

# Performance Box Controller

## User Manual



**Revision 1.2, July 2012**

AKC-PLC-C1-224-00N Performance Box Controller

AKC-PLC-D2-224-00N Hi-Performance Box Controller

AKC-RMC-D2-224-00N Hi-Performance Rack Mount Controller



Keep all manuals as a product component during the life span of the product.  
Pass all manuals to future users / owners of the product.

**KOLLMORGEN**<sup>®</sup>

*Because Motion Matters™*

## Record of Document Revisions

| Revision | Remarks  |
|----------|--|
| 1.0      | Preliminary edition  |
| 1.1      | Added installation instructions for Profibus and Ethernet/IP, and included mechanical drawings in the Appendix. For more information, see section 3.2 (page 11), and Appendix A and B (pages 29 and 31). |
| 1.2      | 7/11/2012<br>Various updates and corrections.  |

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**July 2012**

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# 1 CONSIDERATIONS AND SAFETY PRECAUTIONS

This section provides the item checklist and safety information for the Box Controller.

## 1.1 Appropriate Use

The main purpose of the Box Controller is the use and operation with 24VDC-powersources.

The surrounding areas of the Box Controller are dry rooms. The Box Controller is intended for industrial applications in machine and plant control engineering.

The user is not entitled to change the system components or open the body without consulting Kollmorgen.

## 1.2 Item Checklist

Your Box Controller comes securely packaged in solid shipping cartons. Upon receiving your Box Controller, open the cartons and remove the contents carefully. The shipping carton should contain the following items:

- Performance Box Controller
- CPU Support CD (optional)
- 24V DC Power cord (optional)
- This user manual (optional)
- Software installation CD (if implemented)

Carefully inspect each component to ensure that nothing is missing and/or damaged. If any of these items is missing or damaged, contact Kollmorgen immediately. Preserve the packing material for future transportation.

## 1.3 Important Safety Instructions

This section gives you detailed information about how to maintain a safe environment while using the Box Controller. You can maintain its condition and performance by following these guidelines. Read all guidelines carefully to ensure maximum safety.

Observe power supply input voltage requirements. The Box Controller has specific power requirements.

Prevent the Box Controller from humidity. Never pour any liquid on the Box Controller; this may cause fire or electrical shock. Place the Box Controller on a reliable surface when installing. A drop or fall may cause damage.

Do not leave the Box Controller in an unconditional environment. Storage temperature above 70°C may damage the Box Controller.

The opening on the enclosure is for air convection; protect the Box Controller from overheating.

**WARNING!** Do not cover openings!

If the Box Controller is not in use for a long time, disconnect the power supply to avoid possible damage by transient over voltage. If opening the housing of the Box Controller for service, all single parts of the plant must first be switched off, after which the Box Controller can be disconnected from the plant. Secure each part. Do not turn unit on during service.

The following service activities on the Box Controller could cause failures.

- Metal objects such as screws or tools falling on or in the Box Controller
- Inserting or removing cables during operation
- Removing or inserting plug-in cards when the Box Controller is switched on

All cautions and warnings on the Box Controller must be observed.

The system must be shut down and checked immediately if one of the following situations occurs:

- The power cord or plug is damaged
- Liquid has penetrated the Box Controller
- The Box Controller is exposed to moisture
- Obvious signs of breakage are visible

The system does not work properly or is not working according to the application requirements

## 2 OVERVIEW

This section provides an overview of the Box Controller.

### 2.1 Description

The Box Controller is a motion and machine controller that contains a machine control real-time engine and a Window XP embedded interface for ease of use.

Machine and motion control projects for the Box Controller are created with the KAS Integrated Development Environment software (IDE) and downloaded via an Ethernet port. The Box Controller contains the following additional features:

- High Performance EtherCAT network for interface to Drives and Remote I/O.
- CF (Compact Flash) card Data Memory.
- NVRAM Memory to retain data when power is removed.
- USB ports for plugging in external devices.
- Runtime display showing status of each axis and overall operation of the user's project.
- Optional KVB (Kollmorgen Visualization Builder) HMI.
- A fan cooled system.

The system is designed for:

- Installation in an instrument panel or other cabinets.
- Installation by VESA 75/100 compliant mounting system.

The Power button, Reset button, LED control indicators, and user interfaces such as DVI-I/VGA, USB (2.0) LANs (10/100 Mbps or 1 Gbps), and serial ports (RS232) are accessible on the rear side of the system.

The Box Controller is designed to be powered from a 24 VDC external power source.

The front side of the Box Controller system is ensured with an IP30 (NEMA 250 Type 12 and 13) protection class.

The Box Controller is a fan cooled system. There is a fan located inside of the box controller which is responsible for keeping the device within the recommended operating temperature.

**Note:** When powering on the Box Controller, make sure the air intake and exhaust openings are not obstructed.

### 3 HARDWARE INSTALLATION

The Box Controller is developed to work in a control cabinet. Thereby it must be noted that all environmental conditions must be considered. When installing the Box Controller, ensure that there is enough area for ventilations on the rear side. For more information, see Housing Dimensions.

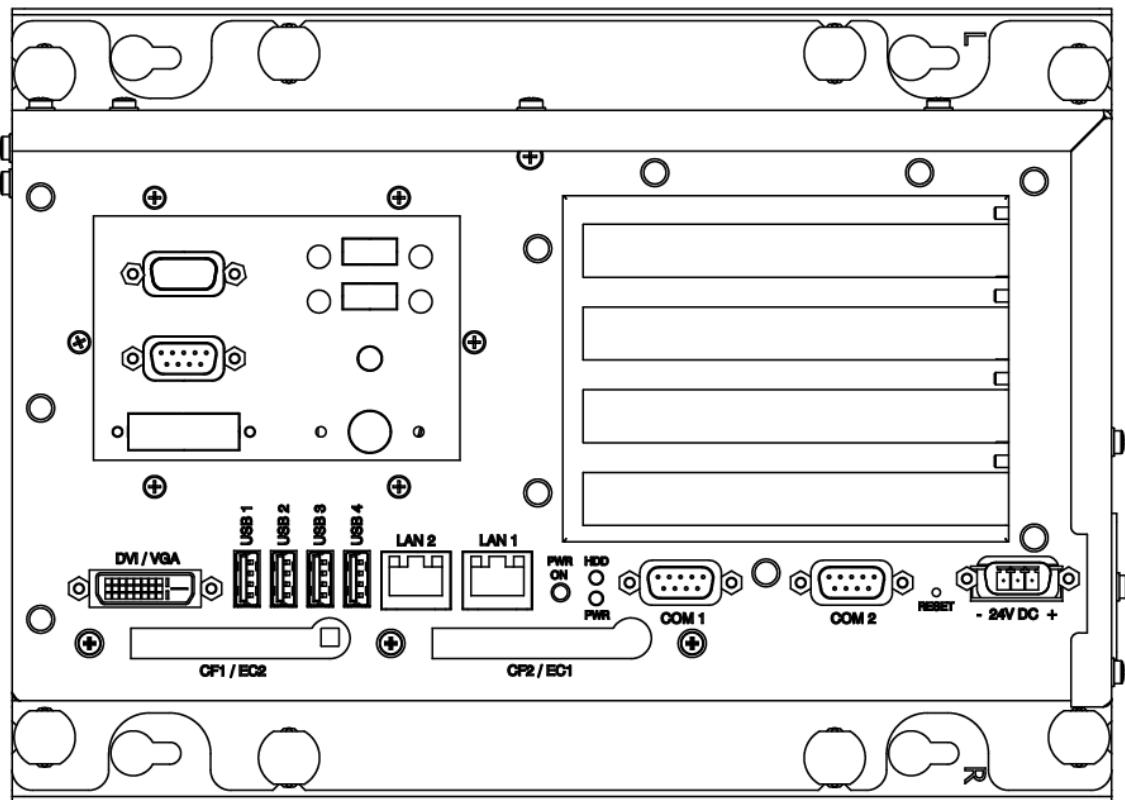
**Note:** The Box Controller weighs approximately 5.6 kg. Use caution when transporting!

**Note:** If your Box Controller was delivered without software, install a keyboard and mouse to view the settings within the BIOS.

**Note:** The Box Controller requires some type of display such as an HMI terminal to view the graphical interface.

#### 3.1 Connecting External Devices

For more information about the pin out of each connector, see Technical Details.



**Figure 3.1** External Connections



### **3.1.1 LAN1 Port (KAS IDE Connection)**

This connection provides an external interface using 10/100 BaseT on RJ45 to connect your panel to other devices in a network such as an HMI terminal.

### **3.1.2 USB Port**

This connector provides four external USB 2.0 interfaces.

### **3.1.3 Serial Interface COM1, COM2**

Three serial interfaces enable connection to an external device with 9-pin DSUB connector, such as mouse or modem. COM2 is selectable as an input for programming the field bus controller.

### **3.1.4 Second LAN2 Port (EtherCAT Connection)**

This connector provides a second external interface using 10/100/1000 BaseT on RJ45 connector to your Box Controller to other devices in a network.

### **3.1.5 DVI/VGA**

This connector provides a external interface using a DVI/VGA connection to your Box Controller to other devices such as a monitor.

### **3.1.6 Reset**

Use the Reset Switch to reset the unit.

### **3.1.7 Main Power IN**

Use this connector to connect the power supply of 24 V DC. Please note the power requirements. For more information, see Technical Details.

### **3.1.8 Power ON Button**

Enables you to switch on and off the main system.

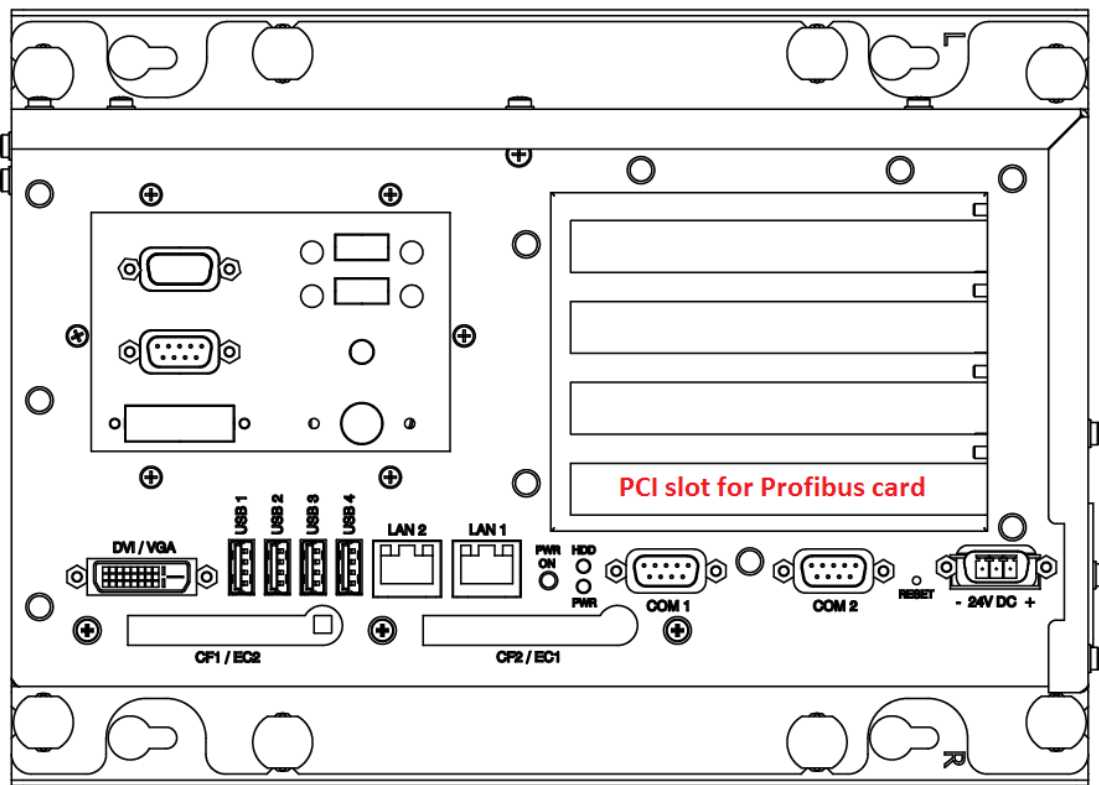
## 3.2 PCI Option Cards

The Panel PAC contains two 32 bit PCI slots. You can expand your system with PCI extension cards as half size length. To expand your system with additional cards, please observe the power consumption specifications specified in the Power Specifications chapter. One example for using these slots is to add bus interface cards

**Note:** Any additional cards must not exceed 25W power consumption.

### 3.2.1 Profibus Installation

Both Profibus cards (Master and Slave) have to be installed in PCI slot number 1. This slot is the closest from the mother board as shown in 3.2.

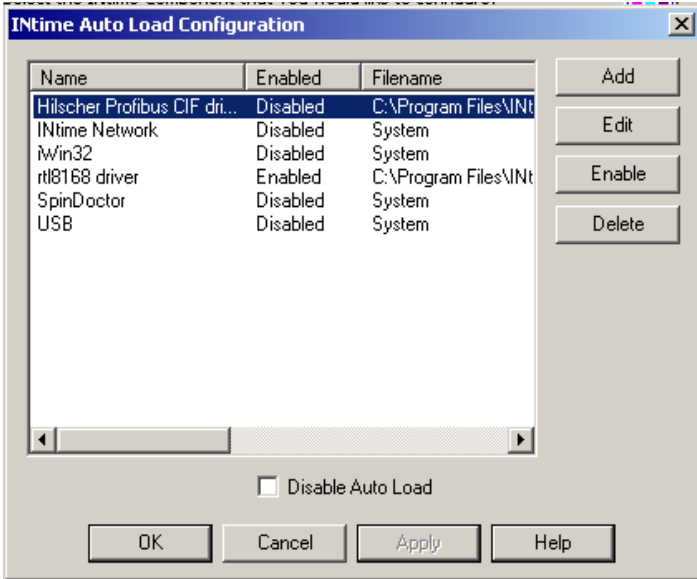


**Figure 3.2:** Profibus PCI Slot on a PAC without Panel

### INtime Configuration

The goal is to load the CIF Driver for Intime

- Right-click on the Intime Icon in the windows service toolbar and select INtime configuration
- Click on the "Autoload" icon
- Select the Hilscher Profibus CIF driver and click on the enable button



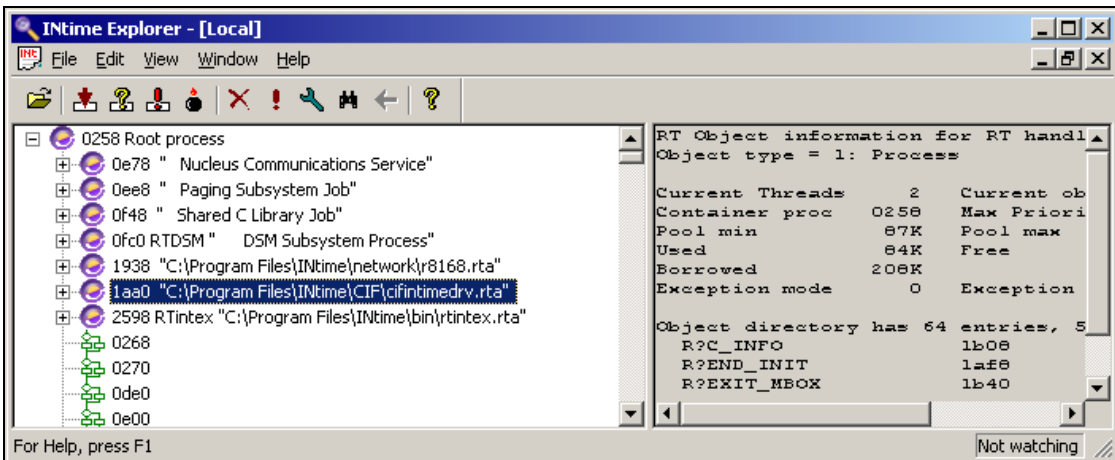
**Figure 3.3:** Intime Auto Load Configuration

- Restart the IPC

### Settings Validation

It is important to double check that cifintimedrv.rta has been correctly loaded

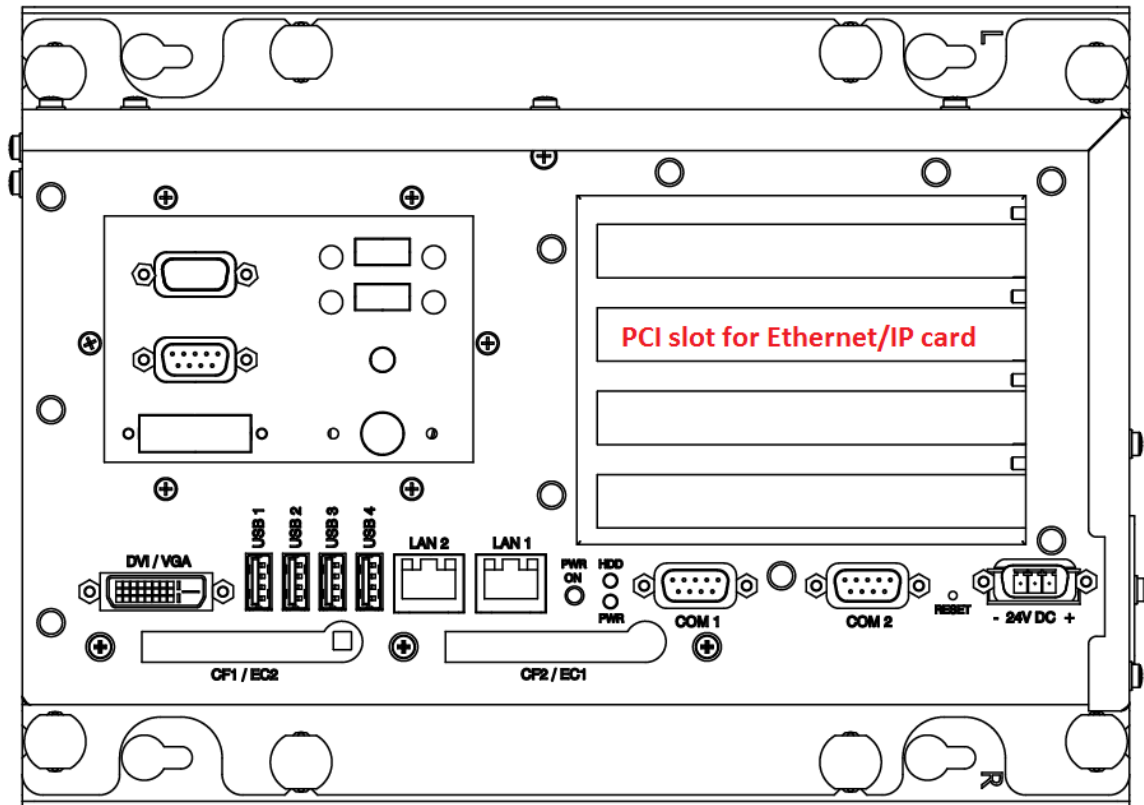
- Click on the INtime icon in the service bar at the bottom right
- Open the INtime Explorer
- Make sure that the driver cifIntimedrv.rta is correctly loaded as shown in the Figure 3.4



**Figure 3.4:** CIF driver loaded in Intime explorer

## 3.2.2 Ethernet/IP Installation

Ethernet/IP cards have to be installed in PCI slot number 3. Slot 3 is shown in red on Figure 3.5.

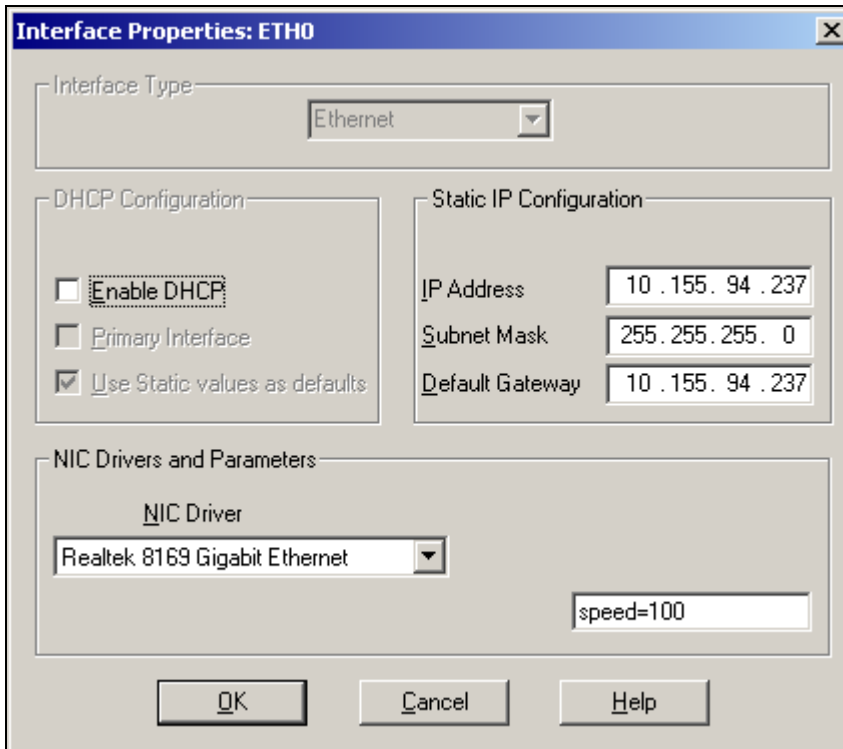


**Figure 3.5:** Ethernet/IP PCI Slot on a PAC without Panel

### INtime Configuration

The following procedure explains how to configure INtime to manage the network card.

1. **Pass the network board from Windows to INtime**
  - Open : INtime Configuration-> INtime Device Manager
  - Expand the network adapter
  - Right-click on the RTL8169 and select "pass to INtime (with legacy IRQ)"
  - Close the windows and restart INtime kernel
2. **Add the NIC Interface**
  - Open INtime Configuration->Real-time Network
  - Check "Auto Start Real-time Networking"
  - Click on the button "NIC Configuration"
  - Double click on the ETH0
  - Set the "Interface Type" to "Ethernet"
  - Check "EnableDHCP" in the "DHCP config"
  - Check "Use Static values as defaults" in the "DHCP config"
  - UnCheck "EnableDHCP" in the "DHCP config"
  - Set your IP parameter according to your Ethernet/IP settings.
  - Select your "Realtek 8169 Gigabit Ethernet" in NIC Driver drop down list.
  - Set "speed=100" in the unnamed text box on the right of the drop down list.
  - Your settings should look like in the Figure 3.6

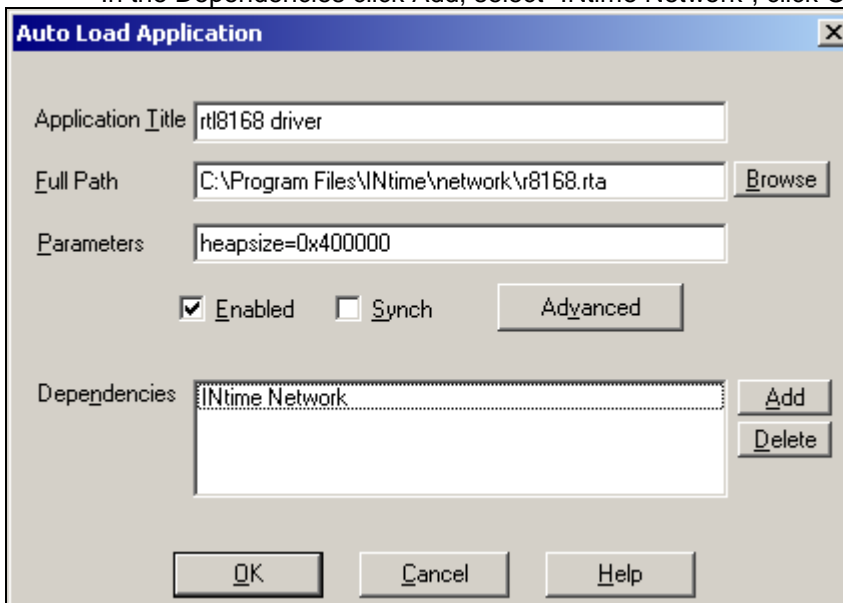


**Figure 3.6:** NIC Configuration

- Then click OK and then Apply.

**3. Set the dependency for the EtherCAT driver.**

- Open INtime Configuration->Autoload
- Double-click on the “rt18168 driver”
- In the Dependencies click Add, select “INtime Network”, click Ok



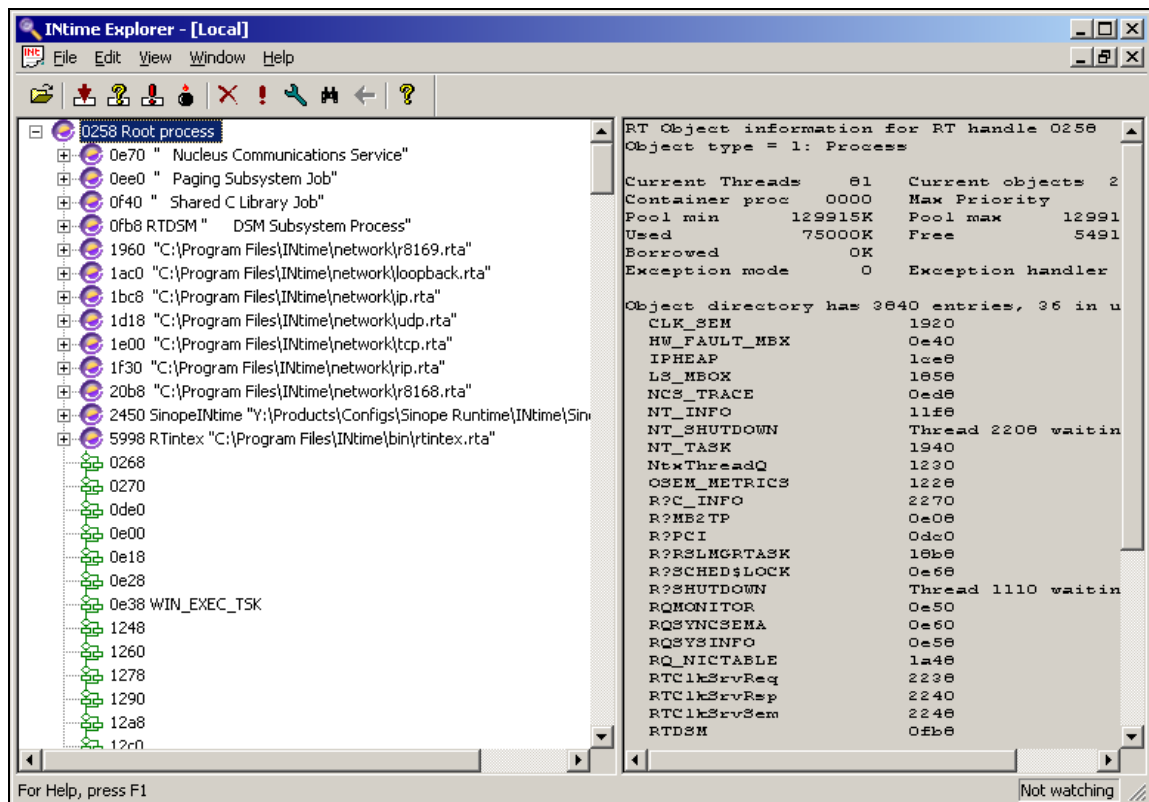
**Figure 3.7:** Driver r8168 setting in Autoload panel

#### 4. Restart the INtime kernel

#### Settings Validation

The INtime network configuration has to be verified as well as the network driver and the network stacks.

- Click on the INtime icon in the service bar at the bottom right
- Open the INtime Explorer
- Make sure that the driver r8168.rta is correctly loaded
- Make sure that the driver r8169.rta is correctly loaded
- Make sure that the network stack(ip.rta, udp.rta, tcp.rta, rip.rta) are correctly loaded like in the Figure 3.8



**Figure 3.8:** Drivers loaded in INtime Explorer

Verify that there are no conflicts with the windows interrupt management.

- Click on the INtime icon in the service bar at the bottom right
- Open the INtime Configuration
- Verify that the Realtek rtl8169/8110...has not conflict indicated
- The windows should be similar to the Figure 3.9

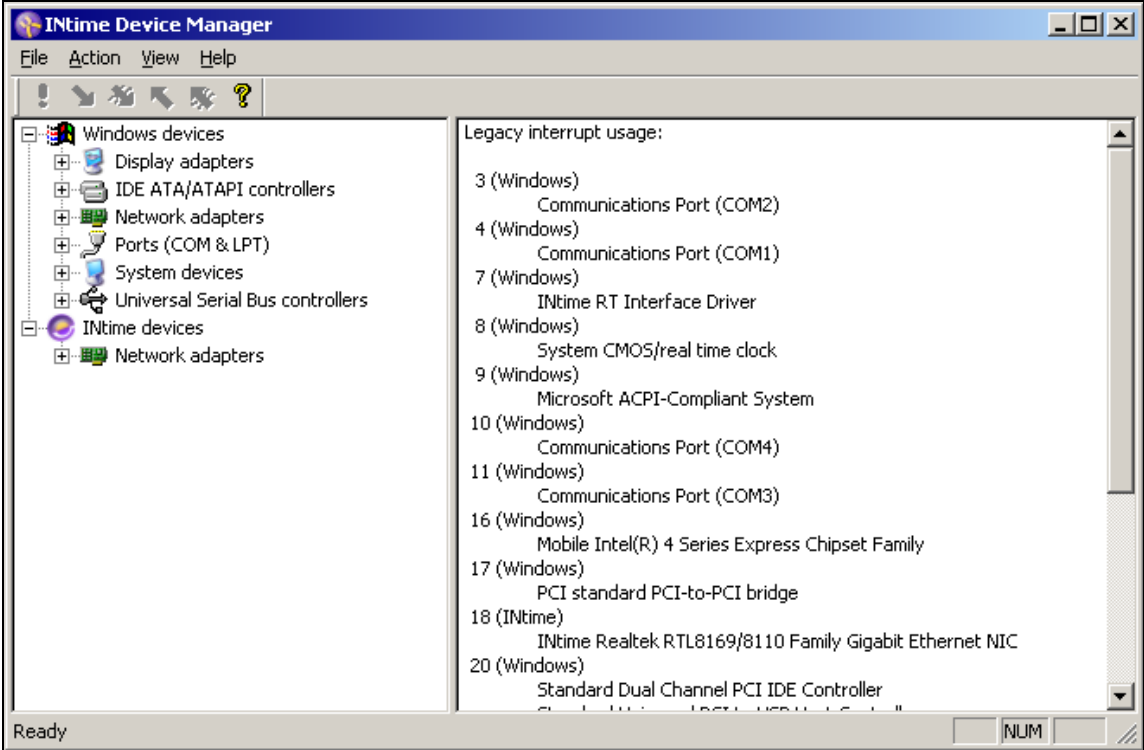


Figure 3.9: INtime Device Manager without any conflict

### 3.3 LED Status Indicators

This section provides information for the LED status indicators.

#### 3.3.1 Power LED

| Description | ON Green | Off      |
|-------------|----------|----------|
| Power       | Power Ok | No power |

### 3.4 Wall Mounting

If you attaching to a wall, four elongated holes are available on the mounting bracket located on the bottom side of the unit. Use four M5 metric screws (not included) to secure the Box Controller.

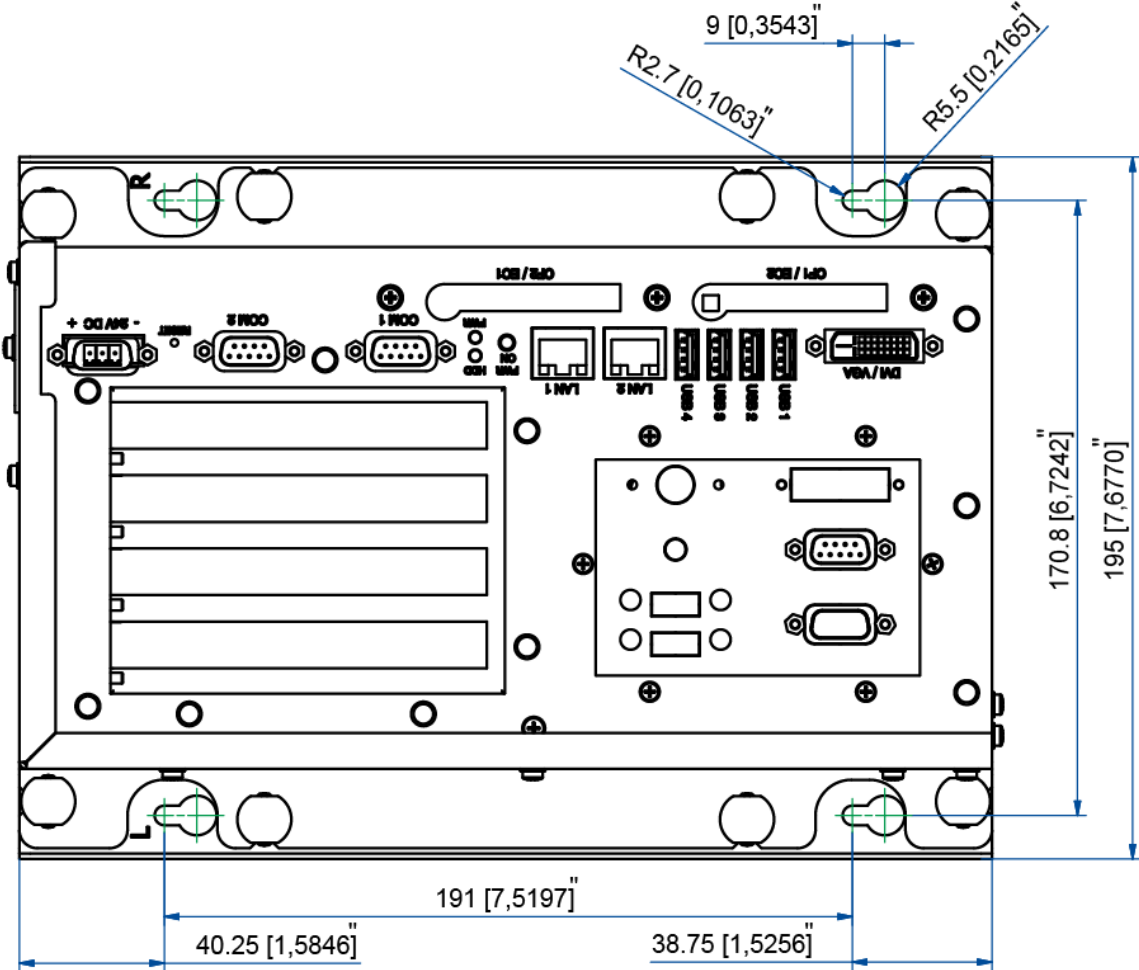


Figure 3.10 Wall Mount



## 4. OPERATION

This chapter provides information on the operation of the Box Controller.

### 4.1 Power Up

When power is applied to the 24 VDC terminal connection, the Box Controller powers up. On the integrated HMI the following start up screen is displayed.

**Note:** The Box Controller requires some type of display such as an HMI terminal to view the graphical interface. If the startup screen does not appear when connected to an external display, press the following shortcut keys to activate:

- **External VGA Port** – Ctrl + Alt + F1
- **External DVI Port** – Ctrl + Alt + F4



The display contains the following information:

| Item         | Description   |
|--------------|---|
| KAS Build    | KAS runtime version loaded on the Box Controller  |
| Boot Time    | The time of the last power up of the Box Controller   |
| CPU          | CPU version contained in the Box Controller   |
| Free Space   | Free space available on the CF (compact flash) drive  |
| Host Name    | Name given to this Box Controller. It can be changed in the Control Panel/ Computer Name tab on the controller. |
| IP Address   | The IP Address of the Box Controller. IT can be changed in Network Connections on the controller.               |
| Memory       | RAM memory size   |
| OS Version   | Windows XP  |
| Service Pack | Service Pack 3  |

| Item                  | Description                        |
|-----------------------|------------------------------------|
| System Type           | Embedded NT                        |
| Snapshot              | Date and time                      |
| KAS AKC Image Version | Version of the Compact Flash image |

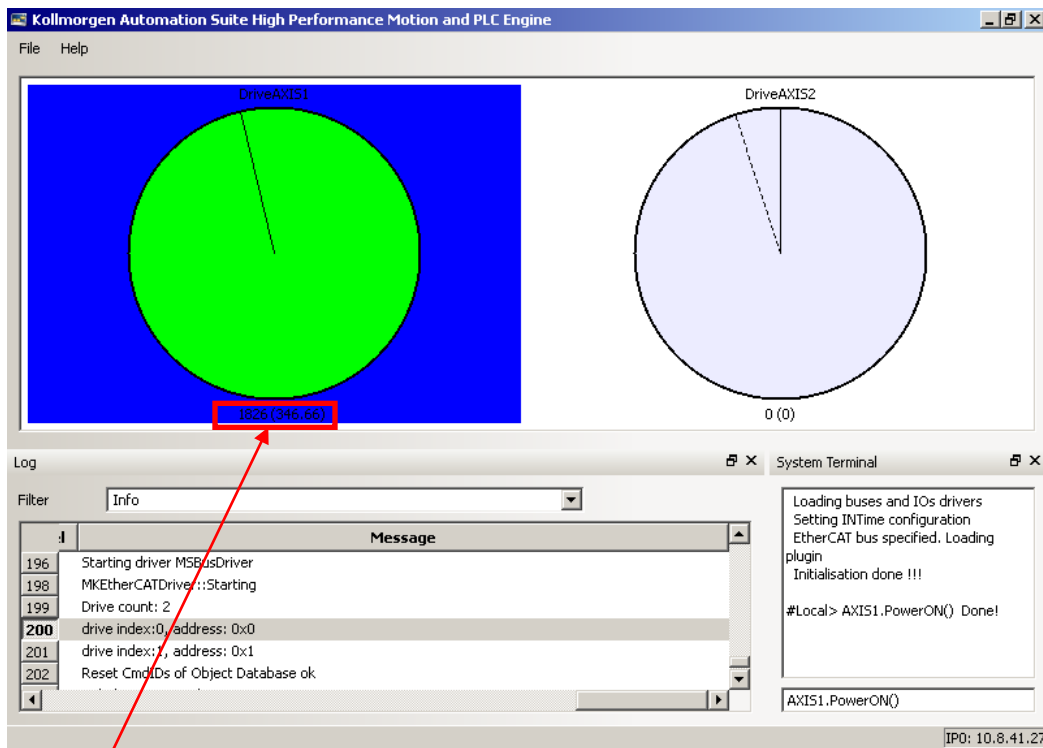
## 4.2 KAS Runtime and Display

The KAS runtime application is represented by the following icon on the start up screen:



The KAS runtime can be configured to start on the Box Controller power (typical configuration) or started by clicking this icon.

When launched, the KAS Runtime interface displays:



**Note:**

1826 = Absolute position over complete length of travel (including modulo).

(346.66) = Absolute position within 1 motor revolution.

### 4.2.1 Axis Display

The colors of the wheels indicate the state of the axis:

| Color                      | State            |
|----------------------------|------------------|
| Gray (or background color) | Axis is Disabled |
| Green                      | Axis is Enabled  |
| Red                        | Axis has a Fault |

The position line on the display:

| Color       | State                 |
|-------------|-----------------------|
| Solid Line  | Commanded Position    |
| Dotted Line | Actual Motor Position |

### 4.2.2 Log

The log contains similar information as the Information and Logs tab in the IDE. Use the Filter control to filter what is shown on the display. Filter options are:

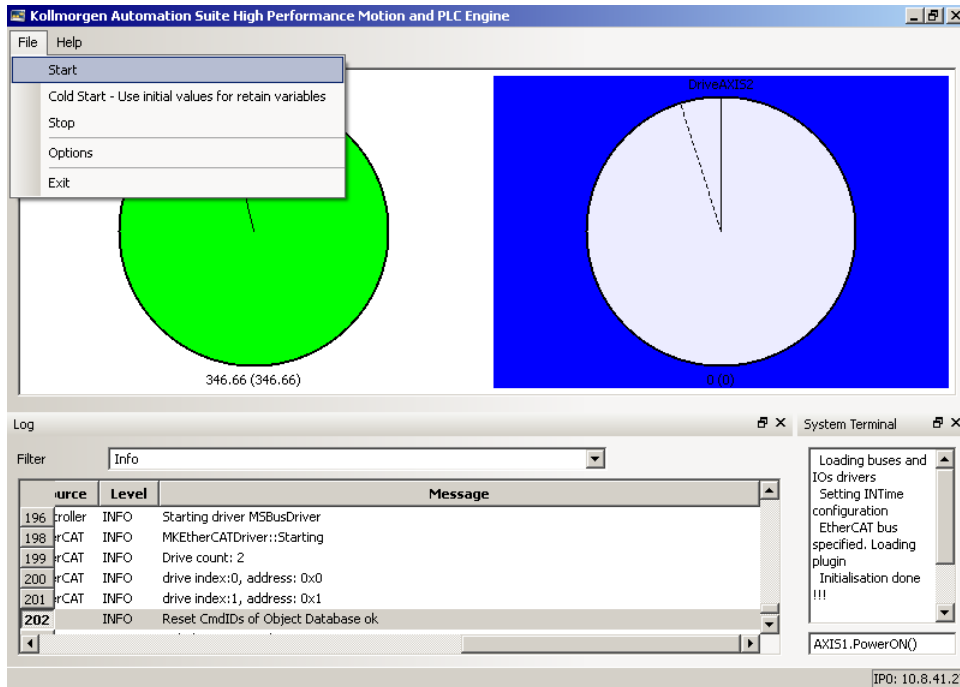
- Info
- Info OR Warning
- Warning AND IDE
- Warning NOT error
- Warning AND IDE NOT Controller

### 4.2.3 System Terminal

The terminal section of the runtime display allows direct commands while a project is running. The list of commands is the same as available through the System terminal window in the KAS IDE. ([Link to Terminal commands](#))

#### 4.2.4 Using the KAS Runtime Application

The File menu provides the following operations for running KAS Runtime.



The following table describes the File menu options for the KAS Runtime application.

| File Menu Options                                      | Description  |
|--|--|
| Start  | Starts the runtime (for use after it has been stopped)   |
| Cold Start – Use initial values for retained variables | Starts the runtime using initial values for all of the Project variables that are located in the IDE Project Dictionary under the “Retained Variables” section   |
| Stop   | Stops the runtime  |
| Options  | Runtime Options: <ul style="list-style-type: none"> <li>• <b>AutoStart</b> – User Application automatically runs when Runtime is started</li> <li>• <b>(with Retained variables)</b> - Retained variables utilized</li> <li>• <b>Profibus</b> – Profibus Option card utilized</li> </ul> |
| Exit   | Closes the KAS Runtime   |

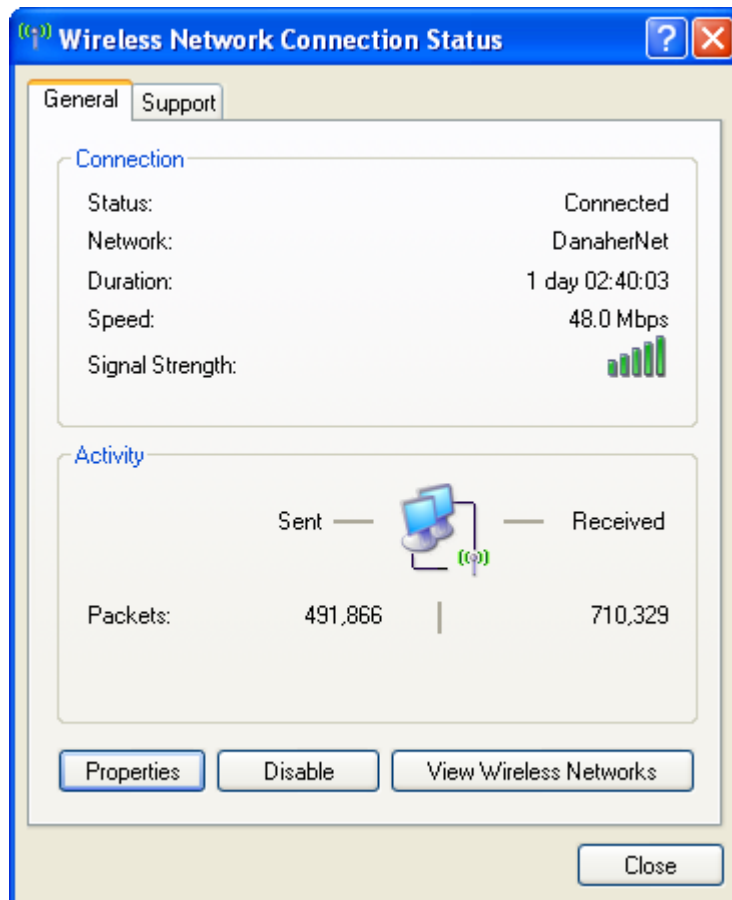
### 4.3 Downloading and Running Projects

The LAN1 Ethernet port is used to download programs from the KAS IDE. If there is a direct cable connection between the PC (running the IDE) and the PAC, the cable must be a crossed Ethernet cable. If the connection is through a hub, switch, or router, a straight through Ethernet cable should be used.

### 4.4 PAC Remote Connection

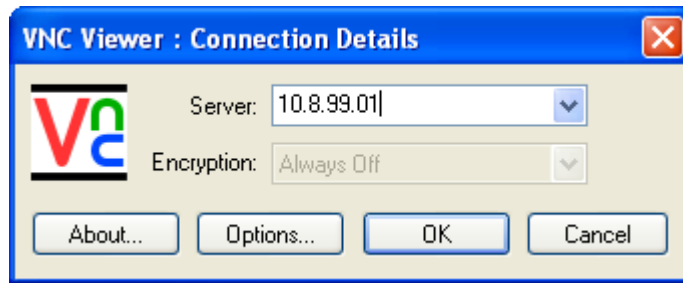
Using a VNC client, any computer can remote connect to a PAC with which it shares a wireless network. Follow these steps to remote connect to your PAC:

1. Check to make sure that your computer is connected to the wireless network:



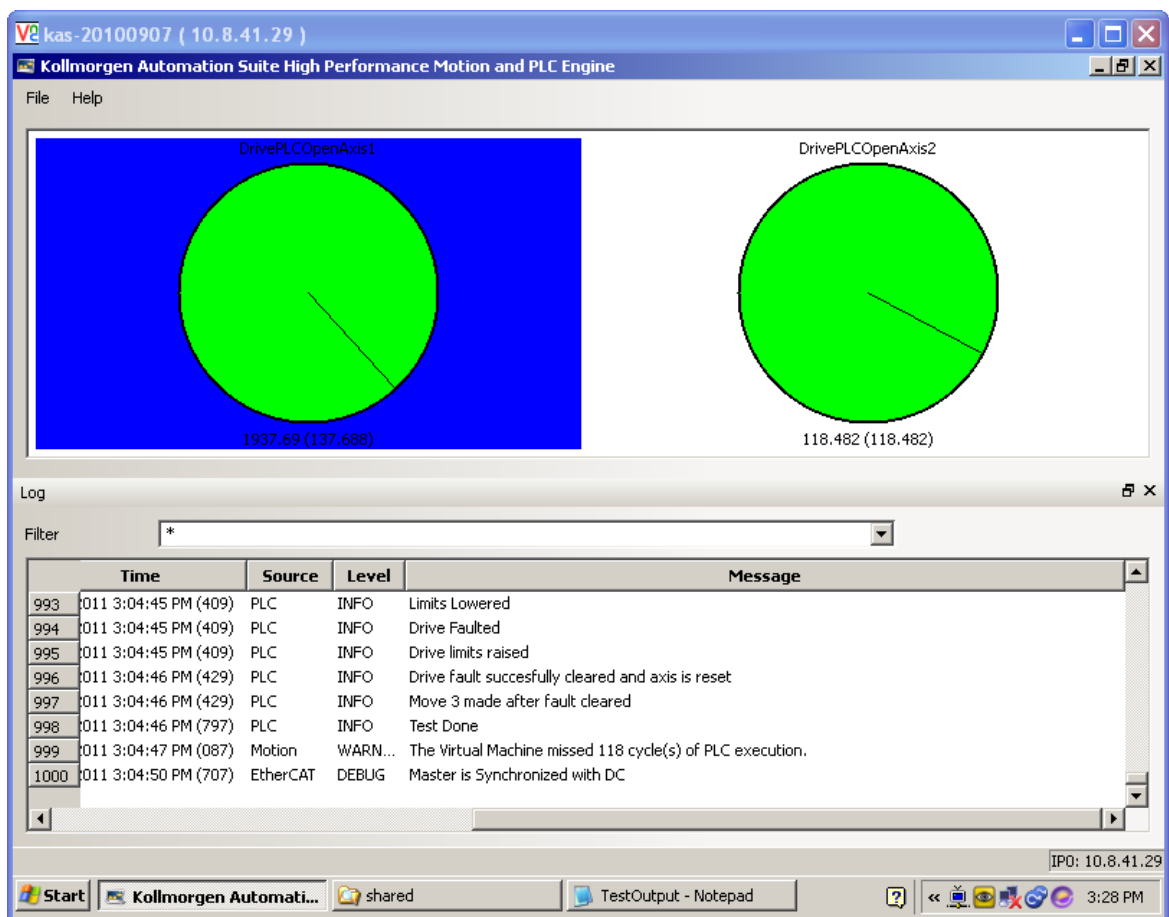
2. Download and install a VNC client from the web.

- In the VNC client, enter the IP address of the PAC you wish to connect to.



- When prompted, enter the password: **dhkas**. Click ok.

After these steps are complete, the VNC client will connect to the PAC:



## 5 TECHNICAL SPECIFICATIONS

This section provides the technical specifications for the Box Controller.

### 5.1 Mechanical

| Features                       | AKC-PLC-C1-224, AKC-PLC-D2-224 | AKC-RMC-D2-224       |
|--------------------------------|--------------------------------|----------------------|
| Overall Dimensions (H x W x D) | 270 x 195 x 233 mm             | 270 x 146.5 x 242.25 |
| Cut-out dimensions (H x W x D) |                                |                      |
| Construction                   | Heavy Duty Steel               |                      |
| Weight                         | 5.6 kg                         |                      |
| Protection Class               | IP20                           |                      |

### 5.2 Electrical

| Features          | AKC-PLC-C1-224                    | AKC-PLC-D2-224            | AKC-RMC-D2-224 |
|-------------------|-----------------------------------|---------------------------|----------------|
| Construction      | Heavy Duty Steel                  |                           |                |
| Processor         | Intel® Celeron®<br>1.2 GHz        | Intel® Dual Core 2.26 GHz |                |
| DRAM              | 2GB                               |                           |                |
| I/O Standard      | 4x USB 2.0, 2-4x RS232            |                           |                |
| Ethernet          | 1x LAN 10/100, 1x LAN 10/100/1000 |                           |                |
| Expansion Slots   | 4x PCI, PCMCIA optional           |                           |                |
| Internal Drives   | 4 GB Compact Flash                |                           |                |
| Operating system  | 4 GB Compact Flash                |                           |                |
| Power Supply      | 24 V DC                           |                           |                |
| Power consumption | 39 W                              |                           |                |
| I max             | 3.6 A                             |                           |                |
| Battery           | Lithium 3,5 V 750 mAh             |                           |                |
| MTBF              | > 40000 h                         |                           |                |

### 5.3 Environment

| Features                   | AKC-PLC-C1-224  | AKC-PLC-D2-224 | AKC-RMC-D2-224 |
|----------------------------|---|----------------|----------------|
| Temperature/<br>Humidity   | Operating: 0o C to +50o C/ 20 to 85% non condensing<br>Storage: -20o C to +60o C/ 5 to 95% non condensing |                |                |
| Cooling                    | Fan cooled  |                |                |
| Shock<br>IEC60068-2-27     | Operating: 15G, 11ms<br>Storage: 30G, 11ms duration   |                |                |
| Vibration<br>IEC 60068-2-6 | Operating: 10-500 Hz, 1G/3 axis<br>Storage: 10-500 Hz: 2G/3 axis  |                |                |

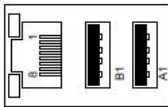
### 5.4 CE Directives and Standards

| Features       | AKC-PLC-C1-224  | AKC-PLC-D2-224 | AKC-RMC-D2-224 |
|----------------|---|----------------|----------------|
| EMC            | US: FCC47 CFR PART15; Class A level<br>CE: EN61000-6-2; EN55022 |                |                |
| Approvals      | CE, FCC, cULus  |                |                |
| RoHS Compliant | Yes   |                |                |

### 5.5 Connector Pinout

This section provides the connector pinout information for the Box Controller.

#### 5.5.1 LAN Connector



| Pin | Signal Name | Pin | Signal Name |
|-----|-------------|-----|-------------|
| 1   | TX+         | 2   | TX-         |
| 3   | RX+         | 4   | NC          |
| 5   | NC          | 6   | RX-         |
| 7   | NC          | 8   | NC          |



### 5.5.2 USB Connector

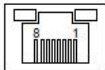


| Pin | Signal Name | Pin | Signal Name |
|-----|-------------|-----|-------------|
| A1  | VCC         | B1  | VCC         |
| A2  | Data-       | B2  | Data-       |
| A3  | Data+       | B3  | Data+       |
| A4  | GND         | B4  | GND         |

### 5.5.3 COM Connector

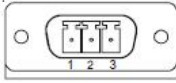
| Pin | Signal Name                  | Pin | Signal Name         |
|-----|------------------------------|-----|---------------------|
| 1   | DCD<br>(Data Carrier Detect) | 2   | RXD ( Receive data) |
| 3   | TXD<br>(Transmit Data)       | 4   | RXD ( Receive data) |
| 5   | GND                          | 6   | DSR(Data set ready) |
| 7   | RTS (Request to send)        | 8   | CTS (Clear to send) |
| 9   | RI (Ring indicator)          |     |                     |

### 5.5.4 LAN2 Port



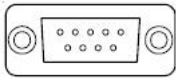
| Pin | Signal Name when 82541ER loaded 10/100/1000 Base T | Signal Name when 82551xx loaded 10/100 BaseT |
|-----|--|--|
| 1   | MX_0+  | TXD+   |
| 2   | MX_0-  | TXD+   |
| 3   | MX_1+  | RXD+   |
| 4   | MX_2+  | NC   |
| 5   | MX_2-  | NC   |
| 6   | MX_1-  | RXD-   |
| 7   | MX_3+  | NC   |
| 8   | MX_3-  | NC   |

### 5.5.5 Power Connector



| Pin | Signal Name |
|-----|-------------|
| 1   | GND         |
| 2   | NC          |
| 3   | 24V IN      |

### 5.5.6 RS232 Connector

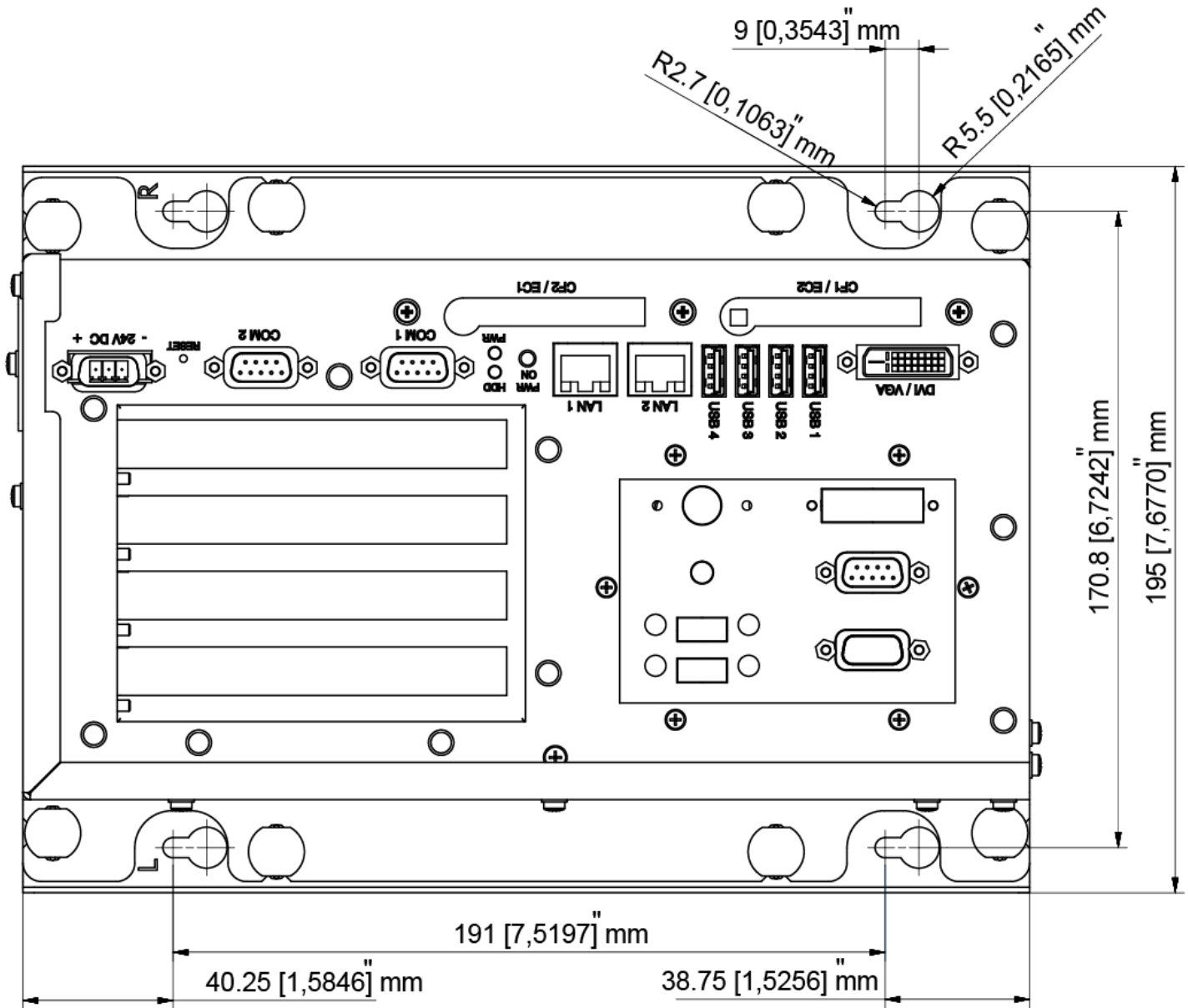


| Pin | Signal Name               |
|-----|---------------------------|
| 1   | DCD (Data Carrier Detect) |
| 2   | RXD (Receive Data)        |
| 3   | TXD (Transmit Data)       |
| 4   | DTR (Data Terminal Ready) |
| 5   | GND                       |
| 6   | DSR (Data Set Ready)      |
| 7   | RTS (Request To Send)     |
| 8   | CTS (Clear To Send)       |
| 9   | RI (Ring Indicator)       |

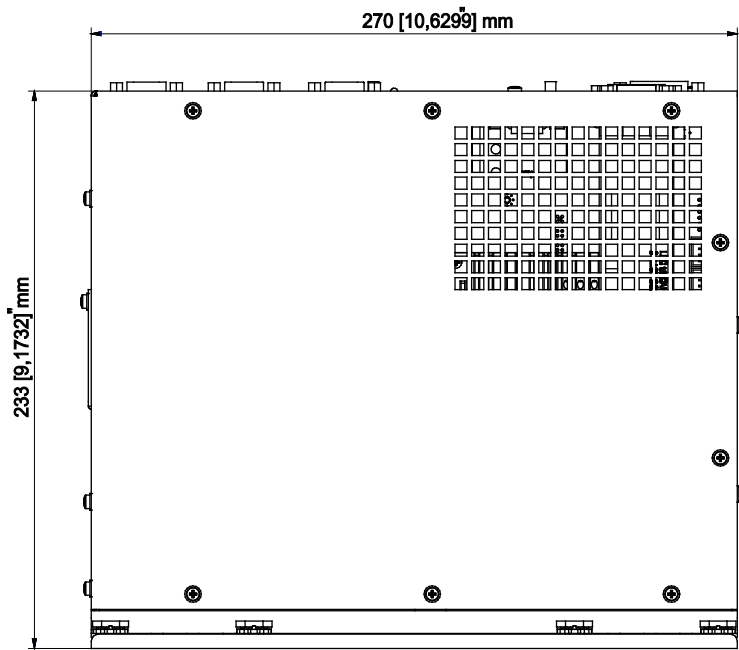
## APPENDIX A

This section provides the mechanical drawings of the AKC-PLC-C1-224-00N and AKC-PLC-D2-224-00N PAC controller.

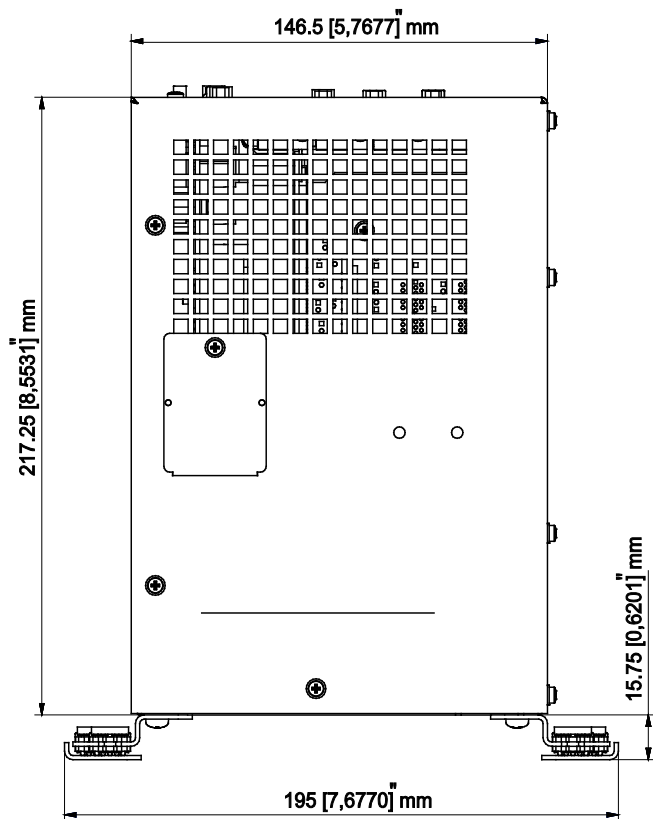
### A.1 AKC-PLC-C1-224-00N and AKC-PLC-D2-224-00N – Front View



**A.2 AKC-PLC-C1-224-00N and AKC-PLC-D2-224-00N – Side View 1**



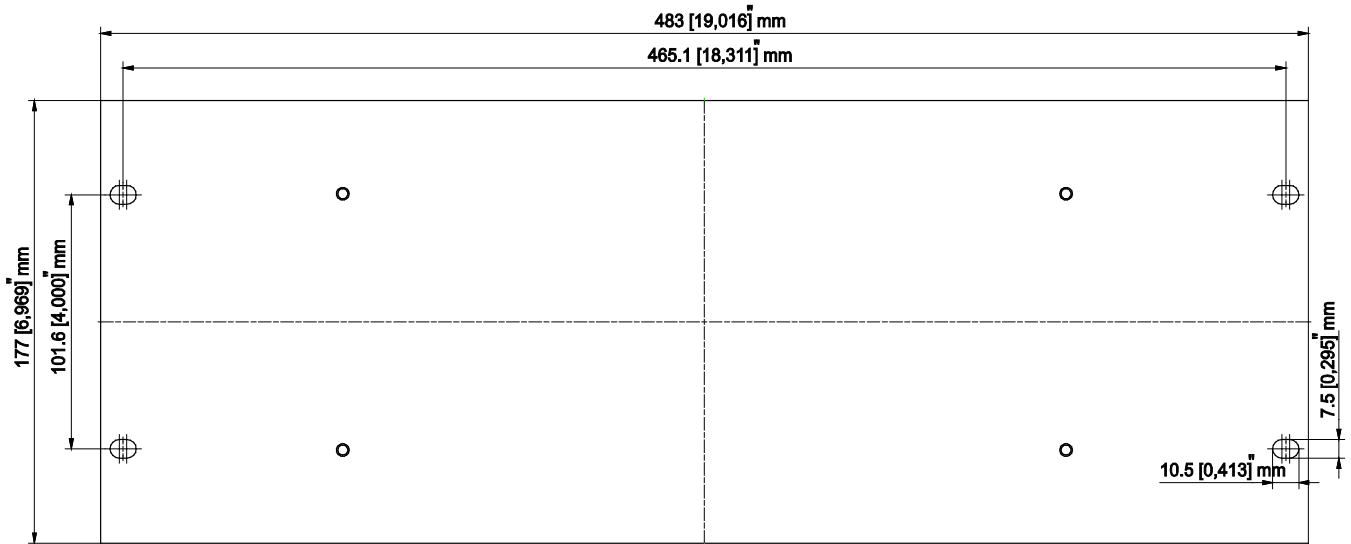
**A.3 AKC-PLC-C1-224-00N and AKC-PLC-D2-224-00N – Side View 2**



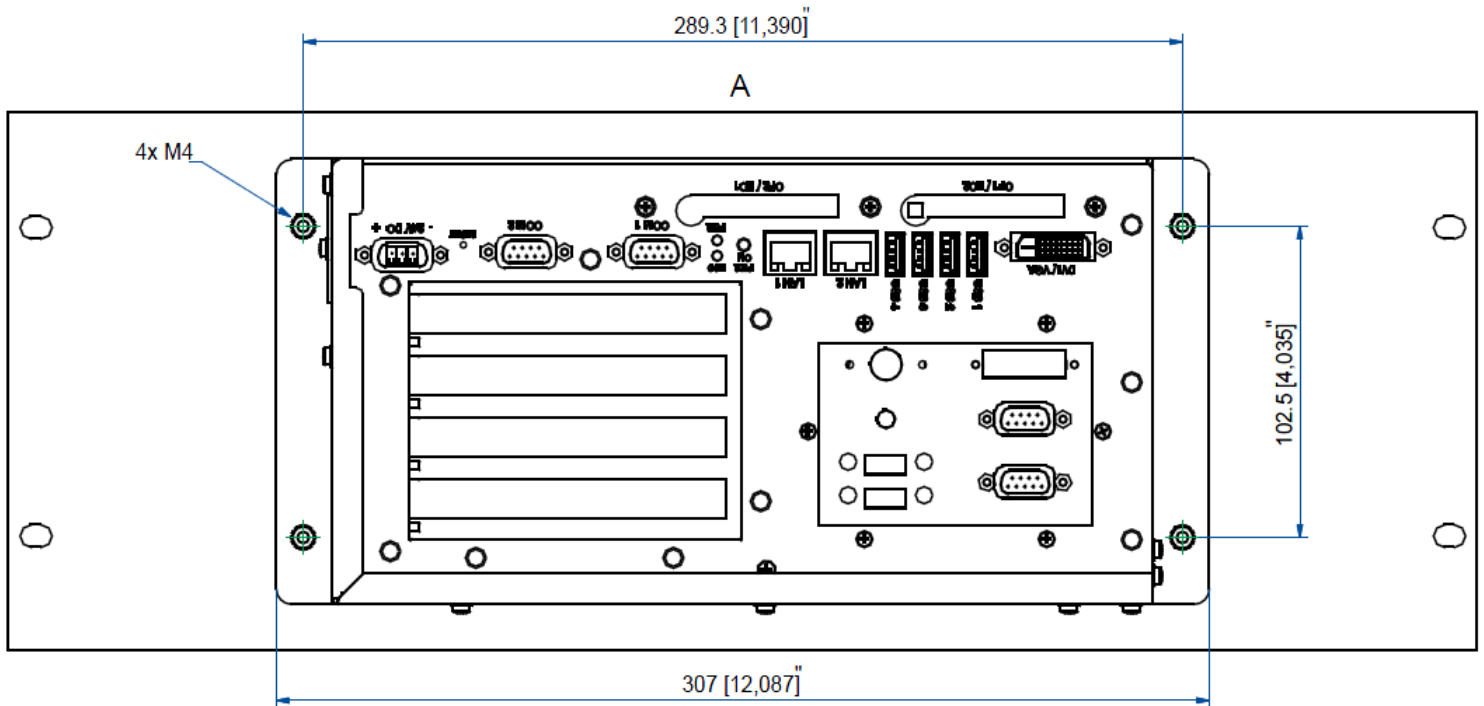
## APPENDIX B

This section provides the mechanical drawings of the AKC-RMC-D2-224-00N Hi-Performance Rack Mount Controller.

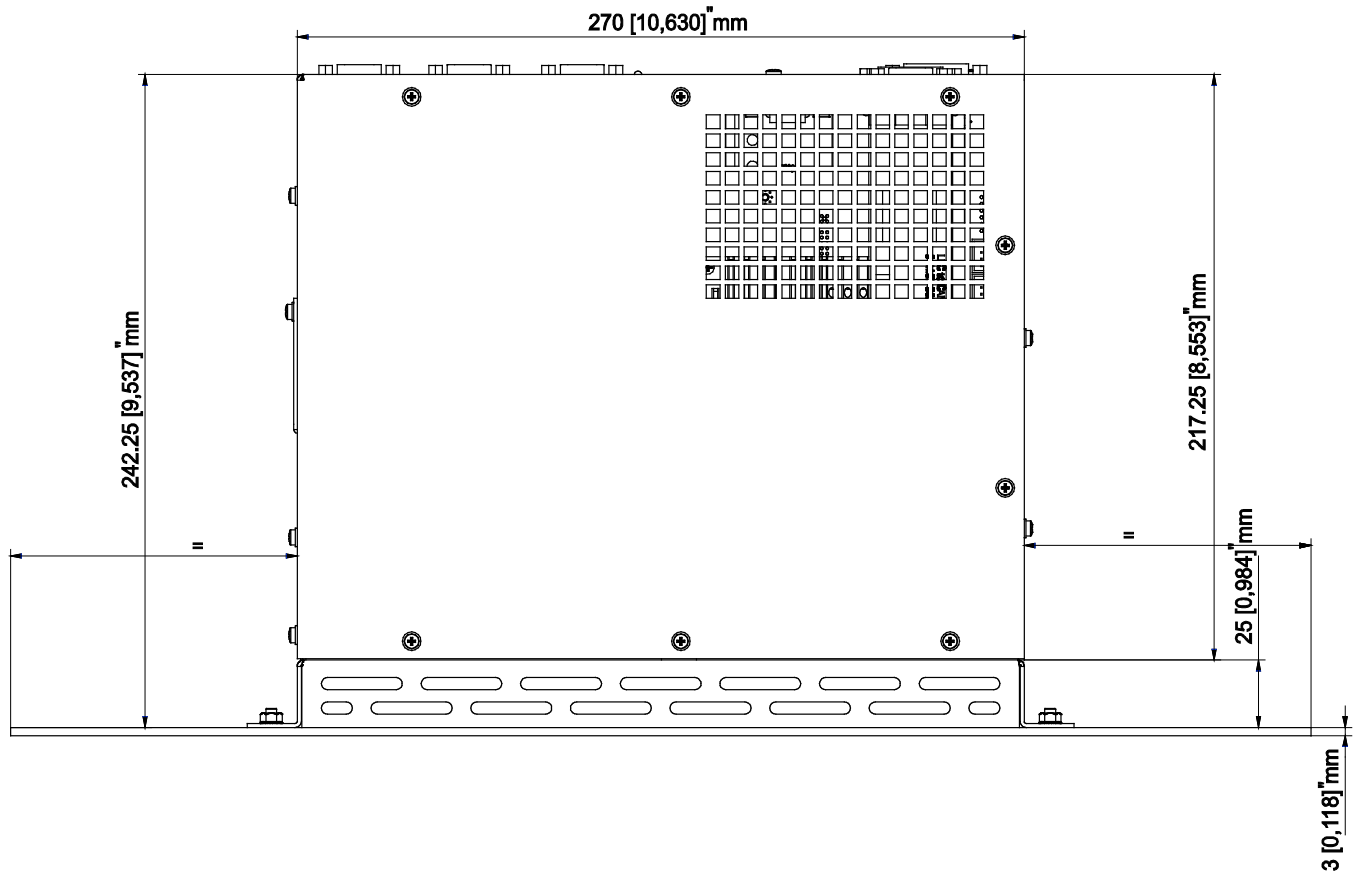
### B.1 AKC-RMC-D2-224-00N – Front View



### B.2 AKC-RMC-D2-224-00N – Back View



### B.3 AKC-RMC-D2-224-00N – Top View



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Kollmorgen is a leading provider of motion systems and components for machine builders. Through world-class knowledge in motion, industry-leading quality and deep expertise in linking and integrating standard and custom products, Kollmorgen delivers breakthrough solutions that are unmatched in performance, reliability and ease-of-use, giving machine builders an irrefutable marketplace advantage.

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