Honeywell Enraf

RELEASE R101

Introduction Manual
CIU 888

PREFACE

General

The CIU 888 is Honyewell Enraf's next generation *Communication Interface Unit*. The CIU 888 is the crucial link between tank gauging instruments and control room systems. It provides operators with reliable and accurate real-time tank inventory data every couple of seconds, 24 hrs a day, 7 days a week.

Purpose of this manual

The purpose of this manual is to provide an overview of the main features and functions of the CIU 888.

Target audience of this manual

This manual is primarily intended for:

- Service technicians who are responsible for commissioning and configuring the CIU 888, diagnosing and troubleshooting problems and errors, and servicing and maintaining the CIU 888
- IT managers who are responsible for implementing and maintaining the technology infrastructure of the company's network
- System integrators who are responsible for designing and verifying the customer's tank farm operations system in which the CIU 888 provides the tank inventory data
- System administrators who are responsible for management of the CIU 888 and the site network

CIU 888 documentation suite

The CIU 888 documentation suite includes the following documents:

- Introduction Manual (Part No. 4417591)
- Installation Manual (Part No. 4417590)
- Configuration Manual (Part No. 4417593)
- Protocol Manual - Modbus Host Part No. 441788)
- Protocol Manual - CIU Emulation Part No. 441789)
- Sealing Guide (Part No. 4417595)
- System Administration Manual (Part No. 4417598)
- IT Security Manual (Part No. 4417597)
- Firmware Upgrade Manual (Part No. 4417596)
- Service and Repair Manual (Part No. 4417594)

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CHAPTER 1 INTRODUCTION

1.1 Next generation CIU

Successor to the CIU 880 Prime and Plus, the CIU 888 is the crucial link between the gauging instruments on bulk liquid storage tanks and the control, monitoring and safety systems in the site control room. The CIU 888 provides operators with reliable and accurate real-time tank inventory data 24 hours a day, 7 days a week, increasing the site's effectiveness and productivity while reducing costs.

FIGURE 1-1 The CIU 888

The CIU 888 serves as data acquisition unit of tank gauging instruments, and continuously scans real-time data. All real-time measurement data is then used to calculate accurate tank inventory data using international standardized methods of calculation, such as API and ASTM among others.

All measured and calculated data is instantly available for use by host applications, such as tank inventory systems, Distributed Control Systems (DCSs), Programmable Logic Controllers (PLCs), and others via multiple and dedicated host links and interfaces. Support of multiple standard protocols guarantees convenient and reliable connectivity between the installed field instruments and the systems in the control room.

1.2 Full support of installed base

Building on the strengths of its predecessors, the CIU 888 can be migrated into an existing tank inventory system with minimal effort. A single CIU 888 can replace a set of CIU 880 Plus and Prime, a single CIU 880 Prime or a single CIU 858/SmartLink.

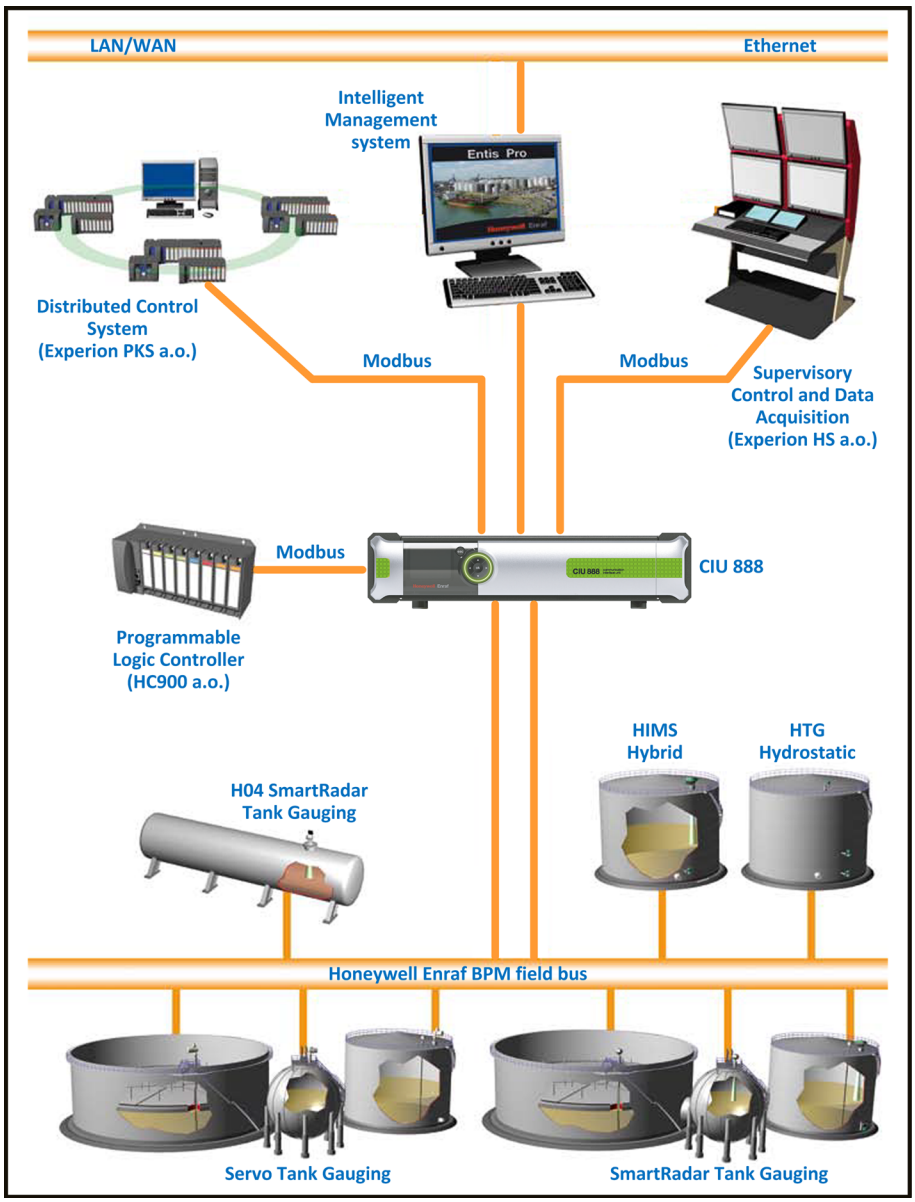


FIGURE 1-2 Tank gauging system with CIU 888 as crucial link between field and control room

The advantages of the CIU 888 become clear when comparing the CIU 888 to previous generations in the CIU series, as shown in TABLE 1-1.

TABLE 1-1 Comparison between CIU 888 and previous generations in CIU series

	CIU 858	SmartLink	CIU Prime	CIU Plus	CIU 888 R100	CIU 888 R1xx
Field lines	3	3	4	2	Up to 4	Up to 6
BPM	✓	✓	✓	×	✓	✓
Serial GPU	×	×	✓	×	✓	✓
Serial Modbus	×	×	×	✓	✓	✓
Host links	1	2	2	4	2 to 4	2 to 4
Serial GPU	✓	✓	✓	×	✓	✓
Serial Modbus	×	×	✓	✓	✓	✓
Ethernet						
Modbus	×	×	×	×	×	✓
OPC	×	×	×	×	×	✓
DNP3	×	×	×	×	×	✓
Separate service port	×	×	×	×	✓	✓
Volume correction	×	×	×	✓	✓	✓
W&M sealing	×	✓	✓	✓	✓	✓

1.3 Designed for users

One of the most striking features of the CIU 888 is its user-friendliness. The CIU 888's user interface guarantees an intuitive operation, and makes sure that users do not suffer from information overload and are presented with the essentials, where it is also possible to analyze the details easily.

1.3.1 Ring of light

The ring of light located at the front of the CIU 888, as shown in FIGURE 1-3, immediately draws the attention of the user. It provides a clear indication of the current CIU 888 status based on NAMUR color coding.

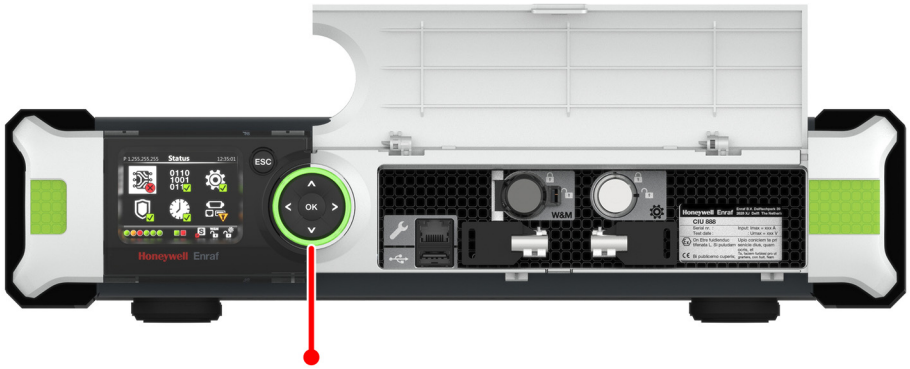


FIGURE 1-3 CIU 888: Ring of light

1.3.2 CIU 888 display and navigation keys

The LCD display, as shown in FIGURE 1-4, provides more detailed information about the status of the CIU 888.

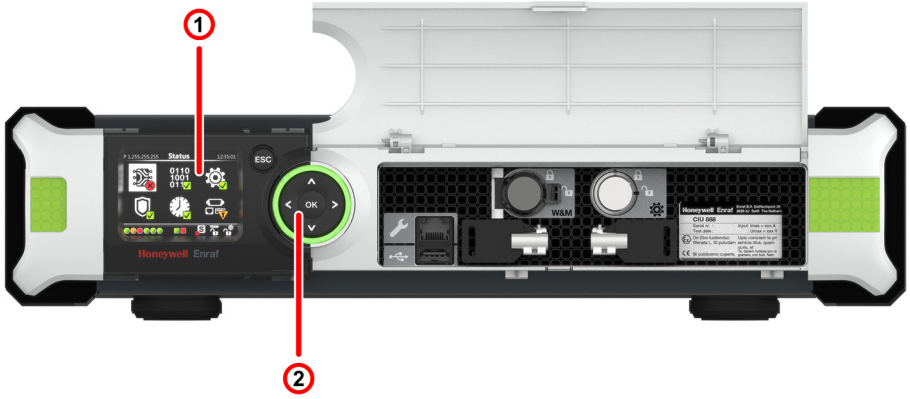


FIGURE 1-4 CIU 888: Display (1) and navigation keys (2)

The main screen of the display, called the *Status Dashboard*, gives users quick feedback on the operational state and health of the CIU 888 and its interfaces. Additionally, the *Status Dashboard* serves as a portal

to more detailed status information and configuration settings, which can be accessed using the navigation keys.

FIGURE 1-5 CIU 888 display: Status Dashboard

1.3.3 CIU 888 Web interface

The CIU 888 Web interface, shown in FIGURE 1-6, can be accessed for in-depth diagnostics, monitoring and service of the CIU 888.

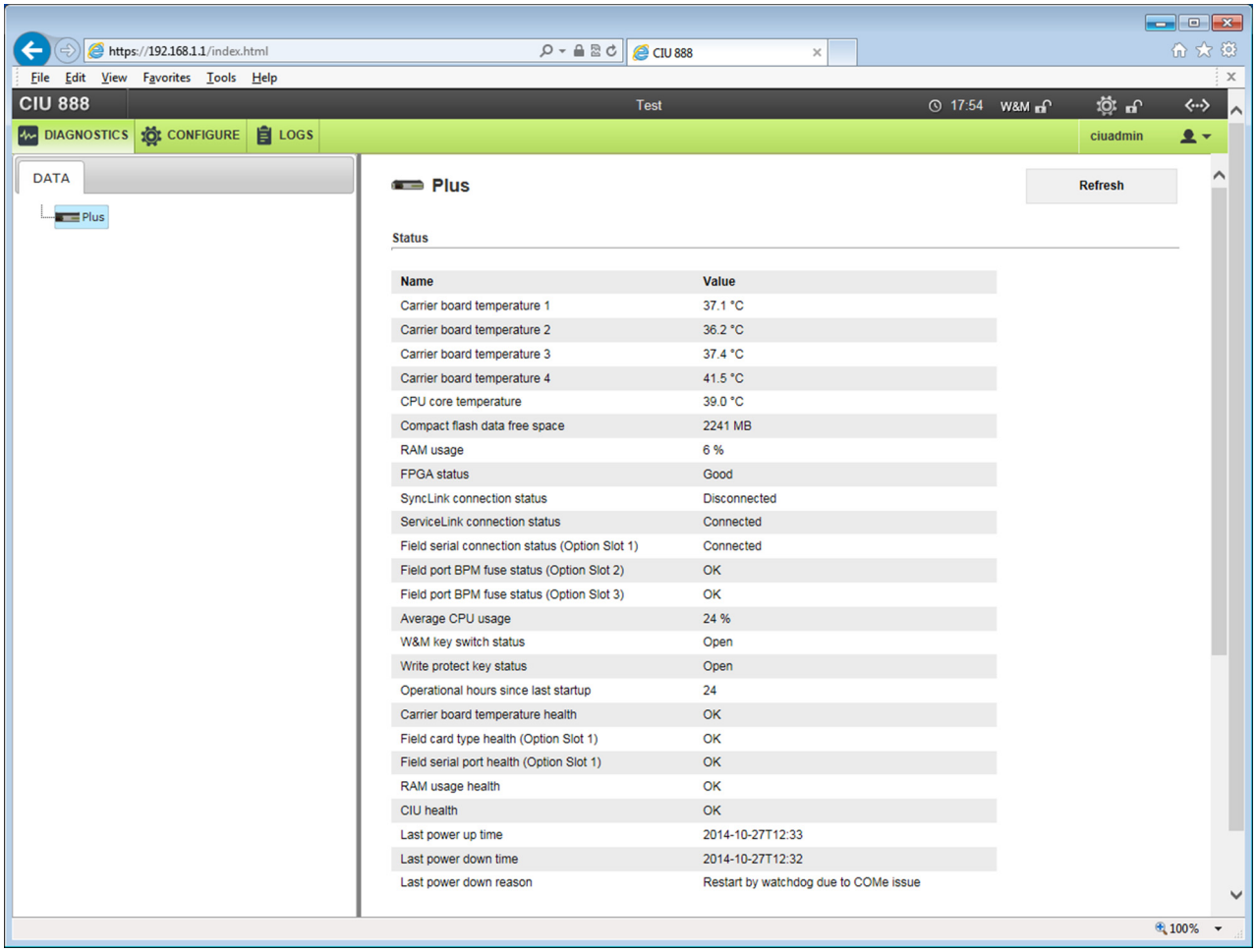


FIGURE 1-6 CIU 888 Web interface

The Web interface is easy accessible via a standard browser and allows users to perform a range of tasks, including commissioning and configuration of the CIU 888, performing system diagnostics, et cetera.

1.4 Increased IT security and safety

The CIU 888 is designed from a multi-layered approach to IT security, in which multiple security measures are placed throughout the device. Should one security measure not be able to avert a security breach, other continue to protect resources and data thereby preventing/limiting any potential damage.

The security measures implemented in the CIU 888 vary in nature, but fundamentally they all share the same goal: protecting the confidentiality, integrity and availability of data.

Below a non-exhaustive list of examples of security measures implemented in the CIU 888:

- Full network segregation via integrated firewall
- User access to the CIU 888 and the CIU 888 Web interface restricted to authorized users
- Use of cyclic redundancy checks (CRCs) to indicate the integrity of site configuration data
- Option to seal the CIU 888 to indicate that the system settings are unchanged after verification and to be used for W&M-certified applications for inventory control, custody transfer, accounting and duties
- Hardened Linux operating system with a low susceptibility to virus and malware infestation to ensure uninterrupted data availability, and availability of critical applications and services
- Read-only partition for Linux operating system to prevent unauthorized modification of firmware
- Auto-disabled USB ports preventing accidental virus infection or distribution of malware through the use of USB drives
- Enabling of only the required port numbers on Ethernet ports

1.5 Delivering ultimate connectivity

Where serial interfaces used to be the standard also in the industry, Ethernet based networks are more common today on several levels. Unlike its predecessors, the CIU 888 not only fully supports current standard interfaces, but also supports Ethernet connectivity. With the right approach on security, possibilities to share data with other applications are easily in reach. Reliable, accurate data can help business applications or planning, reconciliation, etc. to become more effective and efficient.

1.5.1 Ethernet ports

The CIU 888 has six dedicated Ethernet ports, as shown in FIGURE 1-7 and FIGURE 1-8.

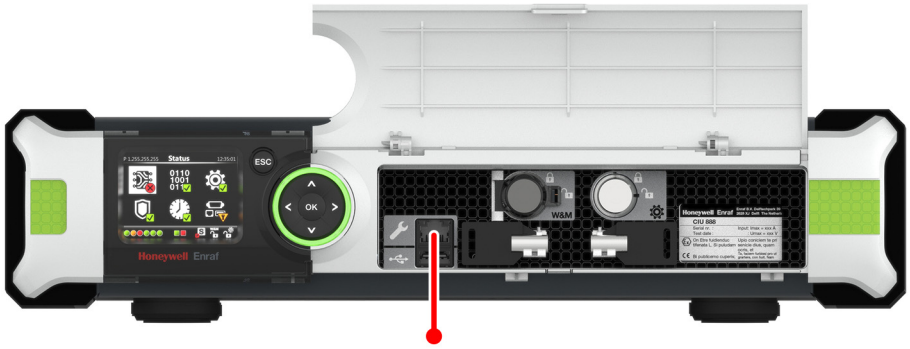
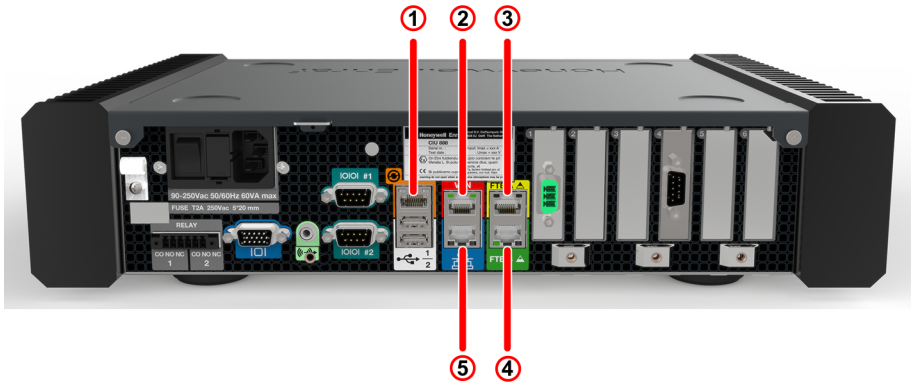


FIGURE 1-7 CIU 888: Service port at the front



1. Sync Link port
2. VPN port
3. FTE port A
4. FTE port B
5. Office LAN port

FIGURE 1-8 CIU 888: Ethernet ports at the back

TABLE 1-2 provides a description of each port.

TABLE 1-2 Description of the Ethernet ports

Ethernet port	Description
Service port	The Service port is used to set up a point-to-point connection between the CIU 888 and a service laptop/PC, allowing service technicians to configure the CIU 888 including field instruments connected to the CIU 888, and to perform system diagnostics. The Service port is also used to perform firmware upgrades and to view/updated the license of the CIU 888. The service port is conveniently located at the front of the CIU 888 for easy access.
Sync Link port	The Sync Link port is used as dedicated, private synchronization link (point-to-point) between two CIU 888s in a redundant system setup. Continuous data synchronization between the CIUs and autonomous switchover guarantee highest data availability.
VPN port	The VPN port is intended to be used to set up a secure point-to-point connection to provide remote access enabling off-site service and diagnostics of CIU 888 and gauges.
FTE ports	The FTE (Fault Tolerant Ethernet) ports are intended to be used to set up individual connections between the CIU 888 and host systems such as PLCs and DCSs. The FTE ports can also be used combined to support an FTE connection with Experion. By providing multiple communication paths between nodes (servers and stations), FTE tolerates more faults, i.e. all single faults, as well as many multiple faults. FTE ensures a rapid response in case of communication failures with minimal switchover time. Ethernet nodes with no FTE hardware or software can be connected to the FTE control network and benefit from its highly available communications environment.
Office LAN port	The Office LAN port is intended to be used to connect the CIU 888 (and the control network it is part of) to the business network of the site in order to securely share data with office applications, thereby saving costs on operation and data exchange.

NOTE: In release R100 the Service port and the Sync Link port are enabled.

Network segregation is supported by the CIU 888 - a software-based firewall ensures that only the required socket ports are opened for each enabled Ethernet port. The firewall monitors and identifies all incoming and outgoing network traffic and blocks all unwanted network traffic.

1.5.2 Serial host ports

To support existing applications, the CIU 888 has two fixed serial (RS-232/RS-485) host ports, as shown in FIGURE 1-9.

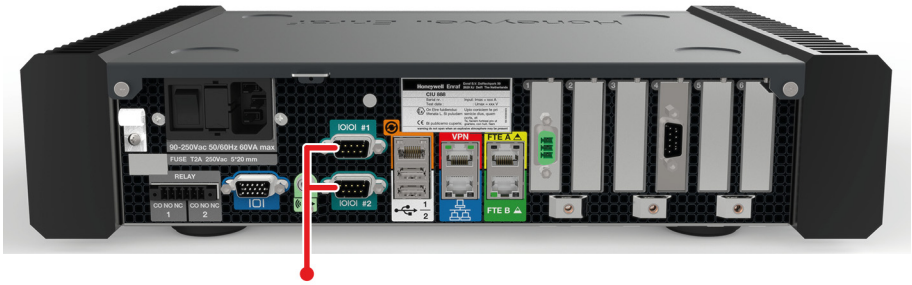


FIGURE 1-9 CIU 888: Fixed serial host ports

The serial host ports can be used to connect the CIU 888 to host systems over serial line using the Modbus RTU protocol.

Alternatively, one the host ports can be configured for emulation of the standard CIU protocol (compatible with the CIU 858) to provide backward compatibility.

1.5.3 Option slots

The CIU 888 has six option slots, as shown in FIGURE 1-10.

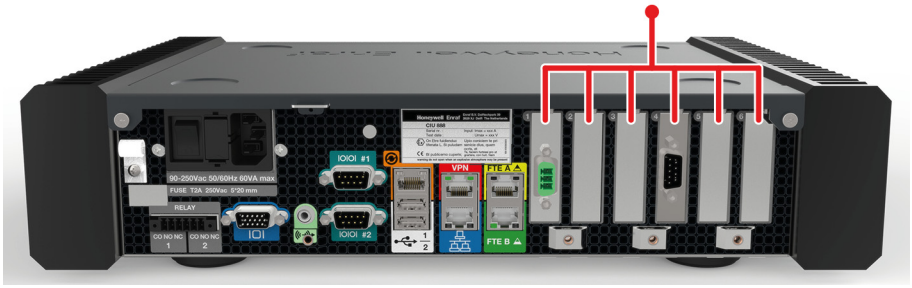


FIGURE 1-10 CIU 888: Option slots

The options slots support a wide range of connectivity possibilities, including:

- Gauging instruments on bulk storage tanks connecting over BPM or serial (RS-232/RS-485) field lines
- Host systems connecting over serial (RS-232/RS-485) field lines
- Downlink CIU (i.e. CIU 858, SmartLink) with gauges, connecting over serial (RS-232/RS-485) field lines

NOTE: In release R100 option slots 5 and 6 are assigned as serial host port.

1.5.4 USB ports

The CIU 888 has three USB ports as shown in FIGURE 1-11 and FIGURE 1-12. The USB ports enable connection of data storage devices, such as USB flash drives and pen drives, in order to install firmware upgrades and CIU 888 license updates.

NOTE: Refer to the Firmware Upgrade Manual CIU 888 (Part No. 4417596) for more information.

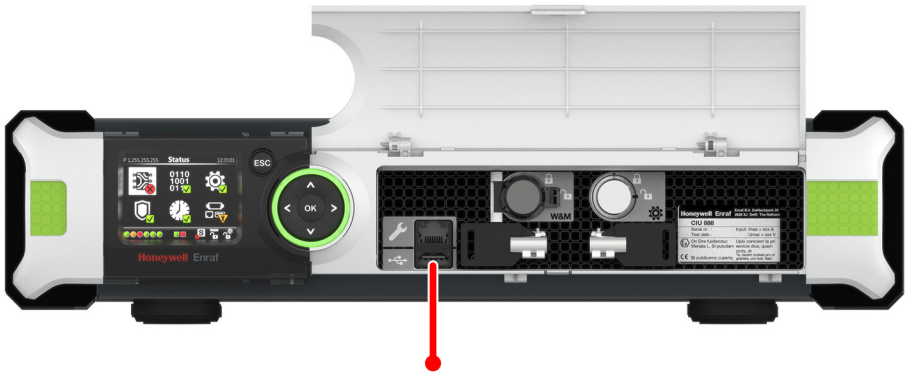


FIGURE 1-11 CIU 888: USB port located at the front

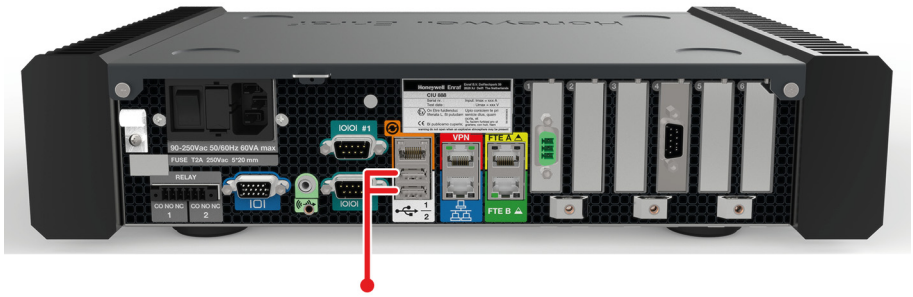


FIGURE 1-12 CIU 888: USB ports located at the back

By default, access to the USB ports is disabled in order to prevent accidental infection or distribution of malware. Note that other mechanisms also prevent virus attacks. Access to the USB ports can be enabled via the CIU 888 Web interface only.

NOTE: Refer to the IT Security Manual CIU 888 (Part No. 4417597) for more information.

1.5.5 Relays

The CIU 888 has two relays located at the back, as shown in FIGURE 1-13. Each relay has three contacts: CO (Common), NO (Normally open) and NC (Normally closed).

FIGURE 1-13 CIU 888: Relays

The relays are intended to be used for multiple purposes, for example to control systems like Distributed Control Systems (DCSs) via a hardwire connection, and indicate system status. Use of the relays is especially useful in case of a redundant system setup, since no effort is required to check which system is active and provides the correct data.

1.5.6 Other connections

The VGA connector and the audio input located at the back of the CIU 888, as shown in FIGURE 1-14, are for future use.

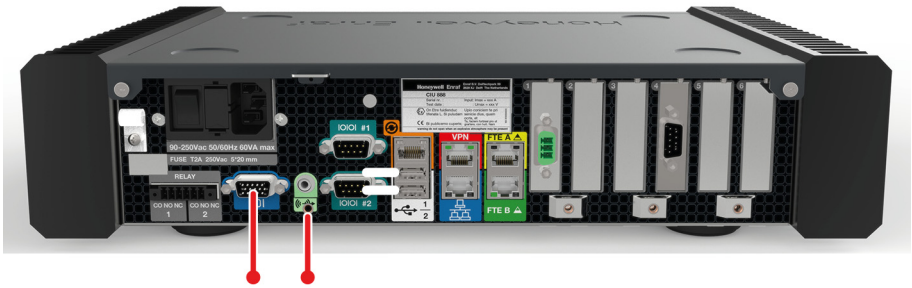


FIGURE 1-14 CIU 888: VGA connector and audio input

1.6 Up-to-date regulatory compliance

The CIU 888 is verified and approved by internationally recognized metrology authorities, to international accepted industry standards for the assessment of taxes or duties. Coverage can be expanded to support new or specific standards.

NOTE: Refer to the Sealing Guide CIU 888 (Part No. 4417595) for more information.

1.7 Maximizing data availability through full redundancy

Operations for inventory control and custody transfer rely on accuracy, reliability and availability of the tank gauging system. By setting up two CIU 888s in a redundant system setup, system reliability and availability can be increased even more. Continuous data synchronization and autonomous switchover ensure highest data availability and smooth transition between CIUs, with minimal interruption of critical applications and services.

1.8 Remote access for safe and secure support of gauges

The CIU 888 is the interconnection between gauging instruments in the field and service tools, such as Honeywell Enraf's *Engauge*, in the site control room. All gauging instruments can be accessed and configured remotely via the CIU 888 in a safe and secure way, enabling site support and more efficient commissioning.

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CHAPTER 2 TECHNICAL SPECIFICATIONS AND DIMENSIONS

2.1 Technical Specifications - Functional (Software version R100)

General	
Description	Field scanning and communication interface for tank Inventory applications with optional embedded tank inventory calculation functionality.
Application	For all applications requiring accurate and reliable process and inventory data, such as refineries, tank farms and terminals. Data is suitable for custody transfer, safe product transfer and tank farm operation.
Intended Use	Control room equipment
Legal Metrology and Custody Transfer	Compliant to API standards as stated by approval and certification by notified bodies as NMi.

Functional Specification[1]	
Tank Database	50 tanks (CIU 880 and Entis Pro compatibility)[2]
Redundancy	Hot standby, real-time synchronization and autonomous switch-over
Supported Gauge Models	All GPU enabled tank gauges (such as 811[3], 813[3], 865[3], 866[3], 854, 872[3], 873[3], 877[3], 894[3], and 990)
Gauge Commands	- Lock Test - Freeze - Alarm Test (SmartRadar) - Unlock - Calibrate (854, 894) - Water Dip - Block - Density Dip
Tank Scanning	Max. 4 field ports sequential and/or parallel, refresh rate 2-4 sec.[4]
Inventory Calculations	Conform API MPMS Ch. 12.1
Tank Capacity Tables (strapping tables)	Up to 5,000 straps per tank, 200,000 straps total
Support API/ASTM Product Calculations	- ASTM D1250-52 Table 23, 24, 53 and 54 - ASTM D1250-1980; conform Vol. X - Tables, 5, 6, 23, 24, 53, 54, 59 and 60 and 59, 60 Alternative Temperature, product groups A, B, C, D - API MPMS Ch. 11.1 (2007; adj. to ASTM D1250-04 and IP-200) - Tables 5, 6, 23, 24, 53, 54, 59, 60 and 59, 60 Alternative Temperature, product groups A, B, C, D - API MPMS Ch. 11.2.4 (GPA TP-27) - Tables 5, 6, 23, 24, 53, 54, 59, 60 and 59, 60 Alternative Temperature
Product Group E	- ASTM D4311-83 Table 1 and 2 - ASTM D4311-96 Table 1 - ASTM D4311-04 Table 1 and 2
Available Gauge Data[5]	- Product Level - Product Temperature - Gas Pressure - Water Level - Gauge Status and Alarms - Vapor Temperature - Ambient Temperature - Observed Density (Servo, HTG, HIMS)
Available (Calculated) Inventory Data	- S&W, Vapor (4 types), DCF, TCF, manual CTL - Volume (TOV, GOV, GSV, NSV) - Reference Density - Mass (liquid, vapor, total) - Volume Correction Factor (VCF, CTL) - Volume Derived Flow

Functional Specification[1]		
Clock & Time Synchronization	Internal or external using (optional) Entis Pro	
Supported Engineering Units	- Level	m, mm, ft, in, in/16 and ft-in-16 (fis)
	- Temperature	°C, °F
	- Density	kg/m^3, °API, lb/ft^3, RD60/60, lb/Usgal
	- Pressure	kgf/m^2, kPa, psi(g), Pa
	- Volume	m^3, USgal, bbl, l(L)
	- Mass/weight	kg, lb, metric ton, long ton, US ton
	- Flow	m^3/min, m^3/h, l/min, bbl/min, bbl/h, USgal/min USgal/h
Available Correction Methods	- CTSh[6] - Floating Roof Weight	

Host Connectivity	
Serial Ports	2x Modbus serial (2 additional ports by using option slots)
Supported Host Protocols	- Serial Modbus (Slave) - CIU 858 emulation - CIU 880 Prime/Plus emulation (Entis Pro compatible)
Ethernet/LAN	Future use

Field Connectivity	
Field Ports	6x option slots (of which 2 ports can instead be used for host connectivity)
Wireless Connectivity	ISA 100 via Honeywell WDM
Available Option Boards	- Enraf BPM fieldbus - RS-232C serial Modbus

Compliance & Certifications	
European Directives	- CE - 2006/95/EC (Low Voltage directive) - 2004/108/EC (EMC)
IT Security	Conform WIB M 2784-X - 10
User Interface	Designed for compliance with NAMUR NE 43
Self Monitoring & Diagnostics	Designed for compliance with NAMUR NE 107
Legal Metrology (Weights & Measures)	- NMi - Netherlands - OIML - Global - PTB - Germany (pending)

End notes

1 Functionality depends on installed software version. This overview lists functionality related to Release R100.

2 In release R100 the maximum number of gauges equals the number of tanks.

3 Discontinued models.

4 Depending on number of used field ports, scan strategy, and baud rate.

[5] Depending on gauge functionality.

[6] Ambient temperature input required.

2.2 CIU 888 Option Board Specifications

Enraf BPM Field Bus Card	
Physical Layer	2-wire Bi-phase mark modulated (MIL-STD-1553)
Supported Protocol(s)	Enraf BPM
Typical No. Field Devices	10-15, depending on cable specifications and length
Baud Rate	1200/2400 Baud
Distance	10 km or more depending on cable characteristics
Cable Characteristics	1 uF/200 Ohm max.
Type of Galvanic Isolation	Transformer coupled with ground shield
Galvanic Isolation	1500 V

Serial Modbus Card	
Physical layer	2-4 wire RS-485 or RS-232C
Protocol(s)	Modbus - Slave (for host communication)
Baud Rate	1200 up to 38400 Baud
Type of Galvanic Isolation	Opto isolation
Galvanic Isolation	1500 V

Enraf Serial Communication Card	
Physical layer	4-wire RS-485 or RS-232C
Protocol(s)	Modbus - Slave (for host communication)
Baud rate	1200 up to 19200 Baud
Type of galvanic isolation	Opto isolation
Galvanic isolation	1500 V

2.3 Technical Specifications - Hardware

Electrical	
Power Supply	100-240 Vac, auto ranging (-15% to +10%), 45-65 Hz
Power Rating	Max. 60 VA (35 VA nominal)
Nominal Start-Up Current	60 mA (Fuse: 2A Slow Blow) Start Up Current is (inrush): 60A @230V
Overall Voltage Category	II
Cooling System	2 heat sinks with heat pipe design (no moving parts)
Battery	Type 3V, 225mAh, 23mm (for back-up system clock only - 10 years estimated service time)

Processor & Operating System	
O/S	Linux Arch version 3.4.7-1
Memory	4 GB Flash memory (upgradable)

User Interface and I/O	
Front Panel Display	Backlight LCD color display (50 x 38 mm; 320 x 240 pixels) for status and diagnostics
User Input	6 switches (⇦, ⇨, ⇧, ⇩, OK and Esc) with LED (ring of light) status indication
Key Lock Switches	2x (for configuration and W&M sealing respectively)
Relay Output	2x DPDT for CIU status (Hot Standby); contact rating: 30VDC,1A
Video Output	SVGA (future use)
Audio Output	1x std. line out (x Vtt), 3.5 mm mini-jack
Serial Ports	2x non-isolated
Ethernet Ports	5x 10/100 Mb on back side (future use)
Service Ethernet Port	1x behind front panel - DHCP enabled, auto sensing, 10/100 Mb
USB Ports	1x behind front panel; 2x on back side - default disabled

Environmental	
Ambient Temperature	0 °C to +60 °C (+32 °F to +140 °F)
Storage Temperature	-20 °C to +85 °C (-40 °F to +185 °F)
Enclosure Classification	Against mechanical impact IP 30 (NEMA 1)
Humidity	0% to 90% non-condensing
Emc Class	CLASS A

Mechanical	
Materials	- Enclosure: Acryl painted steel - Heat sinks (left and right side): Black anodized aluminum - Front panel: ABS/PPE
Dimensions	400 x 93 x 283 mm (WxHxD) (15¾ x 3¾ x 11¼ in. (WxHxD))
Weight	~ 7.5 kg (16.5 lb) (excluding option cards)
Installation	Wall mounting, 19” rack or table top

Mechanical	
Max. Load on Top (Table Top Use)	10 kg (22.0 lb)

2.4 Dimensional drawing

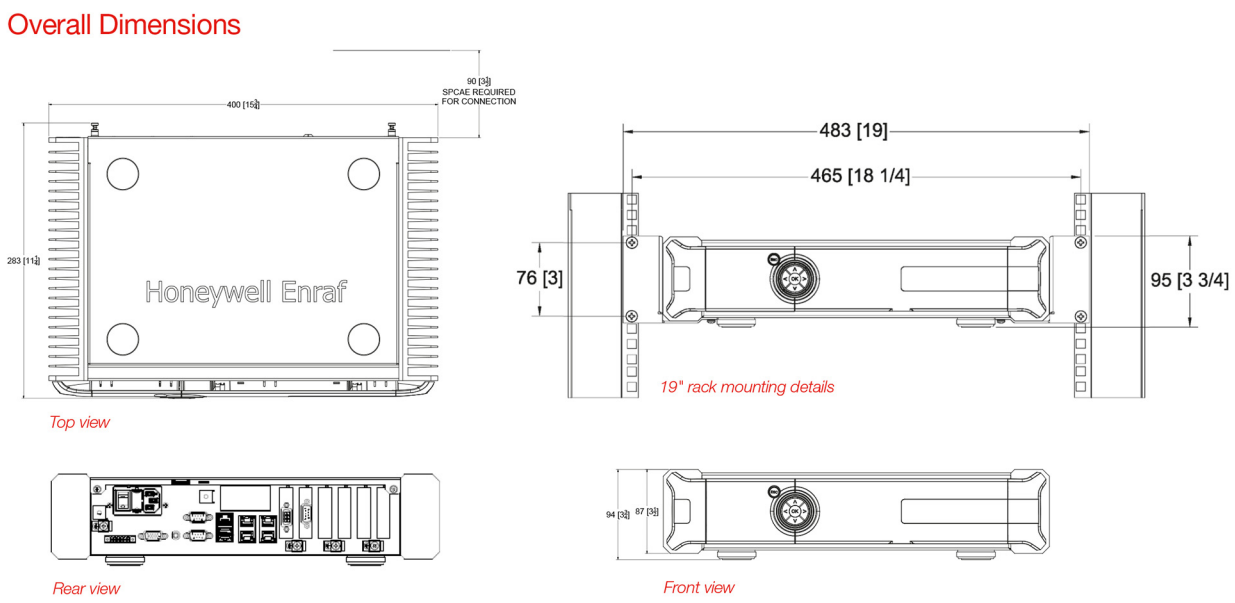

FIGURE 2-15 Overall dimensions of the CIU 888

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APPENDIX A LIST OF ABBREVIATIONS

Abbreviation	Meaning
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
BPM	Bi-Phase Mark
CRC	Cyclic Redundancy Check
CTL	Correction for Temperature on Liquid
DCS	Distributed Control Systems
FTE	Fault Tolerant Ethernet
GOV	Gross Observed Volume
GPU	Gauge Processing Unit
GSV	Gross Standard Volume
IT	Information Technology
LAN	Local Area Network
NMi	Netherlands Measurement Institute (Nederlands Meetinstituut)
NSV	Net Standard Volume
OIML	International Organization of Legal Metrology (French: *Organisation Internationale de Métrologie Légale*)
PC	Personal Computer
PLC	Programmable Logic Controller
RS	Recommend Standard
RTU	Remote Terminal Unit
TOV	Total Observed Volume
USB	Universal Serial Bus
VCF	Volume Correction Factor
VGA	Video Graphics Array
VPN	Virtual Private Network
W&M	Weights and Measures

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For service-related questions, contact:

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