

# Enhanced Universal Control Network Specification



**EUCN03-600**

**TPN Release R684**

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## Revision History

Revision	Date	Description
1	2012/06/22	First Issue

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## 1. Acronyms and Definitions

APM	Advanced Process Manager
CF9	Control Firewall (9 ports including the Uplink port)
EPNI2	Enhanced Process Network Interface (Version 2 for EUCN)
EHPM	Enhanced High Performance Process Manager
ENIM	Enhanced Network Interface Module
EPKS	Experion Process Knowledge System
EUCN	Enhanced Universal Control Network
FTE	Fault Tolerant Ethernet
HPM	High performance Process Manager
IEEE	Institute of Electrical and Electronics Engineers
LCN	Local Control Network
NIM	Network Interface Module
PKS	Process Knowledge Solution
PM	Process Manager
TDC	Total Distributed Control system
TPN	Total Plant Network (Predecessor Control, I/O, and Supervisory Systems to the Experion Family)
TPS	Total Plant Systems
UCN	Universal Control Network

## 2. Product Introduction

### 2.1. Enhanced Universal Control Network

The Universal Control Network is a time honored network provided by Honeywell for over 20 years. Even as other industries abandoned the IEEE 802.4 (Coax) Token bus network, Honeywell continues to serve the installed base using this technology.

To address sustainability by enabling installed capital investments to be used for an extended period of time as well to facilitate plant expansions investments, Honeywell is making the next evolutionary step to modernize the UCN applying IEEE 802.3 Ethernet technology. This alternate network is named Enhanced Universal Control Network (EUCN).

The heart of the EUCN is Fault Tolerant Ethernet (FTE). FTE is a robust control network using commercial Ethernet technology in a patented advanced networking solution. FTE provides multiple communication paths between nodes, enabling an FTE network to tolerate all single faults and many multiple faults. FTE provides not only fault tolerance but also the performance, determinism, and security required for TPN based control applications.

EUCN represents changes on the network cable while the remaining system functions remain identical to the existing ones. Since those strategies are maintained along with all existing supervisory support there is no operator training required with EUCN.

In addition EUCN will allow the same network tools used on existing FTE based Experion systems (Wireshark ® Protocol Analysers, SolarWinds® network management software, Experion maintenance Displays , ETools, etc.) to be used on EUCN based TPN systems. These highly refined tools help the customer diagnose network failures and but also monitor system loading for risk prevention resulting in improved system maintenance effectiveness.

The EUCN provides the infrastructure for a future control level unification between TPN/TPS and Experion Process Knowledge System (EPKS) controllers applying FTE technology.

The FTE based control level unification will provide possibility to

- Increase the effective life time of the control equipment with modernization
- Improve your plant performance with incremental upgrades and expansion of the control with new devices

The Enhanced High Performance Process Manager (EHPM) is the controller which can be connected to the EUCN. The High Performance Process Manager (HPM) remains the controller which can be connected to the UCN. The EHPM has the functionality of HPM while allowing executing communication and data exchange across the FTE based control network.

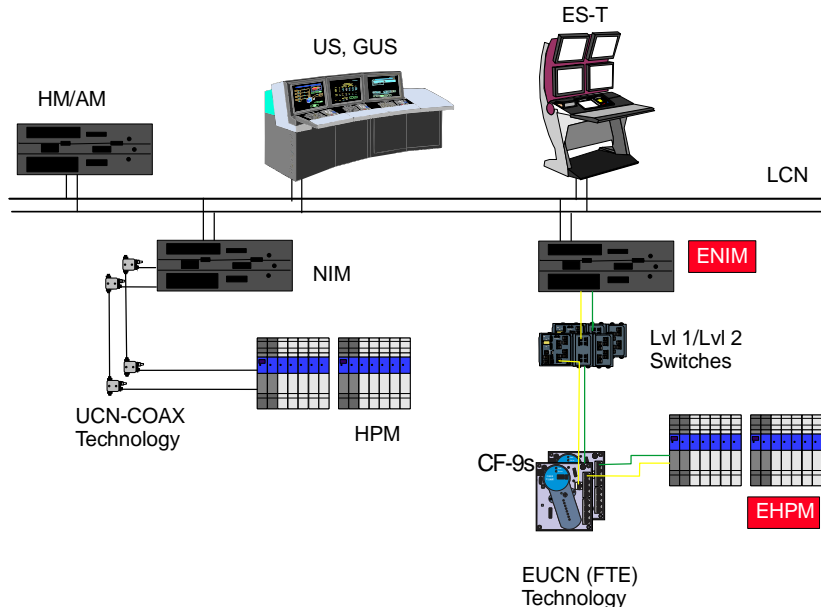
The Enhanced Network Interface Module (ENIM) is the gateway device between EUCN and the Local Control Network (LCN). The Network Interface Module (NIM) remains the gateway device between UCN and the LCN.

## 2.2. Architecture Overview

The functionality of the TPN/TPS system remains unchanged, but allows independent usage of two types of control networks

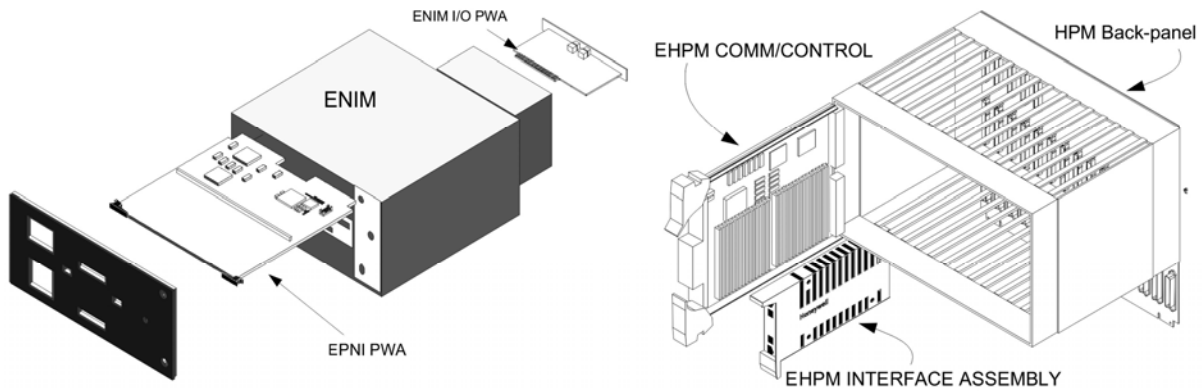
- Universal Control Network (UCN) based on IEEE 802.4 coax based technology
- Enhanced Universal Control Network (EUCN) based on IEEE 802.3 Ethernet applying FTE

The TPN/TPS system comprises several different integrated hardware and software solutions that support a wide range of application needs. Figure 1 represents a subset of the possible nodes and controllers



**Figure 1: TPN/TPS System with FTE based UCN**

In order to take advantage of FTE, the older IEEE 802.4 interfaces on the Network Interface Module (NIM) and HPM were redesigned to connect to Ethernet (IEEE 802.3) based FTE. These redesigned interfaces along with the use of Ethernet cables are the basis of the EUCN (Figure 2)..

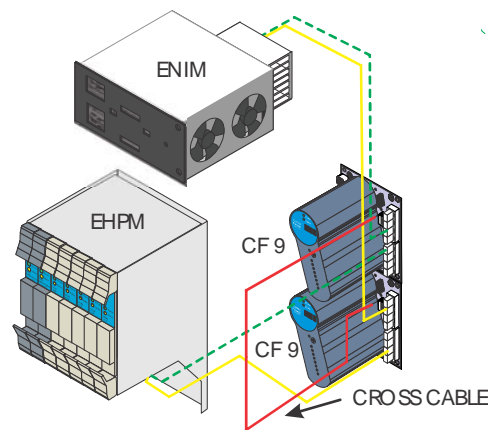


**Figure 2: Assemblies on NIM and HPM modified to use EUCN**

For FTE connectivity:

- The EHPM has new Communications and Control Assembly and its associated EHPM FTE Interface Assembly (see).
- The ENIM has new EPNI2 Assembly and its associated EPNI2 I/O Assembly

A minimal EUCN network (see Figure ) consists, at a minimum, of two nodes (the ENIM and EHPM) connected by FTE media (Copper/Fiber optic Ethernet cables attached to a Honeywell Control Firewall). Larger networks incorporate Level 2 FTE switches and other (typically redundant) ENIMs and EHPMs.



**Figure 3: Minimal Non-redundant EUCN System**

Depending on the “routed cable” communication distance, EUCN uses fiber optic cables and shielded copper cables to ensure reliable operation in high noise industrial environments. FTE network security is achieved through the use of Level 1 Honeywell Control Firewall and Level 2 Industrial Ethernet switch configurations.

# Large EUCN Configuration

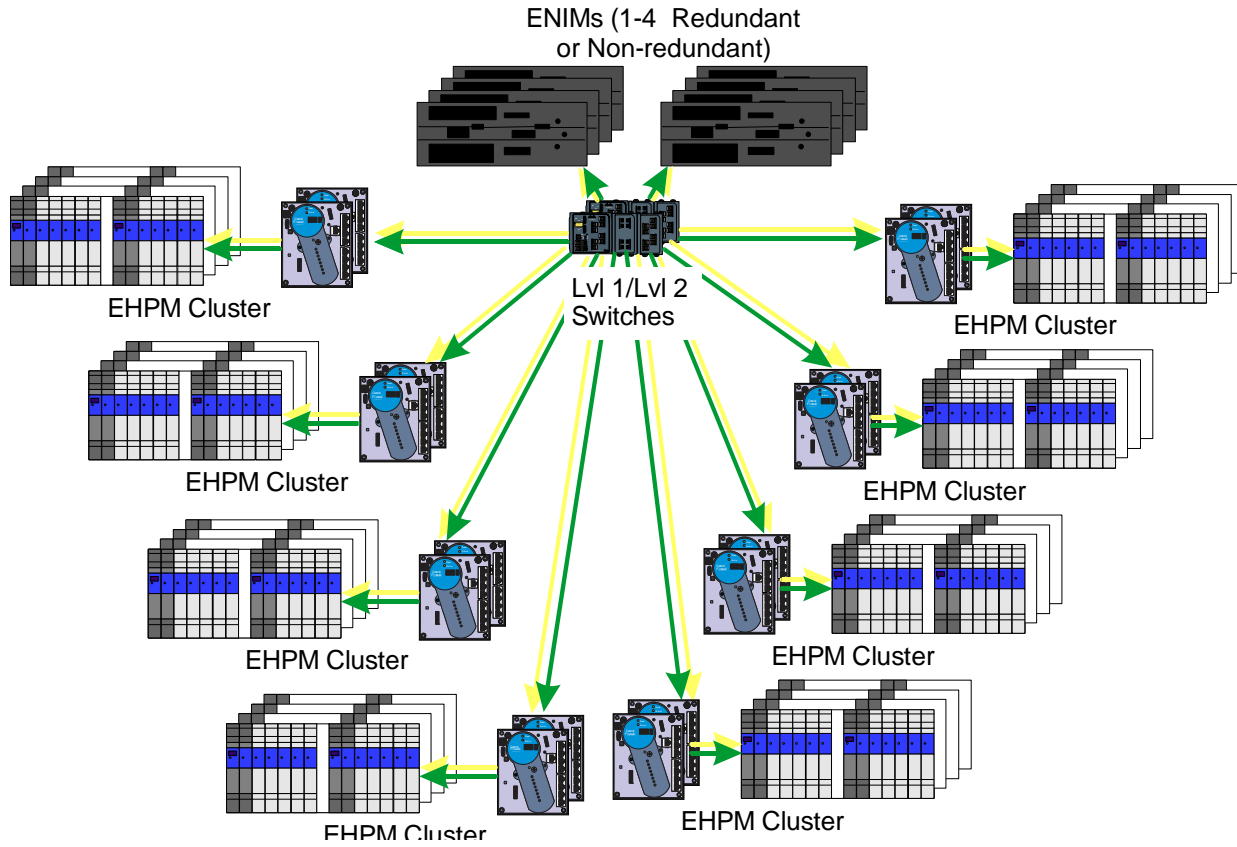


Figure 2: View of Large EUCN system

## 2.3. System Software Integration

In order to properly handle network error messages there were some changes to TPN software. New Maintenance displays were developed to aid in reliable network fault diagnosis. Thus there is a minimum release level of TPN/TPS software needed to use the EUCN nodes. That level of software is show in the table below.

Honeywell Software System	Minimum Software Release Level
TPN	<ul style="list-style-type: none"> <li>• R684</li> </ul>
TPS	<ul style="list-style-type: none"> <li>• R421</li> </ul>

## 2.4. Functional Overview

The EUCN provides a powerful communications platform for efficient, secure, real-time process communications. The UCN is based on IEEE 802.3 and extended message services operating in up to at a 100 megabit/second rate using efficient message structures to support the high-speed communications requirements of a process network

The EUCN provides the following features:

- Support of redundant devices for added security
- Deterministic event/alarm distribution
- TPS Network time synchronization to enable high resolution, digital input sequence of events recording
- Extensive ENIM and EUCN communications and network diagnostics
- The EUCN uses redundant FTE cables as standard, and can accommodate up to 32 redundant devices.
- Devices can be added to, or removed from, the EUCN in a modular fashion to adjust to changing system requirements.

Besides full support of these special features, the EUCN also provides the applications layer necessary for a well-integrated, high integrity, real-time process communications network. For example, the EUCN supports orderly data access of all data acquisition, control, configuration, and status parameters for both peer-to-peer and higher level communications, extensive alarm and message handling routines, on-going devices and communications diagnostics monitoring, support of high-level control with assignable control modes, plus system and device configuration support. All of these communications management functions are provided as standard with the EUCN.

The EUCN supports peer-to-peer communications. This means that EUCN devices on the same logical EUCN can write data to and read data from other EUCN devices for additional control strategy flexibility and coordination.

### Message Handling

There are several types of message frames that can be transmitted across EUCN. These include message frames that transfer commands, aid in diagnosis, transfer information, and control access to the network..

. A message can be directed in one of three ways:

- Point-to-point—a single destination device processes the message
- Multicast—more than one destination device processes the message
- Broadcast—all devices process the message

All devices connected to the EUCN follow well-defined techniques for message priority processing, request/response time-out processing, and communication retries. These techniques ensure that device operations are deterministic and communication is secure.



## Network Interface Module

Information about the process and about the status and configuration of the EUCN devices is transferred through the ENIM from the EUCN to the TPS Network. Commands and configuration information for up to 8000 points, with up to 2400 parameters per second (K4LCN ENIM), are transferred through the ENIM from the TPS Network to the EUCN. For added flexibility, physical EUCNs can be divided into logical EUCNs by adding additional ENIMs. The additional ENIMs can be used to load level heavy loads that might exist on a single physical EUCN.

The ENIM provides the protocol conversion and buffering necessary to efficiently exchange information between the devices connected to the EUCN. The ENIM broadcasts the TPS Network time to all EUCN devices, thereby synchronizing the EUCN time with the TPS Network. This supports 5 ms digital input sequence of events reports from the EUCN connected devices

## ENIM Functions

- Provides for data access between the TPS Network and the EUCN connected devices
- Converts data and protocol between the TPS Network and the EUCN
- Channel EUCN events to the TPS Network for alarming
- Synchronizes TPS Network and EUCN time

## Reliability

The use of FTE CRC frame-check sequence (FCS) verification on every received frame, and message-length checks by software ensures higher reliability than the UCN network.

A second level of security is built into each network device in the form of diagnostic and statistical software that monitors and reports device and network conditions. These checks assure a high performance real-time network for process control applications.

If multiple cable failures ever occur, the ENIM, EHPM and other EUCN connected devices communication software continuously tries to reestablish the node on the EUCN network. This is termed auto-reconnect. Auto-reconnect ensures that either the primary or secondary of a redundant pair will reestablish communication on the EUCN network when multiple cable faults are repaired.

The secondary ENIM is kept up-to-date with relevant information from the primary ENIM so that the secondary can take over at any time. This occurs automatically and is transparent to the network itself; however, the operator is notified of any device switchover.

## Use of Fiber Optic Cable on EUCN

The EUCN provides for up to 2 kilometers of extension from the Level 2 switch using fiber optic cables. An option of the Level 2 Switch provides up to 8 fiber optic 100BASE-FX ports. The 100BASE-FX ports provide for connection of multimode fiber with LC connectors. This multimode cable can then be connected to the Control Firewall (CF9) with a Control Firewall multimode Fiber Module.

### 3. Product Specifications

#### 3.1. EUCN Specifications

Parameter	Specification
Maximum Length of Copper cable	100 Meters
Maximum Length of Fiber Optic cable	2 Kilometers
Max Cable Length from ENIM to farthest EHPM	2 Kilometers
Network type	Fault tolerant Ethernet
Speed of Data Tru-put	100 Mbit/second (100 Base T)
Ambient temperature	0 – 70 Degrees C
Relative Humidity	5-95%
Corrosive environment	G3 (Harsh)
Maximum Number of ENIMs	4 ENIMs (single or redundant)
Maximum Number of EHPMs	31 Nodes (62 if all nodes redundant)
Maximum Number of EUCN Nodes	32 Node total (64 nodes if all nodes are redundant)
Location of ENIM in Star Network	Must be the center of the star
Cross cable Must be Installed	In one location at the highest level on the EUCN Network

Control Firewall (CF9)	Specification
Maximum Number of Level 1 connections Per CF9 (either ENIM or EHPM)	<ul style="list-style-type: none"> <li>8</li> </ul>
Minimum number of CF9s (always occur in pairs)	<ul style="list-style-type: none"> <li>2</li> </ul>
Speed of Data Thru-put	<ul style="list-style-type: none"> <li>100 Mbs (100 Base T)</li> </ul>
Mounting Locations for CF9s	<ul style="list-style-type: none"> <li>HPM cabinets only ( for Class 1 Div 2 Approval)</li> </ul>

Level 2 Switch (CISCO IE3000)	Specification
Maximum Number Level 1 Copper Ports	<ul style="list-style-type: none"> <li>10 per switch (with Dual-Purpose Ports Configured as Level 1 Copper)</li> </ul>
Maximum Number o f Level 2 Copper Ports	<ul style="list-style-type: none"> <li>10 per switch (with Dual-Purpose Ports Configured as Level 2 Copper)</li> </ul>
Maximum Number of Level 2 Fiber Optic Ports	<ul style="list-style-type: none"> <li>10 per switch (with Dual Purpose Ports Configured as Level 2 Fiber Ports and inclusion of 8 port fiber expansion module)</li> </ul>
Speed of Data Thru-put	<ul style="list-style-type: none"> <li>100 Mbs (100 Base T)</li> </ul>
Mounting Locations for Switches	<ul style="list-style-type: none"> <li>LCN cabinets only ( Recommended)</li> </ul>

## 3.2. ENIM Specifications

ENIM	Description
<b>Power Options</b>	Universal AC Input <ul style="list-style-type: none"> <li>• 102-264 Vac (Autoranging)</li> <li>• 47-63 Hz (Frequency Range)</li> </ul> All Network Interface Modules operate without disruption through an interruption in the input ac voltage of up to 40 ms duration.
<b>Point Capacity</b>	Up to 8000 points per NIM or redundant NIM pair (both K2LCN & K4LCN)
<b>Data Access</b>	1200 single-parameter accesses per second (K2LCN NIM) 2400 single-parameter accesses per second (K4LCN NIM)
<b>Configuration Capability</b>	Maximum Number of ENIMs per TPS Network <ul style="list-style-type: none"> <li>• 20 — single or redundant</li> </ul> Maximum Number of ENIMs per EUCN <ul style="list-style-type: none"> <li>• 4 — single or redundant</li> </ul>

## 4. Model Numbers

### 4.1. ENIM Models

Model Number	Description
MP-ENIMR1	ENIM, REDUNDANT
MP-ENIMS1	ENIM, SINGLE

### 4.2. EUCN Network Equipment

Model Number	Description
<b>Level 2 Switch (CISCO IE3000)</b>	
MP-FTES11	EUCN, FTE EQUIPMENT LCN CAB (Mounting For CISCO IE3000 Switches)
NE-SW508S	SWITCH, ETHERNET 8 PORT CIE30008TC
NE-SW51P1	POWER MODULE FOR SWITCH CPWRIE3000AC
NE-SW58TM	SWITCH, EXPANSION CU 8 PORT CIEM30008TM (Copper)
NE-SW58FM	SWITCH, EXPANSION FOR 8 PORT CIEM30008FM (Fiber Optic)
<b>Control Firewall (CF9)</b>	
MU-FTES01 (1	EUCN, FTE EQUIPMENT (Mounting for CF9s in HPM Cabinets)
CC-FMMX01	CF Multi-Mode Fiber Module
Note 1 – Consist of 2x CF9s firewall on a common 16" mounting channel	

### 4.3. Upgrade Kits

Kits are available to allow upgrades from existing PM/APM/HPM based systems to EUCN. The upgrade process has been designed to minimize system downtime and impact to the existing hardware installation.

Model Number	Description
<b>ENIM Kits</b>	
MP-ZENIMR	UPG, NIM TO ENIM, REDUNDANT
MP-ZENMRC	UPG, NIM TO ENIM, REDUNDANT, CE
MP-ZENIMS	UPG, NIM TO ENIM, SINGLE
MP-ZENMSC	UPG, NIM TO ENIM, SINGLE, CE
NE-ZFTEB2	UPG, FTE BASE W/8-PORT COPPER EXPANDER
NE-ZFTEB3	UPG, FTE BASE W/8-PORT FIBER EXPANDER
NE-ZFTEB4	UPG, FTE BASE W/8-PORT CPR&FIBER EXPANDR

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