Document Name	Data Reception Specifications	Product Names	GL800
Issued By	Measurement and FA Division	Issue Date	January 24, 2007

Data Reception Specifications

This document describes how to use the GL800 to acquire data through its interface. The document assumes that the data logger is ready to send and receive commands with the interface already connected. For connecting the interface, refer to samples. For sending and receiving commands, consult the Command Specifications.

1. Types of Data Reception

The GL800 (hereafter called GL) has two major modes for capturing data:

1. Real-time data reception
2. Captured-data reception

In real-time reception mode, the GL receives instantaneous values, capable of monitoring the current data status.

In captured-data reception mode, the GL receives data already captured in its medium (USB memory). The captured-data reception mode can be used to back up previously captured data or data received in real time.

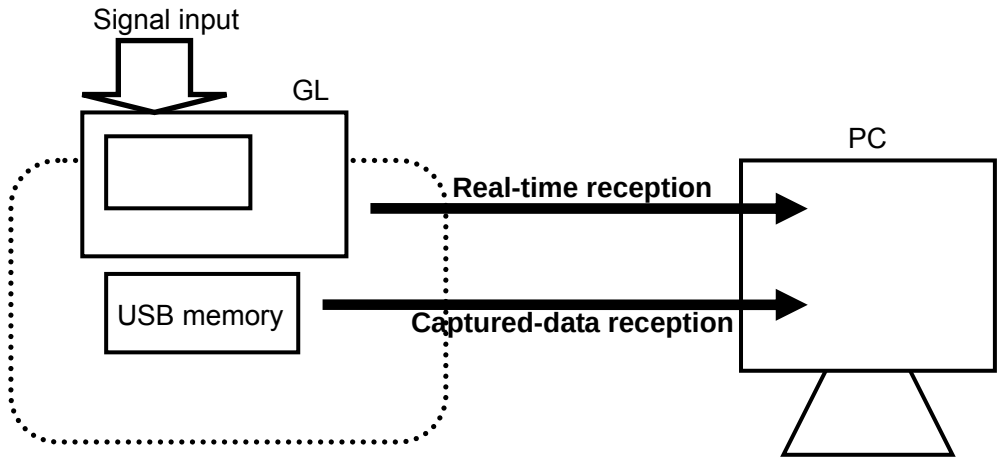


Figure 1. Types of Data Capturing

Version	Revision Date	Description
1	January 24, 2007	First edition
2		
3		
4		
5		

Document Name	Data Reception Specifications	Product Names	GL800
Issued By	Measurement and FA Division	Issue Date	January 24, 2007

1.1 Real-time Data Reception

Real-time data reception mode can be used as soon as you turn on the GL. The GL can always receive data even during free running. The configuration for real-time reception contains an internal buffer (temporary storage) to reduce data loss. It prevents data loss from occurring if data can be received before the buffer becomes full to cause data to overflow. The internal buffer available can accommodate 1000 samples (*). If the sampling interval has been set to 1 second, for example, the internal buffer provides an extra margin for 1000 seconds.
(The GL500A has an internal buffer for 2000 samples.)

In real-time data reception mode, the GL receives data using either of the following two different methods:
1. Receiving all data from the internal buffer (All-data reception)
2. Receiving only the data of a single instantaneous value (Single-data reception)
Method 1 above allows the GL to receive detailed data as it can receive all data unless the internal buffer becomes full. Method 2 is available to sample data during data capturing for an extended period of time as the GL receives only the current instantaneous value.

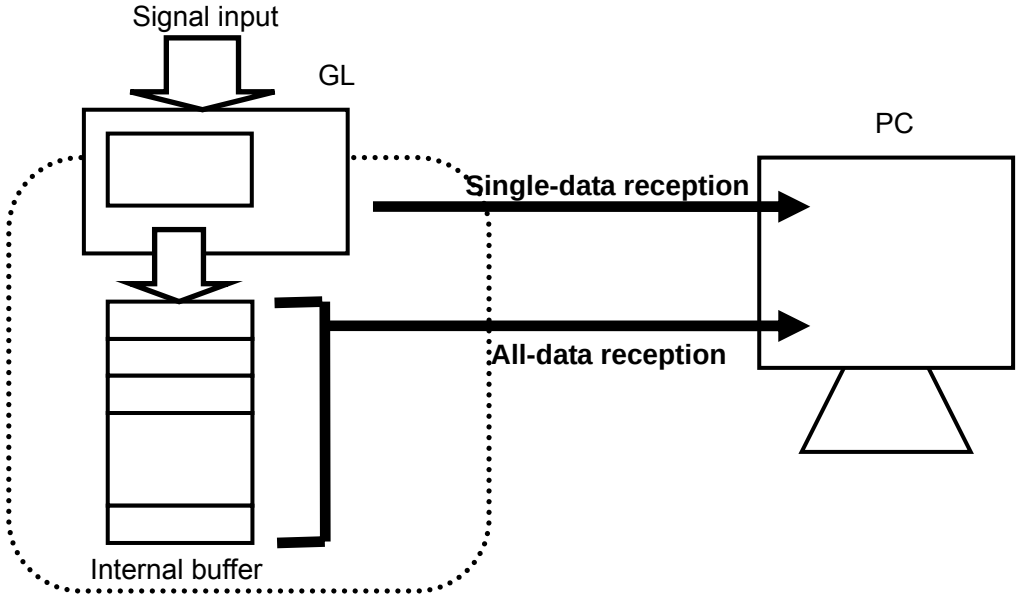


Figure 2. Configuration for Real-time Data Reception Modes

*: Sample data indicates data captured in one cycle. An example is "CH1, CH2, CH3, CH4, ALARM" which is a collection of data items captured in one sampling session.

Version	Revision Date	Description
1	January 24, 2007	First edition
2		
3		
4		
5		

1.1.1 All-data Reception

(1) Commands to be used

To receive all data from the internal buffer, use the following commands:

Command Used	Query	Description
:MEAS:OUTP:CLR?	#6000000	Clears all data in the buffer.
:MEAS:OUTP:ACK?	See (3) below.	Receives all data from the buffer.
:MEAS:OUTP:STAT?	See (2) below.	Checks the internal status of the buffer.

As the first step before starting data reception, use ":MEAS:OUTP:CLR?" to clear data off the internal buffer. Then, use ":MEAS:OUTP:ACK?" to continuously receive data before the buffer overflows.

(2) Description of ":MEAS:OUTP:STAT?"

Use ":MEAS:OUTP:STAT?" to check the status of the internal buffer. The query is formed as follows:

:MEAS:OUTP:STAT <Buffer Size>,<Data No>,<Break Num>	
<Buffer Size>	Number of data items in the internal buffer
<Data No>	Serial number of a data item in the internal buffer
<Break Num>	Number of data items discarded as the internal buffer becomes full

If <Break Num> is 1 or greater, data has already been discarded and thus data received subsequently has no continuity to data already received.

(3) Description of ":MEAS:OUTP:ACK?"

The contents of data received by the ":MEAS:OUTP:ACK?" command vary depending on the number of data items in the internal buffer, the number of terminal units mounted on the GL, and so on. Data from each channel is 16 bits long (2 bytes). The GL receives the upper one byte first and then the lower one byte as it uses the big endian method for byte ordering.

Document Name	Data Reception Specifications	Product Names	GL800
Issued By	Measurement and FA Division	Issue Date	January 24, 2007

Example: When the input terminal unit is a 20-channel unit, and there are two items of data in the internal buffer

Data Received	Description
#6******	Header (ASCII): #6 is a fixed prefix, followed by six characters ****** representing the number of bytes to be received.
CH1 analog data	CH1 data in binary format (2 bytes)
CH2 analog data	CH2 data in binary format (2 bytes)
: Omitted	: Omitted
CH19 analog data	CH19 data in binary format (2 bytes)
CH20 analog data	CH20 data in binary format (2 bytes)
Pulse 1 data 1	Pulse 1 data 2 high-order bytes The pulse data totals 4 bytes of data (32 bits): 2 high-order bytes and 2 low-order bytes
Pulse 1 data 2	Pulse 1 data 2 low-order bytes
Pulse 2 data 1	Pulse 2 data 2 high-order bytes
Pulse 2 data 2	Pulse 2 data 2 low-order bytes
Pulse 3 data 1	Pulse 3 data 2 high-order bytes
Pulse 3 data 2	Pulse 3 data 2 low-order bytes
Pulse 4 data 1	Pulse 4 data 2 high-order bytes
Pulse 4 data 2	Pulse 4 data 2 low-order bytes
Logic data	Logic data in binary format (2 bytes)
Alarm data 1	CH1 to CH16 alarm data (2 bytes)
Alarm data 2	CH17 to CH20 alarm data (2 bytes)
Alarm data (Logic/Pulse)	Logic and Pulse alarm data (2 bytes)
Status	Data status information (2 bytes)
CH1 analog data	CH1 data in binary format (2 bytes) **←The second sample starts here**
CH2 analog data	CH2 data in binary format (2 bytes)
:（Omitted）	: （Omitted）
CH19 analog data	CH19 data in binary format (2 bytes)
CH20 analog data	CH20 data in binary format (2 bytes)
Pulse 1 data 1	Pulse 1 data 2 high-order bytes The pulse data totals 4 bytes of data (32 bits): 2 high-order bytes and 2 low-order bytes

Version	Revision Date	Description
1	January 24, 2007	First edition
2		
3		
4		
5		

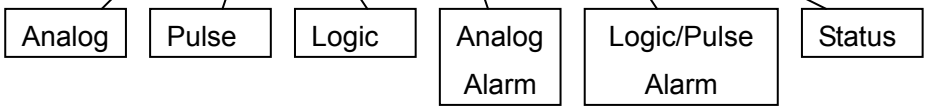
Pulse 1 data 2	Pulse 1 data 2 low-order bytes
Pulse 2 data 1	Pulse 2 data 2 high-order bytes
Pulse 2 data 2	Pulse 2 data 2 low-order bytes
Pulse 3 data 1	Pulse 3 data 2 high-order bytes
Pulse 3 data 2	Pulse 3 data 2 low-order bytes
Pulse 4 data 1	Pulse 4 data 2 high-order bytes
Pulse 4 data 2	Pulse 4 data 2 low-order bytes
Logic data	Logic data in binary format (2 bytes)
Alarm data 1	CH1 to CH16 alarm data (2 bytes)
Alarm data 2	CH17 to CH20 alarm data (2 bytes)
Alarm data (Logic/Pulse)	Logic and Pulse alarm data (2 bytes)
Status	Data status information (2 bytes)

The first item of data is a fixed number of bytes regardless of whether the channel is ON or OFF.

(The data for OFF channels is also transmitted.)

The number of bytes transmitted can be calculated from the following formula.

```
mch = :INFO:Number of channels
Number of bytes = (mch + 8 +  1 + ((mch+15)/16) + 1 +  1) * 2;
```



Version	Revision Date	Description
1	January 24, 2007	First edition
2		
3		
4		
5		

Document Name	Data Reception Specifications	Product Names	GL800
Issued By	Measurement and FA Division	Issue Date	January 24, 2007

Logic data bits

Bit	Description: (When 0, LO; when 1, HI)
0	Logic 1 data
1	Logic 2 data
2	Logic 3 data
3	Logic 4 data
4-15	Unused

Analog channel alarm data bit

The alarm data is expressed as a bit corresponding to each analog channel.
Accordingly, the number of bytes also varies according to the number of input terminal units that are actually installed. For example, if the number of channels installed is 20, since 20 bits are required, the 16-bit Big Endian format is used as the data unit and 4 bytes (= 32 bits) are transferred as alarm data.

Offset	Bit	Description: (When 0, an alarm has not been generated; when 1, an alarm has been generated)
+0	0	CH1 alarm data
	1	CH2 alarm data
:	:	: Omitted
	14	CH15 alarm data
	15	CH16 alarm data
+2	0	CH17 alarm data
	1	CH18 alarm data
	2	CH19 alarm data
	3	CH20 alarm data
	4-15	Unused

Version	Revision Date	Description
1	January 24, 2007	First edition
2		
3		
4		
5		

Document Name	Data Reception Specifications	Product Names	GL800
Issued By	Measurement and FA Division	Issue Date	January 24, 2007

Logic/Pulse alarm data bit

Bit	Description: (When 0, an alarm has not been generated; when 1, an alarm has been generated)
0	Pulse 1 alarm data
1	Pulse 2 alarm data
2	Pulse 3 alarm data
3	Pulse 4 alarm data
4	Logic 1 alarm data
5	Logic 2 alarm data
6	Logic 3 alarm data
7	Logic 4 alarm data
8-15	Unused

Status data bits

Bit	Description
0	0 = trigger not generated status/1 = trigger generated status
1	0 = free space in data capture device status/1 = no free space status
2-3	Bits 2 and 3 indicate the battery status.
4	0 = operating on battery power/1 = operating on AC power (AC adapter)
5-15	Unused

Bit	High	Medium	Low	Empty
3	0	0	1	1
2	0	1	0	1

Version	Revision Date	Description
1	January 24, 2007	First edition
2		
3		
4		
5		

(4) Conversion of analog data

Analog data is signed 16 bit data in a full-scale range of +/- 20000. Conversion of transmitted data into character strings depends on the CH range setting. The CH range determines the divisor and decimal point position, and analog data is converted to voltage and temperature values.

1. Converting voltage values

Voltage Range	Voltage Range Examples	Calculation for conversion
Range in "1" series	10mV/100mV/1V/10V/100V, etc.	Divide measured value by 2.
Range in "2" series	20mV/200mV/2V/20V/200V, etc.	Divide measured value by 1.
Range in "4" series	40mV/400mV/4V/40V/400V, etc.	Divide measured value by 5.
Range in "5" series	50mV/500mV/5V/50V/500V, etc.	Divide measured value by 4.

2. Adjusting the decimal point position

Voltage Range	Voltage unit: V	Voltage unit: mV
10mV/20mV	Divide calculation result in 1. above by 1000000.	Divide calculation result in 1. above by 10000.
50mV/100mV/200mV	Divide calculation result in 1. above by 100000.	Divide calculation result in 1. above by 1000.
500mV/1V/2V	Divide calculation result in 1. above by 10000.	Divide calculation result in 1. above by 10.
5V/10V/20V	Divide calculation result in 1. above by 1000.	Divide calculation result in 1. above by 1.
50V/100V/200V	Divide calculation result in 1. above by 100.	Multiply calculation result in 1. above by 10.
500V/1000V	Divide calculation result in 1. above by 10.	Multiply calculation result in 1. above by 100.

Example: When data is +12000 in the 50 mV range

+12000 ÷ 4 = +3000 → +3000 ÷ 100 = +30.0 mV

Example: When data is -612 in the 10-V range

-612 ÷ 2 = -306 → -306 ÷ 1000 = -0.306 V

Temperature Range	Divisor	Decimal point position
Any range	Fixed as 1	Divide calculation result by 10.

Example: When data is+9123

+9123 ÷ 1 = +9123 → +9123 ÷ 10 = +912.3 degrees centigrade

When data is 0x7ffd in hexadecimal, it is burnout data.

Although humidity values are obtained in the same way as with the settings in the 1 V voltage range, the GL800 scaling feature performs conversions of "0 V -> 0%" and "1 V -> 100%".

(5) Analog data that has a special meaning

Some of the data values included in the analog data have special meanings. If this type of data is transmitted, please handle these data values not as normal values, but as data according to their respective meanings.

Binary value	Meaning of the value
-0x7fff	Minus FS data
0x7fff	Calculation error data
0x7ffe	Measurement OFF data
0x7ffd	Burnout data
0x7ffc	Plus FS data

Minus FS data:

Data values smaller than -22000 (decimal values smaller than 10% of the FS range value with the delay band included) will uniformly become this data value.

Plus FS data:

Data values larger than +22000 (decimal values larger than 10% of the FS range value with the delay band included) will uniformly become this data value.

Calculation operation error data:

This data value is output when some kind of calculation operation was performed on an A/D value prior to outputting data, but the operation attempted was one that was impossible (such as dividing by zero). Output of data on which a calculation operation has been performed is a function that is not provided with the GL800 however, and so this data value is never output.

Measurement OFF data:

This is the data value for analog channels for which OFF has been specified for the device's Input setting.

Burnout data:

If Temperature has been selected for the device's Input setting and thermocouples are being used, this data value is output when a thermocouple burnout (disconnection) is detected.

1.1.2 Single-data Reception

(1) Commands to be used

To receive only data of one instantaneous value, use the following command:

Command Used	Query	Description
:MEAS:OUTP:ONE?	See (2) below.	Receives only data of one instantaneous value.

(2) Reception of data

The GL receives data in the same way as in (3) "Reception of data" in Section 1-1-1. The difference is that the GL receives only one data item in this case.

(3) Conversion of analog data

For conversion of analog data, see (4) in Section 1-1-1.

(4) Analog data that has a special meaning

See "1-1-1.(5) for details on analog data with special meanings.

1.2 Captured-data Reception

In captured-data reception mode, the GL receives data already captured into its medium. The storage medium is the GL's internal memory or USB Memory. See the command table for data specification and browsing methods.

Commands for captured-data reception

(1) Commands to be used

Command Used	Query	Description
:TRANS:SOUR DISK,<"PATH">	----	Specifies the medium to receive data from. (The GL200 does not require the MEM setting.)
:TRANS:OPEN?	See (2) below.	Opens the medium.
:TRNS:OUTP:HEAD?	See (3) below.	Receives header data.
:TRANS:OUTP:DATA <START>,<END>	See (4) below.	Specifies the data reception size.
:TRANS:OUTP:DATA?	See (5) below.	Receives data.
:TRANS:CLOSE?	See (6) below.	Closes the medium.

(2) ":TRANS:OPEN?" query

The ":TRNS:OPEN?" query is binary.	
First byte	ID number (For ID numbers, see "TRNS Group" in the command list.)
Second byte	Unused
Third byte	Bit 0: 0 = Opened successfully / 1 = Failed to open

(3) Description of ":TRNS:OUTP:HEAD?"

For the order of items of captured data to be received, check the header data. The contents of the header data are described in "GBD File Specifications". The ordering of data items is covered in the "Order" section.

Example: Order = CH1 , CH3 , CH4 , CH5 , CH6 , CH7 , CH8 , Logic , Alarm1

Check the order of data items such as above before receiving data.

(4) Description of ":TRANS:OUTP:DATA <START>,<END>"

<START> and <END> in ":TRANS:OUTP:DATA <START>,<END>" specify the first data and last data to receive. Set <START> to 1. If the GL installed in a network attempts to receive a large amount of data at one time, it may cause congestion. You should therefore set the command to receive data in as small segments as possible.

(5) Description of ":TRANS:OUTP:DATA?"

Sending the ":TRANS:OUTP:DATA?" command receives data in the following order.

Example: When data has been captured using a 20-channel input terminal unit

Data Received	Description
#6******	Header (ASCII): #6 is fixed by the prefix characters. The next 6 characters indicate the number of bytes received from the subsequent ******. Please note that the status and checksum bytes are not included in the byte count.
Status	Data status information (2 bytes)
-The data section starts here-	
CH1 analog data	CH1 data in binary format (2 bytes) (confirmation of the HEADER ORDER)
CH2 analog data	CH2 data in binary format (2 bytes) (confirmation of the HEADER ORDER)
: Omitted	: Omitted
CH19 analog data	CH19 data in binary format (2 bytes) (confirmation of the HEADER ORDER)
CH20 analog data	CH20 data in binary format (2 bytes) (confirmation of the HEADER ORDER)
Pulse 1 data 1	Pulse 1 data 2 high-order bytes The pulse data totals 4 bytes of data (32 bits): 2 high-order bytes and 2 low-order bytes (confirmation of the HEADER ORDER)
Pulse 1 data 2	Pulse 1 data 2 low-order bytes (confirmation of the HEADER ORDER)
Pulse 2 data 1	Pulse 2 data 2 high-order bytes (confirmation of the HEADER ORDER)
Pulse 2 data 2	Pulse 2 data 2 low-order bytes (confirmation of the HEADER ORDER)
Pulse 3 data 1	Pulse 3 data 2 high-order bytes (confirmation of the HEADER ORDER)
Pulse 3 data 2	Pulse 3 data 2 low-order bytes (confirmation of the HEADER ORDER)
Pulse 4 data 1	Pulse 4 data 2 high-order bytes (confirmation of the HEADER ORDER)
Pulse 4 data 2	Pulse 4 data 2 low-order bytes (confirmation of the HEADER ORDER)
Logic data	Logic data in binary format (2 bytes) (confirmation of the HEADER ORDER)
Alarm data 1	CH1 to CH16 alarm data (2 bytes) (always included)
Alarm data 2	CH17 to CH20 alarm data (2 bytes) (always included)
Alarm data (Logic/Pulse)	Logic and Pulse alarm data (2 bytes) (confirmation of the HEADER ORDER)
The data section ends here. The samples specified by <START>, <END> are received repeatedly.	
Checksum	Information confirming data integrity (2 bytes)

Status bit

If <START> and <END> specified by [:TRANS:OUTP:DATA?] <START>, <END> are not valid, refer to this bit.

Bit	Description
0	0 = error not generated/1 = error generated
1	0 = error not generated at END position/1 = error generated at END position
2	0 = error not generated at START position/1 = error generated at START position
3	Unused
4-15	Unused

Logic bit

Bit	Description: (When 0, LO; when 1, HI)
0	Logic 1 data
1	Logic 2 data
2	Logic 3 data
3	Logic 4 data
4-15	Unused

Document Name	Data Reception Specifications	Product Names	GL800
Issued By	Measurement and FA Division	Issue Date	January 24, 2007

Analog channel alarm data bit

The alarm data is expressed as a bit corresponding to each analog channel.
Accordingly, the number of bytes also varies according to the number of input terminal units that are actually installed. For example, if the number of channels installed is 20, since 20 bits are required, the 16-bit Big Endian format is used as the data unit and 4 bytes (= 32 bits) are transferred as alarm data.
Even if no data has been captured for an analog channel (MEAS = OFF), a fixed number of bytes is always transmitted as analog alarm data.

Offset	Bit	Description: (When 0, an alarm has not been generated; when 1, an alarm has been generated)
+0	0	CH1 alarm data
	1	CH2 alarm data
:	:	: Omitted
	14	CH15 alarm data
	15	CH16 alarm data
+2	0	CH17 alarm data
	1	CH18 alarm data
	2	CH19 alarm data
	3	CH20 alarm data
	4-15	Unused

Logic/Pulse alarm data bit

Bit	Description: (When 0, an alarm has not been generated; when 1, an alarm has been generated)
0	Pulse 1 alarm data
1	Pulse 2 alarm data
2	Pulse 3 alarm data
3	Pulse 4 alarm data
4	Logic 1 alarm data
5	Logic 2 alarm data
6	Logic 3 alarm data
7	Logic 4 alarm data
8-15	Unused

Version	Revision Date	Description
1	January 24, 2007	First edition
2		
3		
4		
5		

Document Name	Data Reception Specifications	Product Names	GL800
Issued By	Measurement and FA Division	Issue Date	January 24, 2007

Checksum

This is low-order 16-bit data that is a total sum of all the data bytes excluding the header, status and checksum bytes.

Checksum is used as follows:

If the low-order 16-bit data that is a total sum of the received data bytes is the same value as the received checksum, this indicates that data has been received correctly.

Version	Revision Date	Description
1	January 24, 2007	First edition
2		
3		
4		
5		

(6) Conversion of analog data

For conversion of analog data, see (4) in Section 1-1-1.

(7) Analog data that has a special meaning

See "1-1-1.(5) for details on analog data with special meanings.

(8) ":TRANS:CLOSE?" query

Be sure to send ":TRANS:CLOSE?" after performing a series of data transfer tasks.

The ":TRNS:OPEN?" query is binary.	
First byte	Unused
Second byte	Bit 0: 0 = Closed successfully / 1 = Failed to close