MGTR
Megger GPS Timing Reference

- **Small and Lightweight**
- **Easy to use Programmable Output Pulse for Synchronized end-to-end testing**
- **100 ns Accuracy within minutes of start-up, 12-channel GPS Timing Receiver**
- **Near-Rubidium stability during temporary GPS signal loss**

DESCRIPTION

The MGTR is a small, lightweight, field portable, GPS satellite receiver system specifically designed to perform end-to-end tests of line protection schemes, with Megger SMRT, MPRT and Pulsar relay test systems. The MGTR provides a precise Programmed Output Pulse (POP), with 100 nanoseconds of resolution. This output pulse provides a trigger synchronization of two or more SMRT, MPRT or PULSAR test systems to less than ±1 µ Sec of the Universal Time Coordinated (UTC).

The MGTR consists of a twelve-channel GPS timing receiver integrated with proprietary microprocessor-controlled timing and interface logic. The MGTR simultaneously tracks all available GPS satellites. The microprocessor-controlled timing and interface logic derives precise timing information. In addition, the MGTR provides a standard 1 Pulse Per Second (PPS), and ASCII serial time message, external event time-tag, a 10 MHz output signal and most importantly, a Programmable Output Pulse for performing end-to-end tests.

The unit comes with a 50 foot (15.2 m) long cable and all-weather, high-performance, high noise immunity antenna with an integrated low-noise preamplifier. The antenna comes with a 4 inch tall antenna mount.

Control of the MGTR is through a standard RS-232 serial connection and an adapter cable with a 9-pin D-sub connector. Software is provided to communicate to, and control the MGTR unit.

APPLICATIONS

Once energized, and after a period of time tracking GPS satellites, the accuracy of this unit approaches the accuracy of the Cesium clocks in the GPS satellites. This insures the highest accuracy possible for triggering end-to-end tests, as well as other timing applications. In addition to the Programmable Output Pulse for performing end-to-end tests, the 10 MHz output is extremely high quality in terms of phase noise and spectral purity.

Two of the most advanced characteristics of the MGTR unit are the Intelligent Holdover™ and *FastStart*™ features. The Intelligent Holdover feature provides near-Rubidium holdover characteristics in the absence of GPS signals. This can be especially useful when performing end-to-end tests near government facilities, which may locally block GPS signals from time to time. This allows high accuracy triggering even when not receiving GPS timing signals. Under normal operating conditions, the *FastStart* feature brings the MGTR unit to high precision timing and stability within just minutes of applying power.

Typical test equipment set up for end-to-end tests is shown in the following figure. The test system shown consists of an MPRT relay test set, an MGTR satellite receiver and a personal computer to control the MPRT and MGTR units. A typical notebook computer will have a variety of communication ports. Shown in this figure the RS-232 port is being used to control the Programmable Output Pulse of the MGTR satellite receiver. A PCMCIA IEEE-488 card is being used to communicate to the MPRT test set, and a USB to RS-232 Serial interface is being used to communicate with the relay system under test.

The three phase voltage and current outputs from the MPRT are connected to the relay under test. The breaker sensing inputs of the relay are connected to the binary output terminals of the MPRT, which will serve to simulate the circuit breaker. The relay trip contacts are connected to the binary input terminals of the MPRT. The MGTR units at the opposing terminals, with programmable trigger outputs, are programmed to trigger the MPRT test sets less than 1 microsecond of the UTC. This provides the synchronized outputs of multiple relay test sets at terminals that can be a hundred miles apart. Connections to SMRT are similar to those shown below.

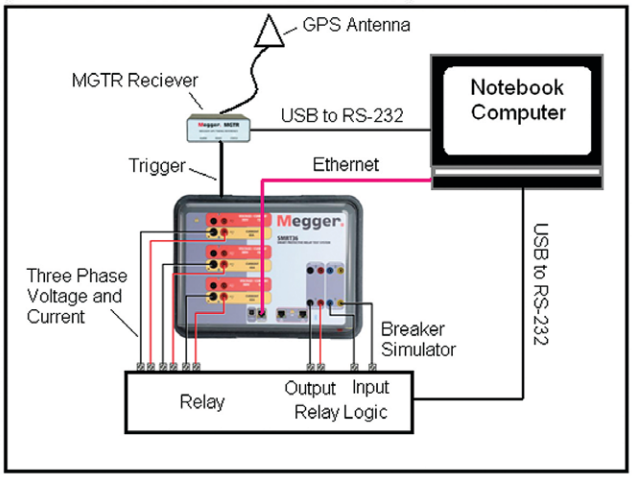

Figure 1: Typical End to End Test Setup

FEATURES AND BENEFITS

- **Programmable Output Pulse (POP)** - Used to trigger the end-to-end tests using Megger PULSAR or MPRT relay test sets. The POP can be specified by date, time, repetition (single pulse, or multiples), pulse polarity, and pulse width with 100 nanoseconds of resolution.
- **External Event Time Tag (ETT)** - Used to mark date and time of an external event with 100 nanoseconds of resolution. Multiple events are buffered, and the control software allows events to be archived.
- **State-of-the-art 12 channel GPS technology** - Capable of tracking up to 12 satellites simultaneously.
- **Intelligent Holdover™** - provides near-Rubidium holdover characteristics in the absence of GPS signals. This allows high accuracy triggering even when not receiving GPS timing signals. This provides end-to-end test capability in high foliage, mountainous, urban canyon environments and near government facilities where GPS signals may be temporarily blocked.
- **FastStart™** - Offers high accuracy within minutes of start-up, which provides faster time to first test.
- **GPS Disciplined Ovenized Crystal Oscillator** - insures the highest accuracy possible for triggering end-to-end tests.
- **Windows® Based Control /Software** - Provides simple user interface to set the Programmable Output Pulse for end-to-end tests.
- **100 nanosecond Accuracy** - Insures the highest available accuracy for synchronized end-to-end tests.
- **RS-232 serial port** - The RS-232 port provides a computer interface to perform automatic testing.
- **Immediate error indication** - Visual alarm indicates when unit cannot supply corrected precise time due to loss of GPS signals.

SPECIFICATIONS

Input Power

AC/DC Adapter
90 to 265 VAC, 47-63 Hz to 24 VDC, 400mA, with 4-plug kit

Disciplined Oscillator
High performance ovenized crystal control (OCXO)

Long-Term Stability
1×10^{-12} after 24 hours tracking

Short-Term Stability
1×10^{-11} after 1 second tracking

Accuracy While Coasting
1×10^{-10} per day after 3 days of locked operation

Receiver Type
12 parallel channel, code + carrier tracking, CA mode, L1 carrier

Time to First Fix (typical)

Hot Start:
< 30 seconds (with valid almanac, time, date, position & ephemeris)
Warm Start:
< 60 seconds (with valid almanac, time, date & position)
Cold Start:
< 3 minutes typical, 12.5 minutes max (with no almanac, time, date or position)
Position Update Rate: Once per second, nominal

Programmable Output Pulse

Drive: TTL into 50Ω
Rise/Fall Time: 10 ns Maximum
Pulse Width: Programmable from 1 µs - 250 ms
Polarity: Selectable, positive/negative
Resolution: 100 ns
Accuracy: 100 ns RMS

External Event Input

TTL/CMOS level, edge-triggered, polarity selectable
Resolution: 100 ns
Accuracy: 100 ns RMS

MUX 1 Output

The output is user selectable. Outputs available are; 1, 10, 100 kHz, 1, 5, 10 MHz, 1 PPS
Drive: TTL into 50Ω
Rise/Fall Time: 10 ns Maximum

1 PPS Output
(Referenced to UTC)
Drive: TTL into 50Ω
Rise Time: 10 ns Maximum
Pulse Width: Positive pulse, 1 ms nominal, rising edge on-time
Accuracy: 100 ns RMS

10 MHz Output
Standard frequency output 10 MHz. High spectral purity sinewave, +10 dBm into 50Ω, ± 2 dB

Temperature Range (MGTR)
Operating: 14 to 158° F (-20 to 70° C)
Storage: -6 to 185° F (-40 to 85° C)
Relative Humidity (MGTR): 95% RH, Non-condensing

Temperature Range (GPS Antenna)
Operating /Storage: -11.2 to 158° F (-45 to 85° C)
Relative Humidity (Antenna): Water-proof/all weather

Dimensions
MGTR Unit Enclosure
4.125 W x 1.5 H x 4.0 D in.
104.8 W x 38.1 H x 101.6 D mm

MGTR Unit Weight
1.0 lbs. (0.453 kg)

GPS Antenna Enclosure
5.0 H x 3.54 Diameter (in.)
38.1 H x 90.0 Diameter (mm)

GPS Antenna Weight
0.66 lbs. (0.30 kg)

Safety
IEC 61010-1, Amendments 1 and 2

Enclosure
The unit comes mounted in a rugged enclosure for field portability. An optional padded soft-sided carry case is available. The soft-sided carry case protects the unit from light rain and dust. The soft case also has pockets to hold the antenna, cables and AC/DC power supply.

MGTR unit Front View

MGTR unit Rear View


MGTR Unit with Accessories

ORDERING INFORMATION

Item (Qty)	Cat. No.
Megger GPS Timing Reference unit	MGTR
MGTR Includes	
Instruction Manual (1 ea)	750018
MGTR Receiver Unit, with Software CD (1 ea)	569010
Control Cable Assembley (1 ea)	620082
GPS Antenna Kit (1 ea)	801055
BNC to Banana Test Lead adapter	90003-671
AC/DC Power Adapter (1 ea)	561024
Antenna Kit contains the following:	
GPS Antenna (1 ea)	650016
50 ft. cable (1 ea)	620083
4 inch SS Antenna Mount (1 ea)	650017
Optional Accessories	
100 ft. cable (1 ea)	90003-691
Soft-sided transit case (1 ea)	MC6674

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ISO STATEMENT
Registered to ISO 9001:1994 Reg no. Q 09250
Registered to ISO 14001 Reg no. EMS 61597

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