Honeywell | CIU 888

Protocol Manual - CIU Emulation

Release R210

PREFACE

General

In order to support backward compatibility with earlier generations in the CIU series, the CIU 888 features a CIU Emulation component. This component enables host systems connected to the CIU 888 to communicate via the CIU 888 using the GPU protocol on serial (RS-232/RS-485) instead of the Modbus protocol.

Similarly, the virtual tunnel component of the CIU 888 enables service tools, such as Engauge, to communicate with tank gauges via the CIU 888 using the GPU protocol on TCP/IP.

NOTE: The virtual tunnel component also enables communication through Honeywell's proprietary FlexConn protocol on TCP/IP. This protocol will not be described further in this manual.

The Modbus Emulation component of the CIU 888 enables the Emerson servicing tool (TankMaster Winsetup) to communicate with Emerson Rex gauges through the CIU 888 using the Modbus RTU protocol on the serial (RS232/RS485) hostport.

Purpose of this manual

The purpose of this manual is to give information about CIU Emulation to Virtual Tunnel and Modbus Emulation as implemented in the CIU 888. In addition, this manual provides a general description of the GPU protocol.

Target audience of this manual

This manual is primarily intended for:

- Service technicians who are responsible for setting up (commissioning) and configuring the CIU 888, and for configuring gauges via the CIU 888 using service tools such as Engauge and TankMaster Winsetup
- System integrators who are responsible for designing and verifying the customer's system in which the CIU 888 is the tank gauging component

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CHAPTER 1 CIU EMULATION

CIU 888 has 2 fixed serial host ports and upto 4 field cards can be converted as host ports resulting in a maximum of 6 host ports. Maximum of 4 of these 6 host ports can be configured for emulation of the CIU protocol (compatible with the CIU 858) to provide backward compatibility with earlier generations in Honeywell's series of CIUs (i.e. CIU 880 Prime and Plus, CIU 858, SmartLink).

NOTE: CIU emulation can be configured for only one host port when using Ensite Pro.

Using CIU emulation, external clients (i.e. host systems) connected to the CIU 888 can communicate with the devices connected to the CIU 888 field port via the CIU 888. This communication involves GPU protocol on serial (RS-232/RS-485) instead of the default protocol used for host communication (i.e. Modbus protocol). Examples of external clients are *Entis XL*, *Profiles*, etc.

For CIU Emulation, perform the following configurations:

- Configure host port for CIU Emulation (see section 1.1)
- Configure field port communication settings.

NOTE: Refer to the Configuration Manual CIU 888 (Part No. 4417584) for more information about the configuration of the field port communication settings.

FIGURE 1-1 shows a schematic representation of CIU emulation in the CIU 888.

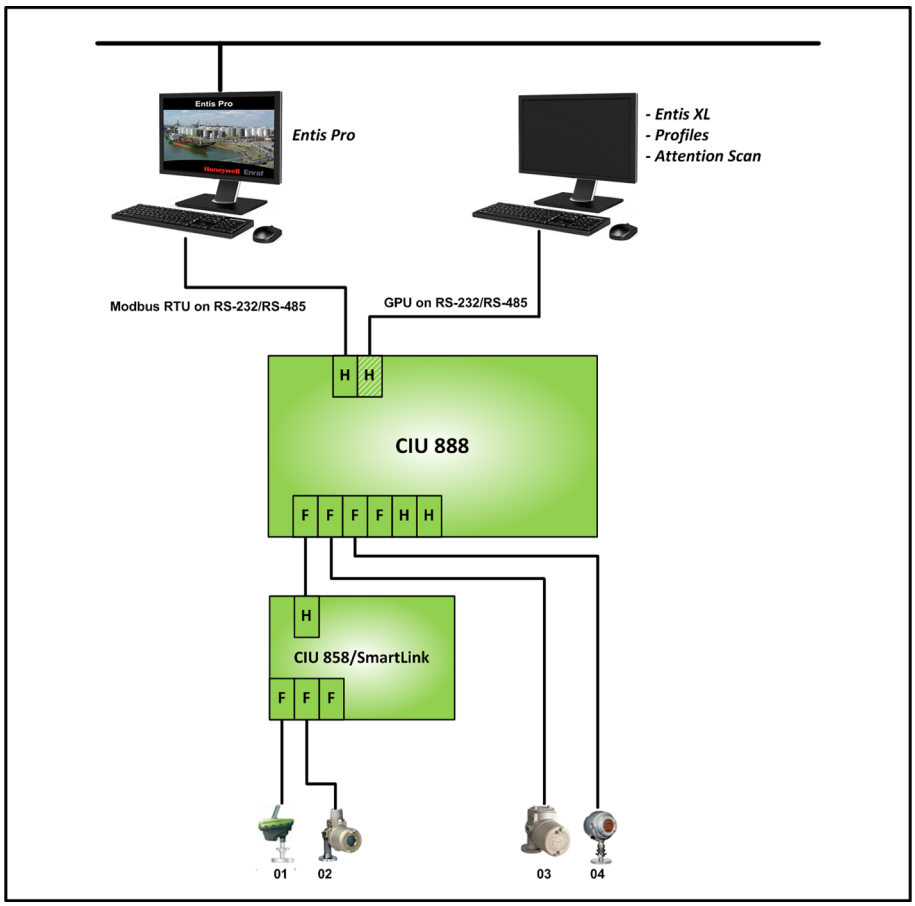

FIGURE 1-1 Schematic representation of CIU Emulation in the CIU 888

1.1 CIU Emulation Configuration Procedure

NOTE: For guidance on which tool to use for CIU Emulation configuration, refer to Introduction section of configuration manual.

1.1.1 Configuring a host port for CIU Emulation using Service tool

The following configuration settings in Service tool need to be applied to enable CIU Emulation for one of the host ports of the CIU 888.

NOTE: Refer to the Configuration Manual CIU 888 (Part No. 4417584) for more information about the commissioning and configuration of the CIU 888.

1. On the **HostPort** tab, Set the **Protocol Type** property to **CIU-GPU** (see FIGURE 1-2, 1).
2. If required, select the **MSU mode** option (see FIGURE 1-2, 2). Refer to section 1.3.3 for more information about MSU mode.
   A check mark is displayed in the associated check box.
3. If required, enable or disable the **Host port cache** option (see FIGURE 1-2, 3).

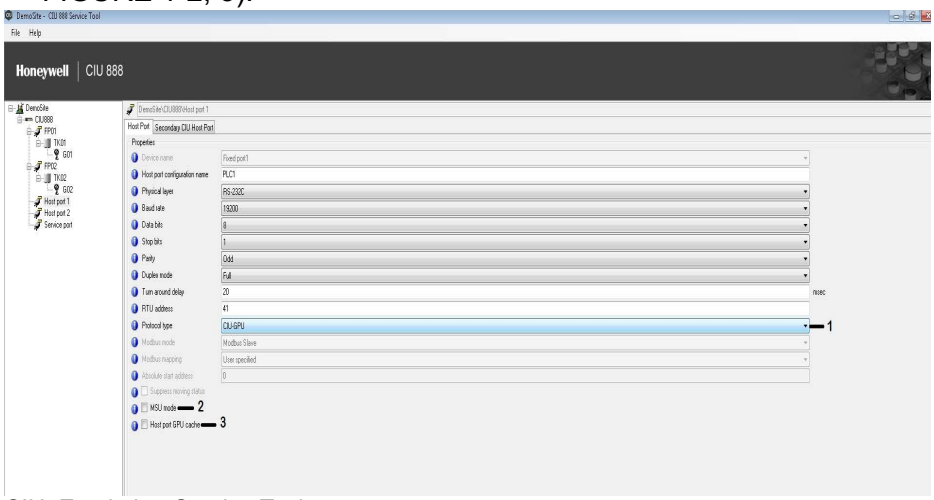

FIGURE 1-2 CIU Emulation-Service Tool

1.1.2 Configuring a host port for CIU Emulation using Ensite Pro

The following configuration settings in Ensite Pro need to be applied to enable CIU Emulation for one of the host ports of the CIU 888.

NOTE: Refer to the Configuration Manual CIU 888 (Part No. 4417584) for more information about the commissioning and configuration of the CIU 888.

CIU Prime

1. On the **HostPort 2** tab, select the **Advanced** option (see FIGURE 1-3, 1).

A check mark is displayed in the associated check box. The advanced configuration settings become available.

2. Select the **CIU 858 compatible** option (see FIGURE 1-3, 2).
   A check mark is displayed in the associated check box.
3. If required, select the **MSU mode** option (see FIGURE 1-3, 3). Refer to section 1.3.3 for more information about MSU mode.
   A check mark is displayed in the associated check box.

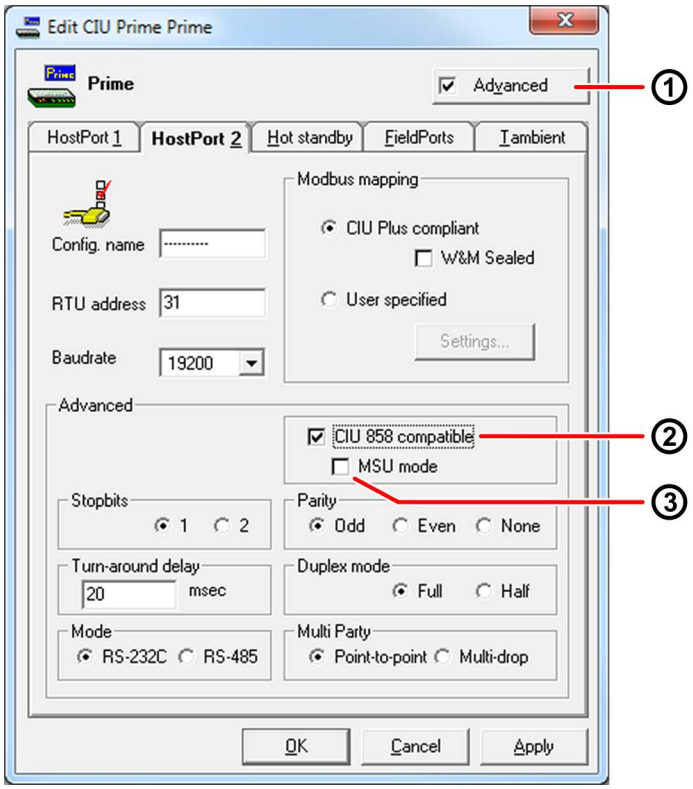

FIGURE 1-3 CIU Emulation - CIU Prime configuration settings

CIU Plus

On the *HostPorts* tab, set the type to **None** for the host port that must be enabled for CIU Emulation (see FIGURE 1-4).

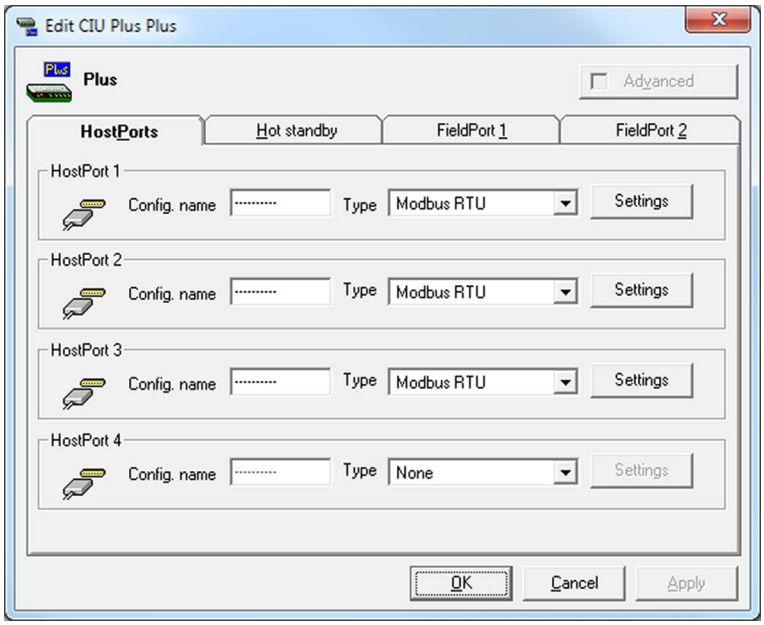

FIGURE 1-4 CIU Emulation - CIU Plus configuration settings

REMARKS:

1. Although each of the four host ports can be enabled for CIU Emulation, it is recommended to reserve HostPort 1 for connecting to Entis Pro.
2. CIU Emulation can be configured on only one of the host ports of the CIU 888. When configuring a new site, CIU Emulation is usually configured on either HostPort 2 or HostPort 4. However, if a CIU 880 database is migrated to the CIU 888, the configuration will depend on the CIU 880 Plus host ports that were configured in the first place.

Cache mode for a host port can be configured via the CIU 888 WEB-interface (see FIGURE 1-6).

NOTE: In case of 880 Migrations, Cache mode is configured in CIU web interface. For the new sites, it will be configured by Service Tool.

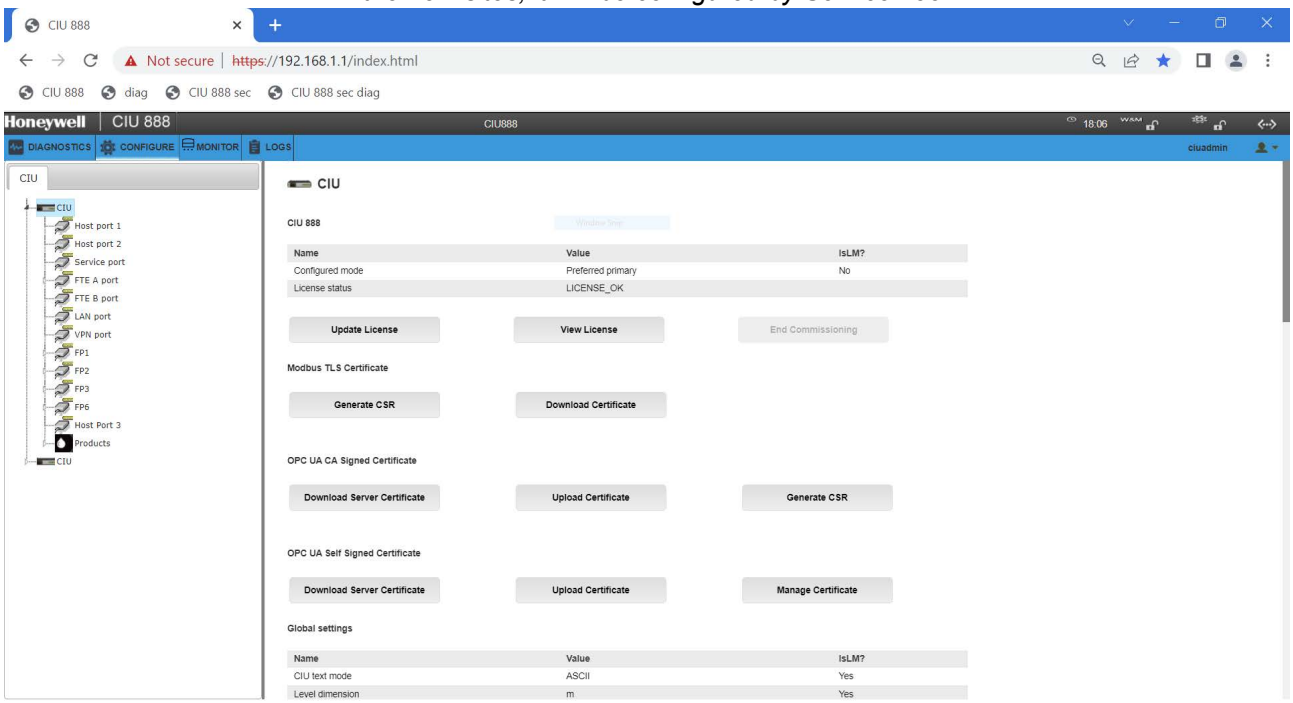

FIGURE 1-5 CIU 888 WEB-interface: Configuration of cache mode for a host port

1.2 Downlink CIU

A field port can be used to connect an existing CIU with tank gauges. This CIU is called a downlink CIU. The CIU 888 can communicate with a downlink CIU using the GPU protocol on serial (RS-232/RS-485), creating an extra layer between the CIU 888 and the tank gauges connected to the downlink CIU. The following CIUs can act as a downlink CIU:

- CIU 858
- SmartLink
- in principle, a CIU Prime or a CIU 888 when it has CIU emulation enabled

The downlink option is especially useful in situations where there are CIU 858s in the field that act as switches and are spread across the site. In this situation, only the ‘main’ CIU (probably a CIU 880) need to be replaced by a CIU 888 leaving the CIU 858s intact.

1.3 Addressing

1.3.1 RS-232 point-to-point configuration

When a host connected to the CIU 888 sends a GPU message (i.e. request) to a gauge, the CIU 888 interprets the message and tries to determine which field port the gauge is connected to.

In order to find out this, the CIU 888 takes the first digit of the three-digit gauge address (e.g. 402BB) in the request and compares it with the last digit of the RTU address (e.g. 54) defined for the host port. If the digits are not equal, the CIU 888 sends the request (inclusive CIU address) to all configured field ports that support the GPU protocol (see FIGURE 1-6).

If, on the other hand, those digits match, the CIU 888 uses the second and third digit of the gauge address (02 in the example above) to determine if the gauge is already configured in the site database. If this is the case, the CIU 888 is able to determine the field port where the gauge is connected to and forwards the request to the appropriate field port. A request to a gauge address that cannot be found in the database is broadcast to all field lines.

Notice that when cache mode is enabled and the received request is also part of the regular scanned items, the CIU 888 will reply with the last value stored in the database and will not forward the request to the field. In this way, faster responses are provided to the host and unnecessary overloads in the field scans are avoided. If GPU messages are addressed to gauges underneath a downlink CIU, another extra digit will be found in the request; this is: first digit for CIU address, second digit for downlink CIU, third and fourth for gauge address. Hence, the CIU 888 forwards the GPU message to the downlink CIU, which in turn forwards the message to the addressed gauge. The responses are transferred back up in a similar manner.

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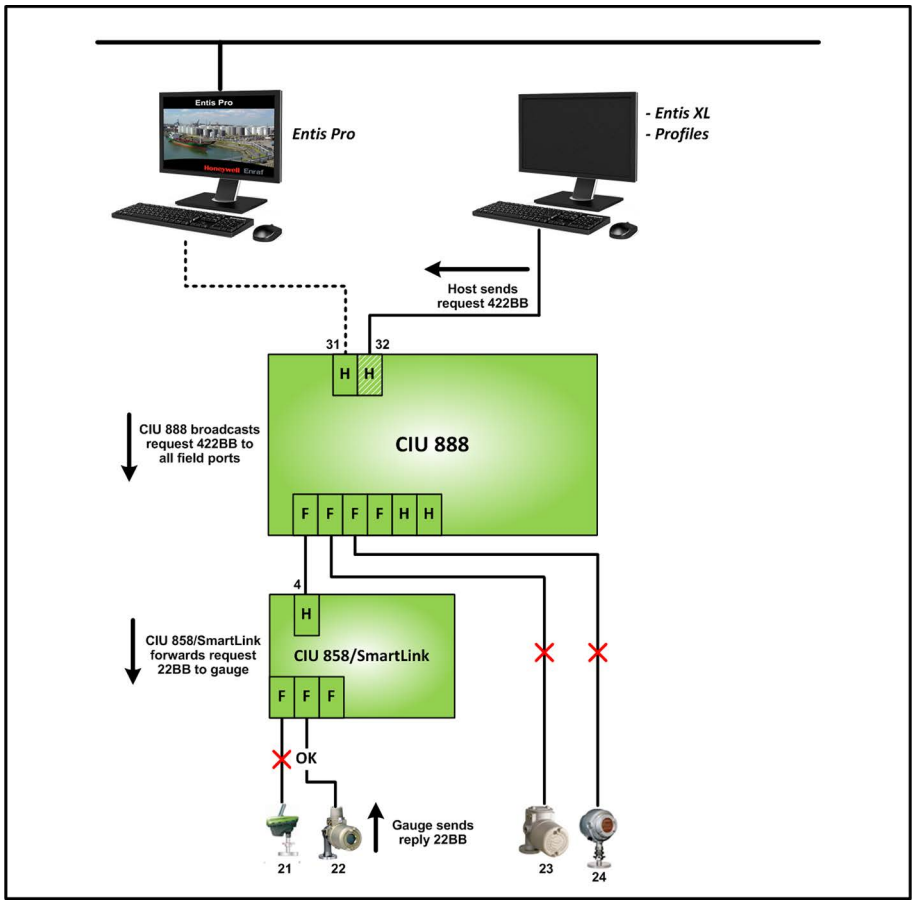


FIGURE 1-6 Schematic representation of the handling of request and reply between a host system and gauges underneath a downlink CIU in RS-232 point-to-point configuration

1.3.2 RS-485 multi-drop configuration

In case of an RS-485 multi-drop setup, there is a restriction in the use of RTU addresses. For example, RTU addresses 32 and 42 for two CIU 888s connected to the same RS-485 line will malfunction, while RTU addresses 32 and 34 will work properly (see FIGURE 1-7).

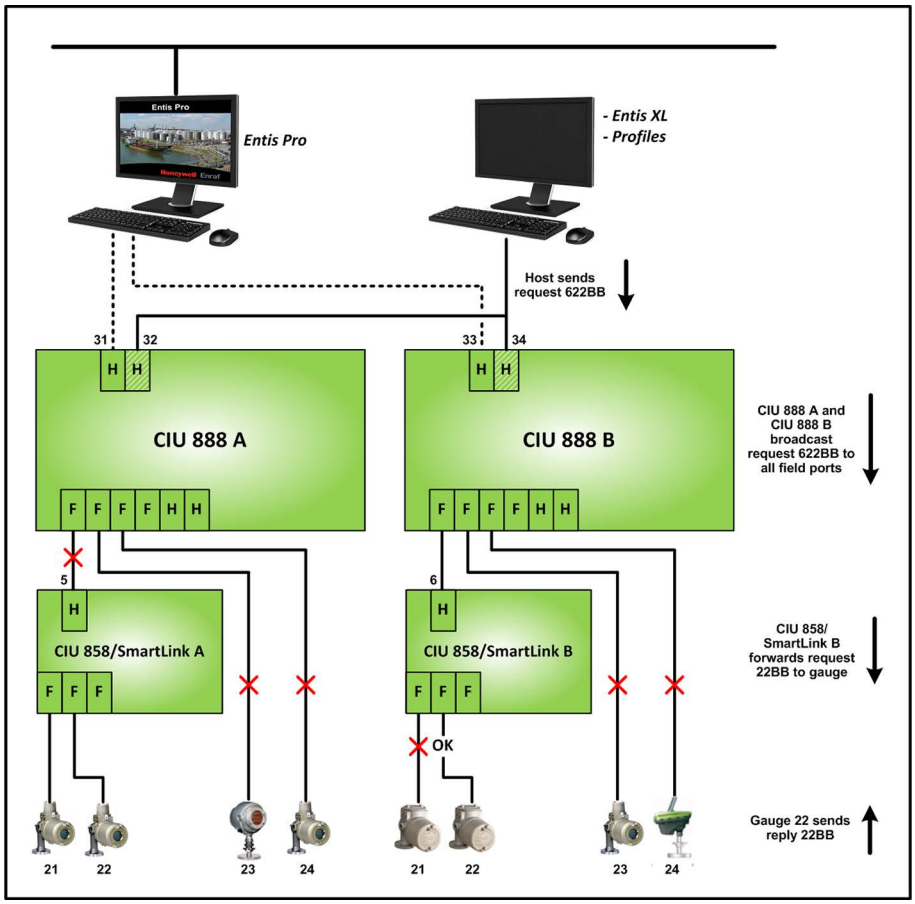


FIGURE 1-7 Schematic representation of the handling of request and reply between a host system and gauges underneath a downlink CIU in RS-485 multi-drop configuration

1.3.3 Normal mode versus MSU mode in RS-485 multi-drop configurations

In a RS-485 multi-drop configuration, it is recommended to enable MSU mode instead of Normal mode (configuration setting of the CIU Prime host port) to ensure a proper handling of requests and replies.

In Normal mode, requests are handled according to the diagram shown in FIGURE 1-8.

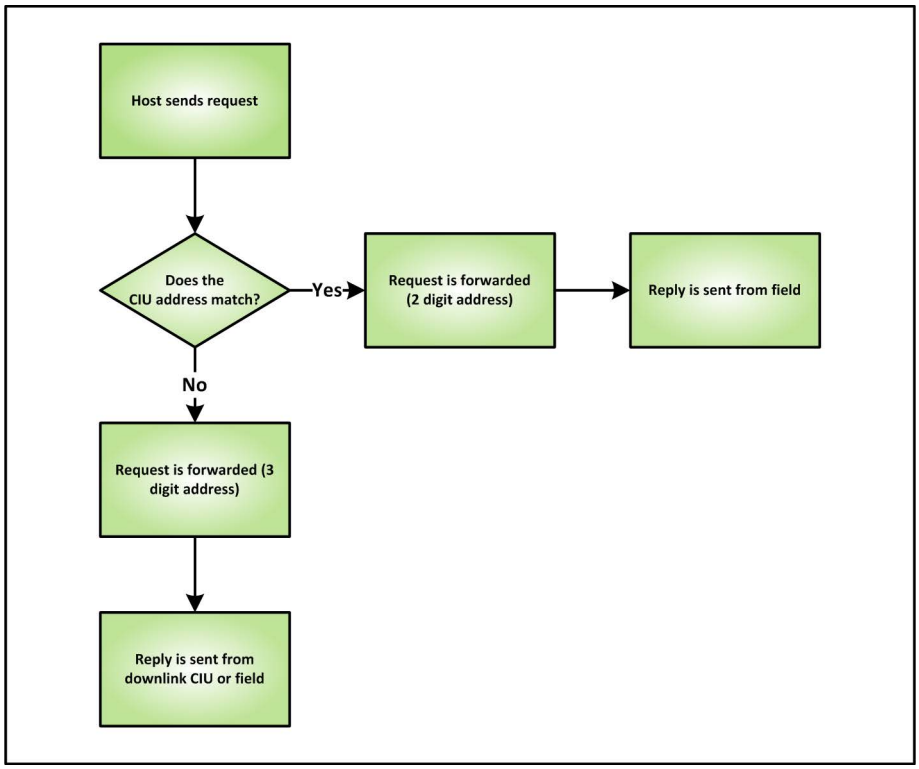


FIGURE 1-8 Diagram for handling of requests in Normal mode (MSU mode not enabled)

In MSU mode, requests are handled according to the diagram shown in FIGURE 1-9.

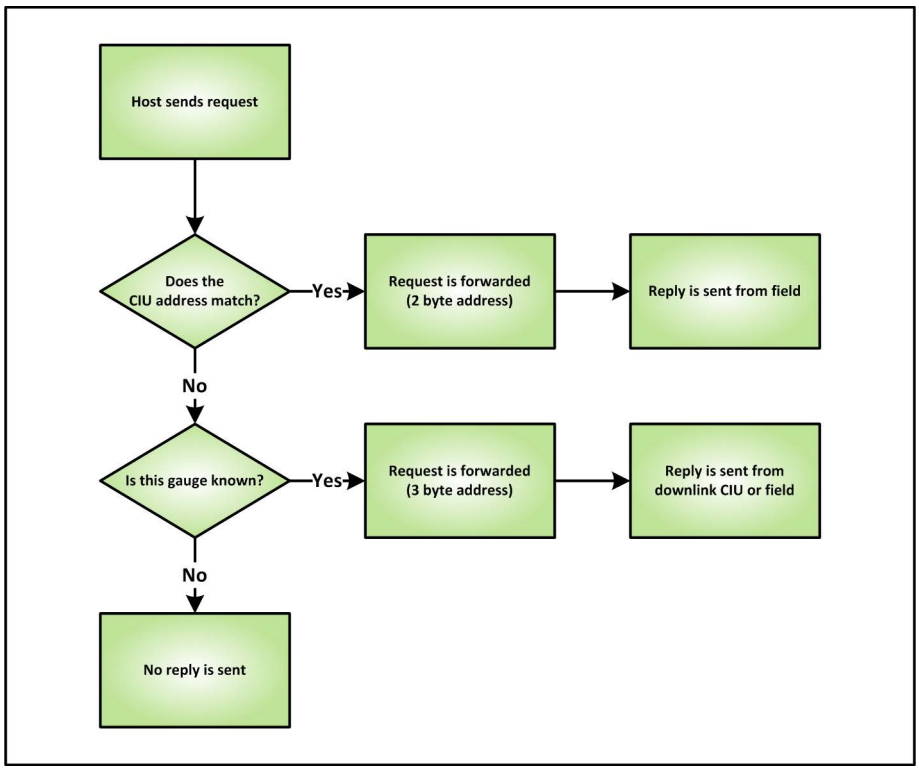


FIGURE 1-9 Diagram for handling of requests in MSU mode (MSU mode enabled)

If, in Normal mode, a request is sent to a gauge connected to a downlink CIU, and the address of the CIU or the address of the gauge does not match, time-outs will occur and notifications of these time-outs will be sent to the host system. In MSU mode, on the other hand, no time-out replies will be sent.

1.4 CIU Emulation in a redundant setup

If two CIU 888s are configured as a redundant pair and CIU Emulation is enabled, GPU requests sent to the secondary CIU 888 will be ignored.

NOTE: Refer to the Configuration Manual CIU 888 (Part No. 4417584) for more information about redundancy.

1.5 GPU protocol on serial (RS-232/RS-485)

Refer to APPENDIX A for more information about the GPU protocol.

CHAPTER 2 VIRTUAL TUNNEL

The CIU 888 allows service tools (TCP/IP clients), i.e. Engauge, to communicate with gauges via the CIU 888 using the GPU protocol on TCP/IP or FlexConn protocol on TCP/IP. The CIU 888 acts as a virtual tunnel for transmitting the GPU/FlexConn messages between the service tool connected to the Service port of the CIU 888 and the gauges connected to the CIU 888.

NOTE: 1. FlexConn is a Honeywellproprietary protocol and will not be described further in this manual.

NOTE: 2. Servicing of Honeywell BPM gauges and Honeywell TRL/2 gauges follows the below path:

FIGURE 2-1 shows a schematic representation of a Service port connection.

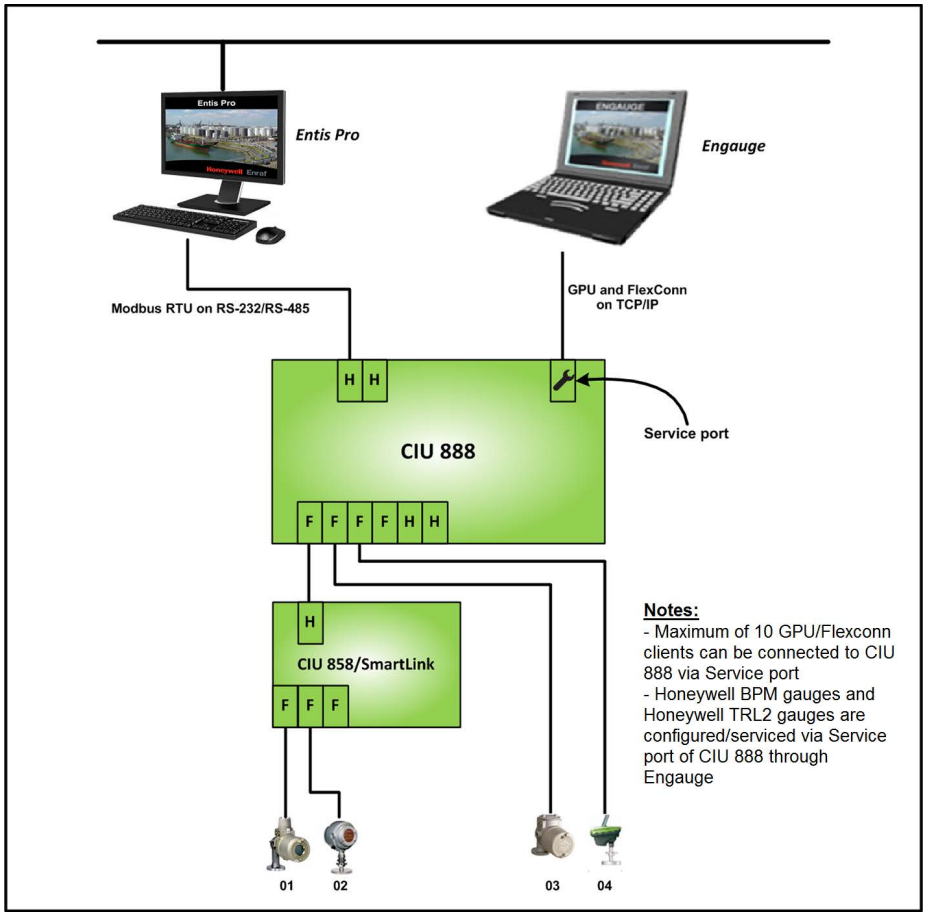


FIGURE 2-1 Schematic representation of Service port connection

2.1 Downlink CIU

The principle of a downlink CIU with gauges is for a virtual tunnel similar to that for CIU Emulation. The main difference concerns addressing, as described in section 2.2. See section 1.1 for more information about downlink CIU.

2.2 Addressing

Addressing for virtual tunnel is similar to addressing for CIU Emulation. The main difference is, that with addressing for virtual tunnel only the address of the gauge is needed, whereas with addressing for CIU Emulation both the address of the CIU 888 and the address of the gauge are needed. With addressing for virtual tunnel, the CIU address is not needed, because an IP address is used to address the CIU 888. See section 1.3 for more information about addressing.

As with CIU Emulation, cache mode is also supported. Service tools (TCP/IP clients) connected to the Service port of the CIU 888 can retrieve cached data if they are connected through port 55598, or non cached data through port 55597.

2.3 Virtual tunnel in a redundant setup

If two CIU 888s are configured as a redundant pair and virtual tunnel is enabled, requests for connection sent to the service port of the secondary CIU 888 will be rejected.

NOTE: Refer to the Configuration Manual CIU 888 (Part No. 4417584) for more information about redundancy.

2.4 GPU protocol on TCP/IP

The GPU protocol on TCP/IP is similar to the GPU protocol on serial (RS-232/RS-485). The main difference concerns addressing, as described in section 2.2. See APPENDIX A for more information about the GPU protocol.

2.5 Configuration through Service port

To setup a virtual tunnel, a PC/laptop with Honeywell's Engauge installed is needed. Engauge is a software tool designed to configure, commission and adjust Honeywell's gauging instruments. In addition, a Cat. 5 Ethernet cable is required.

NOTE: Refer to the Installation and Operation Manual Engauge 2.6 - Professional (Part No.: 4417485) for more information about Engauge.

Perform the following steps to set up a virtual tunnel:

1. Connect the PC/laptop with Engauge installed to the Service port of the CIU 888 using the Ethernet cable. The Service port is located at the front of the CIU 888 (see FIGURE 2-2).

FIGURE 2-2 CIU 888: Service port

2. Launch Engauge by clicking **Start** > **All Programs** > **Honeywell**> **Configuration** > **Engauge**.
   When Engauge is launched, the *Site Explorer* window is displayed (see FIGURE 2-3):

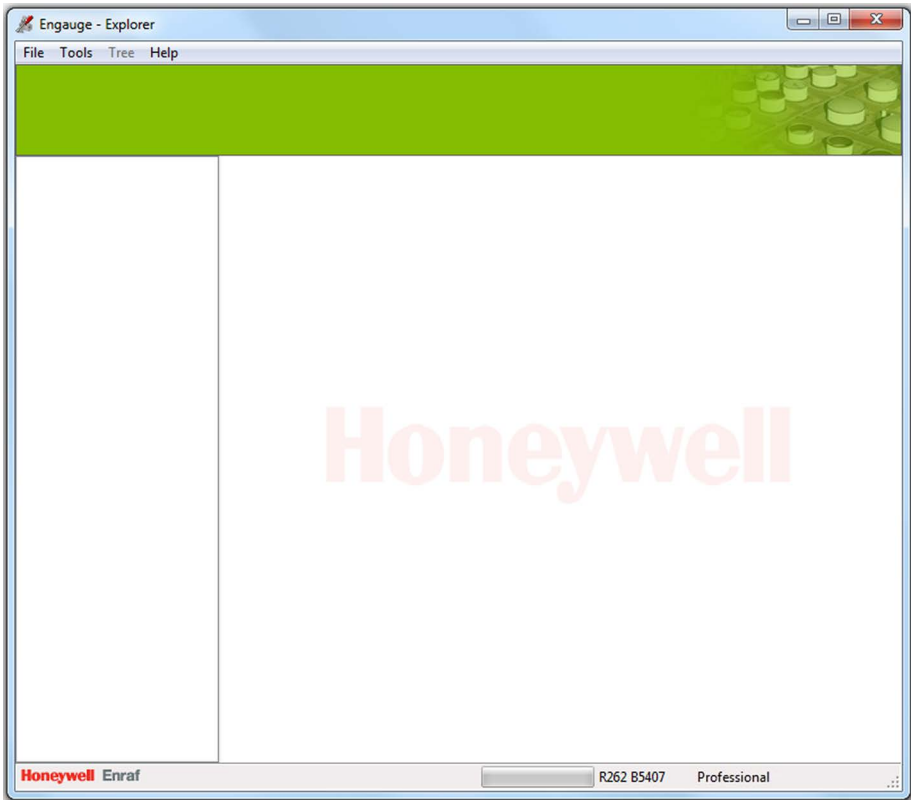


FIGURE 2-3 Engauge: *Site Explorer* window

3. Create a new site:
   a) From the *File* menu, select **New** > **Site...**.
      The *Site control* window is displayed (see FIGURE 2-4).

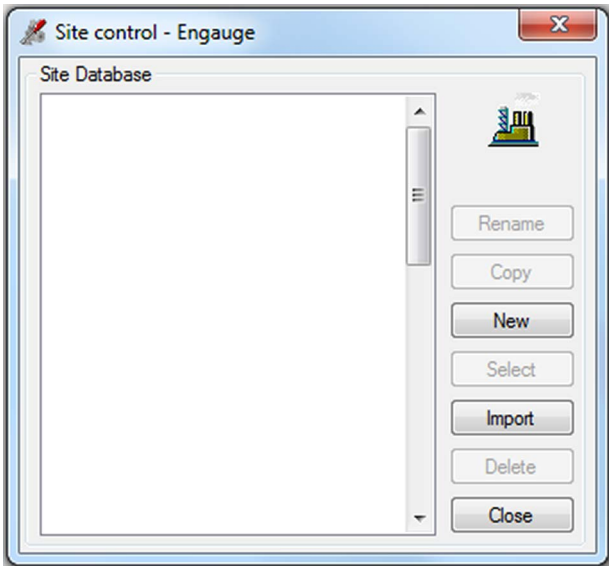


FIGURE 2-4 Engauge: *Site control* window

   b) Click **New**.
      The *Site Name* window is displayed (see FIGURE 2-5).

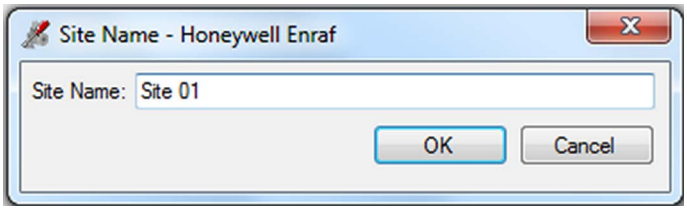


FIGURE 2-5 Engauge: *Site Name* window

c) Enter the site name in the text entry box. Next, click **OK**.
The *Global Settings* window is displayed (see FIGURE 2-6).

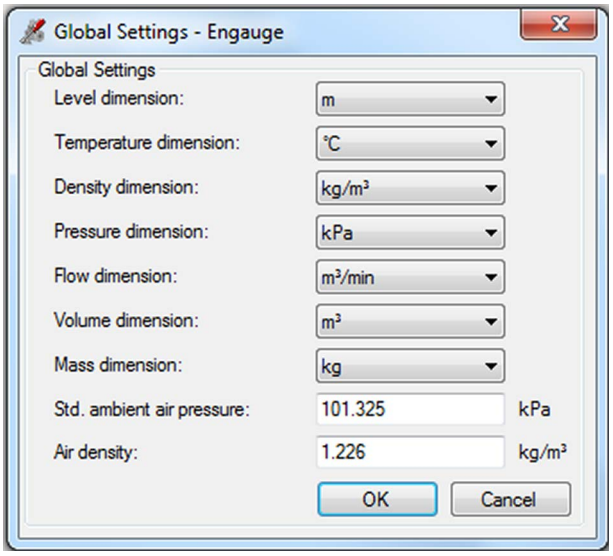


FIGURE 2-6 Engauge: *Global Settings* window

d) Select the dimensions to be used in the site. Next, click **OK**.
A dialogue box will be displayed to confirm the settings.

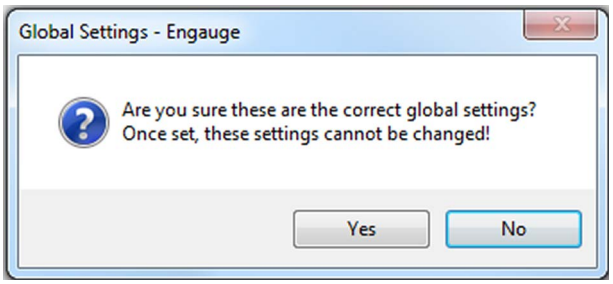


FIGURE 2-7 Engauge: Global settings confirmation dialogue box

e) Click **YES** to confirm the settings.
The site is created and the properties of the site are displayed in the right pane of the *Site Explorer* window.

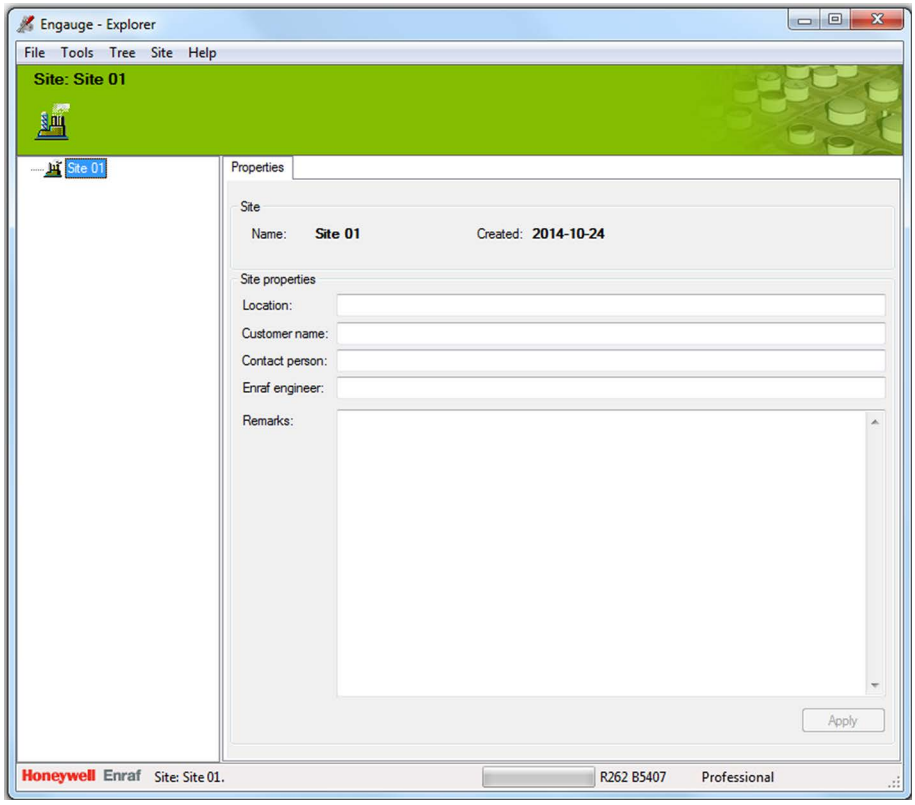


FIGURE 2-8 Engauge: *Site Explorer* window - Site created

f) If necessary, update the properties of the site. Next, click **Apply**.

4. Add a device (i.e. the CIU 888) to the site:

a) Right-click the site name in the site tree, and then click **Add Device** > **TCP/IP** in the pop-up menu.
The *Ethernet Port* window is displayed.

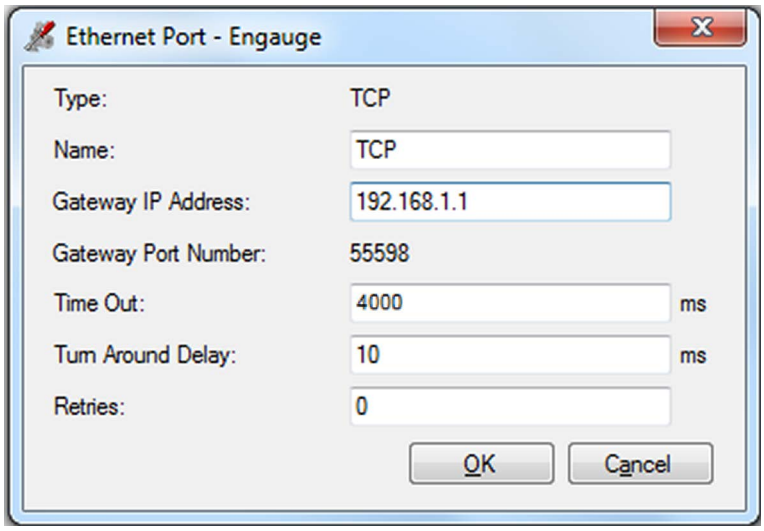


FIGURE 2-9 Engauge: *Ethernet Port* window

b) Enter the properties of the device. In the *Gateway IP Address* text entry box, enter the IP address of the CIU 888, i.e. **192.168.1.1**.In the *Time Out* text entry box, enter 4000. The other settings can be left as they are. Next, click **OK** to save the settings and to close the *Ethernet Port* window.

*NOTE: When Honeywell TRL/2 gauges are connected to CIU 888, configure **Time Out** as **8000** and **Retries** as **3***

The device is added to the site and is displayed in the Site Explorer window (see FIGURE 2-10).

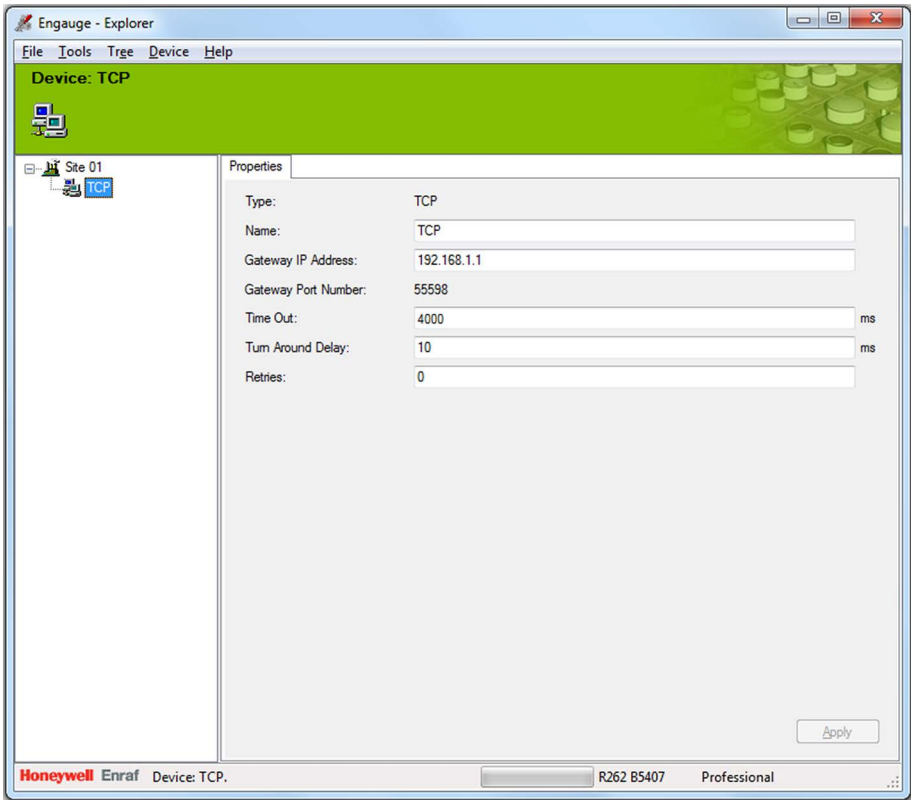


FIGURE 2-10 Engauge: *Site Explorer* window - Device created

5. Perform a TCP/IP site scan:
   a) In the *Site Explorer* window, right-click the device name in the site tree, i.e. TCP. Next, click **Start TCP/IP Site Scan...** in the pop-up menu (see FIGURE 2-11).

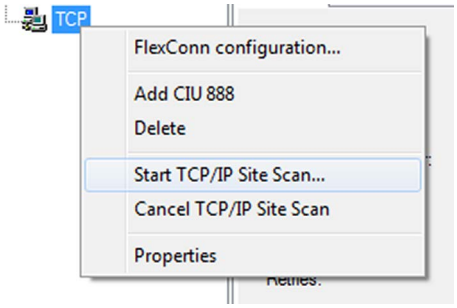


FIGURE 2-11 Engauge: *TCP* pop-up menu

The *TCP/IP Site Scan* window is displayed (see FIGURE 2-12).

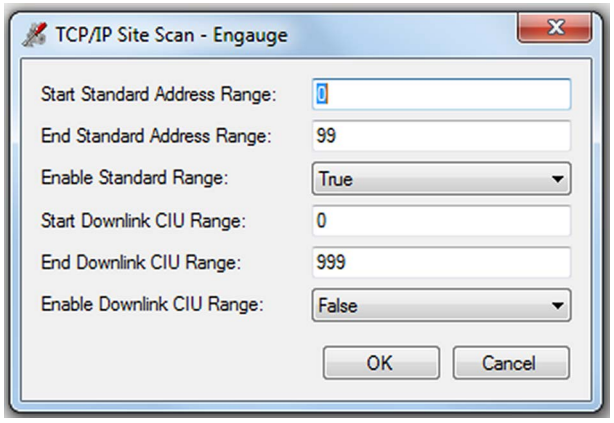


FIGURE 2-12 Engauge: *TCP/IP Site Scan* window

b) Click **OK**.
The TCP/IP site scan is performed. The progress of the scan in displayed at the bottom of the window (see FIGURE 2-13).

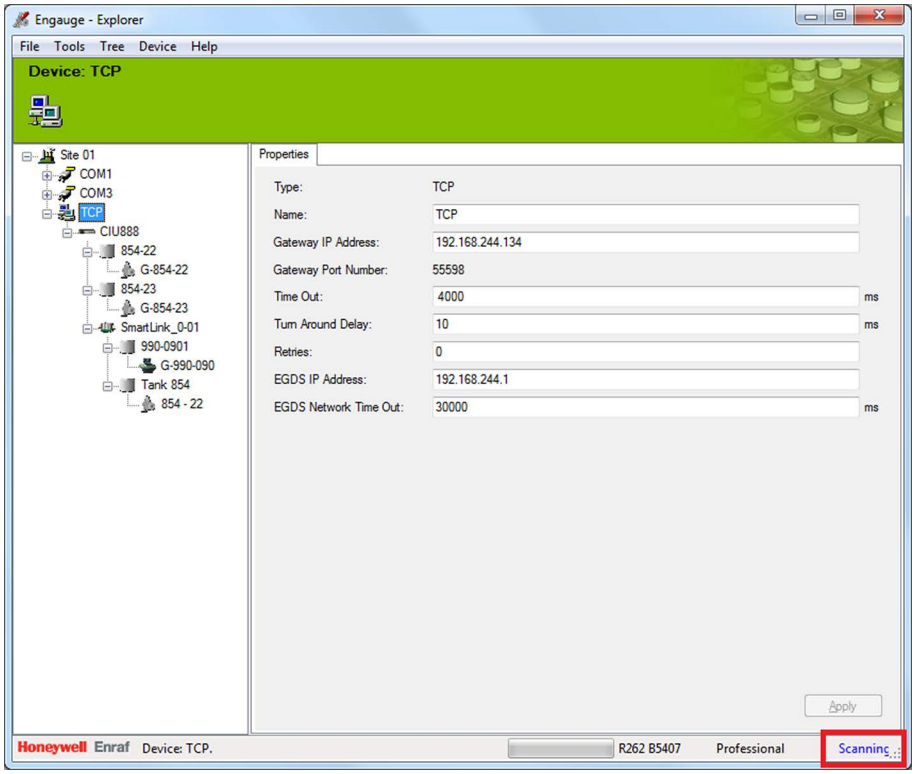


FIGURE 2-13 Engauge: *Site Explorer* window - TCP/IP site scan in progress

When the TCP/IP site scan is complete, all ports, devices, tanks and gauges that were detected during the TCP/IP site scan are displayed (see FIGURE 2-14).

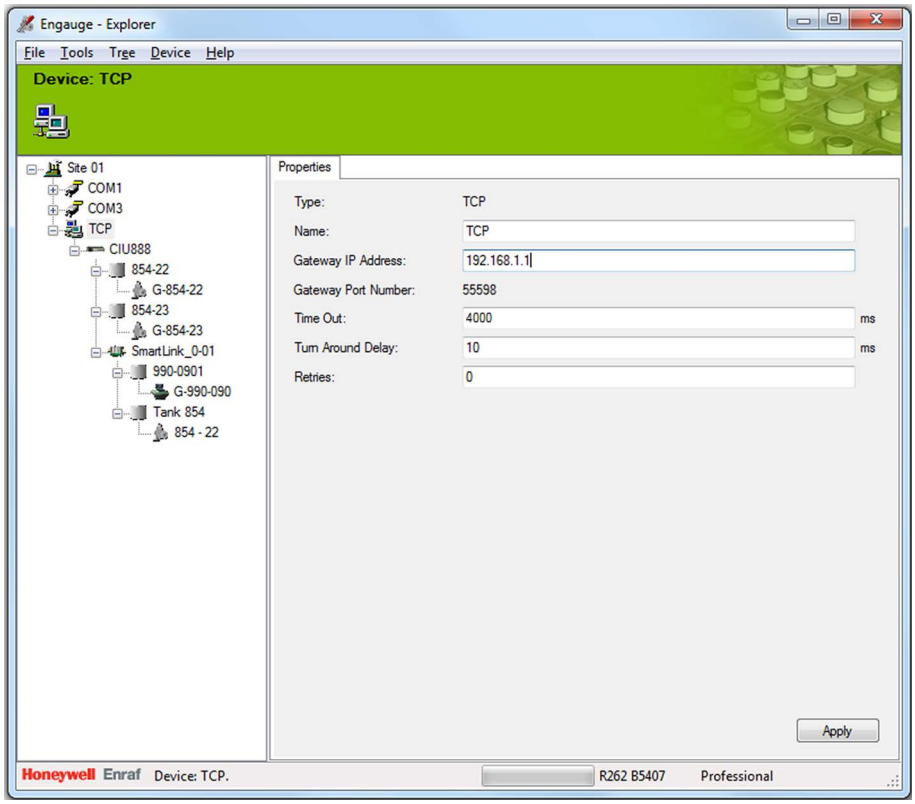


FIGURE 2-14 Engauge: *Site Explorer* window - TCP/IP site scan complete

CHAPTER 3 MODBUS EMULATION

The CIU 888 allows Emerson service tool, i.e. TankMaster Winsetup, to communicate with Emerson Rex gauges via the CIU 888 using the Modbus RTU protocol. The CIU 888 acts as a transparent tunnel for transmitting the Modbus RTU messages between the Emerson service tool connected to the serial host port (RS-232/RS-485) of the CIU 888 and the Rex gauges connected to the CIU 888.

Any serial host port of CIU 888 can be configured for Modbus emulation.

For CIU Emulation, perform the following configurations:

- Configure host port for Modbus Emulation (See section 3.1)
- Configure field port communication settings.

NOTE: Set 1000 ms as TRL/2 field port timeout and Refer to the Configuration Manual CIU 888 (Part No. 4417584) for more information about the configuration of the field port communication settings.

FIGURE 3-1 shows a schematic representation of a Service port connection.

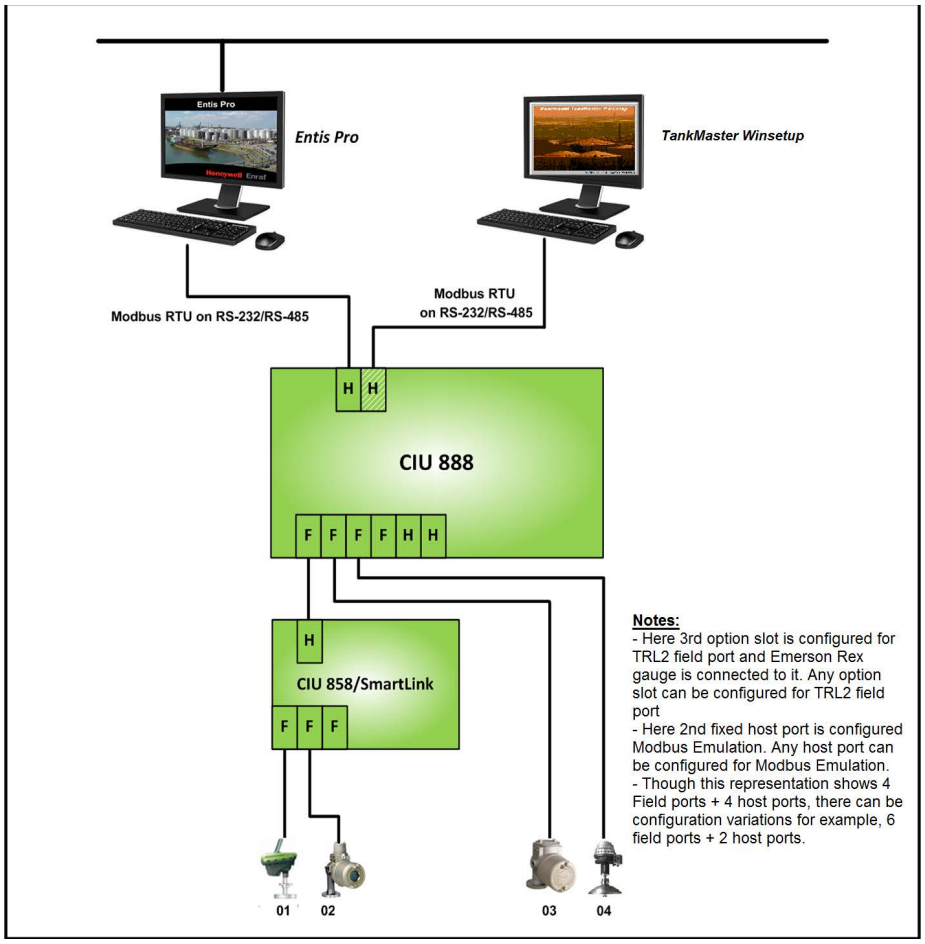


FIGURE 3-1 Schematic representation of Modbus Emulation in the CIU 888

3.1 Modbus Emulation Configuration Procedure

3.1.1 Configuring a host port for MODBUS Emulation using Service tool

The following configuration settings in Service tool need to be applied to enable Modbus Emulation for one of the host ports of the CIU 888.

NOTE: Refer to the Configuration Manual CIU 888 (Part No. 4417584) for more information about the commissioning and configuration of the CIU 888

1. On the **HostPort** tab, Set the **Protocol Type** property to **Modbus RTU** and set the **Modbus Mode** property to **Modbus Emulation** (or)

Modbus Slave and **Modbus Emulation** (see figure 3-2). Refer to Table 3-1 for more details on **Modbus mode** property.

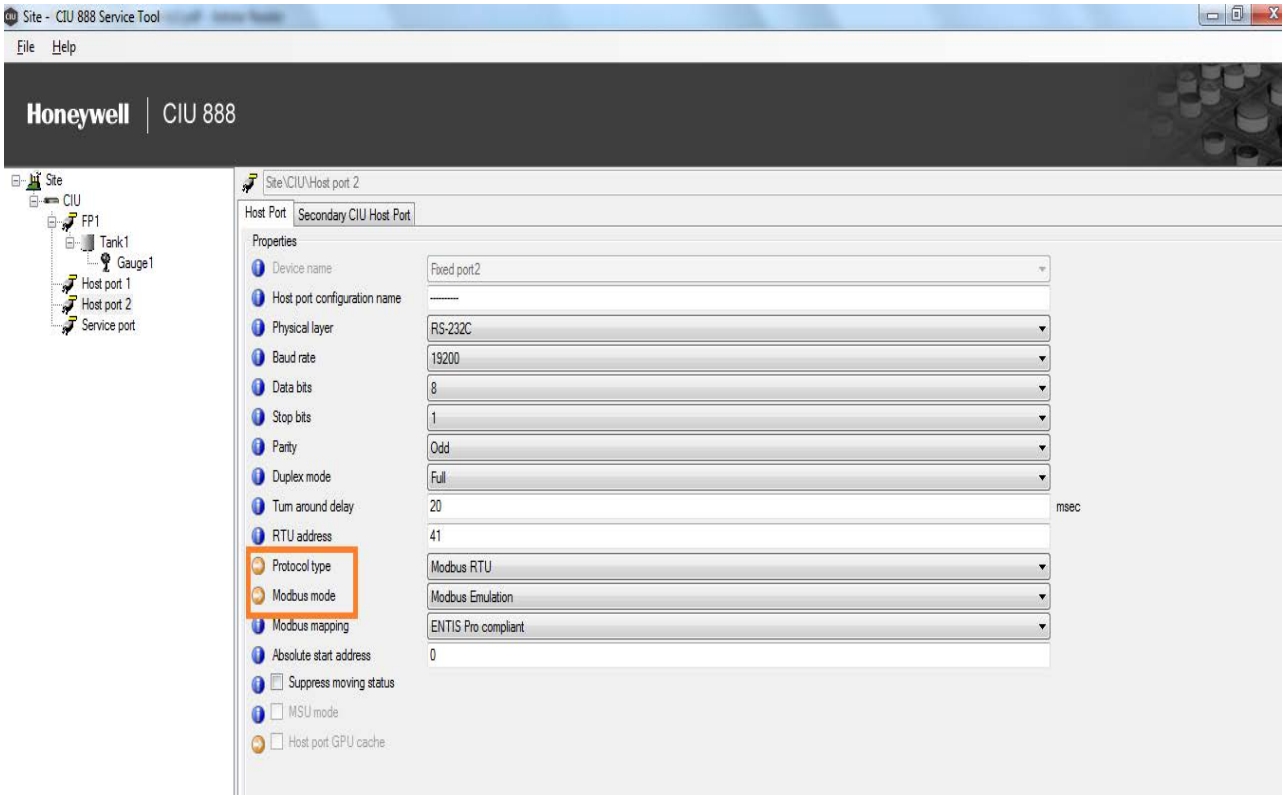


FIGURE 3-2 Modbus Emulation - Service Tool

3.1.2 Modbus Mode

When host port is configured for Modbus RTU protocol, Modbus Mode property indicates the operation mode for the host port. Refer to the Table 3-1 for the supported operation modes.

TABLE 3-1 Modbus Operation Modes

Modbus Mode	Description
Modbus Slave	This mode is used when Entis Pro, other DCS / SCADA / PLC is connected to CIU 888 and requesting for tank data. This is CIU 880 compatible Modbus mode. In this mode, CIU 888 acts a Modbus slave and services the Modbus requests similar to that of CIU 880.
Modbus Emulation	This mode is used when TankMaster Winsetup is connected to CIU 888 to service Emerson Rex gauges. In this mode, CIU 888 acts as a transparent Modbus tunnel and passes all the Modbus requests from TankMaster Winsetup to the field Emerson Rex gauges.

Modbus Mode	Description
Modbus Slave and Modbus Emulation	This mode is used when we have limited number of host ports in CIU 888 and there is no host port dedicated for Modbus Emulation. In this mode, Entis Pro / SCADA / DCS / PLC and TankMaster Winsetup can be connected a host port one at a time without any CIU 888 configuration change. In this mode, CIU 888 acts as a Modbus Slave for the Modbus requests with RTU address of the CIU 888's host port and CIU 888 acts as a Modbus tunnel and passes others Modbus requests from TankMaster Winsetup to the Emerson Rex gauges.

3.2 Modbus Emulation in a redundant setup

If two CIU 888s are configured as a redundant pair and Modbus Emulation is enabled, Modbus RTU tunnel requests sent to the secondary CIU 888 will be ignored.

NOTE: Refer to the Configuration Manual CIU 888 (Part No. 4417584) for more information about redundancy.

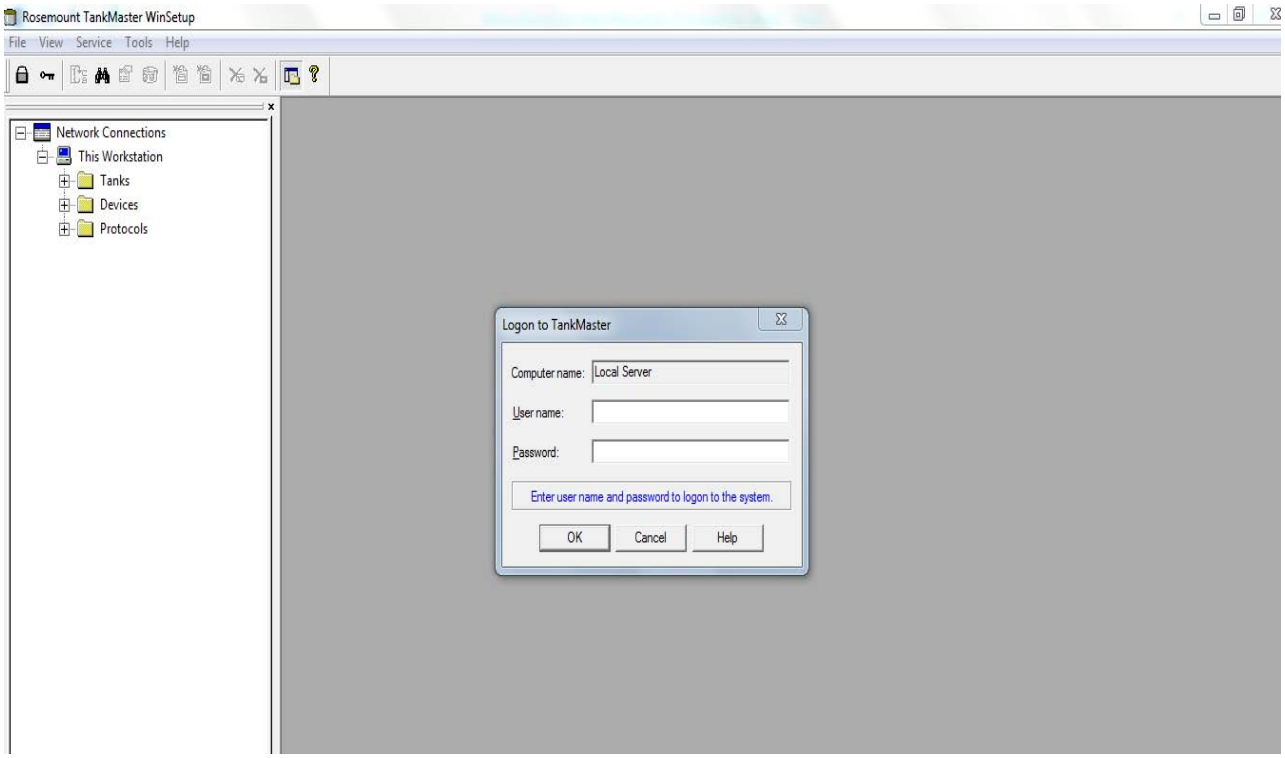
3.3 Emerson Rex Gauge Configuration through host port

A PC/laptop with TankMaster Winsetup installed is needed. TankMaster Winsetup is a software tool designed to configure, commission and service Emerson Rex Gauges. The PC/laptop is connected to CIU 888's serial host port and the serial host port is configured for Modbus Emulation.

Perform the following steps to configure Rex Gauges via CIU 888:

1. Connect the PC/laptop with TankMaster Winsetup installed to the serial host port of CIU 888 using RS-232 / RS-485 cable.

2. Launch TankMaster Winsetup by clicking **Start** > **All Programs** > **Rosemount TankMaster** > **WinSetup** and login in by providing the credentials.



3. Select the Rex gauge in the tree view and perform the required gauge configuration / servicing operations.

NOTE: Refer to the TankMaster Winsetup User guide for more information about Rex Gauge configuration and servicing procedure.

APPENDIX A GPU COMMUNICATION PROTOCOL

A.1 Introduction

The CIU 888 uses a communication protocol based on a request/reply schedule. The protocol consists of command records and answer records.

A record consists of a data field packed in an envelope. The envelope allows the receiver to detect the incoming record and to verify its proper reception.

A record consists of the following items:

STX	DATAFIELD	ETX	BCC

Item	Description
STX	Start of Text Character (ASCII value 02)
DATA FIELD	Data field packed in an envelope
ETX	End of text character (ASCII value 03)
BCC	Block Check Character

The general form of a communication record is as follows:

STX	ADDRESS(ES)	TOI	TOR	(DATA)	ETX	BCC

A.2 Command records

The following records can be sent to the CIU.

- CIU individual command records, see section A.2.1
- Instrument individual command records, see section A.2.2
- Instrument group command records, see section A.2.3

A.2.1 CIU individual command record

This command is executed in the addressed CIU, which sends back an answer record.

STX	N	TOI	TOR	ETX	BCC

Item	Position(s)	Description
STX	1	Start of Text Character (= Start of transmission)
N	2	CIU address (0-9)
TOI	3	R CIU-GPU version
TOR	4	X Send identify record
ETX	5	End of Text Character (End of transmission)
BCC	11	Block Check Character

A.2.2 Instrument individual command record

The CIU will pass on these records (without the CIU address) to any connected field instrument.

STX	N	nn	TOI	TOR	ETX	BCC

Field	Position(s)	Description
STX	1	Start of Text Character (Start of transmission)
N	2	CIU address (0-9)
nn	3, 4	Instrument address (00-99)
TOI	5	Type of Instrument: • B = 811, 854, 873 instrument with GPU protocol and instruments with Gauge type B • C = Instruments with Gauge type C • E = 811 instrument with external alarms and instruments with Gauge type E • @ = Any type
TOR	6	Type of Record See the *Protocol Manual* of the related field instrument for more information.
ETX	7	End of Text Character (End of transmission)
BCC	8	Block Check Character

REMARK: The value referring to the CIU address (i.e. 'N') will not be part of the GPU commands in case of TCP/IP communication.

A.2.3 Instrument group command record

The instrument group commands are transmitted (without the CIU address) to every connected instrument.

STX	N	n	n	TOI	TOR	ETX	BCC

Field	Position(s)	Description
STX	1	Start of Text Character (Start of transmission)
N	2	CIU address (0-9)
nn	3, 4	Instrument address (00-99): • ** = The command is intended for all connected instruments. • *n = The command is intended for all instruments ending with instrument address n. • n* = The command is intended for all instruments starting with instrument address n.
TOI	5	Type of Instrument: • B = 811, 854, 873 instrument with GPU protocol and instruments with Gauge type B • C = Instruments with Gauge type C • E = 811 instrument with external alarms and instruments with Gauge type E • @ = Any type
TOR	6	Type of Record See *Protocol Manual* of the related field instrument for more information.
ETX	7	End of Text Character (End of Transmission)
BCC	8	Block Check Character

REMARK: The value referring to the CIU address (i.e. 'N') will not be part of the GPU commands in case of TCP/IP communication.

A.3 CIU answer records

The following records are transmitted to the computer system after reception of a CIU individual command record.

A.3.1 X-record (Identification record)

For compatibility reasons the X-record is implemented. A default answer will be given.

STX	N	RX888 R100	ETX	BCC

Item	Position(s)	Description
STX	1	Start of Text Character (Start of transmission)
N	2	CIU address (0-9)
RX888 R100	3...9	Default answer
ETX	10	End of Text Character (End of transmission)
BCC	11	Block Check Character

A.3.2 Time-out record

A time-out record will be transmitted to the computer system after an instrument group command is transmitted to the connected field instruments. The time-out record will also be transmitted if there was a malfunction in the field or in case a field instrument is not responding.

STX	N	@	0	ETX	BCC

Item	Position	Description
STX	1	Start of Text Character (Start of transmission)
N	2	CIU address (0-9)
@	3	Type of instrument is CIU858 compatible
0	4	(Zero) error code (default is 0)
ETX	5	End of Text Character (End of transmission)
BCC	6	Block Check Character

A.4 Instrument answer records

After a correctly received instrument individual command, the addressed instrument will answer to the CIU. This answer is passed on to the computer system by the CIU (the CIU adds its own address to the record).

STX	N	n	n	TOI	TOR	data	data	....	data	ETX	BCC

Item	Position	Description
STX	1	Start of Text Character (Start of transmission)
N	2	CIU address
nn	3, 4	Instrument address
TOI	5	Type of Instrument: • B = 811, 854, 873 instrument with GPU protocol and instruments with Instrument type B • C = Instruments with Gauge type C • E = 811 instrument with external alarms and instruments with Gauge type E
TOR	6	Type of Record See *Protocol Manual* of the related field instrument for more information.
data	7, 8	For the data in answer record, see Protocol Manual
ETX	n-1	End of Text Character (End of transmission)
BCC	n	Block Check Character

A.5 BCC calculation

The Block Check Character (BCC) is calculated by taking the binary sum without carrying over the seven individual data bits (exclusive or) of all transmitted bytes, according to ANSI standard X3.28 - 1976. STX is excluded; ETX is included. The BCC is also called the 'horizontal parity check'.

Since the BCC summation can produce any one of the 128 code combinations, be sure to interpret it as the BCC, not as something else. For example, if the value of the BCC is 02 hexadecimal do not read this as an STX character.

Here is the answer record from the CIU to the computer system:

STX	1	R	X	8	8	8		R	1	0	0	ETX	BCC

Spelled out in bits:

Char	Parity	b6	b5	b4	b3	b2	b1	b0	Comment
STX	0	0	0	0	0	0	1	0	Start of transmission (excluded from BCC calculation)
1	0	0	1	1	0	0	0	1	CIU address
R	0	1	0	1	0	0	1	0	
X	0	1	0	1	1	0	0	0	
8	0	0	1	1	1	0	0	0	
8	0	0	1	1	1	0	0	0	
8	0	0	1	1	1	1	0	0	
	0	0	1	0	0	0	0	0	Space
R	0	1	0	1	0	0	1	0	
1	0	0	1	1	0	0	0	1	
0	1	0	1	1	0	0	0	0	
0	1	0	1	1	0	0	0	0	
ETX	1	0	0	0	0	0	1	1	End of transmission
BCC	0	1	0	0	0	0	1	1	Calculated over 7 bits

A.6 ACK characters

The computer system always initiates communication with the CIU using a command record. After sending this record, the computer system must wait for a reply from the CIU in the form of an answer record. After the turn around time, an answer record may be sent.

But if the CIU is still busy preparing its reply - or if it is otherwise engaged in field communication - the CIU transmits ACK characters about every 50 milliseconds. These characters are an acknowledgment of the command record, and show that the CIU intends to send an answer record to the computer system as soon as possible. The timeout period of the computer system should start again on reception of an ACK character from the CIU. When a command record is accepted and being processed (i.e. ACK characters are sent every 50 milliseconds) a new command is not accepted. The CIU 888 service tool and CIU 888 web interface provides an option to disable the ACK characters sent to the host system, refer to the Configuration Manual CIU 888 (Part No. 4417584) for more information.

APPENDIX B LIST OF ABBREVIATIONS

Abbreviation	Description
BCC	Block Check Character
CIU	Communication Interface Unit
ETX	End of Text Character
GPU	Gauge Processing Unit
IP	Internet Protocol
STX	Start of Text Character
TCP	Transmission Control Protocol
TOI	Type Of Instrument
TOR	Type Of Record
TRL	Tank Radar Level

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