ioPAC 8500 Series

▶ *Award-winning Product*

TAIWAN
EXCELLENCE 2014
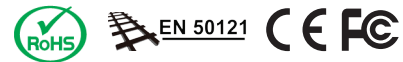
Rugged modular RTU controllers

> 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
> Complies with 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

RoHS   EN 50121   CE   FC

: 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 IO 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 55032, EN 55024
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: 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 50121-4
*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
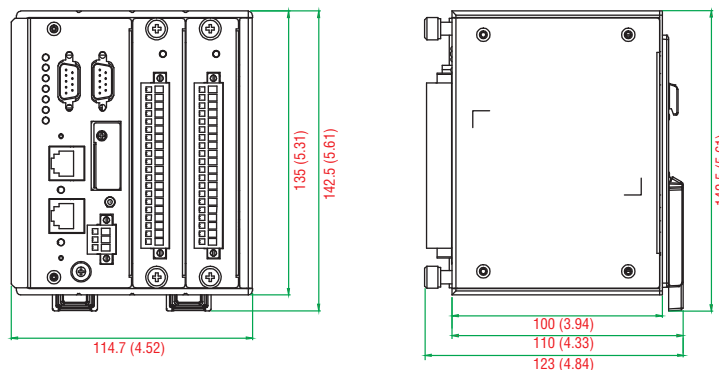**Standard:** Telcordia SR332

Warranty

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

Dimensions

ioPAC 8500-2

Unit: mm (inch)

135 (5.31)
142.5 (5.61)
114.7 (4.52)
142.5 (5.61)
100 (3.94)
110 (4.33)
123 (4.84)

MOXA®

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
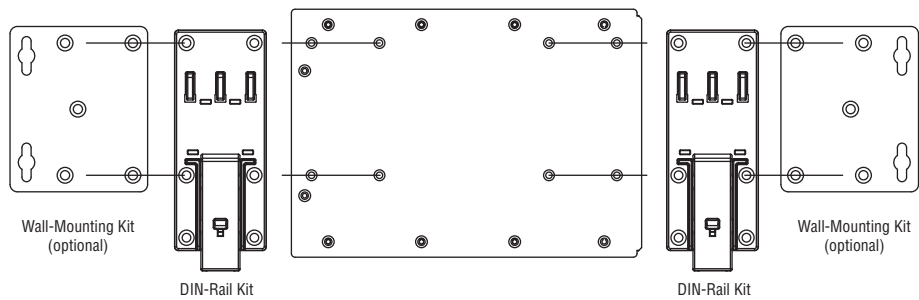
Wall-Mounting Kit
(optional)

DIN-Rail Kit

DIN-Rail Kit
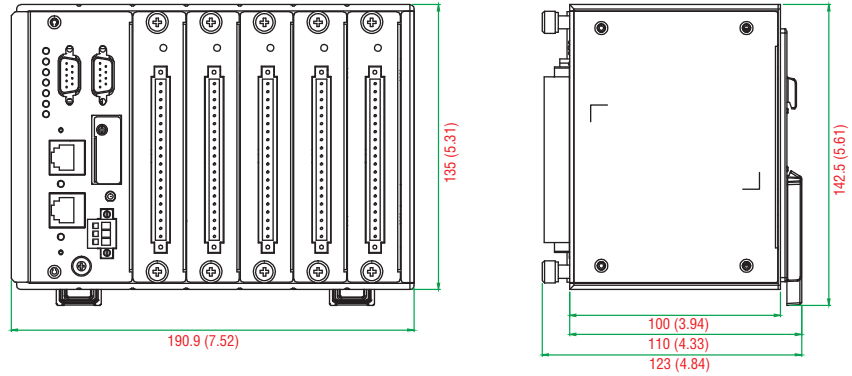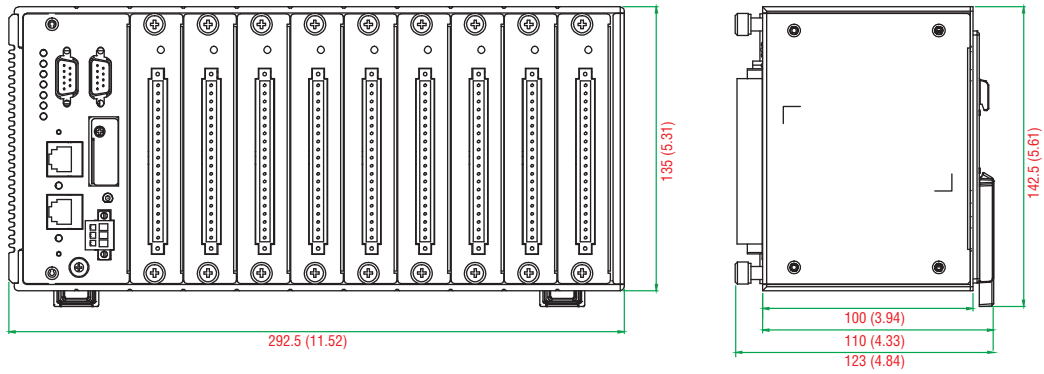
Wall-Mounting Kit
(optional)

: 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

Package Checklist (ioPAC 8500)

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

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

Package Checklist (85M modules)

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

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)

ioPAC 8500 Series (85M) Modules
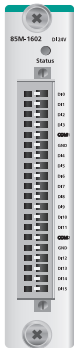
85M-1602-T: 16 digital inputs, 24 VDC, sink/source type

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

RoHS EN 50121 CE FC
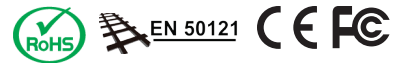
85M-2600-T: 16 digital outputs, 24 VDC, sink-type
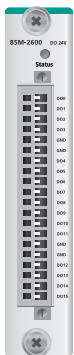
Inputs and Outputs
Digital Outputs: 16 channels
Isolation: 3k VDC or 2k Vrms
Digital Output
Type: Sink
I/O Mode: DO or PWM
Pulse Output Frequency: 5 kHz
Over-Voltage Protection: 45 VDC
Over-Current Protection: 2.6 A (4 channels @ 650 mA)
Over-Temperature Shutdown: 175°C (typical), 150°C (min.)
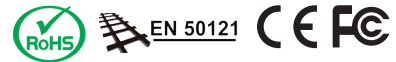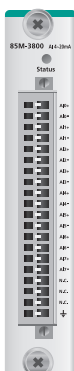**Current Rating:** 200 mA per channel

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

RoHS EN 50121 CE FC

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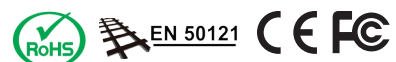**Input Impedance:** 125 ohms (min.)

Physical Characteristics
Wiring: I/O cable, 16 AWG (max.)
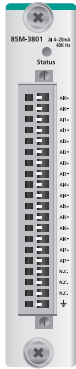**Connector:** Spring-type terminal block
Environmental Limits
Operating Temperature: -40 to 75°C (-40 to 176°F)
Power Requirements
Input Current: 318.2 mA @ 3.3 VDC
MTBF (mean time between failures)
Time: 1,512,906 hrs
Standard: Telcordia SR332

RoHS EN 50121 CE FC

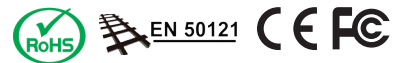## 85M-3801-T: 8 analog inputs, 4 to 20 mA, 40 kHz
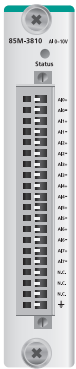
Inputs and Outputs
Analog Inputs: 8 channels
Isolation: 3k VDC or 2k Vrms
Analog Input
Type: Differential
Resolution: 16 bits
I/O Mode: 4 to 20 mA (wire off)
Historical Data Buffering: 60 KB per channel, 6-second data buffer at 5 kHz
Accuracy:
±0.1% FSR @ 25°C
±0.3% FSR @ -40 and 75°C
Sampling Rate:
• 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
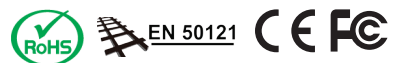
85M-3810-T: 8 analog inputs, 0 to 10 VDC
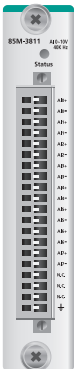
Inputs and Outputs
Analog Inputs: 8 channels
Isolation: 3k VDC or 2k Vrms
Analog Inputs
Type: Differential
Resolution: 16 bits
I/O Mode: 0 to 10 VDC
Accuracy:
±0.1% FSR @ 25°C
±0.3% FSR @ -40 and 75°C
Sampling Rate:
• All channels: 100 samples/sec
• Per channel: 12.5 samples/sec
Input Impedance: 200 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

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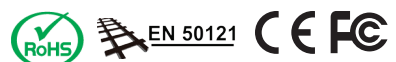
85M-5401-T: 4 serial ports (RS-232/422/485)

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
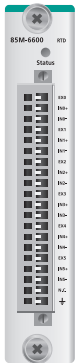**Input Current:** 375.8 mA @ 3.3 VDC
MTBF (mean time between failures)
Time: 596,611 hrs
Standard: Telcordia SR332

RoHS | EN 50121 | CE | FC

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
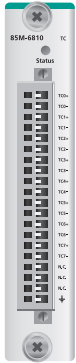**Input Current:** 201.5 mA @ 3.3 VDC
MTBF (mean time between failures)
Time: 571,446 hrs
Standard: Telcordia SR332

RoHS | EN 50121 | CE | FC

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

: Common Specifications

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 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: 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 50121-4
*Complies with a portion of EN 50155 specifications.

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