power Supply, BECO Part Number 430-00444
- Two-Breaker or Three-Breaker configuration
- RS-485 Communication
- One 10 Base-T ethernet port used for PC monitoring and Point-to-Point connection using MODBUS TCP/IP
- 19" Mounting Panel, 6u height, BECO Part Number 441-41248 (Figure 19)

## Power Supply

### **Standard Power Supply (BECO PN 430-00443)**

**Input Voltage:** 72 to 144 V dc or 85 to 132 V ac

**Output Voltage:** 24 V dc  $\pm$  1%

**Output Current:** 4.2 A

**DC Output Power:** 100.8 W

**Working Temperature, Humidity:** -10 to 60° C, 20 to 90 % RH

**Dimensions:** 1.5" high x 3.86 wide x 7.83 deep (3.8 cm x 9.8 cm x 19.9 cm)

**Weight:** 1.32 lbs (0.6 kg)

### **Optional Power Supply (BECO PN 430-00444)**

**Input Voltage:** 200 to 400 V dc

**Output Voltage:** 24 V dc  $\pm$  1%

**Output Current:** 12.5 A

**DC Output Power:** 300 W

**Working Temperature, Humidity:** -25 to 85° C, 5 to 85 % RH

**Dimensions:** 0.9" high x 3.5 wide x 6.3 deep (2.3 cm x 8.8 cm x 16.0 cm)

## GDU/HMI Power Requirements

**Input Voltage:** 24 V dc  $\pm$  5%

**Input Current:** 2 amps instantaneous, 500 milliamps continuous

## Industrial Certifications

UL/CUL Listed

EN50081-2 (1993) & EN50082-2 (1995)

## Electrical Noise Emissions and Immunity

### **Emissions:**

EN55011 (Group 1, Class B) Generic commercial, light & heavy industrial environments

EN50081-1 Generic domestic and light industrial environments

EN50081-2 Generic heavy industrial environments

### **Immunity:**

EN50082-1 Generic domestic and light industrial environments

EN50082-2 Generic heavy industrial environments

## **Transient Protection**

**Voltage Resistance:** 500 V ac (1 minute)

**Isolation Resistance:** exceeds 50 Mohms at 500 V dc

## **Atmospheric Environment**

**Rating/Protection:** Sealed to NEMA 4/12 (IP65) when properly panel mounted (O-ring seal)

**Temperature Range:** 0 to 45° C

**Storage Temperature Range:** –20 to 60° C

**Humidity:** 10% to 90% (non-condensing)

## **Mechanical Environment**

**Vibration Endurance:** 10 to 25 Hz (x,y,z direction; 2G; 30 minutes)

## **Mechanical**

**Material:** Plastic PBT & PB housing with polyester overlay & neoprene gasket

**Mounting:** Panel, 1/8 inch [3.2mm] nominal thickness

## **Physical**

**Size:** 9.4" high x 12.4" wide x 2.6" deep (23.8 cm x 31.5 cm x 6.5 cm)

**Approximate Weight:** 4.4 lbs (2.0 kg)

## **Warranty**

The M-3909 is covered by a five-year warranty from date of shipment.

*Specification subject to change without notice.*

## **Overview of Operation**

The standard graphical displays included with the M-3909 Graphic Display Unit (GDU)/Touch Screen Human Machine Interface (HMI) are illustrated on the following pages. A general overview of unit operation and capabilities are presented below.

### **Main Screen**

The M-3909 Graphic Display Unit Main screen is presented in Figure 1. The Main screen includes the following selections and status indicators:

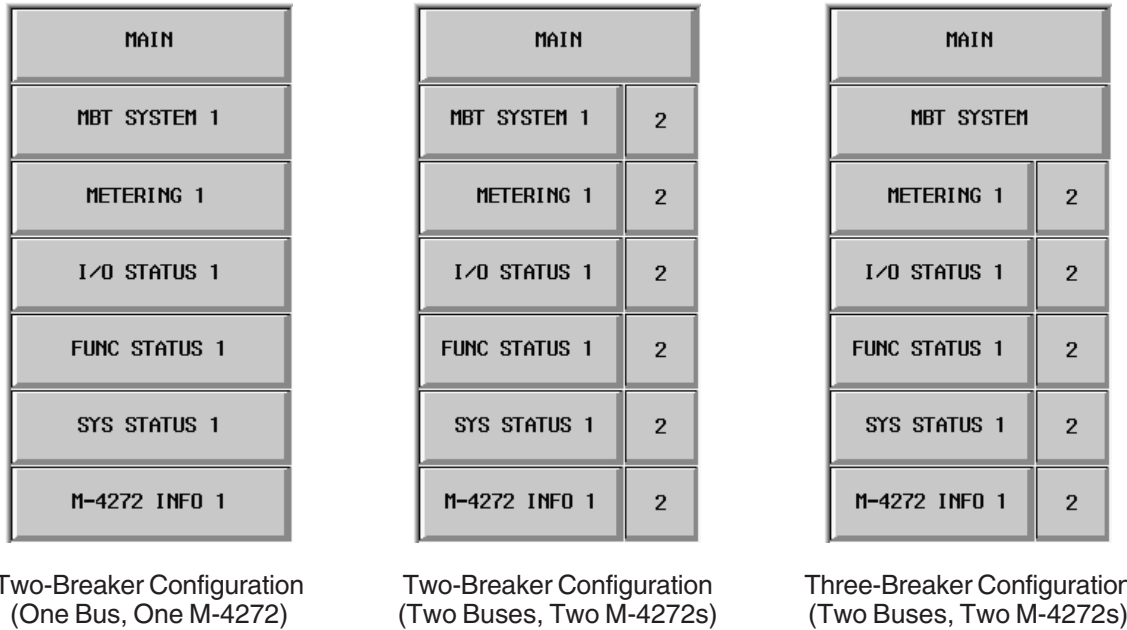
- **Menu** – Touching the “Menu” selection displays the Selection Menu screen (Figure 2)
- **Reset** – Touching the "Reset" selection resets communication between the GDU/HMI and the M-4272 MBTS
- **PWR** – Yellow LED indicates if power is applied to the unit
- **CPU** – Green LED indicates if the unit is operating correctly
- **COM** – Red LED indicates communications activity on PLC port
- **Status** – The "Status" selection is not functional



Figure 1 Graphic Display Unit and Touch Screen Human Machine Interface (HMI) Main Screen

**Selection Menu Screens**

The GDU/HMI Selection Menu screens are presented in Figure 2. The Selection Menu screens represent the three pre-programmed configurations that are currently available. The pre-programmed configuration must be selected at the time the order is placed.



*Figure 2 GDU/HMI Selection Menu Screens*

From the applicable Selection Menu screen the user is able to select the following features and functions for the target M-4272 Digital Motor Bus Transfer System:

- **MAIN** exits Menu Selection and returns the user to the Main screen (Figure 1)
- **MBT SYSTEM** displays the target M-4272 MBTS Single-Line Diagram (SLD), Figure 3 for Two-Breaker configuration, Figure 4 for Three-Breaker configuration.
- **METERING** displays the target M-4272 Metering screen, Figure 8.
- **I/O STATUS** displays the target M-4272 I/O (Inputs/Outputs) Status screen, Figure 9.
- **FUNC(TION) STATUS** displays the target M-4272 Function Status screen, Figure 10.
- **SYS(TEM) STATUS** displays the target M-4272 System Status screen, Figure 11.
- **M-4272 INFO** displays the target M-4272 Information screen, Figure 12.

### Single-Line Diagram (SLD) Screens

When the **MBT SYSTEM** menu item is selected from the Selection Menu screen the unit displays either the pre-programmed Two-Breaker or Three-Breaker configuration of the MBTS Single-Line Diagram (Figures 3 and 4 respectively). The Single-Line Diagrams include a graphical representation of either a Two or Three-Breaker configuration with the appropriate number of M-4272 connected units. Also, remote manual transfers can be performed from the Single-Line Diagram. Included in the graphical representation are the following real-time parameters:

- Voltage (Three-Phase or Single-Phase)
- Current (Source 1 and Source 2)
- Frequency (Delta Angle, Delta Frequency and Delta Voltage)
- Breaker status (Open/Closed)
- Bus Tie-Breaker status (Open/Closed)
- Manual Transfer Ready status
- Lockout/Block status
- Remote/Local status
- Device ON/OFF status
- 52-S1 Circuit Breaker In-Service status
- 52-S2 Circuit Breaker In-Service status
- Transfer Complete
- Transfer Incomplete

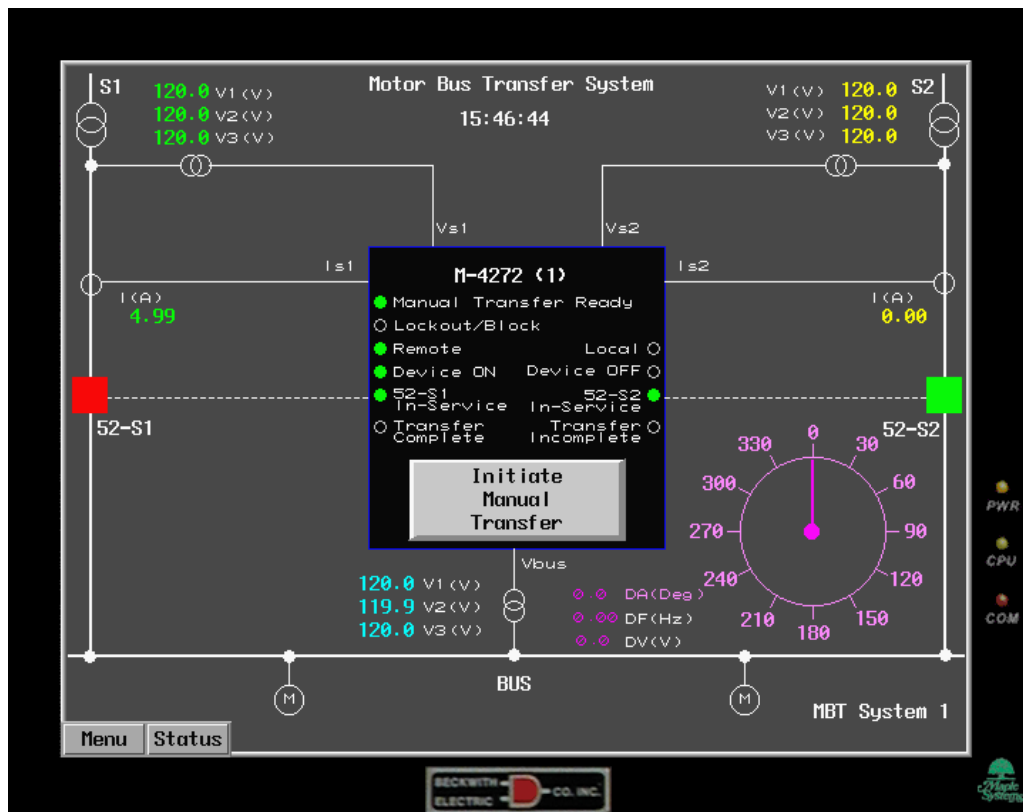


Figure 3 MBTS Single-Line Diagram Screen (Two-Breaker Configuration)

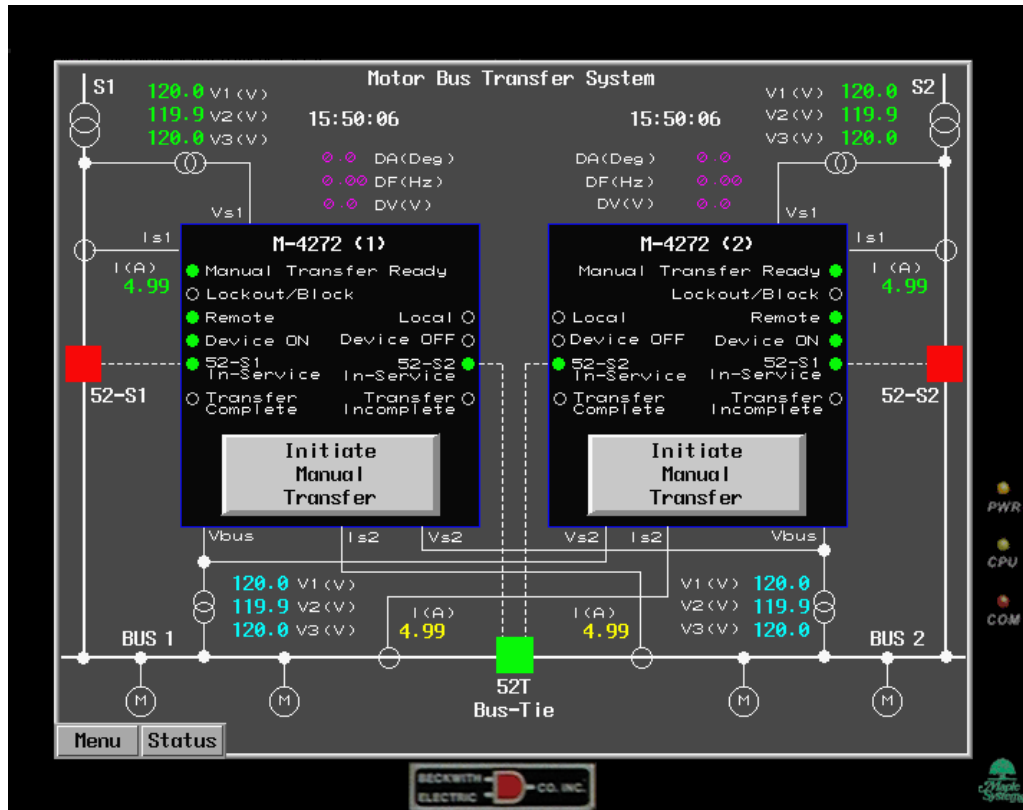


Figure 4 MBTS Single-Line Diagram Screen (Three-Breaker Configuration)

### Initiating Manual Transfers

The GDU/HMI includes the capability to initiate Manual Transfers from the Single-Line diagram. To initiate a Manual Transfer proceed as follows:

1. From the appropriate Single-Line screen (Figure 3 or 4) select **INITIATE MANUAL TRANSFER**. The GDU/HMI will display the "**Initiate Manual TRANSFER**" dialog screen (Figure 5, 6 or 7).
2. Select **Yes** to initiate the manual transfer or **No** to Exit the screen.



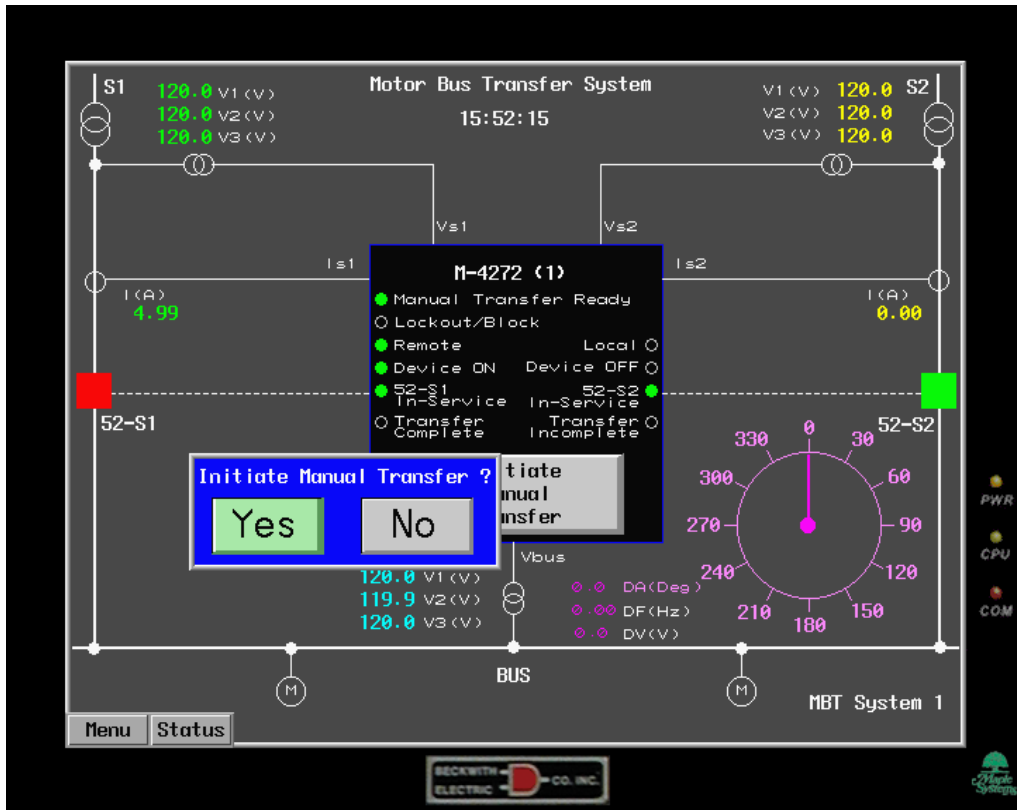


Figure 5 SLD Remote Manual Transfer Initiate Screen (Two-Breaker Configuration)

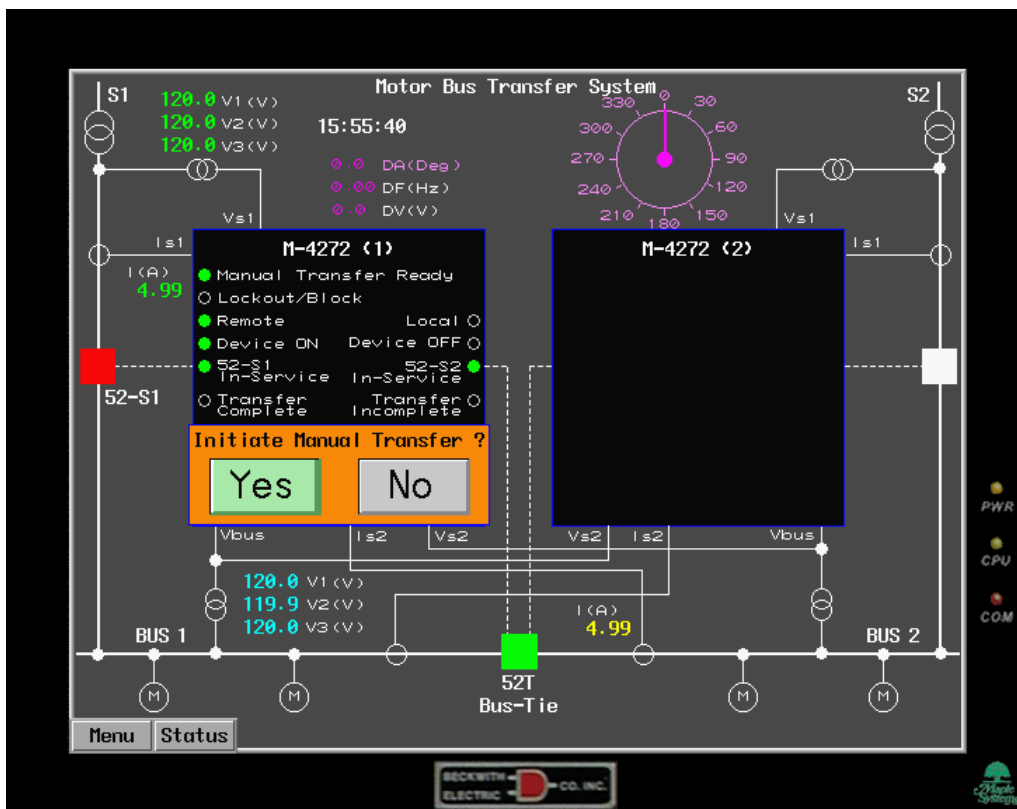


Figure 6 SLD Remote Manual Transfer Initiate Screen (Three-Breaker Configuration, Set 1)

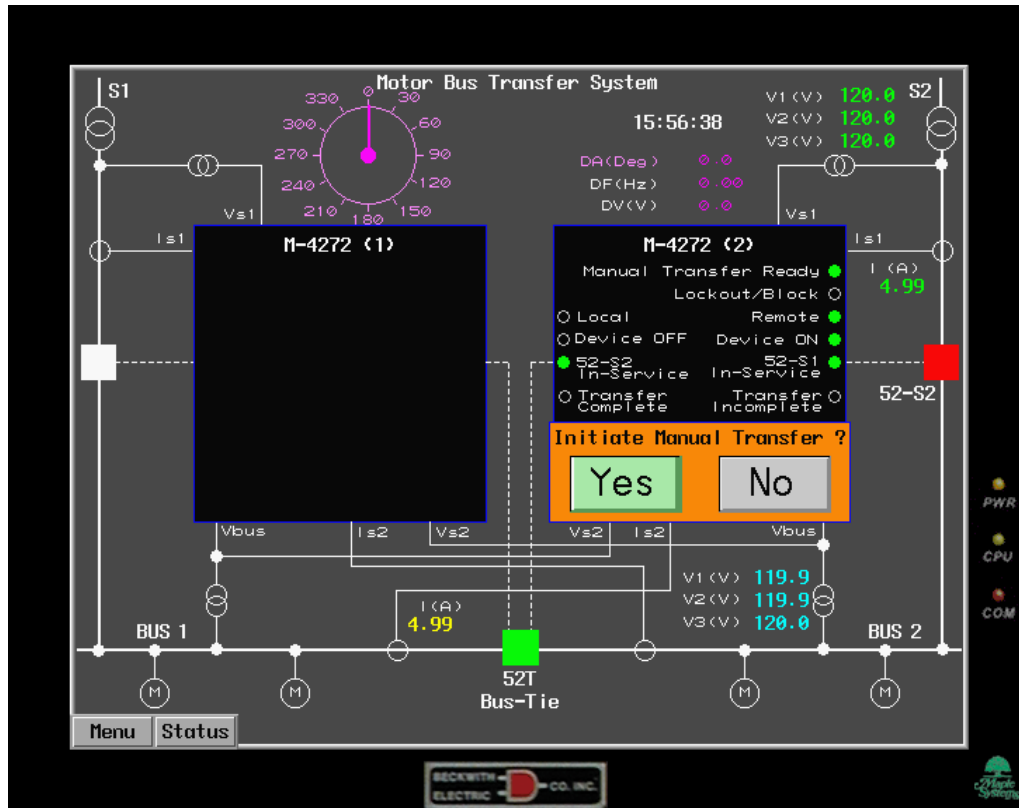


Figure 7 SLD Remote Manual Transfer Initiate Screen (Three-Breaker Configuration, Set 2)

### Metering Screen

When the **METERING** menu item is selected from the Menu Selection screen the unit displays the Metering screen for the selected M-4272, Figure 8. The Metering screen displays the following real-time parameters:

- Voltage, Source 1 and 2, Bus (Three-Phase/Single-Phase)
- Positive Sequence Voltage, Source 1 and 2, Bus
- Negative Sequence Voltage, Bus only
- Current (Source 1 and Source 2)
- Frequency (Bus)
- Delta Angle, Delta Frequency and Delta Voltage (Between Bus and New Source)
- New Source availability (Source1, Source 2). "New Source" is defined as the Source to which the Bus is being transferred.



Figure 8 MBTS Metering Screen

### ***I/O (Input/Output) Status Screen***

When the **I/O STATUS** menu item is selected from the Menu Selection screen the unit displays the I/O Status screen for the selected M-4272, Figure 9. The I/O Status screen displays the real-time Input and Output status.

### ***Function Status Screen***

When the **FUNC STATUS** menu item is selected from the Menu Selection screen the unit displays the Function Status screen for the selected M-4272, Figure 10. The Function Status screen displays the real-time status of the target M-4272 functions. The Function Status screen provides Pickup and Timeout status for each function.

### ***System Status Screen***

When the **SYS STATUS** menu item is selected from the Menu Selection screen the unit displays the System Status screen for the selected M-4272, Figure 11. The System Status screen displays the real-time status of the target M-4272 motor bus transfer functions. The System Status screen provides the status for each element of the motor bus transfer system.

### ***M-4272 Info Screen***

When the **M-4272 INFO** menu item is selected from the Menu Selection screen the unit displays the M-4272 Info screen for the selected M-4272, Figure 12.





Figure 11 MBTS System Status Screen



Figure 12 M-4272 Info Screen

## Installation

### *Managing Electrostatic Discharge*

It is best **NOT** to remove the rear enclosure of the GDU/HMI. When the rear part of the enclosure is removed, the circuitry inside is exposed to possible damage by electrostatic discharge during handling. Minimize the possibility of electrostatic discharge by:

- Discharging personal static by grounding yourself prior to handling the GDU/HMI
- Handling the GDU/HMI at a static-free grounded workstation
- Connecting the frame ground ( $\perp$ ) connector of the HMI to a clean earth ground
- Placing the HMI in an anti-static bag during transport

### *CE Compliance*

The M-3909 GDU/HMI has been tested to conform to European CE requirements per Council Directive 89/336/EEC. The M-3909 GDU/HMI meets or exceeds the noise emissions and immunity requirements as set forth in the EN50081 (Emissions) and EN50082 (Immunity) standards. It is strongly recommend that the installer follow the guidelines outlined in this section for proper wire routing and grounding to insure proper operation.

### *NEMA Rating*

The M-3909 GDU/HMI is rated for NEMA 4/12 (indoor) or IP65 installations. Therefore, when the GDU/HMI is properly mounted to a panel or other enclosure, the front enclosure of the GDU/HMI will provide protection to the inside of the panel from splashing water, wind blown dust, rain, or hose-directed water. The GDU/HMI must be installed according to the instructions in this section to be properly sealed.

### *Environmental Considerations*

The M-3909 GDU/HMI is designed to operate in temperatures from 0 to 45° C. It is intended for indoor installations and not designed for outdoor applications. Avoid installing the M-3909 in environments with severe mechanical vibration or shocks. Do not install the GDU/HMI in enclosures with rapid temperature variations or high humidity. Either will cause condensation of water inside the device and eventual damage to the GDU/HMI.

### *Control Panel Grounding*

The control panel should be connected to a good, high-integrity earth ground both for safety considerations and shielding purposes. Beckwith Electric cannot overemphasize the importance of good grounding. Failure to use good grounding procedures during installation may result in sporadic malfunction of the GDU/HMI.

- Connect the GDU/HMI's chassis ground terminal to a reliable earth ground with a low-resistance path.
- Route all earth ground wires that lead from the GDU/HMI, the M-4272, the power supply, and the line filter to a central earth ground point such as a barrier strip. This will ensure that no ground current from one device influences the operation of the other devices.
- Connect the HMI chassis ground terminal to the control panel door using a heavy-gauge short braided cable or ground wire to minimize resistance.
- Connect the power cable's shield wire to the GDU/HMI's chassis ground terminal.
- Connect the control panel to earth ground using a copper grounding rod close to the GDU/HMI and control panel.

Hinged doors on control panels do not provide a long-term electrical connection to the rest of the enclosure. Corrosion develops over time and prevents good electrical contact. For this reason, a separate wire braid should be installed from the hinged control panel to the rest of the enclosure.

### ***Cable Routing and Noise Immunity***

Follow these guidelines when routing cable to the GDU/HMI:

- Always route the HMI communication cable and the power cable away from any AC voltage or rapidly switching DC control lines.
- Never bundle the HMI cables together with 120 V ac power wires or with relay wiring.
- Try to keep at least 8 inches (20 cm) of separation between the GDU/HMI cables and other power wiring. If voltages greater than 120 V ac are used in the system then, greater separation is required.
- If the GDU/HMI cables must come near AC wiring then, ensure they cross at 90 degrees.
- Route AC power wires in a separate grounded conduit to reduce electrical noise interference.
- Keep the cable lengths for the GDU/HMI as short as possible. Do not coil excess cable and place it next to AC powered equipment.
- Cover any equipment used in the enclosure that operates at high frequency or high current levels with a grounded metal shield.

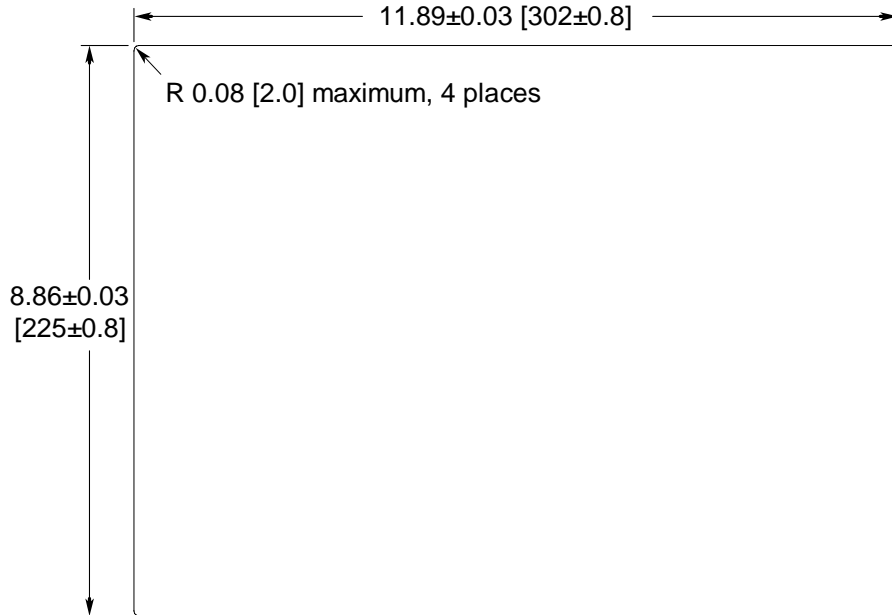
### ***Safety Precautions***

Observe all site/facility specific safety and tagging procedures and the the following precautions when installing the M-3909 GDU/HMI. Failure to comply with these restrictions could result in loss of life, serious personal injury, or equipment damage.

- **WARNING:** Do not operate the GDU/HMI in areas subject to explosion due to flammable gases, vapors, or dusts — doing so may result in death, severe injury.
- ▲ **CAUTION:** Do not connect the HMI to an AC power source. You will cause permanent damage to the GDU/HMI.
- ▲ **CAUTION:** Do not attempt to use a DC power supply that does not meet the GDU/HMI power requirements. You may cause malfunction or permanent damage to the HMI.
- ▲ **CAUTION:** Do not power the GDU/HMI with a DC power supply used for inductive loads. Severe voltage spikes caused by these devices may damage the GDU/HMI.

### ***Panel Preparation***

1. Verify that the metal panel or mounting surface is a minimum thickness of 15 gauge (0.059 inch/ 3.3mm) if cold-rolled steel or hardened steel, or 10 gauge (0.101 inch/2.6mm) if aluminum alloy (6061-T6 preferred).
- ▲ **CAUTION:** The GDU requires a stiff, flat, smooth mounting surface free of blemishes to seal properly to NEMA 4. Thinner panels or surfaces may bow between the mounting clamps and not form a seal with the gasket.
2. Verify that the dimensions of the panel cutout are consistent with the panel cutout dimensions in Figure 13.
  3. Clean and deburr the panel cutout.



■ NOTES:

1. Dimensions are in inches [mm].
2. Maximum panel thickness is 0.125 [3.2].

*Figure 13 Panel Cutout Dimensions*

**Mounting the GDU/HMI to the Panel**

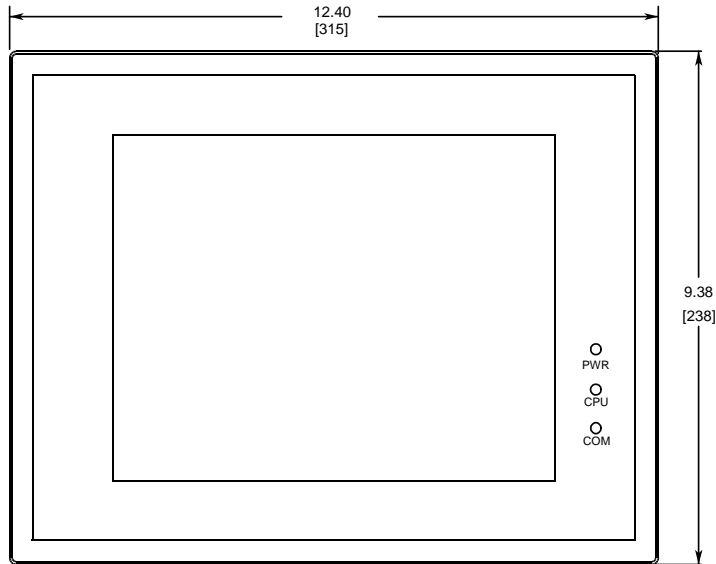
1. Verify that the panel cutout is clean and free of burrs.
2. Ensure that the area of the panel or mounting surface where the gasket comes into contact is flat and free of scratches, pits and other features that prevent the gasket from sealing properly.
3. If the panel or mounting surface is not uniform, thick, flat, stiff, or smooth enough, then a sealant such as silicone may be required.
4. Prepare the six screw clamps for the GDU/HMI by positioning the metal brackets at the mid-points of the screws. Position the screws so that the ends don't protrude from the plastic portions.
5. Set the GDU/HMI in the panel cutout and hold it in place until all clamps are in position.

▲ **CAUTION:** Do not over-tighten the screws beyond snugness, or you may damage the housing.

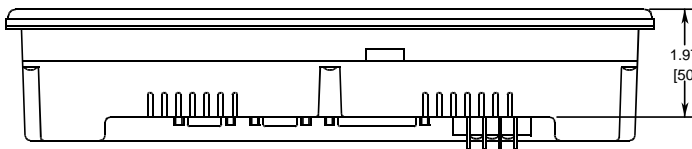
6. Tighten the screw clamps until all are uniformly snug.

■ **NOTE:** Reinstallation, because the gasket will take a “set” to the panel, be sure to reinstall the HMI to the same panel cutout when a NEMA 4 seal is required. For best results, also replace the gasket itself.

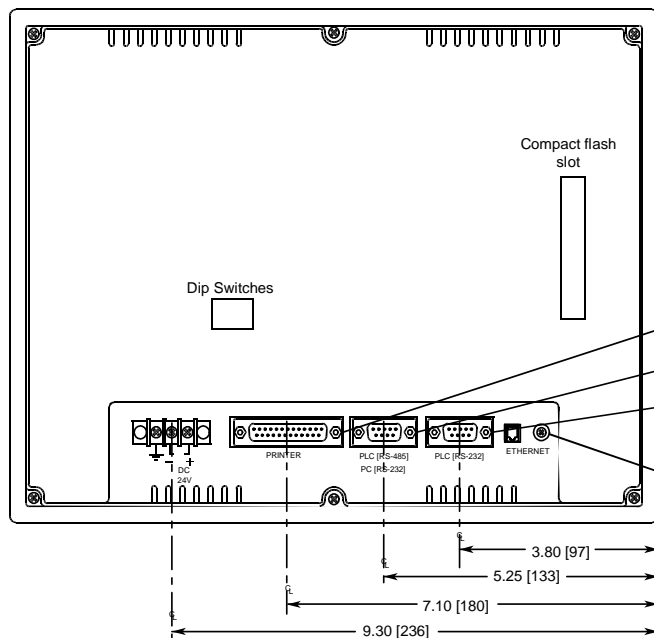




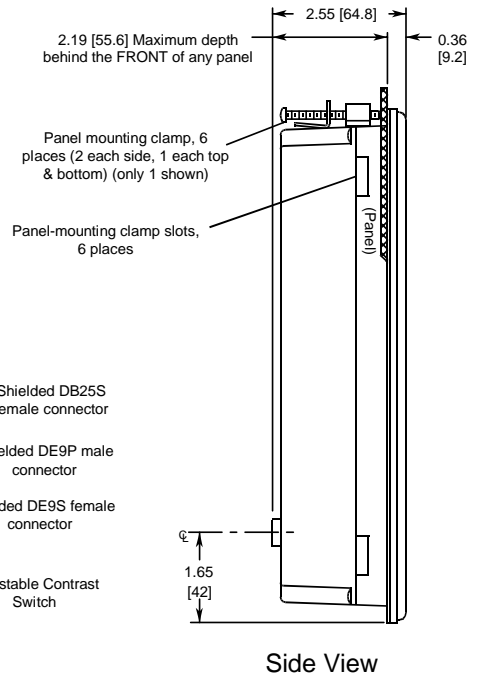
Front View



Bottom View



Rear View



Side View

Dimensions are in inches [mm]

Figure 14 GDU/HMI Mounting and Screw Detail

### ***Grounding The GDU/HMI***

To reduce the possibility of electrical interference, the chassis ground terminal of the GDU/HMI should be connected to a clean earthground.

■ **NOTE:** If the control panel is made of a non-conductive material, it is essential that the chassis ground terminal of the GDU/HMI is connected to a clean earth ground point located close to the panel.

1. If the control panel that the GDU/HMI is mounted in is metal and/or the GDU/HMI is mounted on a door, then ensure it is properly grounded.
2. Utilizing a short heavy-gauge wire (#18 AWG), connect the GDU/HMI chassis ground terminal to the mounting panel ground stud/screw (Figures 17 and 18).

### ***Power Supply***

The standard power supply (BECO Part No. 430-00443) provides an output of +24 V dc  $\pm$  1% measured at the GDU/HMI power terminal block. A power line filter installed at the AC input to the GDU/HMI power supply is highly recommended as a safeguard against conducted RF noise, which is often present. Do not use the power supply used to provide power to the GDU/HMI to power switching relays, solenoids, or other actived evices.

### ***Installing the Power Supply***

1. Determine the appropriate location for the power supply considering the power source.
2. Mount/install the power supply, referring to either Figure 15 or Figure 16.

■ **NOTE:** The power line filter should have a current rating of at least 3 Amps with common mode and differential mode attenuation.

3. If a power line filter is going to be utilized, then perform the following:
  - a. Locate and install the power line filter such that the wires connecting the output of the power line filter to the power supply are kept as short as possible to minimize any additional noise pickup.
  - b. Connect the case of the power line filter to a quiet earth ground.

### ***Connecting Power to the GDU/HMI***

1. Ensure that the supply circuit breaker at the power source is open and safety tagged in accordance with site/local safety tagging rules.

■ **NOTE:** The power cable for the GDU/HMI should be 18 AWG, 2-conductor wire with a shield drain wire and protective shield (foil or braid).

2. Referring to Figure 17 or 18 depending on the specified power supply, connect the power cable to the GDU/HMI as follows:
  - a. Strip the power cable shield to expose 2" of the black and red wires.
  - b. Strip about ¼" of insulation from the black and red wires.
  - c. Thread the black and red wires through the ferrite core. The shield wire must be outside.
  - d. Connect the red wire to the DC positive (+) input of the GDU/HMI power terminal.
  - e. Connect the black wire to the DC negative (-) input of the GDU/HMI power terminal.
  - f. Connect the power cable shield wire to the GDU/HMI power terminal's chassis ground input.
2. Route the power cable to the GDU/HMI power supply. The power cable should not be any longer than necessary.

- Connect the power supply cable wires as follows:

■ **NOTE:** The shield drain wire must be connected to earth ground at both ends of the cable.

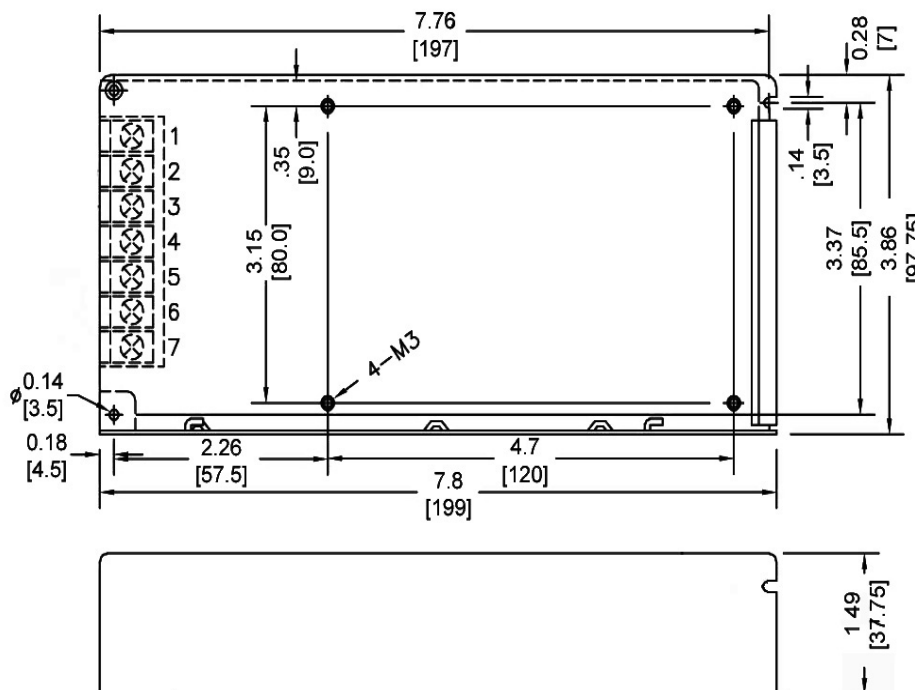
Color	Power Supply	M-3909
Red	+Output/+24 V dc	+dc 24 V
Black	-Output/-24 V dc return	-dc 24 V
Shield	Case Ground	⏏

Table 1 Power Supply Wiring

- Connect the power supply to the power source.

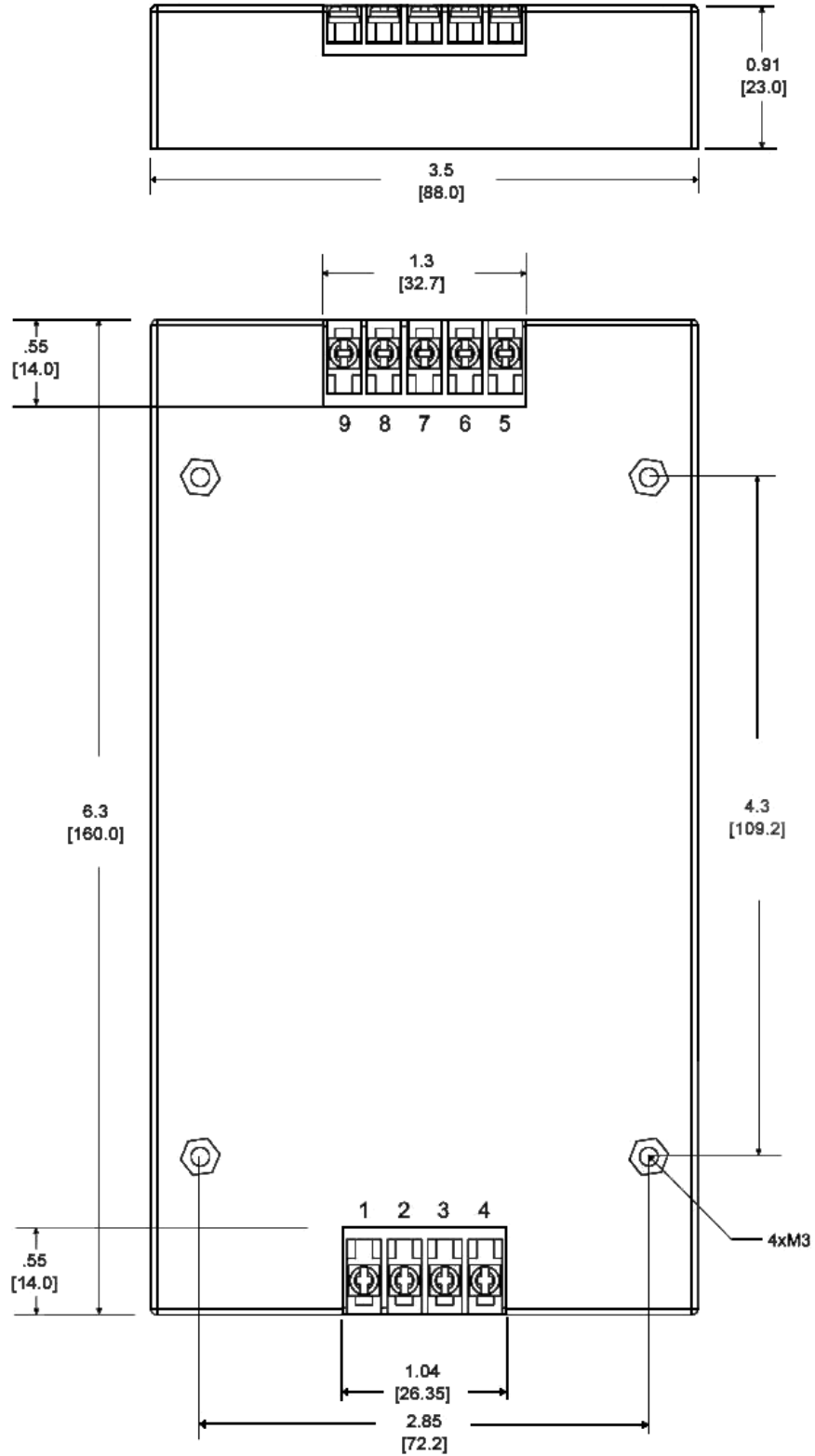
**Connecting Communications Cable**

- Utilizing the supplied RS-232 communications cable, connect the “GDU/HMI” end of the communication cable into the GDU/HMI RS-232 port Labeled "PLC RS-232". Tighten the two cable screws to ensure shield ground path.
- Route the communication cable to the M-4272. Refer to the “Cable Routing and Noise Immunity” section for more information. Tighten the two cable screws to ensure shield ground path.
- If a second M-4272 is part of the application, then route the communication cable to the second M-4272. Tighten the two cable screws to ensure shield ground path.



Dimensions are in inches [mm]

Figure 15 Standard Power Supply (430-00443) Dimensions



Dimensions are in inches [mm]

Figure 16 Optional Power Supply (430-00444) Dimensions

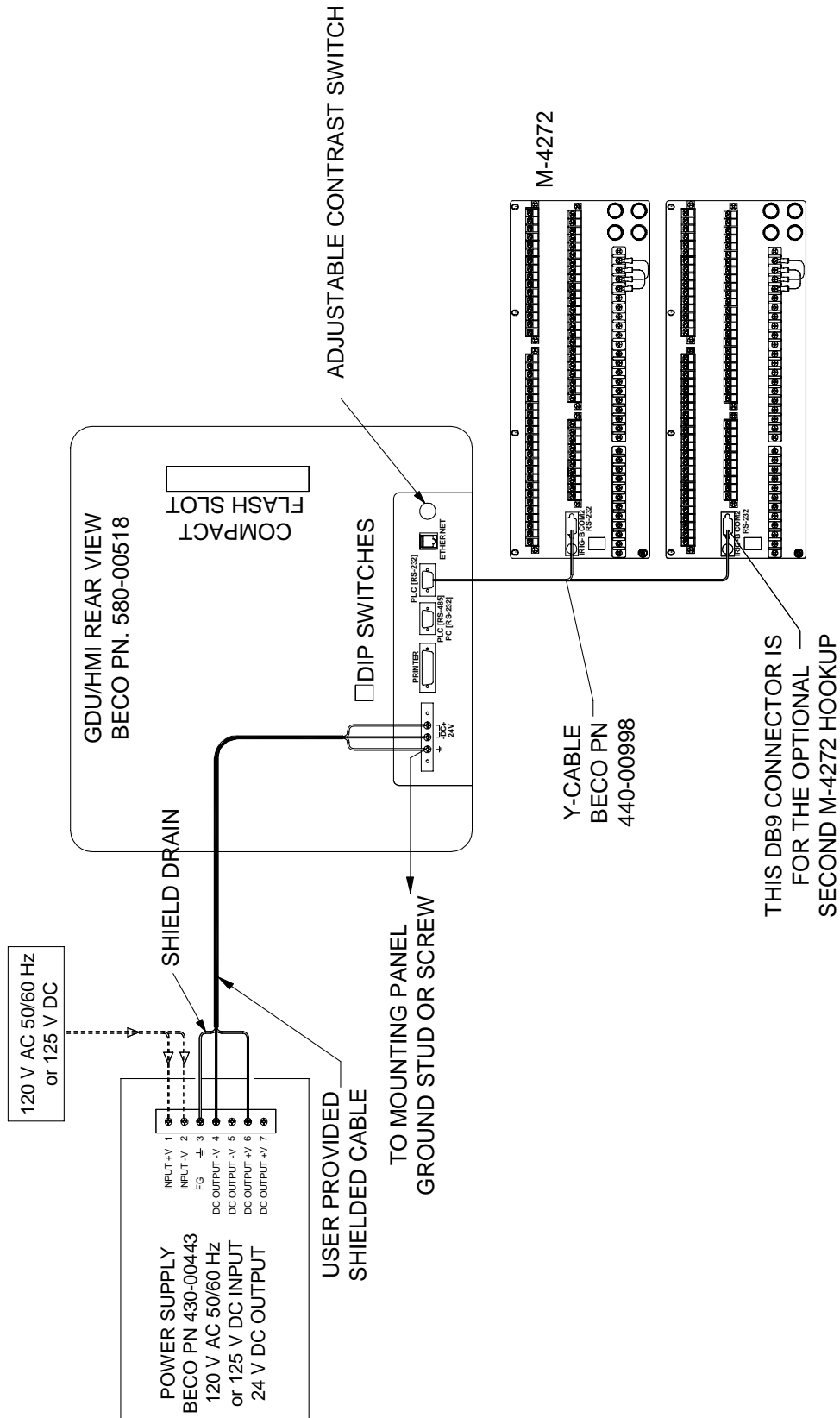


Figure 17 AC/DC Power Supply and Communication Wiring

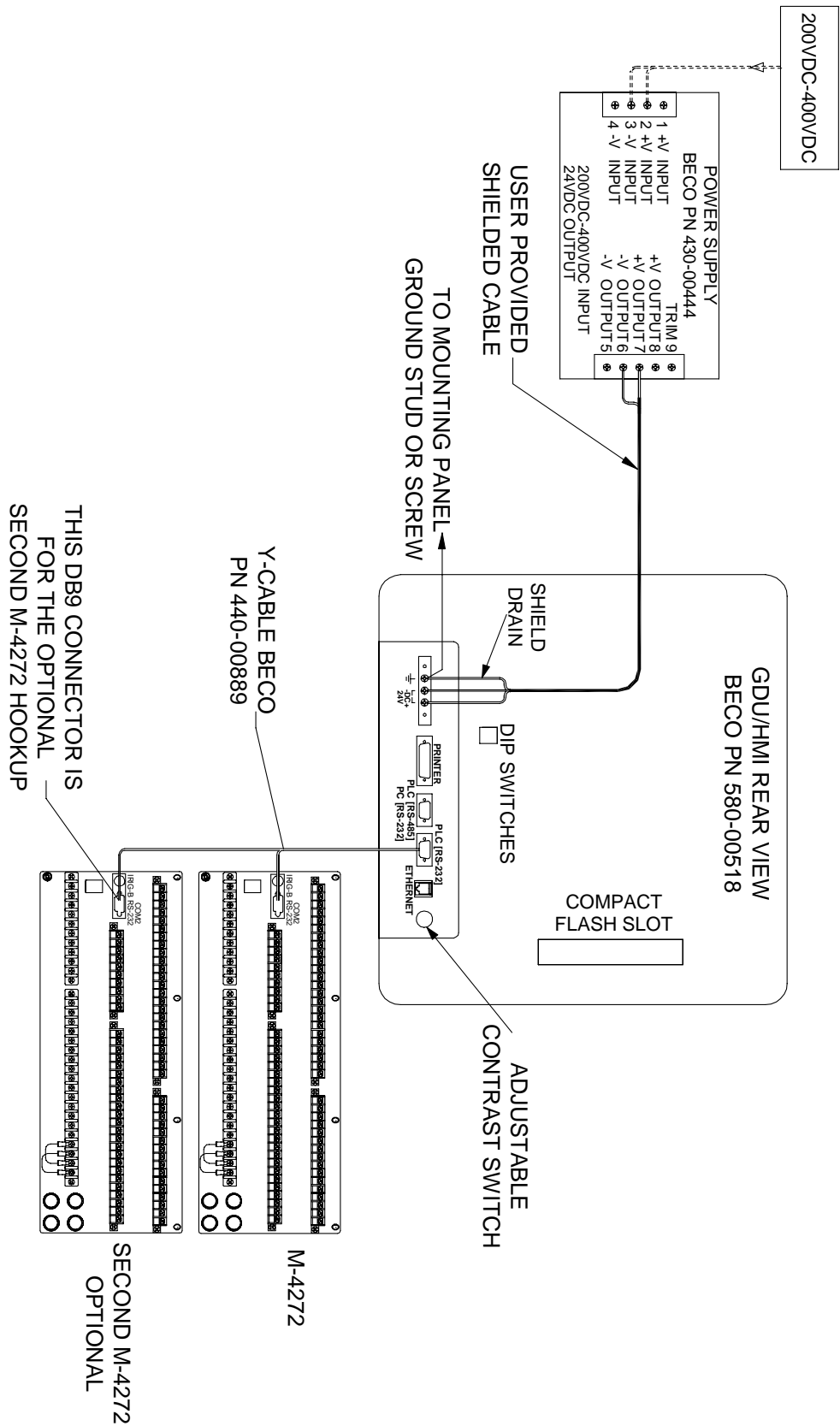


Figure 18 Optional DC Power Supply and Communications Wiring





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