

GST5 Module

High-Accuracy Data Acquisition Module

GENERAL DESCRIPTION

The GST5 module acquires static or dynamic readings from a wide variety of sensor types and transmits the results over a single cable to a central controller module (GCM4). Multiple GST5 modules can be connected to the single network cable creating a distributed monitoring system with high-speed simultaneous sampling that can be operated remotely with wireless modems or in real-time connected directly to a PC computer via Ethernet. The benefits of a distributed monitoring system include: increased signal quality by eliminating noise over long sensor cables, increased operational reliability, reduced costs by eliminating numerous long sensor cables and associated cable protection systems, and simplified field installation.



Technical Features

- ✓ Simultaneous sampling over all network modules
- ✓ High-Speed 24-Bit Analog-to-Digital Converter
- ✓ 9 differential and single-ended analog inputs
- ✓ Precision 5 volt excitation source with excellent long-term stability
- ✓ Change sample parameters remotely
- ✓ On board temperature, humidity, current and voltage monitoring
- ✓ Optional 0.001 resolution bi-axial tilt sensor

A network of GST5 modules connect directly to our GCM4 controller module and results are transmitted via Ethernet directly to a PC computer or to a server computer using a wireless internet modem. Each GST5 module provides four 24-bit resolution high-accuracy converters with automatic fifth-order digital low-pass anti-alias filters designed for high-speed simultaneous sampling. A dedicated trigger line input synchronizes sampling to all GST5 modules across the entire digital network. Each GST5 module provides five additional channels for multiplexed static sampling, and each module can capture over 40,000 samples per sampling event. Table 1 provides a description of all 9 input channels for the GST5.

Table 1
GST5 Channel Description

Channel	Input Type	Input Range	Simultaneous
1	Differential or Single-Ended	Table 2	Yes
2	Differential or Single-Ended	Table 2	Yes
3	Differential or Single-Ended	Table 2	Yes
4	Differential or Single-Ended	Table 2	Yes
5	Differential or Single-Ended	Table 2	No
6	Differential or Single-Ended	Table 2	No
7	Differential or Single-Ended	Table 2	No
8	Single-Ended	0 to 5V	No
9	Single-Ended	0 to 5V	No

The GST5 includes several self-health monitoring features including measurement of temperature, supply voltage, current consumption and humidity. Additionally, the GST5 can be assembled with a high-resolution tilt sensor (as low as 0.001 degrees) to monitor changes in rotation or tilt over time or dynamic low-g accelerations. The GST5 can accept single-ended or differential sensor input types with a wide range of sample rates and input signal ranges as shown in Tables 1, 2 and 3. A precision 5 volt source with excellent long-term stability provides excitation for ratiometric type sensors like strain gauges, piezometers and linear position transducers commonly used in geotechnical and structural monitoring.

Table 2
GST5 Module Input Voltage Range

Input Gain	Input Range (volts)
0.25	±10
0.5	±5
1	±2.5
2	±1.25
4	±0.625
8	±0.3125
16	±0.15625
32	±0.078125
64	±0.0390625
128	±0.01953125

Table 3
GST5 Sample Rate, Noise and Bandwidth Summary

Sample Rate (SPS)	Timing Accuracy (SPS)	Noise ($\mu\text{v rms}$)	Digital Low-Pass -3dB Filter Bandwidth (Hz)
10	0.0005	0.5	4.3
16.6	0.00083	0.55	7.3
50	0.0025	0.65	22
60	0.003	0.7	27
400	0.02	1.4	177
1200	0.06	2.3	525
3600	0.18	3.9	1440
14400	0.72	6.2	2930

Applications

- Static and Dynamic Pile Testing
- Structural Health Monitoring
- Early Warning Systems
- Landslide and Slope Monitoring
- Remote Web-Based Monitoring

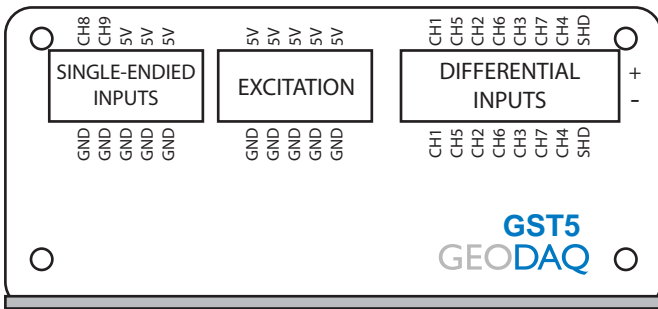


Caltrans Reusable Test Pile

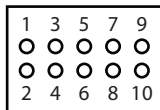
GST5 modules provide high-speed data collection for the Reuseable Test Pile and iBPT system developed at UC Davis.

Sensor Connections

The GST5 has a total of 9 sensor input channels with 24-bit resolution for monitoring external sensors like strain gauges, load cells, piezometers, and displacement transducers. A total of eight 5 volt outputs are provided for sensor excitation. Two shield connections can be connected to the cable shield if applicable. Sensor excitation and outputs are connected to a removable terminal block plugs with push-in wire connections as shown below. Simply push a button and insert the prepared wire. No screws needed.

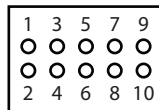


SINGLE-ENDIED INPUTS



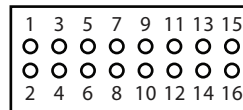
1. CH8 Input (+)
2. CH8 Ground
3. CH9 Input (+)
4. CH9 Ground
5. 5V Excitation
6. Excitation ground
7. 5V Excitation
8. Excitation ground
9. 5V Excitation
10. Excitation ground

EXCITATION



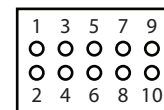
1. 5V Excitation
2. Excitation ground
3. 5V Excitation
4. Excitation ground
5. 5V Excitation
6. Excitation ground
7. 5V Excitation
8. Excitation ground
9. 5V Excitation
10. Excitation ground

DIFFERENTIAL INPUTS



1. CH1 Input (+)
2. CH1 Input (-)
3. CH5 Input (+)
4. CH5 Input (-)
5. CH2 Input (+)
6. CH2 Input (-)
7. CH6 Input (+)
8. CH6 Input (+)
9. CH3 Input (+)
10. CH3 Input (-)
11. CH7 Input (+)
12. CH7 Input (+)
13. CH4 Input (+)
14. CH4 Input (-)
15. Shield
16. Shield

CAN NETWORK



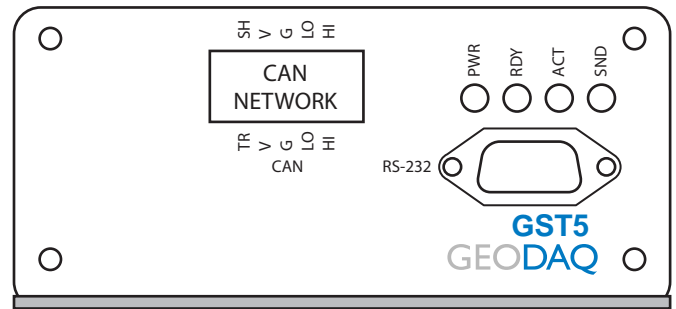
1. Shield
2. Trigger 3.3V
3. CAN V Supply
4. CAN V Supply
5. Ground
6. Ground
7. CAN Data LO
8. CAN Data LO
9. CAN Data HI
10. CAN Data HI

Table 4
GST5 LED Description

LED	Description
PWR	ON when power (CAN V Supply) is provided to the GST5 module
RDY	ON when the GST5 is ready to receive a command from the GCM4
ACT	ON when the GST5 is actively sampling
SND	ON when the GST5 is sending results to the GCM4

Communication

The GST5 communicates with the GCM4 using the CAN NETWORK connections as shown below. The GST5 also has one RS-232 port to provide output results and additional communication to external controllers or devices. A description of the four LED lights is shown in Table 4.



RS-232

GST5
GEODAQ

GST5 SPECIFICATIONS

PARAMETER	MIN	TYP	MAX	UNIT
Resolution	24			Bits
Sample Rate	10		14400	Samples per Second (SPS)
Non-Linearity		±1.5	±10	ppm
Offset Error (Gain = 1)		±50	±250	µV
Offset Drift (Gain = 1)		±0.2	±0.6	µV / °C
Input Impedance		>1		GΩ
Gain Error (All Gains)		±0.03	±0.15	%
Gain Drift		±0.5	±2	ppm / °C
Common Mode Rejection		100	120	dB
Voltage Noise		See Table 3		
Analog Signal Input Range		See Table 2		
5 Volt Excitation Temperature Coefficient		2		ppm / °C
5 Volt Excitation Accuracy		±0.05		%