Voltage free Relay Outputs
5A @30VDC or 125VAC
2A @250VAC

16 Digital Inputs
9-24V AC 50/60Hz
9-24V DC PNP/NPN

IDC Ribbon Cable

24V or PLC's Power Supply

Secondary Expansion connector

Figure 1 - 32 I/O Expansion board for FMD and F-Series PLCs

1. Introduction

The EXP1616R is an expansion board specifically designed for the FMD and F-Series PLCs. It adds additional 16 opto-isolated digital inputs and 16 relay outputs to any of these PLCs. The EXP1616R+ also has a secondary expansion connector on the right side of the PCB, which allows multiple expansion boards or a HMI to be connected. A FMD or F-Series PLC can therefore be expanded to a total I/O of 128 digital inputs and 128 digital outputs.

The EXP1616R is identical in size to the FMD1616-10 PLC. This allows one or more of the expansion board(s) to be "stacked" on top or below a FMD1616-10 PLC for applications where the controllers must be fitted within a very tight space.

2. Physical Mounting & Wiring

The EXP1616R requires 4 PCB standoffs (or some screws and nuts) to support the board. It is usually mounted side-by-side to the right of the FMD or F-Series PLC. You must plug the supplied ribbon cable to the PLC's expansion connector located along the right edge of the PLC.

CAUTION: DO NOT install the EXP1616R with the mechanical relays in the vertical position as shown in the following two diagrams.
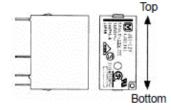

Figure 2 - Incorrect Relay Position

The manufacturer of the mechanical relays currently used on the EXP1616R (part # JQ1a-24V-F) is now specifying that the relay not be installed in the vertical position or it could fail to actuate on occasion, typically after many previous switches. However, the results may vary and it should be assumed that the relay can potentially fail at any time when installed in the specified vertical position.

According to the relay manufacturers revised documentation: "When installing with the relay terminals parallel to the ground, the contact terminals at the bottom and the coil terminals at the top, component friction will occur after numerous switching actions or due to vibration in the non-excitation state. Since this may cause the relay to stop functioning when the pick-up voltage increases even if the nominal voltage is applied, please do not install using this orientation." This is demonstrated in Figure 2 above.

On the EXP1616R, the relays will be orientated this way when the PLC is installed in the following position demonstrated in figure 3. This position should be avoided when the relays are being used.
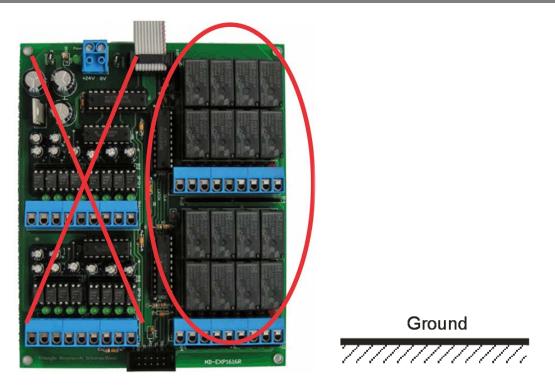
Figure 3 - Incorrect EXP1616R Orientation

The supplied ribbon cable is meant for side by side mounting of the expansion board. If you wish to stack the EXP1616R on top or below the FMD or F-Series PLC, you will need to make or purchase a longer expansion ribbon cable (approximately 8 inches long) in order to connect the PLC to the expansion board.

To build a custom cable, the type of cable that you want to find is an IDC terminated 10-pin ribbon cable with 100 mil (0.1") connector pitch. The center bump is the key, which is standard and should be center orientated. However, please check both ends of the cable to ensure you have the key placed on the correct side of the connector so that it fits in the groove of the sockets on the PLC/Expansion Board. Also note the position of the red line on the ribbon cable, which indicates pin #1.

This type of cable and connector can typically be found from most electronic component suppliers such as DigiKey and Mouser.

Digital I/O Ports: Detachable screw terminals are provided for quick connection to all digital inputs, outputs and power supply wires. Each block of screw terminals can easily be detached from the controller body, enabling easy replacement of the controller board when necessary. Since the terminal block for digital I/Os is inserted vertically to the board surface, you need to remove the terminal block before you can start wiring. Use a small flat-head screw-driver and insert underneath the terminal block, apply even pressure to raise the terminal block until it becomes loosened from the connecting-pin strip, as shown below:
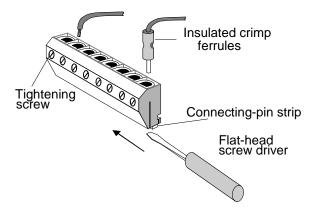
Figure 4 - Removing Screw Terminal block

Although you can connect a single or multi strand wire directly to the screw terminal, we strongly recommend using the insulated crimp ferrules to provide a good end termination to multi-stranded wires. Using ferrules reduces the possibility of stray wire-strands short-circuiting adjacent terminals and their use is therefore highly recommended.

3. Power Supply

The EXP1616R requires a 24VDC power source to operate properly. The power supply can be the same as the PLC if the PLC is also using 24V. However, If the PLC is operating at a lower voltage (e.g. 12VDC), then you need to use a separate +24V DC power source for the EXP1616R.

The +24VDC should be connected to the power supply screw terminals along the left edge of the EXP1616R as shown in Figure 1. The expansion board may still work even if you don't wire the external power to the power supply screw terminals. This is because it can also draw the +24V power from the PLC via the ribbon cable and through an onboard diode. However, we strongly recommend wiring up the power supply terminals to reduce chances of high current induced spikes from interfering with the expansion board I/O signals.

Note: The power supply voltage to the EXP1616R cannot be lower than the power supply voltage to the PLC, otherwise it could cause a high current to flow through the diode that links the PLC's power source to the MD-EXP1616R and blow up the diode.

Please use only industrial grade linear or switching regulated power supply from established manufacturers for best results. Using a poorly made switching power supply can give rise to a lot of problems for the PLC.

Always place the power supply as near to the PLC and the expansion board as possible and use separate wires to connect the power to I/Os. Keep the power supply wire as short as possible and avoid running it along side high current cable in the same cable conduit.
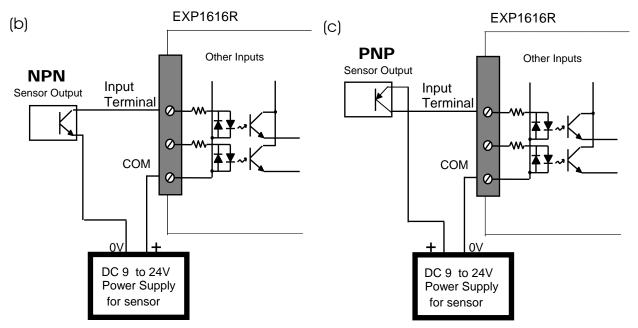
4. Digital Input Circuits

When connected to a FMD88-10, FMD1616-10, or F1616-BA PLC, the first 16 expanded inputs should occupy Inputs #17 to #32. These are all bi-directional opto-isolated that accepts the following industrial voltages:

  a) 9-24V **AC 50/60 Hz**
  b) 9-24V **DC NPN**
  c) 9-24V **DC PNP**

Their respective wiring methods are illustrated in Figure 5(a),(b) & (c)

(a)

(b)

(c)

Figure 5 - EXP1616R Input Wirings

All these inputs have green color LED indicators. Every 8 inputs are grouped together into a single strip of detachable screw terminal and share a single common terminal (marked as "COM"). The input numbers are marked on their screw terminals.

(**Note**: when used with the F2424+ PLC, these inputs occupy #25 to 40, and when used as a second expansion board to another expansion board, these inputs will begin from the number right after the last input number of the first expansion board. Please use the supplied labels for non-default I/O numbering).

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5. Relay Output Circuits

Each EXP1616R features 16 normally-open, voltage-free relay outputs. Every 8 outputs share a common terminal ("COM"). Each output has an LED indicator adjacent to its terminal that lights up when the output is turned ON.

Relay Outputs Electrical Specifications:

Current Ratings   @30V DC   : 5A   (Electrical life = 2×10^5 cycles)
(resistive load)   @125V AC   : 5A   (Electrical life = 2×10^5 cycles)
                          @250V AC   : 2A   (Electrical life = 2×10^5 cycles)

Maximum total current   : 10A   (per block of 8 outputs)
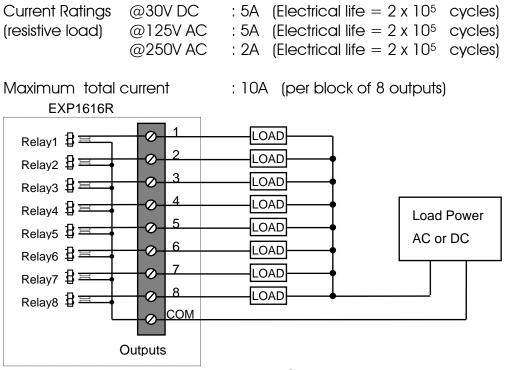

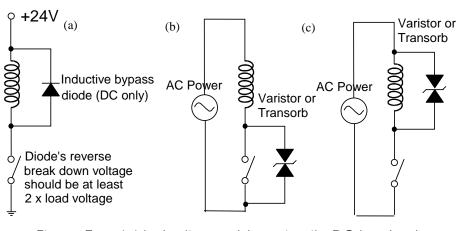Figure 6 - Relay Output interfacing to load

Figure 7 -   (a) Inductive snubber circuit - DC load only.
                    (b), (c) Inductive snubber circuit - AC/DC load.

Note: When switching inductive load, always ensure that either a varistor or bypass diode is connected to absorb inductive kick that occurs when the relay contact opens. If left unchecked, the inductive kick causes an electric arc to form across the contact, which will wear out the contact material and severely shorten the contact life of the relay.