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Find the *Keithley MTHERM-20* at our website: *Click HERE*

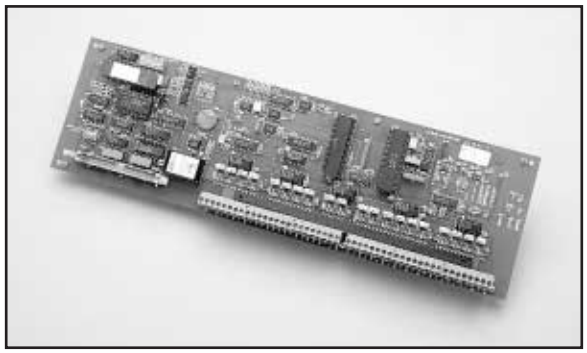
MTHERM-20

20-Channel Thermocouple Interface Board For the METRABUS

Functional Description

The MTHERM-20 is a thermocouple input board employing 20 differential input channels. Designed specifically for use with the METRABUS Industrial Data Acquisition and Control System, the MTHERM-20 employs a 12-bit integrating A/D converter and 20-channel MUX for reliability, accuracy and low cost. The MTHERM-20/METRABUS system is compatible with a very broad range of personal computers and bus structures including IBM PC/XT/AT and compatibles, and virtually all other large or small computers supporting data I/O via the serial input port (RS-232/422). The seven industry-standard thermocouples are supported directly (DIP-switch-selectable for J, K, T, R, S, B, or E) with data conversion to your choice of degree C or F. In addition, cold-junction compensation can be disabled for direct measurement of millivolts in any of four different full scale input ranges (0 to 76.4mV, 0 to 25mV, 0 to 15mV, or 0 to 5mV).

An onboard microcomputer computes the temperature from the measured input voltage, applies CJC and stores the results (internal 256 bytes of RAM) until retrieved. When allowed to collect data continuously, RAM is updated every 1.25 seconds (max, 20 channels). A short-cycle mode is also available when less than the full complement of 20 channels are used. Up to a maximum of 320 input channels (16 MTHERM-20s) are available from a single METRABUS interface board.



The MTHERM-20 is fully isolated to 500 VDC with greater than 72 dB Common Mode Rejection (35 dB NMR). Measurement resolution is 0.1 to 0.8°C (range dependent) with a measurement accuracy of 0.5°C. Signal input filtering can be implemented using a four sample-time constant (switch-selectable). Required power is +5 VDC @ 500 mA (typ) via the METRABUS cable or via an external power supply. Removable screw terminals will accept 14 AWG or smaller thermocouple wire.

The MTHERM-20 interfaces to the METRABUS via a 50 conductor ribbon cable carrying data, power, and control signals to and from the board. Ground lines are interleaved with data lines to assure accurate, noise-free measurements even at lengths of 100 feet (max) from the computer. This allows MTHERM-20 positioning adjacent to its point of use for easy signal connections. The MTHERM-20 can be mounted in standard NEMA type enclosures or in Keithley's own RMT-type enclosure (see accessories, page 479).

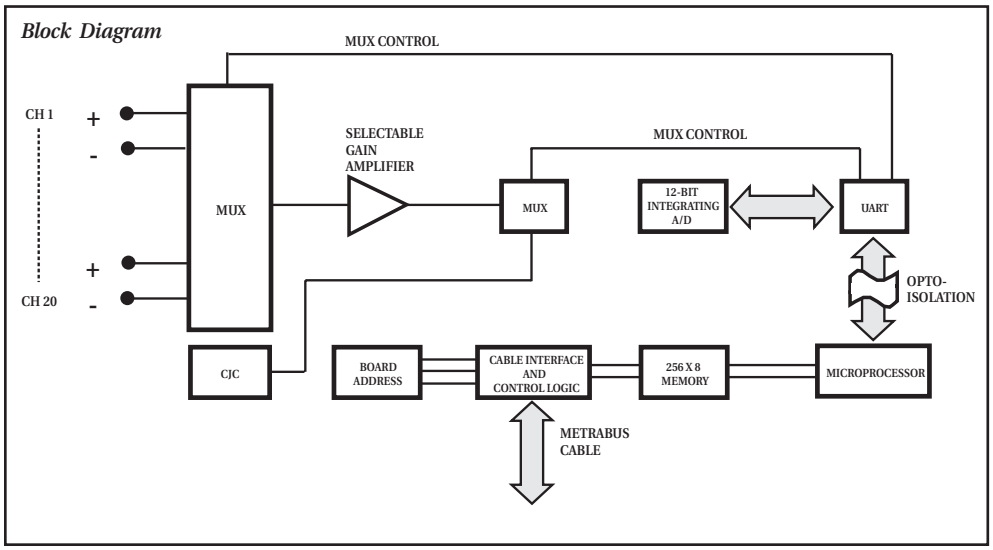
FEATURES

- Low noise 12-bit integrating A/D converter
- Up to 320 input channels per PC expansion slot or driver board
- User selectable for Type J, K, T, R, S, B, or E type thermocouples or mV
- Protected to 500VDC
- Automatic cold-junction compensation circuitry
- Data stored in either degrees C or degrees F format
- Interfaces to any IBM PC/XT/AT or compatible computer, and others computers via the RS-232/422 serial port

APPLICATION

- Process monitoring
- Process control
- Temperature logging
- Distributed systems

Block Diagram



QUESTIONS?

1-800-552-1115 (U.S. only)

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MTHERM-20

Temperature Accuracy in the MTHERM-20

The error in measuring temperature with the MTHERM-20 can be stated as being composed of the following components:

Error = A+B+C+D

where A = Thermocouple sensor error (see manufacturer)

B = Signal conditioning, A/D, and computational errors.

This is twice the resolution or at best 0.4°C (thermocouple type dependent).

If the local CJC is used to correct measurement then:

C = CJC measurement error. This is 0.5°C (0 to 50°).

D = Channel-to-channel temperature gradient at the terminal strip. In table top, 25°C, still air situations, this has been measured to be about ±0.7°C from channel 1 to 20. With proper forced air ventilation, this can be lowered to ±0.1°C.

MTHERM-20 MAXIMUM ERROR SUMMARY TABLE (J TYPE) (°C)

SITUATION	T/C A	A/D B	CJC C	T GRADIENT D (NOTE 1)	TOTAL ERROR
CJC NOT USED	A	0.4	0	0	A+0.4
CJC USED STILL AIR	A	0.4	0.5	0.7	A+1.6
CJC USED VENTED	A	0.4	0.5	0.1	A+1.0

Note 1: These errors are at 25°C measurement and CJC. The effects of CJC error are less at higher measurement temperature.

Programming

Programming the MTHERM-20 is quite straightforward due to its unique address mapping technique. All data I/O and channel selection as well as reading the Options Switch are accomplished via four addresses in the METRABUS address space. These four addresses are consecutive locations starting from the Base Address. Their function and location are detailed below.

ADDRESS LOCATIONS	READ	WRITE
MTHERM-20 ADDRESS	CHAN ID/CJC	CHAN ID/CJC (HOLD)
MTHERM ADDR + 1	DATA (low byte)	CHAN ID/CJC (HOLD)
MTHERM + 2	DATA (high byte)	CHAN ID/CJC (HOLD)
MTHERM ADDR + 3	CONFIGURATION	CHAN ID/CJC (HOLD)

Writing to any of the above locations latches the specified input channel (or CJC channel) and halts A/D conversion thus avoiding read/write conflicts. Prior to retrieving data, the HOLD mode must be cleared by writing to any address other than the four assigned to the MTHERM-20 (above). MTHERM-20 channels are numbered consecutively from 1 to 20 with channel 0 being the Cold Junction reference channel. Reading the MTHERM-20 ADDRESS will return the specified channel number. Data is held in MTHERM RAM (256 × 8) and may be retrieved by reading MTHERM ADDR + 1 and + 2, respectively, for the specified channel. Data is continuously updated in RAM at a rate of 20 channels per 1.25 seconds (RAM is not updated during a HOLD state, but data is still taken and placed in an update queue until HOLD is cleared whereupon collected data is placed in RAM).

Data is stored in MTHERM-20 RAM in two's complement, 16-bit format (divided by 10) from –3276.8 to 3276.7. Upon data retrieval, conversion to temperature is simply a matter of converting from binary to decimal format.

SPECIFICATIONS

METRABUS ADDRESS SPACE

4 consecutive addresses
INPUT CHANNELS: 20 differential
THERMOCOUPLE TYPES: T, S, R, B, J, K, E
MEASUREMENT RESOLUTION: 0.8 to 0.1 (TC dependent) °C
VOLTAGE REFERENCE ERROR: 25ppm/°C max
MEASUREMENTS UNITS: Choice of °C or °F or mV
FILTER: 4-sample time constants (when implemented)
CJC TEMP ERROR (0 to 50°C): 0.5°C
A/D CONVERTER TYPE: 12-bit, dual-slope integrating
A/D ACCURACY: ±1 bit
FULL SCALE RANGES: 76.4, 25, 15, or 5mV
UPDATE RATE: 1.25s (20 channels) 0.31s (5 channels)
INPUT ISOLATION: 500VDC 10MΩ to METRABUS

POWER REQUIREMENTS

+5V: 500 mA typ
±15V: not used

PHYSICAL

OPERATING TEMP: 0 to 70°C
STORAGE TEMP: –40 to 100°C
HUMIDITY: 0 to 95%, non-condensing
DIMENSIONS: 16in L × 4.75in W (40.63cm L × 12.06cm W)

ORDER	DESCRIPTION
MTHERM-20	METRABUS 20-Channel Thermocouple Interface Board

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