Core networks and computer networks are becoming increasingly rapid as the volume of data transmitted in this multimedia data is growing. In addition to the STM-16/OC-48 (2.488 Gbit/s), Fibre channel, Giga-bit Ethernet, etc. are being commercialized. Compact and low-cost BERTSs (Bit Error Rate Test Sets) are required for production inspections of all kinds of transfer devices, optical modules, and logic devices.

The MP1632A realizes a compact and low-cost solution that incorporates existing measuring equipment (MP1652A Pulse Pattern Generator and MP1653A Error Detector) into one cabinet.

**Features**
- 3.2 Gb/s PPG and ED in one cabinet
- Eye diagram measurement and burst signal measurement supported

**Performance and functions**
- **Easy to view, superb operability**
  The MP1632A comes with a large, color LCD with touch screen. Moreover, it employs the Microsoft Windows® operating system version 3.1. In addition to the graphic display of measurement results, customized screens enable one-key and one-parameter operation.
- **High-quality pulse pattern generator**
  Programmable patterns of 8 Mb max, PRBS patterns \( [(2^7 – 1) \text{ to } (2^{30} – 1), \text{ variable mark ratio}] \), and zero substitution patterns can be generated. Moreover, variable cross-point of data output waveform is also supported.

- **Error detector with many functions**
  High input sensitivity (25 mVp-p*) and wide phase margin (250 ps*) performance is provided. Phase margin and threshold margin can be measured using various error rates. Eye diagram display is also supported. Moreover, the autosearch function enables PRBS pattern search in addition to ordinary phase and threshold search.
  *Typical values at 3 Gb/s, PRBS \(2^{23} – 1\)
- **Internal synthesizer with high signal purity (Option)**
  Generates highly pure signals with SSB phase noise characteristics of –85 dBC/Hz or less (10 kHz offset).
- **Support of various applications**
  Testing of SDH/SONET (STM-0, 1, 4, 16/OC-1, 3, 12, 48) devices and modules, research and development on WDM components, Fibre channels, Giga-bit Ethernet, evaluation of E/O and O/E module, GaAs IC, and high-speed ASIC/FPGAs

![MP1632A output waveform (3.2 GHz)](image-url)
### DIGITAL TRANSMISSION MEASURING INSTRUMENTS

#### Specifications

**MU163220A 3.2G Pulse Pattern Generator**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency</td>
<td>10 MHz to 3.2 GHz</td>
</tr>
<tr>
<td>External clock input</td>
<td>0.5 to 2 Vp-p</td>
</tr>
</tbody>
</table>

**Generation pattern**

- **Pseudo random pattern (PRBS)**
  - Pattern length: \(2^n - 1\) (n: 7, 9, 11, 15, 20, 23, 31)
  - Mark ratio: 1/2, 1/4, 1/8, 0/8, 3/4, 7/8, 8/8
  - AND bit shift upon mark ratio setting: 1, 3 bits
- **Data pattern**
  - Data length: 2 to 8,338,608 bits
  - Zero substitution pattern
  - Continuous 0 bit length: 1 to (pattern length – 1) bits
  - Error insertion
    - Error ratio: \(10^{-n}\) (n: 3, 4, 5, 6, 7, 8, 9), single error
  - External error input: Provided

**Data output**

- Number of outputs: 2 (DATA/ DATA, independent)
- Amplitude: 0.5 to 2 Vp-p (10 mV steps)
- Offset voltage: \(-2\) to +2 V (5 mV steps)
- Display: \(V_{OH}, V_{TH}, V_{OL}\) selectable
- Rise/fall time: \(<80\) ps (10% to 90% of amplitude)
- Pattern jitter: \(<30\) ps p-p
- Waveform distortion: 10% or 0.1 V of amplitude, whichever is greater
- Load impedance: 50 \(\Omega\) (with back termination)
- Connector: SMA
- Clock output:
  - Number of output: 2 (CLOCK/CLOCK, independent)
  - Amplitude: 0.5 to 2 Vp-p (10 mV steps)
  - Offset voltage: \(-2\) to +2 V (5 mV steps)
  - Display: \(V_{OH}, V_{TH}, V_{OL}\) selectable
  - Rise/fall time: \(<80\) ps (10% to 90% of amplitude)
  - Load impedance: 50 \(\Omega\) (with back termination)
  - Connector: SMA
  - Clock delay: \(-1\) to +1 ns (2 ps steps)

- **Data output**
  - External burst trigger input
    - Input level: 0 to 1 V, connector: SMA
  - Internal burst signal
    - Burst cycle: 2 \(\mu\)s to 50 ms (1 \(\mu\)s steps); Enable length: 1 \(\mu\)s to 49.999 ms (1 \(\mu\)s steps)
  - Burst trigger output
    - Output level: 0 to 1 V, connector: SMA
  - Sync signal output
    - Number of outputs: 1 (1/8 clock, variable pattern synchronization output selectable)
    - Output level: 0 or 1 V
    - Connector: SMA
  - Operating temperature
    - +5 to +45°C
  - Power
    - \(<200\) VA
  - Dimensions and mass
    - 232 (W) x 49 (H) x 449 (D) mm, \(<4.5\) kg

**MU163240A 3.2G Error Detector**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating frequency</td>
<td>10 MHz to 3.2 GHz</td>
</tr>
</tbody>
</table>
| Data input | Input waveform: NRZ
  - Input voltage: 0.5 to 4 Vp-p
  - Variable threshold voltage: –4 to +4 V (1 mV steps)
  - Termination: Connected to GND, –2 V or +3 V via 50 \(\Omega\)
  - Connector: SMA |
| Clock input | Input waveform: Square wave (<0.5 GHz), square wave or sine wave (>0.5 GHz), duty: 50%
  - Input amplitude: 0.5 to 4 Vp-p
  - Variable input delay: \(-1\) to +1 ns (2 ps steps)
  - Polarity inversion: POS/NEG inversion selectable
  - Termination: Connected to GND, –2 V or +3 V via 50 \(\Omega\)
  - Connector: SMA |
| Auto search function | Phase, threshold, PRBS pattern |
| Receive pattern | Pseudo random pattern (PRBS)
  - Pattern length: \(2^n – 1\) (n: 7, 9, 11, 15, 20, 23, 31)
  - Mark ratio: 1/2, 1/4, 1/8, 0/8, 3/4, 7/8, 8/8
  - AND bit shift upon marker ratio setting: 1, 3 bits
  - Data pattern
    - Data length: 2 to 8,338,608 bits
    - Continuous 0 bit length: 1 to (pattern length – 1) bits
    - Pattern length: \(2^n\) (n: 7, 9, 11, 15) |
| Sync mode | Normal, frame |
| Sync threshold | AUTO or \(10^{-n}\) (n: 2, 3, 4, 5, 6, 7, 8) |
| Error detection mode | Omission, insertion, total |

Continued on next page
### DIGITAL TRANSMISSION MEASURING INSTRUMENTS

**Measurement items**
- Error rate: $0.0000 \times 10^{-16}$ to $1.0000 \times 10^{-6}$
- Number of errors: 0 to $9,999,999$ (interval: 100 ms, 1 s)
- Error free interval (EFI): $0.0000$ to $100.0000\%$
- Clock frequency: $0.01$ to $3.2$ GHz (resolution: $1$ Hz, accuracy: $10$ ppm $\pm 1$ kHz)

**Eye margin measurement function**
Provided

**Error performance calculation function**
Provided

**Measurement channel**
1 to 8 channels, each channel settable independently

**Error output**
- Number of output: 1 (1/8 bit rate OR error), Output level: 0/~1; Connector: SMA

**Sync signal output**
- Number of outputs: 1 (switchable among 1/8 clock, fixed pattern sync, sync gain output)
- Output level: 0/~1 V; Connector: SMA

**Burst trigger input**
- Input level: 0/~1 V, connector: SMA

**Operating temperature**
$+5^\circ$ to $+45^\circ$C

**Power**
$\leq 250$ VA

**Dimensions and mass**
$232$ (W) x $49$ (H) x $449$ (D) mm, $\leq 4.5$ kg

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**MP1632A (Main frame)**

**System environment**
- OS: Microsoft Windows® operating system Version 3.1
- Display: 10.4 inch, color LCD (touch screen), 640 x 480 dots, 256 colors
- Printer: Parallel port for external printer (D-sub, 25-pins)
- Keyboard: 101 type (English), PS/2 (mini DIN 6-pin connector)
- Mouse: Serial, PS/2 (mini DIN, 6-pin connector)
- FDD: 2 modes (1.44 MB, 740 KB)
- HDD: C drive: $\geq 474$ KB (used for system: measurement data, pattern)
- D drive: $\geq 30$ MB (not accessible to users, interface: IDE)

**Remote control**
- RS-232C (standard), GPIB (option): IEEE488.2, Ethernet (option): 10 Base-T

**EMC**
- EN55011: 1991, Group 1, Class A
- EN50082-1: 1992

**Safety**
- EN61010-1: 1993 (Installation Category II, Pollution Degree II)

**Power supply**
- 100 to 120 Vac/200 to 240 Vac, 47.5 to 63 Hz, $\leq 150$ VA

**Operating temperature**
$\pm 5^\circ$ to $+45^\circ$C

**Dimensions and mass**
$426$ (W) x $221.5$ (H) x $451$ (D) mm, $\leq 20$ kg

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**3.2G Internal Synthesizer (Option 03)**

**Frequency range**
- 50 MHz to 3.2 GHz (1 kHz steps)

**Frequency accuracy**
- $\pm 2$ ppm

**SSB phase noise**
- $\leq 85$ dBc/Hz (10 kHz offset, 1 kHz bandwidth)

**Non-harmonic spurious**
- $\leq 60$ dBc (limited to spurious 10 kHz or more distant from carrier frequency)

**Power**
- $\leq 50$ VA

**Mass**
- $\leq 5$ kg

Microsoft Windows is a registered trademark of Microsoft Corporation in USA and other countries.

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### Ordering information

Please specify model/order number, name, and quantity when ordering.

<table>
<thead>
<tr>
<th>Model/Order No.</th>
<th>Name</th>
<th>Model/Order No.</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Main frame</strong></td>
<td>Digital Data Analyzer</td>
<td><strong>MU163220A</strong></td>
<td>3.2G Pulse Pattern Generator</td>
</tr>
<tr>
<td>J0491</td>
<td>Power cord (shielded):</td>
<td>J0693A</td>
<td>Coaxial cord (HRM202B • 3D2W • HRM202B), 1 m: 1 pc</td>
</tr>
<tr>
<td>F0071</td>
<td>Fuse, 8 A:</td>
<td>J0696A</td>
<td>Coaxial cord (AA-165-500), 0.5 m: 2 pcs</td>
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<tr>
<td>Z0319A</td>
<td>PS/2 mouse:</td>
<td>W1386AE</td>
<td>MU163220A/163240A operation manual: 1 copy</td>
</tr>
<tr>
<td>Z0320</td>
<td>Input pen:</td>
<td>Z0306A</td>
<td>List strap: 1 pc</td>
</tr>
<tr>
<td>Z0347</td>
<td>Recovery disk*: 1 set</td>
<td><strong>MU163240A</strong></td>
<td>3.2G Error Detector</td>
</tr>
<tr>
<td>Z0393</td>
<td>Application disk*: 1 set</td>
<td>J0693A</td>
<td>Coaxial cord (HRM202B • 3D2W • HRM202B), 1 m: 1 pc</td>
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<tr>
<td>Z0395</td>
<td>Remote sample disk*: 1 set</td>
<td>J0696A</td>
<td>Coaxial cord (AA-165-500), 0.5 m: 2 pcs</td>
</tr>
<tr>
<td>W1360AE</td>
<td>MP1632A operation manual:</td>
<td>W1386AE</td>
<td>MU163220A/163240A operation manual*: 1 copy</td>
</tr>
<tr>
<td>W1361AE</td>
<td>MP1632A remote control operation manual: 1 copy</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Options</strong></td>
<td>GP1B interface board</td>
<td><strong>J0693A</strong></td>
<td>Coaxial cord (HRM202B • 3D2W • HRM202B), 1 m: 1 pc</td>
</tr>
<tr>
<td></td>
<td>Ethernet interface board</td>
<td><strong>J0696A</strong></td>
<td>Coaxial cord (AA-165-500), 0.5 m: 2 pcs</td>
</tr>
<tr>
<td></td>
<td>3.2G internal synthesizer</td>
<td><strong>W1386AE</strong></td>
<td>MU163220A/163240A operation manual**: 1 copy</td>
</tr>
<tr>
<td><strong>Peripherals</strong></td>
<td>Keyboard (PS/2)</td>
<td><strong>1</strong>: Only for MP1632A customer</td>
<td></td>
</tr>
<tr>
<td>Z0321A</td>
<td>GPIB cable, 2 m</td>
<td><strong>2</strong>: Not supplied when 3.2G pulse pattern generator purchased as same time</td>
<td></td>
</tr>
<tr>
<td>J0008</td>
<td></td>
<td></td>
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</table>