Modular and Compact RTU Controllers

Preliminary

	ioPAC 8600 series	ioPAC 8500 Series	ioPAC 8020 Series	ioPAC 5542 Series
Inputs/Outputs				
Digital Inputs	–	–	–	8
Configurable DIOs	–	–	–	8
Analog Inputs	–	–	–	8
Cellular				
HSPA	–	–	–	✓ (ioPAC 5542-HSPA)
Ethernet				
Ports (Connector)	2 (M12 or RJ45)			2 (RJ45)
Speed	10/100 Mbps			
Switch (Daisy Chain)	✓	–	✓	–
2 MACs	✓	✓	–	✓
Protocols	Modbus TCP (master/slave), SNMP, TCP/IP, UDP, DHCP, BOOTP, SNTP, SMTP		Modbus TCP (master/slave), TCP/IP, UDP, DHCP, BOOTP, SNTP, SMTP	Modbus TCP (master/slave), SNMP, TCP/IP, UDP, DHCP, BOOTP, SNTP, SMTP
Serial				
Ports (Connector)	–	2 (DB9 male)	1 (DB9 male)	2 (DB9 male)
Interface	–	RS-232/422/485		
Protocols	Modbus RTU (master/slave)		Modbus RTU (master)	Modbus RTU (master/slave)
Physical Characteristics				
I/O Module Slots	5/9/12	2/5/9	5/9	–
Environmental Limits				
Operating Temperature	-40 to 75°C (-40 to 176°F)			-40 to 75°C (-40 to 176°F) -30 to 75°C (-22 to 176°F) for HSPA model
Storage Temperature	-40 to 85°C (-40 to 185°F)			
Ambient Relative Humidity	5 to 95% RH (non-condensing)			
Shock	IEC 60068-2-27			
Vibration	IEC 60068-2-6			
Software				
Programmability	C/C++, IEC 61131-3		C/C++	C/C++, IEC 61131-3
MX-AOPC UA Server	✓	✓	✓	✓
Active OPC Server	–	✓	✓	✓
DA Center	–	✓	✓	✓
RTUxpress	✓	–	–	✓
RTUAdmin	–	–	✓	–
Standards and Certifications				
Safety	UL 508			
EMC	EN 55022, EN 55024			
EMI	FCC Part 15 Subpart B Class A, CISPR 22			
EMS	IEC 61000-4-2, IEC 61000-4-3, IEC 61000-4-4, IEC 61000-4-5, IEC 61000-4-6, IEC 61000-4-8			
Radio	–	–	–	NCC (ioPAC 5542-HSPA)
Rail Traffic	EN 50155 (essential compliance*), EN 50121-3-2, EN 50121-4	EN 50155**, EN 50121-3-2, EN 50121-4		EN 50121-4
Hazardous Location	–	–	–	Class 1 Division 2
Reliability				
Warranty	5 years			
Page	15-4	15-11	15-19	15-24

*Moxa defines "essential compliance" to include those EN 50155 requirements that make products more suitable for rolling stock railway applications.
**Complies with a portion of EN 50155 specifications.

I/O Modules for the ioPAC 8600 Series

Preliminary

	Digital Input		Digital Output		Analog Output	Communication	
	86M-1620D-T	86M-1832D-T	86M-2830D-T	86M-2604D-T	86M-4420-T	86M-5212U-T	86M-5250-T
Module Properties							
Channels/Ports (Connector)	16 (terminal block)	8 (terminal block)	8 (terminal block)	6 (terminal block)	4 (terminal block)	2 (M12)	2 (DB9 male)
Input/Output Mode	24 to 110 VDC	24 VDC ch-to-ch isolation	24 VDC ch-to-ch isolation	Relay	0 to 10 V -10 to 10 V 0 to 20 mA 4 to 20 mA	–	–
Type	sink	sink/source	sink	Form A (N.O.)	–	–	–
Communication Ports	–	–	–	–	–	2-wire Ethernet	CAN
Standards	–	–	–	–	–	100BASE-TX IEEE 802.3u 10BASE-T IEEE 802.3 100 Mbps BroadR-Reach® 10 Mbps BroadR-Reach®	CAN 2.0A CAN 2.0B CANopen DS301 CANopen DS401
Enviromental 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% RH (non-condensing)						
Reliability							
Warranty	5 years (see www.moxa.com/warranty)						

I/O Modules for the ioPAC 8500 Series

	Digital Input	Digital Output	Analog Input				High Speed Analog Input		Communication
	85M-1602-T	85M-2600-T	85M-3800	85M-3801	85M-6600-T	85M-6810-T	85M-3801-T	85M-3811-T	85M-5401-T
Module Properties									
Channels/Ports (Connector)	16 (terminal block)	16 (terminal block)	8 (terminal block)	8 (terminal block)	6 (terminal block)	8 (terminal block)	8 (terminal block)	8 (terminal block)	4 (DB44 female)
Input/Output Mode	24 VDC	24 VDC	4 to 20 mA	0 to 10 V	RTD	Thermocouple	4 to 20 mA	0 to 10 V	–
Type	sink/source	sink	–	–	–	–	–	–	–
Sampling Rate	–	–	All channels: 100 samples/sec Per channel: 12.5 samples/sec	All channels: 100 samples/sec Per channel: 12.5 samples/sec	All channels: 12 samples/sec Per channel: 2 samples/sec	All channels: 12 samples/sec Per channel: 1.5 samples/sec	All channels: 40k samples/sec Per channel: 5k samples/sec	All channels: 40k samples/sec Per channel: 5k samples/sec	–
Serial Ports	–	–	–	–	–	–	–	–	RS-232/422/485
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% RH (non-condensing)								
Reliability									
Warranty	5 years (see www.moxa.com/warranty)								

Note: 85M modules can also be used with ioPAC 8600 systems.

I/O Modules for the ioPAC 8020 Series

	Digital Input		Digital Output	Analog Input		Communication
	RM-1050-T	RM-1602-T	RM-2600-T	RM-3802-T	RM-3810-T	KM-2430-T
Module Properties						
Channels/Ports (Connector)	10 (terminal block)	16 (terminal block)	16 (terminal block)	8 (terminal block)	8 (terminal block)	4 (M12)
Input/Output Mode	110 VDC ch-to-ch isolation	24 VDC	24 VDC	4 to 20 mA	0 to 10 VDC	–
Type	sink/source	sink/source	sink	–	–	–
Communication Ports	–	–	–	–	–	Unmanaged Ethernet switch
Standards	–	–	–	–	–	IEEE 802.3 for 10BaseT IEEE 802.3u for 100BaseT(X) IEEE 802.3x for Flow Control
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% RH (non-condensing)					
Reliability						
Warranty	5 years (see www.moxa.com/warranty)					

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Programmable RTU Controllers ∨ Product Selection Guide

ioPAC 8600 Series *Preliminary*

Rugged modular RTU controllers

> Modular CPU/Power/Backplane/IO design supporting ioPAC 8500/8600 series I/O modules
> Supports dual power module with dual power inputs
> Supports C/C++ or IEC 61131-3 programming languages with ready-to-run services
> 24 to 110 V power input range and DI/O modules
> Compliant with EN 50121-3, EN 50121-4, and EN 50155 specifications

EN 50155   UL LISTED   RoHS   EN 50121   CE   FC

: Overview

The ioPAC 8600 modular RTU controllers are 100% modular, giving users the freedom to choose CPU, power, backplane, communication, and I/O modules. In addition, the ioPAC 8600 enhances the hardware system architecture and key features of the ioPAC 8020 and ioPAC 8500 combined. It also adds an Ethernet bus on the backplane to support Ethernet switch modules. The ioPAC 8600 supports the C/C++ and IEC

61131-3 programming languages and ready-to-run services, including Modbus TCP/RTU, SNMP, data logging, and email alarms to fulfill different customers' requirements. With active tag and MX-AOPC data integration software, the ioPAC 8600 series provides a comprehensive solution for data acquisition and control applications in harsh environments.

2-Wire Ethernet Technology

Moxa's 2-wire Ethernet technology offers system integrators an attractive option for upgrading the train's IP network to a 10/100 Mbps* Ethernet backbone with existing 2-wire cable. This innovative 2-wire Ethernet technology supports Ethernet bypass functionality, ensuring that the Ethernet backbone will continue to operate even if one ioPAC is without power. As an added plus, with two 2-wire Ethernet modules in one ioPAC, the network can reach 200 Mbps and provide a redundant architecture.

*Network performance is related to cable quality when using 2-wire technology.
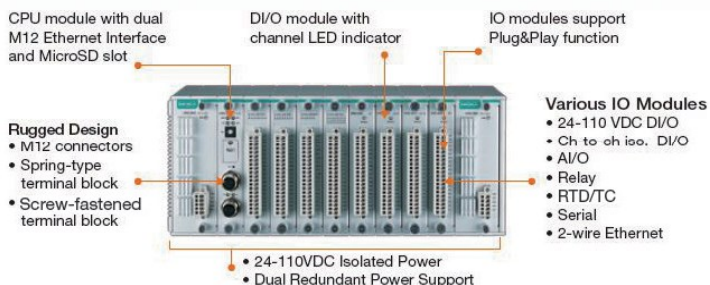
Ready-to-Run Service

Moxa's ioPAC 8600 programmable controllers allow programmers to rapidly configure services (SNMP, Modbus RTU/TCP, E-mail alarm service, etc.) without writing any programs. The ioPAC can reduce the configuration of massively distributed deployments to a few simple mouse clicks, greatly increasing an engineer's productivity.

Automatic Carriage Sequencing (ACS)
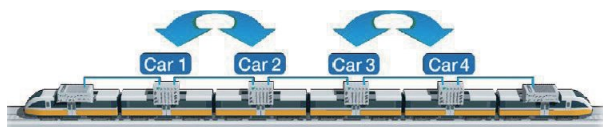
Moxa's Automatic Carriage Sequencing technology quickly and automatically resets the train car sequence, without disrupting network transmissions within the train. This technology greatly reduces the operation effort required for trains that frequently rearrange consists. Onboard passenger information systems can also adjust immediately when changes are made.

Compact Integrated Solution

CPU module with dual
M12 Ethernet Interface
and MicroSD slot

DI/O module with
channel LED indicator

IO modules support
Plug&Play function

Rugged Design
• M12 connectors
• Spring-type
terminal block
• Screw-fastened
terminal block

Various IO Modules
• 24-110 VDC DI/O
• Ch-to-ch iso. DI/O
• AI/O
• Relay
• RTD/TC
• Serial
• 2-wire Ethernet

• 24-110VDC Isolated Power
• Dual Redundant Power Support

The compact ioPAC 8600 is equipped with universal dual-power inputs that support all railway power voltages, and new channel-to-channel, wide voltage DI/DO modules are available for use in trains that use different power systems. The ioPAC 8600 supports a variety of communication interfaces, including Ethernet, serial, CAN, and MVB*. System integrators can control or monitor sub-systems with the ioPAC 8600, which saves space and has powerful functions to reduce both the system integrator's budget and installation difficulties.

*MVB available by project request.

⋮ Specifications

Power Requirements
Input Voltage: 24 to 110 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)
Weight:
• 5-slot version: 2560 g (5.64 lb)
• 9-slot version: 3690 g (8.14 lb)
Mounting: DIN rail (optional), wall (optional), rack (optional)
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 55022/24
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: 3 V/m
  1400 MHz to 2100 MHz: 3 V/m
  2100 MHz to 2700 MHz: 1 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: 3 V
IEC 61000-4-8 PFMF: 3 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.
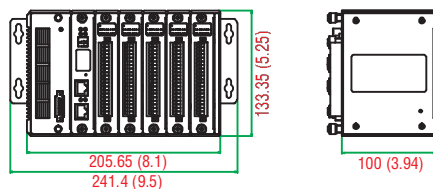Note: Please check Moxa's website for the most up-to-date certification status.
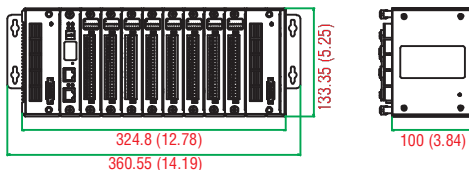
Warranty
Warranty Period: 5 years
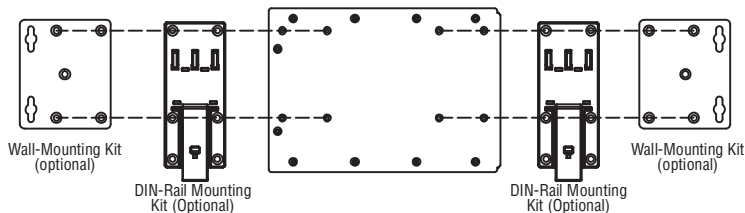**Details:** See www.moxa.com/warranty

Dimensions

Unit: mm (inch)

ioPAC 8600 with 5 I/O slots

133.35 (5.25)
205.65 (8.1)
241.4 (9.5)
100 (3.94)

ioPAC 8600 with 9 I/O slots

133.35 (5.25)
324.8 (12.78)
360.55 (14.19)
100 (3.84)

Mounting Kits

Wall-Mounting Kit
(optional)

DIN-Rail Mounting
Kit (Optional)

DIN-Rail Mounting
Kit (Optional)

Wall-Mounting Kit
(optional)

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Programmable RTU Controllers > ioPAC 8600 Series

: Ordering Information

CPU Modules
ioPAC 8600-CPU10-M12-C-T: ioPAC 8600 CPU module, C/C++ programmable controller, M12 Ethernet ports, -40 to 75°C operating temperature
ioPAC 8600-CPU10-RJ45-C-T: ioPAC 8600 CPU module, C/C++ programmable controller, RJ45 Ethernet ports, -40 to 75°C operating temperature
ioPAC 8600-CPU10-M12-IEC-T: ioPAC 8600 CPU module, IEC 61131-3 programmable controller, M12 Ethernet ports, -40 to 75°C operating temperature
ioPAC 8600-CPU10-RJ45-IEC-T: ioPAC 8600 CPU module, IEC 61131-3 programmable controller, RJ45 Ethernet ports, -40 to 75°C operating temperature

Power Modules
ioPAC 8600-PW10-15W-T: ioPAC 8600 power module, dual power input, 24 to 110 VDC, 15W, -40 to 75°C operating temperature

Backplane Modules
ioPAC 8600-BM005-T: ioPAC 8600 backplane module with 5 slots, -40 to 75°C operating temperature
ioPAC 8600-BM009-T: ioPAC 8600 backplane module with 9 slots, -40 to 75°C operating temperature

I/O Modules (can be purchased separately)
86M-1620D-T: 16 DIs, sink, 24 to 110 VDC, channel LED, -40 to 75°C operating temperature
86M-1832D-T: 8 DIs, sink/source, 24 VDC, ch-to-ch isolation, channel LED, -40 to 75°C operating temperature
86M-2604D-T: 6 relays, form A (N.O.), channel LED, -40 to 75°C operating temperature
86M-2830D-T: 8 DOs, sink, 24 VDC, ch-to-ch isolation, channel LED, -40 to 75°C operating temperature
86M-4420-T: 4 AOs, 0 to 10 V, -10 to 10 V, 0 to 20 mA, or 4 to 20 mA, -40 to 75°C operating temperature
86M-5212U-T: 2-port 2-wire Ethernet switch, -40 to 75°C operating temperature
86M-5250-T: 2 CAN ports, -40 to 75°C operating temperature
85M-1602-T: 16 DIs, sink/source, 24 VDC, dry contact, -40 to 75°C operating temperature
85M-2600-T: 16 DOs, sink, 24 VDC, -40 to 75°C operating temperature
85M-3800-T: 8 AIs, 4 to 20 mA, 16 bits, -40 to 75°C operating temperature
85M-3810-T: 8 AIs, 4 to 20 mA, 16 bits, 40 kHz, -40 to 75°C operating temperature
85M-3801-T: 8 AIs, 0 to 10 VDC, 16 bits, -40 to 75°C operating temperature
85M-3811-T: 8 AIs, 0 to 10 VDC, 16 bits, 40 kHz, -40 to 75°C operating temperature
85M-5401-T: 4 serial ports (RS-232/422/485 3-in-1), -40 to 75°C operating temperature
85M-6600-T: 6 RTDs, -40 to 75°C operating temperature
85M-6810-T: 8 TCs, -40 to 75°C operating temperature
Note: Both 86M modules and 85M modules can be used with the ioPAC 8600 series
Note: Conformal coating available on request.

Optional Accessories (can be purchased separately)
DK-DC50131-01: DIN-rail mounting kit, 50 x 131 mm
WK-75: Wall-mounting kit, 2 plates with 8 screws
CBL-M12D(MM4P)/RJ45-100 IP67: 4-pin D-code M12-to-RJ45 CAT5E UTP Ethernet cable, 100 cm, IP67 waterproof
CBL-RJ458P-100: 8-pin RJ45 CAT5 Ethernet cable, 100 cm
CBL-F9DPF1x4-BK-100: Serial console cable
CBL-M44M9x4-50: DB44 to 4-port DB9 female serial cable
85M-BKTES: Empty slot covers (3 per order)

Package Checklist (CPU Module)
- ioPAC 8600 CPU module
- Serial console cable (C/C++ version only)
- Documentation and software CD

Package Checklist (Power Module)
- ioPAC 8600 power module

Package Checklist (Backplane Module)
- ioPAC 8600 backplane module

Package Checklist (I/O Module)
- 85M/86M module
- Serial cable: CBL-M44M9x4-50 (85M-5401-T only)

ioPAC 8600 Series Modules **Preliminary**

ioPAC 8600-CPU10 Series: 32-bit ARM9 192 MHz CPU

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: 64 MB
Flash: 32 MB (10 MB reserved for user)
FRAM: 128 KB
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.
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), SNMP, 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

🚆 EN 50155   ⓊL LISTED   RoHS   ⚒ EN 50121   CE   FC

ioPAC 8600-PW10-15W-T: Dual-power inputs, 24 to 110 VDC, 15 W

Power
Input Voltage: 24 to 110 VDC (16.8 to 154 VDC)
Note: Compliant with EN 50155 at 24/48/60/72/110 VDC
Wattage: 15 W
Galvanic Isolation: 3k VDC
Dual-Power Input: Yes
Environmental Limits
Operating Temperature: -40 to 75°C (-40 to 176°F)
MTBF (mean time between failures)
Time: 1,579,517 hrs
Standard: Telcordia SR332

🚆 EN 50155   ⓊL LISTED   RoHS   ⚒ EN 50121   CE   FC

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Programmable RTU Controllers > ioPAC 8600 Series Modules

86M-1620D-T: 16 digital inputs, 24 to 110 VDC, channel LED, sink type
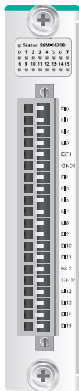
Inputs and Outputs
Digital Inputs: 16 channels
Isolation:
To system:
3k VDC or 2k Vrms
Digital Input
Type: PNP
I/O mode: DI
Logic Definition:
• On: channel voltage > 0.3 x (external power voltage)
• Off: channel voltage < 0.15 x (external power voltage)
Scan Period: 8 ms (typ.)
Scan on Time: 0.5 ms

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, 16 AWG (max.)
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

EN 50155   c(UL)us LISTED   RoHS   EN 50121   CE   FC

86M-1832D-T: 8 channel-to-channel isolated DIs, 24 VDC, channel LED, sink/source type
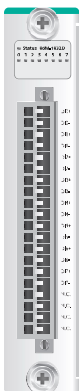
Inputs and Outputs
Digital Inputs: 8 channels
Isolation:
To system: 3k VDC or 2k Vrms
Channel-to-channel: 1k VDC
Digital Input
Sensor Type: Wet contact (NPN or PNP)
I/O Mode: DI, counter, or frequency
Wet Contact (DI+ to DI-):
• On: 10 to 30 VDC
• Off: 0 to 3 VDC
Counter Frequency: 5 kHz
Digital Filtering Time Interval: Software selectable (by 0.1 ms)
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: 12.6 mA @ 24 VDC
MTBF (mean time between failures)
Time: 1,149,108 hrs
Standard: Telcordia SR332

EN 50155   c(UL)us LISTED   RoHS   EN 50121   CE   FC

86M-2604D-T: 6 relays, channel LED, form A (N.O.) type
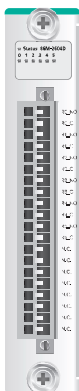
Inputs and Outputs
Relays: 6 channels
Isolation:
To System: 3k VDC or 2k Vrms
Relay
Type: Form A (N.O.)
I/O mode: DO or PWM
Pulse Output Frequency: 0.33 Hz
Contact Current Rating:
Resistive Load: 5 A @ 30 VDC, 250 VAC
Relay On/Off Time: 10 ms (max.)
Initial Insulation Resistance: 1000 mega-ohms (min.) @ 500 VDC
Mechanical Endurance: 5,000,000 operations
Electrical Endurance: 60,000 operations @ 5 A resistive load
Contact Resistance: 100 milli-ohms (max.)

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

EN 50155   c(UL)us LISTED   RoHS   EN 50121   CE   FC

86M-2830D-T: 8 channel-to-channel isolated DOs, 24 VDC, channel LED, sink-type
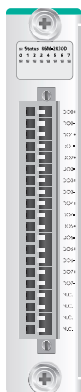
Inputs and Outputs
Digital Outputs: 8 channels
Isolation:
To system: 3k VDC or 2k Vrms
Channel-to-channel: 1k VDC
Digital Output
Type: Sink
I/O Mode: DO or PWM
Pulse Output Frequency: 1 kHz
Short Circuit Protection: 750 mA @ 25℃
Over-Voltage Protection: 41 VDC
Over-Current Protection: 2.6 A (4 channels @ 650 mA)
Over-Temperature Shutdown: 175℃ (typical), 150℃ (min.)
Current Rating: 200 mA per channel

Physical Characteristics
Wiring: I/O cable, 16 AWG (max.)
Connector: Spring-type terminal block
Environmental Limits
Operating Temperature: -40 to 75℃ (-40 to 176℉)
Power Requirements
Input Current: 76.7 mA @ 24 VDC
MTBF (mean time between failures)
Time: 1,766,037 hrs
Standard: Telcordia SR332

EN 50155   c(UL)us LISTED   RoHS   EN 50121   CE FC

86M-4420-T: 4 analog outputs, 0 to 10 V or -10 to 10 V or 0 to 20 mA or 4 to 20 mA
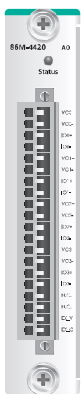
Inputs and Outputs
Analog Outputs: 4 channels
Isolation:
To system: 3k VDC or 2k Vrms
Analog Output
Resolution: 12 bits
Output range: 0 to 10 V, -10 to 10 V, 0 to 20 mA, 4 to 20 mA
I/O mode: Static or Waveform mode
Voltage Output: 10 mA (max.)
Accuracy:
±0.1% FSR @ 25°C
±0.3% FSR @ -40 and 75°C
Current 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℃ (-40 to 176℉)
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

EN 50155   c(UL)us LISTED   RoHS   EN 50121   CE FC

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

Ethernet Communication
Interface: Two 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
Connector: M12 (D-code, female) x 2
Channel LED: Yes
Environmental Limits
Operating Temperature: -40 to 75℃ (-40 to 176℉)
Power Requirements
Input Current: 578 mA @ 3.3 VDC
MTBF (mean time between failures)
Time: 2,498,942 hrs
Standard: Telcordia SR332

EN 50155   c(UL)us LISTED   RoHS   EN 50121   CE FC

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Programmable RTU Controllers > ioPAC 8600 Series Modules

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

Serial 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
CANopen DS401
Speed: 10/20/50/125/250/500/800 kbps, 1 Mbps
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

EN 50155   UL LISTED   RoHS   EN 50121   CE   FC

Common Specifications

Power Requirements
Input Voltage: 24 to 110 VDC (16.8 to 154 VDC)

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 55022/24
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: 3 V/m
  1400 MHz to 2100 MHz: 3 V/m
  2100 MHz to 2700 MHz: 1 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: 1 kV
(L-L), 2 kV (L-PE)
IEC 61000-4-6 CS: 3 V
IEC 61000-4-8 PFMF: 3 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

ioPAC 8500 Series

▶ *Award-winning Product*

TAIWAN EXCELLENCE 2014

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 for analog input
> Pre-recording for analog input data logging
> Supports C/C++ or IEC 61131-3 programming languages
> Compliant with EN 50121-3-2, EN 50121-4, and EN 50155 specifications
> Robust and compact design for harsh environments
> Modular I/O for versatility, flexibility, and scalability

RoHS   EN 50121   CE   FC

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Programmable RTU Controllers > ioPAC 8500 Series

: 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 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++ or IEC 61131-3 programming, 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 capability), 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

Prerecording

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.

Ethernet Interface
LAN: 2 x 10/100 Mbps, 2 MACs (IPs), RJ45 or M12
Protection: 1.5 kV magnetic isolation

Serial Interface
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++ or IEC 61131-3
Protocols: Modbus TCP/RTU (master/slave), SNMP, TCP/IP, UDP, DHCP, BOOTP, SNTP, SMTP

Power Requirements
Input Voltage: 24 VDC (9 to 48 VDC)
Input Current: 152 mA @ 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 (2.87 lb)
• 5-slot version: 2000 g (4.41 lb)
• 9-slot version: 2575 g (5.68 lb)
Mounting: DIN rail (standard), wall (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)
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 55022, EN 55024
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: 3 V/m
  1400 MHz to 2100 MHz: 3 V/m
  2100 MHz to 2700 MHz: 1 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: 1 kV (L-L), 2 kV (L-PE)
IEC 61000-4-6 CS: 3 V
IEC 61000-4-8 PFMF: 3 A/m
Rail Traffic: EN 50155*, EN 50121-3-2, EN 50121-4
*Complies with a portion of EN 50155 specifications.
Note: Please check Moxa's website for the most up-to-date certification status.

MTBF (mean time between failures)
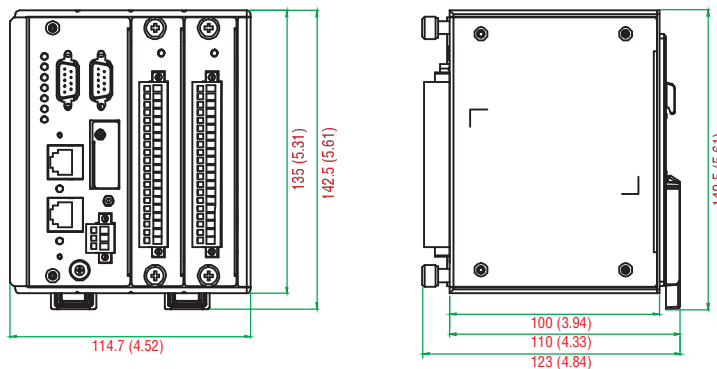**Time:** 859,979 hrs
Standard: Telcordia SR332

Warranty
Warranty Period: 5 years
Details: See www.moxa.com/warranty

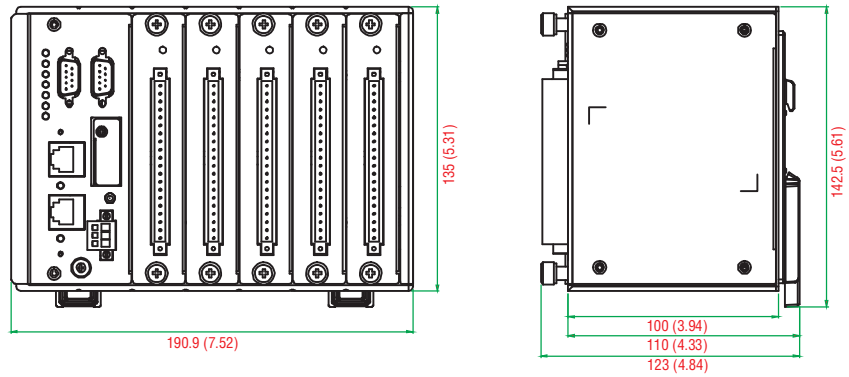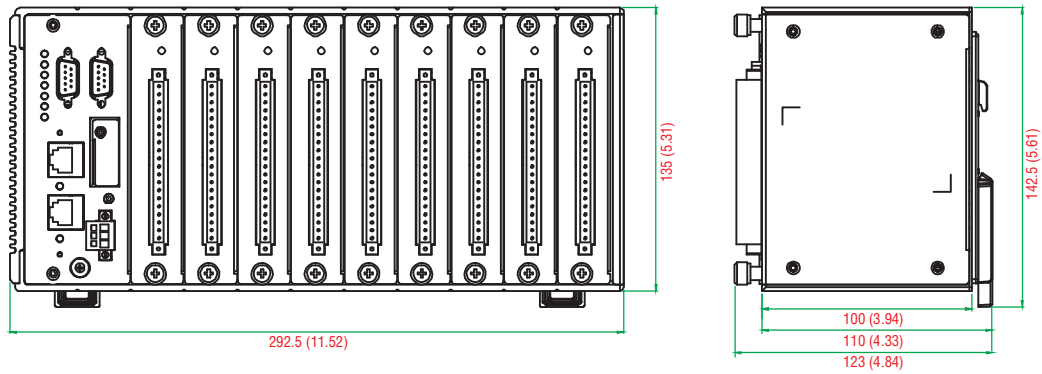### Dimensions

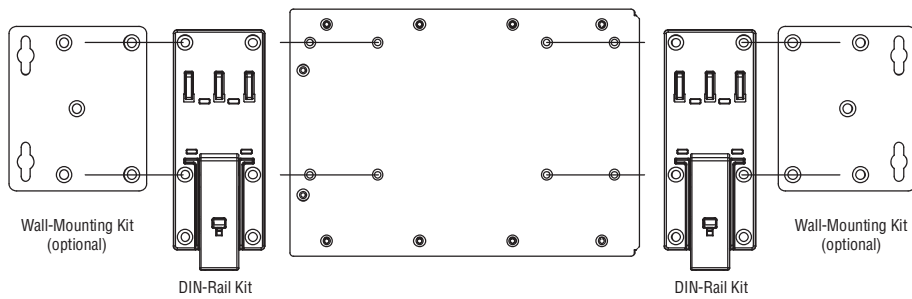**ioPAC 8500-2**

Unit: mm (inch)

Dimensions

Unit: mm (inch)

ioPAC 8500-5

135 (5.31)
190.9 (7.52)
142.5 (5.61)
100 (3.94)
110 (4.33)
123 (4.84)

ioPAC 8500-9

135 (5.31)
292.5 (11.52)
142.5 (5.61)
100 (3.94)
110 (4.33)
123 (4.84)

Mounting Kits

Wall-Mounting Kit
(optional)

DIN-Rail Kit

DIN-Rail Kit

Wall-Mounting Kit
(optional)

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Programmable RTU Controllers > ioPAC 8500 Series

: Ordering Information

System Modules

ioPAC 8500-2-M12-C-T: Modular C/C++ programmable controller with 2 slots, M12 Ethernet ports, -40 to 75°C operating temperature

ioPAC 8500-2-M12-IEC-T: Modular IEC 61131-3 programmable controller with 2 slots, M12 Ethernet ports, -40 to 75°C operating temperature

ioPAC 8500-2-RJ45-C-T: Modular C/C++ programmable controller with 2 slots, RJ45 Ethernet ports, -40 to 75°C operating temperature

ioPAC 8500-2-RJ45-IEC-T: Modular IEC 61131-3 programmable controller with 2 slots, RJ45 Ethernet ports, -40 to 75°C operating temperature

ioPAC 8500-5-M12-C-T: Modular C/C++ programmable controller with 5 slots, M12 Ethernet ports, -40 to 75°C operating temperature

ioPAC 8500-5-M12-IEC-T: Modular IEC 61131-3 programmable controller with 5 slots, M12 Ethernet ports, -40 to 75°C operating temperature

ioPAC 8500-5-RJ45-C-T: Modular C/C++ programmable controller with 5 slots, RJ45 Ethernet ports, -40 to 75°C operating temperature

ioPAC 8500-5-RJ45-IEC-T: Modular IEC 61131-3 programmable controller with 5 slots, RJ45 Ethernet ports, -40 to 75°C operating temperature

ioPAC 8500-9-M12-C-T: Modular C/C++ programmable controller with 9 slots, M12 Ethernet ports, -40 to 75°C operating temperature

ioPAC 8500-9-M12-IEC-T: Modular IEC 61131-3 programmable controller with 9 slots, M12 Ethernet ports, -40 to 75°C operating temperature

ioPAC 8500-9-RJ45-C-T: Modular C/C++ programmable controller with 9 slots, RJ45 Ethernet ports, -40 to 75°C operating temperature

ioPAC 8500-9-RJ45-IEC-T: Modular IEC 61131-3 programmable controller with 9 slots, RJ45 Ethernet ports, -40 to 75°C operating temperature

I/O Modules (can be purchased separately)

85M-1602-T: 16 DIs, sink/source, 24 VDC, dry contact, -40 to 75°C operating temperature

85M-2600-T: 16 DOs, sink, 24 VDC, -40 to 75°C operating temperature

85M-3800-T: 8 AIs, 4 to 20 mA, 16 bits, -40 to 75°C operating temperature

85M-3810-T: 8 AIs, 4 to 20 mA, 16 bits, 40 kHz, -40 to 75°C operating temperature

85M-3801-T: 8 AIs, 0 to 10 VDC, 16 bits, -40 to 75°C operating temperature

85M-3811-T: 8 AIs, 0 to 10 VDC, 16 bits, 40 kHz, -40 to 75°C operating temperature

85M-5401-T: 4 serial ports (RS-232/422/485 3-in-1), -40 to 75°C operating temperature

85M-6600-T: 6 RTDs, -40 to 75°C operating temperature

85M-6810-T: 8 TCs, -40 to 75°C operating temperature

Note: Conformal coating available on request

Optional Accessories (can be purchased separately)

DK-DC50131-01: DIN-rail mounting kit, 50 x 131 mm

WK-75: Wall-mounting kit, 2 plates with 8 screws

CBL-M12D(MM4P)/RJ45-100 IP67: 4-pin D-code M12-to-RJ45 CAT5E UTP Ethernet cable, 100 cm, IP67 waterproof

CBL-RJ458P-100: 8-pin RJ45 CAT5 Ethernet cable, 100 cm

CBL-F9DPF1x4-BK-100: Serial console cable

CBL-M44M9x4-50: DB44 to 4-port DB9 female serial cable

85M-BKTES: Empty slot covers (3 per order)
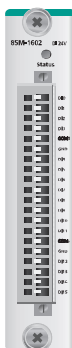
Package Checklist (ioPAC 8500)

- ioPAC 8500 system module
- Serial console cable (C/C++ version only)
- Documentation and software CD

Package Checklist (85M modules)

- 85M module
- Serial cable: CBL-M44M9x4-50 (85M-5401-T only)

ioPAC 8500 Series Modules

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

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

Digital Input
Sensor Type: Wet contact (NPN or PNP), dry contact
I/O Mode: DI, Counter or Frequncy
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, 16 AWG (max.)
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 failures)
Time: 1,132,561 hrs
Standard: Telcordia SR332

EN 50121
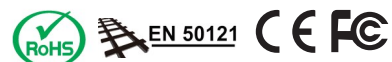
85M-2600-T: 16 digital outputs, 24 VDC, sink-type
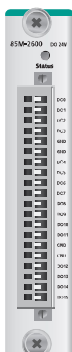
Inputs and Outputs
Digital Outputs: 16 channels
Isolation: 3k VDC or 2k Vrms

Digital Output
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.)
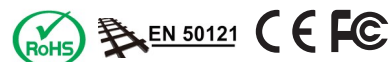**Current Rating:** 200 mA per channel

Physical Characteristics
Wiring: I/O cable, 16 AWG (max.)
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 failures)
Time: 792,571 hrs
Standard: Telcordia SR332

EN 50121

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

Inputs and Outputs
Analog Inputs: 8 channels
Isolation: 3k VDC or 2k Vrms

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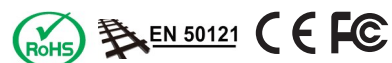**Input Impedance:** 125 ohms (min.)

Physical Characteristics
Wiring: I/O cable, 16 AWG (max.)
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 failures)
Time: 1,512,906 hrs
Standard: Telcordia SR332

EN 50121

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Programmable RTU Controllers > ioPAC 8500 Series Modules

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

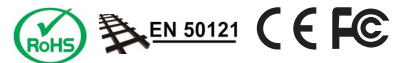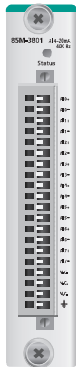### Inputs and Outputs
Analog Inputs: 8 channels
Isolation: 3k VDC or 2k Vrms
Analog Inputs
Type: Differential
Resolution: 16 bits
I/O Mode: 0 to 10 VDC
Accuracy:
±0.1% FSR @ 25°C
±0.3% FSR @ -40 and 75°C
Sampling Rate:
• All channels: 100 samples/sec
• Per channel: 12.5 samples/sec
Input Impedance: 200 kilo-ohms (min.)

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: 315.2 mA @ 3.3 VDC
MTBF (mean time between failures)
Time: 1,530,690 hrs
Standard: Telcordia SR332

RoHS EN 50121 CE FC

85M-3801-T: 8 analog inputs, 4 to 20 mA, 40 kHz
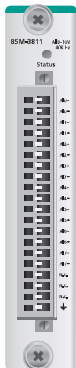
Inputs and Outputs
Analog Inputs: 8 channels
Isolation: 3k VDC or 2k Vrms
Analog Input
Type: Differential
Resolution: 16 bits
I/O Mode: 4 to 20 mA (wire off)
Historical Data Buffering: 60 KB per channel
6-second data buffer at 5 kHz
Accuracy:
±0.1% FSR @ 25°C
±0.3% FSR @ -40 and 75°C
Sampling Rate:
• All channels: 40k samples/sec
• Per channel: 5k samples/sec
Input Impedance: 125 ohms (min.)

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: 378.8 mA @ 3.3 VDC
MTBF (mean time between failures)
Time: 1,426,112 hrs
Standard: Telcordia SR332

RoHS EN 50121 CE FC

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-second 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 mega-ohms (min.)

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: 378.8 mA @ 3.3 VDC
MTBF (mean time between failures)
Time: 1,426,112 hrs
Standard: Telcordia SR332

RoHS EN 50121 CE FC

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

Serial Communication
Interface: 4 RS-232/422/485 ports, software selectable (DB44 female)
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 failures)
Time: 596,611 hrs
Standard: Telcordia SR332

## 85M-6600-T: 6 RTDs

Inputs and Outputs
RTD Inputs: 6 channels
Isolation: 3k VDC or 2k Vrms

RTDs
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 ohms
Sampling Rate (single channel):
• All channels: 12 samples/sec
• Per channel: 2 samples/sec

Resolution: 0.1°C or 0.1 ohms
Accuracy:
±0.1% FSR @ 25°C
±0.3% FSR @ -40 and 75°C
Input Impedance: 625 kilo-ohms (min.)
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: 201.5 mA @ 3.3 VDC

MTBF (mean time between failures)
Time: 571,446 hrs
Standard: Telcordia SR332

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Programmable RTU Controllers > ioPAC 8500 Series Modules
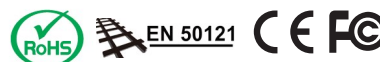
85M-6810-T: 8 thermocouples

Inputs and Outputs
Analog Inputs: 8 channels
Isolation: 3k VDC or 2k Vrms

Thermocouples
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 mega-ohm (min.)
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: 175.5 mA @ 3.3 VDC

MTBF (mean time between failures)
Time: 2,324,891 hrs
Standard: Telcordia SR332

RoHS EN 50121 CE FC

⠿ Common Specifications

Power Requirements
Input Voltage: 24 VDC (9 to 48 VDC)

Environmental Limits
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 55022/24
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: 3 V/m
  1400 MHz to 2100 MHz: 3 V/m
  2100 MHz to 2700 MHz: 1 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: 1 kV
(L-L), 2 kV (L-PE)
IEC 61000-4-6 CS: 3V
IEC 61000-4-8 PFMF: 3 A/m

Rail Traffic: EN 50155*, EN 50121-3-2, EN 50121-4
*Complies with a portion of EN 50155 specifications.

Warranty
Warranty Period: 5 years
Details: See www.moxa.com/warranty

ioPAC 8020 Series

Rugged modular RTU controllers

> Compliant with EN 50121-3-2, EN 50121-4, and a portion of EN 50155 specifications
> Supports C/C++ programming languages
> 2-port Ethernet switch for daisy-chain topologies with bypass function
> Modular I/O for versatility, flexibility, and scalability
> Rugged and compact design for harsh environments
> Wide operating temperature: -40 to 75°C (-40 to 167°F)
> 3-in-1 RS-232/422/485 serial port
> Up to 32 GB SDHC data logging function

RoHS   EN 50121   c UL us LISTED   CE   FC
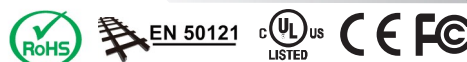
: Overview

Sturdy and dependable, ioPAC 8020-C modular RTU controllers are an ideal solution for rolling stock and trackside applications. This series tolerates temperature extremes from -40 to 75°C, is enclosed in a sealed metal casing, and is compliant with EN 50121-3-2, EN 50121-4, and relevant sections of the EN 50155 anti-vibration standard. The ioPAC 8020-C further features a Linux/GNU platform adapted to data acquisition and condition monitoring. The main advantage of this open C platform is its user-friendly SDK, which helps economize on installation and configuration overhead by reducing your programming workload for key areas, including I/O control and condition monitoring, SCADA/DB interoperability, and improving smart communication controls.

The ioPAC-8020-C has a 2-port Ethernet switch that allows system integrators to easily build control networks with open Ethernet standards and daisy-chain topologies. Built-in dual power inputs ensure non-stop data transfer to the controller and uninterrupted communications management on the control network. For train-related applications, spring-type terminal blocks and optional M12 Ethernet connectors deliver reliable operations in high vibration environments. In addition, a rich selection of hot-swap I/O and communication modules is available for any combination of device applications.

Ethernet bypass feature for seamless data transmission

ioPAC RTU controllers also come with an integrated, independent, 2-port Ethernet switch for the convenient daisy-chaining of ioPAC RTU controllers. In distributed Ethernet data acquisition applications, panels, units, and cabinets are often located at remote sites where space is limited. The daisy-chain capability of ioPAC controllers allows ioPAC RTUs to connect in series either to each other or to other nearby Ethernet devices, drastically saving on both space and wiring costs. Because the Ethernet switch is independent of the main RTU and includes the power-off bypass mechanism, ioPAC RTU controllers are able to maintain continuous and seamless data transmissions even when a linked device fails.
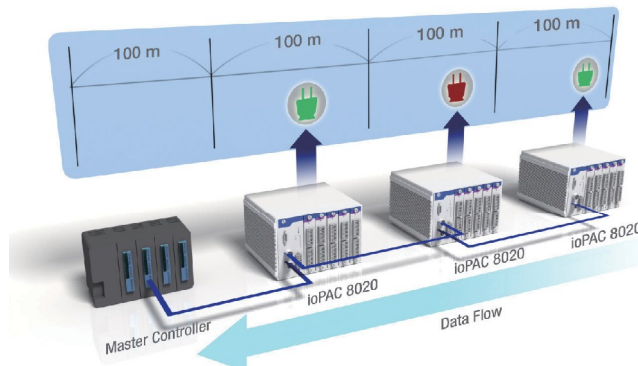
Hot-swappable modular I/O

ioPAC RTU controllers offer a modular design in a compact size to save space in installation cabinets. For modular ioPAC RTU controllers, the hot-swap capability allows users to unplug and then re-plug a module without shutting down the system, so that maintenance engineers can easily complete replacement tasks and reduce system downtime.

Hot-swap

: Specifications

Computer

CPU: 32-bit ARM9 160 MHz CPU
OS: Linux
Clock: Real-time clock with battery backup
SDRAM: 64 MB
Flash: 32 MB
SD™ Slot: Up to 32 GB (SD 2.0 compatible)
Note: For units operating in extreme temperatures, industrial-grade, wide-temperature SD cards are required.

Ethernet Interface

LAN: 2 x 10/100 Mbps, Ethernet bypass, RJ45 or M12
Protection: 1.5 kV magnetic isolation

Serial Interface

Serial Ports: RS-232/422/485 (DB9 male)
Serial Debug Port: RS-232 (4-pin connector)

Serial Ports

RS-232: TxD, RxD, DTR, DSR, RTS, CTS, DCD, GND
RS-422: TxD+, TxD-, RxD+, RxD-, GND
RS-485-4w: TxD+, TxD-, RxD+, RxD-, GND
RS-485-2w: Data+, Data-, GND

Power Requirements

Input Voltage: 12 to 36 VDC
Input Current: 184 mA @ 24 VDC (without I/O modules)
Note: Compliant with EN 50155 at 24 VDC

Physical Characteristics

Housing: Aluminum
Dimensions:
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:
5-slot version: 2,000 g (4.41 lb)
9-slot version: 2,575 g (5.68 lb)
Mounting: DIN rail (standard), wall (optional)
I/O Module Slots: 5 or 9 slots (the 9th slot is reserved)

Environmental Limits

Operating Temperature: -40 to 75°C (-40 to 167°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 55022/24
EMI: FCC Part 15 Subpart B Class A, CISPR 22
EMS:
IEC 61000-4-2 ESD: Contact: 4 kV; Air: 8 kV
IEC 61000-4-3 RS:
  80 MHz to 1000 MHz: 10 V/m
  1400 MHz to 2100 MHz: 3 V/m
  2100 MHz to 2700 MHz: 1 V/m
IEC 61000-4-4 EFT: Power: 2 kV; Signal: 1 kV
IEC 61000-4-5 Surge: Power: 2 kV (L-PE), 1 kV (L-L); Signal: 1 kV (9-slot version)
IEC 61000-4-6 CS: 10 V
IEC 61000-4-8 PFMF: 30 A/m
Rail Traffic: EN 50155*, EN 50121-3-2, EN 50121-4
*Complies with a portion of EN 50155 specifications.
Green Product: RoHS, CRoHS, WEEE
Note: Please check Moxa's website for the most up-to-date certification status.

MTBF (mean time between failures)

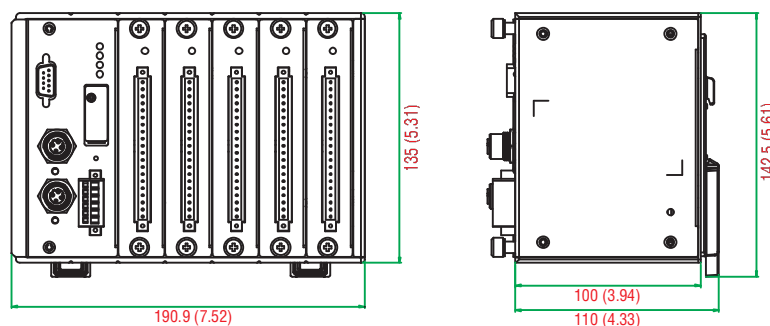**Time:** 690,214 hrs
Standard: Telcordia SR332

Warranty

Warranty Period: 5 years
Details: See www.moxa.com/warranty
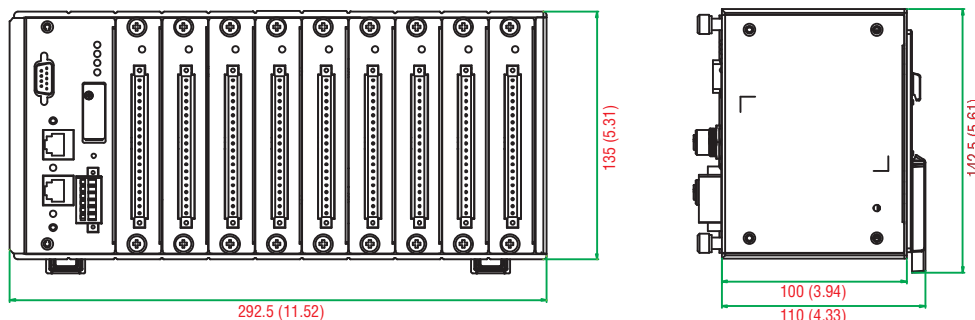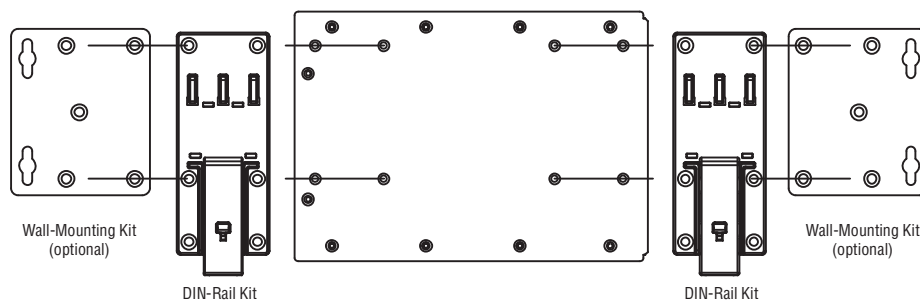
Dimensions

Unit: mm (inch)

ioPAC 8020-5

135 (5.31)
190.9 (7.52)
142.5 (5.61)
100 (3.94)
110 (4.33)

Dimensions

Unit: mm (inch)

ioPAC 8020-9

135 (5.31)

142.5 (5.61)

292.5 (11.52)

100 (3.94)

110 (4.33)

Mounting Kits

Wall-Mounting Kit
(optional)

DIN-Rail Kit

DIN-Rail Kit

Wall-Mounting Kit
(optional)

Ordering Information

System Modules

ioPAC 8020-5-M12-C-T: Modular programmable controller with 5 slots, M12 Ethernet ports, -40 to 75°C operating temperature

ioPAC 8020-5-RJ45-C-T: Modular programmable controller with 5 slots, RJ45 Ethernet ports, -40 to 75°C operating temperature

ioPAC 8020-9-M12-C-T: Modular programmable controller with 9 slots, M12 Ethernet ports, -40 to 75°C operating temperature

ioPAC 8020-9-RJ45-C-T: Modular programmable controller with 9 slots, RJ45 Ethernet ports, -40 to 75°C operating temperature

I/O Modules (can be purchased separately)

RM-1050-T: 10 DIs, 110 VDC, ch-to-ch isolation, -40 to 75°C operating temperature
RM-1602-T: 16 DIs, sink/source, 24 VDC, -40 to 75°C operating temperature
RM-2600-T: 16 DOs, sink, 24 VDC, -40 to 75°C operating temperature
RM-3802-T: 8 AIs, 4 to 20 mA, 16 bits, -40 to 75°C operating temperature
RM-3810-T: 8 AIs, 0 to 10 V, 16 bits, -40 to 75°C operating temperature
KM-2430-T: 4-port unmanaged Ethernet switch, M12, -40 to 75°C operating temperature
Note: Conformal coating available on request

Optional Accessories (can be purchased separately)

DK-DC50131-01: DIN-rail mounting kit, 50 x 131 mm
WK-75: Wall-mounting kit, 2 plates with 8 screws
CBL-M12D(MM4P)/RJ45-100 IP67: 4-pin D-code M12-to-RJ45 CAT5E UTP Ethernet cable, 100 cm, IP67 waterproof
CBL-RJ458P-100: 8-pin RJ45 CAT5 Ethernet cable, 100 cm
CBL-F9DPF1x4-BK-100: Serial console cable

Package Checklist

- ioPAC 8020-C
- Ethernet cable: CBL-M12D(MM4P)/RJ45-100 IP67
- Serial cable: CBL-F9DPF1x4-BK-100
- Documentation and software CD

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Programmable RTU Controllers > ioPAC 8020 Series

ioPAC 8020 Series Modules

RM-1050-T: 10 channel-to-channel isolated DIs, 110 VDC, sink/source type

Digital Inputs: 10 channels, 110 VDC, channel-to-channel isolation
On: 50 to 175 VDC
Off: 0 to 15 VDC
Input Impedance: 120 kilo-ohms (typical)
Response Time: 10 ms
Isolation: 3k VDC or 2k Vrms
Channel-to-Channel Isolation: 2.5k VDC
Operating Temperature: -40 to 75°C (-40 to 176°F)
Input Current: 7 mA @ 24 VDC
Wiring: I/O cable, 14 AWG (max.)
MTBF: 3,993,435 hrs (Standard: Telcordia SR332)

RM-1602-T: 16 digital inputs, 24 VDC, sink/source type

Digital Inputs: 16 channels, 24 VDC, sink/source type
On: 10 to 30 VDC
Off: 0 to 3 VDC
Input Impedance: 3 kilo-ohms (typical)
Common Type: 8 points per 2 COMs
Response Time: 10 ms
Isolation: 3k VDC or 2k Vrms
Operating Temperature: -40 to 75°C (-40 to 176°F)
Input Current: 7 mA @ 24 VDC
Wiring: I/O cable, 14 AWG (max.)
**MTBF:** 4,132,863 hrs (Standard: Telcordia SR332)

RM-2600-T: 16 digital outputs, 24 VDC, sink-type

Digital Outputs: 16 channels, 24 VDC, sink-type
Output Impedance: 120 milli-ohms (typical)
Current Rating: 200 mA per channel
Off-state Resistance: 500 kilo-ohms (typical)
Response Time: 10 ms
Over Current Protection: 2.6 A (4 channels @ 650 mA)
Isolation: 3k VDC or 2k Vrms
Operating Temperature: -40 to 75°C (-40 to 176°F)
Input Current: 10 mA @ 24 VDC
Wiring: I/O cable, 14 AWG (max.)
MTBF: 4,440,241 hrs (Standard: Telcordia SR332)

RM-3802-T: 8 analog inputs, 4 to 20 mA
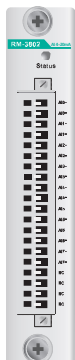
Analog Inputs: 8 channels, differential
Input Range: 4 to 20 mA
Input Impendence: 120 ohms
Resolution: 16 bits, 0.24 µA/bit
Accuracy:
±0.1%, FSR @ 25°C
±0.3%, FSR @ -40°C and 75°C
Sampling Rate:
• All channels: 12 samples/sec
• Per channel: 1.5 samples/sec
Isolation: 3k VDC or 2k Vrms
Operating Temperature: -40 to 75°C (-40 to 176°F)

Input Current: 78 mA @ 24 VDC
Wiring: I/O cable, 14 AWG (max.)
MTBF: 1,222,361 hrs (Standard: Telcordia SR332)

RM-3810-T: 8 analog inputs, 0 to 10 V

Analog Inputs: 8 channels, differential
Input Range: 0 to 10 VDC
Input Impendence: 10 mega-ohms (min.)
Resolution: 16 bits, 0.15 µA/bit
Data Format: 16-bit integer (2's complement)
Accuracy:
±0.1%, FSR @ 25°C
±0.3%, FSR @ -40°C, 75°C
Sampling Rate:
• All channels: 12 samples/sec
• Per channel: 1.5 samples/sec
Isolation: 3k VDC or 2k Vrms
Operating Temperature: -40 to 75°C (-40 to 176°F)

Input Current: 78 mA @ 24 VDC
Wiring: I/O cable, 14 AWG (max.)
MTBF: 1,225,957 hrs (Standard: Telcordia SR332)

KM-2430-T: 4-port unmanaged Ethernet switch module

Standards:
IEEE 802.3 for 10BaseT
IEEE 802.3u for 100BaseT(X)
IEEE 802.3x for Flow Control
Processing Type: Store and Forward
Interface: Front cabling, M12 connector, 10/100BaseT(X) auto negotiation speed
Operating Temperature: -40 to 75°C (-40 to 176°F)
Input Current: 20 mA @ 24 VDC
MTBF: 3,873,592 hrs (Standard: Telcordia SR332)

EN 50121

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Programmable RTU Controllers > ioPAC 8020 Series Modules

ioPAC 5542 Series

Rugged, compact RTU controllers

> Dedicated ARM CPUs for both the main system and I/O channels
> Millisecond timestamp granularity on both digital input and analog input
> Up to 250 Hz sampling rate per analog input channel
> Prerecord feature for analog input data logging
> Supports C/C++ or IEC 61131-3 programming languages
> Compliant with EN 50121-4, UL/cUL Class 1 Division 2
> Robust and compact design for harsh environments

RoHS EN 50121 CE FC c(UL)us LISTED

: Overview

The ioPAC 5500 standalone controllers use an ARM9 industrial-grade CPU for the main system, with ARM Cortex™ M4 based CPUs used for I/O channels. The dual CPU architecture supports up to a 250 Hz per channel analog input sampling rate with millisecond timestamp granularity. The ioPAC 5500 supports C/C++ or IEC 61131-3 programming langauges, rail-level surge and ESD protection, a -40 to

75°C (-30 to 75°C for HSPA models) operating temperature range, UL/cUL Class 1 Division 2 certifications, two 10/100 Mbps Ethernet ports with two MACs (Port Trunking ready), and two 3-in-1 serial ports. With Moxa's Active OPC Server and DA-Center, the ioPAC 5500 series provides a comprehensive solution for data acquisition and control applications in harsh environments.

High Sampling Rate

Moxa's ioPAC 5542 RTUs use an ARM9 industrial-grade CPU, and the dual CPU architecture supports up to a 2000 Hz analog input sampling rate (all channels), giving engineers the analog data precision they need to correctly analyze events, and then formulate the best response.

High sampling rate AI

Prerecorded Analog Input

The ioPAC 5542's prerecord function allows the RTU controller to continuously record analog input data before an event trigger point. The prerecording function is a major improvement over products that only start data logging after an event has occurred, which can lead to the loss of critical data due to the latency between the event and when the data logging actually begins.

Prerecording

: 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.

Cellular (for the ioPAC 5542-HSPA Series)
Network:
• Quad-band GSM/GPRS/EDGE 850/900/1800/1900 MHz
• Five-band UMTS/HSPA+ 800/850/AWS/1900/2100 MHz
Internet:
HSPA
• Up to 5.76 Mbps upload speed
• Up to 14.4 Mbps download speed

UMTS: Up to 384 kbps upload/download speed
EDGE Class 12: Up to 237 kbps upload/download speed
GPRS Class 12: Up to 85.6 kbps upload/download speed
SMS: Point-to-Point Text/PDU mode
SIM Control Voltage: 3/1.8 V

Ethernet Interface
LAN: 2 x 10/100 Mbps, 2 MACs (IPs), RJ45
Protection: 1.5 kV magnetic isolation

Serial Interface
Interface:
• 2 RS-232/422/485 ports, software selectable (DB9 male)
• 1 RS-232 debug port (4-pin connector)
Serial Line Protection: 15 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

Inputs and Outputs

Digital Inputs: 8 channels
Configurable DIOs: 8 channels
Analog Inputs: 8 channels
Isolation: 3k VDC or 2k Vrms

Digital Input

Sensor Type: Wet Contact (NPN or PNP), Dry Contact
I/O Mode: DI Counter or Frequency
Dry Contact:
• On: short to GND
• Off: open
Wet Contact:
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: 4 points per COM
Counter Frequency: 1 kHz
Digital Filtering Time Interval: Software selectable (by 0.5 ms)

Digital Output

Type: Sink
I/O Mode: DO or PWM
Pulse Output Frequency: 1 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

Analog Input

Type: Differential Input
Resolution: 16 bits
I/O Mode: Voltage / Current
Input Range: 0 to 10 VDC, -10 to 10 VDC, 0 to 20 mA, 4 to 20 mA (wire off)
Historical Data Buffering: 60 KB per channel, 120-second data buffer at 250 Hz
Accuracy:
±0.1% FSR @ 25°C
±0.3% FSR @ -40 and 75°C
Sampling Rate:
• All channels: 2000 samples/sec
• Per channel: 250 samples/sec
Input Impedance: 2 mega-ohms (min.)
Built-in Resistor for Current Input: 120 ohms (min.)

Software Characteristics

Automation Languages: C/C++ or IEC 61131-3
Protocols: Modbus TCP/RTU (master/slave), SNMP TCP/IP, UDP, DHCP, BOOTP, SNTP, SMTP

Power Requirements

Input Voltage: 24 VDC (9 to 48 VDC)
Input Current:
• ioPAC 5542-HSPA series: 305 mA @ 24 VDC
• ioPAC 5542 series: 264 mA @ 24 VDC

Physical Characteristics

Housing: Aluminum
Dimensions: 90.05 x 135 x 105.4 mm (3.55 x 5.32 x 4.15 in)
Weight:
• ioPAC 5542-HSPA Series: 1100 g (2.43 lb)
• ioPAC 5542 Series: 1000 g (2.20 lb)
Mounting: DIN rail (standard), wall (optional)
Connector: Spring-type terminal block

Environmental Limits

Operating Temperature:
• ioPAC 5542 Series: -40 to 75°C (-40 to 176°F)
• ioPAC 5542-HSPA Series: -30 to 75°C (-22 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: 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 55022/24
EMI: FCC Part 15 Subpart B Class A, CISPR 22
EMS:
IEC 61000-4-2 ESD: Contact: 4 kV; Air: 8 kV
IEC 61000-4-3 RS: 80 MHz to 1000 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: 1 kV
IEC 61000-4-6 CS: 3 V
IEC 61000-4-8 PFMF: 1 A/m
Radio: NCC
Rail Traffic: EN 50121-4
Hazardous Location: Class 1 Division 2
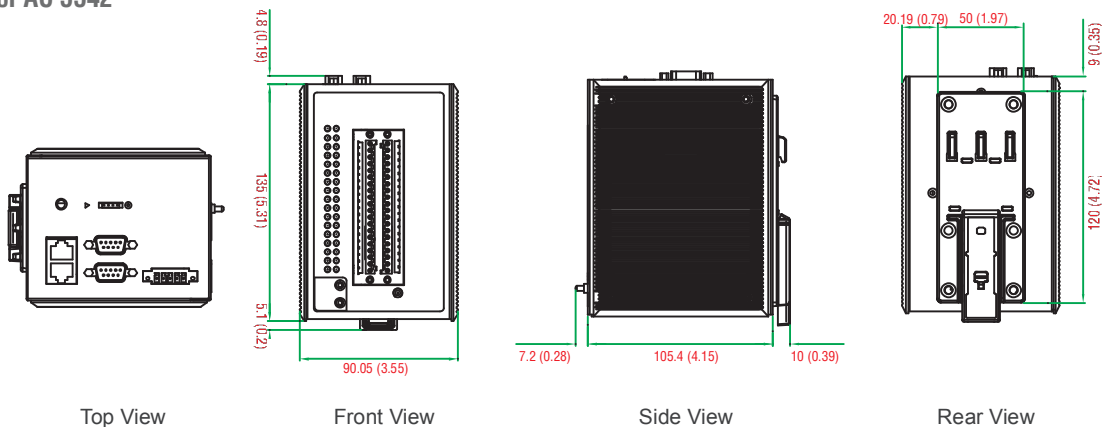Note: Please check Moxa's website for the most up-to-date certification status.

Warranty

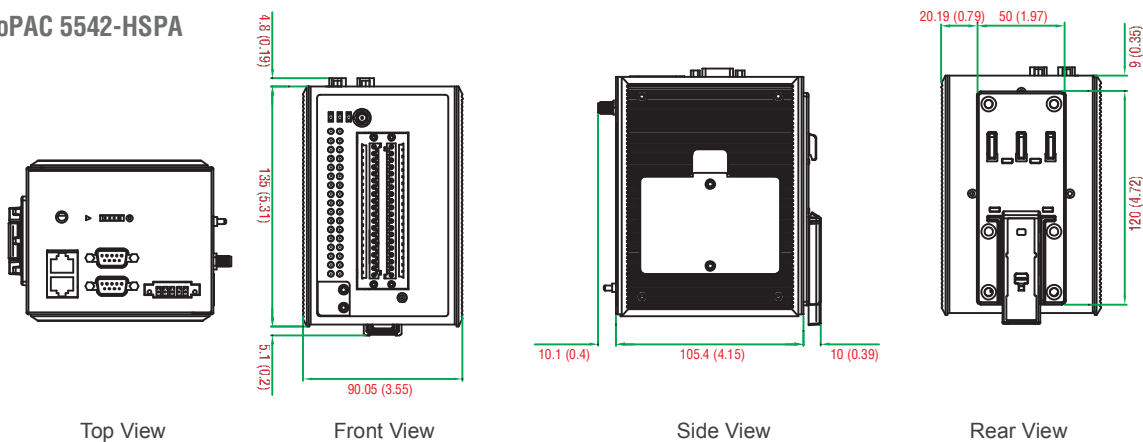**Warranty Period:** 5 years
Details: See www.moxa.com/warranty

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Programmable RTU Controllers > ioPAC 5542 Series

Dimensions

Unit: mm (inch)

ioPAC 5542

4.8 (0.19)

135 (5.31)

5.1 (0.2)

90.05 (3.55)

Top View   Front View

7.2 (0.28)   105.4 (4.15)   10 (0.39)

Side View

20.19 (0.79)   50 (1.97)   9 (0.35)

120 (4.72)

Rear View

ioPAC 5542-HSPA

4.8 (0.19)

135 (5.31)

5.1 (0.2)

90.05 (3.55)

Top View   Front View

10.1 (0.4)   105.4 (4.15)   10 (0.39)

Side View

20.19 (0.79)   50 (1.97)   9 (0.35)

120 (4.72)

Rear View

: Ordering Information

Available Models

ioPAC 5542-C-T: Rugged, compact, Ethernet, C/C++ programmable controller with 8 DIs, 8 DIOs, 8 AIs, -40 to 75°C operating temperature

ioPAC 5542-IEC-T: Rugged, compact, Ethernet, IEC 61131-3 programmable controller with 8 DIs, 8 DIOs, 8 AIs, -40 to 75°C operating temperature

ioPAC 5542-HSPA-C-T: Rugged, compact, HSPA, C/C++ programmable controller with 8 DIs, 8 DIOs, 8 AIs, -30 to 75°C operating temperature

ioPAC 5542-HSPA-IEC-T: Rugged, compact, HSPA, IEC 61131-3 programmable controller with 8 DIs, 8 DIOs, 8 AIs, -30 to 75°C operating temperature

Optional Accessories (can be purchased separately)

DK-DC50131: DIN-rail mounting kit, 50 x 131 mm
CBL-RJ458P-100: 8-pin RJ45 CAT5 Ethernet cable, 100 cm
CBL-F9DPF1x4-BK-100: Serial console cable
WK-51-01: Wall-mounting kit, 2 plates with 6 screws
ANT-WCDMA-AHSM-04-2.5m Black: 3G cellular antenna

Package Checklist

- ioPAC 5500 controller
- Serial cable: CBL-F9DPF1x4-BK-100
- Cellular 3G antenna: ANT-WCDMA-AHSM-04-2.5m black
- Documentation and software CD