



C-Programmable Controller

# PK2200 Series

The PK2200 Series of C-programmable controllers is based on the Zilog Z180 microprocessor. The PK2200 includes digital, serial, and high-current switching interfaces. The standard PK2200 includes a rugged enclosure with 2×20 LCD and 2×6 tactile keypad. The PK2200 also has a PLCBus™ expansion port, allowing you to connect several Z-World expansion boards (such as the XP8100 or XP8300) if you need extra I/O.

The following PK2200 Series controllers are available:

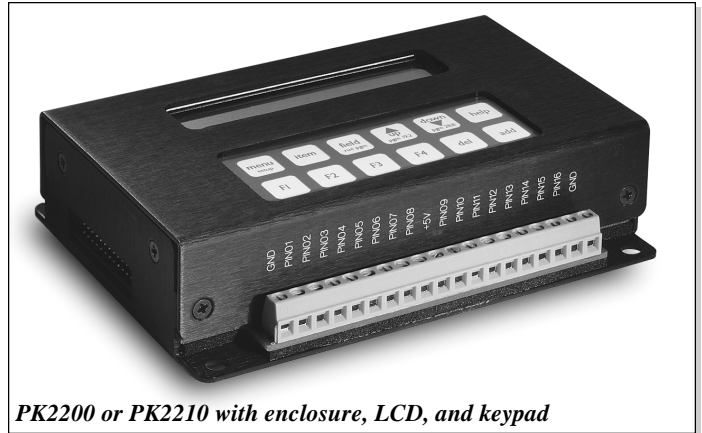
- PK2200 With enclosure, 2×20 LCD, and 2×6 keypad. 18.432 MHz clock.
- PK2210 With enclosure, 2×20 LCD, and 2×6 keypad. 9.216 MHz clock.
- PK2220 No enclosure, LCD, or keypad. 18.432 MHz clock.
- PK2230 No enclosure, LCD, or keypad. 9.216 MHz clock.
- PK2240 With enclosure, 128 x 64 backlit graphics LCD, 3×4 keypad. 18.432 MHz clock.

The following PK2200 Series options are available:

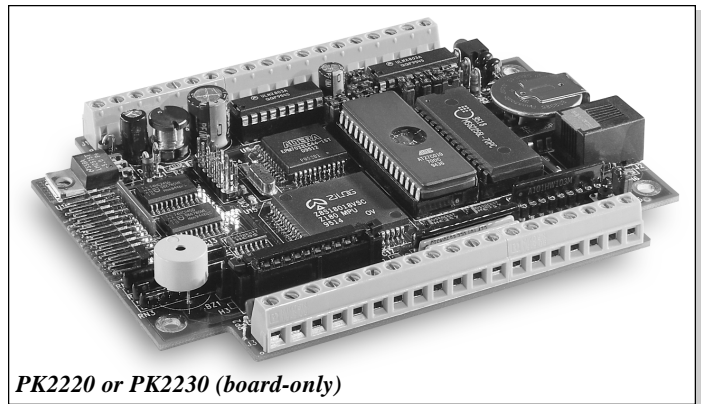
- 128K flash (32K EPROM is standard)
- 128K or 512K RAM (32K is standard)
- Backlit character LCD (with PK 2200 or PK2210)
- Sourcing driver kit. Replaces sinking (2803) high-current driver chips with sourcing (2985) drivers.

## Features

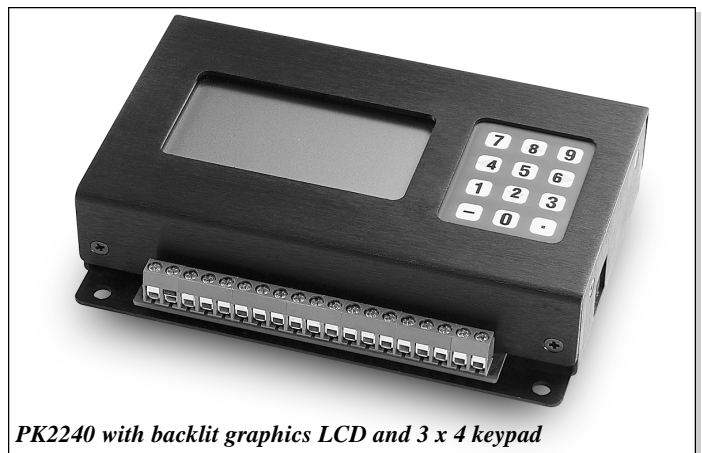
- Battery-backed static RAM, up to 512K bytes.
- EPROM, up to 512K bytes, or flash memory to 256K bytes.
- Battery-backed real-time clock (RTC).
- Lithium backup battery, rated at 165 mA-hours. The RTC and full 512K RAM draw about 16  $\mu$ A with power disconnected. At that rate, the battery will sustain the RTC and RAM for about 1.1 years [10,000+ hours].
- Watchdog timer.
- Power failure warning interrupt.
- EEPROM, 512 bytes standard.
- LCD. The standard screen has 2 lines of 20 characters. Other displays can be installed, on special order.
- Keypad, 2 rows of 6 keys, for a total of 12 keys. PK2240 has 4 rows of 3 keys.
- Self-resonating beeper.



**PK2200 or PK2210 with enclosure, LCD, and keypad**



**PK2220 or PK2230 (board-only)**



**PK2240 with backlit graphics LCD and 3 x 4 keypad**

## Specifications

Board Size	4.0" × 5.32" × 0.63".
Enclosure Size	4.0" × 5.5" × 1.35".
Operating Temp.	-40°C to +70°C. With LCD, 0°C to 50°C.
Humidity	5% to 95% non-condensing.
Input Power	9-36VDC, switching p.s. Draws 40-70 mA.
Processor	Z180. at 18.432 MHz [9.216 MHz optional].
Power Consumption	1.5W.

## The Interface

- 1 16 protected digital inputs, with a 2.5 volt threshold. Three of the inputs also function as counter inputs.
- 2 14 high-current outputs suitable for driving relays or solenoids. These outputs can sink approximately up to 500 mA individually, at up to 48V, subject to total heat dissipation restrictions for the driver chips.
- 3 An RS485 serial port and an RS232 serial port operating at up to 57,600 baud. You can have either
  - (a) one RS232 channel (with CTS/RTS handshaking) and one half-duplex RS485 channel, or
  - (b) two 3-wire RS232 channels (no handshaking).
- 4 A 26-pin expansion bus for Z-World PLCBus™ devices or customer-designed devices. Refer to the *PLCBus data sheet*.

## The Terminals

There are 38 screw terminals (19 each side) used for input, output, and power connections. There are also two connectors on the sides of the controller: an RJ12 “phone jack” for the RS232 port, and a 26-pin connector for the expansion bus. The signals on the screw terminals are shown below.

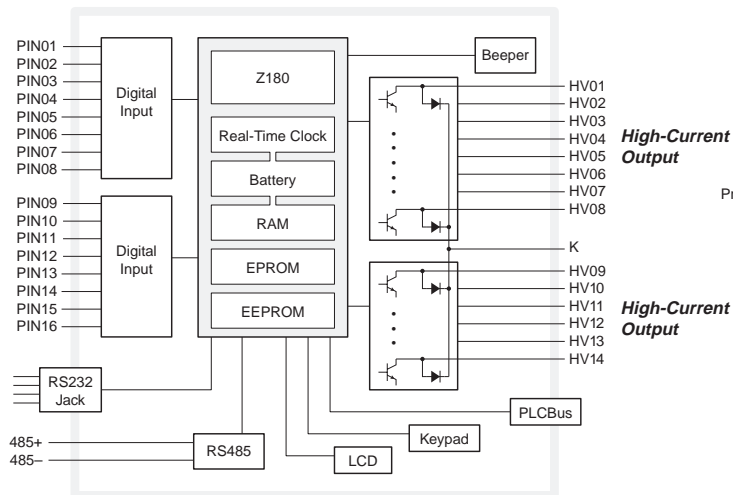
Signal	Meaning
+5V	Output from 5V regulator
GND	Ground
PIN01–PIN16	Digital inputs
+DC	External power, nominally +24VDC. Accepts 9–36VDC.
K	Protection for high-current outputs
HV01–HV14	High-current outputs
485+, 485–	RS485

## Using the PK2200

### Digital Inputs

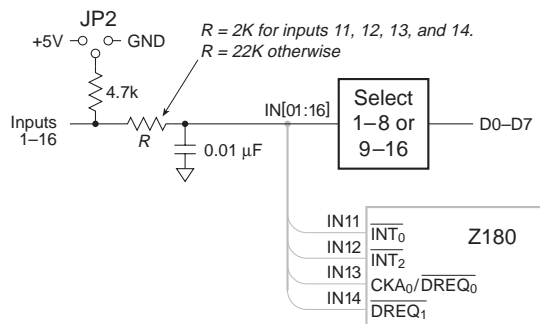
The 16 digital inputs accept an input voltage with a digital threshold at approximately 2.5 volts. The inputs are protected against overload over the range of ±48 volts.

Figure 1. PK2200 Block Diagram



These inputs are convenient for detecting contact closures or sensing devices with open collector transistor outputs. The inputs can detect CMOS logic levels if the low voltage level is less than 0.9V and the high voltage level is greater than 4.2V.

Inputs 1–8 can be read simultaneously and inputs 9–16 can be read simultaneously. Inputs 11 and 12 can be used as interrupt lines. Inputs 13 and 14 connect to the DMA request lines. Z-World software uses the two on-board DMA channels to implement high-speed counters.



Jumper block JP2 allows you to apply pull-up or pull-down resistors to the digital inputs, in groups of eight.

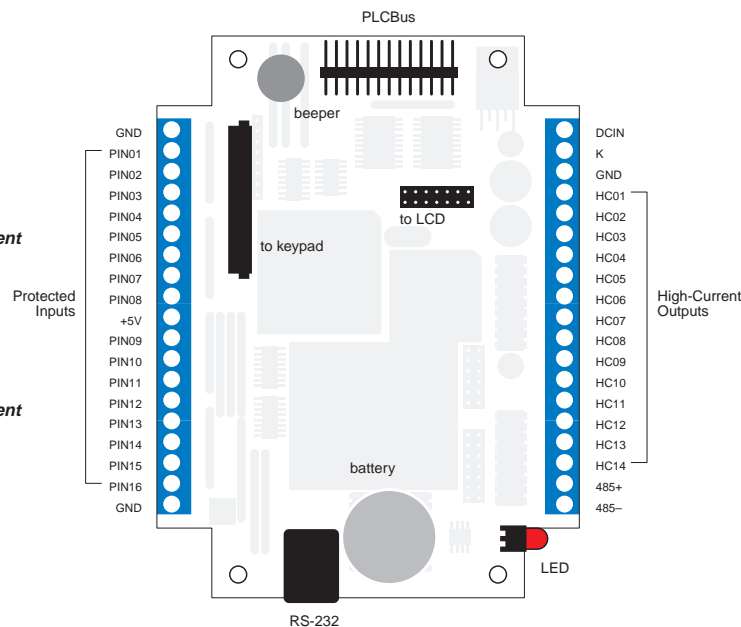
When jumpered, the input impedance is 4.7 kΩ in the range 0–5V. Outside this range, the impedance is 3.9 kΩ.

### High-Current Outputs

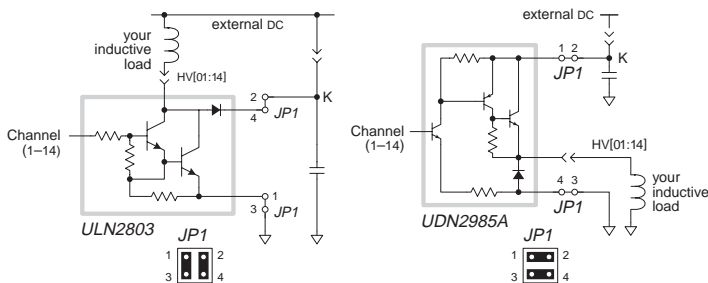
There are 14 high-current outputs HV01–HV14 available at external terminals of the PK2200. These outputs can drive inductive loads, such as relays, small solenoids, or stepper motors.

Each output uses a common connector (“K”) for the protective diodes. Sinking drivers (ULN2803) are standard. Sourcing drivers (ULN2985) are available as an option.

Figure 2. PK2200 Interface



These are the driver connections:



The ULN2803 is rated at 48V, with 500 mA maximum per channel. The maximum current per channel is approximately ~160 mA per output if all outputs are on at the same time continuously. The UDN2985 is rated at 30V max, It will carry ~140 mA per output when all outputs are on simultaneously.

**Battery-Backed Real-Time Clock**

The real-time clock (Toshiba TC8250) stores a representation of time and date, and runs independently, clocked at 32,768 Hz. Refer to the manufacturer’s data sheet for details.

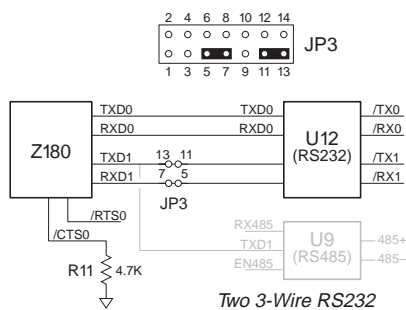
**Beeper**

To operate the self-resonating beeper, write to address 0x140. Set bit 7 to turn it on; clear bit 7 to turn it off.

**The Serial Ports**

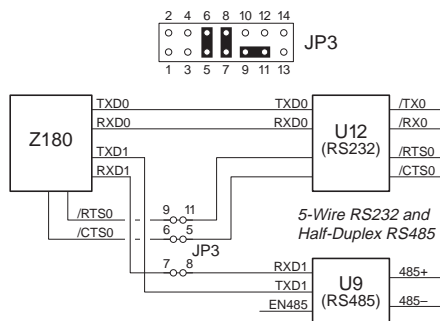
Two ports support asynchronous serial communication at baud rates from 300 to 57,600 (115,200 at 18.432 MHz) bits per second. Using jumper block JP3, the drivers can be configured as two 3-wire RS232 ports or one 5-wire RS232 port (with RTS and CTS handshaking) and one half-duplex RS485 port.

This illustrates the configuration of two 3-wire RS232 channels:



Two 3-Wire RS232

This illustrates the configuration of one 5-wire RS232 channel and one half-duplex RS485 channel:



The Z180 has two independent asynchronous serial channels (0 and 1) with a separate baud rate generator for each channel.

The serial ports have a multiprocessor communications feature. When enabled, an extra bit is included in the transmitted character (where the parity bit would normally go). Receiving processors can be programmed to ignore all received characters except those with the extra multiprocessing bits enabled. This provides a 1-byte attention message that can wake up a processor without the processor having to monitor (intelligently) all traffic on a shared communications link.

The serial ports can be polled or interrupt-driven. Normal options are available: 7 or 8 data bits, 1 or 2 stop bits, odd, even or no parity, and parity, overrun, and framing error detection.

Refer to the Z180 MPU User’s Manual for detail.

**LCD**

The 2x20 LCD used with the PK2200 can come from one of several vendors. All the LCDs are identical in operation, electrical connections, and dimension. They may differ in timing.

Refer to any of the the LCD manufacturers’ data sheets for information regarding LCD operations.

The LCD connector is a 2x7 header, H1.

**Keypad**

To sample the 2x6 matrix keypad, read once from addresses 1BxH and once from the corresponding addresses 1AxH. Each of the low four address bits corresponds to a row of the keypad. Addresses 1Bx return keypad columns 4 and 5 (in bits 4 and 5). Addresses 1Ax return keypad columns 0–3 in bits 4–7 respectively. You must negate the logic to get 1s for pressed keys.

Jumper block JP4 uses keypad signals (/KH2, and /KV1–/KV3) for operation mode settings.

Row 1 is the bottom row. Column 0 is the rightmost column.

**EEPROM**

The EEPROM (512 bytes) contains a few factory-set parameters. Other than these, the EEPROM is for your use.

Refer to the 24C04 manufacturer’s data sheet for information on reading and writing the EEPROM. The PK2200 lines SCL (serial clock), and SDA (serial data) apply.

**Heat Sinking**

The PK2200 has one regulator. The aluminum enclosure provides the heat sink. In the board-only version, the mounting rails provide the heat sink. The regulator transfers heat through two mounting “pem” nuts. Maximum dissipation by this regulator is 1.5W when the ambient temperature is 50°C. Power dissipation is given by the formula:

$$P = (V_{IN} - 5) \times (I + 0.15)$$

V<sub>IN</sub> = input voltage

I = current, in amperes, drawn from +5V supply by external accessories on bus or from the +5V terminal.

### Environmental Temperature Constraints

No special precautions are necessary over the range of 0–50°C (32–122°F). For operation at temperatures much below 0°C, the PK2200 should be equipped with a low temperature LCD. The heating effect of the power dissipated by the unit may be sufficient to keep the temperature above 0°C, depending on the insulating capability of the enclosure used. The LCD unit is specified for a maximum operating temperature of 50°C. Except for the LCD, which fades at higher temperatures, the PK2200 can be expected to operate at 60°C, or more, without problem.

### Expansion Bus

The PLCBus™ is a general purpose expansion bus for Z-World controllers. Multiple expansion boards may be daisy-chained together and connected to a Z-World controller to form an extended system. For details, refer to the *PLC Bus Data Sheet*.

### Power Failure Interrupts

The following events occur when power fails:

- 1 The power-failure NMI (non-maskable interrupt) is triggered when the unregulated DC input voltage falls below approximately 7.9 volts (subject to the voltage divider R1/R2).
- 2 The system reset is triggered when the regulated +5V supply falls below 4.5 volts. The reset remains enabled as the voltage falls further. At this point, the chip select for the SRAM

is forced high (standby mode). The real-time clock and SRAM are switched to the lithium backup battery as the regulated voltage falls below the battery voltage of approximately 3 volts.

### Jumpers and Headers

Figures 4–7 below show important headers and jumpers. Figure 8, next page, shows header and jumper positions. Pin 1 positions are indicate by “+” markers.

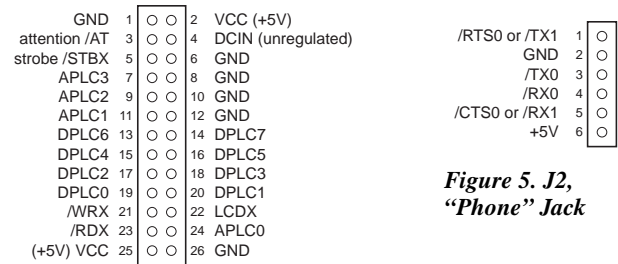


Figure 5. J2, "Phone" Jack

Figure 4. H2, PLCBus connector

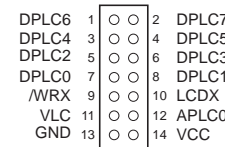


Figure 6. H1, LCD Connector

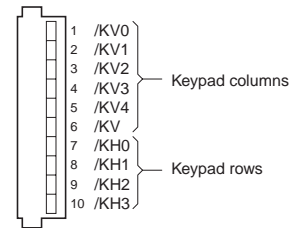


Figure 7. H3, Keypad Connector

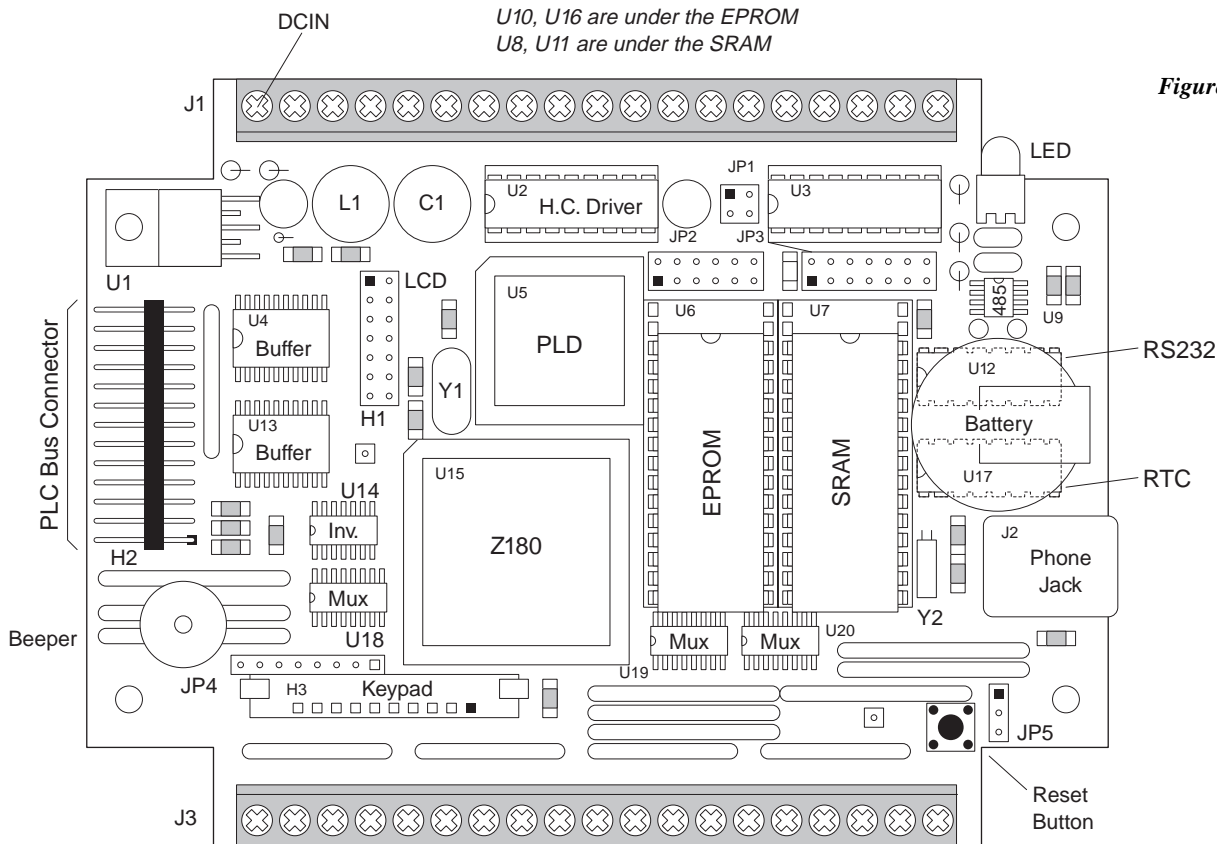


Figure 3. Parts Locations

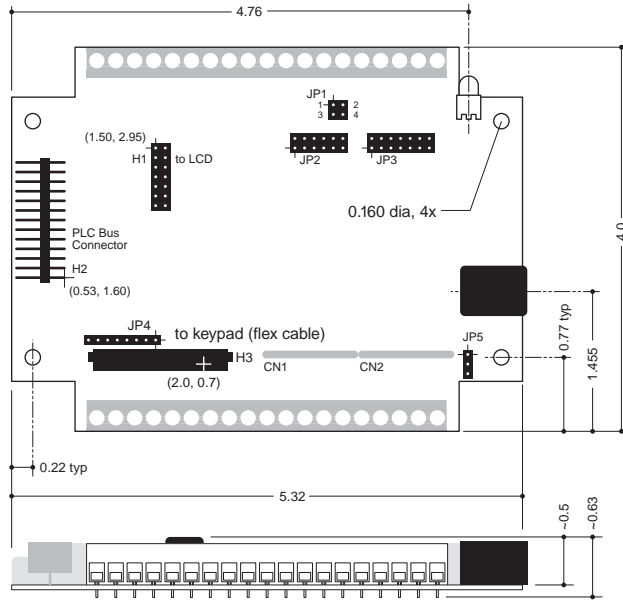


Figure 8. Board Dimensions

### Board Dimensions

Figure 8 shows board dimensions, mounting hole locations and sizes, all the jumpers and headers, and pin 1 positions for important headers. Mounting holes are (0.22, 0.77) from the extreme edges of the board.

Maximum height of components above the board is 0.5" approximately. Overall height is 0.63" approximately.

### Enclosure Dimensions

Figures 9 and 10 show the size of the aluminum enclosure, the locations of the PLCBus port, phone jack, and LED, and the apertures for the keypad and LCD. Keys are 14 mm square and on 17 mm centers.

The PK2240 enclosure is fundamentally the same as the enclosure for the PK2200, PK2210, PK2220, and PK2230. Only the LCD and keypad locations differ.

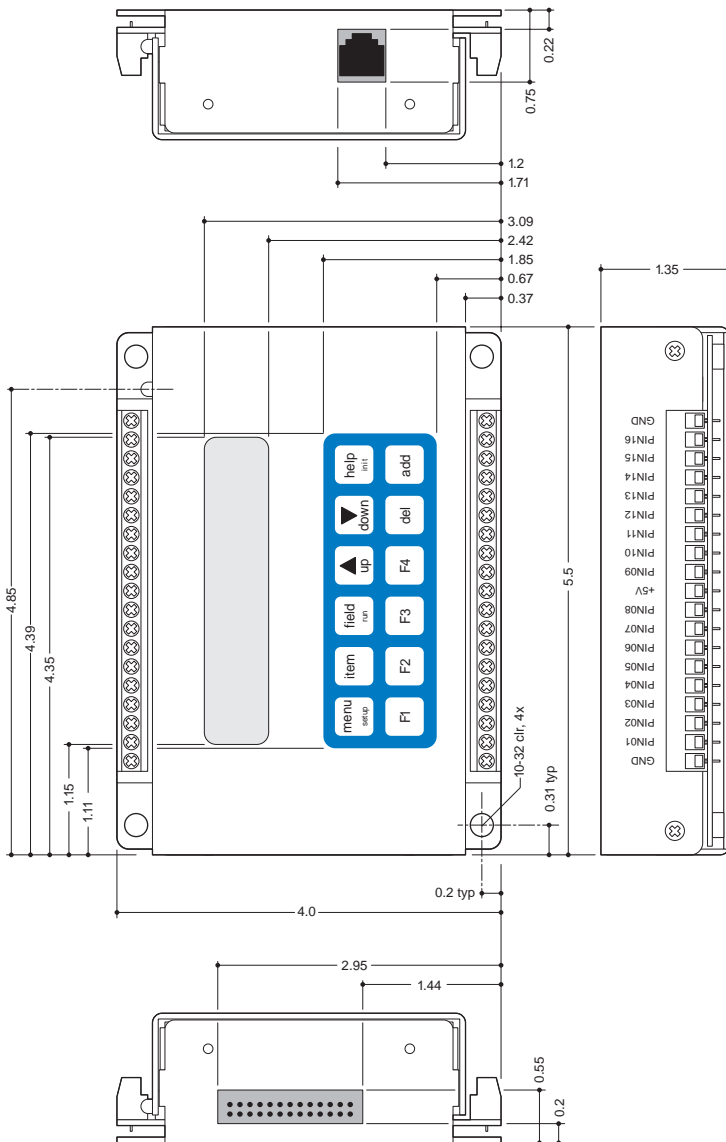


Figure 9. Enclosure Dimensions, PK2200-PK2230

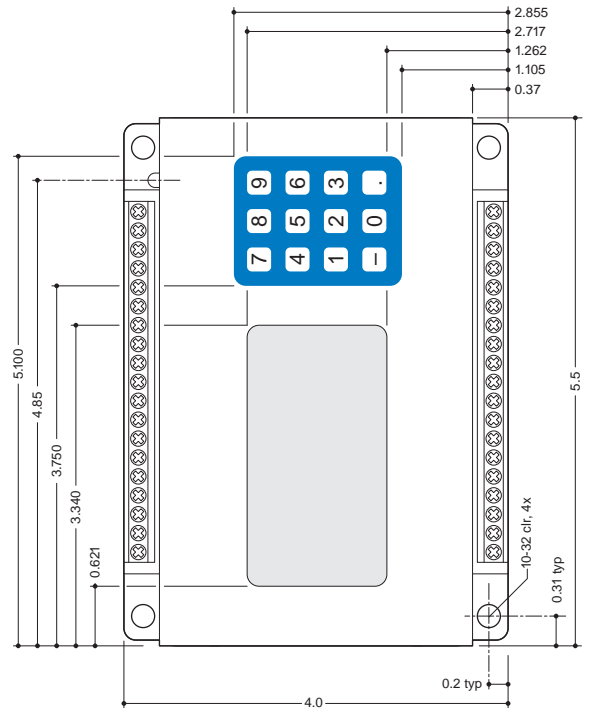


Figure 10. PK2240 Panel Dimensions