

Specifications

This appendix details the Specifications of the GB 1400 Generator (TX) and GB 1400 Analyzer (RX).

Note: The same term can be expressed three different ways.

CLOCK	= CLOCK BAR	= NOT CLOCK
DATA	= DATA BAR	= NOT DATA

GB1400 Generator (TX)

Internal Clock Source

Frequency Range	1 MHz to 1400 MHz
Step Size Range	0.01,0.1,1,10,100,1000 MHz
Resolution	1 kHz
Accuracy	10 ppm (within calibration interval)
Frequency Memory	10 frequencies

External Clock Source

Frequency Range	1 MHz to 1400 MHz
Burst Mode Option	150 kHz to 1400 MHz
Input Level	0.5V to 2.0Vp-p
Impedance	50 Ohm, AC coupled (with Burst Mode option, 50 Ohm ECL)
Connector	SMA

Data Patterns

Format	NRZ-L, Normal and Complement
Type	PRBS or WORD (User-programmable)
PRBS Patterns	2^n ; n=7,15,17,20,23
WORD Lengths	8 and 16-bit only, 1 Mbit memory (with optional memory)

PRBS Phase Tap Information

The Pseudo-Random data patterns used in the GB 1400 TX are generated by shift-register and exclusive-OR feedback technique. The pattern is dependent on which feedback taps (shift register outputs) are selected.

For example, PN7 is defined as a seven-stage shift register, which the output of stages 6 and 7 fed back (through an exclusive-OR gate) to the beginning of the shift register. The feedback taps used in the GB 1400 are tabulated here.

Pattern	Feedback	Taps
PN7	6	7
PN15	14	15
PN17	14	17
PN20	17	20
PN23	18	23

Data Output (True and Complement)

Amplitude	Variable 0.5V to 2.0V, 50 mV steps
Baseline Offset	Variable -2.0V to +1.0V, 50 mV steps -2.0V to +1.8V, 50 mV steps, with PECL option
Pulse Top Limit	+2.0V into 50 Ohms, +4.0V open load +2.8V into 50 Ohms (with PECL option)
Rise/Fall Time	150 pS, typical (20-80%) at 1 V amplitude
Source Impedance	50 Ohms
Output Timing	CLOCK/DATA edge-aligned (+/- 100 pS)
Jitter:	100 pS, peak-to-peak Max. referenced to EXT clock
Connectors	SMA
Data Inhibit	Rear panel SMA, ECL (50 Ohms to -2V term)
Data Inhibit Rate	Asynchronous, 1 bit and 500 pS minimum width
Data Invert	Front Panel Selectable

Clock Output (True and Complement)

Amplitude	Variable, 0.5V to 2.0V, 50 mV steps
Baseline Offset	Variable, -2.0V to +1.0V, 50 mV steps -2.0V to +1.8V, 50 mV steps, with PECL option
Pulse Top Limit	+2.0V into 50 Ohms, +4V open load +2.8V into 50 Ohms, with PECL option
Rise/Fall Time	150 pS, typical (20-80%) at 1 V amplitude
Jitter:	100 pS, peak-to-peak Max. referenced to EXT clock
Source Impedance	50 Ohms
Connectors	SMA

Rear Panel Auxiliary Outputs: Phase A, Phase B, Clock/2

Format	NRZ-L
Level	250 mV p-p into 50 Ohms, 50 mV into Hi
Clock/ Output	1/2 Clock Rate
Phase A output	Half rate data pattern
Phase B output	Half rate data pattern
	When in WORD mode, Phase A and Phase B outputs are alternating bits.
Connectors	SMA

Error Injection

Internal Rates	Single or $1 \times 10^\circ$ for n=3,4,5,6,7
External	1 error injected for each rising edge, ECL
Connectors	Rear panel mounted BNC

Front Panel Auxiliary Outputs: Pattern Sync; Clock/4

Level	250 mVp-p into 50 Ohms, 500 mV into Hi-Z
Pattern Sync	One-bit wide pulse per frame
Clock/4	Quarter Rate Clock
Connectors	SMA

RS-232 and GPIB Interfaces

Controlled functions	Remote control of all front panel functions except POWER and PANEL LOCK.
Read-back functions	Read-back of ten clock frequencies and ten data patterns stored in non-volatile memory, unit operating frequency, clock source status, pattern select.
GPIB EOS character	LF (line feed) (OA hex)
GPIB Address	Front panel select, 0-30, or OFF-BUS

AC-Power Requirements

Voltage range	90 VAC to 250 VAC, auto-ranging
Frequency range	47-63 Hz
Power	125 VA Max.
Fuse rating	115 VAC; 5 Amp SLO-BLO, 230 VAC 5 Amp SLO-BLO
Operating range	0 to +50 degrees C

Mechanical

Weight	10 Kg (22 lbs.)
Size	152 mm H x 366 mm W x 340 mm D (6" x 14.4" x 13.4")
Rack Height	275 mm (7") (4 RMU)

GB1400 Analyzer

Clock Input

Frequency Range	1MHz to 1400 MHz
Input Level	0.5V to 2.0Vp-p,. Single Ended or Differential
Impedance	50 Ohms, AC coupled (50 Ohm ECL to -2V with BURST MODE option)
Input Threshold	Non-programmable (fixed threshold levels)
Connector	SMA
Burst Mode (option)	150 kHz to 1400 Mhz (ECL Levels)

Data Input

Format	NRZ-L, True or inverted, differential or single-ended
Data Rate	1 to 1400 Mb/s (Burst Mode option 150 kbps to 1400 Mbps)
Input Threshold	-1.5V to +1.0V, 50 mV steps
Input Level	0.5V to 2.0Vp-p, (Single-ended operation requires external cable connection)
Impedance	50 Ohms
Termination Voltage	Selectable, Grid, -2.0V or AC
Delay Range	0-3.99 ns variable, in 5 ps steps
Connectors	SMA

Data Patterns

Format	NRZ-L
Type	PRBS or WORD (User-programmable)
PRSB Patterns	2^n where $n = 7, 15, 17, 20, 23$
WORD Length	8- and 16-bit only, 1 Mbit with optional memory

PRBS Phase Tap Information

The Pseudo-Random data patterns used in the GB 1400 RX are generated by shift-register and exclusive-OR feedback technique. The pattern is dependent on which feedback taps (shift register outputs) are selected.

For example, PN7 is defined as a seven-stage shift register, which the output of stages 6 and 7 fed back (through an exclusive-OR gate) to the beginning of the shift register. The feedback taps used in the GB 1400 are tabulated here.

Pattern	Feedback	Taps
PN7	6	7
PN15	14	15
PN17	14	17
PN20	17	20
PN23	18	23

Reference Data Input

Format	NRZ-L true
Data Rate	1 Mb/s to 1400 Mb/s
Input Threshold	Variable, -1.5 V to +1.0 V, 50 mV steps
Input Level	0.5V to 1.5Vp-p
Impedance	50 Ohms
Termination Voltage	Selectable, Gnd, -2.0V or AC
Delay Range	0-3.90 ns, variable, in 100 pS steps
Connectors	SMA

Auxiliary Signals: Pattern Sync, Clock, Data, Error and Threshold

Level	250 mVp-p into 50 Ohms, 500 mV into Hi-Z
Impedance	50 Ohms
Data Monitor	Latched Input Data
Clock Monitor	Buffered Input Clock
Pattern SYNC	1-bit wide pulse per frame
Error Inhibit	Rear panel, ECL
Error Output	Rear panel, ECL
AUX	Rear panel, Data Threshold output Note: Connect this output to DATA BAR (Not DATA) for single-ended operation.
Connectors	SMA

Synchronization

Auto Search

Unit automatically finds the Data Threshold , the Clock/Data input timing phase delay, the input Data Pattern (PRBS or WORD mode), and Data Polarity.

There are two modes to find the Data Delay

FAST - A quick method using the Clock/Data phase indicator.

BER - A slower method which uses the signal's bit error rate.

Either method will make available the width of the Data Eye (if possible). The BER method allows user control over:

Data Sample Size (10E-4 to 10E-11). This is the number of data bits sampled at each Delay setting used to determine the center of the Data Eye.

Bit Error Rate Threshold (10E-3 to 10E-10). This is the threshold used to determine which Delay settings are part of the Data Eye Crossing.

Manual Mode

User selects parameters, then unit attempts to synchronize on the input data pattern.

Disable Mode SYNC circuitry disabled

SYNC thresholds

PRBS mode 25% (1024 errors/4096 bits)

WORD mode 3.1% (128 errors/ 4096 bits)

Optional 1 Mbit WORD thresholds, programmable

Level	BER	Ratio (Errors/bits)
1	3.1E-2	256/8192
2	7.8E-3	256/32768
3	1.9E-3	256/131072
4	9.7E-4	256/262144
5	4.8E-4	256/524288
6	2.4E-4	256/1048576
7	1.2E-4	256/2097152
8	6.1E-5	256/4194304
9	3.0E-5	256/8388608

Measurements

BER Measurements

Three simultaneous BER measurements (Totalim, Window and Test) displayed as:

BER 9.9E-01 to <1.0E-16

Totalize 0 to 99999999, then 1.0E8 to 9.9E36

Totalize Mode BER since power on or reset

Window Mode BER over sliding window,
programmable in time (1-sec to 24 24hrs) or bits (1E-8-1E-16)

Test Mode BER over time of test, programmable in time (1-sec to 24-hrs). Additional calculations include ES, EFS, TES, SES, DM, US, and LOS.

Frequency System Clock Frequency, 10 KHz resolution

History Indicators SYNC loss, Bit Error, Phase Error, Power

RS-232 and GPIB Interfaces

Controlled functions	Remote control of all front panel functions except POWER and PANEL LOCK,
Read-back functions	Read-back of ten data patterns stored in non-volatile memory - unit operating frequency, bit error rate information, sync and history status, pattern select.
GPIB EOS character	LF (line feed) (OA hex)
GPIB Address	Front panel select, 0-30, or OFF-BUS

Printer Interface

Format	Parallel Centronics-type and re-directable to serial (RS-232C) or GPIB ports.
Hardcopy	Front panel key, prints unit setup
Print on event	Print if BER threshold is exceeded; programmable rate (IE-02 to IE-16)
Print on EOW	Print on End of Window, programmable in time (1 sec - 24 hrs), or bits (1E8-1E16)
Print on EOT	Print on End of Test, programmable rate 1 sec to 24 hours

AC-Power Requirements

Voltage range	90 VAC to 250 VAC, auto-ranging
Frequency range	47-63 Hz
Power	125 VA Max.
Fuse rating	115 VAC; 4 Amp, 230 VAC 2 Amp
Operating range	0 to +50 degrees C

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