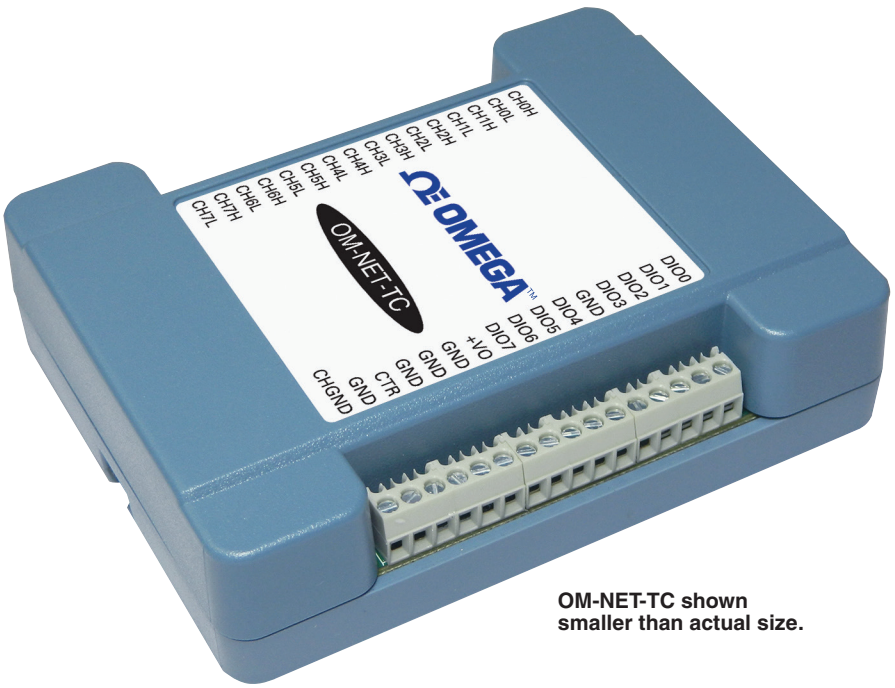
8-Channel Thermocouple Input Ethernet Data Acquisition Module

OMEGA™
a spectris company

OM-NET-TC 1 YEAR WARRANTY CE

- **Eight 24-Bit Differential Thermocouple Inputs with Thermocouple Channel-to-Host Isolation**
- **4 Samples/Sec Channel Maximum Sample Rate**
- **Two Integrated Cold Junction Compensation (CJC) Sensors**
- **Open Thermocouple Detection**
- **8 Digital I/O Isolated From Thermocouple Inputs and Host**
- **Digital Outputs Have ±24 mA Drive Capability and are Configurable as Thermocouple Alarms**
- **10/100 Ethernet Interface**



OM-NET-TC shown smaller than actual size.

The OM-NET-TC thermocouple input data acquisition module offers high-accuracy temperature measurement with an Ethernet interface. The device offers the best value per channel and the best possible accuracy because the accuracy of the internal measurement electronics exceeds the accuracy specifications of the thermocouple sensors. The OM-NET-TC is functionally equivalent to an OMEGA™ OM-USB-TC module (USB interface to computer) which makes application migration very easy.

Ethernet Interface

The OM-NET-TC has a built-in high-speed communication port. Users can remotely access and configure the device with software over the Internet.

Thermocouple Input

Connect up to eight differential thermocouple (TC) input channels to the OM-NET-TC. The OM-NET-TC supports a maximum sample rate of 4 S/s per channel, and thermocouple types J, K, T, E, R, S, B and N. Thermocouple types are software-selectable per channel.

Cold-Junction Compensation

The OM-NET-TC has two high-resolution cold-junction compensation (CJC) sensors (one per four thermocouple inputs).

Open-Thermocouple Detection

The OM-NET-TC is equipped with open-thermocouple detection (OTD) for all thermocouple input channels. With OTD enabled, users can monitor for broken or disconnected thermocouple inputs.

Digital I/O

The OM-NET-TC has eight digital I/O channels that are electrically isolated from the analog circuits. Each bit is individually configurable for input or output. Data can be transferred at rates up to 5 kS/s when the device and host are connected by Ethernet to the same local network. Typical throughput is system-dependent. All DIO channels are pulled high by default to 5V through 47 kΩ resistors with a jumper on the circuit board. Each jumper configures the digital port for pull-up or pull-down.

Temperature Alarms

Each digital output can be optionally configured as an alarm for each thermocouple input. When an alarm is enabled, the output line associated with the alarm is driven to the appropriate state determined by the alarm options and input temperature. Use the alarm outputs to control a device or application that indicates when a temperature threshold has been exceeded, or to indicate an open thermocouple condition.

Counter Input

The 32-bit event counter pin counts TTL pulses, and accepts frequency inputs up to 10 MHz.

Power

The OM-NET-TC requires external power from the 5V, 1A power adapter (OM-NET-PS) included with the device.

Calibration

The OM-NET-TC is factory-calibrated using a NIST-traceable calibration process. Specifications are guaranteed for one year. For calibration beyond one year, Contact Omega and return the device for recalibration.

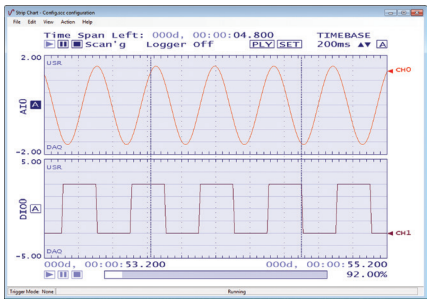
Software

The OMB-NET-TC module ships with an impressive array of software, including the new TracerDAQ®, a full-featured, out-of-the-box data logging, viewing, and analysis application. Driver support and detailed example programs are included for Universal Library programming libraries for Microsoft® Visual Studio® programming languages, and other languages, including DASYLab®, and ULx for NI LabVIEW® (comprehensive library of VIs and example programs compatible with 32-bit and 64-bit LabVIEW 2010 or later) and InstaCal™ installation, calibration and test utility-powerful solutions for programmers and nonprogrammers alike. These modules operate under Microsoft Windows® VISTA/7/8/10 (32-bit and 64-bit) operating systems.

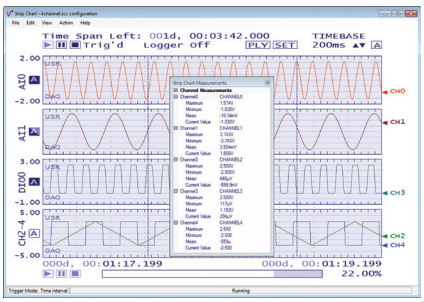
The OMB-NET-TC data acquisition module is supplied with TracerDAQ software which is a collection of four virtual instrument applications used to graphically display and store input data and generate output signals:

- Strip Chart—Log and graph values acquire from analog inputs, digital inputs, temperature inputs and counter inputs
- Oscilloscope—Display values acquired from analog inputs
- Function Generator—Generate waveforms for analog outputs
- Rate Generator—Generate waveforms for counter outputs

TracerDAQ PRO is an enhanced version of TracerDAQ and is available as a purchased upgrade (SWD-TRACERDAQ-PRO). A comparison of some of the features included in TracerDAQ vs TracerDAQ Pro is shown below.



TracerDAQ Strip Chart.



TracerDAQ Pro Strip Chart with Measurements.

Features Comparison

Strip Chart

Feature	TracerDAQ	TracerDAQ Pro
Channel Types	Analog input, temperature input, digital input, event counter	Analog input, temperature input, digital input, event counter
Number of Channels	8	48
Number of Lanes	2	8
Maximum Samples per Channel	32,000	1 million
Alarm Conditions	No	Yes
Measurements Window	No	Yes
Enter Annotations	No	Yes
Software Triggering	No	Yes
Hardware Triggering	No	Yes
Time-of-Day Triggering	No	Yes
Linear Scaling	No	Yes

Oscilloscope

Feature	TracerDAQ	TracerDAQ Pro
Channel Type	Analog input	Analog input
Number of Channels	2	4
Measurements Window	No	Yes
Reference Channel	No	Yes
Math Channel	No	Yes

Rate Generator

Feature	TracerDAQ	TracerDAQ Pro
Channel Type	Counter output	Counter output
Number of Channels	1	20

Function Generator

Feature	TracerDAQ	TracerDAQ Pro
Channel Type	Analog output	Analog output
Number of Channels	1	16
Waveform Types	Sine	Sine, square, triangle, flat, pulse, ramp, random, arbitrary
Duty Cycle	No	Yes
Phase	No	Yes
Gate Ratio	No	Yes
Rate Multiplier	No	Yes
Sweep (Linear and Exponential)	No	Yes

Specifications
(Typical for 25°C unless otherwise specified)

THERMOCOUPLE INPUT

A/D Converter Type: Delta-Sigma

A/D Resolution: 24-bit

Number of Channels: 8 differential channels

Isolation Between Any Thermocouple Input Channel and Digital/Chassis Ground: 500 Vdc absolute max

Channel Configuration: Software-selectable for thermocouple types J, K, T, E, R, S, B, N (factory default configuration is type J). Channel configuration is stored on EEPROM external to the isolated microcontroller by the firmware whenever any item is modified. Modification is performed by commands issued from an external application, and the configuration is made non-volatile through the use of the EEPROM.

Differential Input Voltage Range: ±0.128V (calibration is performed at ±70 mV)

Absolute Maximum Input Voltage (Between any Two TCx Inputs): ±25V (power on), ±25V (power off)

Differential Input Impedance: 40 MΩ

Input Current:

Open Thermocouple Detect Disabled: 1 nA

Open Thermocouple Detect Enabled: 65 nA

Common Mode Rejection (f_{in} = 50 Hz or 60 Hz): 110 dB

Noise Rejection (f_{in} = 50 Hz or 60 Hz): 75 dB

Input Bandwidth: 10 Hz

Crosstalk Between Any Two Thermocouple Inputs: -90 dB

Sample Rate: 4 Hz max (per channel). The enabled thermocouple inputs are continuously converted at the maximum A/D converter rate. If channels are enabled and have an open thermocouple connection the sampling rate will be lower.

Input Noise: 250 nV rms

Gain Error: 0.006% FSR

Offset Error: 3 µV

Thermocouple Input

Types	Ranges
J	-210 to 1200°C (-346 to 2192°F)
K	-270 to 1372°C (-454 to 2502°F)
T	-270 to 400°C (-454 to 752°F)
E	-270 to 1000°C (-454 to 1832°F)
R	-50 to 1768°C (-58 to 3214°F)
S	-50 to 1768°C (-58 to 3214°F)
B	0 to 1820°C (32 to 3308°F)
N	-50 to 1768°C (-58 to 3214°F)

Thermocouple Measurement Accuracy, Including CJC Measurement Error. All Specifications are (±).

Sensor Type	Sensor Temperature (°C)	Accuracy Error Maximum (°C), 15 to 35°C	Accuracy Error Typical (°C), 15 to 35°C	Accuracy Error Maximum (°C), 0 to 45°C	Accuracy Error Typical (°C), 0 to 45°C
J	-210	1.896	0.823	2.228	0.990
	0	0.760	0.328	0.815	0.364
	1200	0.717	0.324	1.336	0.585
K	-210	2.196	0.938	2.578	1.141
	0	0.787	0.334	0.848	0.377
	1372	0.974	0.431	1.807	0.786
S	-50	2.144	0.711	2.566	1.053
	250	1.595	0.528	1.888	0.775
	1768	0.750	0.178	1.759	0.649
R	-50	2.266	0.749	2.715	1.113
	250	1.617	0.534	1.917	0.786
	1768	0.631	0.148	1.579	0.584
B	250	1.934	0.453	2.552	0.977
	700	0.740	0.179	1.128	0.439
	1820	0.482	0.137	1.213	0.492
E	-200	1.700	0.742	1.987	0.884
	0	0.752	0.327	0.806	0.360
	1000	0.629	0.285	1.142	0.500
T	-200	1.920	0.817	2.253	0.993
	0	0.801	0.339	0.870	0.385
	400	0.519	0.223	0.702	0.308
N	-200	2.125	0.876	2.518	1.101
	0	0.857	0.351	0.940	0.412
	1300	0.668	0.291	1.352	0.585

Thermocouple measurement accuracy specifications include polynomial linearization, cold junction compensation, and system noise. The accuracy specifications assume the device is operated within its enclosure and has been warmed up for the recommended 20 minutes. Errors shown do not include the inherent thermocouple error. When thermocouples are attached to conductive surfaces, the voltage differential between multiple thermocouples must remain within ±1.8V. For best results, it is recommended to use electrically insulated thermocouples when possible.

Measurement Sensitivity (Smallest Change in Temperature That Can Be Detected):

Thermocouple Type J,K,T,E,N: 0.09°C

Thermocouple Type R,S: 0.11°C

Thermocouple Type B: 0.13°C

Warm-Up Time: 20 minutes min

Open Thermocouple Detect Response Time: 1 s

CJC Sensor Accuracy (0 to 45°C): ±0.20°C typ, ±0.40°C max

DIGITAL I/O

Digital Type: 5V TTL input/ CMOS output

Number of I/O: One port of 8 bits, shared with temperature alarms

Configuration: Each bit can be independently configured for input or output

Pull-Up Configuration: All pins pulled up to 5V using 47 K resistors (default). Can be changed to pull-down using an internal jumper

Digital I/O Transfer Rate (System-Paced): 100 to 5000 port reads/writes or single bit reads/writes per second typ, on local network. This is the typical throughput when the device and host are both connected by Ethernet to the same local network. The throughput can vary significantly, and typical throughput is not guaranteed if a wireless connection is involved or data is sent over the internet

Alarm Functionality: Any combination of DIO bits may be configured to become outputs and go to defined values when an Ethernet connection with a host is established or lost

Power On and Reset State: All bits are input unless the alarm functionality is enabled for them

Input High Voltage Threshold: 2.0V min

Input High Voltage Limit: 5.5V absolute max

Input Low Voltage Threshold: 0.8V max

Input Low Voltage Limit: -0.5V absolute min, 0 V recommended min

Output High Voltage: 4.4V min (IOH = -50 µA), 3.76V min (IOH = -24 µA)

Output Low Voltage: 0.1V max (IOL = 50 µA), 0.44V max (IOL = 24 µA)

Power On and Reset State: Input

TEMPERATURE ALARMS

Number of Alarms: 8 (one per digital I/O line)

Alarm Functionality: Each alarm controls its associated digital I/O line as an alarm output. When an alarm is enabled, its associated I/O line is set to output and driven to the appropriate state determined by the alarm options and input temperature. The alarm configurations are stored in non-volatile memory and loaded at power on

Alarm Input Modes:

- Alarm when input temperature ≥T1, reset alarm when input temperature <T2
- Alarm when input temperature ≤T1, reset alarm when input temperature >T2
- Alarm when input temperature is <T1 or >T2
- T1 and T2 may be independently set for each alarm

Alarm Error Modes:

- Alarm on temperature reading only
- Alarm on temperature reading or open thermocouple error
- Alarm on thermocouple error only

Alarm Output Modes:

- Disabled, digital I/O line may be used for normal operation
- Enabled, active high output (DIO line goes high when alarm condition is met)
- Enabled, active low output (DIO line goes low when alarm condition is met)

Alarm Latency: 1 second (Alarm settings are applied when changed and at power-ON. Temperatures are converted on enabled channels and processed for alarm conditions regardless of the communications connectivity)

COUNTER

Pin Name: CTR

Counter Type: Event counter

Number of Channels: 1

Input Type: Schmitt trigger, 47 kΩ pull-down to ground

Input Source: CTR screw terminal

Resolution: 32 bits

Schmitt Trigger Hysteresis: 0.6V min, 1.7V max

Input High Voltage Threshold: 1.9V min, 3.6V max

Input High Voltage Limit: 5.5V absolute max

Input Low Voltage Threshold: 1.0V min, 2.3V max

Input Low Voltage Limit: -0.5V absolute min, 0V recommended min

Input Frequency: 10 MHz max

High Pulse Width: 50 ns min

Low Pulse Width: 50 ns min

MEMORY

EEPROM: 4096 bytes

POWER

External Power Supply: 5V, 1A (via included AC adapter)

Supply Current (Quiescent Current): 177 mA typ (this is the total quiescent current requirement for the device that includes the LEDs and does not include any potential loading of the digital I/O bits or +VO terminal

User Output Voltage Range (Available at +VO Terminal): 4.40V min to 5.25V max, assumes supplied AC adapter is used

User Output Current (Available at +VO Terminal): 10 mA max

NETWORK

Ethernet Connection

Ethernet Type: 100 Base-TX, 10 Base-T

Communication Rates: 10/100 Mbps, auto-negotiated

Connector: RJ-45, 8 position

Cable Length:1 meter standard and up to 100 meters (328') max

Additional Parameters: HP auto-MDIX support

NETWORK INTERFACE

Protocols Used: TCP/IP (IPv4 only), UDP

Network Ports Used: UDP:54211 (discovery), UDP:6234 (bootloader only), TCP:54211 (com¬mands)

Network IP Configuration: DHCP + link-local, DHCP, static, link-local

Network Name: E-TC-xxxxxx, where xxxxxx are the lower 6 digits of the device MAC address

Network Name Publication: By NBNS (responds to b-node broadcasts, therefore only available on the local subnet)

NETWORK FACTORY DEFAULT SETTINGS

Factory Default IP Address: 192.168.0.101

Factory Default Subnet Mask: 255.255.255.0

Factory Default Gateway: 192.168.0.1

Factory Default DHCP Setting: DHCP + link-local enabled

NETWORK SECURITY

Security Implementation: TCP sockets are not opened unless application sends the correct PIN code (stored in non-volatile memory, may be changed by user, default value 0000)

Number of Concurrent Sessions: 1

Vulnerabilities: TCP sequence number approximation vulnerability

LED DISPLAYS AND THE FACTORY RESET BUTTON

Factory Reset Button: Used to reset the network configuration settings to the factory default values.

Power LED (Top) 4.2V <Vext <5.6V: On

Vext <4.2V, Vext >5.6V: Off (power fault)

Activity LED (Bottom): On when there is a valid host connection and blinks when a command is received

Ethernet Connector LEDs Left, Green: Link/activity indicator; on when there is a valid Ethernet link and blinks when network activity is detected.

Right, Yellow: Speed indicator; on for 100 Mbps, off for 10 Mbps or no link.

ENVIRONMENTAL

Operating Temperature Range:
0 to 55°C max (32 to 131°F)

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

Humidity: 0 to 90% RH non-condensing max

Screw Terminal Connectors

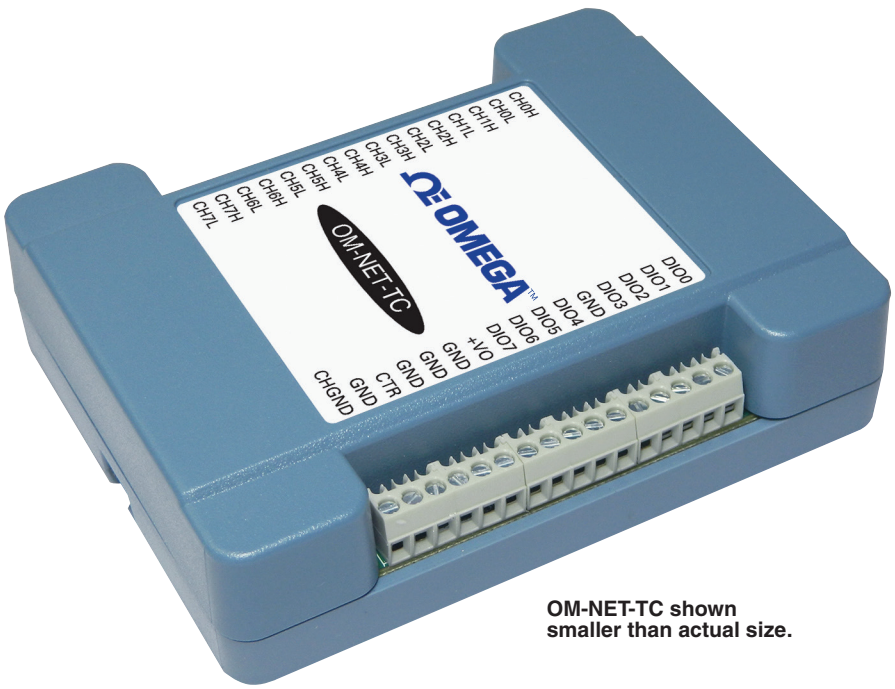
Connector Type: Screw terminal

Wire Gauge Range: 16 to 30 AWG

MECHANICAL

Dimensions:
117.9 L × 82.8 W × 29.0 mm H
(4.64 × 3.26 × 1.14")

Weight: 0.4 kg (0.88 lb)



OM-NET-TC shown smaller than actual size.

To Order	
Model No.	**Description**
OM-NET-TC	8-channel thermocouple input Ethernet data acquisition module
OM-NET-DINRAILKIT	DIN rail mounting kit for OM-NET-TC
OM-NET-PS	Spare AC power adapter for OM-NET-TC, 100/240 Vac 50/60 Hz input, 5V output (includes field interchangeable plugs for US, UK, Europe and Australia)

Comes complete with 1 m (3.2') CAT-6 Ethernet cable, universal AC adapter, quick start guide, software and operator's manual on CD.
***Ordering Example: OM-NET-TC** 8-channel thermocouple input Ethernet data acquisition module.*