

# **ioPAC 8600 Hardware User's Manual**

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# ioPAC 8600 Hardware User's Manual

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# 1

## Introduction

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The following topics are covered in this chapter:

- **Overview**
- **Package Checklist**
- **Appearance and Dimensions**
  - Appearance
  - Dimensions
- **System Module Selection Guide**
- **System Module Hardware Specifications**
  - CPU10 System Module
  - CPU30 System Module
  - Common Specifications



# Overview

The ioPAC 8600 modular programmable controller supports a modular CPU, power, backplane, and I/Os, giving users greater flexibility for selecting CPU, power, backplane, and I/O modules for different applications. The controllers have 5, 9, or 12 I/O slots and support both 85M series and 86M series modules. The ioPAC 8600 supports C/C++ and IEC 61131-3 programming capability, rail-level surge and ESD protection, a -40 to 75°C operating temperature range, anti-vibration, hot-swappability of modules, as well as two 10/100 Mbps Ethernet ports with two MACs (Port Trunking ready) or Ethernet bypass function with one MAC. With Moxa's MX-AOPC UA Suite, the ioPAC 8600 series provides a comprehensive solution for data acquisition and control applications in harsh environments.

## Package Checklist

### **ioPAC 8600 CPU**

- ioPAC 8600 CPU module
- Serial console cable (C/C++ models only)
- Documentation and software CD

### **ioPAC 8600 Power**

- ioPAC 8600 power module

### **ioPAC 8600 Backplane**

- ioPAC 8600 backplane module

### **86M Modules**

- 86M module

### **Optional Accessories (can be purchased separately)**

- WK-75: Wall Mounting kit
- CBL-M12D(MM4P)/RJ45-100 IP67: M12 to RJ45 cable
- CBL-RJ458P-100: 8-pin RJ45 CAT5 Ethernet cable, 100 cm
- CBL-F9DPP1x4-BK-100: Serial console cable
- CBL-M44M9x4-50: DB44 to 4-port DB9 female serial cable
- 85M-BKTES: Empty slot cover for ioPAC 85xx and 86xx modules (3 pcs per package)

# Appearance and Dimensions

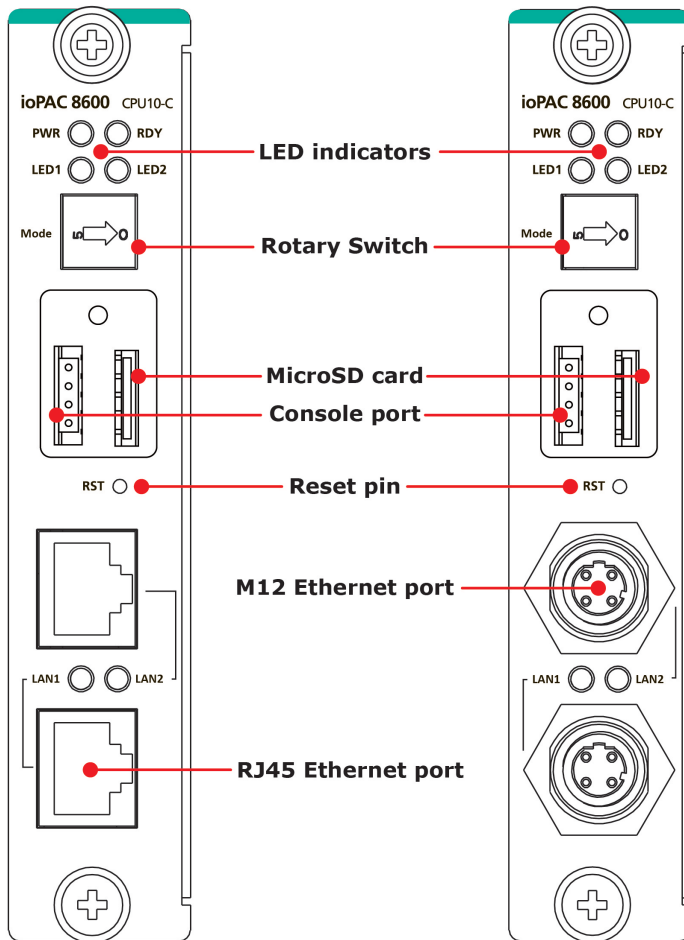
## Appearance

### ioPAC 8600 CPU Module

The following figures show the ioPAC 8600 CPU module. There are two types of CPU module. The ioPAC 8600-CPU10 is a standard CPU module with a 32-bit ARM9 192 MHz CPU. The ioPAC 8600-CPU30 is a more powerful CPU module with a 32-bit Cortex-A8 1 GHz CPU. The two modules have both RJ45 and M12 LAN connectors.

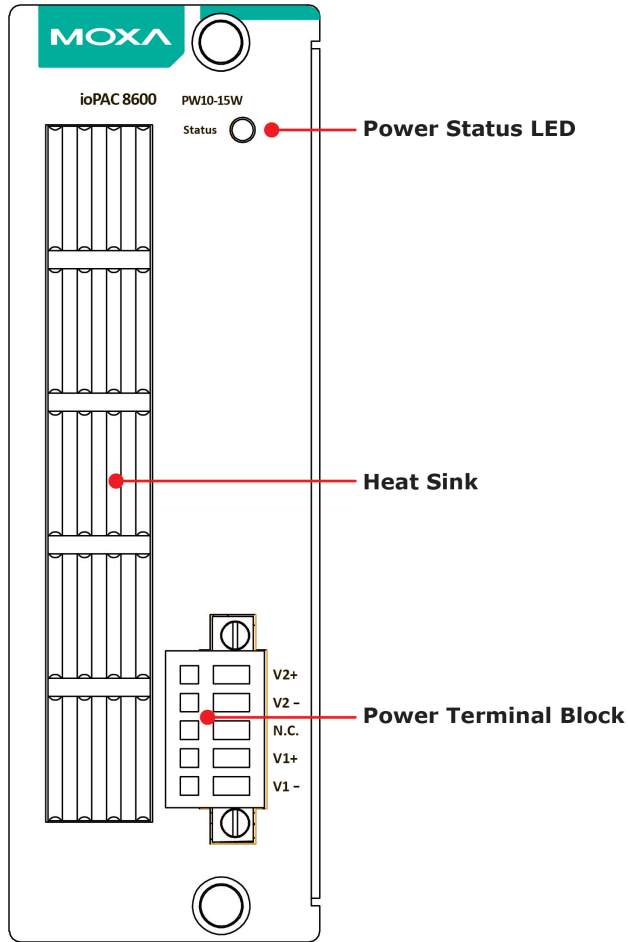
ioPAC 8600-RJ45

ioPAC 8600-M12



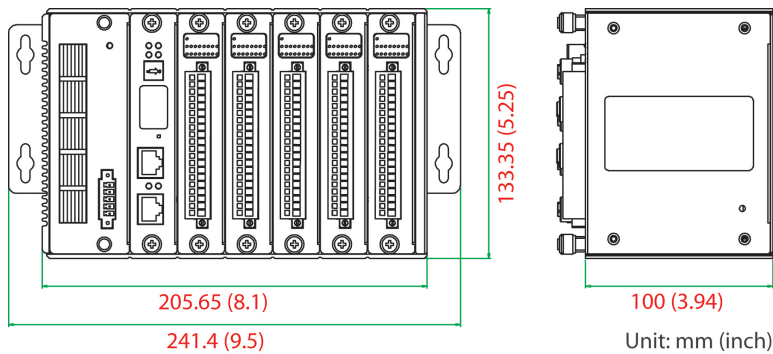
### ioPAC 8600 Power Module

The following figure shows the ioPAC 8600 power module. Users can choose between a 15 W version or a 30 W version.

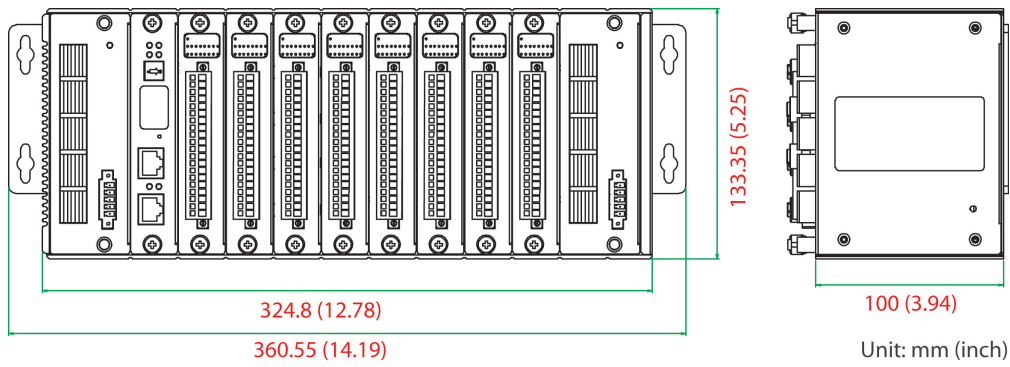


### Dimensions

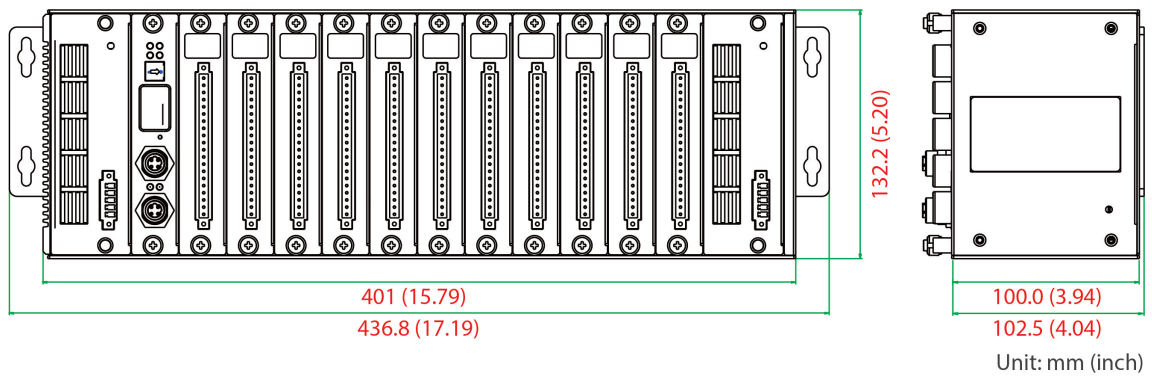
#### ioPAC 8600 with 5 Slots



### ioPAC 8600 with 9 Slots



### ioPAC 8600 with 12 Slots



## System Module Selection Guide

Model Name	Description
ioPAC 8600-CPU30-M12-C-T	1 GHz CPU, C/C++, M12
ioPAC 8600-CPU30-M12-IEC-T	1 GHz CPU, IEC 61131-3, M12
ioPAC 8600-CPU30-RJ45-C-T	1 GHz CPU, C/C++, RJ45
ioPAC 8600-CPU30-RJ45-IEC-T	1 GHz CPU, IEC 61131-3, RJ45
ioPAC 8600-CPU10-M12-C-T	CPU, C/C++, M12
ioPAC 8600-CPU10-M12-IEC-T	CPU, IEC 61131-3, M12
ioPAC 8600-CPU10-RJ45-C-T	CPU, C/C++, RJ45
ioPAC 8600-CPU10-RJ45-IEC-T	CPU, IEC 61131-3, RJ45
ioPAC 8600-PW10-15W-T	15 W PWR, 24-110 VDC
ioPAC 8600-PW10-30W-T	30 W PWR, 24-110 VDC
ioPAC 8600-BM005-T	5-slot backplane
ioPAC 8600-BM009-T	9-slot backplane
ioPAC 8600-BM012-T	12-slot backplane

**NOTE** Conformal coating available on request.

# System Module Hardware Specifications

## CPU10 System Module

### Computer

**CPU Type:** 32-bit ARM9 192 MHz CPU

**OS:** Linux

**Clock:** Real-time clock with super capacitor  
(retains charge for 7 days)

### Memory

**SDRAM:** 512 MB DDR3(L)

**Flash:** 32 MB (10 MB reserved for user)

**FRAM:** 128 KB

**microSD™ Slot:** Up to 32 GB (SDHC compatible)

**Note:** For units operating in extreme temperatures, industrial-grade, wide-temperature microSD cards are required.

### Switches & Buttons

**Rotary Switch:** 0 to 9

**Button:** Reset to factory defaults

### Ethernet Interface

**LAN:** 2 x 10/100 Mbps, Ethernet bypass or 2 MACs (IPs), jumper selectable, RJ45 or M12

**Protection:** 1.5 kV magnetic isolation

**Automation Languages:** C/C++ or IEC 61131-3

**Protocols:** Modbus TCP/RTU (master/slave), SNMPv1, SNMPv2c, SNMPv3, TCP/IP, UDP, DHCP, BOOTP, SNTP, SMTP

### Environmental Limits

**Operating Temperature:** -40 to 75°C (-40 to 176°F)

### Power Requirements

**Input Current :** 200 mA @ 24 VDC

### MTBF (mean time between failures)

**Time:** 1,032,466 hrs

**Standard:** Telcordia SR332

## CPU30 System Module

### Computer

**CPU Type:** 32-bit Cortex-A8 1 GHz CPU

**OS:** Real-time Linux (PREEMPT\_RT)

**Clock:** Real-time clock with super capacitor  
(retains charge for 7 days)

### Memory

**SDRAM:** 512 MB DDR3(L)

**eMMC:** 4 GB (1.7 GB reserved for user)

**SPI-NVRAM:** 128 KB

**microSD™ Slot:** Up to 32 GB (SDHC 2.0 compatible)

**Note:** For units operating in extreme temperatures, industrial-grade, wide-temperature microSD cards are required.

### Switches & Buttons

**Rotary Switch:** 0 to 9

**Button:** Reset to factory defaults

### Ethernet Interface

**LAN:** 2 x 10/100 Mbps, Ethernet bypass or 2 MACs (IPs), jumper selectable, RJ45 or M12

**Protection:** 1.5 kV magnetic isolation

**Automation Languages:** C/C++ or IEC 61131-3

**Protocols:** Modbus TCP/RTU (master/slave), SNMPv1, SNMPv2c, SNMPv3, TCP/IP, UDP, DHCP, BOOTP, SNTP, SMTP

### Environmental Limits

**Operating Temperature:** -40 to 75°C (-40 to 176°F)

### Power Requirements

**Input Current :** 223 mA @ 24 VDC

### MTBF (mean time between failures)

**Time:** 1,358,656 hrs

**Standard:** Telcordia SR332

## Common Specifications

### Power Requirements

**Input Voltage:** 24 to 110 VDC (16.8 to 154 VDC)

### Physical Characteristics

**Housing:** Aluminum

#### Dimensions:

- 5-slot version: 205.65 x 133.35 x 100 mm (8.1 x 5.25 x 3.94 in)
- 9-slot version: 324.8 x 133.35 x 100 mm (12.79 x 5.25 x 3.94 in)
- 12-slot version: 401 x 132.2 x 100 mm (15.79 x 5.2 x 3.94 in)

#### Weight (system only):

- 5-slot version: 2560 g (5.64 lb)
- 9-slot version: 3690 g (8.14 lb)
- 12-slot version: 3090 g (6.81 lb)

**Mounting:** Wall-mounting kit

### Environmental Limits

**Operating Temperature:** -40 to 75°C (-40 to 176°F)

**Storage Temperature:** -40 to 85°C (-40 to 185°F)

**Ambient Relative Humidity:** 5 to 95% (non-condensing)

**Shock:** IEC 60068-2-27

**Vibration:** IEC 60068-2-6

**Altitude:** Up to 2000 m

**Note:** Please contact Moxa if you require products guaranteed to function properly at higher altitudes.

### Standards and Certifications

**Safety:** UL 508

**EMC:** EN 55032/24

**EMI:** FCC Part 15 Subpart B Class A, CISPR 32

#### EMS:

IEC 61000-4-2 ESD: Contact: 6 kV; Air: 8 kV

IEC 61000-4-3 RS:

80 MHz to 1000 MHz: 20 V/m

1400 MHz to 2000 MHz: 10 V/m

2000 MHz to 2700 MHz: 5 V/m

5100 MHz to 6000 MHz: 3 V/m

IEC 61000-4-4 EFT: Power: 1 kV; Signal: 0.5 kV

IEC 61000-4-5 Surge:

Power: 2 kV (L-PE), 1 kV (L-L)

Signal: 2 kV (L-PE), 1 kV (L-L)

IEC 61000-4-6 CS: 10 V IEC 61000-4-8 PFMF: 100 A/m

**Rail Traffic:** EN 50155\*, EN 50121-4

\*This product is suitable for rolling stock railway applications, as defined by the EN 50155 standard. For a more detailed statement, click here: [www.moxa.com/doc/specs/EN\\_50155\\_Compliance.pdf](http://www.moxa.com/doc/specs/EN_50155_Compliance.pdf)

### Warranty

**Warranty Period:** 5 years

**Details:** See [www.moxa.com/warranty](http://www.moxa.com/warranty)

This chapter includes instructions on how to install the ioPAC 8600.

The following topics are covered in this chapter:

### ❑ **Basic Installation**

- Wall-Mounting Kit Installation Procedure
- Module Installation Procedure (Power-Off)
- Module Installation Procedure (Power-On)

### ❑ **Configuring the Power**

- Powering on the ioPAC Controller

### ❑ **Installing a microSD Card**

### ❑ **ioPAC 8600 LED Indicators**

- System LEDs
- C/C++ Version LEDs: LED1 and LED2
- IEC 61131-3 Compliant LEDs: R/S and ERR
- Communication LEDs

### ❑ **The Rotary Switch**

- IEC 61131-3 Models
- C/C++ Models

### ❑ **Reset Button: Factory Reset Process**

### ❑ **Connecting to the Network**

- Ethernet Jumper Settings
- Ethernet Communication

### ❑ **Serial Connectivity**

- Serial Console (Debug Port)



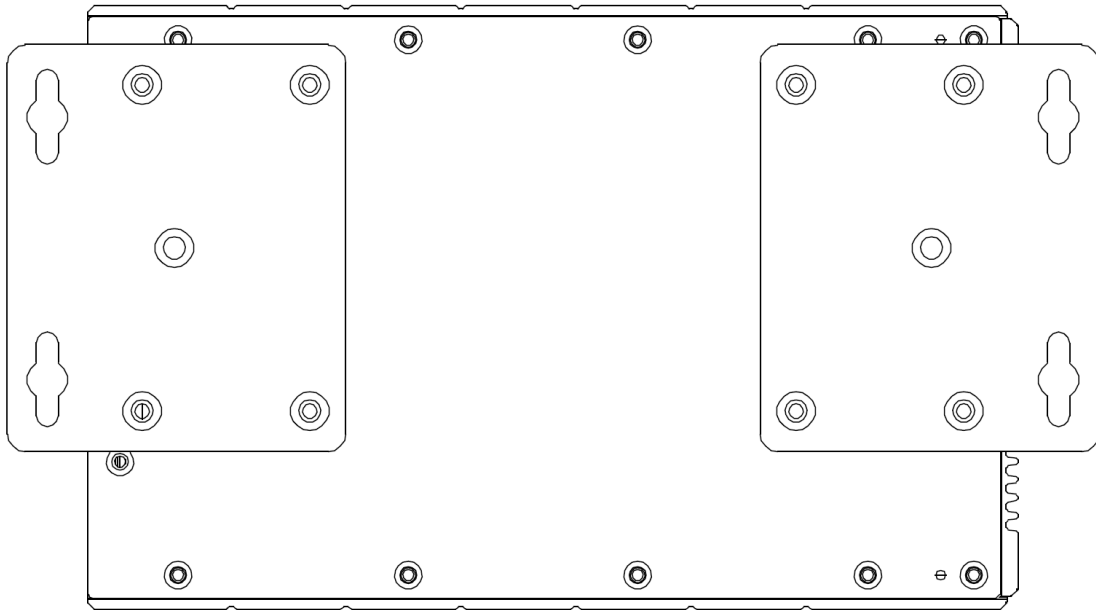
# Basic Installation

To ensure proper cooling, when installing the ioPAC 8600, make sure there is at least 5 cm of space between the ioPAC and items (other devices, walls, etc.), located next to the ioPAC.

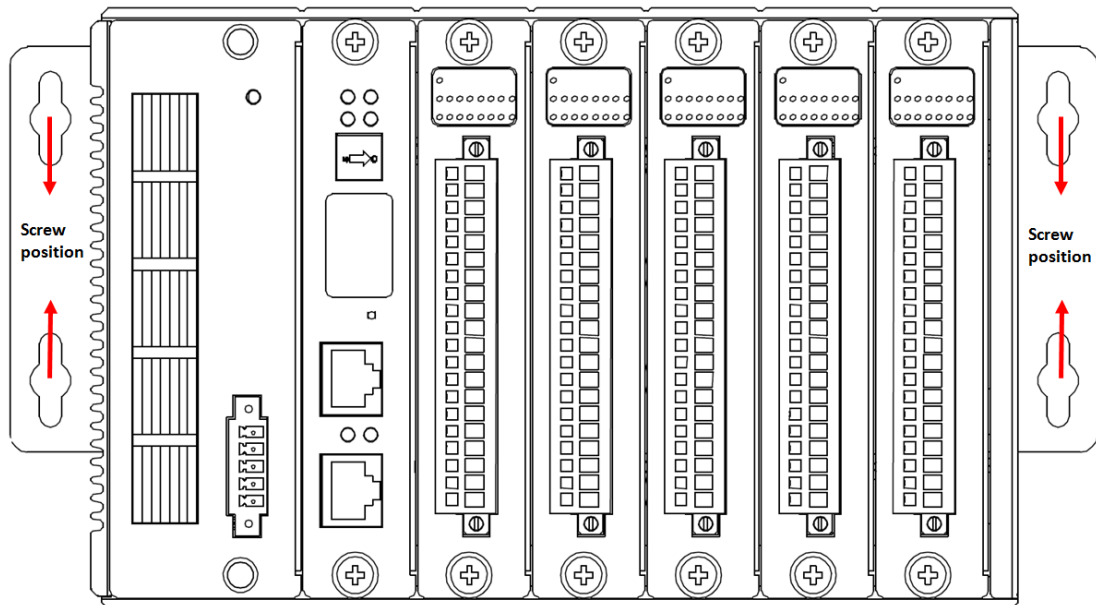
## Wall-Mounting Kit Installation Procedure

The wall-mounting kit is an inbox accessory for the ioPAC 8600 backplane module.

**STEP 1:** Screw the Wall Mounting Kit to the back of the ioPAC 8600, as shown below:



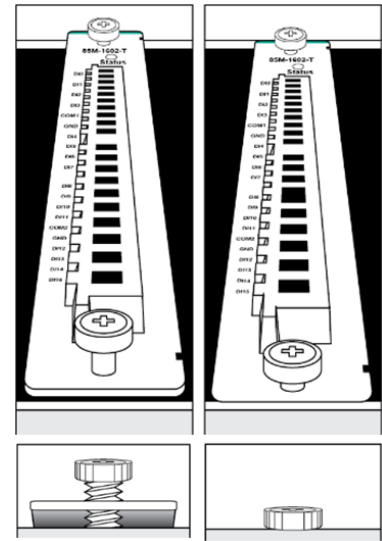
**STEP 2:** Use screws to fix the wall mounting kit to a wall.



## Module Installation Procedure (Power-Off)

Moxa's ioPAC 8600 controllers come with 5, 9, or 12 slots for 85M/86M-series modules. Use the following procedure to install modules when your system is powered off.

**Step1:** Install the module into the ioPAC 8600 system. The module's PCB should align with the edge of the frame. Push the module into the slot and make sure the module is plugged into the backplane.



**Step2:** Fasten the two screws using  $3.5 \pm 0.5$  kg of torque.

## Module Installation Procedure (Power-On)

All 86M/85M modules are hot-swappable when inserted in the ioPAC 8600, which means that you can safely install, remove, and replace modules while the system is powered on. When a module is removed or installed when the system is powered on, the ioPAC 8600 system stops processing and registers the newly installed or recently removed module, and scans for a configuration change. There is no disruption to normal operation during module insertion or removal.

After installing a new module, it could take about ten seconds for the system to recognize and activate the module, at which point the module's LED will turn green.



### ATTENTION

While the system is running, you may remove a module and then reinstall a module that is the same model as the module that was removed. If you install a module that is not the same model as the module that was removed, the system will not recognize the module without reconfiguring the system.



### ATTENTION

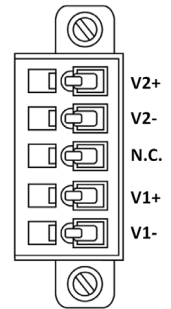
When the system is powered on, do not install more than one module at a time. If you need to install multiple modules, wait until the most recently installed module's LED turns GREEN before installing the next module.

# Configuring the Power

## Powering on the ioPAC Controller

The ioPAC 8600 controller can receive power from a 24 to 110 VDC power source, and is compliant with EN 50155 at 24 VDC. Input power is applied to the positive (V1+ and V2+) and negative (V1- and V2-) terminals on the connector.

- When the input voltage is below the minimum recommended voltage the ioPAC will turn off.
- The ioPAC 8600 has reverse protection and power input over-voltage protection, allowing it to resist a maximum voltage of 154 V, and the ioPAC's power input over-current fuse protection specification is 4 A.



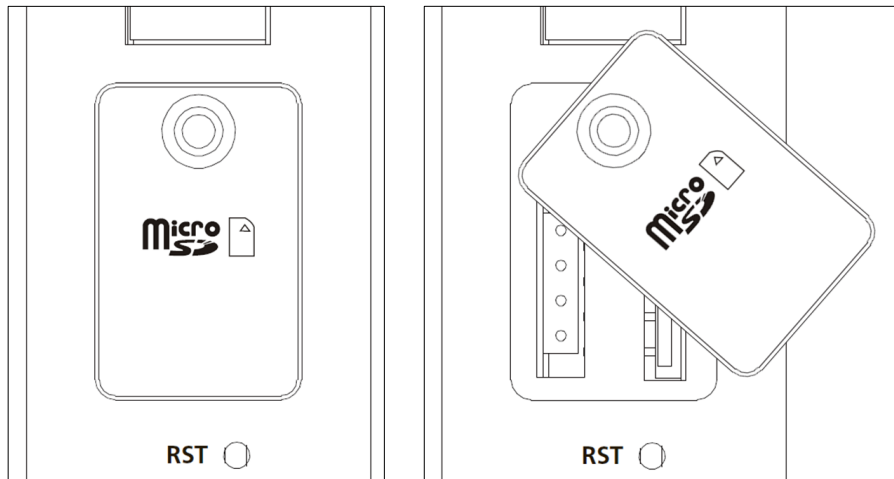
After connecting the Moxa ioPAC controller to the power supply, it will take about 30 to 60 seconds for the operating system to boot up. The green Ready LED will illuminate continuously until the operating system is ready.

## Installing a microSD Card

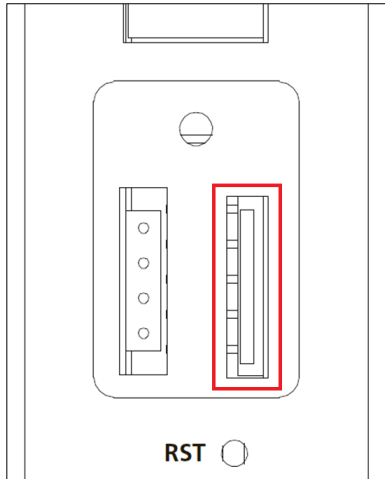
The ioPAC is equipped with one slot for a microSD card. The card reader slot is located inside the ioPAC CPU module, so you will need to unscrew and remove the card cover to install your microSD card. When inserting a microSD card, remember to keep the front edge of the card facing down.

Follow these steps to remove or install a microSD card:

1. Remove the screw holding the card cover in place.



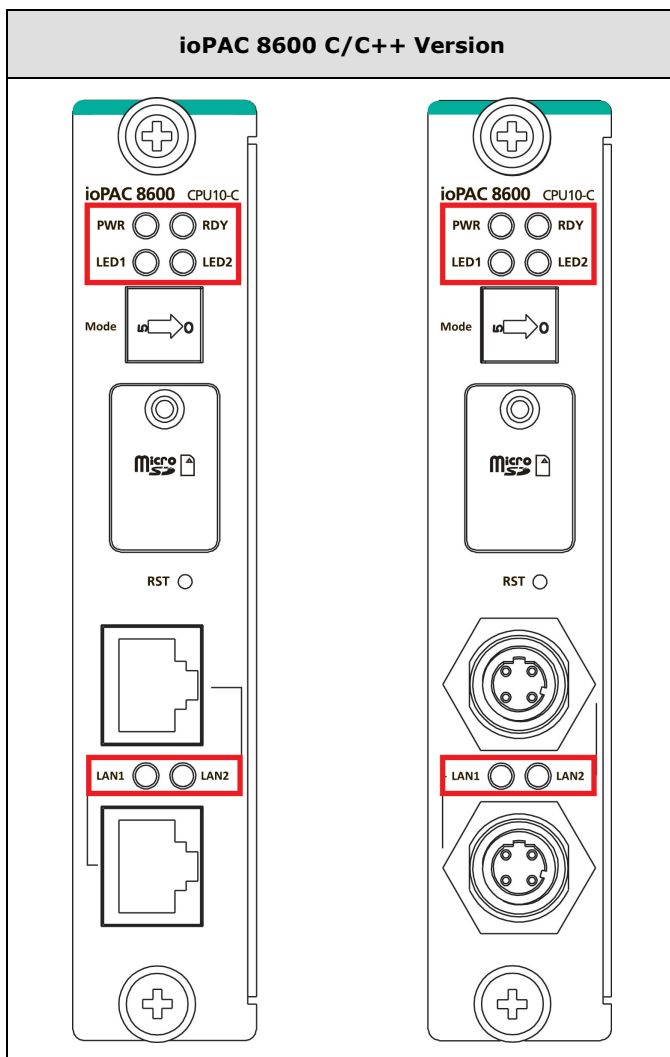
- 2. (a) Insert the microSD card into the microSD card slot, or  
(b) Remove the microSD card from the microSD card slot.



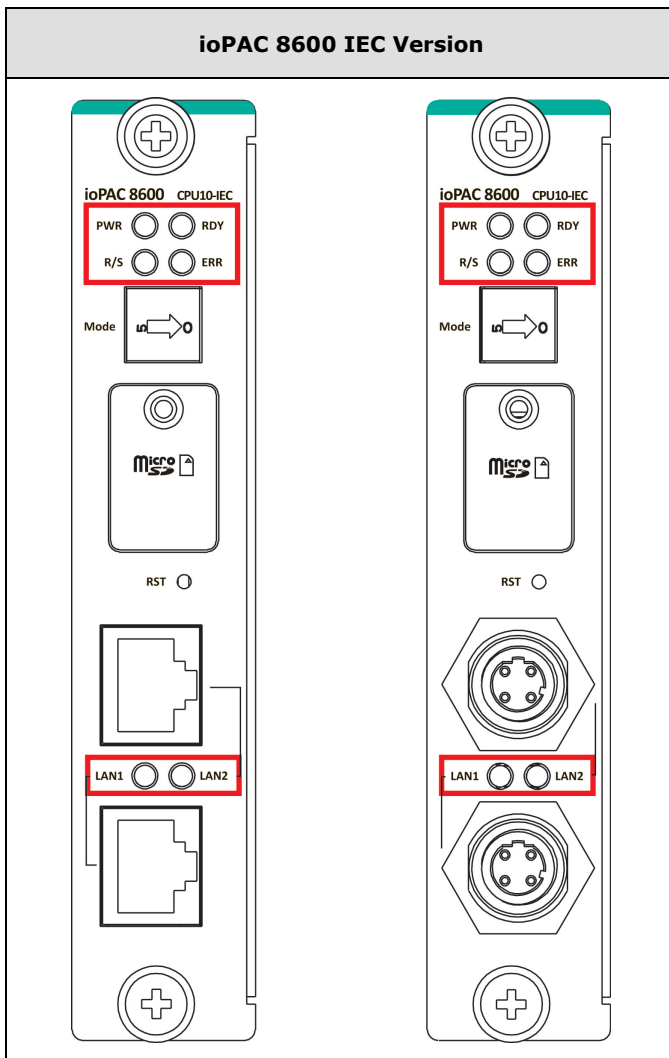
- 3. Fasten back the screw holding the card cover in place.

## ioPAC 8600 LED Indicators

There are 6 LEDs on the ioPAC 8600 CPU module.



Category	Label	Usage	Description
System	PWR	CPU power	<b>On:</b> Power On <b>Off:</b> Power Off
	RDY	System Ready (Kernel)	<b>Green:</b> System Ready <b>Green Blinking:</b> System Booting-up (10s after booting up) <b>Red:</b> System Error or Factory Default Executing <b>Red Blinking:</b> Factory Default Triggering
		firmware upgrade mode (rotary switch mode 9)	<b>Green:</b> firmware upgrade success <b>Green Blinking:</b> the firmware is upgrading <b>Red Blinking:</b> firmware upgrade error
C/C++ version	LED1, LED2	User-defined	User-defined
Communication	LAN1, LAN2	Ethernet communication	<b>Green:</b> 100Mb <b>Amber:</b> 10Mb <b>Blinking:</b> data transmitting <b>Off:</b> disconnected



Category	Label	Usage	Description
System	PWR	CPU power	<b>On:</b> Power On <b>Off:</b> Power Off
	RDY	System Ready (Kernel)	<b>Green:</b> System Ready <b>Green Blinking:</b> System Booting up (10s after booting up) <b>Red:</b> System Error or Factory Default Executing <b>Red Blinking:</b> Factory Default Triggering
		firmware upgrade mode (rotary switch mode 9)	<b>Green:</b> firmware upgrade success <b>Green Blinking:</b> the firmware is upgrading <b>Red Blinking:</b> firmware upgrade error
IEC version	R/S	Run/Stop Mode	<b>Green:</b> The CPU is running <b>OFF:</b> The CPU is idle and can be programmed
	ERR	Error	<b>Red:</b> System, I/O, or Service error <b>OFF:</b> No error (auto update if error fixes)
Communication	LAN1, LAN2	Ethernet communication	<b>Green:</b> 100Mb <b>Amber:</b> 10Mb <b>Blinking:</b> data transmitting <b>Off:</b> disconnected

## System LEDs

### PWR (Power LED)

The Power (PWR) LED indicates the status of the system power. When the system is on, this LED will turn green, and when the system power is off this LED will be off.

### RDY (Ready LED)

The Ready (RDY) LED indicates the status of the system's kernel. When the LED is green the system kernel is ready. When the LED is green and blinking, the system's kernel is booting-up. When the Ready (RDY) LED is red, there is either a system error or the system is being reset to factory defaults. When the Ready LED is red and blinking, the device's factory default mode has been triggered.

The Ready (RDY) LED is also used in firmware upgrade mode (rotary switch mode 9). When the switch is changed to mode 9 and then powered on, the ioPAC will enter firmware upgrade mode. In this mode, you can save the FWR file to the SD card with specific name and path, the firmware upgrade process will be executed automatically. When the RDY LED is blinking green, the firmware is upgrading. After the RDY LED changes to steady green, the firmware upgrade process is finished and you can set the rotary switch to "0" and power cycle. If the RDY LED changes to red, the firmware upgrade failed. In this case, check to make sure the file name and path are correct.

## C/C++ Version LEDs: LED1 and LED2

The ioPAC controller allows the user to configure these two LEDs (through the software interface). Refer to the **C/C++ Sample Code Programming Guide for ioPAC Programmable Controllers** for details.

## IEC 61131-3 Compliant LEDs: R/S and ERR

The ioPAC controller supports IEC 61131-3 compliant Run/Stop and Error (ERR) LEDs for ISaGRAF-specific notifications. These LEDs are not user configurable.

## Communication LEDs

### LAN1 and LAN2

The ioPAC controller comes with two Ethernet ports, with the LAN1 and LAN2 LEDs used to represent the status of the two connections. When the LED is green, data is transmitting at 100 Mbps. When the LED is amber, data is transmitting at 10 Mbps. When the LED is blinking, data is being transmitted. When the LED is off, there is no Ethernet connection, or the Ethernet connection has been disconnected.

## The Rotary Switch

The rotary switch functions differently depending on your ioPAC programming language model.

### IEC 61131-3 Models

IEC Version		
Rotary Switch Position	Mode of Operation	Description
0	RUN mode	RUN mode is the default operation mode. Use this mode for most tasks and configurations. The CPU will run automatically in this mode (this function should be enabled in RTUxpress).
1	STOP mode	Stop the CPU (this function should be enabled in RTUxpress).
2 to 8	Reserved	
9	Firmware upgrade mode (only available when booting up)	<p>Use this mode to update the firmware from the SD card.</p> <ol style="list-style-type: none"> <li>1. Save the firmware file in the root folder of the microSD card. The filename must be rtu.hfm.</li> <li>2. Stop the ioPAC and insert the SD card.</li> <li>3. Turn the rotary switch to position 9. While booting up the ioPAC: <ol style="list-style-type: none"> <li>a. Hold in the reset button to erase all settings and configurations and upgrade the firmware.</li> <li>b. Do not hold in the reset button to upgrade the firmware and retain the current configuration.</li> </ol> </li> <li>4. When the upgrade is complete, turn the rotary switch to 0 and reboot the ioPAC.</li> </ol> <p>Note: The microSD card should be FAT32 format.</p>

## C/C++ Models

C Version		
Rotary Switch Position	Mode of Operation	Description
0 to 4	Reserved	
5 to 8	User-defined	
9	Firmware upgrade mode (only available when booting up)	<p>Use this mode to update the firmware from the SD card.</p> <ol style="list-style-type: none"> <li>1. Save the firmware file in the root folder of the microSD card. The filename must be rtu.hfm.</li> <li>2. Stop the ioPAC and insert the SD card.</li> <li>3. Turn the rotary switch to position 9. While booting up the ioPAC:               <ol style="list-style-type: none"> <li>a. Hold in the reset button to erase all settings and configurations and upgrade the firmware.</li> <li>b. Do not hold in the reset button to upgrade the firmware and retain the current configuration.</li> </ol> </li> <li>4. When the upgrade is complete, turn the rotary switch to 0 and reboot the ioPAC.</li> </ol> <p>Note: The microSD card should be FAT32 format.</p>

## Reset Button: Factory Reset Process

Use the following procedure to reset the ioPAC to the factory defaults. Note that when you reset the ioPAC, all of your tag definitions, software programs, and files will be deleted, and the service and runtime engine will be restarted.

1. When the system is booting up and the RDY LED is blinking GREEN, hold the reset button.
2. Continue to hold the reset button until the "RDY" LED turns a solid RED, and then release the reset button. It will take around 90 seconds to complete the factory reset process.
3. When the "RDY" LED starts blinking GREEN (indicating that the kernel is rebooting), the factory reset is completed.

**NOTE** Do NOT power off, operate, or connect any devices when the **RDY** LED is a solid **red**. The factory reset function is only activated when the system is booting up.

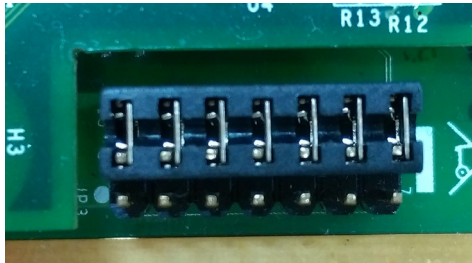


# Connecting to the Network

## Ethernet Jumper Settings

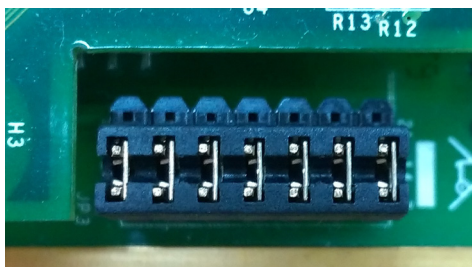
The ioPAC 8600 CPU module supports two Ethernet modes: one MAC or two MACs. The mode is configured by jumper.

To use the two MAC mode, do not use jumpers, as shown in the following figure.



When the jumper is configured for one MAC mode, the ioPAC 8600 programmable controller will support the Ethernet Bypass function. In this case, you can connect the ioPAC 8600 using a daisy-chain architecture.

To use the one MAC mode, use jumpers, as shown in the following figure.



## Ethernet Communication

Connections to the LAN port are made through an RJ45 or M12 connector on the module. The wiring and pin connections for these connectors are described in separate sections below.

**TCP/IP Settings:** Dual Speed Functionality: The ioPAC 8600's Ethernet ports auto negotiate with the connected devices and then use the fastest data transmission rate supported by both devices. The following table shows the TCP/IP parameters supported by the LAN port. Default values are set when a Factory Reset is performed on the controller.

LAN Port 1		LAN Port 2	
Parameter	Supported Values	Parameter	Supported Values
IP Address	Default: 192.168.127.254	IP Address	Default: 192.168.126.254
Subnet Mask	Default: 255.255.255.0	Subnet Mask	Default: 255.255.255.0
Gateway	Default: 0.0.0.0	Gateway	Default: 0.0.0.0

**IP Address** is the IP address of the controller.

**Subnet Mask** determines the subnet on which the controller is located.

**Gateway** determines how your controller communicates with devices outside its subnet. Enter the IP address of the gateway.

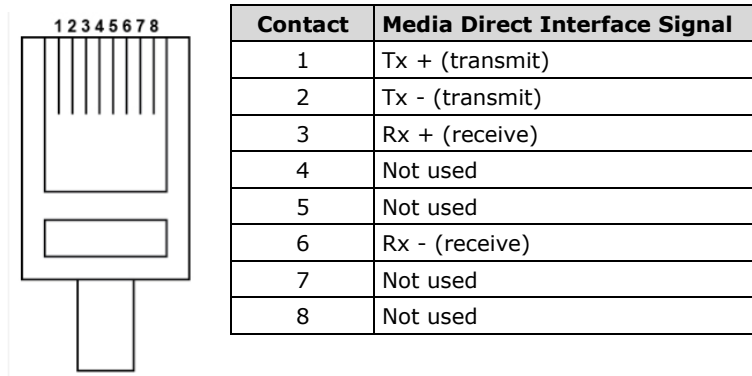
The IP address, subnet mask, and gateway are static; contact your network administrator to obtain these addresses for the controller.

## RJ45 Ethernet Connector

The ideal maximum cable length of a 10/100BaseT connection is 100 m (350 feet), but the actual limit could be longer or shorter depending on the amount of electrical noise in the environment. To minimize the amount of noise, Ethernet cables should not run parallel to power cables or other types of cables that generate electrical noise.

The following diagram and table shows the pin connections for the RJ45 Ethernet connector:

### RJ45 Connector Pin Assignment



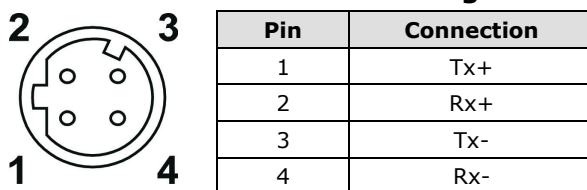
## M12 Ethernet Connector

The ioPAC 8600 has two 10/100BaseT(X) Ethernet ports that use 4-pin shielded M12 connectors with D coding. The 10/100T(X) ports located on the front panel of ioPAC 8600 are used to connect to Ethernet-enabled devices. Most users configure these ports for Auto MDI/MDI-X mode, in which case the port's pinouts are adjusted automatically depending on the type of Ethernet cable used (straight-through or cross-over), and the type of device (NIC-type or HUB/Switch-type) connected to the port.

- **The Auto MDI/MDI-X function** (M12 connector) allows users to connect the ioPAC 8600's 10/100BaseTX ports to any kind of Ethernet device, without needing to pay attention to the type of Ethernet cable being used for the connection. This means that you can use either a straight-through cable or cross-over cable to connect the ioPAC 8600 to Ethernet devices.

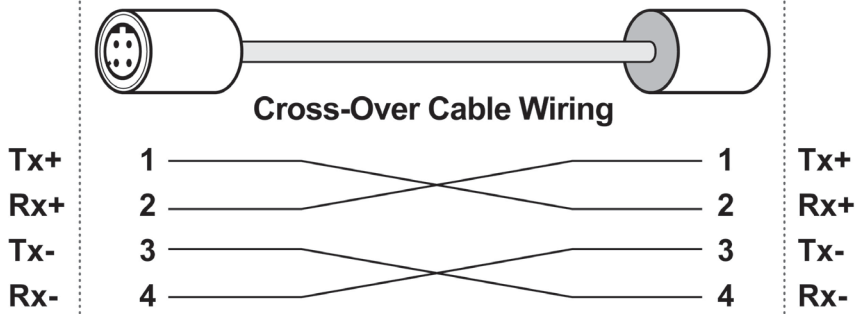
The following diagram and table shows the pin connections for the M12 Ethernet connector:

### M12 Ethernet Connector Pin Assignments

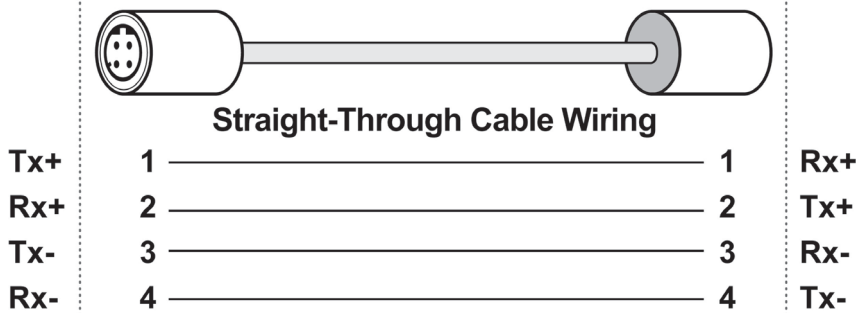


In what follows, we give pinouts for both MDI (NIC-type) ports and MDI-X (HUB/Switch-type) ports. We also give cable wiring diagrams for straight-through and cross-over Ethernet cables.

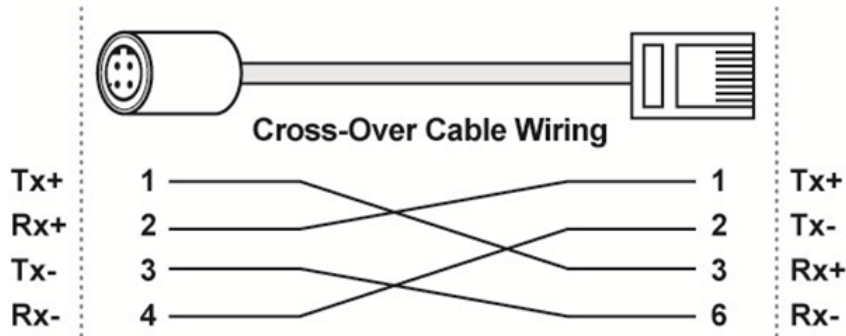
**M12 (4-pin, M) to M12 (4-pin, M) Cross-Over Cable Wiring**



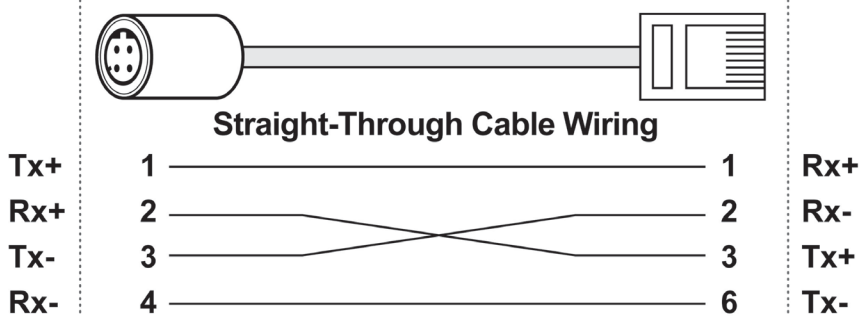
**M12 (4-pin, M) to M12 (4-pin, M) Straight-Through Cable Wiring**



**M12 (4-pin, M) to RJ45 (8-pin) Cross-Over Cable Wiring**



**M12 (4-pin, M) to RJ45 (8-pin) Straight-Through Cable Wiring**



**ATTENTION**

Configuring the two LAN ports on the same ioPAC programmable controller to the same network domain (e.g., 192.168.1.1 and 192.168.1.2) is not recommended.

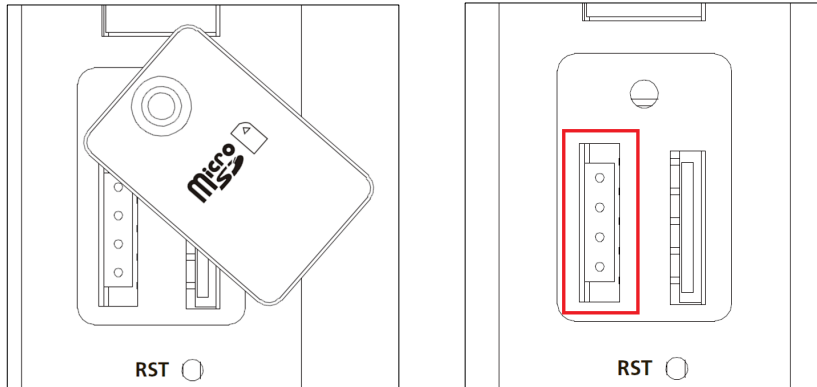
# Serial Connectivity

## Serial Console (Debug Port)

The serial console gives users a convenient way of connecting to the programmable controllers. This method is particularly useful when using the computer for the first time. The serial console is also effective for connecting the Moxa programmable controllers when you do not know target network settings and IP addresses.

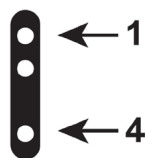
**Step 1:** To use the serial console, remove the microSD cover.

### Console Port for the ioPAC Series



**Step 2:** Attach the 4-pin serial console cable to the console port. The following diagram shows the 4-pin serial connector and pin connections.

### Pin Assignment for the Serial Console Port



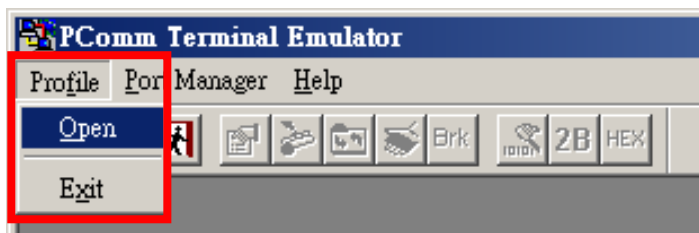
Pin	Definition
1	TxD
2	RxD
3	NC
4	GND

### Serial Console Default Settings

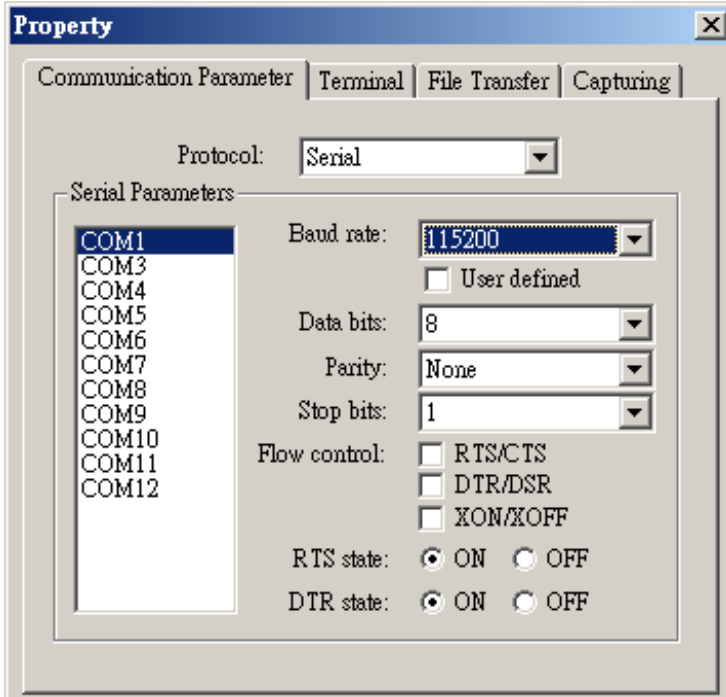
Parameter	Value
Baudrate	115200 bps
Parity	None
Data bits	8
Stop bits	1
Flow Control	None
Terminal	VT100

We recommend using Moxa PComm Terminal Emulator to connect to the serial console. The following steps describe how to connect the console.

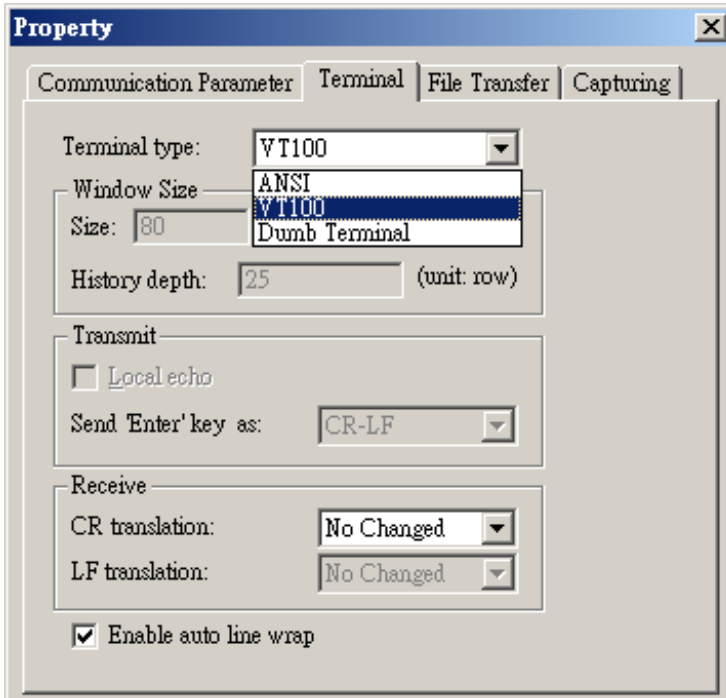
1. Download Moxa PComm Lite from the Moxa website ([www.moxa.com](http://www.moxa.com)) or copy it from the following folder on the Documentation and Software CD: Software\utility\PComm\.
2. Install Moxa PComm Lite to the host Windows PC.
3. Run PComm Lite Terminal Emulator from **Start** → **Programs** → **PComm Lite Ver 1.x** → **Terminal Emulator**.
4. Click **Profile** → **Open**.



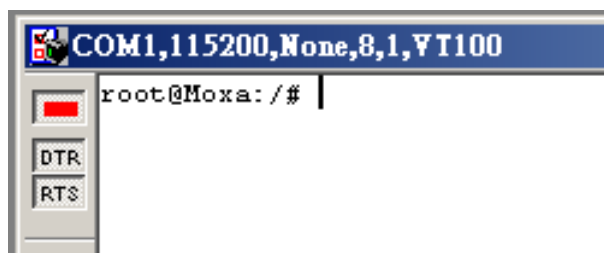
- 5. Specify which COM port is connecting to the Moxa controller, and then use the following configuration settings: 115200, 8, none, 1.



- 6. Click on the Terminal tab and configure the Terminal Type to VT100. Click **OK** to proceed.



- 7. The serial console will be displayed on the terminal screen.



## The RTUxpress Utility

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In this chapter, we introduce Moxa's RTUxpress Utility. The ioPAC Series can be managed and configured over an Ethernet using RTUxpress, which provides easy access to all status information and ready-to-run service settings.

The following topics are covered in this chapter:

▣ **RTUxpress Introduction**

- Quick Start
- User Interface

▣ **Device and Service Configuration**

- Settings Page
- Log Message Window

# RTUxpress Introduction

Moxa RTUxpress is a user-friendly and intuitive offline configuration tool for configuring Moxa’s ioPAC Programmable Controllers. RTUxpress is provided free of charge, and can be upgraded for free when future upgrades become available. RTUxpress has a user-friendly interface for device setup, tag management, and service configuration.

The TagEasy feature implements tag-centric programming through RTUxpress, in which a “tag” links resources (DI, DO, AI, etc.) with ready-to-run services (alarms, logging, active tags, etc.).

For example, users can read a pre-defined DI tag to get the channel status, or change the value of a pre-defined internal variable to trigger a logging service.

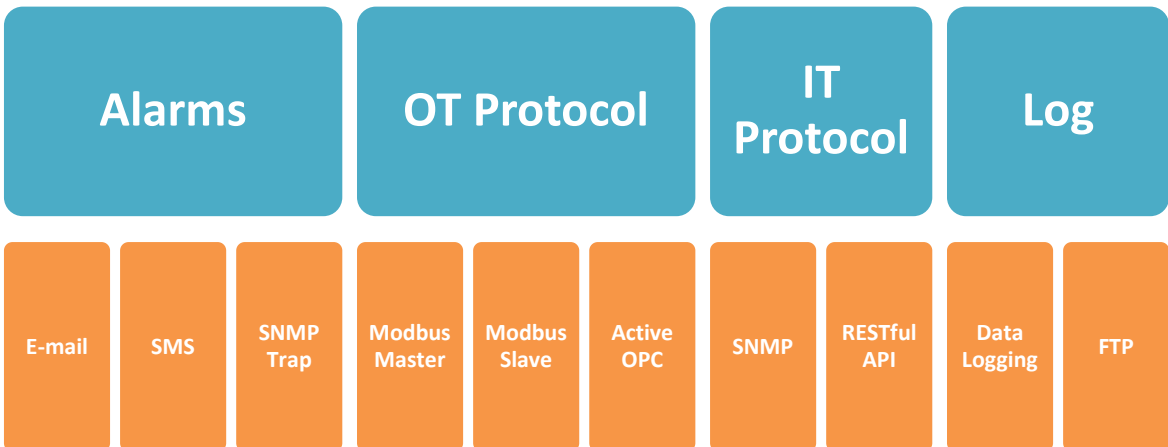
From the point of view of the engineer responsible for programming, the focus has changed from incorporating lots of APIs to just configuring simple tags instead.

This change of focus greatly reduces the programming effort.



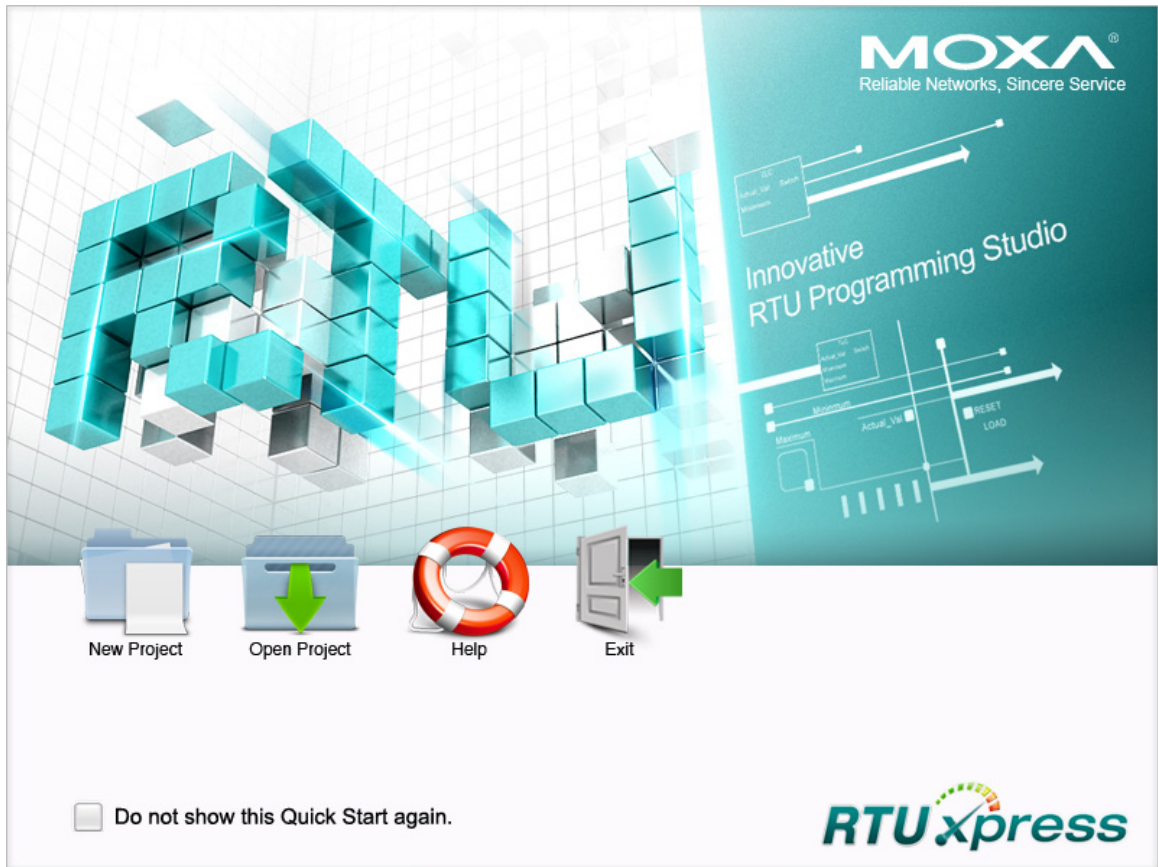
Moxa’s ioPAC programmable controllers provide ready-to-run services, including alarms, data logging, and communication, to help programmers reduce the time and effort needed for program design. With Moxa’s RTUxpress utility, programmers only need to configure the appropriate services, and then upload the configuration file to the ioPAC programmable controllers. Once ioPAC is configured, all of the services will be ready to run.

## Ready-to-Run Services



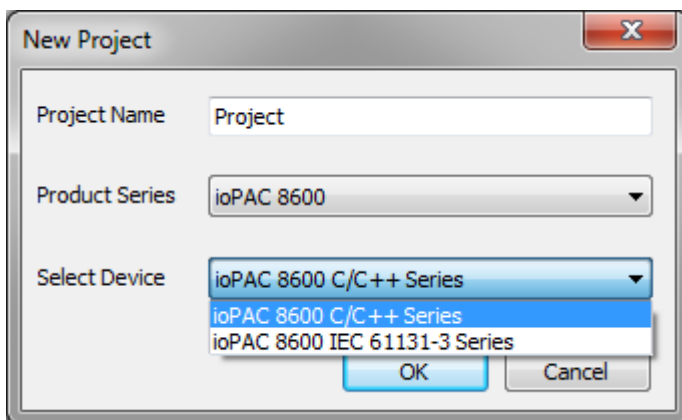
## Quick Start

When you start RTUxpress, click on **New Project**, **Open Project**, or **Help**, located at the bottom of RTU Quick Start window. If do not want the Quick Start window to appear the next time you log in, select the **Do not show this Quick Start again** checkbox before proceeding.



## New Project

When you create a new ioPAC 8600 project for ioPAC 8600 device configuration, you can specify the **Project Name**, set the **Product Series** to ioPAC 8600, and choose the C/C++ or IEC 61131-3 programming language from the **Select Device** dropdown box. Click **OK** to proceed.

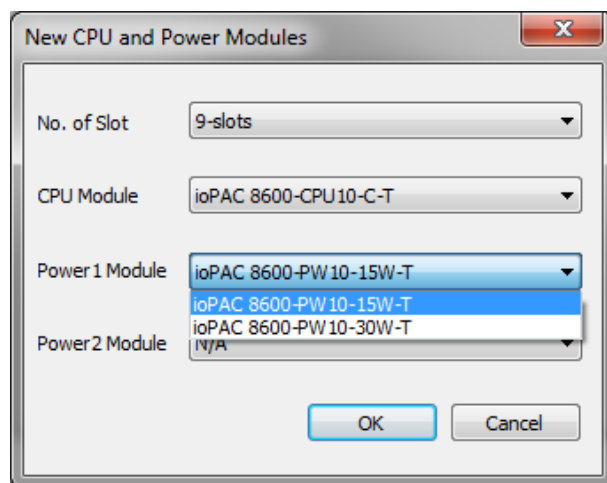




The **New CPU and Power Modules** dialog allows you to specify the characteristics of the backplane module you are using.

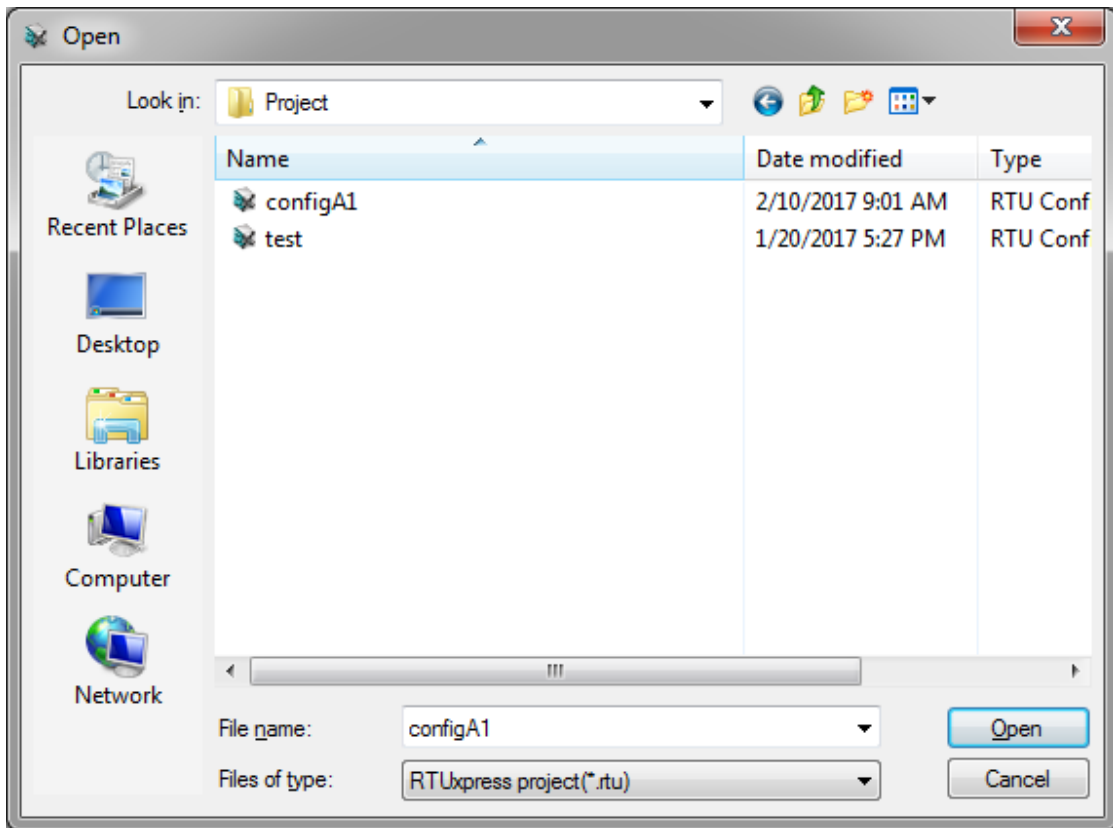
- Select the number of slots from the **No. of Slots** dropdown box.  
Three models are supported: 5 slots, 9 slots, 12 slots.
- Select the CPU model you are using from the **CPU module** dropdown box.
- Select the model of power module you are using from the **Power 1 Module** dropdown box.
- ioPAC 8600 9-slot and 12-slot backplane modules support redundant power modules. If you are using either a 9-slot or 12-slot module, you can select an additional power module from the **Power 2 Module** dropdown box.

**NOTE** You must specify the same power module models in the Power 1 Module and Power 2 Module dropdown boxes.



## Open Project

When you click on the **Open Project** icon from the Quick Start interface, use the **Open** dialog to select which project you would like to open.



## Help

Click the Help button to open the RTUxpress help utility, and then select a help topic from the left menu.



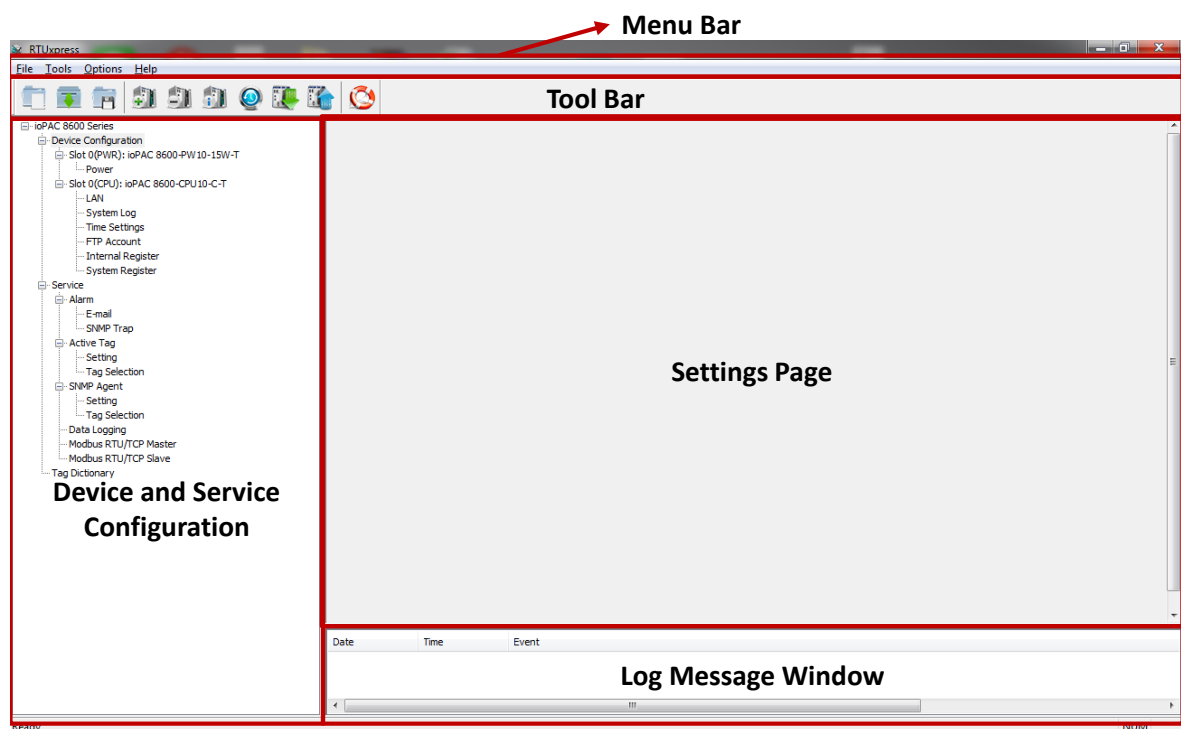
## Exit

Click the **Exit** icon to close the RTUxpress utility.

## User Interface

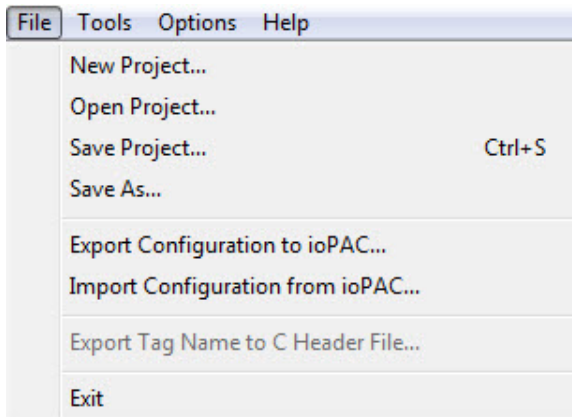
The RTUxpress interface is divided into six main areas:

- Menu bar
- Tool bar
- Device configuration options
- Service configuration options
- Settings panel
- Log message panel



## Menu Bar

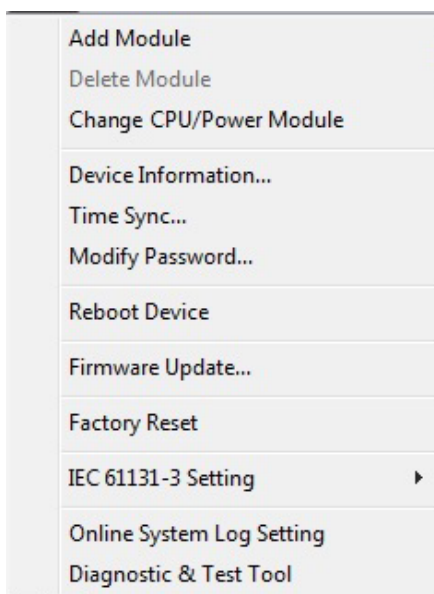
### File:



The following options are available under the **File** menu item:

- New Project: Create a new RTUxpress project
- Open Project: Open an existing RTUxpress project
- Save Project: Save the RTUxpress project that is currently opened
- Save As: Save the currently opened project as a new project
- Export Configuration to ioPAC: Export the configuration file to an ioPAC Programmable Controller
- Import Configuration from ioPAC: Import the configuration file from an ioPAC Programmable Controller
- Export Tag Name to C Header File: Export the tag name to a C header file for use in a C/C++ program
- Exit: Close the RTUxpress utility

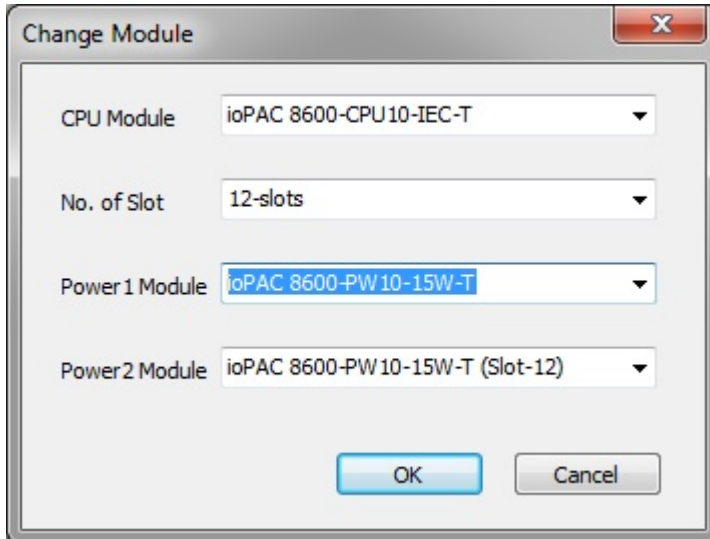
### Tools:



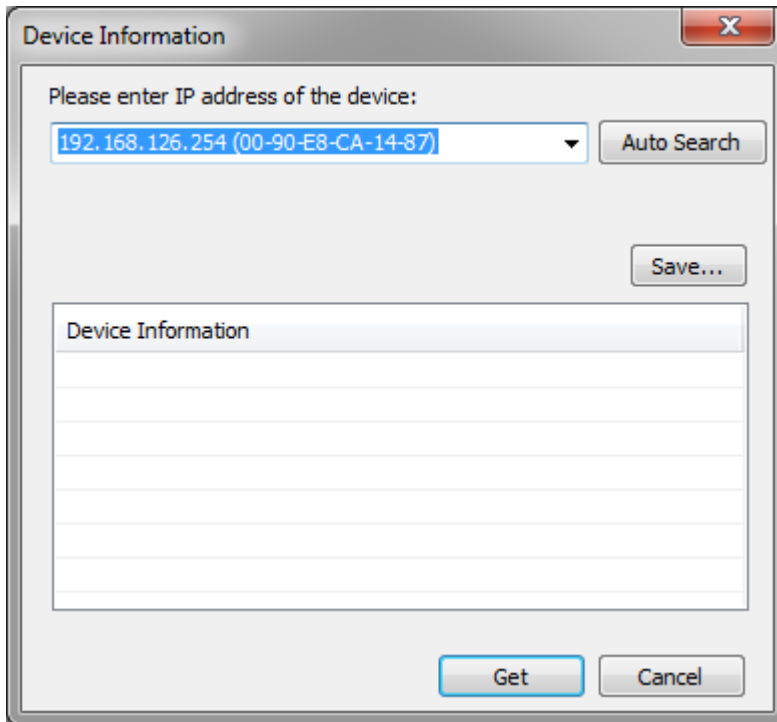
The following options are available under the **Tools** menu item:

- Add Module: Add an ioPAC I/O module to the RTUxpress project
- Delete Module: Delete an ioPAC I/O module from the RTUxpress project

- Change CPU/Power Module: Change the CPU, Power, backplane settings for the RTUxpress project



- Device Information: Get the device information for a particular device



**NOTE** A username and password are required to retrieve device information. the default Username/Password is moxa/moxa for the ioPAC 8600-CPU30 series and root/root for other ioPAC series products.

- Time Sync: Synchronize the device time with the PC's time, or set the time manually

Time Sync

Please enter IP address of the device:

192.168.126.254 (00-90-E8-CA-14-87) Auto Search

Synchronize the time with PC time

Set time manually

Date: 4/16/2017

Time: 14:14:43

Submit Cancel

- Modify Password: Modify the administrator password

Modify Password

Please enter IP address of the device:

192.168.126.254 (00-90-E8-CA-14-87) Auto Search

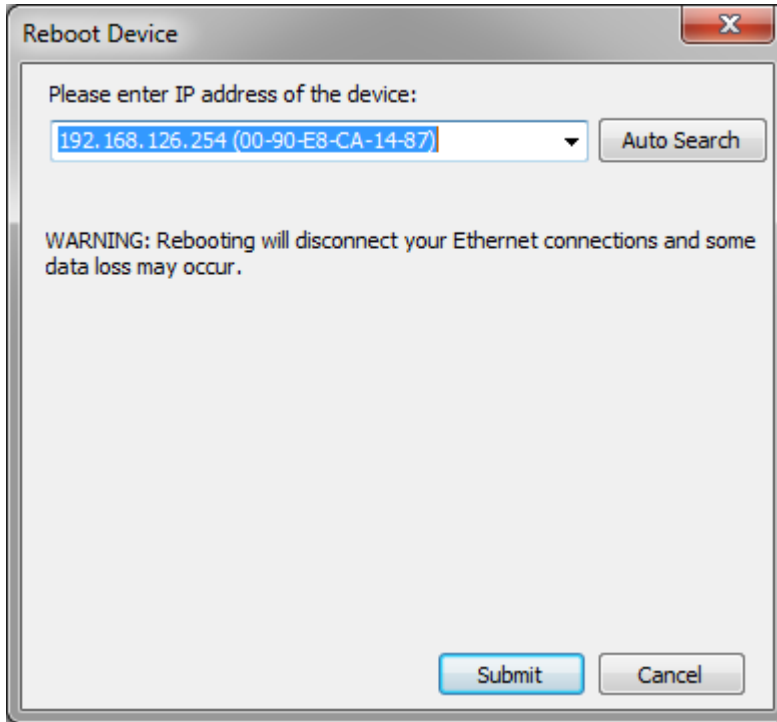
User name:

Password:

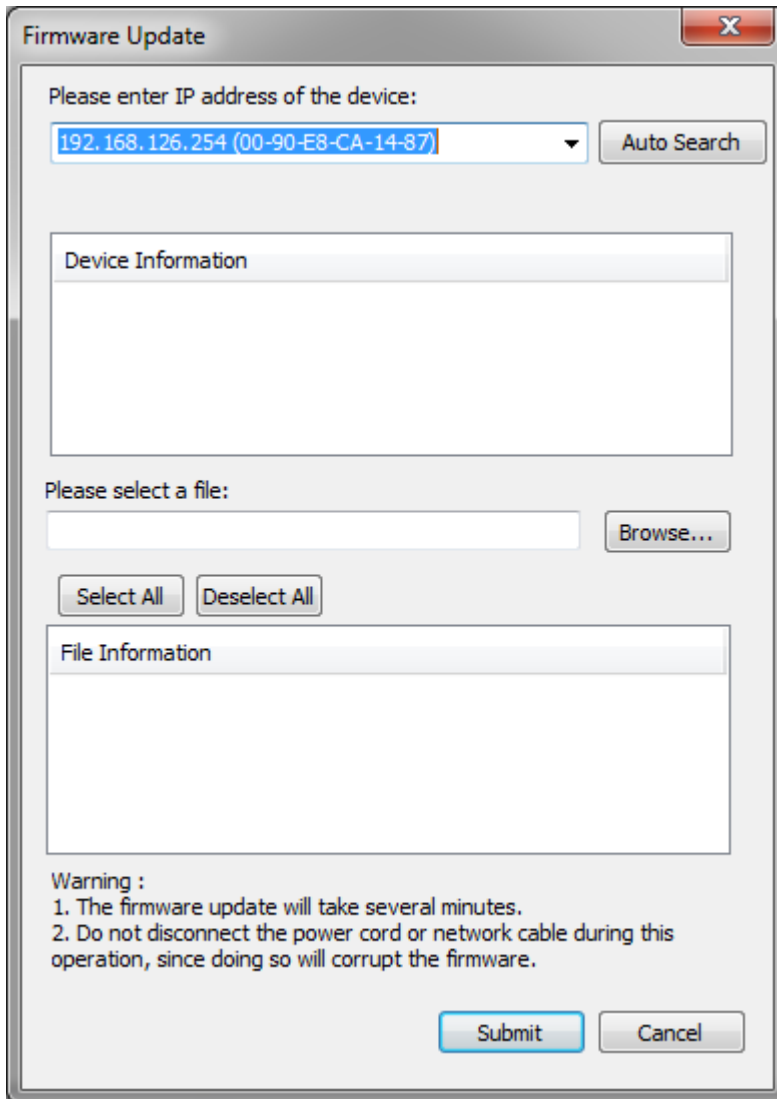
Confirm Password:

Submit Cancel

- Reboot Device: Reboot the ioPAC Programmable Controller



- Firmware Update: Upgrade the ioPAC Programmable Controller’s firmware



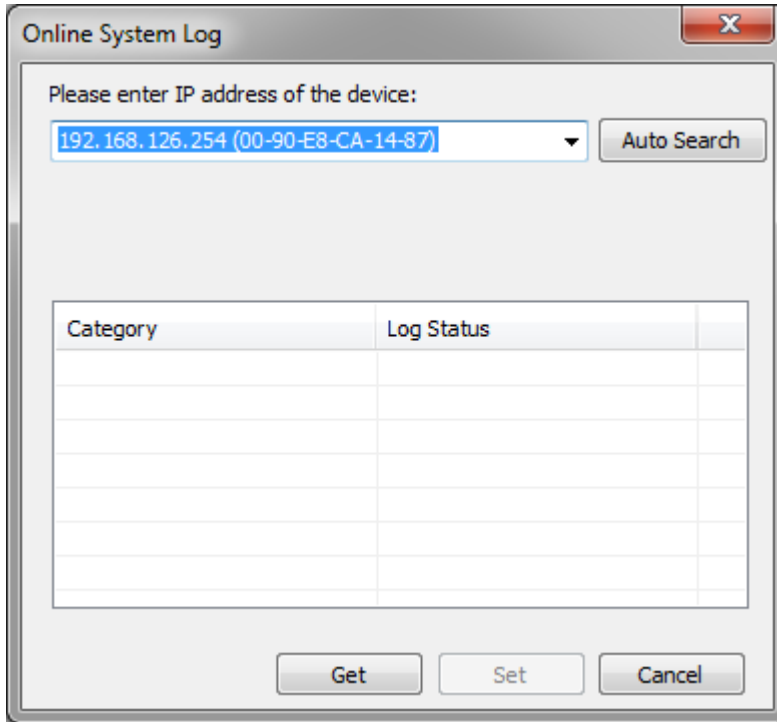
- Factory Reset: Reset all settings and configurations to default settings  
IEC 61131-3 Setting:

IEC 61131-3 Setting	Resource information
Online System Log Setting	ISaGRAF Run Time Engine Reset to Default

- a. Resource information: Indicates how many resources are supported by the ioPAC and whether or not the resources are running.
- b. ISaGRAF Runtime Engine Reset to Default: Deletes all resources and programs in the ioPAC and restarts the ISaGRAF runtime engine.



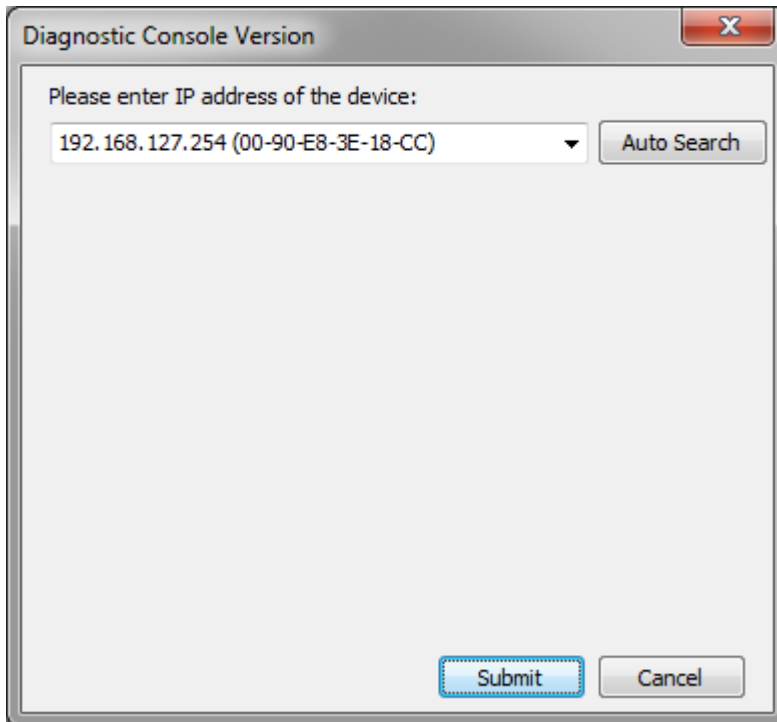
- Online System Log: Users can change the system log settings online.



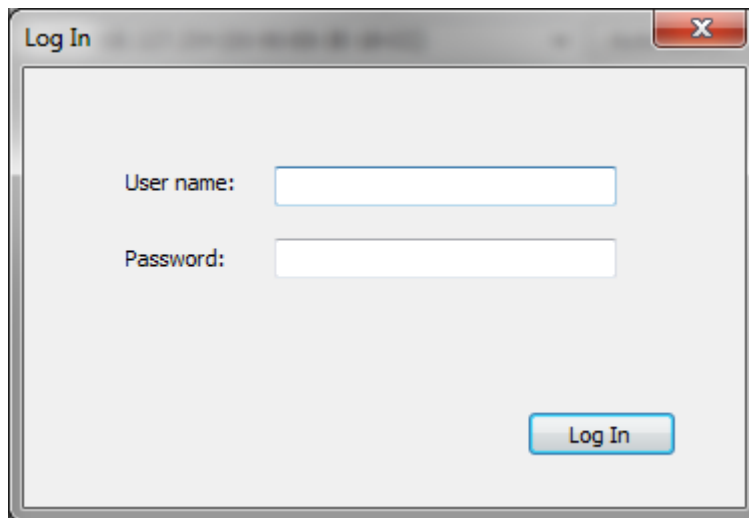
**NOTE** Enabling the log will affect device performance. However, we recommend enabling it so that runtime details will be logged when the ioPAC experiences unexpected errors.

- Diagnostic & Testing Tool: The tool can be used to pre-test or monitor the IO status of the device. Take the following steps to use the tool:

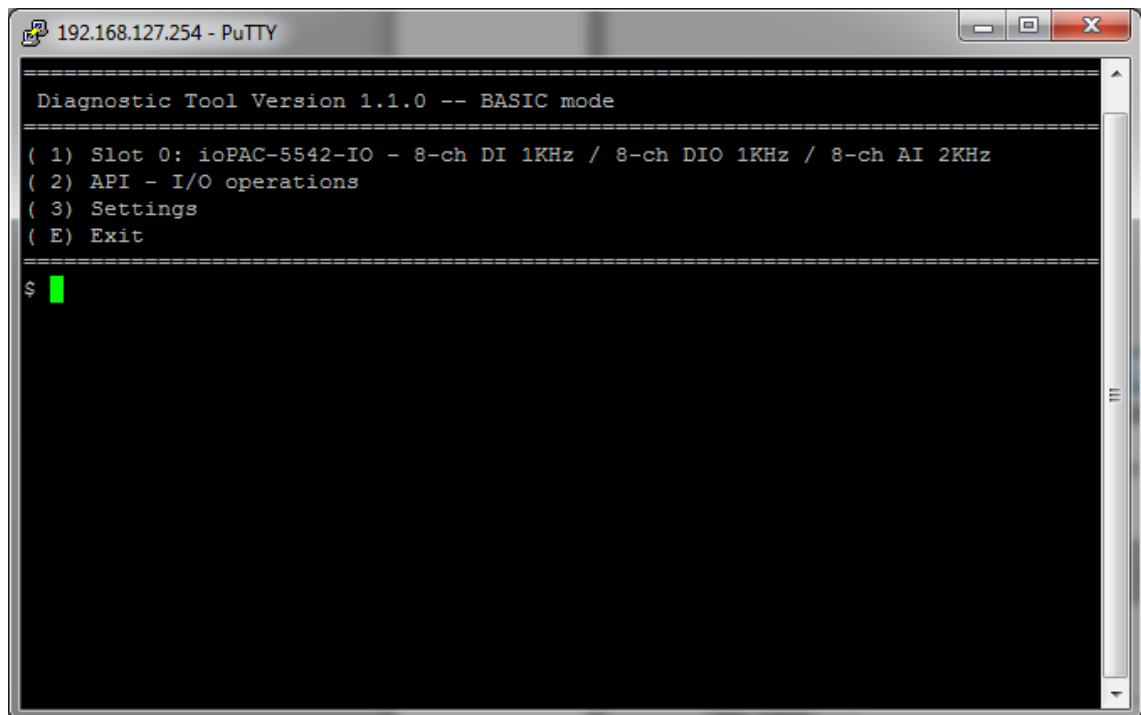
Step 1: Start the tool, key in an IP address or auto search for a device, and then then click submit.



Step 2: When the Log in window appears, enter the user name and password to log in. RTUxpress will open PuTTY to establish an SSH connection between the ioPAC and the PC.

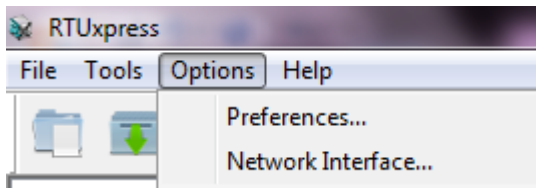


Step 3: When a connection has been established, the slot and API information will be displayed in the PuTTY window. Use the commands listed on the screen to monitor the device.

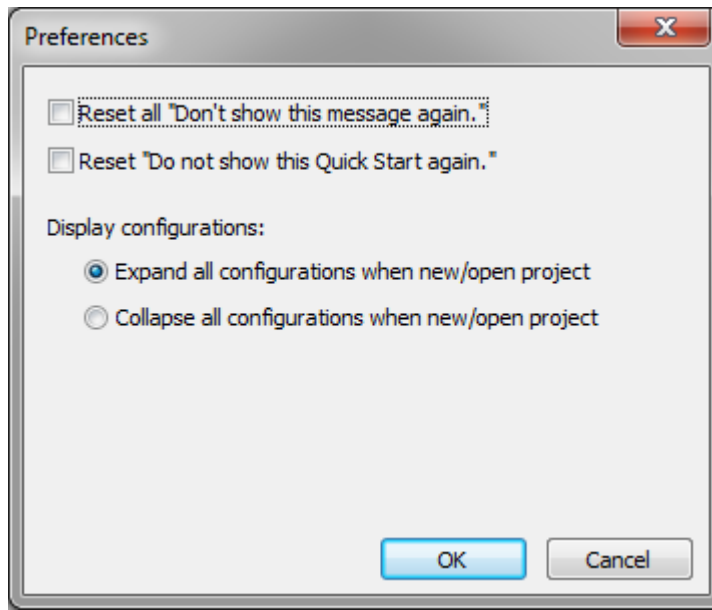


**NOTE** The tool may affect the operation of the ioPAC. If you want to use the tool when the ioPAC is operating, we strongly suggest that you to stop the ioPAC first to avoid unexpected results.

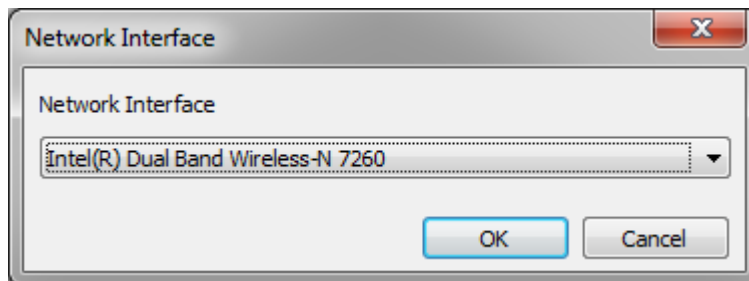
## Options:



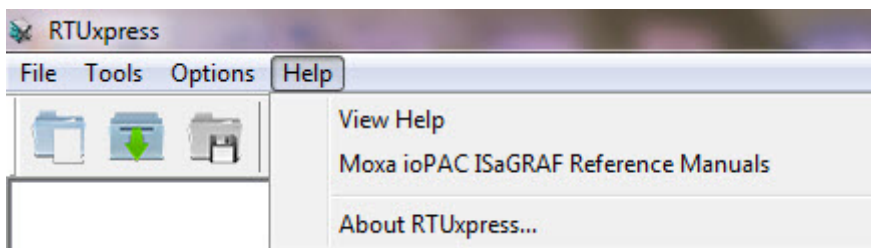
- Preferences: Allows you to configure the preferences shown below



- Network Interface: Allows you to select the network interface













## Help:



- View Help: Opens the **RTUxpress.chm** help utility
- Moxa ioPAC ISaGRAF Reference Manuals: Opens the **Moxa\_ioPAC\_ISaGRAF.chm** utility
- About RTUxpress: it will show the RTUxpress utility version

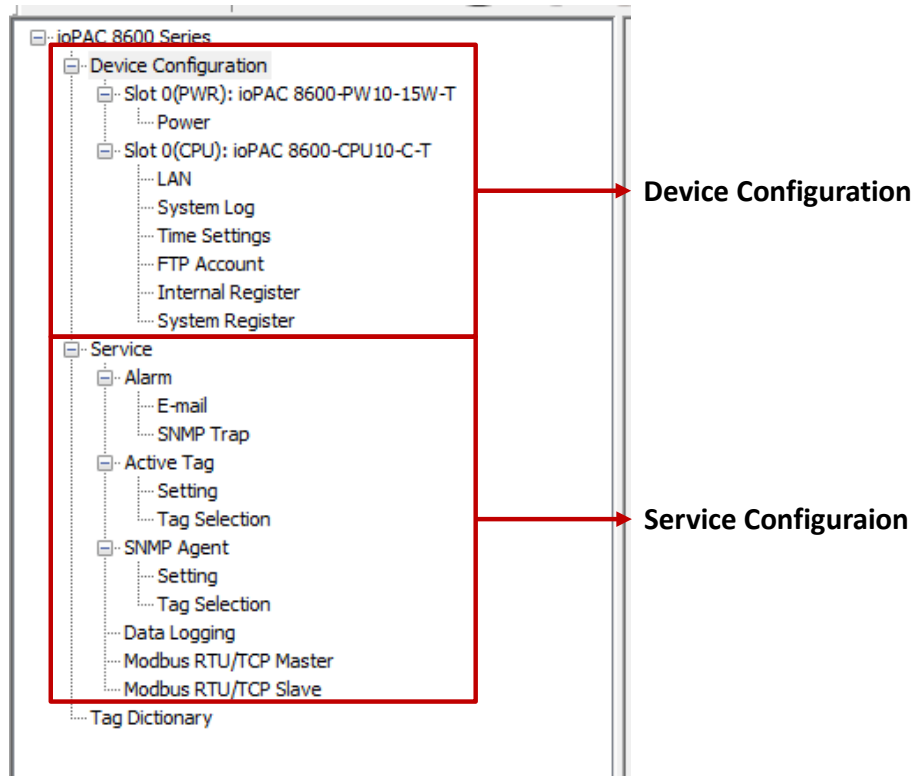
## Tool Bar

-  New Project: Create a new RTUxpress project
-  Open Project: Open an existing RTUxpress project
-  Save Project: Save a currently opened RTUxpress project
-  Add Module: Add an ioPAC I/O module
-  Delete Module: Delete an ioPAC I/O module
-  Device Information: Get device information
-  Time Sync: Device time synchronization
-  Export Configuration to ioPAC: Export a configuration file to the ioPAC Programmable controller
-  Import Configuration from ioPAC: Imports the configuration file from ioPAC Programmable Controller
-  Help: Opens the **RTUxpress.chm** help utility

# Device and Service Configuration

Device Configuration is to configure ioPAC Programmable Controller settings and resources. You can configure the LAN, IO, an serial settings in the device's configuration section. Since the product has a modular design, a module's function settings will appear once the module has been added to the device.

ioPAC also provides services (Modbus, SNMP, Data Logging, etc.) to reduce the developer's effort. Configure the function in the service configuration page, and then upload the configuration to the device. The service will start working automatically.



## Settings Page

Detailed device and configuration settings will be displayed in this window. Check in RTUxpress's help file for the definition of each setting.

## Log Message Window

Operation and message logs will be displayed in this window for reference.

# 86M/85M Module Hardware Introduction

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In this chapter, we provide the 86M/85M modules' specifications.

The following topics are covered in this chapter:

❑ **I/O and Communication Module Descriptions**

❑ **Common Specifications**

❑ **Module Specifications**

- 86M-1620D-T: 16 DIs, sink, 24 to 110 VDC, channel LED
- 86M-1832D-T: 8 DIs, sink/source, 24 VDC, ch-to-ch isolation, channel LED
- 86M-2604D-T: 6 relays, form A (N.O.), channel LED
- 86M-2821D-T: 8 DOs, source, 24 to 110 VDC, channel LED
- 86M-2830D-T: 8 DOs, sink, 24 VDC, ch-to-ch isolation, channel LED
- 86M-4420-T: 4 AOs, 0 to 10 V, -10 to 10 V, 0 to 20 mA, or 4 to 20 mA
- 86M-5212U-T: 2-port 2-wire Ethernet switch
- 86M-5250-T: 2 CAN ports, channel LED
- 85M-1602-T: 16 DIs, sink/source, 24 VDC, dry contact
- 85M-2600-T: 16 DOs, sink, 24 VDC
- 85M-38XX-T: 8 AIs
- 85M-5401-T: 4 serial ports (RS-232/422/485 3-in-1)
- 85M-6600-T: RTDs
- 85M-6810-T: 8 TCs

# I/O and Communication Module Descriptions

The ioPAC 8600 controllers support the following modules.

Model Name	Description
86M-1620D-T	16 DIs, sink, 24 to 110 VDC, channel LED
86M-1832D-T	8 DIs, sink/source, 24 VDC, ch-to-ch isolation, channel LED
86M-2604D-T	6 relays, form A (N.O.), channel LED
86M-2821D-T	8 DOs, source, 24 to 110 VDC, channel LED
86M-2830D-T	8 DOs, sink, 24 VDC, ch-to-ch isolation, channel LED
86M-4420-T	4 AOs, 0 to 10 V, -10 to 10 V, 0 to 20 mA, or 4 to 20 mA
86M-5212U-T	2-port 2-wire Ethernet switch
86M-5250-T	2 CAN ports
85M-1602-T	16 DIs, sink/source, 24 VDC, dry contact
85M-2600-T	16 DOs, sink, 24 VDC
85M-3800-T	8 AIs, 4 to 20 mA, 16 bits
85M-3801-T	8 AIs, 4 to 20 mA, 16 bits, 40 kHz
85M-3810-T	8 AIs, 0 to 10 VDC, 16 bits
85M-3811-T	8 AIs, 0 to 10 VDC, 16 bits, 40 kHz
85M-5401-T	4 serial ports (RS-232/422/485 3-in-1)
85M-6600-T	6 RTDs
85M-6810-T	8 TCs

**NOTE** Conformal coating available on request.

## Common Specifications

The following are specifications common to all 85M/86M modules.

### Environmental Limits

**Operating Temperature:** -40 to 75°C (-40 to 176°F)

**Storage Temperature:** -40 to 85°C (-40 to 185°F)

**Ambient Relative Humidity:** 5 to 95% (non-condensing)

**Shock:** IEC 60068-2-27

**Vibration:** IEC 60068-2-6

### Standards and Certifications

**Safety:** UL 508

**EMC:** EN 55032/24

**EMI:** FCC Part 15 Subpart B Class A, CISPR 22

#### EMS:

IEC 61000-4-2 ESD: Contact: 6 kV; Air: 8 kV

IEC 61000-4-3 RS:

80 MHz to 1000 MHz: 20 V/m

1400 MHz to 2000 MHz: 10 V/m

2000 MHz to 2700 MHz: 5 V/m

5100 MHz to 6000 MHz: 3 V/m

IEC 61000-4-4 EFT: Power: 1 kV; Signal: 0.5 kV

IEC 61000-4-5 Surge:

Power: 2 kV (L-PE), 1 kV (L-L)

Signal: 2 kV (L-PE), 1 kV (L-L)

IEC 61000-4-6 CS: 10 V IEC 61000-4-8 PFMF: 100 A/m

**Rail Traffic:** EN 50155 (essential compliance\*), EN 50121-3-2, EN 50121-4

\*Moxa defines "essential compliance" to include those EN 50155 requirements that make products more suitable for rolling stock railway applications.

### Warranty

**Warranty Period:** 5 years

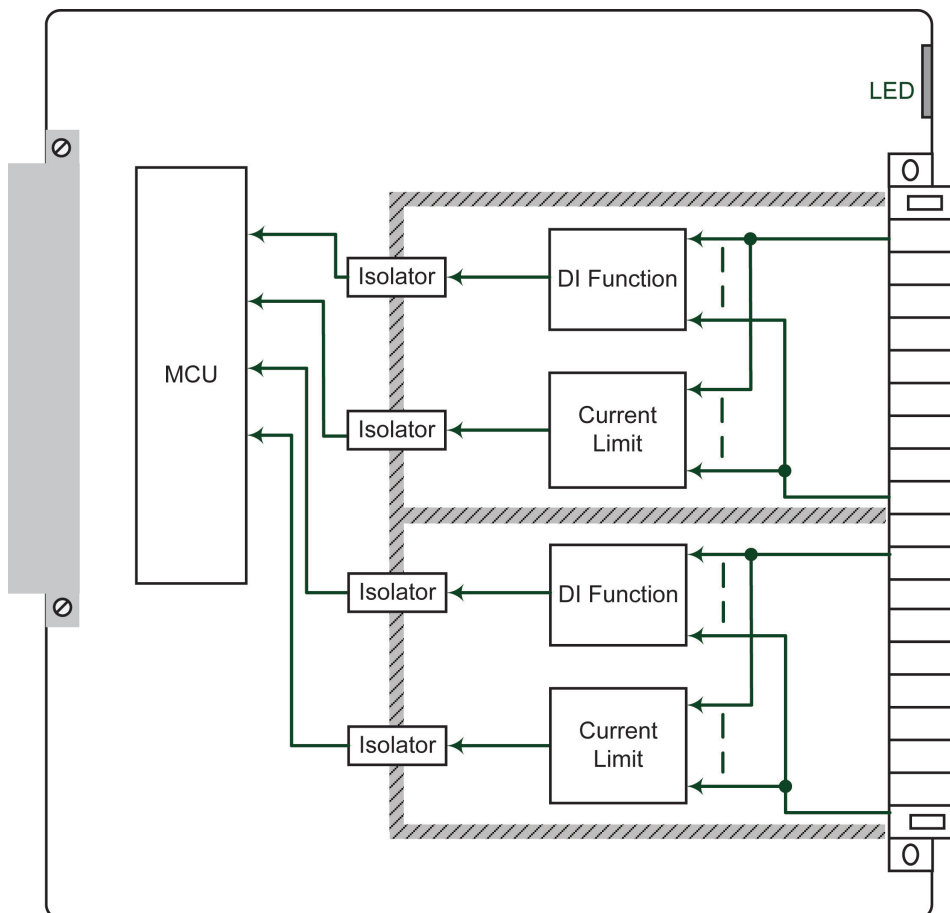
**Details:** See [www.moxa.com/warranty](http://www.moxa.com/warranty)

## Module Specifications

### 86M-1620D-T: 16 DIs, sink, 24 to 110 VDC, channel LED

The 86M-1620D-T module is a 16-channel, sink-type digital input module that support wide temperature and 24 to 110 VDC voltage input range.

### Block Diagram



### Specifications

#### Inputs and Outputs

**Digital Inputs:** 16 channels

**Isolation:** 3k VDC or 2k Vrms

#### Digital Inputs

**Sensor Type:** Wet contact (PNP)

**I/O Mode:** DI



**Logic Definition:**

- On: channel voltage > 0.3 x (external power voltage)
- Off: channel voltage < 0.15 x (external power voltage)

**Scan Period:** 8 ms (typ.)

**Scan on Time:** 0.5 ms

**Debouncing Function:** Software disable/enable

**Debouncing Time:** 1 to 15 ms (software-selectable)

**Common Type:** 8 points per COM

**Physical Characteristics**

**Wiring:** I/O cable, max. 16 AWG

**Connector:** Spring-type terminal block

**Channel LED:** Yes

**Environmental Limits**

**Operating Temperature:** -40 to 75°C (-40 to 176°F)

**Power Requirements**

**Input Current:** 12.6 mA @ 24 VDC

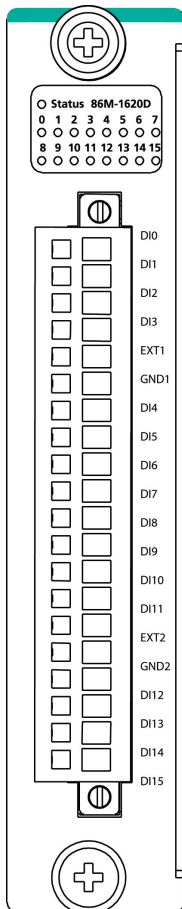
**MTBF (mean time between failures)**

**Time:** 1,115,244 hrs.

**Standard:** Telcordia SR332

**Pin Assignment**

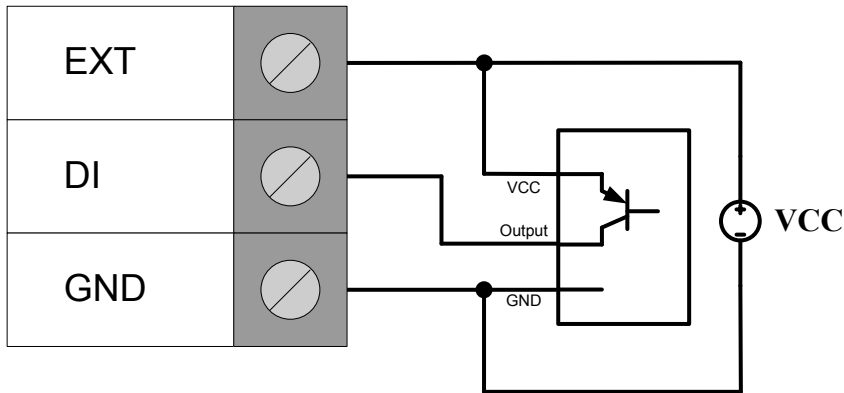
The following is the 86M-1620D-T module’s pin assignment.



Label	Indication	Color	Action
Status	Module status	Green	Module ready
		Red	Configuration failed
		Off	Not connected
X (0, 1, 2, ...)	Channel status	Green	channel ON
		Green Blinking	Counter or pulse mode
		Off	channel OFF

### Wiring Guide

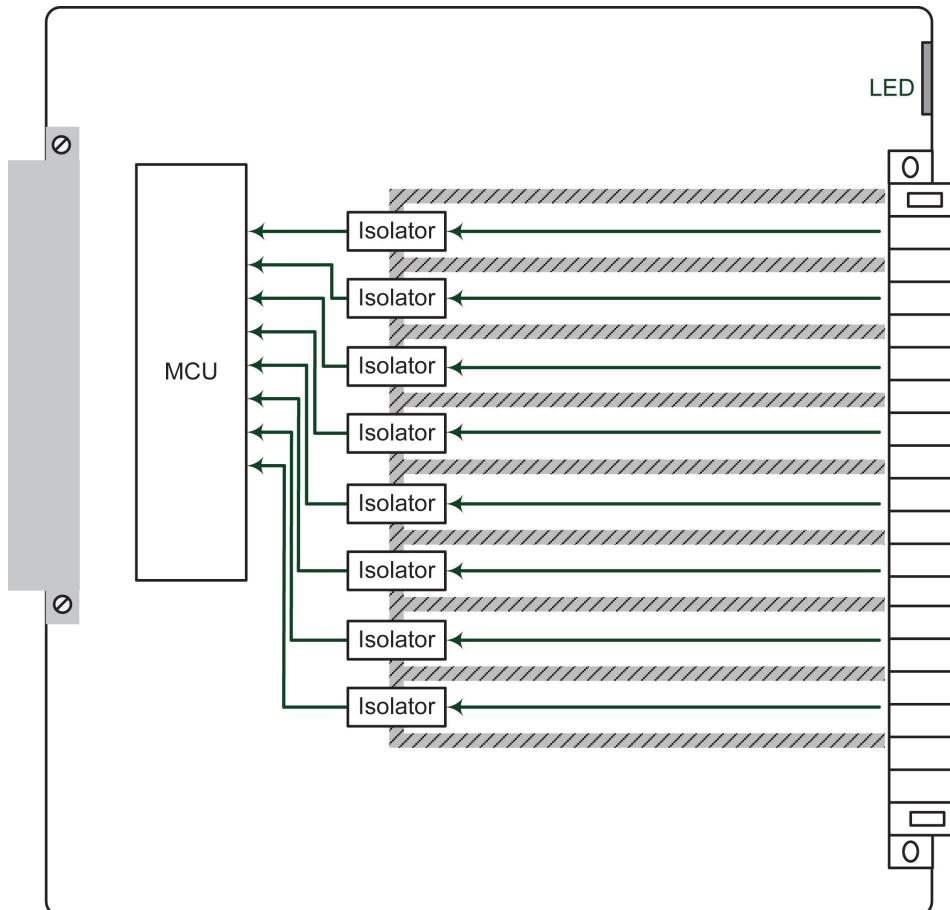
The following wiring guide is for the 86M-1620D-T module.



### 86M-1832D-T: 8 DIs, sink/source, 24 VDC, ch-to-ch isolation, channel LED

The 86M-1832D-T module is an 8-channel, sink/source, or dry contact type digital input module that supports wide temperature and channel-to-channel isolation.

### Block Diagram



## Specifications

### Inputs and Outputs

**Digital Inputs:** 8 channels (channel-to-channel isolation)

**Isolation:** 3K VDC or 2K Vrms

### Digital Inputs

**Sensor Type:** Wet contact (NPN or PNP)

**I/O Mode:** DI, counter or frequency

**Wet Contact (DI+ to DI-):**

- Off: 0 to 3 VDC
- On: 10 to 30 VDC

**Counter Frequency:** 5 kHz

**Digital Filtering Time Interval:** Software selectable by 0.1 ms

### Physical Characteristics

**Wiring:** I/O cable, max. 16 AWG

**Connector:** Spring type terminal block

### Environmental Limits

**Operating Temperature:** -40 to 75°C (-40 to 176°F)

### Power Requirements

**Input Current:** 12.6 mA @ 24 VDC

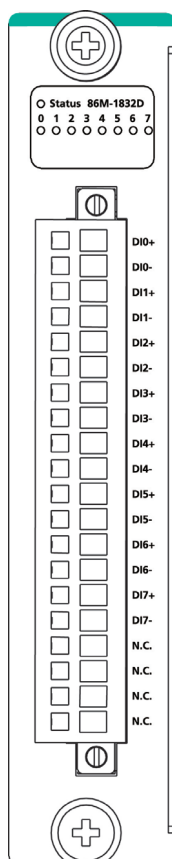
### MTBF (mean time between failure)

**Time:** 1,149,108 hrs.

**Standard:** Telcordia SR332

## Pin Assignment

Refer to the following figure for the 86M-1832D-T module's pin assignment.



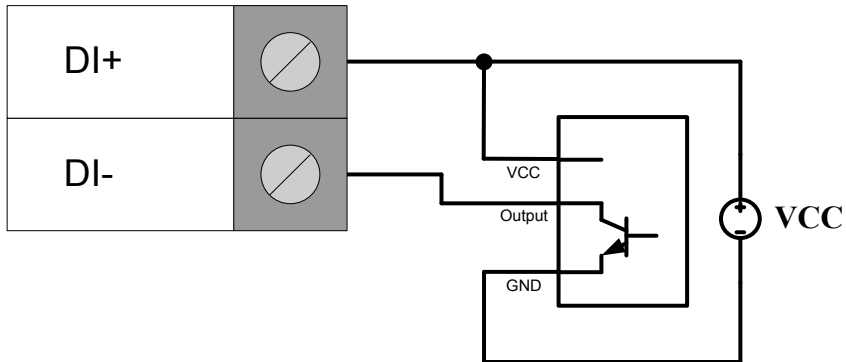
Label	Indication	Color	Action
Status	Module status	Green	Module ready
		Red	Configuration failed
		Off	Not connected
X (0, 1, 2, ...)	Channel status	Green	channel ON
		Green Blinking	Counter or pulse mode
		Off	channel OFF

## Wiring Guide

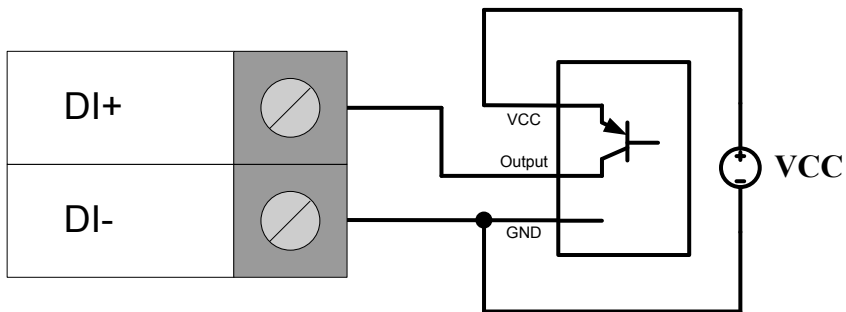
The following wiring guide applies to the 86M-1832D-T module.

### Wet Contact

#### Source Type



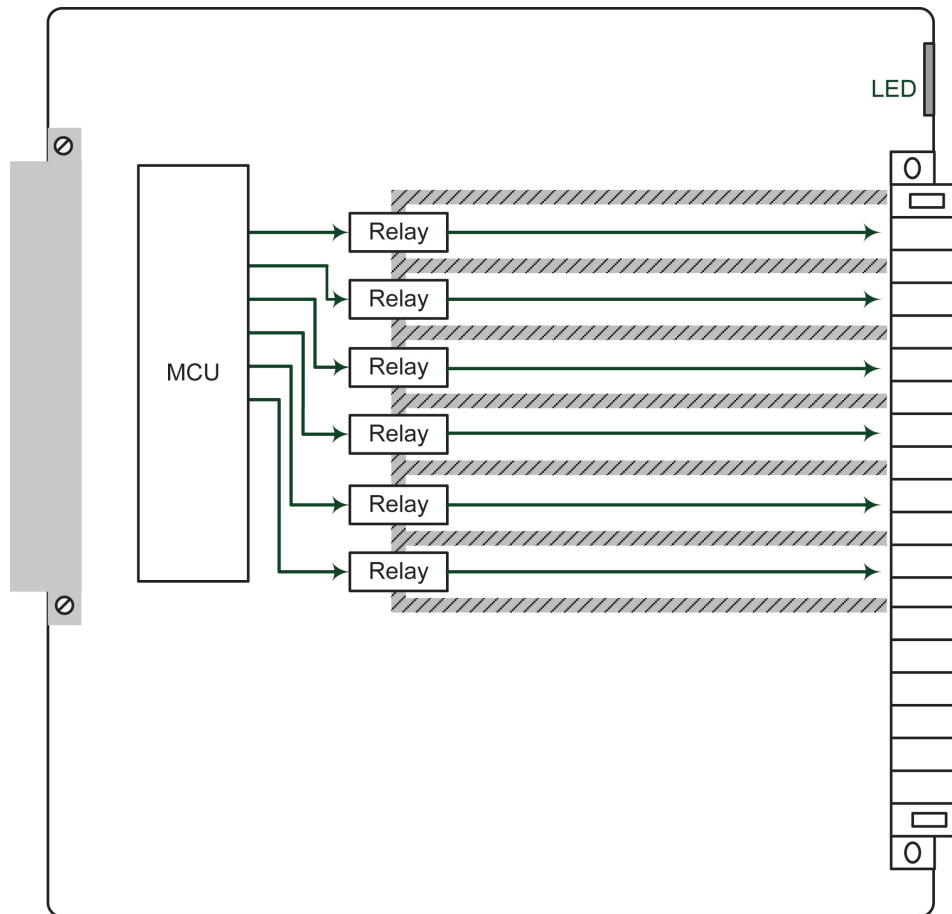
#### Sink Type



## 86M-2604D-T: 6 relays, form A (N.O.), channel LED

The 86M-2604D-T module is a 6-channel relay output module that supports wide temperature and channel-to-channel isolation.

### Block Diagram



### Specifications

#### Inputs and Outputs

**Relay Outputs:** 6 channels

**Isolation:** 3K VDC or 2K Vrms

#### Relay Output

**Type:** Form A (N.O.)

**I/O mode:** Relay or PWM

**Pulse Output Frequency:** 0.33 Hz

#### Contact Current Rating:

**Resistive Load:** 5 A @ 30 VDC, 250 VAC

**Relay On/Off Time:** 10 ms (max.)

**Initial Insulation Resistance:** 1000 M ohms (min.) @ 500 VDC

**Mechanical Endurance:** 5,000,000 operations

**Electrical Endurance:** 60,000 operations

**Contact Resistance:** 100 m ohms (max.) (24VDC, 1A)

**Note:** Ambient humidity must be non-condensing and remain between 5 and 95%. The relays of the 86M-2604D-T may malfunction when operating in high condensation environments below 0° Celsius.

**Physical Characteristics**

**Wiring:** I/O cable, 16 AWG (max.)

**Connector:** Spring-type terminal block

**Environmental Limits**

**Operating Temperature:** -40 to 75°C (-40 to 176°F)

**Power Requirements**

**Input Current:** 127 mA @ 24 VDC

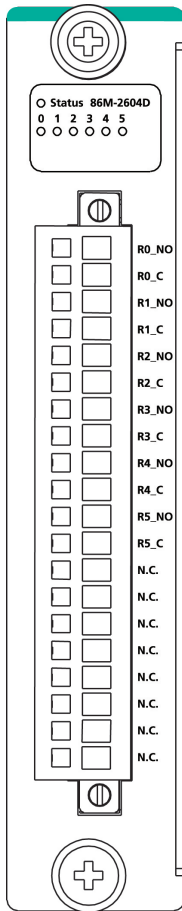
**MTBF (mean time between failures)**

**Time:** 4,173,843 hrs.

**Standard:** Telcordia SR332

**Pin Assignment**

Refer to the following figure for the 86M-2604D-T module’s pin assignment.



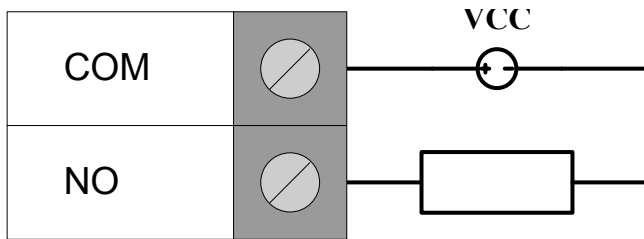
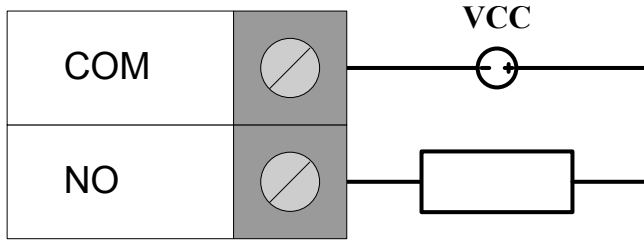
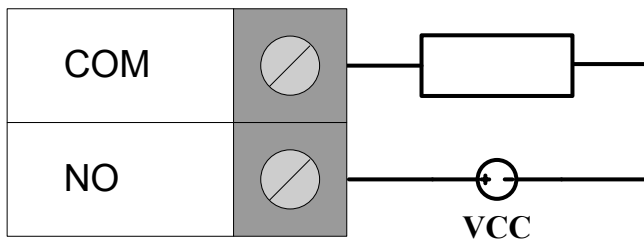
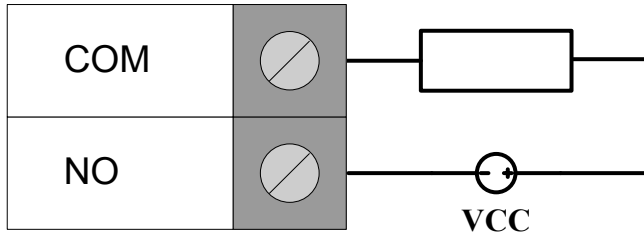
Label	Indication	Color	Action
Status	Module status	Green	Module ready
		Red	Configuration failed
		Off	Not connected
X (0, 1, 2, ...)	Channel status	Green	channel ON
		Green Blinking	Counter or pulse mode
		Off	channel OFF

## Wiring Guide

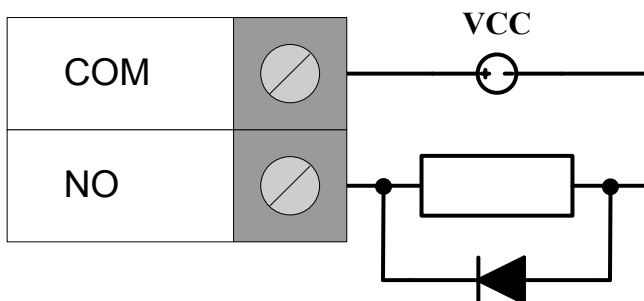
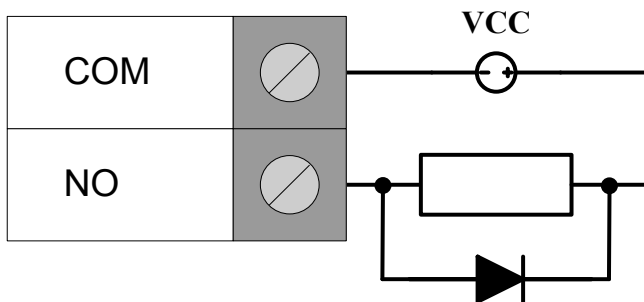
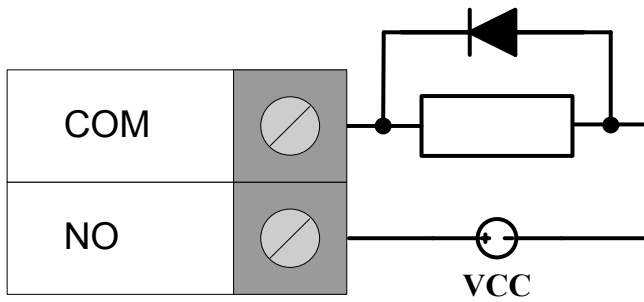
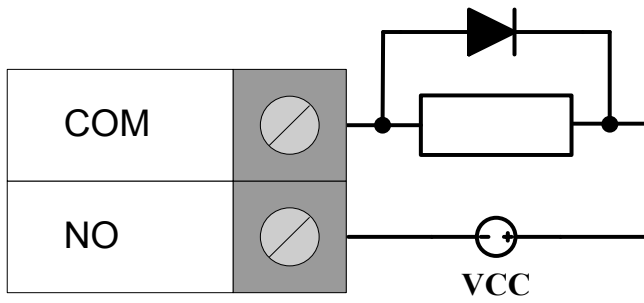
The following diagram shows the 86M-2604D-T module's wiring guide.

### DC Voltage:

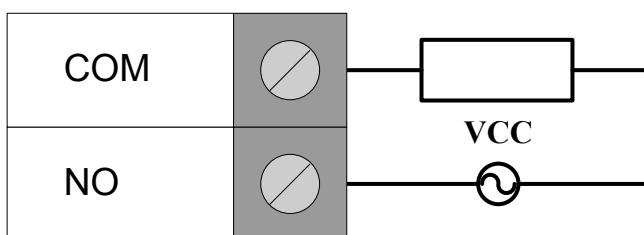
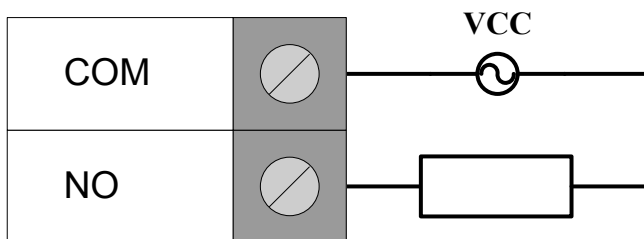
#### Resistive Load



**Inductive Load**



**AC Voltage:**

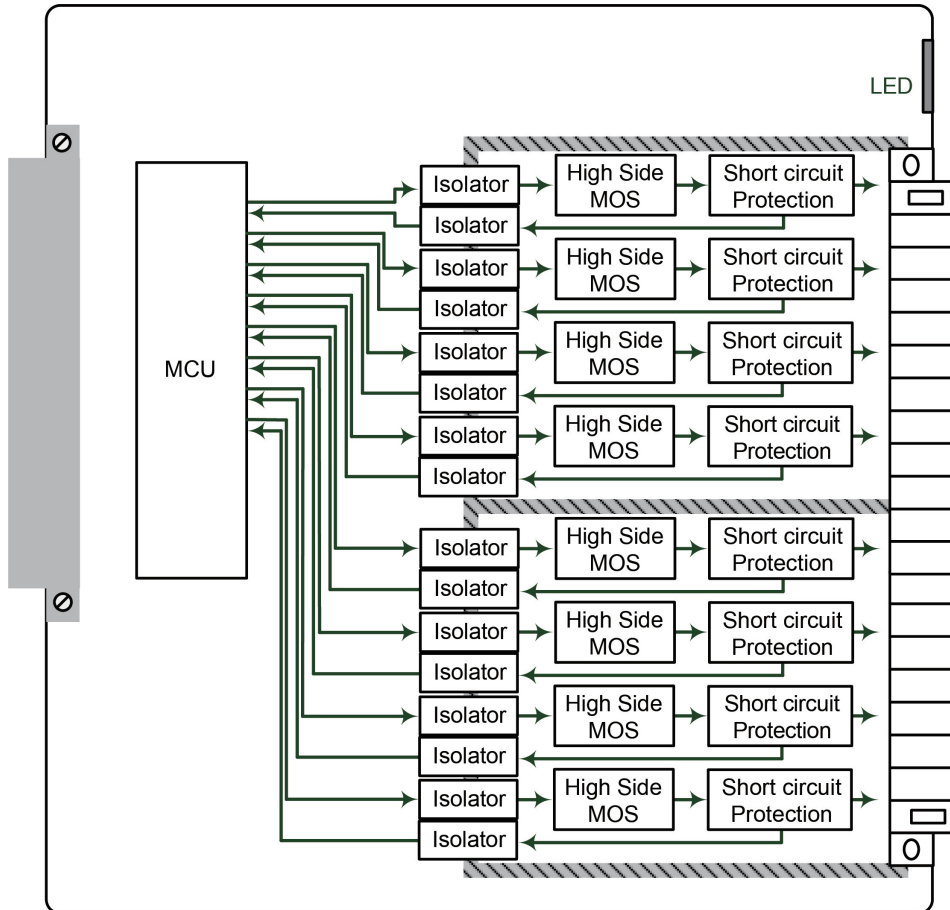




## 86M-2821D-T: 8 DOs, source, 24 to 110 VDC, channel LED

The 86M-2821D-T module is a 8-channel, source type digital output module that support 24 to 110 VDC voltage input range.

### Block Diagram



### Specifications

#### Inputs and Outputs

**Digital Outputs:** 8 channels

**Isolation:** 3K VDC or 2K Vrms

#### Digital Outputs

**Type:** Source

**I/O Mode:** DO or PWM

**Pulse Output Frequency:** 100 Hz

**Short Circuit Protection:** 2.8 A @ 25°C

**Over-voltage Protection:** 160 VDC

**Current Rating:** 1.5 A per channel

#### Physical Characteristics

**Wiring:** I/O cable, max. 16 AWG

**Connector:** Spring type terminal block

**Channel LED:** Yes

#### Environmental Limits

**Operating Temperature:** -40 to 75°C (-40 to 176°F)

**Power Requirements**

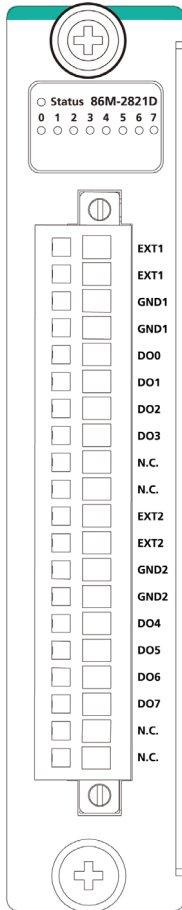
**Input Current:** 85.2 mA @ 24 VDC

**MTBF (mean time between failure)**

**Time:** 696,245 hrs.

**Standard:** Telcordia SR332

**Pin Assignment**



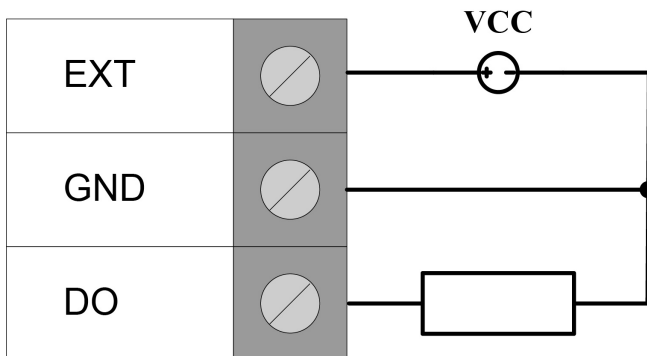
Label	Indication	Color	Action
Status	Module status	Green	Module ready
		Red	Configuration failed
		Off	Not connected
X (0, 1, 2, ...)	Channel status	Green	channel ON
		Green Blinking	Counter or pulse mode
		Off	channel OFF

Refer to the following figure for the 86M-2821D-T module’s pin assignment.

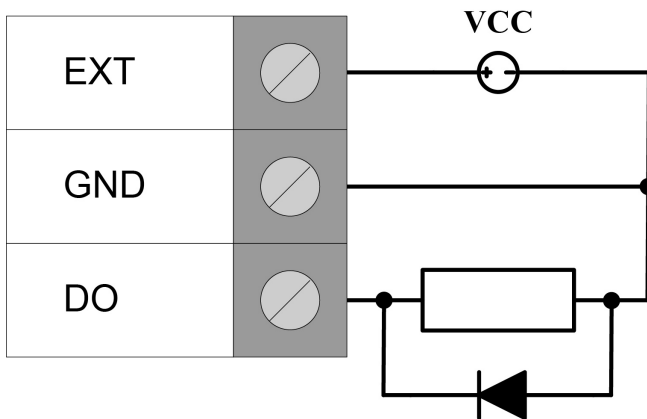
## Wiring Guide

The following diagram shows the 86M-2821D-T module's wiring guide.

### Resistive Load



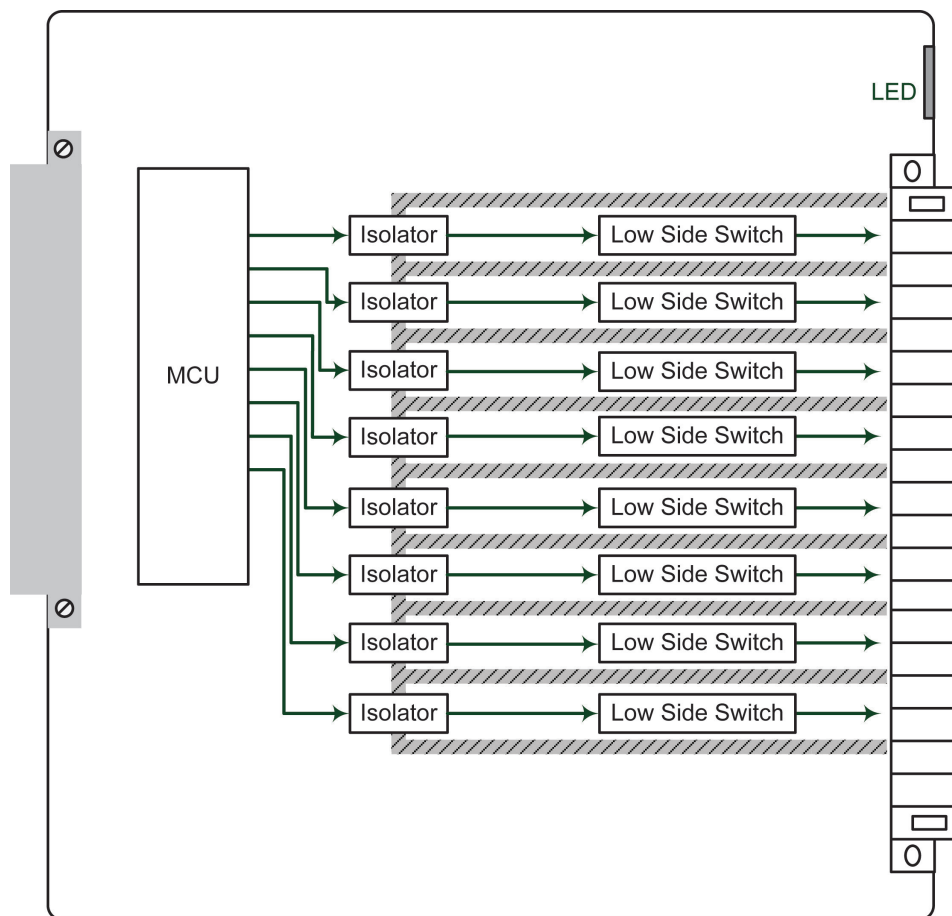
### Inductive Load



## 86M-2830D-T: 8 DOs, sink, 24 VDC, ch-to-ch isolation, channel LED

The 86M-2830D-T module is an 8-channel digital output module that supports wide temperature and channel-to-channel isolation.

## Block Diagram



## Specifications

### Inputs and Outputs

**Digital Outputs:** 8 channels (channel to channel isolation)

**Isolation:** 3K VDC or 2K Vrms

### Digital Outputs

**Type:** Sink

**I/O Mode:** DO or PWM

**Pulse Output Frequency:** 1 kHz

**Short Circuit Protection:** 750 mA @ 25°C

**Over-voltage Protection:** 41 VDC

**Over-temperature Shutdown:** 175°C (typical), 150°C (min.)

**Current Rating:** 200 mA per channel

### Physical Characteristics

**Wiring:** I/O cable, max. 16 AWG

**Connector:** Spring type terminal block

### Environmental Limits

**Operating Temperature:** -40 to 75°C

### Power Requirements

**Input Current:** 76.7 mA @ 24 VDC

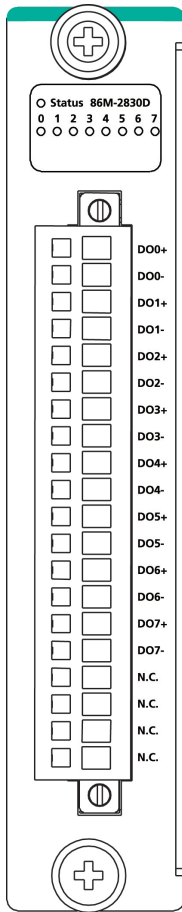
### MTBF (mean time between failure)

**Time:** 1,766,037 hrs.

**Standard:** Telcordia SR332

### Pin Assignment

Refer to the following figure for the 86M-2830D-T module's pin assignment.

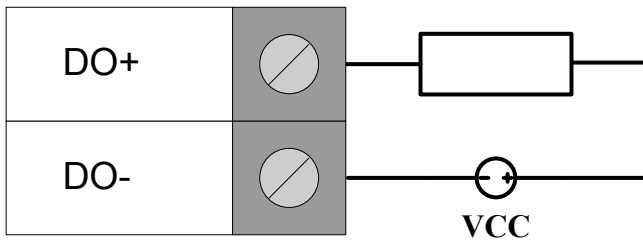


Label	Indication	Color	Action
Status	Module status	Green	Module ready
		Red	Configuration failed
		Off	Not connected
X (0, 1, 2, ...)	Channel status	Green	channel ON
		Green Blinking	Counter or pulse mode
		Off	channel OFF

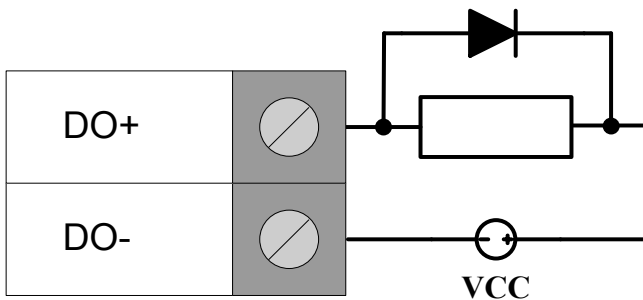
### Wiring Guide

The wiring guide shown below is for 86M-2830D-T module.

**Resistive Load**



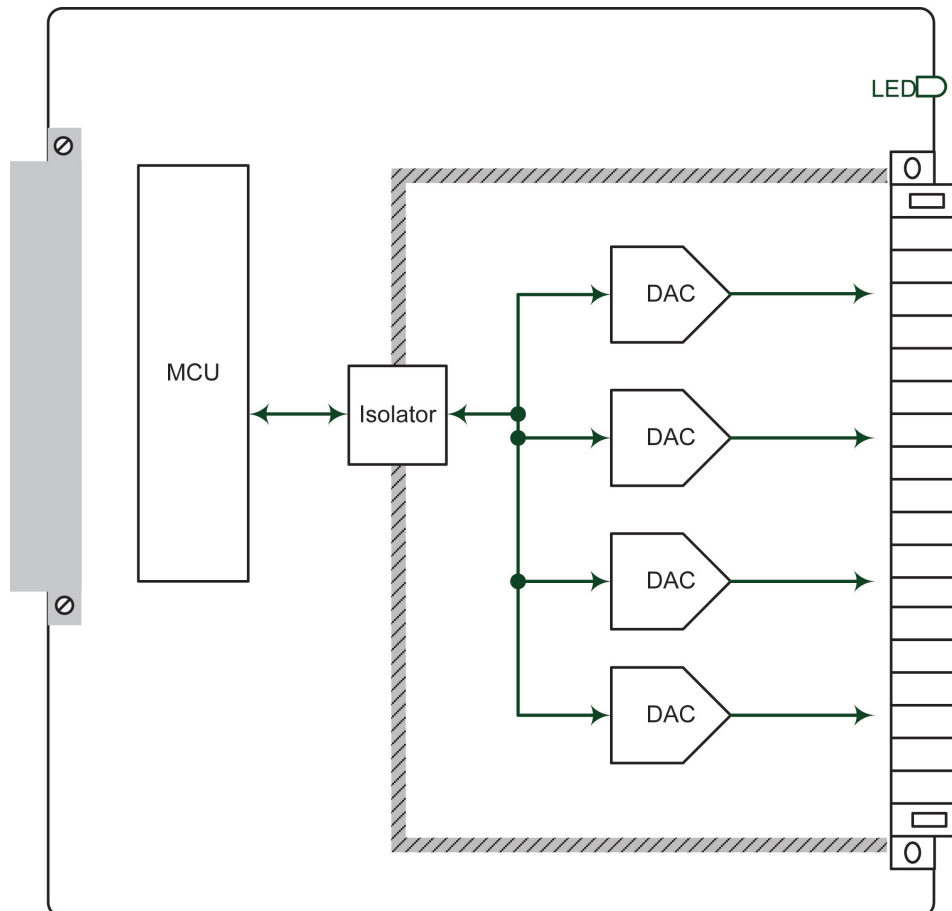
**Inductive Load**



## 86M-4420-T: 4 AOs, 0 to 10 V, -10 to 10 V, 0 to 20 mA, or 4 to 20 mA

The 86M-4420-T module is a 4-channel analog output module that supports wide temperature operation.

### Block Diagram



### Specifications

#### Inputs and Outputs

**Analog Outputs:** 4 channels

**Isolation:** 3K VDC or 2K Vrms

#### Analog Output

**Resolution:** 12 bits

**Output Range:** -10 to 10 V, 0 to 10 V, 0 to 20 mA, 4 to 20 mA

**I/O mode:** Static or Waveform mode

**Voltage Output:** 10 mA (max.)

**Accuracy:**  $\pm 0.1\%$  FSR @ 25°C  $\pm 0.3\%$  FSR @ -40 and 75°C

#### Current Load Resistance:

Internal Power: 400 ohms

External 24 VDC Power: 1000 ohms

**Update Rate:** Software polling or waveform mode

**Waveform Type:** Sine, Triangle, Square

**Wavemode Frequency:** 125 Hz

**Physical Characteristics**

**Wiring:** I/O cable, 16 AWG (max.)

**Connector:** Spring-type terminal block

**Environmental Limits**

**Operating Temperature:** -40 to 75°C (-40 to 176°F)

**Power Requirements**

**Input Current:**

94.2 mA @ 24 VDC (voltage)

143.8 mA @ 24 VDC (current)

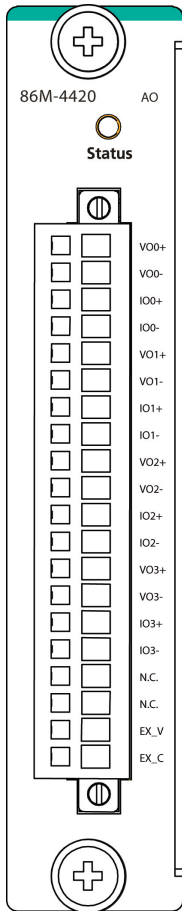
**MTBF (mean time between failures)**

**Time:** 2,409,345 hrs.

**Standard:** Telcordia SR332

**Pin assignment**

Refer to the following figure for the 86M-4420-T module’s pin assignment.

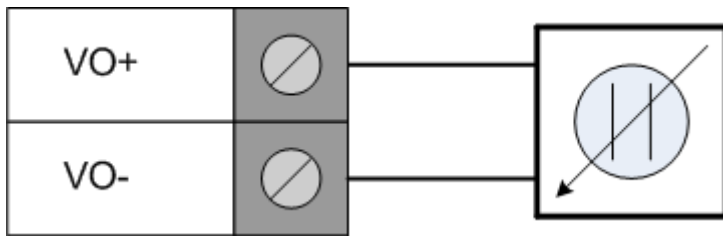


Label	Indication	Color	Action
Status	Module status	Green	Module ready
		Red	Configuration failed
		Off	Not connected

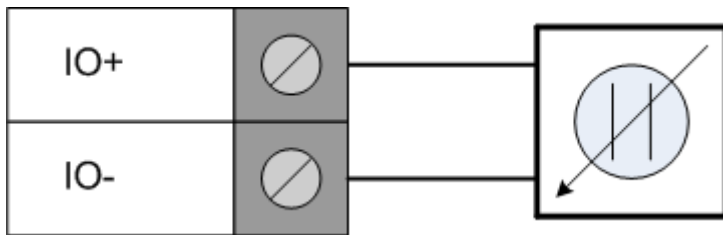
### Wiring Guide

The wiring guide shown below is for the 86M-4420-T module.

#### Voltage



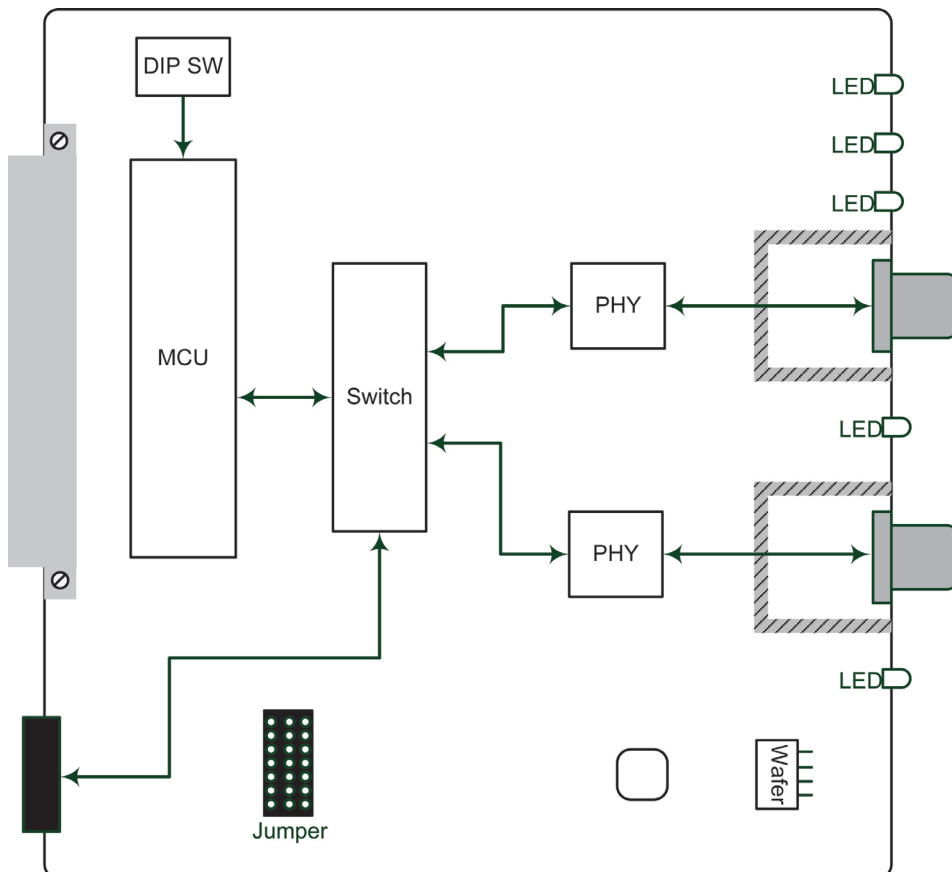
#### Current



### 86M-5212U-T: 2-port 2-wire Ethernet switch

The 86M-5212U-T module is a 2-port 2-wire Ethernet switch module that support wide temperature operation.

#### Block diagram





## Specifications

### Ethernet Communication

**Interface:** 2 2-wire Ethernet ports

**Isolation:** To system: 3k VDC or 2k Vrms

### Standards

**Supported Standards:**

100BASE-TX IEEE 802.3u

10BASE-T IEEE 802.3

100 Mbps BroadR-Reach®

10 Mbps BroadR-Reach®

### Physical Characteristics

**Wiring:** CAT 5 standard cable with M12 D-code male connection

**Connectors:** M12 (D-code, female) x 2

**Channel LED:** Yes

### Environmental Limits

**Operating Temperature:** -40 to 75°C (-40 to 176°F)

### Power Requirements

**Input Current:** 578 mA @ 3.3 VDC

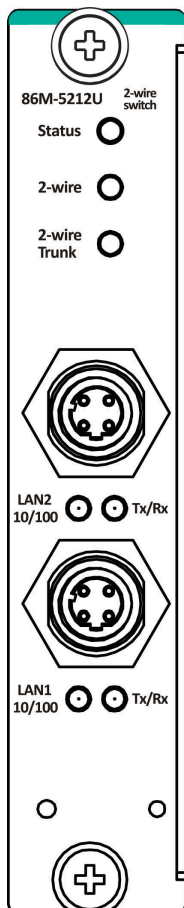
### MTBF (mean time between failures)

**Time:** 2,498,942 hrs.

**Standard:** Telcordia SR332

## Pin Assignment

The following is the 86M-5212U-T module's pin assignment.



**Pin 1: Reserved**

**Pin 2: TRD+**

**Pin 3: Reserved**

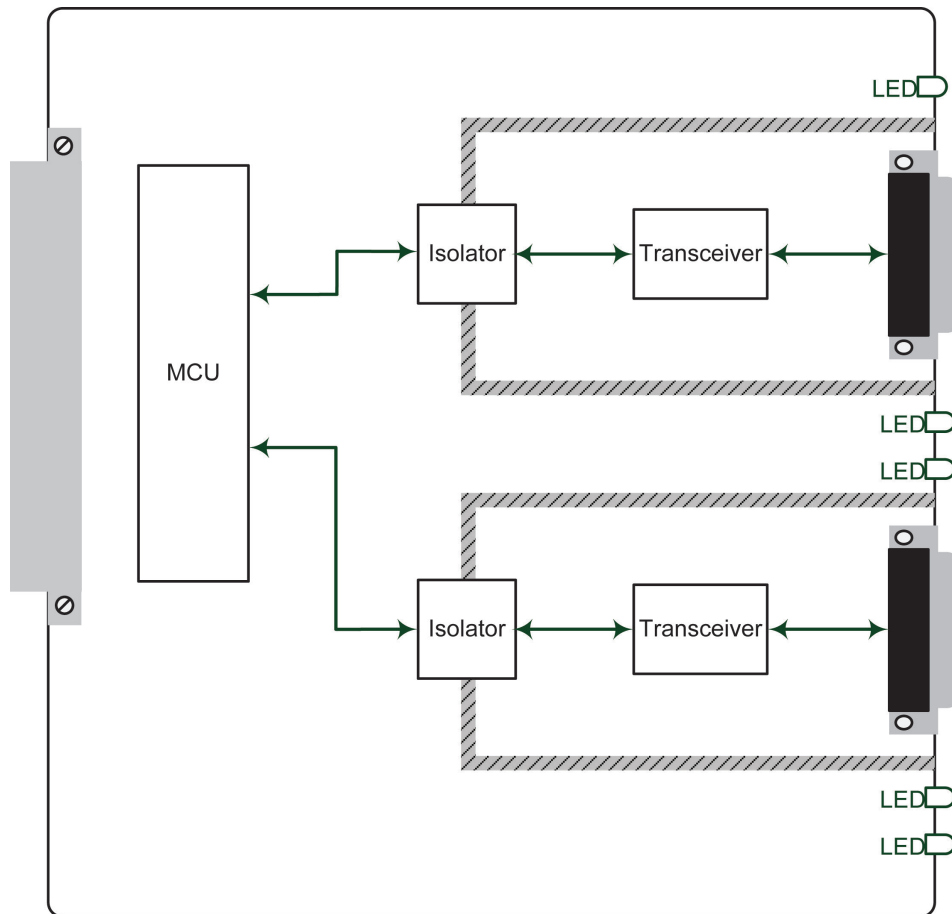
**Pin 4: TDR-**

Label	Indication	Color	Status
Status	Module status	Green	Module ready
		Red	Configuration failed
		Off	Not connected
2-wire	2-wire	Green	Device in 2-wire mode
2-wire trunk	2-wire trunk	Green	Device in 2-wire trunk mode
LANx 10/100 (x = 1, 2)	LAN port	Green	100 Mbps
		Amber	10 Mbps
		Off	Not connected
Tx/Rx	Tx/Rx	Green blinking	Data transmission

## 86M-5250-T: 2 CAN ports, channel LED

The 86M-5250-T module is a 2-port CAN communication module that supports wide temperature operation and the CANopen protocol.

### Block diagram



### Specifications

#### Ethernet Communication

**Interface:** 2 CAN ports

#### Isolation:

To system: 3k VDC or 2k Vrms

#### CAN Bus Communication

##### Protocols:

CAN 2.0A

CAN 2.0B

CANopen DS301, V4.02

**Speed:** 10/20/50/125/250/500/800/1000 kbps and user define

**Termination Resistor:** N/A, 120 ohms (by DIP)

#### Physical Characteristics

**Connector:** DB9 male

**Channel LED:** Yes

#### Environmental Limits

**Operating Temperature:** -40 to 75°C (-40 to 176°F)

**Power Requirements**

**Input Current:** 60 mA @ 24 VDC

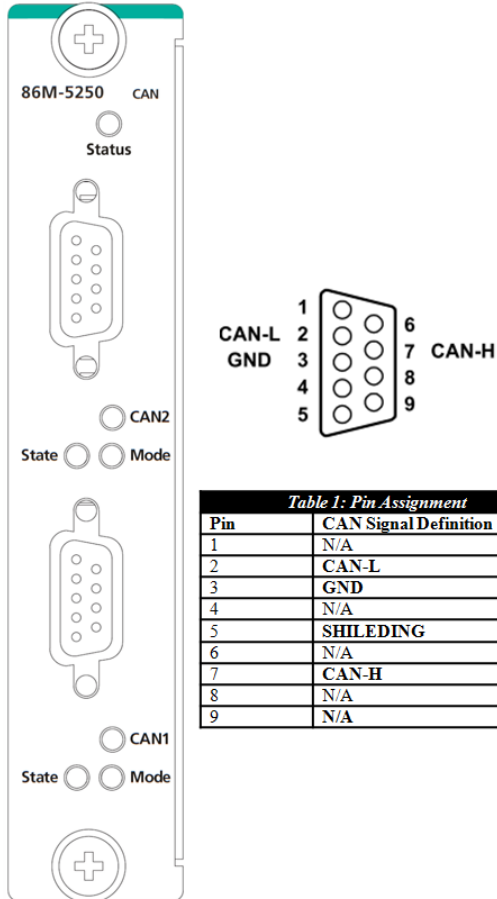
**MTBF (mean time between failures)**

**Time:** 3,306,609 hrs.

**Standard:** Telcordia SR332

**Pin Assignment**

The following is the 86M-5250-T module’s pin assignment.



*Table 1: Pin Assignment*

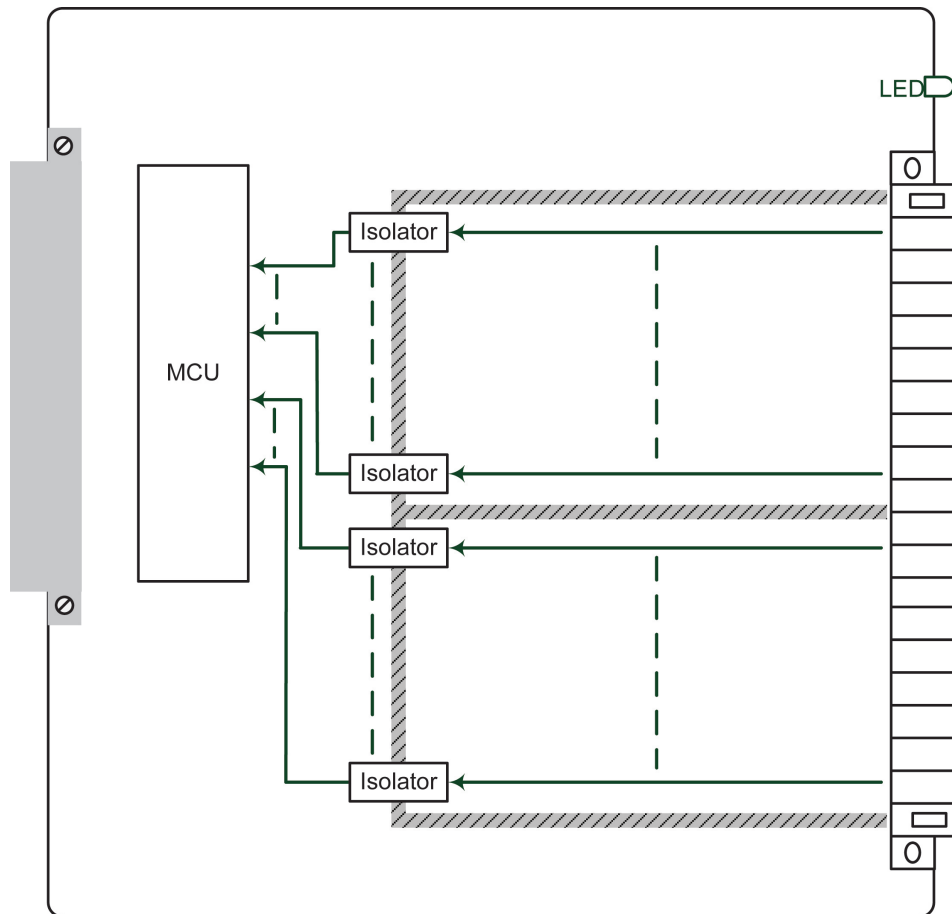
Pin	CAN Signal Definition
1	N/A
2	CAN-L
3	GND
4	N/A
5	SHIELDING
6	N/A
7	CAN-H
8	N/A
9	N/A

Label	Indication	Color	Status
Status	Module status	Green	Module ready
		Red	Configuration failed
		Off	Not connected
CANx	CAN Port	Green blinking	Tx transmitting
		Amber blinking	Rx transmitting
		Off	Not transmitting
Mode	CAN Mode	Green	Master mode
State	CAN State	Amber	Error
		Off	Normal

## 85M-1602-T: 16 DIs, sink/source, 24 VDC, dry contact

The 85M-1602-T module is a 16-channel, sink/source, or dry contact type digital input module that support wide temperature and high isolation protection.

### Block Diagram



### Specifications

The following are the 85M-1602-T module's product specifications.

#### Inputs and Outputs

**Digital Inputs:** 16 channels

**Isolation:** 3K VDC or 2K Vrms

#### Digital Inputs

**Sensor Type:** Wet contact (NPN or PNP), dry contact

**I/O Mode:** Counter or Frequency

#### Dry Contact:

- On: short to GND
- Off: open

#### Wet Contact (DI to COM):

- Off: 0 to 3 VDC
- On: 10 to 30 VDC

**Common Type:** 8 points per COM

**Counter Frequency:** 5 kHz

**Digital Filtering Time Interval:** Software selectable (by 0.1 ms)

**Physical Characteristics**

**Wiring:** I/O cable, max. 16 AWG

**Connector:** Spring type terminal block

**Environmental Limits**

**Operating Temperature:** -40 to 75°C (-40 to 176°F)

**Power Requirements**

**Input Current:** 363.6 mA @ 3.3 VDC

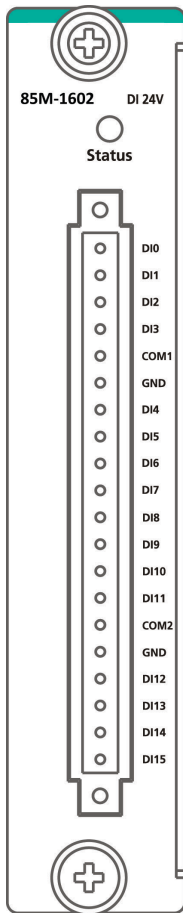
**MTBF (mean time between failure)**

**Time:** 1,132,561 hrs.

**Standard:** Telcordia SR332

**Pin Assignment and Wiring Guide**

The following is 85M-1602-T module’s pin assignment and wiring guide.

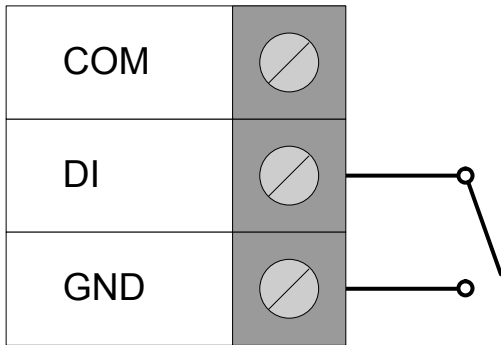


Label	Indication	Color	Action
Status	Module status	Green	Module ready
		Red	Configuration failed
		Off	Not connected

## Wiring Guide

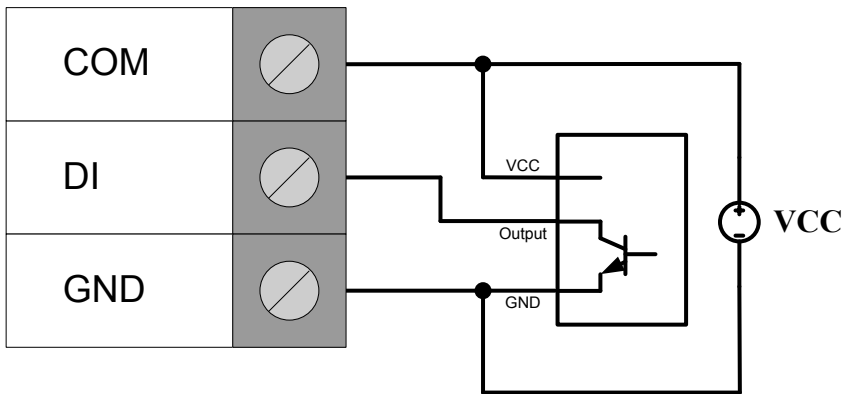
The following wiring guide is for the 85M-1602-T module.

### Dry Contact

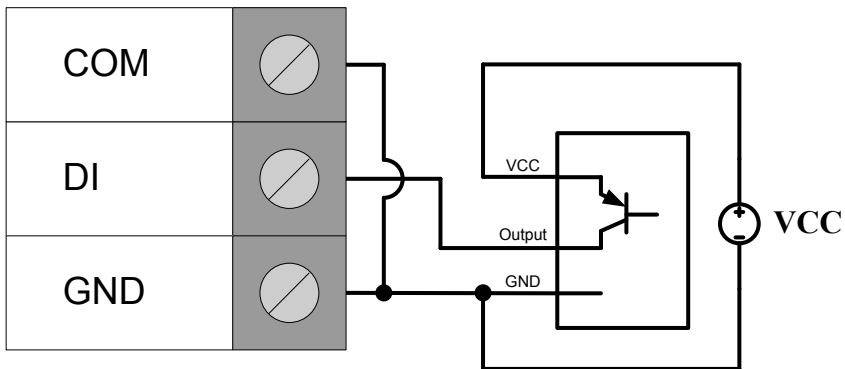


### Wet Contact

#### Source Type



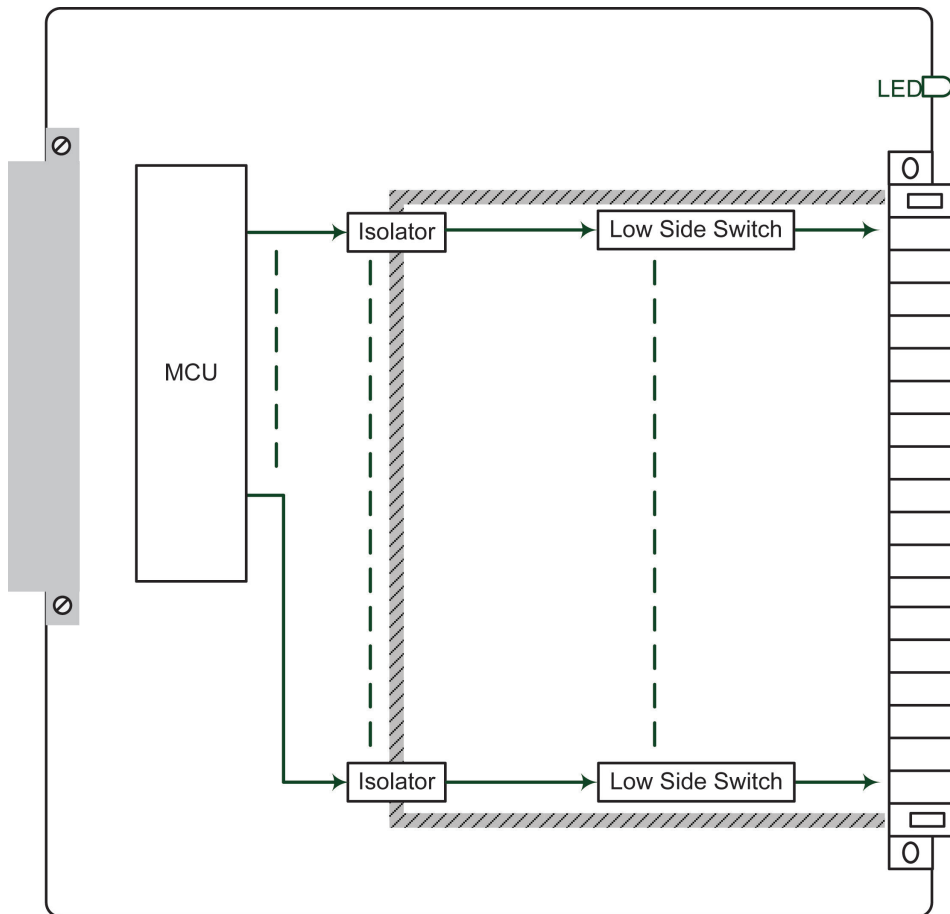
#### Sink Type



## 85M-2600-T: 16 DOs, sink, 24 VDC

The 85M-2600-T features sink type sixteen digital output channels. The 85M-2600-T can use the module's digital outputs to determine the state of limit or safety switches, or to receive remote digital signals.

### Block Diagram



### Specifications

The following are the 85M-2600-T module's product specifications.

#### Inputs and Outputs

**Digital Outputs:** 16 channels

**Isolation:** 3K VDC or 2K Vrms

#### Digital Outputs

**Type:** Sink

**I/O Mode:** DO or PWM

**Pulse Output Frequency:** 5 kHz

**Over-voltage Protection:** 45 VDC

**Over-current Protection:** 2.6 A (4 channels @ 650 mA)

**Over-temperature Shutdown:** 175°C (typical), 150°C (min.)

**Current Rating:** 200 mA per channel

#### Physical Characteristics

**Wiring:** I/O cable, max. 16 AWG

**Connector:** Spring type terminal block

**Environmental Limits**

**Operating Temperature:** -40 to 75°C (-40 to 176°F)

**Power Requirements**

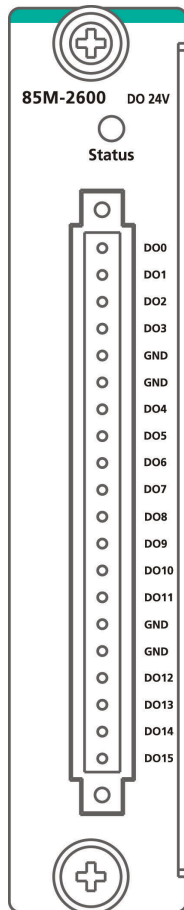
**Input Current:** 257.6 mA @ 3.3 VDC

**MTBF (mean time between failure)**

**Time:** 792,571 hrs.

**Standard:** Telcordia SR332

**Pin Assignment and Wiring Guide**



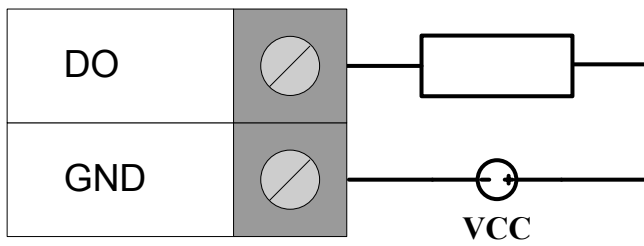
Label	Indication	Color	Action
Status	Module status	Green	Module ready
		Red	Configuration failed
		Off	Not connected



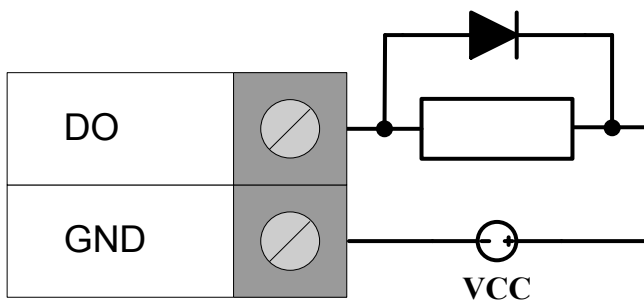
## Wiring Guide

The following wiring guide is for the 85M-2600-T module.

### Resistive Load



### Inductive Load

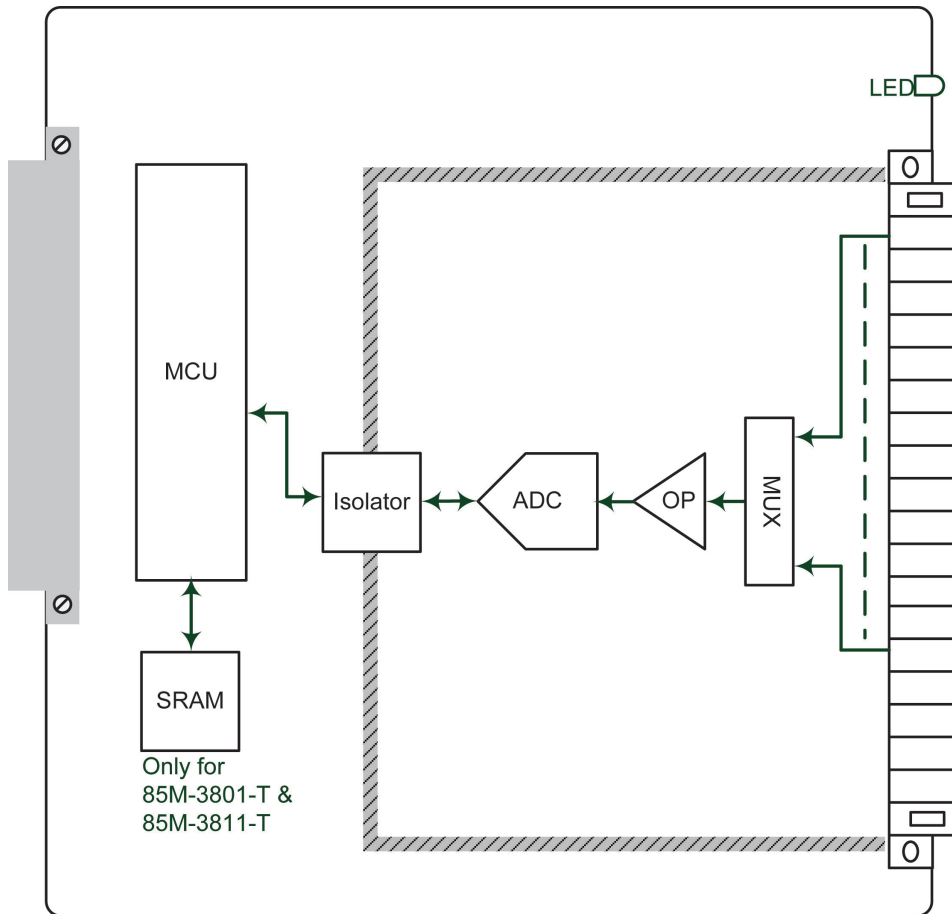


### 85M-38XX-T: 8 AIs

The 85M-38XX-T series provides eight 16-bit analog input modules. It accepts voltage inputs (0–10 V) and current input (4–20 mA). This high performance analog input module features high density I/O with a flexible topology and hot-swappable functionality. This module is cost-effective solution for most industrial application.

### Block Diagram

The following is the 85M-38XX-T module’s block diagram. The 85M-38XX-T uses an MCU processor that has three communication interfaces: SPI, RS232, and USB. The MCU processor accesses the ADC and SRAM by SPI, whereas the 85M-38XX-T module communicates with the modular head through RS-232 and USB interfaces. The 85M-38XX-T has isolation protection up to 3K VDC or 2K Vrms.



## Specifications

The following are the 85M-38XX-T module's product specifications.

### **85M-3800-T: 8 analog inputs, 4 to 20 mA Specifications**

#### **Inputs and Outputs**

**Analog Inputs:** 8 channels

**Isolation:** 3K VDC or 2K Vrms

#### **Analog Inputs**

**Type:** Differential

**Resolution:** 16 bits

**I/O Mode:** 4 to 20 mA (wire off)

#### **Accuracy:**

±0.1% FSR @ 25°C

±0.3% FSR @ -40 and 75°C

#### **Sampling Rate:**

- All channels: 100 samples/sec
- Per channel: 12.5 samples/sec

**Input Impedance:** 125 ohms (min.)

#### **Physical Characteristics**

**Wiring:** I/O cable, max. 16 AWG

**Connector:** Spring type terminal block

#### **Environmental Limits**

**Operating Temperature:** -40 to 75°C (-40 to 176°F)

#### **Power Requirements**

**Input Current:** 318.2 mA @ 3.3 VDC

#### **MTBF (mean time between failure)**

**Time:** 1,512,906 hrs.

**Standard:** Telcordia SR332

### **85M-3801-T: 8 analog inputs, 4 to 20 mA, 40 kHz Specifications**

#### **Inputs and Outputs**

**Analog Inputs:** 8 channels

**Isolation:** 3K VDC or 2K Vrms

#### **Analog Inputs**

**Type:** Differential

**Resolution:** 16 bits

**I/O Mode:** 4 to 20 mA (wire off)

**Historical Data Buffering:** Up to 6 sec per channel

#### **Accuracy:**

±0.1% FSR @ 25°C

±0.3% FSR @ -40 and 75°C

#### **Sampling Rate:**

- All channels: 40k samples/sec
- Per channel: 5k samples/sec

**Input Impedance:** 125 ohms (min.)

#### **Physical Characteristics**

**Wiring:** I/O cable, max. 16 AWG

**Connector:** Spring type terminal block

#### **Environmental Limits**

**Operating Temperature:** -40 to 75°C (-40 to 176°F)

#### **Power Requirements**

**Input Current:** 378.8 mA @ 3.3 VDC

**MTBF (mean time between failure)****Time:** 1,410,655 hrs**Standard:** Telcordia SR332**85M-3810-T: 8 analog inputs, 0 to 10 VDC Specifications****Inputs and Outputs****Analog Inputs:** 8 channels**Isolation:** 3K VDC or 2K Vrms**Analog Inputs****Type:** Differential**Resolution:** 16 bits**I/O Mode:** 0 to 10 VDC**Accuracy:**

±0.1% FSR @ 25°C

±0.3% FSR @ -40 and 75°C

**Sampling Rate:**

- All channels: 100 samples/sec
- Per channel: 12.5 samples/sec

**Input Impedance:** 200 k-ohms (min.)**Physical Characteristics****Wiring:** I/O cable, max. 16 AWG**Connector:** Spring type terminal block**Environmental Limits****Operating Temperature:** -40 to 75°C (-40 to 176°F)**Power Requirements****Input Current:** 315.2 mA @ 3.3 VDC**MTBF (mean time between failure)****Time:** 1,530,690 hrs.**Standard:** Telcordia SR332**85M-3811-T: 8 analog inputs, 0 to 10 VDC, 40 kHz Specifications****Inputs and Outputs****Analog Inputs:** 8 channels**Isolation:** 3K VDC or 2K Vrms**Analog Inputs****Type:** Differential**Resolution:** 16 bits**I/O Mode:** 0 to 10 VDC**Historical Data Buffering:** Up to 6 sec per channel**Accuracy:**

±0.1% FSR @ 25°C

±0.3% FSR @ -40 and 75°C

**Sampling Rate:**

- All channels: 40k samples/sec
- Per channel: 5k samples/sec

**Input Impedance:** 20 M-ohms (min.)**Physical Characteristics****Wiring:** I/O cable, max. 16 AWG**Connector:** Spring type terminal block**Environmental Limits****Operating Temperature:** -40 to 75°C (-40 to 176°F)**Power Requirements****Input Current:** 378.8 mA @ 3.3 VDC

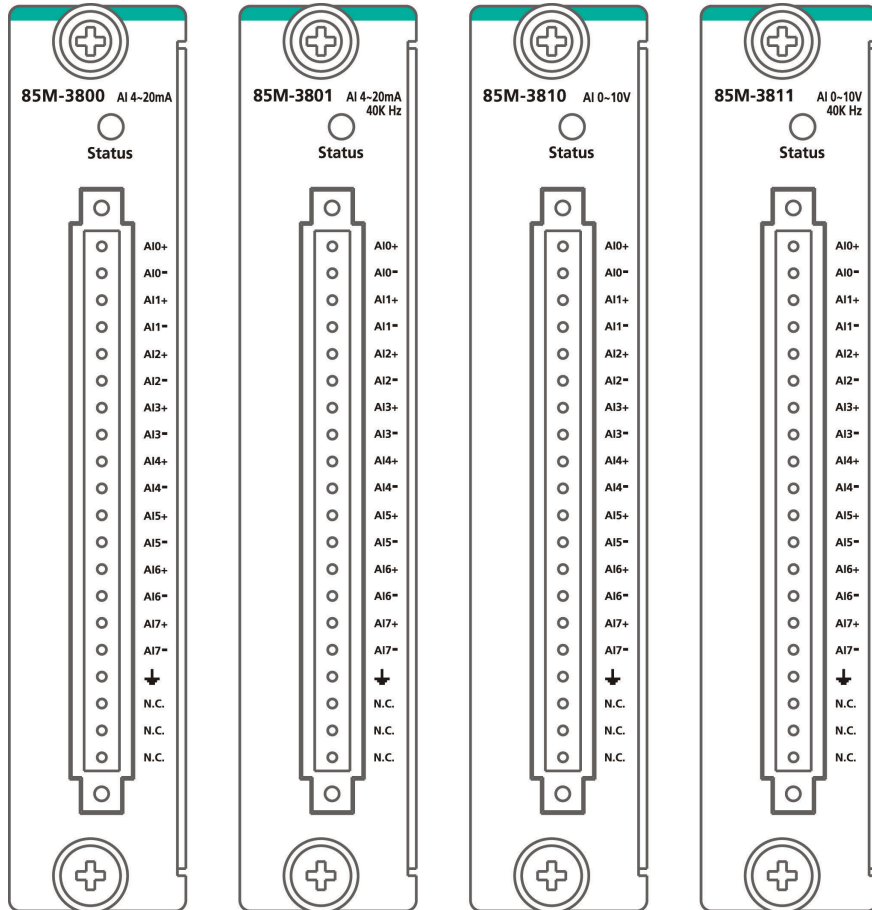
**MTBF** (mean time between failure)

**Time:** 1,426,112 hrs.

**Standard:** Telcordia SR332

**Pin Assignment**

The following is the 85M-38XX-T module's pin assignment.

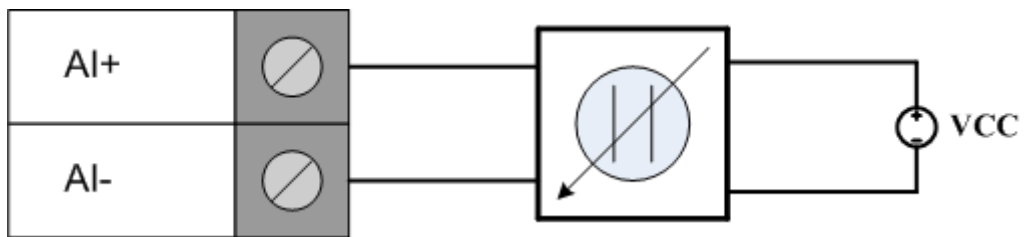


Label	Indication	Color	Action
Status	Module status	Green	Module ready
		Red	Configuration failed
		Off	Not connected

## Wiring Guide

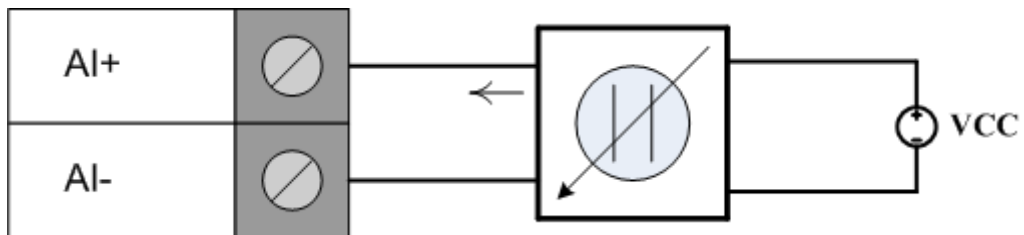
The following wiring guide for the 85M-38xx-T module.

### Voltage:

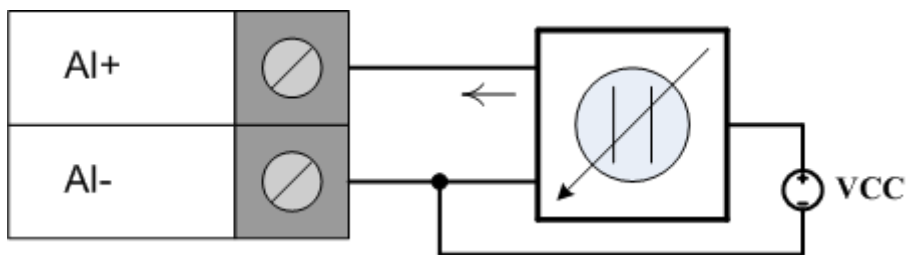


### Current:

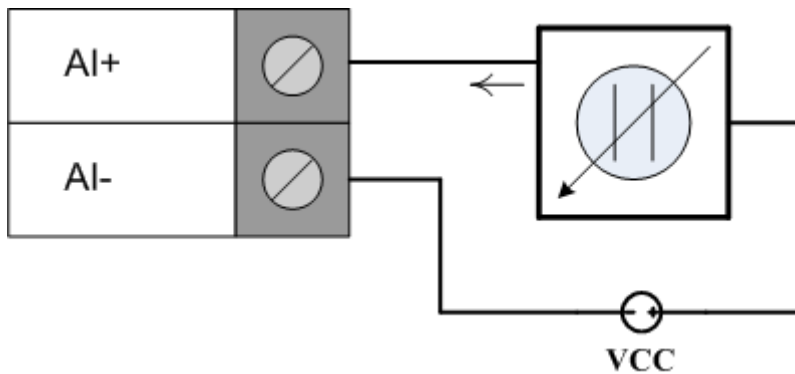
#### 4-wire



#### 3-wire



#### 2-wire



## Analog Input Data Format

The I/O analog inputs have a 16-bit, unipolar, and analog to digital (A/D) converter that measures input voltages from 0–10 V and current from 4–20 mA (with Burnout). The following chart is the raw data conversion table for current and voltage.

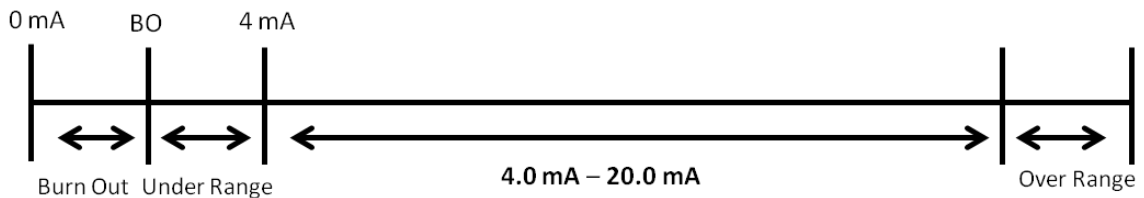
The voltage ranges from 0 to 10 V. The lowest voltage of 0 V represents raw data of 0, and the highest voltage of 10 V represents raw data of 65535. When the raw voltage data is at 1, it represents 0.15 mV. The current ranges from 0 to 20 mA. The lowest current of 0 mA represents a raw data value of 0. Users can manually adjust the burnout value from 0 to 4 mA. All raw data below the burnout value will be 0. The highest current of 20 mA represents raw data of 65535. Raw current data of 1 represents 0.3125  $\mu$ A.

Burnout mode can indicate if the current analog input has burned out.

**NOTE** Refer to the **ioPAC Programmable Controller Software User's Manual** for the burnout mode settings.

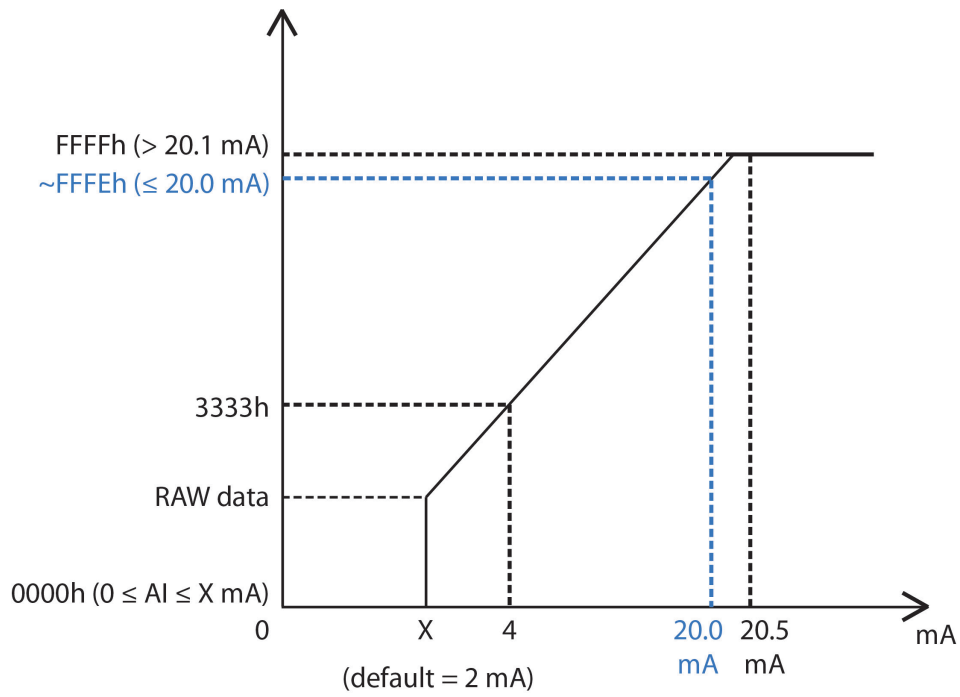
**NOTE** Grounding the device through the earth/ground pin (  $\perp$  ) gives 6kV ESD protection.

The 4–20 mA burnout mode values are defined in the following diagram:



Users can define burnout values for selected ranges. When input values are in the burnout range, raw data will register as 0000h to indicate analog input burnout. The definition of raw data is as follows:

Burnout Value (BO)	0.0 < BO < 4.0	User-defined (default: 2 mA)
Burnout State	$0 \leq AI < BO$ mA	S/W output 0000h
Under Range	$BO \leq AI < 4$ mA	S/W output raw data
Normal Range	$4 \leq AI \leq 20.00$ mA	S/W output raw data until FFFEh
Over Range	$XX > 20.00$ mA	S/W output FFFFh



**Current**

Data	Current
0	0 mA
1	0.3125 $\mu$ A
13107	4 mA
49152	15 mA
65534	20 mA
65535	> 20 mA

**Voltage**

Data	Voltage
0	0 V
1	0.16 mV
16384	2.5 V
32768	5 V
65535	10 V

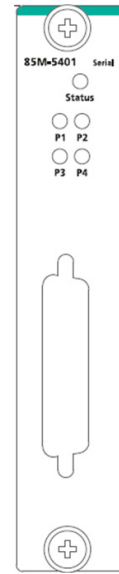


## 85M-5401-T: 4 serial ports (RS-232/422/485 3-in-1)

The 85M-5401-T module is a 3-in-1 DB-44 serial communication port module, which supports RS-232, RS-422, and RS485 communications. The following table shows the serial and protocol communication parameters supported by the 85M-5401-T.

Parameter	Supported Values
Baudrate	300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 921600 bps (Default: 9600 bps)
Mode	RS-232/422/485 (Default: RS-232)
Duplex	Full or Half duplex (Default: Full duplex)
Parity	Odd, None or Even (Default: None)
Data Bits	7 or 8 Bits (Default: 8 Bits)
Stop Bits	1 Bit

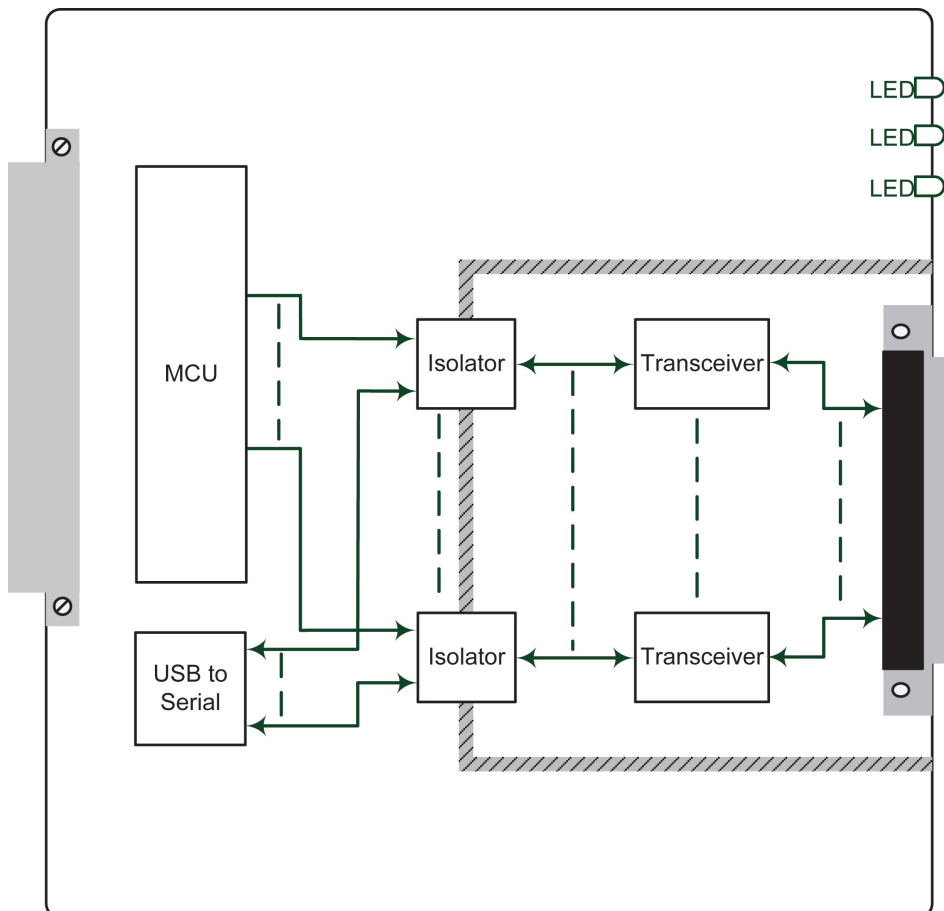
View of the 85M-5401 front panel.



### ATTENTION

The ioPAC Programmable controller only supports up to 2 85M-5401-T modules.

### Block Diagram



## Specifications

The following are the 85M-5401-T module's product specifications.

### Serial Communication

**Interface:** 4 RS-232/422/485 ports, software selectable (DB44 male)

**Isolation:** 3K VDC or 2K Vrms

**Note:** DB44 to 4-port DB9 cable included in the package.

### Serial Communication Parameters

**Parity:** None, Even, Odd

**Data Bits:** 7, 8

**Stop Bits:** 1, 2

**Flow Control:** RTS/CTS, XON/XOFF

**Baudrate:** 300 bps to 921.6 Kbps

### Serial Signals

**RS-232:** TxD, RxD, RTS, CTS, DTR, DSR, DCD, GND

**RS-422:** Tx+, Tx-, Rx+, Rx-, GND

**RS-485-4w:** Tx+, Tx-, Rx+, Rx-, GND

**RS-485-2w:** Data+, Data-, GND

### Physical Characteristics

**Connector:** DB44 female

### Environmental Limits

**Operating Temperature:** -40 to 75°C (-40 to 176°F)

### Power Requirements

**Input Current:** 375.8 mA @ 3.3 VDC

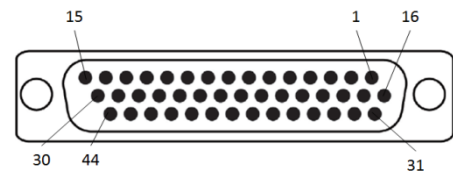
### MTBF (mean time between failure)

**Time:** 596,611 hrs.

**Standard:** Telcordia SR332

## Pin Assignment

The 85M-5401-T module's pin assignment follows. The DB44 to 4-port DB9 cable should be included in the package.



## DB44 Pin Assignments

### DB44 (Female): RS-232

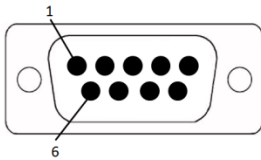
Pin	Signal	Pin	Signal	Pin	Signal
1	TxD3	16	CTS3	31	DCD3
2	RxD3	17	DTR3	32	-
3	RTS3	18	DSR3	33	GND
4	-	19	-	34	-
5	TxD2	20	CTS2	35	DCD2
6	RxD2	21	DTR2	36	-
7	RTS2	22	DSR2	37	GND
8	-	23	-	38	-
9	TxD1	24	CTS1	39	DCD1
10	RxD1	25	DTR1	40	-
11	RTS1	26	DSR1	41	GND
12	-	27	-	42	DCD0
13	TxD0	28	CTS0	43	-
14	RxD0	29	DTR0	44	GND
15	RTS0	30	DSR0		

### DB44 (Female): RS-422/RS-485 (4-wire)

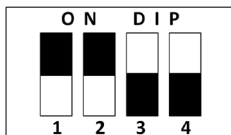
Pin	Signal	Pin	Signal	Pin	Signal
1	RxD3+(B)	16	-	31	TxD3-(A)
2	TxD3+(B)	17	RxD3-(A)	32	-
3	-	18	-	33	GND
4	-	19	-	34	-
5	RxD2+(B)	20	-	35	TxD2-(A)
6	TxD2+(B)	21	RxD2-(A)	36	-
7	-	22	-	37	GND
8	-	23	-	38	-
9	RxD1+(B)	24	-	39	TxD1-(A)
10	TxD1+(B)	25	RxD1-(A)	40	-
11	-	26	-	41	GND
12	-	27	-	42	TxD0-(A)
13	RxD0+(B)	28	-	43	-
14	TxD0+(B)	29	RxD0-(A)	44	GND
15	-	30	-		

**DB44 (Female): RS-485 (2-wire)**

Pin	Signal	Pin	Signal	Pin	Signal
1	Data3+(B)	16	-	31	-
2	-	17	Data3-(A)	32	-
3	-	18	-	33	GND
4	-	19	-	34	-
5	Data2+(B)	20	-	35	-
6	-	21	Data2-(A)	36	-
7	-	22	-	37	GND
8	-	23	-	38	-
9	Data1+(B)	24	-	39	-
10	-	25	Data1-(A)	40	-
11	-	26	-	41	GND
12	-	27	-	42	-
13	Data0+(B)	28	-	43	-
14	-	29	Data0-(A)	44	GND
15	-	30	-		

**DB9 Pin Assignment****DB9 (Female): RS-232/RS-422/RS-485**

Pin	RS-232	RS-422/RS-485(4-wire)	RS-485 (2-wire)
1	DCD	TxD-(A)	-
2	RxD	TxD+(B)	-
3	TxD	RxD+(A)	Data+(B)
4	DTR	RxD-(B)	Data-(A)
5	GND	GND	GND
6	DSR	-	-
7	RTS	-	-
8	CTS	-	-
9	-	-	-

**DIP Switch**

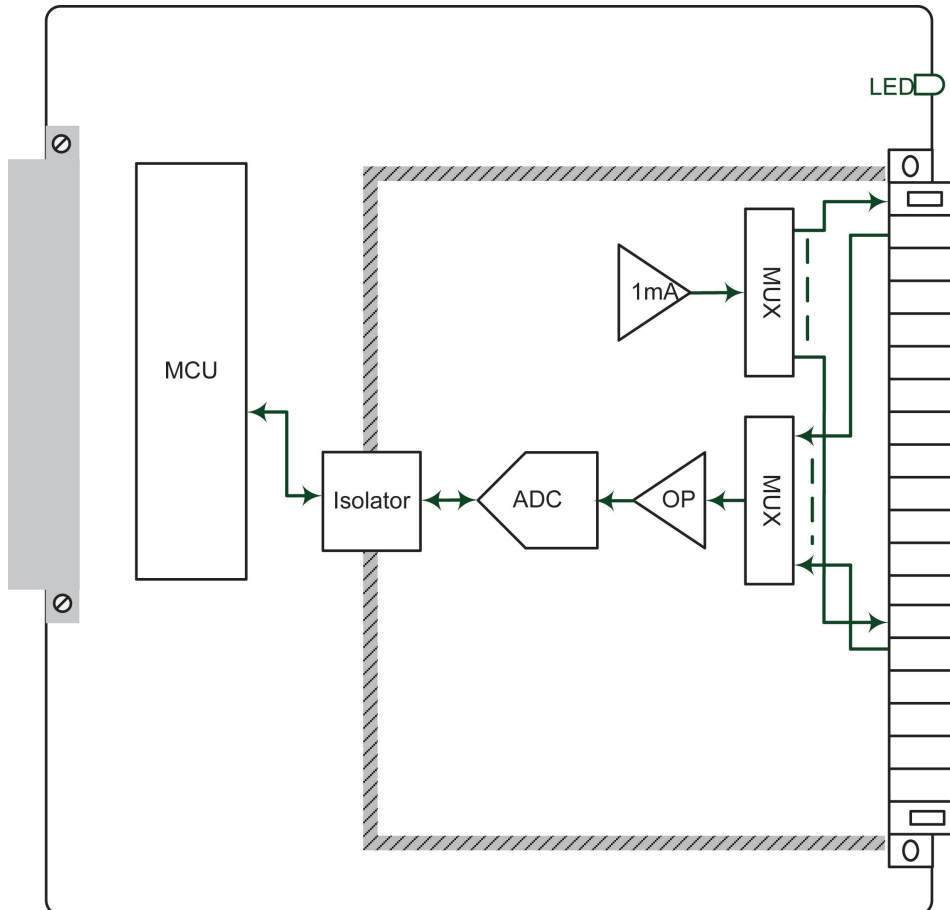
DIP Switch	ON	OFF
1	1K Ohm Pull High Resistor	150K Ohm Pull High Resistor (default)
2	1K Ohm Pull Low Resistor	150K Ohm Pull High Resistor (default)
3	120 Ohm Terminal Resistor	None (default)
4	Reserved	Reserved (default)

## 85M-6600-T: RTDs

The 85M-6600-T module provides 6-channel RTD which features high density I/O with a flexible topology and hot-swappable functionality. This module is cost-effective solution for most industrial application.

### Block Diagram

The following is the 85M-6600-T module's block diagram. The 85M-6600-T uses an MCU processor that has three communication interfaces: SPI, RS232, and USB. Whereas the 85M-6600-T module communicates with the modular head through RS-232 and USB interfaces. The 85M-6600-T has isolation protection up to 3K VDC or 2K Vrms.



### Specifications

#### Inputs and Outputs

**RTD Inputs:** 6 channels

**Isolation:** 3K VDC or 2K Vrms

#### RTD Inputs

##### Input Type:

- PT50, PT100, PT200, PT500 (-200 to 850°C)
- PT1000 (-200 to 350°C)
- JPT100, JPT200, JPT500 (-200 to 640°C)
- JPT1000 (-200 to 350°C)
- NI100, NI200, NI500 (-60 to 250°C)
- NI1000 (-60 to 150°C)
- NI120 (-80 to 260°C)
- Resistance of 310, 620, 1250, and 2200

**Sampling Rate (single channel):**

- All channels: 12 samples/sec
- Per channel: 2 samples/sec

**Resolution:** 0.1°C or 0.1 ohm

**Accuracy:** ±0.1% FSR @ 25°C ±0.3% FSR @ -40 and 75°C

**Input Impedance:** 625 kohms (min.)

**Physical Characteristics**

**Wiring:** I/O cable, max. 16 AWG

**Connector:** Spring type terminal block

**Environmental Limits**

**Operating Temperature:** -40 to 75°C (-40 to 176°F)

**Power Requirements**

**Input Current:** 201.5 mA @ 3.3 VDC

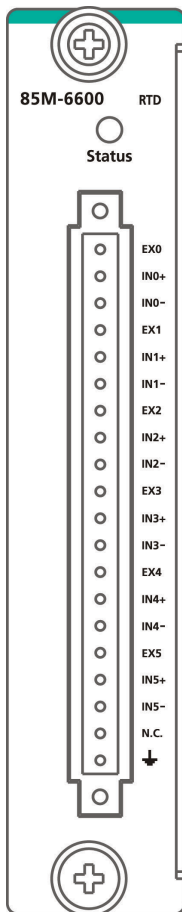
**MTBF (mean time between failure)**

**Time:** 571,446 hrs.

**Standard:** Telcordia SR332

**Pin Assignment**

The following is the 85M-6600-T module’s pin assignment.

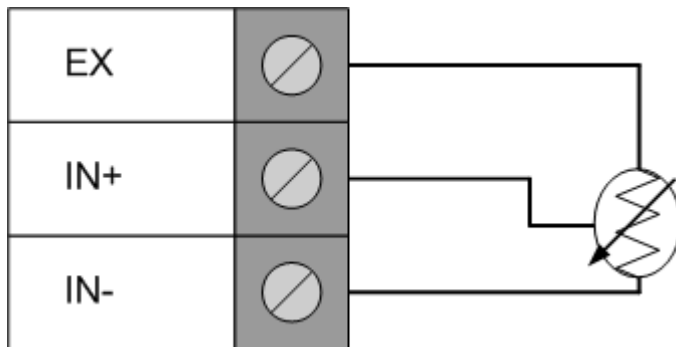


Label	Indication	Color	Action
Status	Module status	Green	Module ready
		Red	Configuration failed
		Off	Not connected

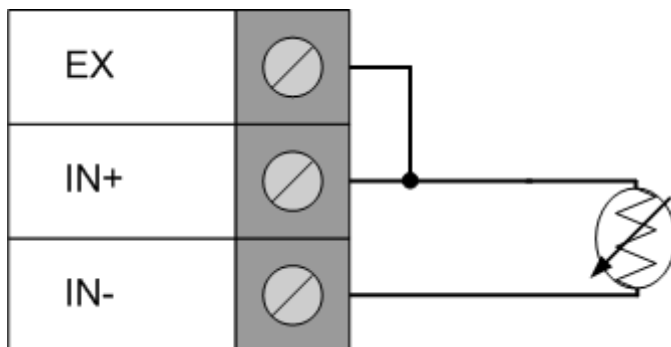
## Wiring Guide

The following wiring guide is for the 85M-6600-T module.

### 3-wire



### 2 wire

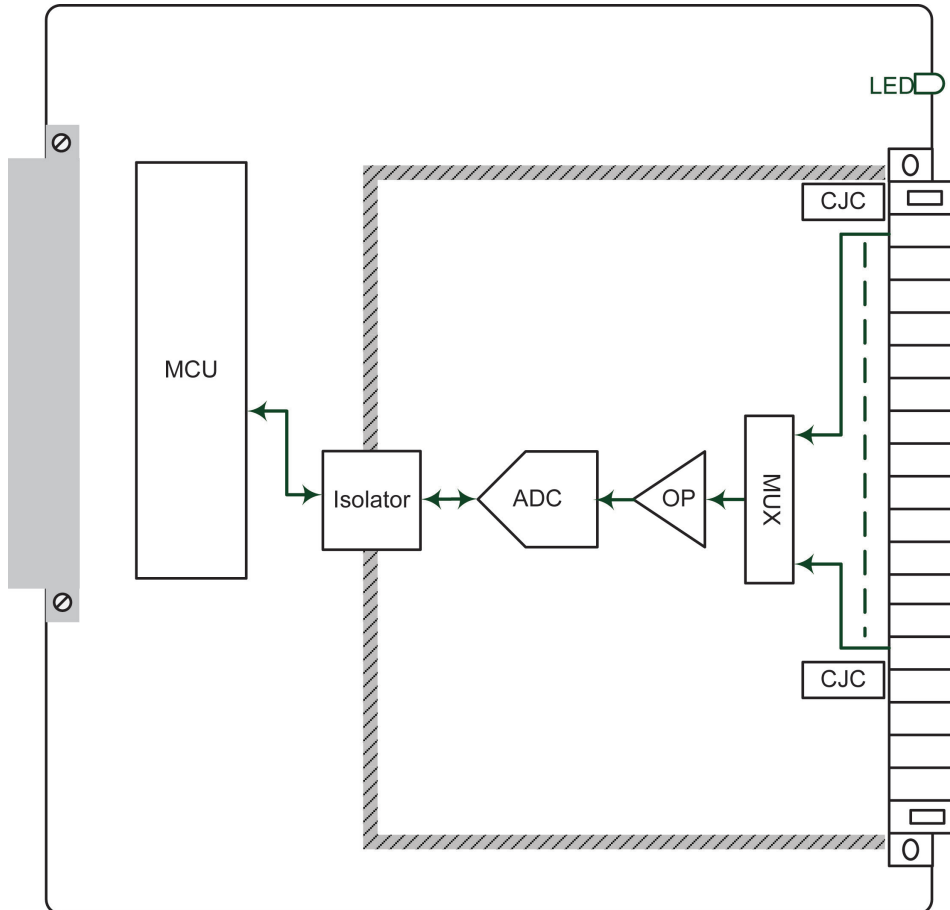


## 85M-6810-T: 8 TCs

The 85M-6810-T module provides 8-channel TC which features high density I/O with a flexible topology and hot-swappable functionality. This module is cost-effective solution for most industrial application.

## Block Diagram

The following is the 85M-6810-T module's block diagram. The 85M-6810-T uses an MCU processor that has three communication interfaces: SPI, RS-232, and USB. Whereas the 85M-6810-T module communicates with the modular head through RS-232 and USB interfaces. The 85M-6810-T has isolation protection up to 3K VDC or 2K Vrms.



## Specifications

### Inputs and Outputs

**Analog Inputs:** 8 channels

**Isolation:** 3K VDC or 2K Vrms

### Thermocouple Inputs

**Sensor Type:** J (0 to 750°C), K (-200 to 1250°C), T (-200 to 350°C), E (-200 to 900°C), R (-50 to 1600°C), S (-50 to 1760°C), B (600 to 1700°C), N (-200 to 1300°C)

### Millivolt Type:

- Mode:  $\pm 78.126$  mV,  $\pm 39.062$  mV,  $\pm 19.532$  mV
- Fault and over-voltage protection: -35 to +35 VDC (power off); -25 to +30 VDC (power on)

### Sampling Rate (single channel):

- All channels: 12 samples/sec
- Per channel: 1.5 samples/sec

**Resolution:** 16 bits

**Accuracy:**  $\pm 0.1\%$  FSR @ 25°C  $\pm 0.3\%$  FSR @ -40 and 75°C

**Input Impedance:** 1 Mohms (min.)

### Physical Characteristics

**Wiring:** I/O cable, max. 16 AWG

**Connector:** Spring type terminal block



**Environmental Limits**

**Operating Temperature:** -40 to 75°C (-40 to 176°F)

**Power Requirements**

**Input Current:** 175.5 mA @ 3.3 VDC

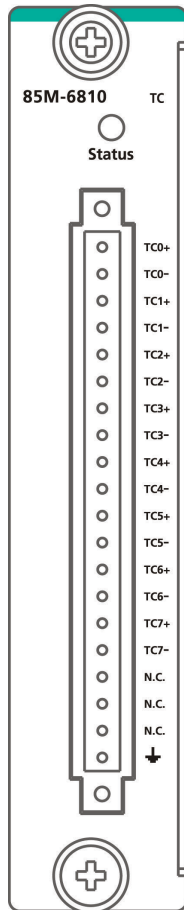
**MTBF (mean time between failure)**

**Time:** 2,324,891 hrs.

**Standard:** Telcordia SR332

**Pin Assignment**

The following is the 85M-6810-T module's pin assignment.

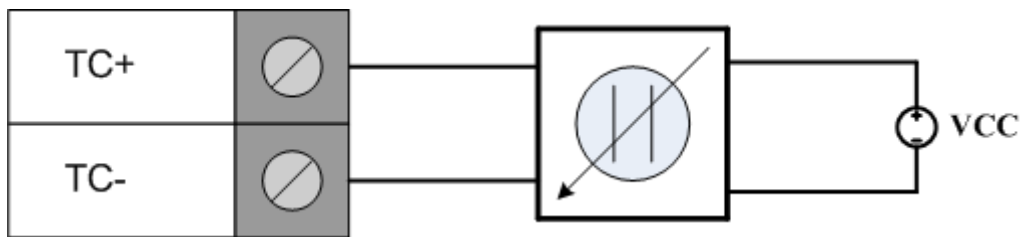


Label	Indication	Color	Action
Status	Module status	Green	Module ready
		Red	Configuration failed
		Off	Not connected

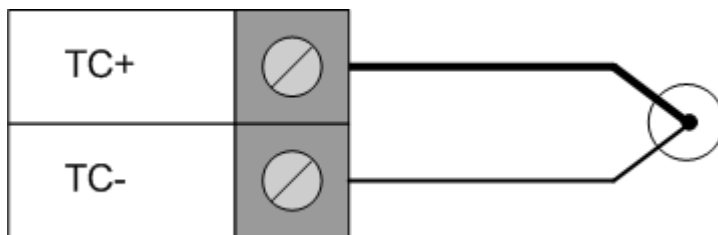
## Wiring Guide

The following wiring guide is for the 85M-6810-T module.

### Voltage



### Thermocouple



**NOTE** Grounding the device through the earth/ground pin (  $\perp$  ) gives 6 kV ESD protection.