# Temperature String „Digital" <u>High Accuracy</u>


Overview

The Family of the M-Log5W Data Loggers comprises a version for Temperature Strings (TS). Here a high precision temperature sensor with digital signals is used. This gives a great flexibility for the electrical realisation of the sensors: Since the data are transmitted as a digital signal, there are no cable losses, like for traditional analogue sensors. Also one single cable is sufficient for a large number of sensors.
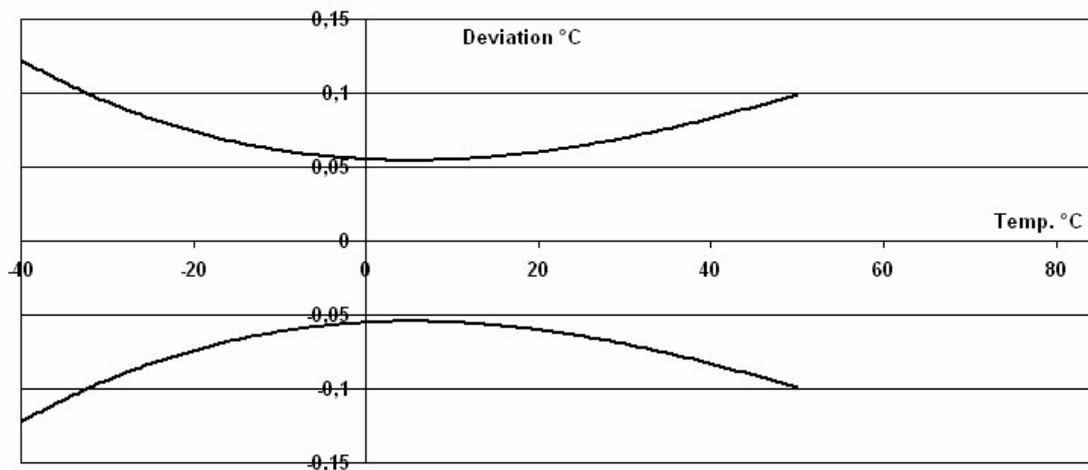
The platinum based high precision sensors itself are optimised for the temperature range -10°C to +20°C, but it is suitable for the range -40°C to +85°C with reduced accuracy. The long term stability of the sensors, if operated in the range -20°C to +40°C is not significant. The resolution of the sensors are 0.01°C.

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Topology and Electrical Data

As mentioned, the sensors are digital, so the electrical connection is absolutely uncritical, any topology: as line or as star or as a combination of both. The only restriction is the total cable length. This factor depends on the electrical data of the used cable (mainly the cable capacity). Typically (as for our standard cables, made of PUR material) the maximum total length is 20-50 meters for unshielded cables. Lengths of up to >100 meters are possible on request:
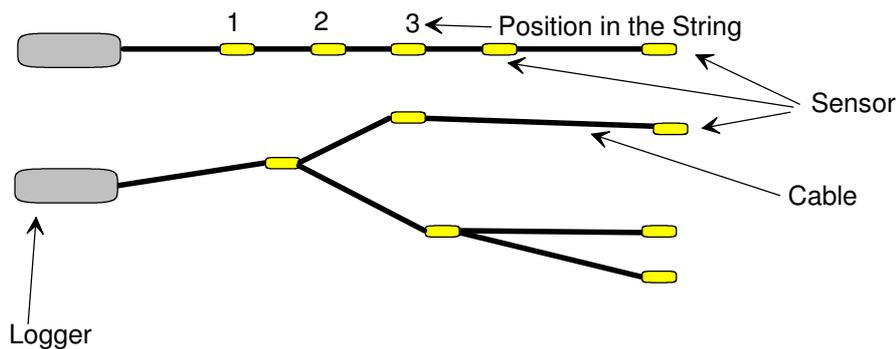
The total cable length should be kept less then
less than 20-50 meters (depending on the cable type and number of sensors)!

If the line length is too long, the digital signals are falsified. Also, there is the possibility, that in very noisy environments (electrical noise, as issued e.g. by electrical machines) can falsify the signals. The logger will recognise these erroneous data.

Electrical Setup

The sensors need 2 wires. By default these colours are used:

Red or Brown: Digital Signal
Black: Digital GND
Blue: (not useed, connected to Digital GND).

Software Setup

Each digital sensor has an 2 Byte unique serial number. The logger is able to scan all connected sensors and list their serial numbers.

Hint: Normally each logger is delivered already configured and with string, <u>ready for use</u>!
For (own, manual) changes: Open the terminal window (via Setup) in the software „GP-Shell", entering the command „cs" will scan all serial numbers of the connected temperature sensors (in decimal and hexadecimal representation). These serial numbers must be entered in the parameter Setup „SNO" as hexadecimal numbers. The position can be found out by a test measure with terminal command „cm", output is in units of 0.01°C.

Technical Data

Logger: Temperature range: -40°C to +85°C. Radio transmission frequency: a) EC, parts of Africa and Asia): 433.92 MHz (harmonised frequency for license free operation within the EC, Switzerland, Norway, Iceland. (for other countries please check the local regulations. b)   USA/Canada: 905 MHz. Effective emitted energy < 5mW

Memory: 512-2048kB (non volatile) Flash memory. Up to 100.000-400.000 measures: 1 measure typically uses 5.5 Bytes per value. Each HK-record (time stamp and optional HK-data) typically requires another 6 to 9 bytes. Since HK-values are recorded only after a selectable number of measures, (factory default is 6).
Example: 24 measures, 2 values per day require 24*5.5*2 =   264 Bytes. Additionally 4 HK-records require additional 4 * 6..9 = 36 Bytes. Sum: ca. 300 Bytes per day. Conclusion: 2048kB will be good for (theoretically) ca. 20 years without clearing the memory. The memory has a duty cycle of >100 000 clearing cycles.

HK-data: Internally the battery voltage and internal temperature can be recorded. The internal temperature is <u>only</u> calibrated on demand. Calibrated accuracy is +/- 1°C in the range -20°C to +40°C. The battery voltage is measured with a resolution of 1 mV.

Sensor: PT1000 based Temperature sensor. Resolution: 0.01°C, accuracy see graph above. The sensor range is -40°C to +85°C (please note: the logger itself is only designed for temperatures from -40°C to +60°C (+85°C for short times)). Sensor cables are possible from 50 cm to >100 meters.

Battery: SB-AA11 from www.vitzrocell.com :
                       3.6 Volt Lithium (Li-SoCl2), 2400mAh.
                       Max. Pulse load: <20 mA
                       Size: AA with solder terminal
                       Low self discharge rate (less than 1% after 1 year of storage at +20°C)
                       Non flammable
                       Non restricted for transport

               The battery can be replaced by the user. Similar types of battery are available from all major battery production companies.
               About the battery voltage: The voltage is around 3.4-3.6 V at 20°C, but „drops down" to 3.1-3.3°C at -40°C. The battery voltage does not significantly reflect the remaining power of the battery, the „temperature drops" show this better, as described below.

Calculation the battery capacity

4 main factors impact the battery capacity/lifetime:

- Constant load: about 10µA for the current version Mode „Sleeping" with periodically checking the radio. So 1 mAh is good for ca. 100 hours of „Sleeping"

- Pulse load: about 2mA for 1 seconds per measure and sensor, so 1 mAh is good for ca. 360 measures
- Self discharge: about 10% after 10 years
- Temperature cycles: difficult to predict, could be up to 50% (worst case) for harsh environments like high mountain sites.

As a rough estimation: Theoretically 2400 mAh are good for >25 years of „Sleeping" or > 500000 measures (this is almost 60 years for 1 measure per hour), if no self discharge is assumed. Practically we normally calculate only with 1/3 of the capacity (the rest is for spare): For 1 measure per hour each year requires in total 113 mAh (25 mAh for the measures and 88mAh for „Sleeping"), with the rest of 2400 mAh / 3 = 800 mAh still more than 6 years of operation should be possible. Hence we would recommend to replace the battery with these settings after 5 years or later, if „temperature drops" for cold phases rises significantly.

2.54cm

Model: LOG-W2R10
FCC-ID: 2AAREML5WR10
IC: 11303A-ML5WR10

1cm

Label

Compliance informations (only for USA/Canada):

a) User Information according to FCC 15.21:
Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

b) Part 15 Statement according FCC 15.19/RSS Gen Issue 3 Sect. 7.1.3
This device complies with Part 15 of the FCC Rules and with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

LOG-W2R10:   FCC-ID: 2AAREML5WR10 / IC Certification No IC: 11303A-ML5WR10
(Label assembled over battery screw cap)