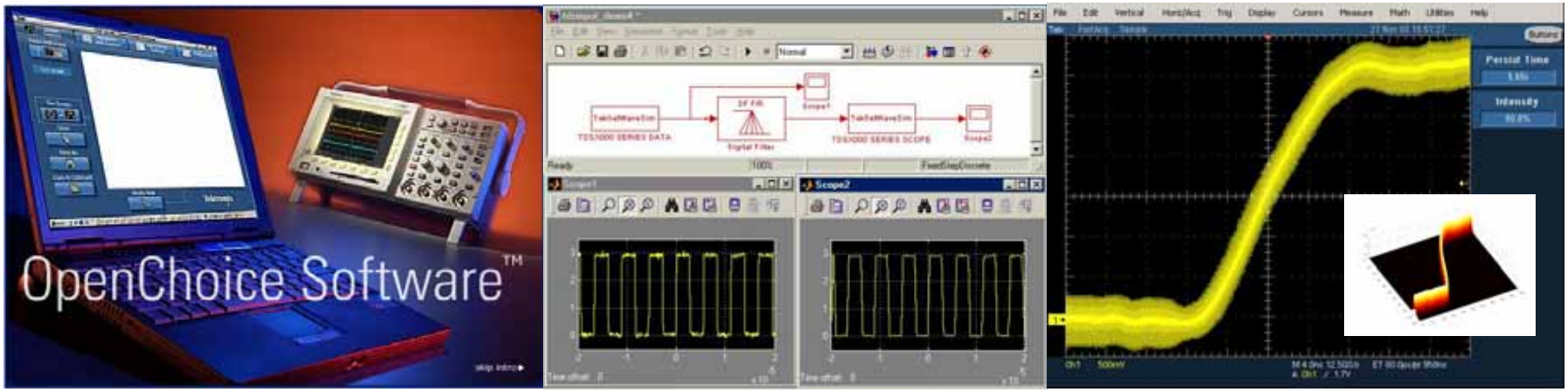
Open Choice with MATLAB

Easy-to-use Tools for MATLAB with Source Code and Example Program



Tektronix, Japan

Applications Engineering

MATLAB (1)

- MATLAB is compliant with both TekVISA and ActiveX
  - Combination of TekVISA and ActiveX technology can be supported
  - TekVISA
    - TekVISA is easily supported by TekStart and TekEnd to start or end the VISA session
    - After starting the session by TekSTart, standard functions such as query、fprintf、fscanf、fread work for VISA Handle returned from TekStart
    - Example

      instr = TekStart; id = query(instr, '*idn?'); TekEnd(instr)
  - ActiveX
    - ActiveX is supported by TekStartA and TekEndA
    - After starting the ActiveX Control, TekQueryA、TekWriteA、TekReadA work for input or output data
    - Example

      g = TekStartA;
      id = TekQueryA(g, '*idn?');
      recordLen = invoke(g, 'Query', 'HOR:RECORD?');
      TekEndA(g)

MATLAB (2)

- TekBegin is alternative function to control full parameters for VISA
  - TekBegin controls lVISA Resource Name, I/O Buffer Size and Timeout
  - Example

```
instr = TekBegin('GPIB8::1::INSTR', 1000000, 5);
% Use Scope Internal High-Speed I/O Bus, Buffer Size is set to 1000000 for long record-length waveform
% and set Timeout to 5 seconds
[y, sI, xZ, iT] = TekGetWave(instr, 'ch1');
t = ([0:1:length(y)-1] - iT) * sI + xZ;
plot(t, y);
TekEnd(instr)

% y:        Waveform Y Vector (V)
% t:        Time Vector (s)
% sI:       Sampling Interval (s)
% xZ:       X-Zero (s)
% iT:       Index Trigger ( e.g. if iT is 2500 in 5000 record-length, it means Center Trigger )
```

MATLAB (3)

- Get/Set Functions serve for input or output waveform
  - Get/Set functions enable to get waveform from the targeted source or set waveform to REF memory
  - Example

```
instr = TekStart;
b = firgauss(2, 3);
for n = [1:1000]
    [y, sI, xZ, iT] = TekGetWave(instr, 'ch1'); % Get Waveform from Channel 1
    filterY = filter(b, 1, y);                  % Filter processing
    TekSetWave(instr, filterY, 'ref1');         % Set filtered waveform to REF 1
end;
TekEnd(instr)

% y:        Original Waveform Data
% filterY:  Filtered Waveform Data
```

MATLAB Source Code (1)

- Initialize and Open TekVISA Session
  - TekVISA I/O function can be used until TekEnd is called
- Source Code of TekBegin.m
  - % Begin TekVISA for TDS5000/6000/7000/8000 ...
  - % function [v] = TekBegin(r, bs, t)
  - % v : TekVISA Handle returned
  - % r : TekVISA Resource (e.g. GPIB8::1::INSTR)
  - % bs : Buffer Size (e.g. if you use CURVE QUERY, set CURVE Size for it)
  - % t : Timeout with unit of ms
  - function [v] = TekBegin(r, bs, t)
  - if length(r) < 1
  - r = 'GPIB8::1::INSTR';
  - end;
  - v = visa('tek', r);
  - set(v, 'InputBufferSize', bs);
  - set(v, 'OutputBufferSize', bs);
  - set(v, 'Timeout', t);
  - fopen(v);
  - return;

MATLAB Source Code (2)

- Close the current TekVISA Session
- Source Code of TekEnd.m
  - % End TekVISA for TDS5000/6000/7000/8000 ...
  - function TekEnd(instr)
  - fclose(instr);
  - delete(instr);
  - return;

MATLAB Source Code (3-1)

- Get Waveform from Scope
- Source Code of TekGetWave.m

```
function [data, sI, xZ, iT] = TekGetWave(instr, srcName)
    clear fastA;
    clear data;
    fastA = query(instr, ':head 0;:fasta?');
    if fastA(1) == '1'
        fprintf(instr,':fasta:state 0');
        %pause 0.05
    end;

    horizLen = str2num(query(instr,':HOR:RECORD?'));
    fprintf(instr,':data:width 1;encod rib');
    fprintf(instr,[':DATA:SOU ' srcName ';START ' num2str(1) ';STOP ' num2str(horizLen)]);
    fprintf(instr,':CURVE?');

    header = fscanf(instr,'%s',2);
    header1 = fscanf(instr,'%s',str2num(header(2)));

    [data,count] = fread(instr,horizLen,'int8');
    Curveterminator = fread(instr,1,'char');
```

MATLAB Source Code (3-2)

- Continued

```
% get x zero
    xZ = str2num(query(instr,'WFMOUTPRE:XZERO?'));
    % get the sampling interval
    sI = str2num(query(instr,'WFMOUTPRE:XINCR?'));
    % get the trigger point within the record
    iT = str2num(query(instr,'WFMOUTPRE:PT_OFF?'));
    ymult = str2num(query(instr,'WFMOUTPRE:YMULT?'));
    yoff = str2num(query(instr,'WFMOUTPRE:YOFF?'));
    yzero = str2num(query(instr,'WFMOUTPRE:YZERO?'));

    % scale the data to the correct values
    data = ymult*(data - yoff) - yzero;

flushinput(instr);
flushoutput(instr);
return;
```

MATLAB Source Code (4)

- Alternative function to initialize and open TekVISA Session
  - It serves for input and output data in a typical condition as follows
    - VISA Resource Name: GPIB8::1::INSTR
    - Buffer Size: 100000 (you should use TekBegin for longer record-length waveform)
    - Timeout: 10 seconds
- Source Code of TekStart.m
  - % Start TekVISA for TDS5000/6000/7000/8000 ...
  - function [v] = TekStart()
  - r = 'GPIB8::1::INSTR';
  - bs = 100000;
  - t = 10;
  - v = visa('tek', r);
  - set(v, 'InputBufferSize', bs);
  - set(v, 'OutputBufferSize', bs);
  - set(v, 'Timeout', t);
  - fopen(v);
  - return;

MATLAB Source Code (5-1)

- Set Waveform to Scope REF memory
- Source Code of TekSetWave.m

```
function TekSetWave(instr, data, destName)

    fprintf(instr,[':head 0;:data:dest ' destName ';:data:start 1']);

    dataSize = length(data);
    dataSizeStr = num2str(dataSize);
    ymin = min(data);
    ymax = max(data);
    yScaleF = (ymax - ymin ) / 250.0;
    if yScaleF == 0.0
        if ymax == 0.0
            yScaleF = 1;
        else
            yScaleF = ymax / 250.0;
        end;
    end;
```

MATLAB Source Code (5-2)

- Continued
  - fprintf(instr,':WFMINPRE:BYT_NR 1;BIT_NR 8;ENCDG BIN;BN_FMT RP;BYT_OR MSB');
  - fprintf(instr,['CURVE #' num2str(length(dataSizeStr)) dataSizeStr]);
  - dataByte = uint8((data - ymin) / yScaleF);
  - fwrite(instr,dataByte,'uint8');
  - fwrite(instr,char(10),'char');
  - flushoutput(instr);
  -
  - fprintf(instr,[':select:' destName ' 1']);
  - return;

MATLAB Example Screen Image

- After setting Vertical Scale to 500mV per div. and Horizontal Scale to 10 micro second, the example program gets waveform from channel 1 and plots it