

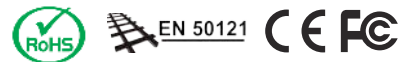
# ioPAC 8500 Series



## Rugged modular RTU controllers



- > Dedicated ARM (RISC) CPUs for the main system and each I/O module
- > Millisecond timestamp granularity for digital input and analog input
- > Supports 5 kHz sampling rate on every channel
- > Pre-recording for analog input data logging
- > Supports C/C++ and IEC 61131-3 programming languages
- > Compliant with EN 50121-3-2, EN 50121-4, and a portion of EN 50155 specifications
- > Robust and compact design for harsh environments
- > Modular I/O for versatility, flexibility, and scalability



### Overview

The ioPAC 8500 modular RTU controllers use an ARM9 industrial grade CPU for the system, and ARM Cortex™ M4 CPUs for the modules. The controllers have 2, 5, or 9 I/O slots for 85M series modules. The USB bus between the controller CPU and module CPUs transmits data at up to 200 Mbps, and the dual CPU architecture supports a 5 kHz (per channel) analog input sampling rate, pre-recording of analog input data, and timestamping with millisecond granularity. Moreover, the ioPAC 8500 supports C/C++, rail-level surge

and ESD protection, a -40 to 75°C operating temperature range, vibration protection, hot-swappable modules, two 10/100 Mbps Ethernet ports with two MACs (with port trunking capabilities), and two 3-in-1 serial ports. Accompanied by Moxa's Active OPC Server and DA-Center data integration software, the ioPAC 8500 series provides a comprehensive solution for data acquisition and control applications in harsh environments.

### High Sampling Rate



High sampling rate AI

Moxa's ioPAC 8500 RTUs use an ARM9 industrial-grade CPU, and the dual CPU architecture supports up to a 5 kHz (per channel) analog input sampling rate, giving engineers the analog data precision they need to correctly analyze events after they have occurred.

### Analog Input Prerecord Feature



Pre-recording

The ioPAC 8500 RTU's prerecord feature allows the RTU controller to continuously record analog input data before an event is triggered. The prerecord feature is a major improvement over products that only start logging data after an event has occurred, because these conventional approaches can often lead to the loss of critical data due to network latency during the event.

### Millisecond Timestamp Granularity



Timestamp

Millisecond timestamp granularity is a powerful aid in post-event analysis and troubleshooting. For example, if an emergency triggers 10 separate I/O events within a 10-millisecond time interval, you will still be able to clearly identify the sequence in which the events occurred, even if the I/O events are recorded by different modules.

### I/O Module Hot-Swapping



Hot-swap

The ioPAC 8500 RTU controller lets you hot-swap I/O modules, allowing engineers to quickly and easily install and replace modules in the field, reducing maintenance costs and streamlining maintenance procedures.

## Specifications

### Computer

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

**I/O CPU:** 32-bit ARM Cortex M4 80 MHz CPU

**OS:** Linux

**Clock:** Real-time clock with battery backup

**Memory:**

- SDRAM: 64 MB
- Flash: 32 MB
- SRAM: 256 KB (battery backup lasts for 1 week)
- microSD™ Slot: Up to 32 GB (SD 2.0 compatible)

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

**Backplane Bus Speed:** Up to 200 Mbps for all slots

### Ethernet Interface

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

**Protection:** 1.5 kV magnetic isolation

### Serial Communication

**Interface:**

- 2 RS-232/422/485 ports, software selectable (DB9 male)
- 1 RS-232 debug port (4-pin connector)

**Serial Line Protection:** 8 kV ESD for all signals

### 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, DTR, DSR, RTS, CTS, DCD, GND, RI

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

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

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

### Software Characteristics

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

**Protocols:** Modbus/TCP, Modbus/RTU Master

### Power Requirements

**Power Input:** 24 VDC nominal, 9 to 48 VDC

**Note:** Compliant with EN 50155 at 24 VDC

**Current for I/O Modules:** 5 A @ 3.3 VDC (max.)

**Power Consumption:** 3.65 W @ 24 VDC

### Physical Characteristics

**Housing:** Aluminum

**Dimensions:**

- 2-slot version: 114.7 x 135 x 100 mm (4.52 x 5.31 x 3.94 in)
- 5-slot version: 190.9 x 135 x 100 mm (7.52 x 5.31 x 3.94 in)
- 9-slot version: 292.5 x 135 x 100 mm (11.52 x 5.31 x 3.94 in)

**Weight:**

- 2-slot version: 1300 g
- 5-slot version: 2000 g
- 9-slot version: 2575 g

**Mounting:** DIN rail mounting (standard), wall mounting (optional)

**Connector:** Spring-type terminal block

### 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)

**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

**EMI:** EN 55022, EN 61000-3-2; EN 61000-3-3; FCC Part 15 Subpart B Class A

**EMS:** EN 55024, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-11

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

**Freefall:** IEC 60068-2-32

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

**Rail Traffic:** EN 50155\*, EN 50121-3-2, EN 50121-4

\*Complies with a portion of EN 50155 specifications. Please contact Moxa or a Moxa distributor for details.

**Note:** Please check Moxa's website for the most up-to-date certification status.

### MTBF (mean time between failures)

**Time:** 859,979 hrs

**Database:** Telcordia (Bellcore)

### Warranty

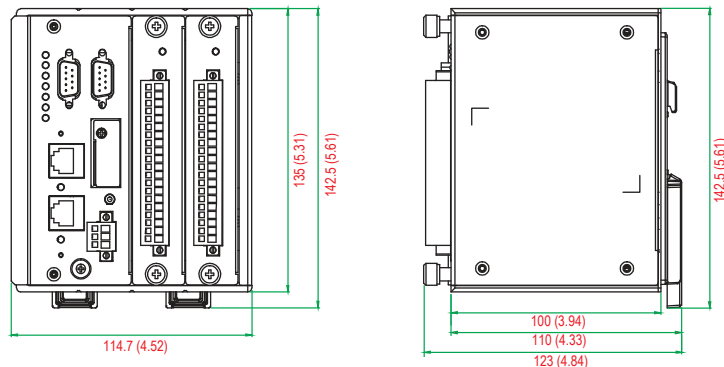
**Warranty Period:** 5 years

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

## Dimensions

Unit: mm (inch)

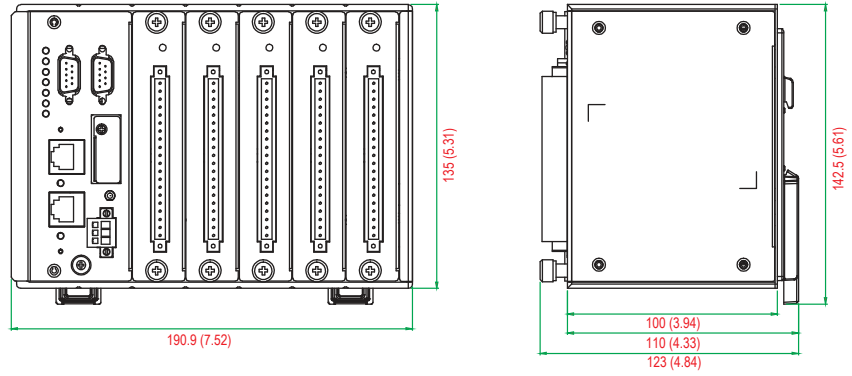
### ioPAC 8500-2



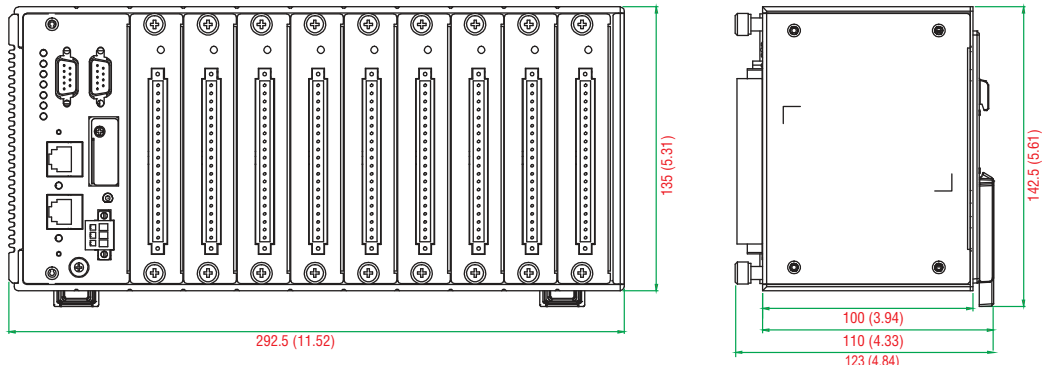
Dimensions

Unit: mm (inch)

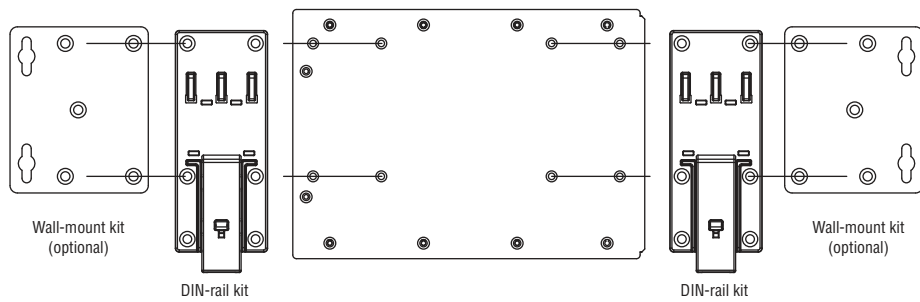
ioPAC 8500-5



ioPAC 8500-9



Mounting Kits



## : Ordering Information

### Available Models

**ioPAC 8500-2-RJ45-C-T:** Modular RTU controller with RJ45 connectors, 2 I/O slots, C/C++, -40 to 75°C operating temperature

**ioPAC 8500-2-M12-C-T:** Modular RTU controller with M12 connectors, 2 I/O slots, C/C++, -40 to 75°C operating temperature

**ioPAC 8500-2-RJ45-IEC-T:** Modular RTU controller with RJ45 connectors, 2 I/O slots, IEC 61131-3, -40 to 75°C operating temperature

**ioPAC 8500-2-M12-IEC-T:** Modular RTU controller with M12 connectors, 2 I/O slots, IEC 61131-3, -40 to 75°C operating temperature

**ioPAC 8500-5-RJ45-C-T:** Modular RTU controller with RJ45 connectors, 5 I/O slots, C/C++, -40 to 75°C operating temperature

**ioPAC 8500-5-M12-C-T:** Modular RTU controller with M12 connectors, 5 I/O slots, C/C++, -40 to 75°C operating temperature

**ioPAC 8500-5-RJ45-IEC-T:** Modular RTU controller with RJ45 connectors, 5 I/O slots, IEC 61131-3, -40 to 75°C operating temperature

**ioPAC 8500-5-M12-IEC-T:** Modular RTU controller with M12 connectors, 5 I/O slots, IEC 61131-3, -40 to 75°C operating temperature

**ioPAC 8500-9-RJ45-C-T:** Modular RTU controller with RJ45 connectors, 9 I/O slots, C/C++, -40 to 75°C operating temperature

**ioPAC 8500-9-M12-C-T:** Modular RTU controller with M12 connectors, 9 I/O slots, C/C++, -40 to 75°C operating temperature

**ioPAC 8500-9-RJ45-IEC-T:** Modular RTU controller with RJ45 connectors, 9 I/O slots, IEC 61131-3, -40 to 75°C operating temperature

**ioPAC 8500-9-M12-IEC-T:** Modular RTU controller with M12 connectors, 9 I/O slots, IEC 61131-3, -40 to 75°C operating temperature

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

**WK-75:** Wallmount kit

**CBL-M12D(MM4P)/RJ45-100 IP67:** M12 to RJ45 cable

**85M-BKTES:** Empty slot cover for ioPAC 85xx modules (3 pcs per package)

**I/O Modules** (can be purchased separately)

**85M-1602-T:** ioPAC 85xx I/O module with 16 DIs, 24 VDC sink/source type, -40 to 75°C operating temperature

**85M-2600-T:** ioPAC 85xx I/O module with 16 DOs, 24 VDC sink type, -40 to 75°C operating temperature

**85M-3800-T:** ioPAC 85xx I/O module with 8 AIs, 4 to 20 mA, -40 to 75°C operating temperature

**85M-3810-T:** ioPAC 85xx I/O module with 8 AIs, 0 to 10 V, -40 to 75°C operating temperature

**85M-3801-T:** ioPAC 85xx I/O module with 8 AIs, 4 to 20 mA, 40 kHz, -40 to 75°C operating temperature

**85M-3811-T:** ioPAC 85xx I/O module with 8 AIs, 0 to 10 V, 40 kHz, -40 to 75°C operating temperature

**85M-6600-T:** ioPAC 85xx I/O module with 6 RTDs, -40 to 75°C operating temperature

**85M-6810-T:** ioPAC 85xx I/O module with 8 TCs, -40 to 75°C operating temperature

**85M-5401-T:** ioPAC 85xx communication module with 4-port Serial, DB44 connectors, -40 to 75°C operating temperature

**Note:** Conformal coating available on request

### Package Checklist (ioPAC 8500)

- ioPAC 8500 controller
- Serial console cable
- Documentation and software CD

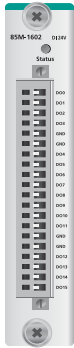
### Package Checklist (85M modules)

- 85M module
- DB44 to 4-port DB9 cable included in 85M-5401-T package



# ioPAC 8500 Series I/O Modules

## 16 digital inputs, 24 VDC, sink/source, dry contact type



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

#### 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:** DI or event counter

#### Dry Contact:

- On: short to GND
- Off: open

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

- NPN (DI to GND):
- On: 0 to 3 VDC
  - Off: 10 to 30 VDC
- PNP (DI to GND):
- 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

#### Power Requirements

**Power Consumption:** 1.2 W @ 3.3 VDC

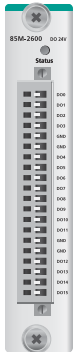
**MTBF (mean time between failures)**

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

**Database:** Telcordia (Bellcore)



## 16 digital outputs, 24 VDC, sink type



### 85M-2600-T: 16 digital outputs, 24 VDC, sink type

#### Inputs and Outputs

**Digital Outputs:** 16 channels  
**Isolation:** 3k VDC or 2k Vrms

#### Digital Outputs

**Type:** Sink  
**I/O Mode:** DO or pulse output  
**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

#### Power Requirements

**Power Consumption:** 0.85 W @ 3.3 VDC

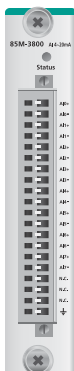
**MTBF (mean time between failures)**

**Time:** 792,571 hrs

**Database:** Telcordia (Bellcore)



## 8 analog inputs, 4 to 20 mA



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

#### 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

#### Power Requirements

**Power Consumption:** 1.05 W @ 3.3 VDC

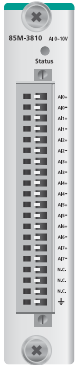
**MTBF (mean time between failures)**

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

**Database:** Telcordia (Bellcore)



## 8 analog inputs, 0 to 10 VDC



### 85M-3810-T: 8 analog inputs, 0 to 10 VDC

#### 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

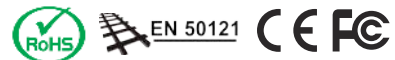
**Wiring:** I/O cable, max. 16 AWG  
**Connector:** Spring type terminal block

#### Environmental Limits

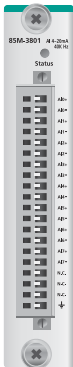
**Operating Temperature:** -40 to 75°C

#### Power Requirements

**Power Consumption:** 1.04 W @ 3.3 VDC  
**MTBF (mean time between failures)**  
**Time:** 1,530,690 hrs  
**Database:** Telcordia (Bellcore)



## 8 analog inputs, 4 to 20 mA, 40 kHz



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

#### 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:** 60KB per channel,  
 6 seconds data buffer at 5KHz

**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

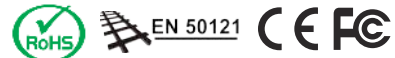
**Wiring:** I/O cable, max. 16 AWG  
**Connector:** Spring type terminal block

#### Environmental Limits

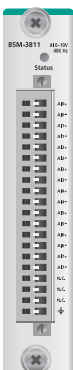
**Operating Temperature:** -40 to 75°C

#### Power Requirements

**Power Consumption:** 1.25 W @ 3.3 VDC  
**MTBF (mean time between failures)**  
**Time:** 1,410,655 hrs  
**Database:** Telcordia (Bellcore)



## 8 analog inputs, 0 to 10 VDC, 40 kHz



### 85M-3811-T: 8 analog inputs, 0 to 10 VDC, 40 kHz

#### 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:** 60 KB per channel,  
 6 seconds data buffer at 5 kHz

**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

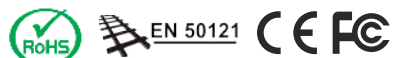
**Wiring:** I/O cable, max. 16 AWG  
**Connector:** Spring type terminal block

#### Environmental Limits

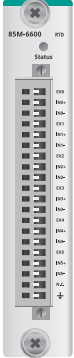
**Operating Temperature:** -40 to 75°C

#### Power Requirements

**Power Consumption:** 1.25 W @ 3.3 VDC  
**MTBF (mean time between failures)**  
**Time:** 1,426,112 hrs  
**Database:** Telcordia (Bellcore)



## 6 RTD inputs



### 85M-6600-T: 6 RTD inputs

#### 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.)

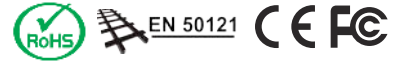
#### Physical Characteristics

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

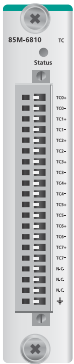
**Connector:** Spring type terminal block

#### Environmental Limits

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



## 8 thermocouple inputs



### 85M-6810-T: 8 thermocouple inputs

#### 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: ±78.126 mV, ±39.062 mV, ±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:** ±0.1% FSR @ 25°C

±0.3% FSR @ -40 and 75°C

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

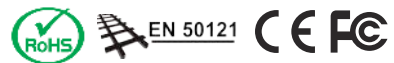
#### Physical Characteristics

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

**Connector:** Spring type terminal block

#### Environmental Limits

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



## 4 serial ports



### 85M-5401-T: 4 serial ports

#### 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:** Tx+, Rx+, 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 male

#### Environmental Limits

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

#### Power Requirements

**Power Consumption:** 1.24 W @ 3.3 VDC

**MTBF (mean time between failures)**

**Time:** 596,611 hrs

**Database:** Telcordia (Bellcore)



EN 50121



## Common Specifications

### Environmental Limits

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

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

### Standards and Certifications

**Safety:** UL 508

**EMI:** EN 55022, EN 61000-3-2, EN 61000-3-3,

FCC Part 15 Subpart B Class A

**EMS:** EN 55024, EN 61000-4-2, EN 61000-4-3,

EN 61000-4-4, EN 61000-4-5, EN 61000-4-6,

EN 61000-4-8, EN 61000-4-11

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

**Freelfall:** IEC 60068-2-32

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

**Rail Traffic:** EN 50155\*, EN 50121-3-2, EN 50121-4

\*Complies with a portion of EN 50155 specifications. Please contact Moxa or a Moxa distributor for details.

Note: Please check Moxa's website for the most up-to-date certification status.

### Warranty

**Warranty Period:** 5 years

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