Thin Film Measurement solution
Software, sensors, custom development and integration

MPROBE UVVISF EMBEDDED FOR MULTICHANNEL IN-SITU MEASUREMENT

MProbe UVVisF is using optical reflectance to measure thickness and optical constants of the thin-films. It is designed for in-situ and online measurement. Up to 8 spectral channels are supported in one unit

Main Features and Benefits

1. Thickness measurement: 1nm – 20 µm
2. Usable Spectral range: 200nm -800nm
3. Two spectral channels with simultaneous measurement (up to 8 channels are supported in one system)
4. Xe Pulsed light source (20 W)
   - high intensity in UV range
   - measurement with plasma and other radiation background
   - measurement of moving wafers
5. Intelligent sensor with embedded controller
   - fully contained unit: perform measurement and data analysis
   - save data locally or directly to network connected database
   - support full remote diagnostics over LAN/Internet using remote desktop
   - Windows 7 operating system
6. TFCompanion software provides:
   - Thickness measurement and end-point detection
   - direct integration with third party software using build in Modbus TCP and/or OPC servers.
   - client/server software included (client resides on the Host computer, server in embedded system)
   - 5 TTL outputs and/or custom RS232 communication with Deposition Control system
   - Connection to MProbe system via Ethernet (LAN) or USB port
7. CE and ROHS compliant

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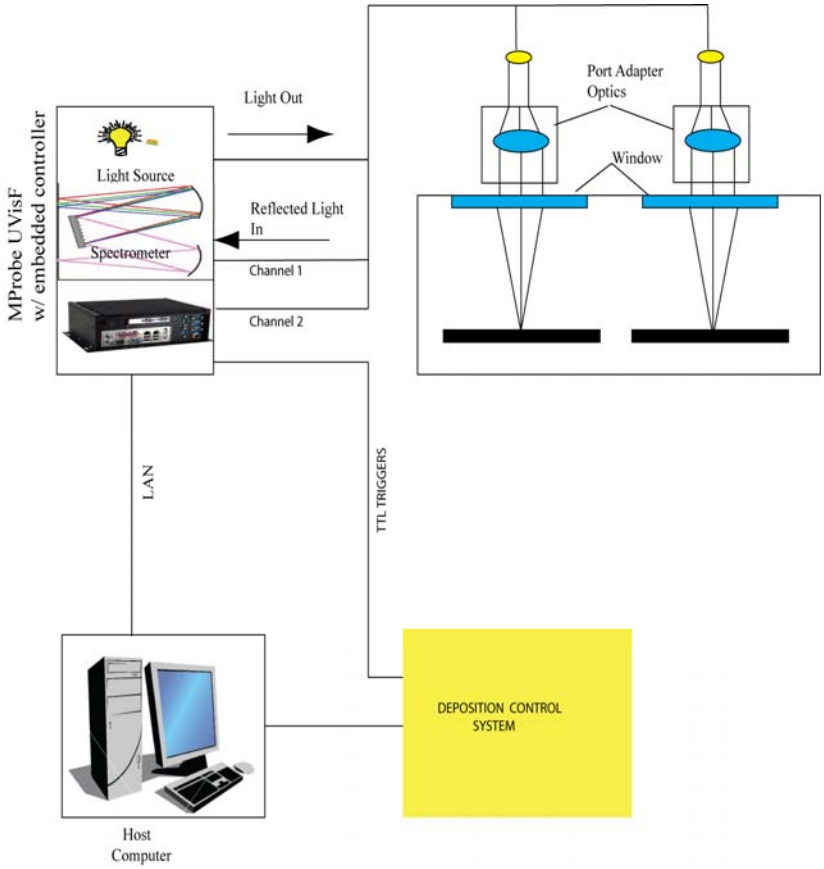

Fig. 1 Configuration diagram (2 channel system)

1. *Host computer* - computer used by the customer to control deposition system
   It has client TFCompanion software installed for communication with the MProbe system
2. MProbeUVVisF w/ embedded controller - main system described in this document
   It is running TFCompanion server and performs measurement and data analysis. The system uses Fiberoptics reflectance probe that is connected to the Port adapter to measure samples.
3. Port adapter is a kinematic mount with quartz lens. It is mounted on the optical port of the deposition chamber

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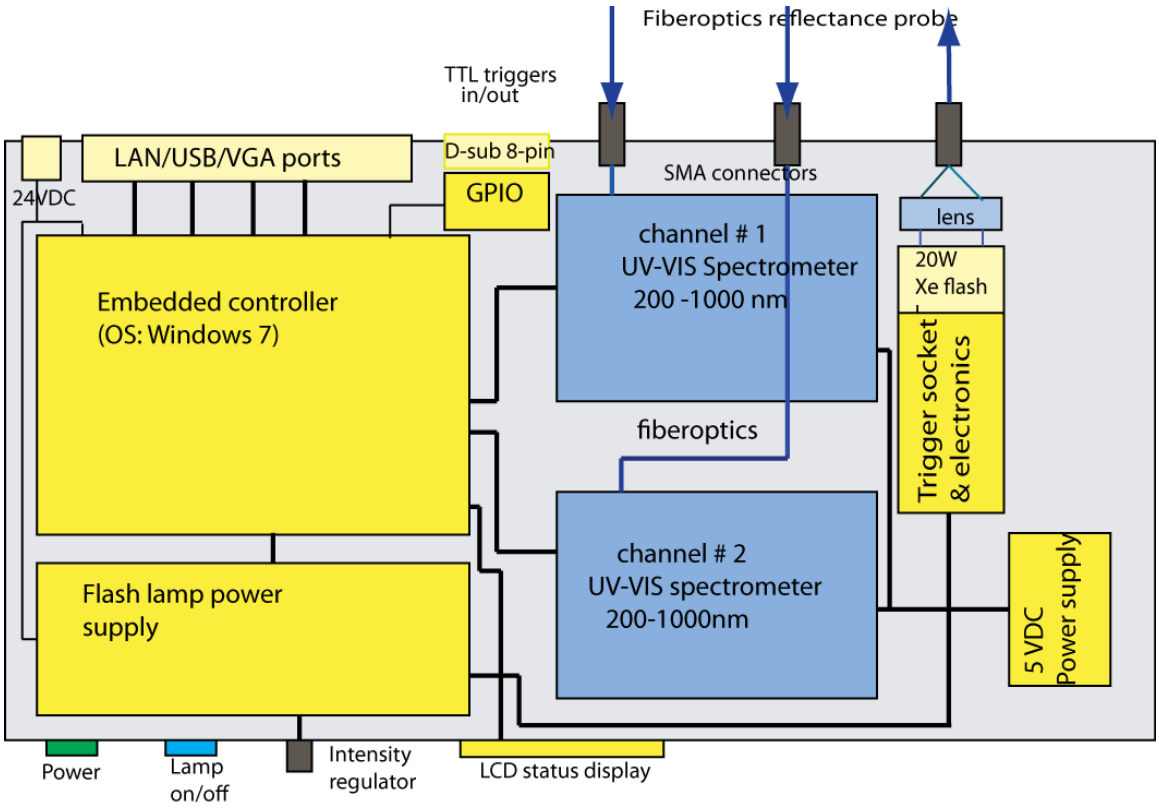

Fig. 2 MProbe UVVisF-embedded schematic diagram (2 channel system is shown)

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Feature Details.

1. Thickness measurement: 1nm – 20 µm

Two methods are used to determine thickness accurately:
a). Fit of the model to the measured data
This method is used for thin films, refinement of the previous measurement or during sequential measurement of continuous deposition. The filmstack parameters (thickness and n&k) are adjusted to fit the measured data. **Fig. 3** shows example of this approach.
b). Thick film algorithm (FFT based)
This approach uses analysis of the fringe pattern of the spectrum to determine thickness of the thick films (> 5µm)
This approach is rarely used directly in in-situ measurement. In most cases it is combined with the first approach to allow the use the same recipe for a wide range of thicknesses.

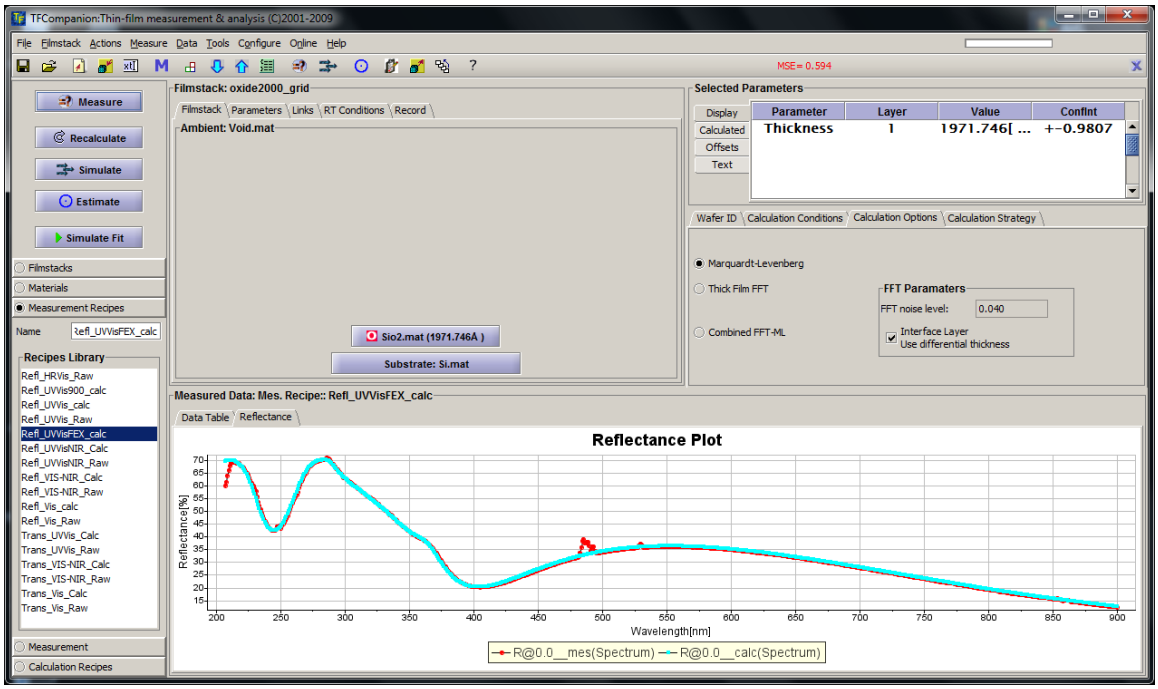

Fig. 3 Thickness measurement SiO2: 197nm

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2. Usable Spectral range: 200nm -800nm

Xe flash lamp emits in a wide spectral range but ~ 50% of energy is concentrated in the UV part of the spectrum

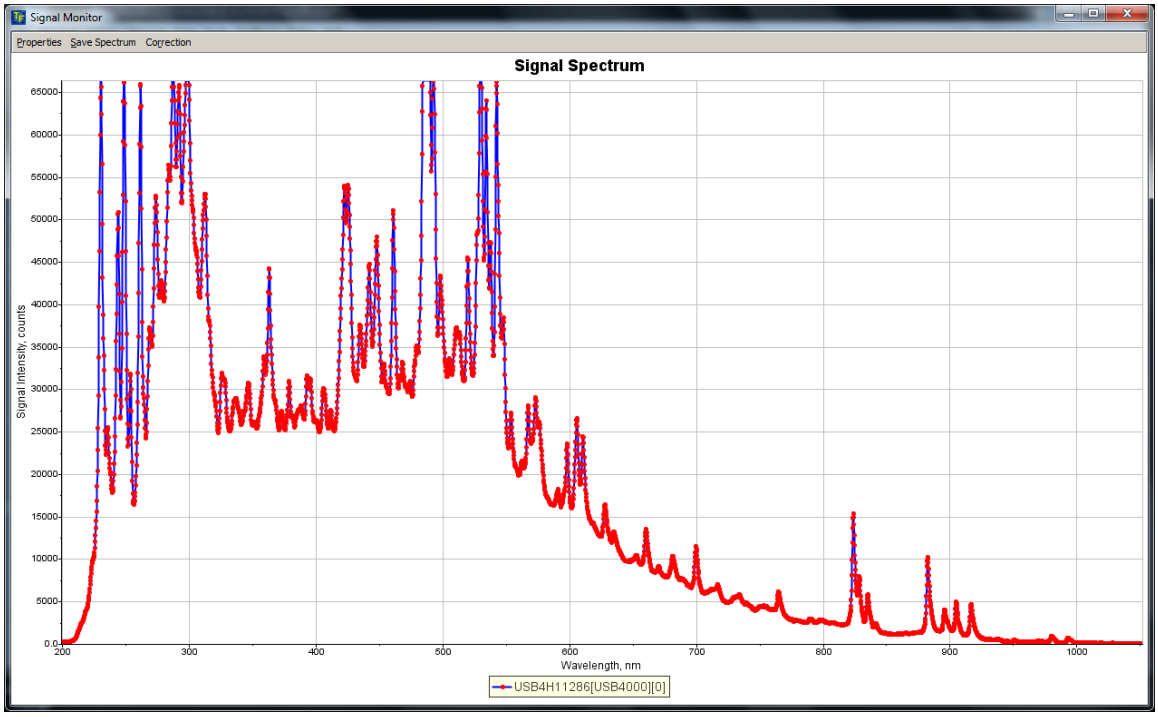

Fig. 4 Flash lamp spectrum - raw reflection signal from Si wafer

3. Xe Pulsed light source (20 W)

High light intensity is important to be able to measure in deposition chamber with strong radiation background. There are many radiation sources in the deposition chamber: IR heating lamps, plasma (sputtering, etc.)… They all produce continuous radiation with changing intensity and wavelength spectrum.
Xe lamp strobe is very short less than 10us. When measurement is synchronized with the light strobe, the data acquisition time can be also short. Since, detector signal is proportional to exposure time – the effect of background radiation can be dramatically reduced or eliminated altogether. At the same time, the entire useful reflectance signal is fully collected.

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System Configuration

There are many different configuration of the MProbe depending of the deposition system. Two most common configurations are: normal incidence and oblique incidence. MProbe UVVisF system is using fiberoptics reflectance probe to illuminate the wafer and collect reflected light. In case of normal configuration, the optical port is located above the wafer. Port Adapter with optical lens is attached to the optical port of the chamber.

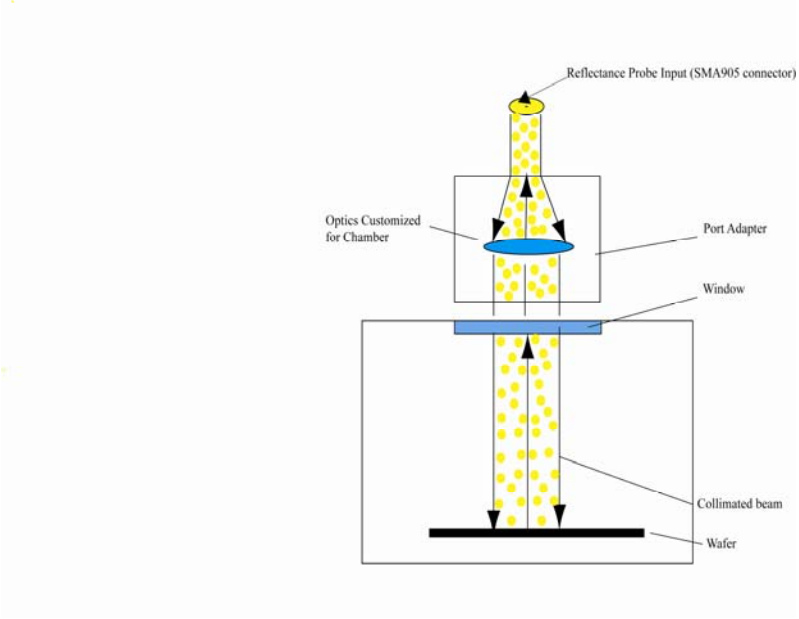

Fig. 5 Normal incidence with collimated beam

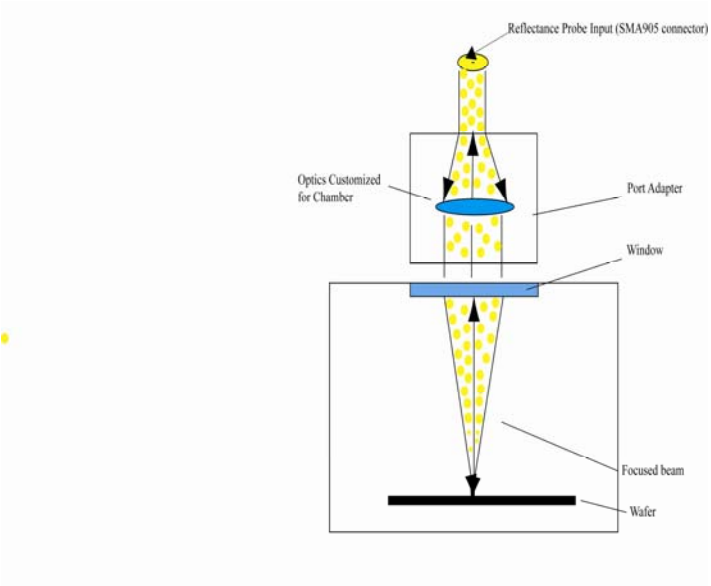

Fig.6. Normal incidence with focused beam

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Fig. 7 Window Port Adapter (includes optics and 2D adjustment). Standard adapter for KF63 flange.

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SPECIFICATION

Wavelength range	200nm-800nm	Option: 230nm -800nm
Wavelength resolution	<2nm	Option E: <1nm
CCD	3600 pixels	
Thickness range	1nm – 20 µm	Option E: 1nm – 50 µm
Light source	20W Xe flush lamp	
Light source lifetime	10^9 pulses	
Data acquisition	Synchronized with lamp pulses	Option: External synchronization trigger
Light color temperature	>12000 K	High intensity in UV
Light source power	20W	
Fiber connection	SMA 905	
Reflectance probe	2m long, 1 m common leg, 0.5m illumination/read legs. 400 µm core fiber, UV solarization resistant Stainless steel interlocked jacket	Custom length fibers are available
Automation	Modbus TCP, OPC (DA 2.0/3.0)	Control from the host computer
Software	TFCompanion software	Client can be installed on the host computer
Number of spectrometer channels	2	Up to 8 channels are supported (integrated in the same package)
Weight	6 kg	
Dimensions	2U rackmount enclosure 19”W x 17.7”L x 3.5”H (inches) 482W x 449L x 88.9 (mm)	Desktop version available
Power	95 -250 VAC, 50/60 Hz 50W	
Compliance	CE, ROHS	

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SOFTWARE CONFIGURATION AND MEASUREMENT CONTROL

1. Software configuration

   TFCompanion software includes:

   a). Desktop GUI application – this application is used to setup recipes, build filmstacks, create new materials for a new application/process. It is deployed in embedded system and can be started in remote desktop mode.

   b). TFCServer application – this application is deployed in the embedded controller and used during the measurement. It uses Modbus TCP communication with the TFC client on the Host computer.

   c). TFC client is a small GUI application that is deployed on the Host computer

   d). SDK (dll library) for integration with the third party software (this library implements Modbus TCP client for communication with the TFCServer). It exposes simple API for easy integration

   e). OPC server (DA 2.0/3.0 support) – this server can be deployed on the embedded controller for integration with third party control software.
   OPC client connector and libraries are deployed on the host computer.

2. Measurement control.

   Measurement is controlled either using TFC client (deployed on the host computer) or SDK (dll library) or OPC server

   a). TFC Client using pull approach to measurement control i.e. user select interval between measurements (0 for as fast as possible) and start the measurement. Lamp start/stops automatically with the measurement or it can be controlled independently.

   b). OPC server using the same approach as TFC Client. User define the measurement recipe (application, recipe, etc), start the lamp and start the measurement.
   OPC client is, typically, controlled using script. Measurement is stopped based on thickness reading.

   c). In case of Modbus communication (dll library integration). Measurement is initiated explicitly by the third party i.e. each measurement needs to be called.

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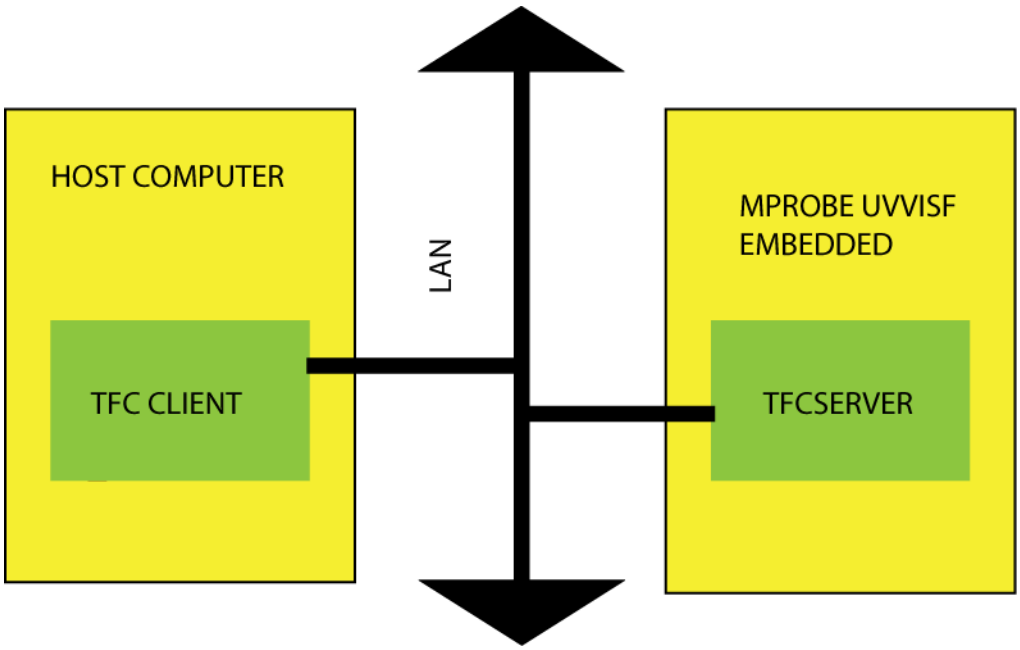

FIG. 8. TFC CLIENT-SERVER CONFIGURATION.
TFC client (Desktop application) is installed on the host computer and allow to control MProbe system. There is no integration with the SCADA or other control software in this scenario

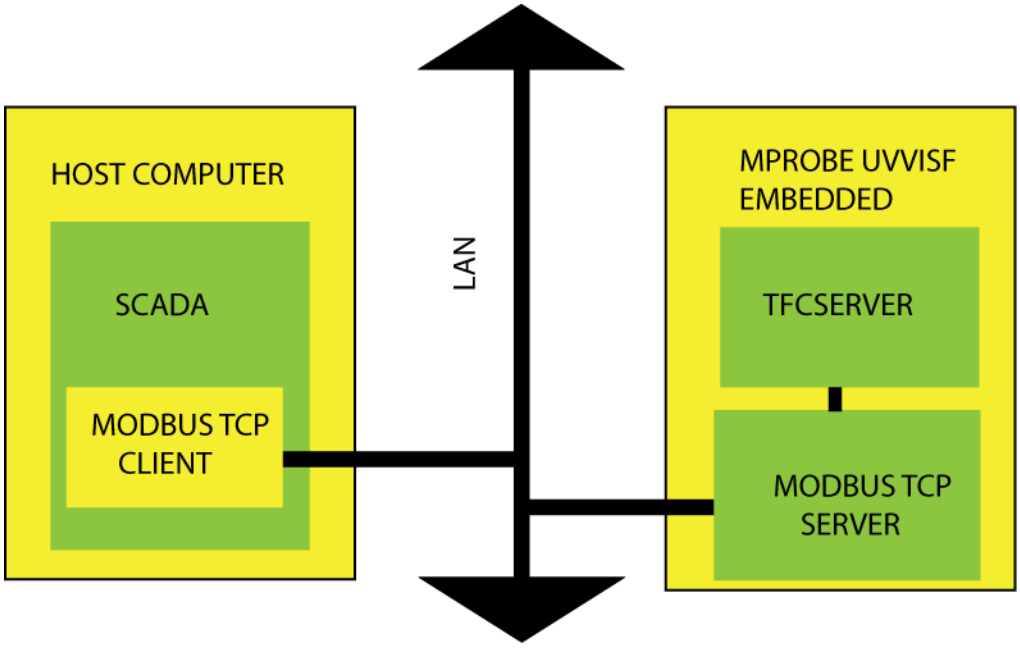

FIG. 9 MODBUS TCP COMMUNICATION
Most SCADA packages include Modbus TCP client, it can be used to control MProbe. Modbus TCP server is an option included with the MProbe software.

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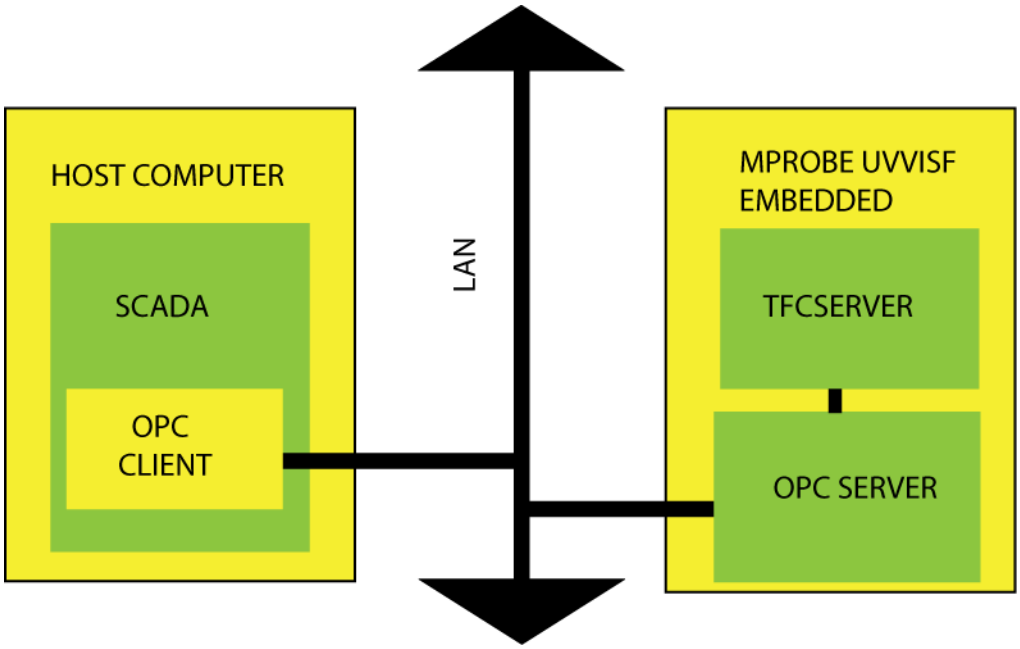

FIG. 10. OPC COMMUNICATION

Most SCADA packages include OPC DA client – it can be used to control MProbe. OPC server is an option included with the MProbe software.

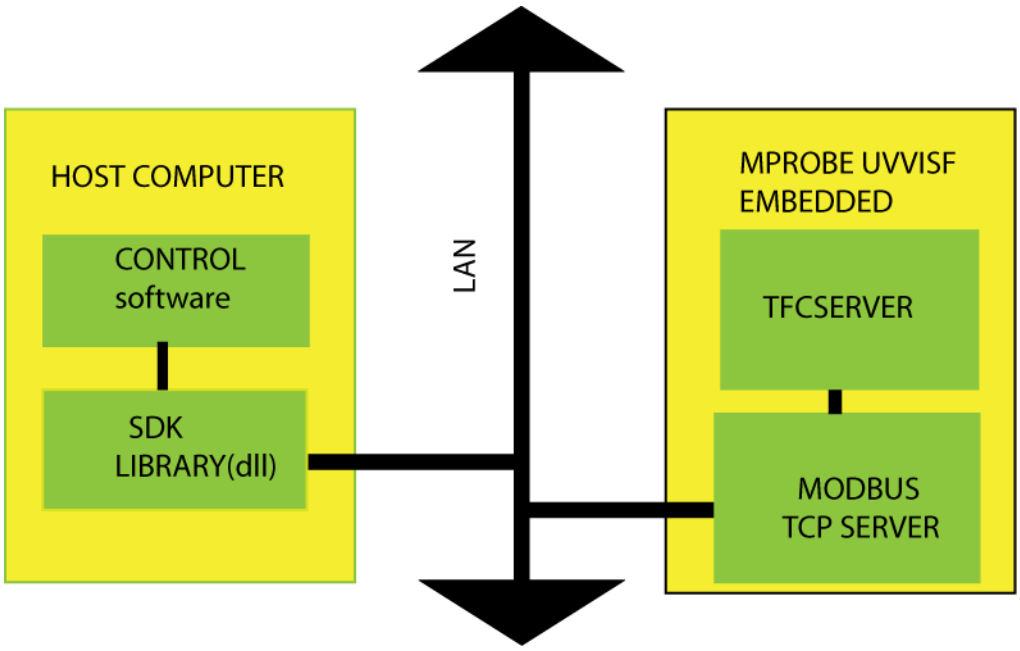

FIG. 11 SDK USE FOR INTEGRATION AND COMMUNICATION

This is the most flexible option that allows integration of the third party software. SDK (dll library) is provided for this integration. Third party software can use calls to this dll library to control MProbe system. Dll library is implemented in C language.

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INSTALLATION, WARRANTY, OTHER DETAILS

1. Delivery: **6 weeks** ARO
   Repeat orders with same configuration (for OEM): 5 days ARO

2. Installation period
   The system is fully configured and ready for installation. Installation, typically, takes 1 or 2 hours. With test deposition run and application configuration it takes one day. Installation is easy and, typically, does not require additional support.

3. Warranty period
   One year from installation (consumables are excluded)

4. Problem resolution
   Remote diagnostics via internet of any measurement or configuration problems. We use TeamViewer software to remotely login to the system and diagnose it.

6. Software bugs/problem correction
   Response time within 24 hours. High priority problems fixed within 48 hours and new update build is released. Software includes updater that can automatically check for new builds (when connected to internet)

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