Scanivalve

Universal Thermocouple Scanner

Features

• Accepts type E, J, K, N, R, S, T, and B

• Engineering Unit output, °C, °F, °R, or K

• Ethernet TCP/IP & UDP protocol

• 1000Vdc channel-to-channel isolation

• 600Vdc input isolation

• 50 - 60 Hz noise rejection

• Open thermocouple test

• IEEE1588 PTPv2 synchronization

• 16, 32, and 64 channel

DTS4050/32 Channel (shown)

General Description

The DTS4050 series temperature acquisition system represents the next generation of intelligent thermocouple scanning. The DTS4050 is a direct replacement for its predecessor, the DTS3250. The DTS4050, Digital Thermocouple Scanner, accepts 16, 32, or 64 thermocouple inputs. It incorporates integral low pass filters, 22 bit A/D converters, and a DSP microprocessor. The DTS module is specifically designed for high-noise environments and as such can withstand unmatched common mode noise.

An isothermal block is incorporated for the Uniform Temperature Reference (UTR) for each 16 channel input. NIST thermocouple tables for standard thermocouple types are stored in flash memory. The microprocessor uses these look-up tables to convert mV inputs to Engineering Units. Temperature data are output in °C, °F, °R, K, millivolts and counts.

The DTS4050 accuracy for types E, J, K, N, and T is ± .25°C to ±0.5°C depending on the thermocouple type and the useful temperature range. (Refer to accuracy table for a complete listing of supported thermocouples and associated accuracies)

Multiple standard thermocouple types may be used with one DTS4050.

Applications

The DTS4050 Digital Temperature Scanner is ideal for use in turbine engine, diesel engine, and compressor test cells, as well as other industrial environments such as boiler and oven temperature monitoring. The module has a corrosion resistant, stainless steel enclosure with a locking lid for input terminal access. The standard DTS is insulated, rugged, and splash resistant and incorporates shock mounts for vibration isolation.

The DTS4050's electronics were specifically designed to endure punishing high EMI noise environments while still being able to provide accurate engineering data.

The DTS4050 is typically mounted in close proximity to the test article, thus minimizing thermocouple wire lengths. Shorter thermocouple wires not only reduce errors, but also lower costs due to the elimination of extension cables. Field calibrations can be used to modify coefficients which can also improve overall system accuracy.

The standard DTS4050 module accepts two wire or three wire shielded thermocouples.

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DTS4050 Module

IEEE1588 PTP

The DTS4050 has a hardware supported slave implementation of the Precision Time Protocol defined by IEEE 1588-2008, otherwise known as PTP V2. This protocol is used to synchronize the DTS4050 internal clock over the Ethernet network.

The primary function of the PTP is to accurately schedule the DTS4050 acquisition and timestamp the data it transmits. It can also be used to timestamp an external trigger, such as an IRIG-B pulse rate signal.

The DTS4050 may be configured to start an acquisition at a future date and time. When a SCAN command is received, the DTS4050 schedules an event for the first frame and calculates the times of the subsequent frames of data based on the RATE setting. By configuring them identically, a number of DTS4050 units may be configured to start acquiring data synchronously. The DTS4050's support for IEEE 1588 not only allows for synchronization between multiple DTS4050 units, but also make it simple to correlate data with any other IEEE 1588 devices on the network.

Temperature Measurement

There are a number of standardized thermocouple types available on the market. Each has different properties, which makes them suitable for specific temperature ranges and environmental conditions.

Accuracy of a thermocouple measurement is highly dependent upon the reference junction connection, its material, installation techniques, and temperature.

The DTS4050 intelligent temperature scanner measures the mV signal from the thermocouples and compensates for the temperature of the cold junction.

NIST mV-temperature tables for each type thermocouple listed in this brochure are stored in the DTS4050 flash memory. This table is broken down into increments of 0.1°C. The DTS4050 microprocessor utilizes the compensated EMF and the NIST look-up table for conversion to engineering units. Temperature data are then output via Ethernet with TCP/IP or UDP protocol.

Legacy Compatibility

The DTS4050 software is backward compatible to existing Scanivalve DTS data systems. Therefore, DTS3250 and DTS4050 modules can operate in parallel on a single network, communicating with the same controlling software.

Common Mode Rejection

The DTS4050 product line was specifically designed to operate in environments with high levels of EMI. The DTS' unique architecture allows it to precisely read microvolt signals even amongst hundreds of volts of common mode noise. Supporting this capability, the DTS is built around a robust front end. Every thermocouple input channel has its own dedicated 22-bit A/D circuit providing a huge, 1000Vdc channel-to-channel isolation buffer. It is this unique parallel front end architecture that provides the DTS' unmatched common mode rejection ratio.

The specific common mode rejection ratio will vary between installations depending on the voltage, frequency, scan rate and thermocouple type used, but the graph below can be used to roughly determine the MicroVolt offset caused by various common voltages across the frequency spectrum. In addition to the 1000Vdc channel-to-channel isolation, the DTS is built to endure a sustained 600Vdc per channel of input isolation, while still providing accurate engineering unit data output.

MicroVolts offset per Frequency
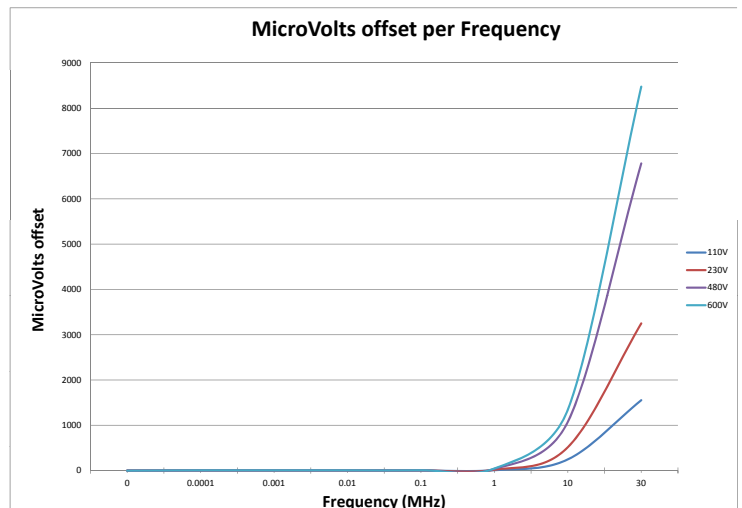
In order to take advantage of the DTS's high common mode rejection capability, the DTS was also designed to endure the physical stresses that can be associated with high-noise environments. The DTS is mounted on Mil-Spec rated shock mounts and enclosed in a rugged stainless steel chassis. The integrated UTR block and included insulation cover provide a stable, accurate reference point for all incoming thermocouple junctions.

DTS4050 System / Specifications / Ordering

DTS4050 Communications

The DTS4050 module interfaces directly to a host via an Ethernet connection. Scanivalve's free ScanTel communications program is designed to assist a user in establishing communications and data collection, as well as configuring the DTS module.

Additionally available is a Software Development Kit for users who want to write their own detailed data acquisition program in LabVIEW®. This Development Kit includes the Configuration Utility software and examples to assist a user in the setup of the system. An OPC driver is also available (16Tx only).

Specifications

Inputs (Px): 16, 32, or 64 pairs of 6-32 brass screw terminals plus shields or optional panel jack connectors

Thermocouple Types:
screw terminal: E, J, K, N, R, S,T, and B
panel jack option: E, J, K, S and T

DTS4050 Accuracy:

Accuracy Table*		
Thermocouple Type	Accuracy over Full Operating Range	Accuracy at Constant Ambient
E,J,K,N, and T	±0.5°C	±0.25°C
R and S	±2.0°C	±1.0°C
B	±4.0°C	±2.0°C

UTR Accuracy: ±0.1°C

A/D Resolution: 22 bit

Scan Rate:
64Tx: 10 Hz/channel
32Tx: 20 Hz/channel
16Tx: 40 Hz/channel

Operating Temperature:

	Std unit	with optional heater
16Tx	-10 to 60°C	-20 to 60°C
32Tx	-5 to 60°C	-20 to 60°C
64Tx	-5 to 60°C	N/A

Communication: Ethernet 100baseT
RS-232 (configuration only)

Output: °C, °F, °R, K, mVolts, or Counts

Communication Protocol: TCP/IP or UDP

Mating Connector Type:
100BaseT — RJ-45
-Conec 17-101794 shell optional
Power: Bendix PTO6A-8-3S-SR, 3 pin female
RS232/Trigger: Amphenol MS27473T8F6S, 6 pin female

Power: (18–36Vdc)
Standard—No heater:
16Tx: .58 Amps @ 28Vdc
32Tx: .83 Amps @ 28Vdc
64Tx: 1.45 Amps @ 28Vdc
With Optional Heater:
16Tx: 1.6 Amps @ 28Vdc
32Tx: 4.8 Amps @ 28Vdc

External Trigger: 6.5 mA at 5-15 Vdc minimum leading edge sensing

Weight:
Screw terminal-16 Tx: 13.00 lbs (5.9 kg)
Panel jack option-16 Tx: 12.00 lbs (5.45 kg)
Screw terminal-32 Tx: 15.5 lbs (7.03 kg)
Panel jack option-32 Tx: 15.0 lbs (6.80 kg)
Screw terminal-64 Tx: 25.0 lbs (11.35 kg)

Input/Output Isolation: 600 Vdc

Channel-Channel Isolation: 1000 Vdc

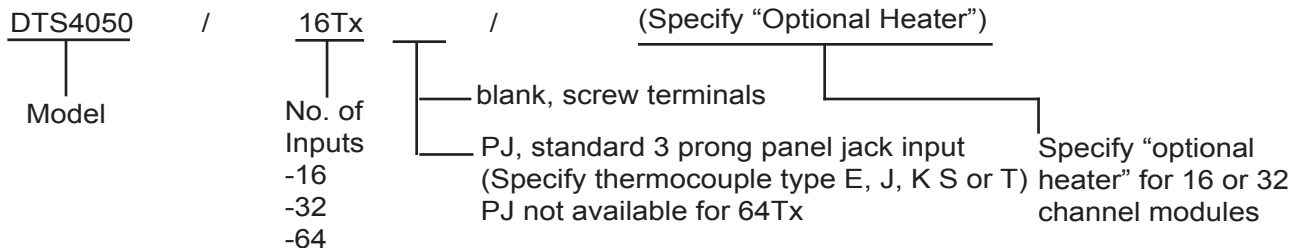**CE Mark Standards:** Class A EN61326-1 v2006

*System accuracy specifications are valid after a three hour warm up period. Accuracy does not include Thermocouples, Thermocouple Extension Wire, or Panel Jack Connector option.

Ordering Information

DTS4050 / 16Tx / (Specify "Optional Heater")

Model

No. of Inputs
-16
-32
-64

blank, screw terminals

PJ, standard 3 prong panel jack input (Specify thermocouple type E, J, K S or T) PJ not available for 64Tx

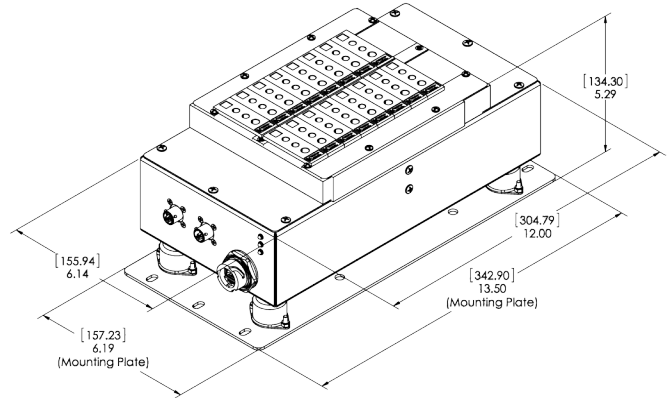Specify "optional heater" for 16 or 32 channel modules

For 32 channel rack mount kit, order 21195-2
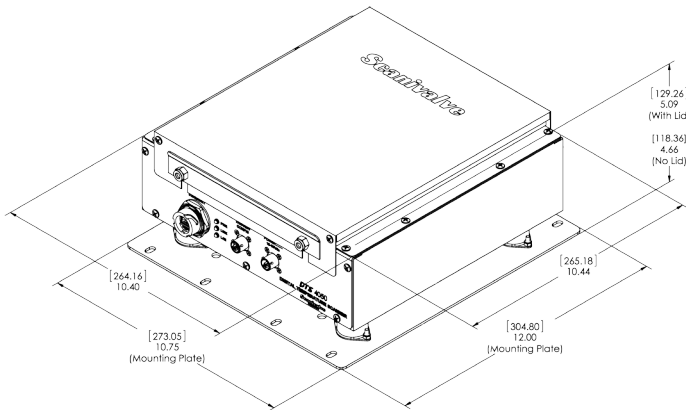For 64 channel rack mount kit, order 21195-1.
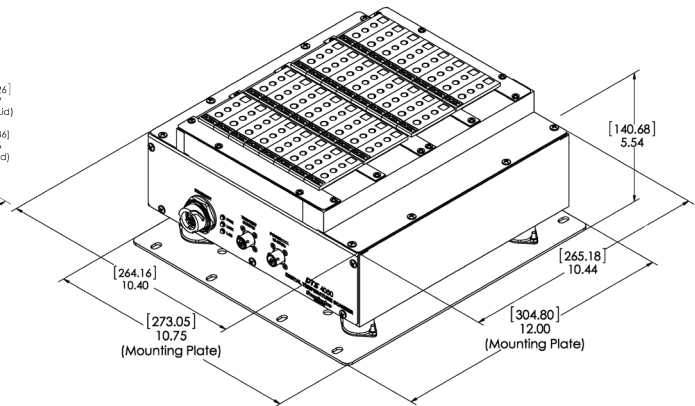
DTS4050 Dimensions
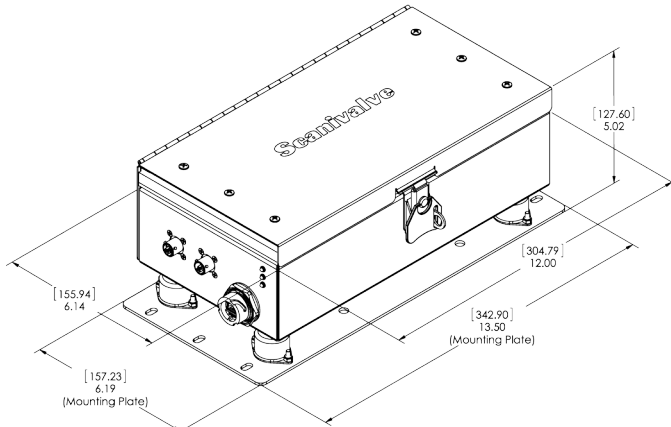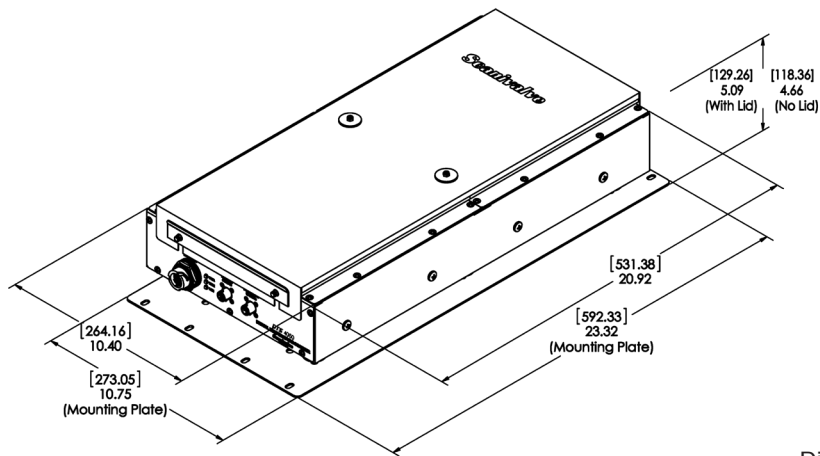
16Tx Screw Terminal Inputs

16Tx Panel Jack Connector Inputs

32Tx Screw Terminal Inputs

32Tx Panel Jack Connector Inputs

64Tx Screw Terminal Inputs

Dimension in inches [mm]

*Specifications are subject to change without notice.

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