



# Visualization and Integrated Control & Visualization

*Guide Form Specification*





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## 1 Overview

### 1.1 Purpose

The purpose of this paper is to capture requirements for a visualization and integrated visualization/control system. This system can function as an Operator Interface (OI) for visualization only or as a controller with an integrated OI functions. The system has a built in web server allowing access to data, application panels, and logic.

### 1.2 Definitions

- OI: Operator Interface. Used to provide a graphic representation of data from a process and to accept user commands to be fed back to the process.
- Ethernet: A very high performance local area network standard providing the two lower levels of the ISO/OSI seven layer reference model, the physical layer and the data link layer.
- TCP/IP: a protocol widely used across Ethernet networks for connecting computers and programmable controllers.
- Web Browser: A client application that provides a user interface via the World Wide Web. Netscape and Microsoft Internet Explorer are two popular examples.
- Communications Protocol: A formal set of conventions governing the control of Inputs and Outputs between the two communicating processes.
- Network: An interconnected group of nodes, a series of devices, nodes or stations connected by communications channels.
- Operating System: A program that controls the entire overall operation of the system hardware / software.





## 2 Technical Requirements

### 2.1 System Architecture

The system shall be an open micro-process based computer with an integrated flat-panel display. There shall be no rotating media and the system will use a standard operating system. An expansion bus must be available for connecting to standard communications networks. Built in Serial and Ethernet ports shall also be available. The system shall have the ability to accept an External keyboard and mouse through a built in USB port.

The system shall have the ability to implement a full-featured HMI application. The system must also support an integrated HMI and control automation application.

The system will be shipped ready for use. The ports communication settings will be set using the operating system.

#### 2.1.1 Operating System -

The operating system shall be Microsoft Windows CE.NET™. This is a full 32-bit Operating system with a graphical user interface.

#### 2.1.2 Development and Run Time system –

The system shall include a run time engine for execution of automation applications.

The development system is a tool, which fully integrates control and visualization. This tool shall be a Windows base environment. The development environment must share the same set of tools, providing a consistent user interface throughout the development process. The system shall provide drag-and-drop capabilities between tools and editors.

The development system shall be scalable across a full range of OI to HMI applications.

#### 2.1.3 Networking

- 2.1.3.1 The system shall be capable of supporting the following Ethernet network configurations:  
Ethernet: 10/100Base T Auto-Negotiate, full or half duplex Ethernet ports (IEEE802.3 compliant), Connection via RJ45 and an unshielded, twisted pair, UTP CAT 50. Port status LED indicators must be provided

The system shall be capable of supporting the following Ethernet based Protocols:

Control:

GE Fanuc Ethernet Global Data Class 1  
Modbus TCP

View:

GE Fanuc SRTP & TCP/IP  
Allen-Bradley TCP/IP  
Modbus TCP

- 2.1.3.2 The system shall be capable of expansion to support Fieldbus communication configurations:

Control:

GE Fanuc Series 90-30 I/O  
DeviceNet Master  
PROFIBUS Master

View:

PROFIBUS Slave  
DeviceNet Slave  
GE Genius





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- 2.1.3.3 The system shall be capable of supporting the following Serial communication configurations:  
COM1 – General purpose bi-direction serial data channel supporting EIA232C and EIA485 electrical standards

COM2 - General purpose bi-direction serial data channel supporting EIA232C electrical standards

The system shall be capable of supporting the following serial network Protocols:

Control:

Modbus RTU Slave

View:

GE Fanuc SNP, SNP-X  
Allen-Bradley DF1 & DH  
Allen-Bradley SLC500  
Siemens PPI  
Siemens MPI  
Siemens D SY/MAX  
CTC Serial Driver  
Honeywell UMC Series  
Modbus RTU

## 2.2 Licensing

### 2.2.1 Run Time

The system shall include a license for Microsoft Windows CE.NET™ operating system. The system shall also include runtime license for execution and operation of user run time applications.

## 2.3 Documentation

- 2.3.1 Product Documentation must be available on the vendor's web site for users to download.

- 2.3.2 The online help system in the product needs to be context sensitive such that immediate help is available for the selected functionality.





### 3 Software Requirements

#### 3.1 Security

- 3.1.1 The security system shall control access to an automation application and control the operations that are permitted within that application.
- 3.1.2 Access to administrative functions needs to be limited to those with Administrative privileges.
- 3.1.3 The system should have an option for enforcing operations based on the highest level of permission for the specific user.
- 3.1.4 The system shall provide option for a unique combination of two distinct identification components (username and encrypted password).

#### 3.2 Version Management

- 3.2.1 At run time an option for limiting user access to application project information will be provided.
- 3.2.2 During development a version control system shall manage up to 10 revisions of the application on the local computer or optionally an unlimited number of versions on a server
- 3.2.3 Automatic Version Numbering of User application Development: The version control system shall automatically increment version numbers as changes are checked into the system.
- 3.2.4 The system shall provide an interface for reporting on revision history of a specific user application.
- 3.2.5 The system shall allow the ability to revert to a previous version of a user application without deleting the newer versions in the system.
- 3.2.6 Version numbers shall not be editable
- 3.2.7 The system shall have the facility to add version comments as each version is saved.
- 3.2.8 It needs to be possible to retrieve an older version of a document in a read only format.

#### 3.3 Audit Trails

- 3.3.1 The Audit Trail database shall be configurable for one of Access, SQL Server, or Oracle.
- 3.3.2 The Audit trail database needs to be able to be secured if using SQL Server or Oracle, such that it cannot easily be tampered with.
- 3.3.3 The system shall record user and administrative actions in the system.
- 3.3.4 Changes made by the user to projects (i.e. Check in, Check out, Open, etc.) shall be logged in the audit trail database.
- 3.3.5 The database shall store as a minimum:
  - Date and Time in UTC format
  - User ID and Full user name
  - The action that was performed (Check in, Check out, etc)
  - User comment





- 3.3.6 Audit Reports - Audit reports need to be available in a human readable format, either through a built in reporting tool, or 3<sup>rd</sup> party tools. The delivery of the reports shall be in a format, such that they cannot be tampered with.
- 3.3.7 The actions that trigger an audit entry should be configurable based on the product type and general actions such as login/logout.
- 3.3.8 Changes to the audit configuration shall be recorded by the audit trail itself, such that if an audit is turned off, it is traceable to the individual that made the change.

### **3.4 Administration**

- 3.4.1 Administration functions shall be available only to those users belonging to the administrator groups, or to those granted permission for the specific administrative function.
- 3.4.2 Administration of the system needs to be possible from any client. The user must have appropriate permissions to access these functions.

### **3.5 User Software Functions**

- 3.5.1 The development system shall include online help for application validation and user application development.
- 3.5.2 The system shall have the capability to enable the view of Application data, control logic, and application visualization screens using a web browser. Web Browsers such as Microsoft Internet Explore 4.0 or later.
- 3.5.3 The development system shall provide a repository of preconfigured object templates, which can be dragged-and-dropped into an automation application project. These objects can be as simple as a single ladder logic instruction, or as complex as a robotic arm with fully configured ladder logic and HMI animation
- 3.5.4 The development and runtime system shall support automation application customization through the use of scripting.
- 3.5.5 The development and runtime system shall support alarm messages. Alarm message are used to display information in response to specific conditions within the system.
- 3.5.6 The system shall support OLE for Process Control allowing the automation control application to communicate to IO data locally with application within the same system or remotely with application located on a different system. The OLE for Process Control (OPC) shall support all required OPC interfaces in versions 1.0a and 20.0 of the OPC specifications.
- 3.5.7 The HMI system shall allow the configuration of multi-language support. The system shall dynamically translate languages at run time. The system shall allow the current language to be change based on an input condition.

### **3.6 Automation Control Logic Development Software**

- 3.6.1 The logic development system provides the tools required to develop automation control projects. The logic develop environment shall allow the creation of programs using standard IEC 61131-3 editors in a graphic environment.
- 3.6.2 The logic development system shall support Sequential Function Chart, Ladder Diagram, Instruction List, Structure Text, and Function Block Diagram editors. Both online and offline editors shall be provided.





## 4 Hardware System

- 4.1.1 The system shall support 32MB of DRAM, 512KB of battery-backed static RAM, 32 MB of non-volatile Flash Memory. A DIMM memory slot for up to 64 MB of DRAM expansion shall be supported.
- 4.1.2 The system shall support a Compact Flash (CF) card expansion. This slot will allow for the addition of optional flash memory or other functions supported in the compact flash format.
- 4.1.3 The system shall include a programmable real time clock capable of reporting the current time in Year/Month/Day/Hour/Minute/Second.
- 4.1.4 The system shall be powered with 12Vdc (@+/- 10% regulated power supply) or 24VDC (@+/- 20% regulated power supply).
- 4.1.5 The system shall support an integrated flat-panel touch screen display. The touch screen shall have 12-bit resolution. The flat screen shall have the capability of providing 15 bits per pixel for a total of 32,768 colors for color TFT and STN displays.
- 4.1.6 The system shall have 2 front visible LEDs for visual diagnostic. One LED shall be Indicate power applied and the other shall be accessible form the user program.

## 4.2 Industry Standards

All products shall be designed, manufactured, and tested in accordance with recognized UL, CSA, IEC and JIS industrial standards. The system shall be operational during and after testing. See tables below for standards requirements.

<b>AGENCY APPROVALS OVERVIEW</b>		<i>Comments</i>
Quality Assurance in Design/Development, Production, Installation & Servicing	<b>ISO9001:2000</b>	Certification by BSI Quality Assurance
Industrial Control Equipment [Safety]	<b>UL508/C-UL</b>	Certification by Underwriter's Laboratories to UL standard and equivalent CSA standard
Safety for Hazardous Locations Class I, Div. 2, Groups A, B, C, D	<b>UL1604/C-UL</b>	Certification by Underwriter's Laboratories to UL standard and equivalent CSA standard
Safety for Hazardous Locations Class I, Zone 2, Groups IIA, IIB, IIC	<b>UL2279</b>	Certification by Underwriter's Laboratories to UL standard

<b>AGENCY APPROVALS OVERVIEW</b>		<i>Comments</i>
Explosive Atmospheres Directive European Safety for Hazardous Locations Equipment Group II, Category	<b>ATEX</b>	Certification in accordance with European Directives
Low Voltage Directive European safety for Industrial Control Equipment	<b>CE</b>	Self-declaration in accordance with European directives.
Electromagnetic Compatibility Directive European EMC for Industrial Control Equipment	<b>CE</b>	Certification by competent body in accordance with European directives.





<b>STANDARDS OVERVIEW</b>		<i>Conditions</i>
<b>ENVIRONMENTAL</b>		
Vibration	<b>IEC68-2-6</b>	10 – 57 Hz, 0.012” peak to peak displacement 57 – 500Hz, 1.0g acceleration
Shock	<b>IEC68-2-27</b>	15G, 11ms (Sine Wave)
Operating Temperature		0°C to 50°C
Storage Temperature		-20°C to +70°C
Humidity		10% to 90%, non-condensing
NEMA Rating	<b>NEMA</b>	4, 4x, and 12 in a comparably rated NEMA panel.
<b>EMC EMISSIONS</b>		
Radiated, Conducted	<b>EN55011/55022 47CFR15</b>	Class A FCC Class A
<b>EMC IMMUNITY</b>		
Electrostatic Discharge	<b>EN/IEC61000-4-2</b>	8KV Air Discharge, 4Kv Contact Discharge
Radiated RF	<b>EN/IEC61000-4-3, ENV50204</b>	10V <sub>rms</sub> /m, 80Mhz to 1000Mhz, modulated
Fast Transient Burst	<b>EN/IEC61000-4-4</b>	2KV: power supplies, 1KV: I/O, communications
Surge Withstand	<b>EN/IEC61000-4-5</b>	Damped Oscillatory Wave, Class II: power supplies, I/O [12V-240V]
Conducted RF	<b>EN/IEC61000-4-6</b>	10V, 150khz to 80Mhz injection for comm cables >30m
Input Dips, Variations	<b>EN/IEC61000-4-11</b>	During Operation: Dips to 30% and 100%, Variation for AC _10%, Variation for DC _20%
<b>ISOLATION</b>		
Dielectric Withstand	<b>UL508, UL840, IEC664</b>	1.5KV for modules rated from 51v to 250v





## 5 Service and Support

### 5.1 Training

5.1.1 Vendor needs to be able to provide both on-site and off-site training.

### 5.2 Installation Services

5.2.1 The vendor shall have the ability to provide qualified consulting and installation services. These services need to be provided either by the vendor or via certified partners. Services include:

- Site Assessment
- Consultation
- Implementation
- Assistance and turnkey
- Validation services

5.2.2 Global Services

Vendor needs to be able to provide service and support the installations locally worldwide.

### 5.3 Support

The manufacturer or its authorized representative shall provide complete technical support for all of the products. This shall include headquarters or local training, regional application centers, and local or headquarters technical assistance. A toll-free (800) number hot-line shall be available for technical support.

### 5.4 Hardware Warranty

5.4.1 Product shall have a warranty period of at least 1 year from the date of purchase.

### 5.5 Software Warranty

5.5.1 Vendor shall provide the option to purchase support contract. This contract is to include:

- Telephone and Email support Mon-Fri 8:00AM to 8:00PM EST
- 24x7 Emergency Support
- Software Upgrades
- 24x7 Access to web based technical and support information

5.5.2 The vendor shall have a location on their web site where users can download software improvements, bug fixes, add-ons, components and so forth.

5.5.3 The vendor shall provide an easy mechanism for upgrading and installing software improvements and for allowing a user to quickly ascertain what improvements have been installed.





## 6 Vendor Requirements

### 6.1 Development Life Cycle

- 6.1.1 The vendor must have an established documented development procedure. This procedure must track customer requirements, development risk, and corrective action. The procedure must include a product validation cycle.
- 6.1.2 The vendor must have a formal and documented set of quality assurance procedures that are applied to the engineering design, development, and documentation of the software. The presence of a formal quality assurance department shall be required.
- 6.1.3 The vendor must also demonstrate that it's source code for the product is regularly archived with suitable backup.
- 6.1.4 The vendor must follow a documented configuration management system.

### 6.2 Product Life Cycle

- 6.2.1 The vendor must have an established product life cycle policy. Documentation of the product life cycle shall be available.

### 6.3 Manufacturer Qualifications

- 6.3.1 The manufacturer shall have shown a high commitment to product, manufacturing and design process quality. The manufacture shall be ISO9000 registered.
- 6.3.2 The manufacture shall have fully operational quality assurance and quality control programs in place. Complete documentation describing the quality assurance and quality plan shall be available.
- 6.3.3 The HMI, controller and/or I/O system and all of the corresponding components shall be offered by a company who regularly manufactures and services this type of equipment.
- 6.3.4 Vendor needs to be certified under the ISO 9001-2000 guidelines.





## 7 Appendix

### 7.1 Glossary (SUGGEST YOU REVIEW THESE AS NOT ALL ARE REQUIRED)

**Database** (ANSI): Collection of data fundamental to a system.

**Design Specification:**

IEEE: The specification that documents the design of a system or system component to satisfy specified requirements.

**Documentation** (ANSI N45.2.10-1973): Any written or pictorial information describing, defining, specifying, reporting or certifying activities, requirements, procedures, or results.

**Network**

ANSI/IEEE: An interconnected or interrelated group of nodes.

GAMP Forum: An interconnected communications facility. A Local Area network (LAN) is a high bandwidth (allowing a high data transfer rate) computer network operating over a small area such as an office or group of offices.

**Operating System**

PMA CSVC: A set of programs provided with a computer that function as the interface between the hardware and the application programs.

ANSI/IEEE: Software that controls the execution of programs. An operating system may provide services, such as resource allocation, scheduling, input/output control, and data management.

**Procedure** (PMA CSVC): A directive usually specifying how certain activities are to be accomplished.

**Quality Assurance** [QA] (ANSI/IEEE): A planned and systematic pattern of all actions necessary to provide adequate confidence that the item or product conforms to established technical requirements.

**Requirement** (ANSI/IEEE): A condition or capability that must be met or possessed by a system or system component to satisfy a contract, standard, specification, or other formally imposed document. The set of all requirements forms the basis for subsequent development of the system or system component.

**Security** (IEEE): The protection of computer hardware and software from accidental or malicious access, use, modification, destruction, or disclosure. Security also pertains to personnel, data, communications, and the physical protection of computer installations.

**Software** (PMA CSVC): A collection of programs, routines, and subroutines that controls the operation of a computer or a computerized system.

**System**: An assembly of units consisting of one or more microprocessors, associated hardware and software applications.

**Testing** (IEEE): The process of exercising or evaluating a system or system component by manual or automated means to verify that it satisfies specified requirements or to identify differences between expected and actual results.

**User**: The customer or user organization contracting a supplier to provide a product. In the context of this document it is, therefore, not intended to apply only to individuals who use the system, but also to the companies who employ them.





**Validation:** "Establishing documented evidence, which provides a high degree of assurance that a specific process will consistently produce a product meeting its pre-determined specifications and quality attributes". - FDA Guidelines on General Principles of Process Validation May 1987.

**Validation Plan:** A plan created by the customer to define validation activities, responsibilities and procedures.

## 7.2 Acronyms

HMI: Human Machine Interface

OPC: OLE for Process Control

## 7.3 References

