



# HOLLiAS MACS Distributed Control System

# Contents

<b>3</b>		<b>About HOLLiAS</b>
<b>4</b>		<b>HOLLiAS MACS-K Series Hardware</b>
4		Overview
5		Features
7		System Architecture
8		System Specifications
9		System Components
<b>12</b>		<b>HOLLiAS MACS-V6 Software Platform</b>
12		Overview
12		Features
13		Main Nodes
14		System Architecture
16		The Components and Tools of MACS V6
18		Appendix A: Abbreviations Use in the Contents





## ABOUT HOLLiAS

HOLLiAS (HollySys integrated Industrial Automation System) is HollySys' proprietary integrated industrial automation system based on advanced automation technology. With an open system software platform, this system realizes flexible configuration and integration of HollySys' automation systems and devices. It can provide professional solutions to meet various automation control needs in different industries. Its subsystem covers enterprise operation and management layer, enterprise manufacturing management layer and equipment & process control layer.

HOLLiAS consists of many sub-systems that cover the three layers of a typical plant/factory automation system: ERP (Enterprise Resource Planning) layer, MES (Manufacturing Execution System) layer and PCS (Process Control System) layer.

The features of HOLLiAS are as follows:

### Information and Integration

HOLLiAS realizes the multiple management sub-systems based on open real-time relational database, and integrates various control systems and devices to meet different customers' requirements.

The controller configuration is compliant with the IEC61131-3 standards. It not only has advanced high-performance general algorithm of control platform, but also integrates control function in different layers.

### Distributed/Centralized Architecture

Using field bus (especially Profibus-DP), HOLLiAS supports a variety of distributed MCU (Main Control Unit) and intelligent instruments. At the same time, the integrated monitoring platform can provide centralized management to improve efficiency.

### Economical

Due to the improvement in system integration and field bus, users can configure the system flexibly so as to reduce the total project cost.

### Open System and Professional Application Solution

HOLLiAS can connect systems or devices from the third party in different layers through open database, internet protocols/interfaces and field bus.

HOLLiAS integrated advanced control algorithm platform of thermal power, chemical and other industries, which provide the depth and comprehensive professional solutions for factory automation and enterprise management.

# HOLLIAS MACS-K SERIES HARDWARE

## Overview



MACS-K Series refers to a large Distributed Control System (DCS) that HollySys develops for the process industry, which adopts reliability design such as full redundancy and multiple-isolation. MACS-K series follows the design concept of a safety system and is based on a strong heat dissipation design, thus ensuring the long-term stable operation for the system.

The MACS-K series easily integrates with other systems such as SIS, PLC and MES, exchanges the information among the field intelligent instruments, this makes the control system and the enterprise resource planning (ERP) system to realize business intelligence and integration. The system integrates the advanced control platform for power generation and chemical industries, thus providing a total solution of automatic control and production management. MACS-K series helps to minimize the plant life-cycle maintenance costs for customers while maximizing the investment return.

## Features



HOLLiAS MACS-K offers customers a reliable and highly flexible DCS solution which meets the demands of different industrial applications.

### High Reliability

- Full Redundancy

Redundant configuration is available in every aspect, from the system network (SNET), control network (CNET), power supply, controller to the I/O modules, protecting the system against any single-point failure.

- Multiple Isolation

System power and the field power are supplied separately; the module communication is isolated optically from the field signal; and galvanic isolation is provided between the I/O channels.

- Harsh Environment Adaptability

The system is built to perform under harsh industrial environment, with the EMC requirements compliant with IEC 61000 and the airborne contaminants level satisfying ISA S71.04 G3.

- Real-time and Secure Network

The Deterministic Real-time Industrial Ethernet is adopted in the system network (SNET), and anti network-storm components are equipped inside the controller.

- Comprehensive Diagnostics

Complete self-diagnostics are conducted by the controller and I/O modules all the time. All types of faults, such as communication failure, open wire, short circuit and over range, can be detected and reported to the operator in a timely manner.



- **Fail-safe Concepts**

Signal quality is verified before logic calculation; output can automatically switch to the pre-defined safe value when failure occurs; multiple digital bits are used to represent 0/1 to detect and screen the memory error under extreme environment. Failure-safe design is implemented throughout the entire system.

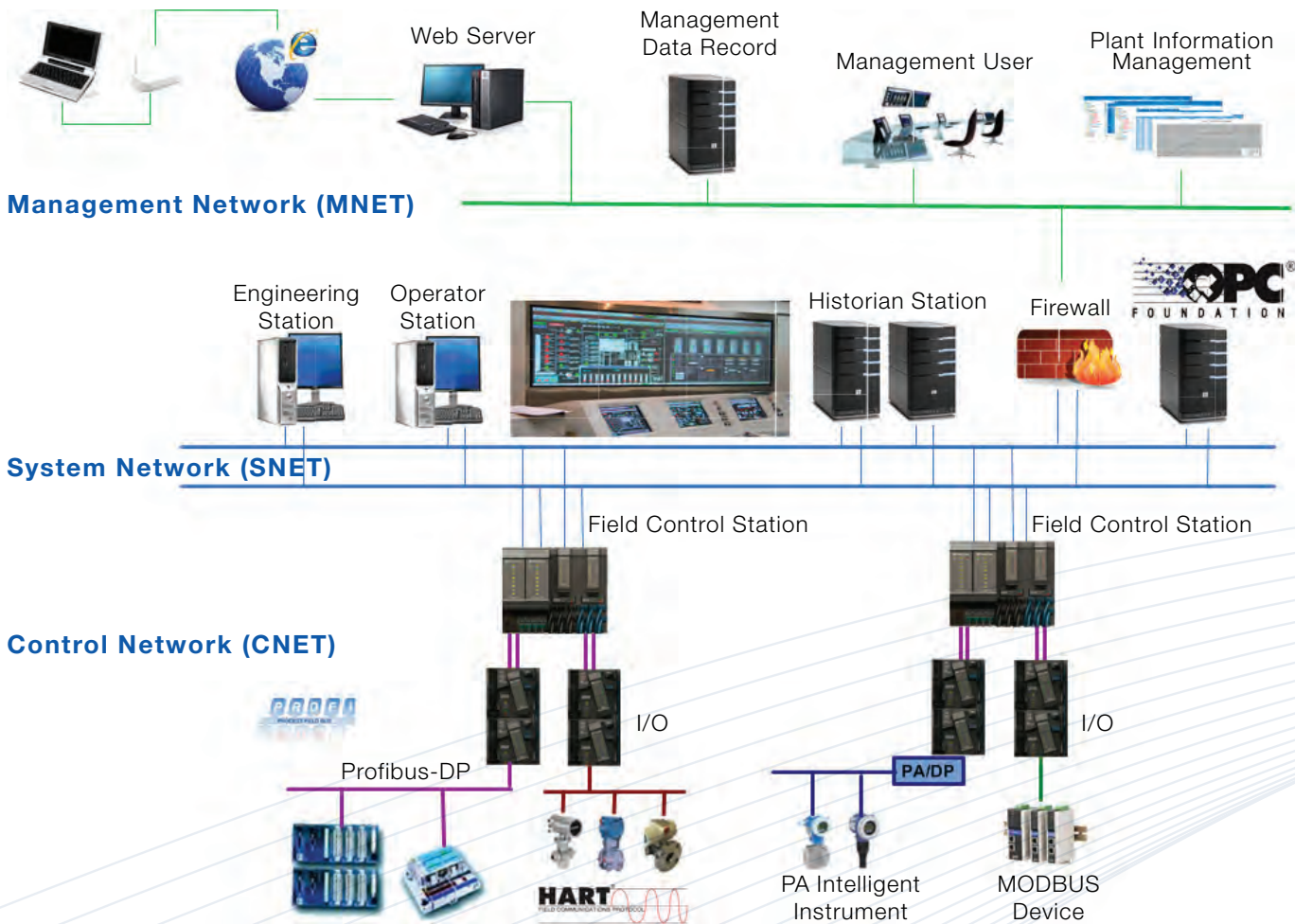
### **Ultimate Flexibility**

- P-to-P (Peer to Peer), C/S (Client/Server), and hybrid system architecture can be selected to meet the needs of both large and medium/small applications.
- HART, PROFIBUS-DP, PROFIBUS-PA, MODBUS and other fieldbus protocols are supported to integrate intelligent devices.
- HollySys legacy I/O modules are fully compatible to help upgrade the legacy systems risk-free and cost-effectively.
- HOLLiAS AMS (Asset Management System), BATCH, APC (Advanced Process Control), SIS (Safety Instrumented System), MES (Manufacturing Execution System), OTS (Operator Training System) and other HollySys products can be seamlessly integrated with HOLLiAS MACS-K.
- Programming language is compliant with IEC61131-3, and user-defined function blocks, symbols and scripts are supported.
- Hardware hot-swap and logic online change provide the customers with the easy and safe maintenance method without any stop or disturbance to the process.



## System Architecture

HOLLiAS MACS-K is an open distributed process control system, which is based on industrial Ethernet and field bus technology, performs with reliable, flexible and easy-to-use features, meeting the demands of different industrial applications. HOLLiAS MACS-K consists of 3 layers of network: the management network (MNET), the system network (SNET) and the control network (CNET).



**Figure 2.1 HOLLiAS MACS K Series DCS System Architecture**

The management network (MNET) is used to communicate with the plant-level management systems and publish information through INTERNET with security control.

The system network (SNET) connects the Engineering Station, the Operator Station, the Field Control Station and other system nodes. P-to-P (Peer to Peer), C/S (Client/Server) and hybrid system architecture can be selected according to the project scale; star and ring topology is available for 100/1000Mbps redundant network.

The control network (CNET) is the link between controller, I/O modules and intelligent devices. Star and bus topology is supported in compliance with IEC 61158/EN 50170 to ensure the reliable, real-time and fast field communication.



## System Specifications

<b>Working Environment</b>		
Working Temperature	-20°C~60°C	
Working Humidity	5%~95% relative humidity, non-condensing	
Storage Temperature	-40°C~70°C	
Storage Humidity	5%~95% relative humidity, non-condensing	
Vibration	Amplitude	Max.1mm (5Hz~13.2Hz)
	Shock	Max.7.5m/s <sup>2</sup> (13.2Hz~100Hz)
Airborne Contaminants	ISA S71.04-1985 Class G3	
<b>Electromagnetic Compatibility</b>		
Electrostatic Discharge Immunity	Compliant with IEC61000-4-2	
RF Electromagnetic Field Immunity	Compliant with IEC61000-4-3	
Electrical Fast Transient/Burst Immunity	Compliant with IEC61000-4-4	
Surge Immunity	Compliant with IEC61000-4-5	
RF Induction Disturbances Immunity	Compliant with IEC61000-4-6	
Voltage Dips and Short Interruptions Immunity	Compliant with IEC61000-4-11	
<b>System Scale</b>		
Number of Domains	15	
Operation Station	64/domain	
Field Control Station	64/domain	
<b>Field Control Station Capacity</b>		
Controllers	2, in redundant configuration	
I/O Modules	100	
I/O Points	1600	
PID Loops	128	
<b>Real-time Response</b>		
Controller Execution Period	50ms, 100ms, 200ms, 500ms, 1s	
SOE Resolution	1ms	
OPS Data Refresh	<1s	
OPS Command to Field Output	<1s	

**Table 2.1 System Specifications**

## System Components

### Controller

Controller	
K-CU01	K Series Controller
Controller Baseplate	
K-CUT01	4-Slot Controller Baseplate 2 controllers and 2 K-BUS modules can be inserted into realize redundant configuration.
K-BUS Module	
K-BUS02	Star-type K-BUS Module 1 pair of K-BUS02 modules is able to connect up to 60 local I/O modules; while another pair of K-BUS02 is needed for up to 40 remote I/O modules.
K-BUS03	Bus-type K-BUS Module Connects up to 30 local I/O modules.

**Table 2.2 Controller Components**

### Power Supply

Power Supply	
SM910	24VDC (120W) Power Supply; Input: 220VAC, Output: 24VDC@120W.
SM913	24VDC (120W) Power Supply; Input: 220VAC, Output: 24VDC@240W.
K-PW01	AC Power Distribution Board with power status indication Input: 2 channels 220VAC, Output: 10 channels 220VAC.
K-PW11	DC Power Distribution Board with power status output Field Power & System Power. Input: 6 channels 24VDC, Output: a pair of 24VDC. Auxiliary Power: Input: 2 channels 24/48VDC, Output: 4 channels 24/48VDC.
K-PW21	Auxiliary Power Distribution Board with power status indication Input: 2 channels 24/48VDC, Output: 16 channels 24/48VDC.

**Table 2.3 Power Supply Components**

### I/O Unit

I/O Unit	Module	Terminal Base	Redundancy	220V AC Protection	DB37 Interface
<b>Analog Input (AI)</b>					
8-Channel 4-20mA AI	K-AI01	K-AT01			
		K-AT02		√	√
		K-AT11		√	
		K-AT21	√	√	√
8-Channel 4-20mA AI with HART	K-AIH01	K-AT01			
		K-AT02		√	√
		K-AT11		√	
		K-AT21	√	√	√
8-Channel RTD	K-RTD01	K-TT01			
		K-TT21	√		√
8-Channel TC	K-TC01	K-TT01			
		K-TT21	√		√

**Table 2.4 I/O Unit Components**

I/O Unit	Module	Terminal Base	Redundancy	220V AC Protection	DB37 Interface
<b>Analog Output (AO)</b>					
8-Channel 4-20mA AO	K-AO01	K-AT01			
		K-AT02		√	√
		K-AT11		√	
		K-AT21	√	√	√
8-Channel 4-20mA AO with HART	K-AOH01	K-AT01			
		K-AT02		√	√
		K-AT11		√	
		K-AT21	√	√	√
<b>Digital Input (DI)</b>					
16-Channel 24VDC DI	K-DI01	K-DIT01			
		K-DIT02		√	√
		K-DIT11		√	
		K-DIT21	√	√	√
16-Channel 24VDC Relay DI	K-DI01	K-DOT01 + K-DIR01			√
		K-DIT21 + K-DIR01	√	√	√
16-Channel 110V/220V AC&DC DI	K-DI01	K-DOT01 + K-DIR03			√
		K-DIT21 + K-DIR03	√	√	√
16-Channel 48VDC DI	K-DI11	K-DIT01			
		K-DIT02		√	√
		K-DIT11		√	
		K-DIT21	√	√	√
<b>SOE</b>					
16-Channel 24VDC SOE	K-SOE01	K-DIT01			
		K-DIT02		√	√
		K-DIT11		√	
16-Channel 48VDC SOE	K-SOE11	K-DIT01			
		K-DIT02		√	√
		K-DIT11		√	
<b>Pulse Input (PI)</b>					
8-Channel PI	K-PI01	K-PIT01			
<b>Digital Output (DO)</b>					
16-Channel Relay DO (220VAC/30VDC)	K-DO01	K-DOT01 + K-DOR01	√	√	√

Table 2.4 I/O Unit Components

**Note:**

K-DOT01 is the general terminal base providing DB37 interface.

DI/DO units with K-DOT01 can connect to expansion terminal blocks (K-DIR01, K-DIR03, K-DOR) via the DB37 interface on it, realizing relay or high voltage signal input/output.

AI/AO units can utilize K-DOT01 for easy connection with safety barriers in the remote cabinets.

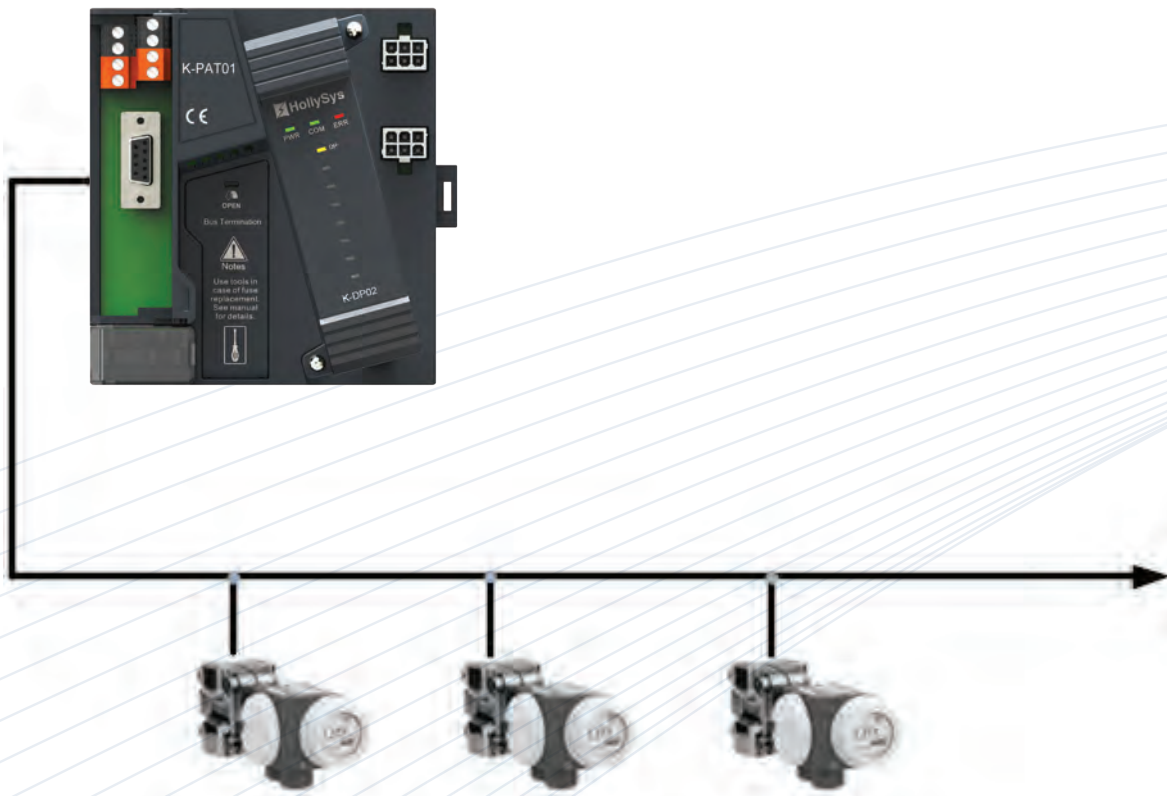
## Fieldbus Communication Unit

For interconnection with 3rd-party intelligent devices, K series communication units are offered as the gateway. The communication units are designed with similar style and features as the normal I/O units, in order to make system easier for installation and more stable for interconnection.

Communication Unit	Module	Terminal Base	Redundancy
Profibus-DP Y-Link Gateway	K-DP02	K-PAT01	
		K-PAT21	√
Profibus-DP/PA Link Gateway	K-PA01	K-PAT01	
		K-PAT21	√
Profibus-DP/Modbus Communication Module	K-MOD01	K-PAT01	
		K-PAT21	√

Table 2.5 Communication Unit Components

Communication Unit



Intelligent Field Devices

Figure 2.2 HOLLiAS MACS K Series DCS Communication Units

# HOLLiAS MACS-V6 SOFTWARE PLATFORM

## Overview

HOLLiAS MACS V6, the HollySys' latest MACS platform software, is to collect and process data, provides all kinds of interfaces and service, and then customize the components such as developing application interfaces, algorithm library and symbol library according to special needs of different industries. All versions of the components share one platform, which makes a wide application for this system.

MACS V6 connects the third party system by OPC and ModBus protocol. Upper computer communicates with lower computer by HollySys' proprietary industrial Ethernet protocol. Lower computer transfers data in the method of Profibus-DP or HART bus.

## Features

---

MACS V6 compares with the previous products, it has following new features:

- HollySys' proprietary HEROS adopts MCU operation system, which greatly improves the compatibility between the hardware and software.
- It simplifies the network architecture; OPS and MCU can communicate directly without a server.
- Several ES can be configured synchronously.
- The interface is much friendlier and easier, which reduces the difficulty for beginners and improves the configuration efficiency and users' comfortable sensation.

HOLLiAS MACS V6 has various powerful functions, including: data acquisition, control regulation, alarm, trend, general appearance chart, simulated flow chart, data list, log management, forms management, SOE, reports and data statistics, display management, human-computer dialogue, print management, failure diagnosis and monitoring, system configuration, operator online parameter setting, data off-line query, control packet, control loop, and so on.

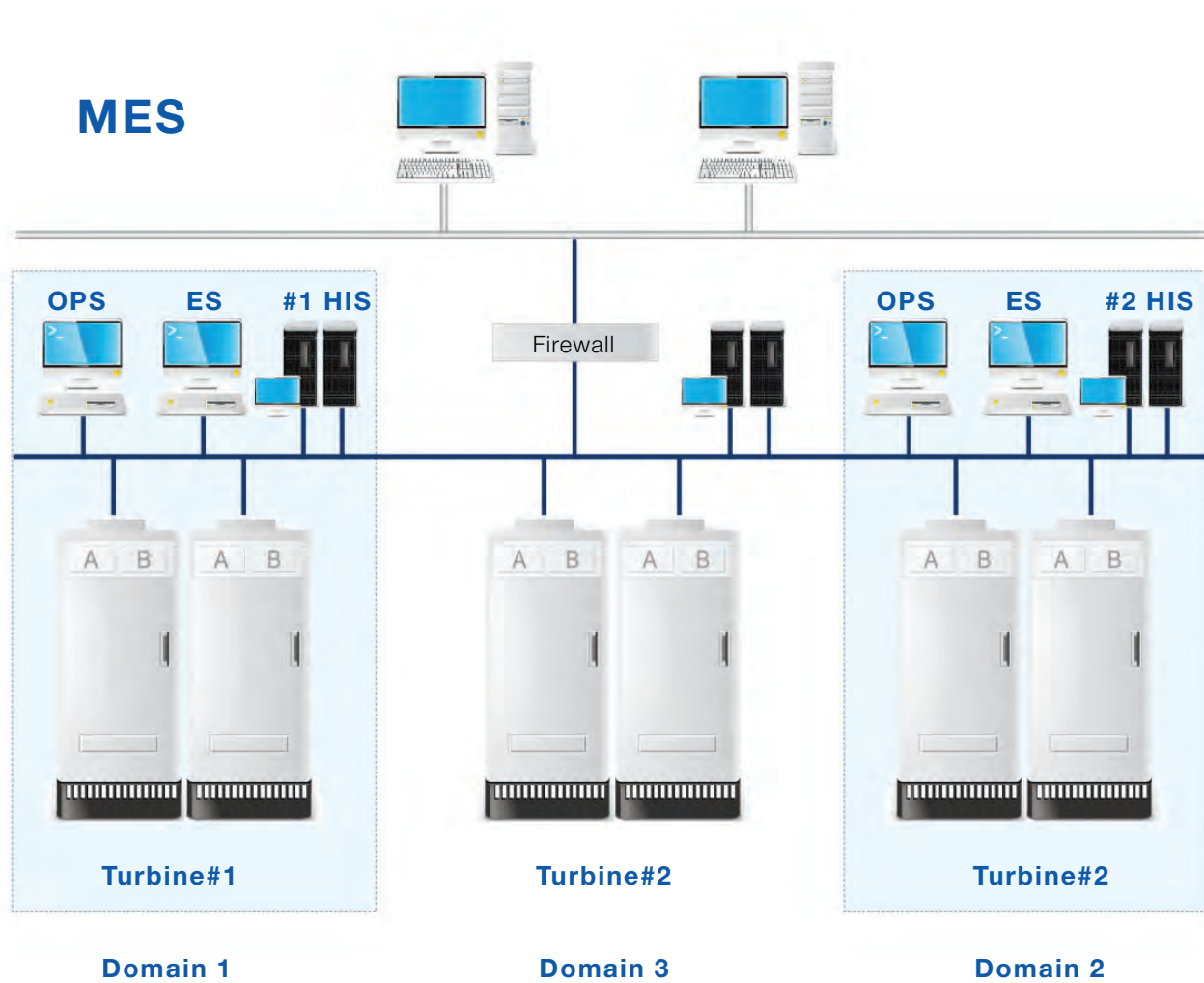
## Main Nodes

Main nodes of MACS V6 include:

- OPS (Operator Station) - is the computer HMI (Human Machine Interface) to monitor and control the running condition of the system. It can be also used as communication station, where some communication software (e.g. Modbus, OPC) run to exchange data with third party system and devices.
- ES (Engineer Station) - is the computer for system configuration, with which the compiled project can be downloaded to OPS, server and FCS (Field Control Station).
- FCS (Field Control Station) - consists of MCU (Main Control Unit), hardware module, cabinet, base module and rack, etc.
- HIS (Historical Data Station) – is a computer to provide the HDB (Historical Database), RTDB (Real-time Database), report printing, alarm and I/O service. The HIS is generally collocated with redundant computers, and KVM is used to switch the two computers.
- MCU (Main Control Unit) - is a control module and also known as lower machine. It deals with the field data through the algorithm pre-downloaded in the memory, and then transfers the results to HIS and operation station as well as the relevant commands to actuator to control the real process.
- I/O Module – is a input/output module to switch or transfer the data/command between controllers and field instruments/actuators.
- Others – network devices such as switch, router, Ethernet cards and cables, etc.

## System Architecture

The architecture of MACS V6 is based on the concept of 'Multi-Domain Management'. The whole system is divided into several individual sub-systems according to the position, function and feature of the controlled system. Each sub-system is called a 'domain', and the data of each domain is relatively independent. This kind of structure is not only good for the system configuration but also helpful for the system expansion and rebuilding. Every domain (sub-system) can be applied and tested respectively without disturbing other domains. What's more, a required node can be connected with the switch directly when a new domain is added. As shown in Figure3.1, the control system of a power plant is divided into several domains.



*Figure3.1 Multi-Domain Management*

**Note:** The system architecture of MACS V6 is divided into two layers from top to bottom.

#### ■ Monitoring and Control Layer

OPS, ES, HIS and switch are included in this layer. This layer communicates with the lower layer through the redundant TCP/IP protocol Ethernet. It displays the processed field data to users and then transfers users' operational command to lower layer. The devices including OPS, ES, CMS, HIS and printer are connect into a network by two switches. In order to guarantee the communication reliability of the system, some important devices such as HIS and switch are redundant configuration.

#### ■ Field Control Layer

This layer consists of FCS, I/O modules, etc. FCS communicates with I/O devices through DP bus. I/O devices transfer the collected data to MCU. MCU processes the data according to the pre-downloaded algorithm and transfers the displayed data to the upper monitoring and control layer. The instructions from upper layer or FCS are also transferred to the field actuator. Field control layer supports HART and FF bus protocol through specialized hardware modules.

#### ■ SNET

It is constituted by the 100M high-speed redundant network. It is used in the System History Station connecting to OPS, ES, controller and network printer. Also it can complete the data monitoring of the entire system and respond to various requests of operators, such as graphics switching, data display, trend display, report printing, screen copy, tables and log inquiries.

#### ■ CNET

CNET communication is responsible for the connection between controller, input/ output modules, and intelligent devices. The real-time and secure communication is implemented through CNET. Both bus and star topologies are supported for flexible configuration.



## The Components and Tools of MACS V6

### Configuration Management

As the most important tool of ES configuration, it consists of three parts:

- **Project Center**

The interface of Project Center runs on the ES, and it is used to deploy and manage the whole DCS system.

This tool integrates the function of project manager, solution manager, database edition, user configuration, node configuration, process graph configuration, overview configuration, control group configuration, tag group configuration, dedicated keyboard definition configuration, area setting, customized definition function, report configuration, compiling and downloading, etc. The domain-oriented project manager stipulates that a project corresponds to a domain. In order to avoid configuration confusion, users could not open multiple projects synchronously.

- **Graph Edit**

Graphic editing tool runs on the ES.

This tool helps to generate on-line operation flow chart and interface template. The rich symbol library can help users to draw various graphic interface and plot chart for data display. User-defined symbol library is also supported for diversity and convenience.

- **AutoThink**

Controller algorithm configuration software runs on the ES.

It integrates the function of editing, management, simulation, on-line debugging and hardware configuration. It supports all four programming languages including ST, LD, SFC and CFC specified in IEC61131-3. The tree-style project structure is adopted for the above three software to manage the information management, which makes clear interfaces and convenient operation for users.

- **Operator Online**

It runs in ES, which is used to monitor and control the software.

It completes real-time data acquisition, dynamic data display, process control automatically, sequence control, advanced control, alarm and log inspection, monitor and operation. So the data can be recorded, counted, displayed, printed and other operation.

### Other Components and Tools

- **OPC Client**

It is completed the third party communication function following the OPC protocol.

- Simulation

It can realize on-line configure and simulation in FCS, HIS and OPS.

- Off-line Query

This tool can query trend, alarm and log historical data to help users to analyze the system running condition and accident causes.

- Controller Program Update

It can upgrade RTS of the controller program.

- One-click Navigation

Each tag has its corresponding faceplate, through which all its associated operations, such as alarm, trend, detailed info, can be easily navigated by one single click, so that the operators are able to master the most complicated process with the simple tool.

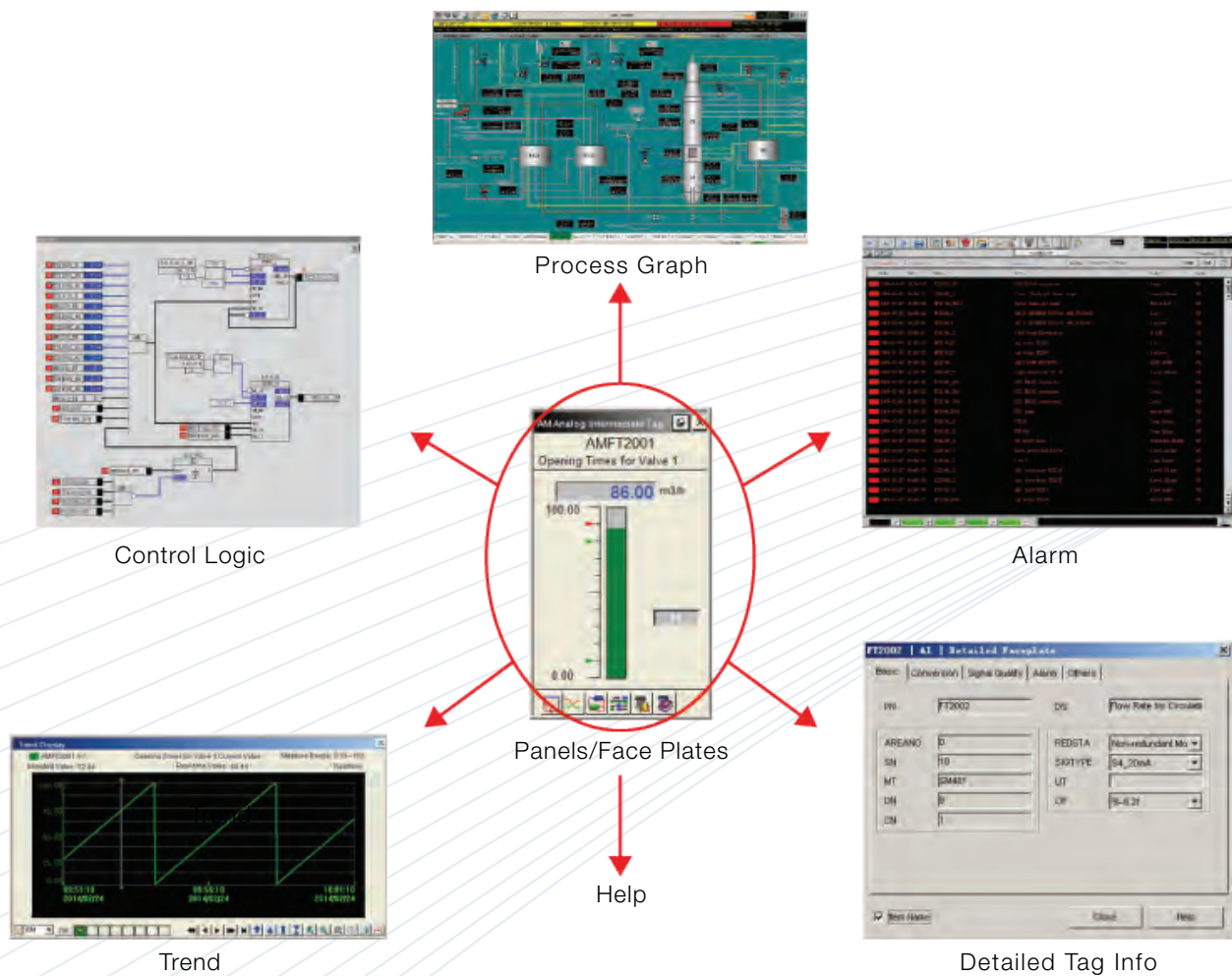


Figure3.2 One-Click Navigation Tool

## APPENDIX A: ABBREVIATIONS USED IN THE CONTENTS

The following abbreviations are used in this brochure as shown in table.

Full Name	Abbreviation
Distributed Control System	DCS
Engineer Station	ES
Operator Station	OPS
Field Control Station	FCS
Real-time Database	RTDB
Historical Database	HDB
Monitoring Net	MNET
System Net	SNET
Control Net	CNET
Multi-Domain Management	MDM
Manufacturing Execution System	MES
Communication Station	CMS
Main Control Unit	MCU
Historical Data Station	HIS

# CONTACT US

## **SINGAPORE (INTERNATIONAL HQ)**

HollySys (Asia Pacific) Pte Ltd  
200 Pandan Loop, #08-01, Pantech 21  
Singapore 128388

Tel : +65 6777 0950

Fax : +65 6777 2730

## **CHINA**

HollySys Group  
Di Sheng Middle Road, No.2  
Economic-Technological Development Area  
100176 Beijing, China

Tel : +86 10 58981000

Fax : +86 10 58981100

## **INDIA**

HollySys Automation India Pvt. Ltd  
No.405, Fourth Floor,  
Sewa Corporate Park Building, MG Road  
Gurgaon 122002, Haryana, India

Tel : +91 124 6900705

## **INDONESIA**

PT. HollySys Automation Indonesia  
Metropolitan Tower  
10th Floor, Unit E, Jl. R. A. Kartini Kav. 14  
Jakarta Selatan 12430

Tel : +62 21 2918 2926

Fax : +62 21 2918 2936