Third Millennium Engineering

Helping customers create and manufacture advanced technology products for our future

Company Profile

Third Millennium Engineering (TME) is a Texas licensed contract engineering company located in Plano, Texas USA. It is owned and operated by Dr. Steve Morra, a Doctor of Engineering and a Texas Professional Engineer. TME is an Agilent Channel Partner (www.agilent.com, search TME) and is registered with the SBA Pro-NET, Dunn & Bradstreet, and the Federal Central Contractor (CCR) programs. TME has been in business since 1996, previously as Microsystem Design Services since 1984.

The company mission is “to help customers create and manufacture advanced technology products for our future”. TME is an engineering intensive company that has served customers in Communication, Semiconductor, Transportation, Sensors, Biotechnology, Energy, Aerospace, Military, and Test Equipment industries over the past 19 years. TME constructs an ad-hoc team matched to a customer's needs and project size from employees, a sub-contracted network of professional associates, and partnering with other suppliers. For more details, pictures, and downloads, please visit the TME web site at http://www.tmeplano.com. Dr. Morra can be reached by email at steve@tmeplano.com or by telephone at 972-491-1132.

What We Do

- Help OEMs and contract manufacturers get their advanced technology product working and to market on time
- Provide business and technical consulting, advanced technology engineering, and manufacturing services
- Partially or fully engineer, prototype, and low volume manufacture a component, module, equipment, or system level product
- Define, produce, and integrate the Full-Custom and Semi-Custom test or process equipment needed to develop or manufacture a product
- Work with a wide variety of electronic, microwave, photonic, packaging technologies and people

Full Custom Products and Services

PRODUCT DESIGN AND PROTOTYPE/PRE-PRODUCTION

TME can provide technical and business consulting, multidisciplinary engineering and design, and low volume manufacturing of advanced technology hybrids, sub-assemblies, modules, equipment, and systems. Technologies include mature and advanced electronic, fiber optic, and packaging technologies. Expertise includes electrical, electronic, RF, microwave, fiber optic, transmission lines, analog, digital, interface, power, sensors, actuators, thermal, pneumatic, acoustic, magnetic, shielding, mechanical design, micro to macro and advanced packaging, hermetic and non-hermetic thin and thick film hybrids and MCM-COBs, SMT and thru-hole p.c. board and flex assemblies, and other technologies. Designs are composed with solid modeling, drafting, schematic capture, circuit layout, publishing, and other CAD software tools. TME maintains extensive CAD and product data libraries and supplier relationships to perform the many engineering tasks needed concerning materials, components, and equipment.

FUNCTIONAL TEST AND PROCESS SYSTEMS

TME can provide technical and business consulting, multidisciplinary engineering and design, construction, and integration of specialized custom test and process equipment needed in product research, development, and manufacturing. Equipment can be designed for products packaged as semiconductor or optical wafers, bare and packaged die, pre-lid and post-lid hermetic and non-hermetic hybrids, sub-assemblies, modules, and systems. Equipment includes simple or complex, manual or automatic, test or process equipment including consoles, single or multi-head precision and/or multi-technology fixtures, custom equipment, interfaces, cabling, calibration standards, and accessories. Partial or complete solutions can be created per customer needs, including evaluating, selecting, procuring, integrating, and documenting custom equipment with commodity equipment. Custom software can be provided upon request (Visual Basic or LabVIEW preferred).

CONTRACTED PROJECTS

TME normally contracts with a customer for an outsourced full custom engineering project, semi-custom products, and for consulting or engineering retainers. TME will develop a written project proposal with the customer, which becomes the contract when the initial payment is received. Proposals typically describe the parties involved, the project in high-level technical terms, price and delivery estimates, and business terms with a project acceptance method. Proposals

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consider project time, risks, and any applicable manufacturing, tooling, materials, labor, yield, rework, warranty, and similar costs.

NON-CONTRACTED PROJECTS

TME can provide full custom products and services without a contract on a per diem plus expenses basis. Non-contracted services can be useful in early stages of a project, such as for business planning, project definition, feasibility studies, or idea generation. They can also be used to accommodate minor changes or modifications in a contracted project. TME does not generally provide consulting and engineering services on an extended “work for hire” basis.

Semi-Custom Functional Test Equipment

TME offers several semi-custom functional test equipment product lines for the telecommunications industry that complement commercially available standard test equipment products. TME test equipment is typically used with SONET/SDH analyzers, Bit Error Rate or Agilent ParBERT™ testers, protocol analyzers, network analyzers, sampling oscilloscopes, and other commercial test equipment. Together such equipment is connected to terrestrial, submarine, and airborne fiber optic telecom products and networks for performance tests during product research, development, manufacturing, deployment, operation, and maintenance. Such telecom products typically function using SONET/SDH, DWDM, Ethernet, Fibre Channel, video, and many other protocols.

TME semi-custom equipment is made to order so customers can freely originate, specify, and procure feasible and excellent test solutions using both semi-custom and standard products. Customers can avoid the funding, staffing, risk, documentation, and support issues in making their own peculiar test equipment or ignoring tests at the risk of their market share. A “buy decision” saves considerable test development money, time, space, risk, inventory, and manning for allocation to much better kinds of value added activities. The annual sales volume for any one model of such "glue" functional test equipment is too low for large companies to justify standard product development. TME is a small engineering-intensive company that is well suited for supplying such custom and semi-custom products.

Being semi-custom, customers can freely specify test equipment and options that exactly meet their needs, constructed from TME standard and/or customer-specified sub-assemblies. Most TME products can be modified at a later date if needed, as customer needs change or obsolescence occurs. All product line models are 19 inch rack-mountable, manual and/or GPIB-IEEE488.2-HPIB, RS-232, or USB controllable (LAN on request), worldwide powerable, and Electro-Static Discharge (ESD) compliant.

Call or email TME or a representative to discuss or define your semi-custom test equipment needs and request a quote. Terms are typically 50% due at order placement, 50% due after instrument acceptance, and financing can be arranged if needed. Depending on the model and options, delivery is typically 14 to 18 weeks ARO without expediting with 8 to 10 weeks possible in some cases.

FIBER OPTIC TRANSLATORS

This is a broad product line of fiber optic transmitter (E to O), receiver (O to E), transceiver (both), and wavelength converter (O to E to O) functional test instruments, collectively called “fiber optic translators”. Models can contain 1 to 16 channels of analog and/or digital fiber optic transmitters and/or receivers with many related optical and electrical options, offering customers millions of possible models. Wavelength converter models can be provided in 1R (linear analog), 2R (limiting analog), and 3R (CDR digital regeneration) configurations. Special analog transmitter and receiver models can be provided with calibration data for use with electrical network analyzers to add O-O, E-O, and O-E test capabilities. See the TME “Fiber Optic Triggers” for specialized receiver models that provide single or multi-rate clock-recovered trigger signals for high-speed optical sampling oscilloscopes.

A variety of wavelengths, fiber types, and electrical I/O choices can be accommodated for each channel. Popular fixed wavelengths include 850 nM, 1310 nM including CWDM channels, and 1550 nM including WWDM channels and S-C-L band DWDM channels on 100, 50, or 25 GHz ITU grid spacing. Tunable transmitter and/or receiver wavelengths are offered for 1550 nM C and L bands on 100, 50, or 25 GHz ITU grid spacing. Popular fiber types include multimode 50 and 62.5 micron fiber (850 nM and 1310 nM) and single mode standard fiber (1310 nM and 1550 nM). Electrical inputs and outputs can be single-ended or differential and AC or DC coupled (single-ended, 50 KHz, AC coupling default). Independent O to E and E to O single-ended polarities are offered with fixed positive (default), fixed negative, or programmable translation polarity. Special wavelengths (such as 980 nM or Raman pump wavelengths), fiber types (such as polarized or plastic), and electrical options can be provided upon request.

Fiber optic transmitters are offered with various modulation methods, wave shapes, speeds, and power levels. Modulation methods include direct, electro-absorptive (EA), and Lithium Niobate ($LiNbO_3$) modulation. Wave shapes include linear analog and digital NRZ, RZ, and CRZ shapes with programmable extinction, contrast ratio, and chirp control respectively. Analog bandwidths from ~50 MHz to ~40 GHz and digital speeds from ~50 Mb/s (OC1) to ~43 Gb/s (OC768 + FEC) are offered. Optical power outputs from –15 dBm to +10 dBm are offered, depending on wavelength and speed limitations.

Transmitter options include SBS Suppression (for long fiber span + optical amplifier tests), channel identification tone generation (for multi-channel testing), and controlled output levels via Variable Optical Attenuator (VOA) and Tapped Coupler Power Monitor (for product under test receiver sensitivity tests or DWDM channel matching). Special multiple output configurations are offered where several different transmitters are driven by one electrical input, either one at a time (selector function) or at the same time (splitter or fan-out function). Special transmitter modulation methods, wave shapes, speeds, and power levels can be provided upon request.

Fiber optic receivers are offered with various detector types, speeds, optical dynamic range, and circuit structures. Detectors include silicon, GaAs, and InGaAs PIN or APD photodiode types, depending on operating wavelength. Analog bandwidths from ~50 MHz to ~40 GHz and digital speeds from ~50 Mb/s (OC1) to ~43 Gb/s (OC768 + FEC) are offered. Optical dynamic ranges are offered from –38 dBm to –7 dBm sensitivity and –7 dBm to +3 dBm overload power, depending on wavelength and speed limitations. Analog output circuit structures are offered having one or more insertable linear fixed gain amplifiers (for dynamic range control) and/or one or more insertable low pass filters (for SONET, Fibre Channel, etc. eye pattern mask testing). Digital clock and data output circuit structures are offered having single or multiple rate clock-data recovery (CDR) circuits and limiting amplifiers. Any data rate between 10 Mb/s and 2.7 Gb/s or 9.3 Gb/s to 12.9 Gb/s is offered with other rates upon request. Circuit structures with both analog outputs and per channel or selected channel digital CDR outputs are offered. This structure is used to drive an Agilent ParBERT™ error detector (analog and clock trigger) or an electrical oscilloscope (analog and clock trigger) and error detector (data and clock) for eye pattern and BER tests.

Receiver options include use of fixed or tunable or lock-on optical filters, channel identification tone detection (for multi-channel testing), and receiver photodiode or tapped coupler power monitor options (makes extinction ratio tests possible with Agilent ParBERT™). A multiple input configuration is offered where one of several different receivers are selected to drive one electrical output. Special receiver CDR data rates and programmable CDR thresholds can be provided upon request.

Other options include various arrangements of optical amplifiers (EDFA or SOA), attenuator, coupler, power monitors, scramblers, polarizers, etc. Connector options include front or rear panel mounted or special optical and/or microwave I/O connectors. Switching options include optical and/or microwave module passthru, bypass, loop back, or selector switches. Electrical options include inclusion of FEC encoding and/or decoding, time or wave division MUX and/or DMUX, amplified data/clock electrical I/O (signal level boosters), and data-to-clock phase shifters (for SONET/SDH analyzers).

An example test system using TME equipment can be created and deployed at one or more telecom central offices for automatic DWDM network trunk line quality of service (QOS) testing “one lambda at a time”. Multiple network DWDM trunk lines can be accessed in duplex or simplex with low loss optical tap couplers. The tapped lines are routed to a special TME transceiver containing optical switches to select the proper tapped lines, optical amplifiers to boost the low tapped optical power levels, a fiber optic transmitter, and a fiber optic receiver. The transmitter is a ~10 Gb/s 1550 nM C-band tunable NRZ laser with VOA, optical power monitor, and SBS suppression. The receiver has a 1550 nM C-band tunable filter with optical power monitor, a 9.953 Gb/s or 10.709 Gb/s clock-data recovery circuit, and an analog output with insertable low pass filter and insertable gain amplifiers. The transceiver is connected to an Agilent ParBERT™ (or a BERT and sampling oscilloscope) and schedule or demand controlled by a computer with a test program. The computer signals the central office equipment to re-route traffic for one color at a time in either duplex or simplex mode. The computer signals the transceiver and ParBERT™ to select the proper trunk lines and transmit and receive one wavelength at a time for BER, optical power, sensitivity, and eye pattern testing. In duplex mode, pattern generation and error detection is done at the same central office using far end loop-back. In simplex mode, pattern generation is at the near end central office and error detection is at the far end central office.

CLOCK REGENERATORS

This is a product line of fiber optic sampling oscilloscope trigger and data-only jitter adapter test instruments. Clock recovery technology is used to extract an electrical trigger signal from an 850 nM, 1310 nM, or 1550 nM optical signal sent to an optical sampling oscilloscope or jitter analyzer, such as those made by Agilent, Anritsu, Tektronix, and others. Various 1310/1550 nM ~10 Gb/s models are offered with 1 to 6 separate trigger rates operating at any rate between 9.3 Gb/s and 12.9 Gb/s with a –5 dBm to +10 dBm optical pass-thru power range. One model variation adds optical amplification and leveling to provide –20 dBm sensitivity. Another model variation adds an analog electrical data output for input to an electrical channel of a sampling oscilloscope or digital error detector.

In one architecture, a single-mode FC/UPC fiber optic signal is passed through a tap optical coupler inside the instrument to the optical input of a fiber optic sampling oscilloscope. The tapped off optical input is delivered to an optical receiver after passing through an optional optical boost amplifier and variable attenuator for more sensitivity. The optical receiver output is amplified and distributed via a microwave switch to one input of one or more clock recovery or clock-data recovery circuits. The clock or clock-data outputs are routed via microwave switches to clock or clock and data microwave output connectors. The clock output is connected to the sampling oscilloscope trigger input. Special models using all-optical clock recovery can be provided upon request for higher trigger rates up to 65 Gb/s.

FIBER OPTIC SPANS

This is a product line of programmable Fiber Optic Span functional test instruments. These instruments function as “programmable telecom superhighway in a box” by providing programmable optical chromatic dispersion, dispersion compensation, and amplification. Models accomplish this by using various arrangements of one or more single mode optical fiber types, dispersion compensating fiber, dispersion compensators, optical switches, optical amplifiers, optical filters, etc. An example single mode C-band model provides –2000 pS/nM to +3200 pS/nM (200 KM) in 100 pS/nM (6.25 KM) steps at 1550 nM using standard single-mode fiber, dispersion compensating fiber, optical switches, and C-band DWDM optical amplifiers. Multimode models can be provided upon request.

FEC TRANSLATORS

This is a product line of electronic transmitter, receiver, and transceiver functional test instruments that perform Forward Error Correction (FEC) on 2.5, 10, or 40 Gb/s telecom signals. Models with 1 to 4 channels for ~10 Gb/s telecom signals are offered for SONET/SDH (9.953 Gb/s) or 10G Ethernet (10.312 Gb/s) data rates to G.975 (10.664 Gb/s), G.709 (10.709 Gb/s), or SuperFEC (~12.4 Gb/s) data rates with several options. Models for ~2.5 Gb/s signals are available on request and models for ~40 Gb/s signals will be offered as components become available.

ELECTRONIC TRANSLATORS

This is a product line of electronic transmitter, receiver, and transceiver functional test instruments that convert, split, or select signals between common analog coax and/or digital logic levels and telecom formats. Common analog signals include single-ended and differential 50, 75, and 100 ohm signals that are input or output for test or measurement equipment. Common digital signals include CMOS, TTL, ECL, and other logic levels. Common telecom signals include DS1, DS3, and other telecom formats.

MR. HORIZON TEST FIXTURE SYSTEM

This product line is a flexible, economical, re-configurable, and recyclable functional test fixturing system. The system can standardize ~75% of test fixturing, make fixture recycling and rapid modification feasible, and be used both in product development and manufacturing. The system consists of various open frame electronic modules, standard cables, quick interconnect blocks, thermally controlled product (UUT) contactor bases, mainframe bases, fixture housings, and other items that are used to construct functional test fixtures. This system uses a programmable mainframe base that can be rack-mounted or used on a tabletop. A fixture can be connected to the mainframe base via a configurable electrical, optical, and pneumatic quick-connector. The mainframe base is configurable with utility resources that include fixed and variable DC power supplies, digital and analog electrical I/O, latching and non-latching relay drivers, cooling and actuating pneumatics, and temperature control via thermo-electric cooler technology. The base quick-connector provides the fixture with access to the base utility resources and access to external power, electrical, and optical test equipment. Fixtures typically consist of a simple chassis design containing a product-specific contactor, a product-to-horizon adaptor p.c. board, and optional items such as microwave relays, optical switches, or various Mr. Horizon modules. Various Mr. Horizon resource fan-out p.c. boards can be used to quickly adapt fixtures when requirements change or to rapidly originate an adapter p.c. board.

COMMUNICATION SWITCH MATRICES

This is a product line of RF, Microwave, and Fiber Optic Switch Matrices designed with communication specific, multi-channel, switching topology. These matrices are used to route fiber optic, microwave, RF, DS3, DS1, or other telecom signals between telecom products and functional test equipment. Switch topology includes loop-back, daisy chain, daisy bypass, float, terminate, short, and channel access for performance test.

