MAPS™ FXO FXS Emulator & tProbe™

Automated Analog Terminal (FXO) and Network Port (FXS)
What is FXO and FXS?

- Foreign Exchange Subscriber (FXS) and Foreign Exchange Office (FXO) are interfaces commonly used with analog phones and phones lines.

- FXO stands for Foreign Exchange Office
  - FXO is the plug on the phone or fax machine, or the plug(s) on your analog phone system
  - FXO receives the analog line

- FXS stands for Foreign Exchange Subscriber
  - FXS is the plug on the wall that delivers a ring signal and dialtone
  - FXS delivers the analog line to the subscriber
MAPS™ FXO FXS Emulator

GL Communications Inc.
tProbe™ Unit

- tProbe™ T1/E1 is an enhanced USB Based T1 and E1 solution that is capable of both T1 and E1 interfacing
- Available with Dual T1 / E1, FXO, FXS, DTE, and DCE interfaces
- Forward thinking hardware design for future daughter board expansion applications
- Connects to a PC via a USB 2.0 port
- Access Remotely
Why the product is superior?

- Portable with advanced test features such as Pulse Shape Analysis and Jitter Management & Analysis
- “Cross-port Through “ Mode and “Cross-port Transmit” Mode- these settings make cabling with Drop insert and Fail-Safe Inline Monitoring very easy
- Enhanced VF Drop and VF Insert Capabilities (Including 3.5mm or Bantam Physical connection options)
- Improved circuitry for very accurate Digital Line Level measurements
- Forward thinking hardware design for future daughter board expansion applications
- Available with Dual T1/E1, FXO, FXS, DTE and DCE Interface.
Main Features

- Script based simulation of 2-Wire Telephone Port (FXO) and Telephone Wall Jack (FXS) for complete automation
- GUI and CLI based testing of FXO/FXS for automation and remote access
- Standalone testing of FXO/FXS with loopback
- Supports input and output signals of 8K samples/sec, u-law, A-law, and 16-bit Linear PCM
- FXO/FXS termination supports for over 70 different termination characteristics (different countries)
- Handle FXO-FXS responses - Caller ID Detection, Continuous monitoring of Voltage and Current, and High and Low Voltage/CURRENTS Triggers.
- Loud speaker provided to hear the voice being transmitted on FXO/FXS ports
- Send /Receive fax image (TIFF format) file over FXO and FXS ports
Applications

- Testing (simulation, and monitoring) 911, E-911, and NG-911 systems
- Testing gateways, VoIP ATAs, telephone lines, handsets, VoIP PBX
- Voice quality testing, 2wire call automation, Caller ID
- Monitoring signalling, voice, and tones on telephone lines non-intrusively
- Generation and reception of traffic on 2-wire telephone lines
- Provides fault insertion, and erroneous call flows testing capability
- Ready scripts make testing procedure simpler, less time consuming and hence time to market products
- Remote operation of FXO FXS ports over TCP/IP
Digital Signal Formats

FXO/FXS supports following digital signal formats:

• A-Law: This is the 8-bit codebook format typically used in E1 systems

• Mu-Law: This is the 8-bit codebook format typically used in T1 systems

• 16-bit Linear: This is a 16-bit linear signal. Intel ("little-endian") byte ordering is used. (Currently this feature is supported only by FXO)
Supported Protocols

- Script based simulation of 2-Wire Telephone Port (FXO) and Telephone Wall Jack (FXS) for complete automation
- T1 Wink Start (R1 wink)
- T1 Loop Start and T1 Ground Start
- T1 Feature Group D (FGD)
- T1 Immediate Start
- T1 CAMA (Centralized Automated Message Accounting)

- E1 MFC-R2 (All variants, full / semi compelled) - Defined by the ITU Recommendations Q.421-Q.442 - uses multi-frequency compelled signaling protocol to exchange address information
- E1 European Digital CAS (EUC)
- E1 Digital E & M
- E1 International Wink Start
- E1 Sweden P7
- Any User-Defined CAS Protocol
tProbe™ FXO Port to Mobile or Landline Phone

Testing Scenarios

MAPS™ FXO FXS sets up the call from tProbe™ FXO port to the Landline or Mobile phone through the wall jack FXS, local PBX, and central office of the service provider and base station.
It is also possible to establish a call from tProbe™ FXO port to another tProbe™ FXO port via a Teltone Switch.

Teltone Switch (TLS) provides two FXS ports in it and acts as a local exchange connecting the two lines.
tProbe™ FXO Call Monitoring

Connection of tProbe™ FXO port in non-intrusive monitor mode via a Teltone Switch
tProbe™ FXO port to IP via ATA

FXO port is connected to VoIP phone or PC with a local network via an ATA device.

The test scenario depicts the call established between tProbe™ FXO port and VoIP phone via ATA.
Script initializes tProbe™ FXO port and tProbe™ FXS port parameters, places the call from the tProbe™ FXO port to tProbe™ FXS port by sending DTMF digits, answers the call by asserting off-hook, captures the incoming traffic into the file and transmits traffic to the other end.
Depicts the call from tProbe™ FXS port to regular phone (2-wire phone) via RJ-11 cable. Places the ring to regular phone (2-wire phone), captures the incoming traffic into the file and transmits traffic to the other end.
tProbe™ FXS port to FXO on GL’s Dual UTA

The call flow between tProbe™ FXS port to GL’s Dual UTA via RJ-11 cable, with Dual UTA HD initiating call.
FAX Simulation over Analog Lines

Send / Receive FAX over FXO Port

Wall Jack-FXS

FXO

MAPSTM FXO FXS Emulator

T1/E1 Loopback

Exchange

Wall Jack-FXS

FAX

Testing Scenarios
FAX Simulation over Analog Lines...

Send / Receive FAX over FXS Port

MAPSTM FXO FXS Emulator

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The tProbe™ FXO port can be directly connected to 911 selective router or PSAP on CAMA-type circuits for simulation of CAMA calls to the selective router or PSAP.

The script will seize the line, wait for wink, dial ANI and wait for call connect.

The tProbe™ T1 FXO port can be tapped onto CAMA-type circuits for non-intrusive monitoring of 911 service.
FXO Monitoring of CAMA Type Trunks

FXO CAMA Monitor Message Sequence

FXO CAMA Signal Monitoring
FXO FXS Testbed Setup

MAPS™ Features

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## FXO FXS Profile Editor

### MAPS™ Features

**FXO FXS Profile Editor**

![FXO FXS Profile Editor](image)

**FXO FXS Profile**

- **FXO Profile Parameters**
  - FXO Card Number
  - FXS Card Number
  - Rx Timeslot
  - Tx Timeslot

**Dial Digit Parameters**

- Dial Digits
- Dial Digit Power in db
- OnTime in msec.
- Off time in msecs.

**Signaling Parameters**

- **Tone**
  - **Tone 1**
    - Tone Name: Dial Tone
    - Tone name defined in MTDF file: Dial Tone
    - Frequency 1 in Hz: 350
    - Frequency 2 in Hz: 440
    - Power in db: -10
    - OnTime in msec.: 3000
    - Off time in msecs.: 0
  - **Tone 2**
    - Tone Name: Ringback Tone
    - Tone name defined in MTDF file: Ringback Tone
    - Frequency 1 in Hz: 440
    - Frequency 2 in Hz: 480
    - Power in db: -10
    - OnTime in msec.: 2000
    - Off time in msecs.: 0

**Add**, **Insert**, **Delete**

![Error Events](image)

![Captured Errors](image)

*Error Events*, *Captured Errors*, *Link Status U=9 Down=0*

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MAPS™ Features

**tProbe™ Windows Client Server (WCS)**

### WCS Server Log

```plaintext
580: get fxs loop current #1;
580: set fxs signaling offhook #1;
580: run task "FaxSimulatorE1:StartFaxSim";
580: run task "FaxSimulatorE1:StartFaxSim";
580: inform task 17 "FX/FAX #2: 5 # 2: 1 TIFF FILE winclientserver/faxsimulator/\[end\] 2.6 CODEC_TYPE ALAW_MIN_DATA_RATE 2400 MAX_DATA_RATE 9600 PAGESIZE_TYPE 1 RESOLUTION_TYPE 1 ECENABLED 1";
580: inform task 18 "START";
580: inform task 16 "FAX/FLX #1: 1 # 1: 5 TIFF_FILE WinClientServer/FAXSimulationRec/FAX_1_5_132461744287-4483-6 CODEC_TYPE ALAW_MIN_DATA_RATE 2400 MAX_DATA_RATE 9600 PAGESIZE_TYPE 1 RESOLUTION_TYPE 1 ECENABLED 1";
580: get fxs battery voltage #2;
580: get fxs loop current #2;
580: get fxs tip-ring voltage #1;
580: get fxs loop current #1;
580: get fxs battery voltage #2;
580: get fxs loop current #2;
580: get fxs tip-ring voltage #1;
580: get fxs loop current #1;
```
WCS Sample Script

```plaintext
// tProbe FXO to tProbe FXS_T1.gs
// For more information refer to the Section 6.2.3
// Note: This script runs automatically without user intervention, recording the traffic
// being sent on FXO and FXS ports.

// Turn on Inward Driver Loopback to allow transmission and reception over FXO and FXS
set latency 20 msec;  // Set the requesting client's transmit latency to 20 ms.
set response 500 msec; // Set the requesting client's response time to 500 ms.

// Concurrent mode is appropriate for FXO and FXS scripts in most cases
concurrent:

// FXO port initialization and setting the parameters
set fxo on #1;   // Enabling the FXO on port 1
get fxo #1;      // Get the status of FXO on port 1, by default it
allocates TS 0(In) and TS4 (Out)
set fxo termination "usa" #1;  // Setting the termination as "USA"
get fxo termination #1;    // Getting the termination, which have been set earlier
set fxo encoding mulaw #1;   // Setting the encoding format as mulaw
get fxo encoding #1;          // Getting the encoding format, which have been set
earlier
set fxo in gain 0.0 db #1;   // Setting the Input gain of FXO on port 1 as 0.0 db
get fxo in gain #1;          // Getting the Input gain, which have been set earlier
set fxo out gain 0.0 db #1;   // Setting the Output gain of FXO on port 1 as 0.0 db
get fxo out gain #1;          // Getting the Output gain, which have been set earlier
set fxo sample rate 8 kzh #1; // Setting the sampling rate 8000 Hz or 8kHz on port 1
get fxo sample rate #1;       // Getting the sampling rate, which have been set earlier
```
FXO FXS Global Configuration
FXO FXS Bulk Call Generation

- Stability/Stress and Performance testing using Load Generation
- Different types of Load patterns to distribute load
- User can load multiple patterns for selected script
- User configurable Test Duration, CPS, Maximum and Minimum Call Rate etc.
FXO FXS Call Ratio Statistics

Call Graph

Call Success Ratio Statistics
2-Wire FXO/FXS

2-Wire FXS

2-Wire FXO

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2-Wire FXO/FXS...

- FXO port on tProbe™ allows to simulate a two-wire FXO device such as a telephone or a fax machine.
- FXO port allows you to capture and analyze data from a two-wire telephone line, as well as to generate and transmit analog data onto that two-wire line.
- The FXS port on tProbe™ emulates a two-wire FXS service such as a telephone wall jack.
- This feature allows you to interface with an FXO device such as a telephone.
Other Analog Testing Products

• **T1/E1 MAPS™ APS and ALS Simulation**
  Using a T1 connection to the APSCB24/48/96, generates a series of up to 384 analog ports with standard FXO interfaces
  MAPS™ APS can be connected to any ATS, PSTN, PBX, or Gateway that supports analog FXO interfaces

• **T1/E1 MAPS™ CAS Emulator**
  Automated test procedure allowing the users to establish calls, and send/receive TDM traffic (DTMF/MF digits, Tones, Fax, Voice)

  Supports testing of various protocols - T1 Wink Start (R1 wink), T1 Loop Start and T1 Ground Start, T1 Feature Group D, T1 Immediate Start, E1 MFC-R2 (All variants, full /semi compelled), E1 European Digital CAS (EUC), E1 Digital E & M, E1 International Wink Start, and Any User-Defined CAS Protocol.
Other Analog Testing Products...

- **VQuad™ Dual UTA**
  
  Fax Testing using the Dual UTA 2-wire FXO or 4-wire analog interfaces. Supports up to 4 simultaneous T.30 faxes.

- **T1/E1 CAS Simulation and Analysis**
  
  It can simulate and analyze any user-defined CAS protocols by providing signaling bit transitions and forward/backward frequency digits and tones.

  GL's CAS simulator and Analyzer are client-side applications that work along with the GL's T1/E1 Analyzer.
Thank you!