

UCI-108 User Manual / Installation Guide

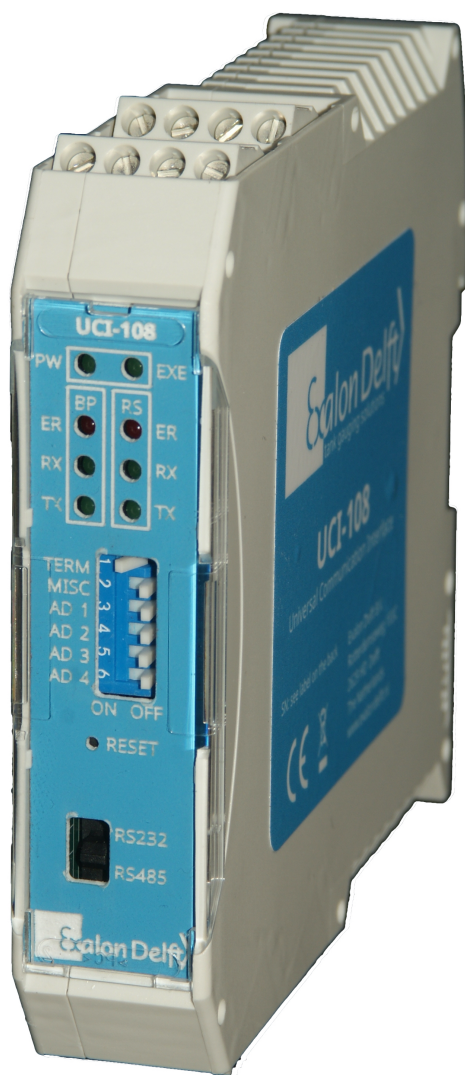


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1 Preface

1.1 Document conventions

Warnings, Cautions and **Notes** are used throughout this installation guide to bring special matters to the immediate attention of the reader.

- A Warning concerns danger to the safety of the technician or user.
- A Caution draws the attention to an action which may damage the equipment.
- A Note points out a statement deserving more emphasis than the general text.

1.2 Preface

This installation guide is intended for technicians involved in the mechanical and electrical installation of the Exalon Delft UCI-108. The technician must have basic technical skills and knowledge of safety regulations.

1.3 Legal aspects

The information in this installation guide is the copyright property of Exalon Delft B.V., Netherlands. Exalon Delft B.V. disclaims any responsibility for personal injury or damage to equipment caused but not limited by:

- Deviation from any of the prescribed procedures.
- Execution of activities that are not prescribed.
- Neglect of the general safety precautions for handling tools, use of electricity and microwave radiation.

The contents, descriptions and specifications are subject to change without notice. Exalon Delft B.V. accepts no responsibility for any errors that may appear in this installation guide.

1.4 EU Declaration of Conformity

This Exalon Delft instrument is in conformity with all applicable EC Council Directives, including the EMC Directive 2014/30/EU. Refer to the EC Declaration of Conformity supplied with each instrument separately.

1.5 Additional information

Please do not hesitate to contact Exalon Delft or its representative if you require additional information.

2 Introduction

2.1 What is the UCI-108?

The UCI-108 is a multipurpose Bi-Phase Mark (BPM) communication interface supporting the Honeywell-Enraf¹ GPU/Flexconn protocol, one of the world's standard fieldbuses in tank gauging.

Primarily the UCI-108 converts serial RS232/RS485 GPU/Flexconn communication messages to the BPM-GPU/Flexconn fieldbus and the other way around.

Due to its scalable design advanced functions can be realized by combining multiple UCI-108s. LED indicators on the front show diagnostic information like communication activity and BPM signal quality.

2.1.1 Limitations

The UCI-108 supports:

- 1 Host Port and 1 Field Port
- 15 Field Devices on the BPM Field Port
- GPU messages up to 192 bytes long
- Flexconn messages up to 192 bytes long
- Modbus RTU messages up to 128 bytes long
- 50 cached GPU responses

¹ Honeywell-Enraf, Enraf, Honeywell are registered trademarks and trademarks of these organizations and companies. All other marks are property of their respective owners.

3 Connecting the UCI-108

The UCI-108 is a DIN-rail mountable product compatible with EN-IEC60715, mounting rail 35x7,5 mm. Multiple UCI-108s can be interconnected by DIN rail bus connectors forming a UCI-108 node.

The UCI-108 has three terminal blocks and one connector for connecting:

- Power supply (on top)
- BPM bus (on top)
- RS232/RS485 bus (on bottom)
- Interconnect by DIN rail bus (at the back side)

3.1 Power supply

Each UCI-108 has to be individually powered by means of the power terminals on top marked with 24V and GND, see Figure 1. The power terminal block provides double terminals for easy daisy-chaining power to the next module in a multi UCI-108 node. The power supply must comply with 24 Vdc +/- 5% and minimal 80 mA per module.

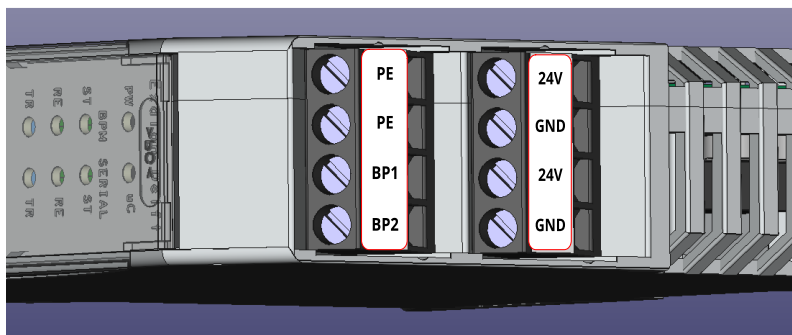


Figure 1: Top connectors

3.2 BPM bus

The BPM bus wires should be connected to BP1 & BP2, see Figure 1. The PE marked terminals are for Protective Earth.

The BPM cable shield has to be connected at one location to the Protective Earth.

3.3 RS232/RS485 serial bus

The RS serial bus should be connected to the terminals with labels A/RX, B/TX and GND terminals. See Figure 2 and Table 1 below.

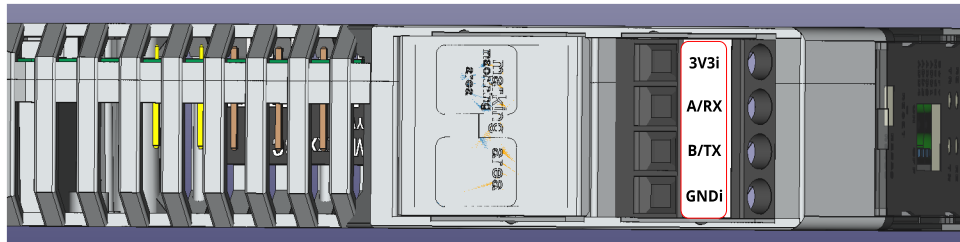


Figure 2: Bottom connectors

Table 1: RS232/RS485 connection

UCI-108 RS232/RS485	RS232 DTE DB9 male	RS485
3V3i		
A/RX	TX (pin 3)	DATA+
B/TX	RX (pin 2)	DATA-
GNDi	GND (pin 5)	GND

Note: RS232 TX is connected to the UCI-108 RX, RS232 RX is connected to UCI-108 TX.

The **3V3i** and **GNDi** is available as an isolated voltage to an optional RS485 external biasing and termination resistor network.

On the RS serial RS the UCI-108 uses the configured baudrate. The other communication settings like number of data bits, parity and number of stopbits are fixed to 8N1, see also Paragraph 5.2.

3.4 Interconnect

The UCI-108 has a PCB bus connector for optional use in a multi UCI-108 node configuration. The UCI-108 is placed in one of the assembled DIN rail bus connectors mounted on the DIN rail forming the local communication bus.

Note: the optional DIN rail bus connector(s) has to be ordered separately.

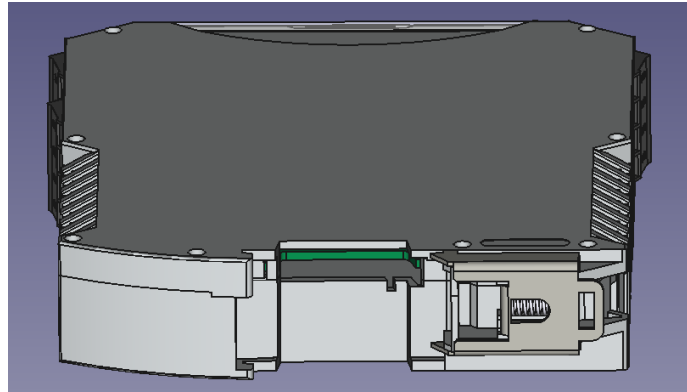


Figure 3: Back plane PCB connector

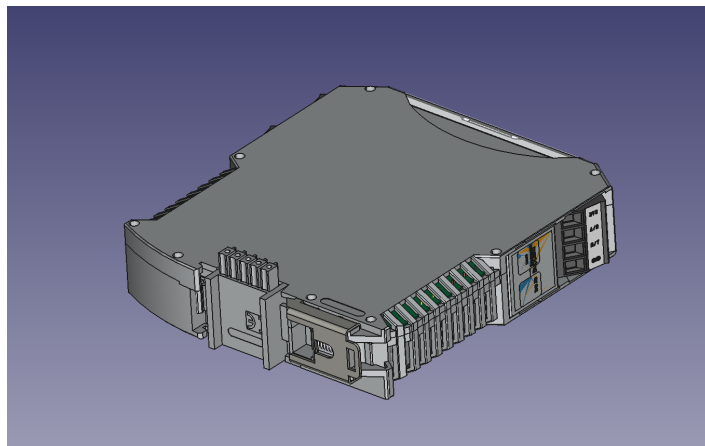


Figure 4: UCI with DIN rail back plane connector

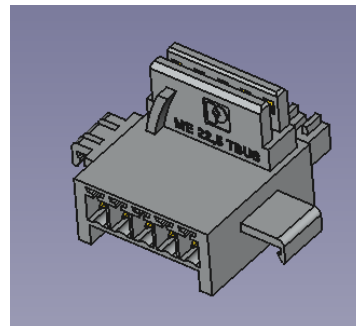
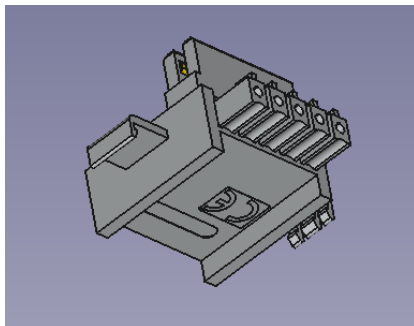


Figure 5: UCI-108 DIN rail bus connector

4 Functionality

The UCI-108 is a versatile and universal communication interface which can be individually configured in three different operating modes covering almost any BPM communication use case. The operating modes are:

- MODEM
- PET
- SMARTLINK
- MODBUSTUNNEL

Each operating mode will be explained in more detail in the following paragraphs.

In addition, multiple UCI-108s can be interconnected to form a single node enabling communicating from multiple host ports to multiple field ports.

The UCI-108 is equipped with an internal command line interpreter for commissioning and BPM communication monitoring purposes. The command line interpreter shares the same RS serial port as used for the operational application. The RS port can be set to TERMINAL or OPERATIONAL mode.

4.1 MODEM mode

In MODEM mode GPU and Flexconn messages received on one bus port are transmitted on the other bus port. None of the ports is active as bus master. A message is passed forward to the other port after being received completely on the one port. Only correct messages are passed on (correct framing, CRC/BCC etc.)² and no address filters are applied.

Typical use case for the MODEM mode is to connect a PC Terminal application to the BPM fieldbus for analyzing the BPM network messages and BPM network signal conditions, see Figure 6.

In MODEM mode the UCI-108 is not visible as Field Device with the 'Sitiescan' function in the Honeywell-Enraf Engauge commissioning tool.

Remote management is possible using the UCI-108s 'GPU Device Address', see paragraph 4.8 Remote Management. On this address the UCI-108 will also respond to an X-record request ('RX'³) and will return "nnRXUCI-108 <tag>" where <nn> is the GPU Device address and <tag> is the current configured UCI-108 tag.

2 ACK characters (used between a Host and a CIU or SmartLink) are not passed on.

3 An '@X' request will not be responded to in order to remain hidden during a site scan.

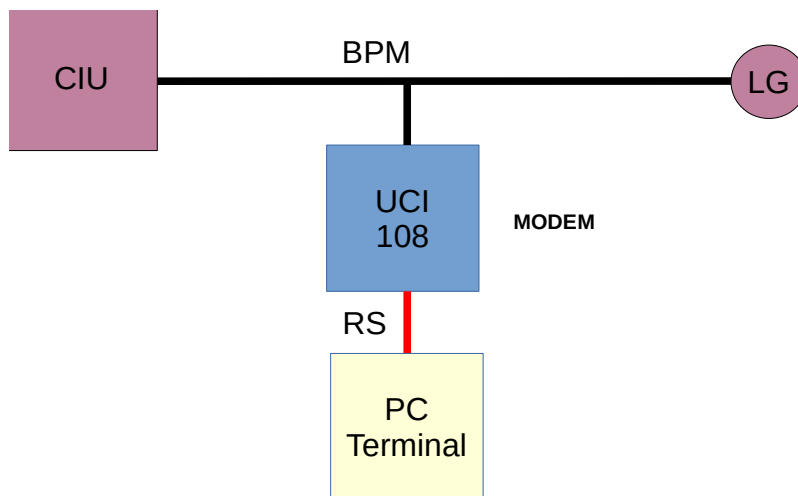


Figure 6: BPM fieldbus monitor

4.2 PET Mode

In PET mode the UCI-108 BPM port has a function as Host or Field port. The RS port will have automatically the opposite function. The UCI-108 only accepts requests on the Host port. The Field port is active as bus master. Messages received on the Field port are considered to be responses. Received responses on the field port without a pending request are ignored.

Typical use cases for PET mode are:

- to connect a Host application (e.g. a Tank Management Application) with RS serial port to one or more BPM fieldbuses.
- to insert a RS, an Ethernet or a Fiber Optic network segment into BPM field network.
- to connect a Field Device (e.g. a proprietary instrument) with a RS serial port to the BPM network.

To support using UCI-108 in parallel PET operation Filters can be set to determine if a message is ignored or passed on, see Figure 7. This will prevent host request and the field responses from other UCI-108(s) connected in parallel which are not in the Filter range to be blocked.

For GPU addresses the filter is specified using a range defined by lower- and upper addresses. Idem for Flexconn addresses. GPU addresses containing a wildcard will always be passed on.

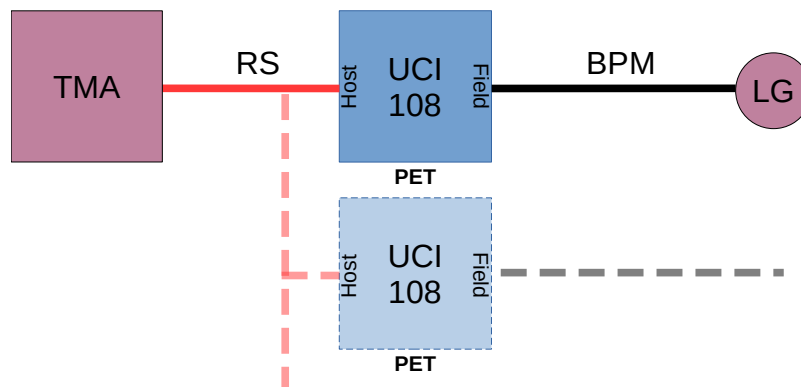


Figure 7: Connect Host application

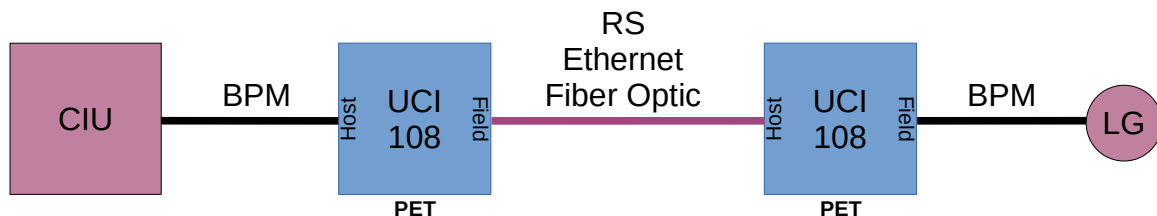


Figure 8: Insert Ethernet network segment

The use of two UCI-108s in series enables the insertion of a network segment using another physical layer and/or protocol in the BPM fieldbus. This can be useful to migrate to e.g. an Ethernet or Fiber Optic communication infrastructure.

Note: to insert an Ethernet or Fiber Optic network segment additional RS to Ethernet or RS to Fiber Optic converters are needed.

The PET mode supports the option to enable the **Fast Responses** feature (see Paragraph 4.6). This optimizes the bandwidth of both BPM segments in the above configuration, see Figure 8.

The rest of the functionality matches that of the MODEM mode.

4.3 SMARTLINK Mode

In SMARTLINK mode the UCI-108 communicates on its RS Host port using the CIU-GPU (CIU858 compatible) or Flexconn protocol.

Typical use cases for the UCI-108 SMARTLINK mode are:

- to connect a Host application (e.g. a Tank Management Application) with RS serial port to one or more BPM fieldbuses.
- to connect as RS 'Downlink' port for the CIU.

This mode supports the following CIU-GPU protocol features:

- Only GPU messages with a matching first address digit (CIU address digit) are handled.
- Optional sending ACK characters while waiting for the Field device to respond.
- Sending GPU Time-out Records to the Host when the Field Device does not respond.
- Identifies itself as a SmartLink with 'Sitiescan' function in Honeywell-Enraf Engauge commissioning tool.
- Configurable Flexconn address range to determine which Flexconn messages will be handled.
- Allows to have **Fast Responses** enabled (see Paragraph 4.6) to optimize the bandwidth between Host and UCI-108.

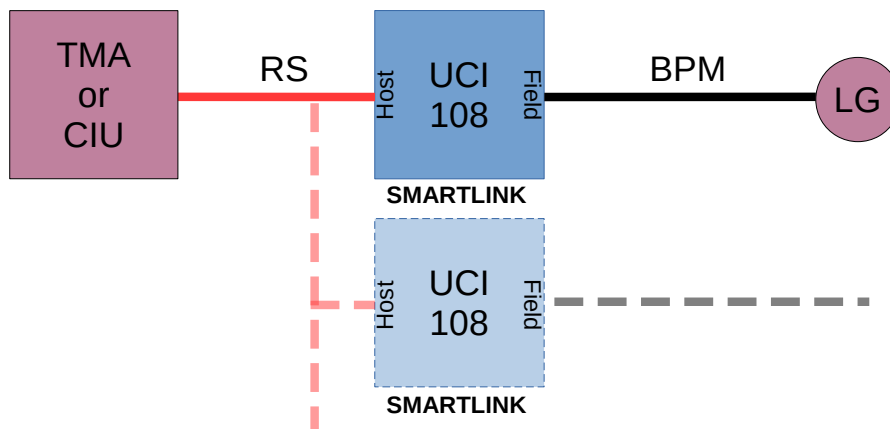


Figure 9: Basic usage of SMARTLINK mode

4.3.1 GPU messages

In SMARTLINK mode the UCI-108 will only handle CIU GPU request messages from a Host directed to its own **CIU GPU address**.

When passing the request message to the other Field port it removes this extra address digit. When passing the response message from a Field Device back to the Host it will add its **CIU GPU address** digit to the message.

4.3.2 Flexconn messages

When passing a Flexconn request message to the Field port it replaces the source address of the message into its own **Flexconn address**. When passing the response message from a Field Device back to the Host it replaces the destination address of the message into the one from the Host.

Note: the UCI-108 will not respond itself to any Flexconn message.

Remote management is possible using the UCI-108s 'CIU GPU Address'.

4.4 Modbus Tunnel Mode

The MODBUSTUNNEL mode allows transparent communication between a Modbus RTU Master and its remote Modbus RTU Slaves over the same BPM fieldbus used by the Tank Management application.

Typical use cases for MODBUSTUNNEL mode are:

- To connect a proprietary PLC host application to one or multiple Modbus Field Device(s) sharing the BPM fieldbus with the Tank Management Application.
- To enable the integration of low cost Modbus, 4..20mA or HART level gauges, pressure and temperature sensors in combination with the CIU888.

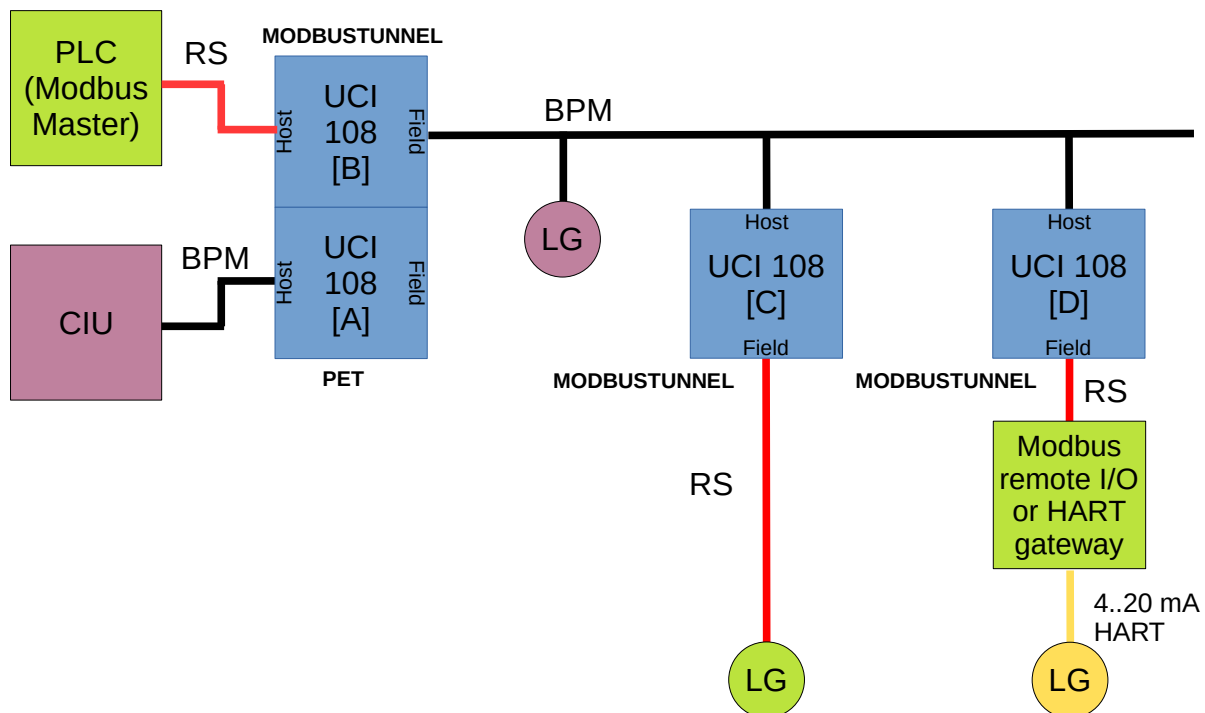


Figure 10: PLC application making use of MODBUSTUNNEL mode

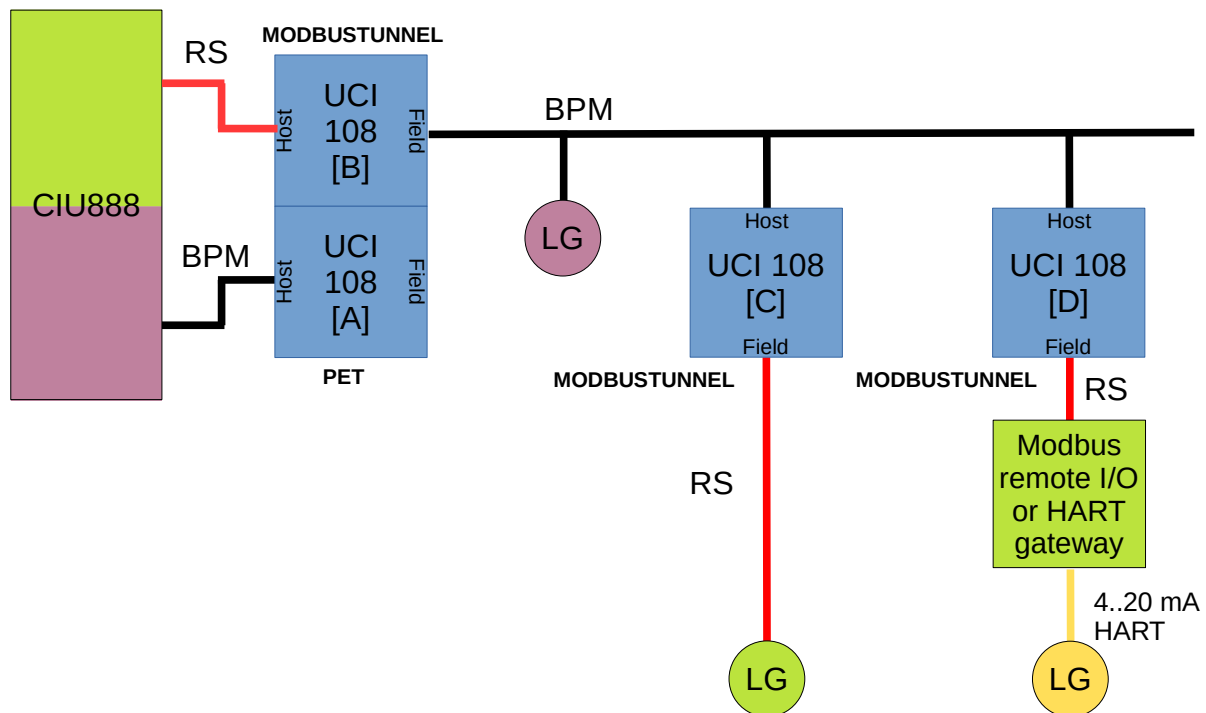


Figure 11: Usage of MODBUSTUNNEL mode for level gauge integration with CIU888

The Modbus tunnel 'host' UCI-108 is connected by its RS port to a Modbus RTU Master and each Modbus tunnel 'field' UCI-108 can connect up to three Modbus RTU Devices (slaves). Multiple 'field' UCI-108s can be connected to the same BPM fieldbus.

4.4.1 Modbus tunnel features

In MODBUSTUNNEL mode the UCI-108 RS port will work in both RS232 as in RS485 mode. Only RS485 communication can be used in multipoint systems, it is strongly advised to use RS485 for both the 'host' as 'field' UCI-108.

The baudrate of the UIC-108 RS port can be set to 9600, 19200, 38400, 57600 and 115200 (see item RB in paragraph 5.5 Item list). The parity is fixed to None, the number of stop bits is fixed to 1. The character format is 8N1.

Only valid Modbus RTU messages with frame length of maximum 128 bytes are processed. A Modbus filter in the 'host' UCI-108 determines whether a message is passed. This prevents requests/responses to/from other slave devices connected to the same physical Master RTU RS485 bus to be tunneled over the BPM field bus.

4.4.2 Modbus addressing

Modbus messages will be packed into GPU messages and sent over the BPM fieldbus between the Modbus tunnel 'host' and the 'field' UCI-108s.

The Modbus RTU slave address is one to one mapped to the GPU Device address of the 'field' UCI-108 to which it is connected. They share the same address. The Modbus address range is therefore limited to the range of 1..99. All GPU addresses must be unique so a Modbus RTU Slave Device cannot have the same address as any other GPU Field instrument.

The 'field' UCI-108 accepts up to three different GPU Device addresses representing the different Modbus RTU slave addresses of the slave devices connected.

The Modbus address 0 is reserved as Modbus broadcast address. When the Modbus Master sends a broadcast message this is tunnelled using a GPU message with address '**' so all GPU Devices on the fieldbus will receive it. Even though this is supported we advise to not use these broadcast messages in order to not confuse other GPU devices on the network.

4.5 Multi UCI-108 node

Up to four UCI-108s can be interconnected together via the DIN rail bus connector forming a single node enabling communicating from multiple host ports to multiple field ports.

Typical use case for Multi node applications are:

- to connect one Host application (e.g. a Tank Management Application) with RS serial port to one or more BPM fieldbuses.
- to connect multiple Host applications to one or more BPM fieldbuses addressing the same Field Devices.
- to extend a BPM fieldbus by means of a repeater function

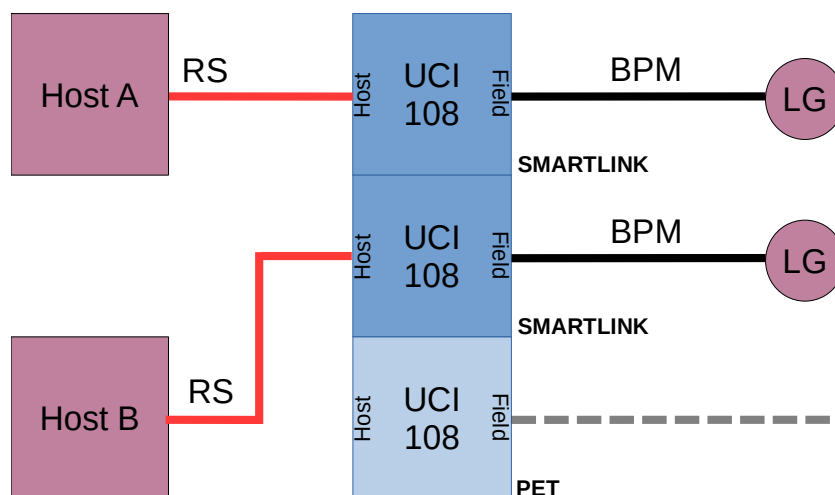


Figure 12: Connect (multiple) Host with Multi node

To enable this feature each UCI-108 must have a unique address set using it's DIP switches. See Table 5 in Chapter 5 Configuring the UCI-108.

Note: for this mode to work it is mandatory to have a functional First Node with DIP-switch 3 with label AD-1 set to ON .

In Multi-Node arrangement:

- Each individual UCI-108 has its own operational mode and its own GPU Device Address or CIU Address.
- Only nodes in PET and SMARTLINK mode will transfer messages to their configured ports.
- A node in MODEM mode can be used to monitor message traffic.

Tip: reserve a spare DIN rail backplane position for a temporarily UCI-108 used for commissioning and service purposes. Make this UCI-108 node fixed as the Fourth node making it work in every UCI-108 multi node.

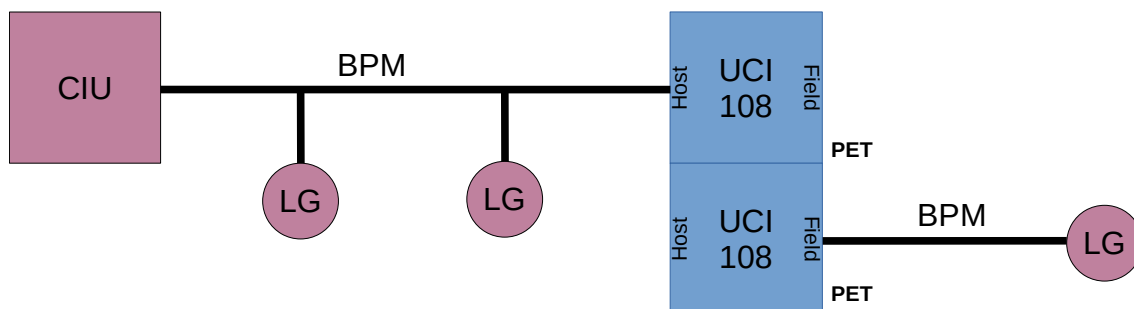


Figure 13: Repeater configuration with Multi node

4.6 Fast Responses

In SMARTLINK mode and PET mode *Fast Responses* can be enabled. This means received requests and responses are cached. The cache works as follows:

- When a request is present in the cache it's associated response will immediately be returned to the Host. The request will be queued for the Field Device to update the associated response.
- New requests not in the cache have a higher priority in the queue than already cached commands/responses.
- Requests and their responses will age. If they are not repeated within a (configurable) time out they will be removed from the cache.

- In case the cache is full the entry with the oldest time stamp will be removed to make space for the new request/response.

The cache will store a maximum of 50 request/responses. GPU requests/responses to the UCI-108 address itself nor Flexconn messages will be cached.

There is no automatic cyclic polling of requests. Requests have to be periodically refreshed by the host to stay updated in cache.

4.7 Command Line Interpreter

The UCI-108 features a command-line interpreter for commissioning and communication monitoring purposes. The command-line interpreter shares its RS232 communication port with the RS Host or Field port. Only one of these functions can be assigned to this RS port at the same time.

4.7.1 Sending messages on the BPM bus

To test Field Devices connected to the BPM fieldbus the command line interpreter allows to send arbitrary GPU commands⁴ (see Paragraph 5.2). For example to request the software version by the item 'SV' item from device with address '00':

```
gpu 00BZSV
```

The given string will be wrapped in a GPU message-start and -end and the parity bits and BCC will be calculated. Any address digits need to be part of the specified string.

This command also enables monitoring the reply messages so any response will be shown. For example:

```
GPU[B] 00BZSV854NVRAC4.0XPUA4.1SPUD2.1MPUB1.4, rt: 22, qa: 3038/1488
```

Where `GPU[B]` indicates a GPU message has been received on the BPM port, `rt` indicates the response time and `qa` indicates the signal voltages (in mV) of the response.

4.7.2 Message monitoring on the buses

The command line interpreter (see Paragraph 5.2) also supports monitoring (listen mode) for both GPU, Flexconn and Modbus messages on the field port of the network. This will be initiated by the command: `msgmon`.

4 Not supported in MODEM mode

The logged message will be labeled with:

- GPU, FLX or MDB to indicate the protocol type of the message.
- [B], [B1], [B2], [B3], [B4], [R], [R1], [R2], [R3] or [R4] to indicate on which port the message has been received. 'B' for BPM port and 'R' for RS port. The number indicates the UCI node address if applicable.
- Q and A indicating a Request or Answer message.

After the response data follows the timestamp (labeled with t_s) and the BPM signal quality of the message (labeled with q_a). The signal quality are two voltage values (in mV) measured on the UCIs internal BPM receiver hardware, see Paragraph 4.9.

Example:

```
GPU[B2]A      09RZSVUCI-108 2.1.1 MODBUSTUNNEL 09 UNITXXXC      ts: 8511425 qa:
3038/3038
MDB[R2]Q      09 03 00 02 00 08 E4 84 ts: 6600075
MDB[B2]A      09 03 10 0C 68 1D F2 00 01 00 01 03 91 08 41 0F 8F 1B C7 BC D7
ts: 6600295 qa: 3038/3038
```

To ease importing the data in a spreadsheet the fields are separated using a TAB character⁵.

4.8 Remote Management

Remote management for configuration or status monitoring of a single or multi UCI-108 node is accomplished using proprietary GPU commands to the connected UCI-108 GPU Device Address in MODEM, PET or MODBUSTUNNEL mode. In SMARTLINK mode the remote management is done by the CIU GPU addressing. See Paragraph 5.3 Configuring the UCI.

4.9 Measuring BPM signal and noise

The BPM signal strength and noise indication feature can be used to determine the signal quality of the BPM fieldbus. The quality of the signal is effected by different factors like cable wire resistance, number of connected field instruments, location of connected field instruments, injected noise.

With this feature possible BPM communication issues can be isolated. It can be used to determine the location for placing a repeater to extend or improve the BPM fieldbus.

⁵ Note that some terminal programs replace a TAB character with spaces. For example TeraTerm does this but using its 'log to file' option the TAB characters remain preserved.

The UCI-108 BPM receiver circuit contains a Programmable Gain Amplifier (configured using item BG, see chapter 5.3 Configuring the UCI). The signal strength of the received BPM messages before and after this PGA is measured. Different items are available to obtain information for analysis depending on UCI-108 BPM port configuration (field or host port).

The example in Figure 14: Measuring BPM fieldbus signal strength shows a setup to determine the BPM signal and noise on location B, the location of expected communication issues. One UCI-108 is temporary added at location A as command terminal in a multi node configuration and one in the field at location B. Different scenario's can be executed to locate the issue, see Chapter 7 Diagnosing BPM fieldbus.

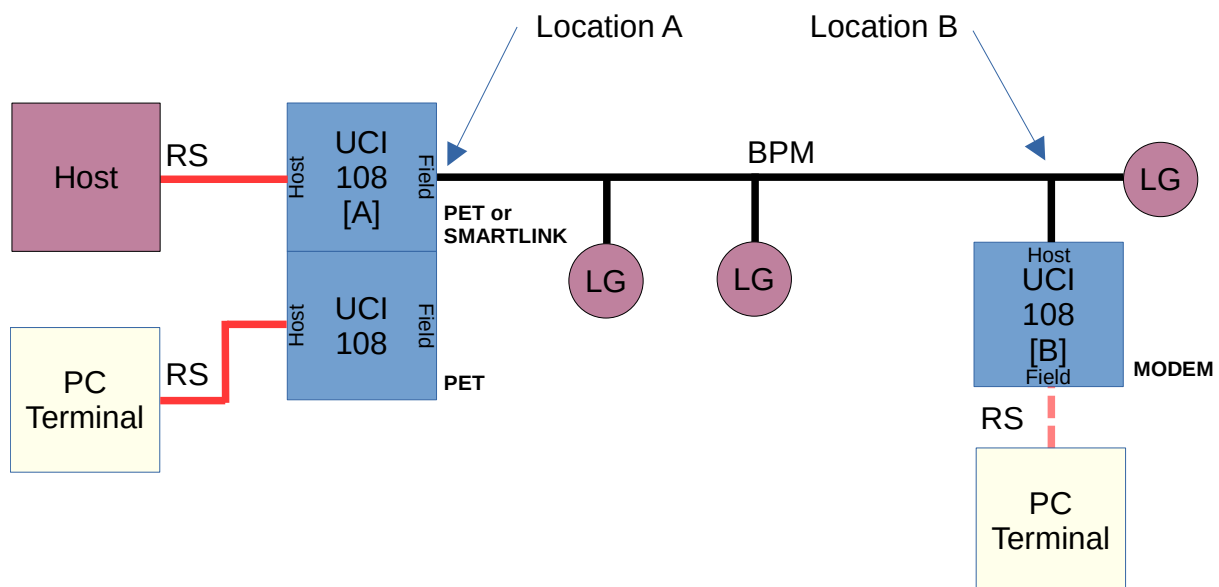


Figure 14: Measuring BPM fieldbus signal strength

4.10 LED indicators

The UCI-108 has 8 LEDs on its front.

Table 2: LEDS

Name	Description
PW	When the device is powered this LED will be on.
EXE	When the firmware is running this LED will blink.

BPM	These LEDS will flash when traffic is active on the BPM bus.
RS	These LEDS will flash when traffic is active on the serial bus.

EXE LED

During normal operation the EXE LED will blink with a rate of: 1S on / 1S off.

- When the UCI-108 is running in the bootloader the rate will be:
- When the bootloader detected an application in memory the LED will blink one short pulse.
- When the bootloader did **not** detect an application in memory the LED will blink two short pulses.

Table 3: BPM and RS LEDs

Name	Description
ERR	Will flash whenever an error occurs with the reception of a message on the bus.
RX	Host port: on unless receiving Field port: off unless receiving
TX	Host port: off unless sending Field port: on unless sending

When the RS port is set to RS232 and TERMINAL Mode the RS LEDs will flash when terminal input is received or transmitted.

5 Configuring the UCI-108

Configuring the UCI-108 is done using the switches on the outside of the enclosure and by item commands entered via a PC terminal program connected to the RS232 port.

5.1 Front Panel and Switches

Table 4: Front panel

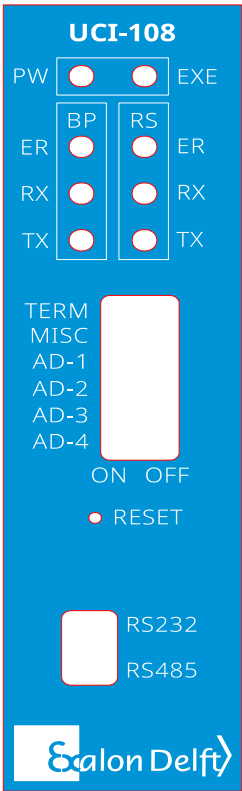
	<p>For the significance of the LEDs see Table 2: Leds.</p> <p>For the DIP-switch positions see Table 5: DIP-switches.</p> <p>The Reset button will make the device restart.</p> <p>The RS switch needs to be set in the position corresponding the type connection in use: RS232 or RS485.</p>
--	--

Figure 15: Front plate

The hardware switches allow to configure:

Table 5: DIP-switches

Name	Label	Description
RS switch	RS232 RS485	Set the RS front port in 'RS232' or 'RS485' mode.
DIP switch 1	TERM	Set the UCI-108 in 'TERMINAL' mode (ON) or

		'OPERATIONAL' mode (OFF).
DIP switch 2	MISC	Reserved
DIP switch 3..6		UCI-108 node address. When connecting multiple UCI-108s using the DIN rail bus connector use this switch to configure their individual node addresses.
	AD-1	Switch 3 ON: First Node
	AD-2	Switch 4 ON: Second Node
	AD-3	Switch 5 ON: Third Node
	AD-4	Switch 6 ON: Fourth Node

Note: detection of the DIP-switch positions and activation of related function is performed only after a power cycle or reset. of the UCI.

5.2 TERMINAL mode

The UCI-108 features a command-line interpreter for commissioning and communication monitoring purposes. The command-line interpreter shares its communication port with the RS Host or RS Field port.

In order to use the command-line interpreter the RS port has to be set to RS232 and assigned for TERMINAL mode. Remove the power, connect a PC terminal emulator to the RS port, set the RS switch into it's RS232 position, set the 'TERM' DIP-switch into the 'ON' position and set power on.

The communication parameters for the terminal emulator are: 115200 baud, 8 data bits, 1 stop bit, no parity, no flow control.

The UCI-108 built-in command-line interpreter sends text lines ending with a 'newline character'.⁶

The command-line interpreter supports the following commands:

```

help      : print list of all available commands or items
item      : get/set configuration using Items
msgmon    : monitor messages (GPU & Flexconn)
gpu       : send GPU command on the BPM bus
stats     : show/reset statistics
config    : show/reset the current configuration

```

⁶ When using the 'Tera Term' application set the terminal configuration New-line options to: 'Receive: LF' and 'Transmit: CR' and uncheck 'Local Echo'.

```

reset    : reset the UCI
cu       : change UCI (if multi node is enabled)

```

- The 'help' command prints above list.
- The 'item' command allows to read or write an Item value. See 5.3 Configuring the UCI.
- The 'msgmon' command enables received messages to be printed on the terminal. Pressing a key will make this stop. 'Msgmon' shows Flexconn and Modbus messages using a hex dump of the complete messages.
- The 'gpu' allows to send GPU commands on the BPM port. See 4.7.1 Sending messages on the BPM bus.
- The 'stats' command allows to read the current communication and/or system statistics.
 - stats cacheshow : show cache statistics
 - stats commshow : show communication statistics
 - stats commreset : reset communication statistics
 - stats sysshow : show system statistics
- The 'config' command allows to read the current configuration stored in non-volatile memory. The following command parameters are supported:
 - config setup : quick configuration by means of menu choices
 - config show : shows the items values for the configured mode
 - config showall : shows all items values (also the not used items)
 - config items : generate items replicate of the current configuration
 - config reset : will reset the configuration back to the factory defaults

Some commands support the `help` parameter. For example `item help` prints a list of supported items.

To exit TERMINAL mode turn of the power, set the 'TERM' DIP-switch in the OFF position and if needed reconnect the front RS port.

5.3 Configuring the UCI

5.4 Configuring using Items

The UCI-108 can be configured by using Items, see Table 6: Item list for the overview of available items. This configuration can be accomplished in TERMINAL mode via the command 'item' or remotely via the Host port using the UCI-108 GPU Device address or CIU Device address with GPU messages requesting read/write **Items**.

5.4.1 Configuring in TERMINAL mode

The current UCI-108 configuration overview by description, item name and item value can be showed by the following commands:

- `config show` : shows the items values for the configured mode
- `config showall` : shows all items values (also the not used items for mode).

Command `config reset` resets the configuration back to the factory defaults.

Configuration via item command

Items are read by the command `item <Item>` where `<Item>` is one of the items from the Item list, see Table 6: Item list. To get an overview of available Items type `item help` at the terminal prompt.

For example command `item UM` (the item for UCI-108 mode) will respond with e.g.,
UMMODEM

Items can be written by the command `item <Item>=<Value>` where `<Item>` is one of the items from the Item list and `<Value>` one of the permitted possible values.

For example command `item UM=PET` sets the UCI-108 to PET mode and will respond with `UM=PET&`. The `&` is added to indicate a successful write.

Configuration via menu options

Each UCI-108 have a set of applicable individual Items to configure, between 5 to 14 items depending on its mode. To make this process easier and better structured the command `config setup` is introduced. Via the menu the current values of the Items are shown in a list, can be selected by typing the menu option number and can be modified. After each modification the applicable Items are shown again. This is the recommended method for configuration.

Save and restore the configuration

Once the UCI-108 configuration is finished this can be saved by the command `config items`. All configurable Items are printed to the terminal screen with the prefix `item`. This text can be selected, copied to the clipboard and saved to a plain text file.

The file content can be copied to the clipboard and pasted to the command prompt to restore the configuration.

5.4.2 Configuring via Device Address

The GPU read command messages consists of the elements:

- The two digit UCI-108s GPU Device address (default 99) in MODEM and PET mode or the CIU address digit (default 0) when in SMARTLINK mode,
- RZ, for the TOI/TOR for Items,
- The two letter Item indication. See Table 6: Item list.

For example `99RZSV` results in a reply of `99RZSVUCI-108 0.2`

A write command message consist of the same three elements as the read command plus the string `'=<value>'` with `<value>` the new value to set.

The UCI-108 returns with the write command appended with:

- a `'&'` to indicate a successful write
- a `'!'` in case of an invalid Item or value for the requested value. Any error message will be appended (in text) after the `'!'`.

For example `99RZBG=3` results in the reply `99RZBG=3&`

To prevent unwanted actions the command items need confirmation data in the form of `'YES'`. For example:

```
99RZX=YES
```

The item request messages can be generated by the Engauge GPU command line tool (Direct Communication).

Note: some Items need a restart of the UCI-108 before they become active. Therefore it is best to perform a reset or a power cycle when configuration is completed.

5.5 Item list

Items are grouped to configure Common, BPM, RS, SmartLink, Modbus tunnel, Field Device Location, PET Filter and Cache settings. For diagnostic purposes a group of Read Only items are available. Command Items can be given force the UCI-108 to a certain state.

Table 6: Item list

Name		Description
Common		
UM	Item name: Description: Possible values:	UCI-108 Mode Read or set the UCI-108 operating mode MODEM, PET, SMARTLINK, MODBUSTUNNEL (default MODEM) <i>Note: changing the Mode during operation will effect handling messages. It is advised to perform a reset (item US or hardware reset) after changing this item.</i>
UA	Item name: Description: Possible values:	UCI-108 GPU Device Address. Read or set the UCI-108 Field Device address for remote use while in MODEM, PET or MODBUSTUNNEL operating mode 0..99 (default 99)
UT	Item name: Description: Possible values:	UCI-108 Tag Read or set the UCI-108 identification label of exactly eight (8) ASCII characters with no spaces. In case of more than 8 characters only the first 8 characters are used, less than 8 characters results in error message. ASCII character: '!' .. '~' (default 'UCI_0001')
BPM		
BB	Item name: Description: Possible values:	BPM Baudrate Read or set the baudrate of the BPM port 1200, 2400 or 4800 (default 1200)
BG	Item name: Description: Possible values:	BPM Gain Read or set the sensitivity of the BPM receiver 1..8 (default 8, maximum)
BD	Item name: Description: Possible values:	BPM Turnaround delay Read or set the minimum time the UCI-108 waits before sending a reply after it has received a request on a BPM Host port 0..100 ms (default 10 ms) <i>Note: this Item is only applicable when the BPM port is the HOST port.</i>
BT	Item name: Description:	BPM port Time-out ⁷ Read or set the time-out value of a BPM Field port on

	Possible values:	Field Device responses when in PET or SmartLink mode. 10..2000 ms (default 250 ms) <i>Note: this Item is only applicable when the BPM port type is the FIED port.</i>
RS		
RB	Item name: Description: Possible values:	RS port Baudrate Read or set the baudrate of the RS port 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200 (default 38400) <i>Note: the new value will become in use only after a the UCI-108 has been reset</i>
RD	Item name: Description: Possible values:	RS port Turnaround delay Read or set the minimum time the UCI-108 waits before sending a reply after it has received a message on its RS Host port. 0..100 ms (default 1 ms) <i>Note: this Item is only applicable when the RS port type is the HOST port.</i>
RT	Item name: Description: Possible values:	RS port Time-out ⁷ Read or set the time-out value of a RS Field port on Field Device responses when in PET or SmartLink mode. Possible values: 10..2000 ms (default 600 ms) <i>Note: this Item is only applicable when the BPM port type is the FIELD port.</i>
SmartLink <i>Note: these Items are only applicable when the operational Mode is configured as SMARTLINK. The RS port is always the HOST port.</i>		
SA	Item name: Description: Possible values:	SmartLink ACK state Read or set the enabling of the ACK handshake to the Host on a RS Host port. When enabled the UCI-108 will, in SMARTLINK mode, send ACK characters to the Host while processing a request. ENABLED, DISABLED (default ENABLED)
SG	Item name: Description:	UCI-108 SmartLink CIU Address Read or set the address digit of the UCI-108 in

7 The time-out value is the maximum allowed time between the end of the request and the start of the response message (its first completely received byte)

	Possible values:	SMARTLINK mode for GPU messages. 0..9 (default 0)
SF	Item name: Description: Possible values:	SmartLink Flexconn Address Read or set the Flexconn address of the UCI-108 when in SMARTLINK mode. 1900..1999 (default 1900) <i>Note: the Flexconn address is used to comply with the Flexconn protocol. The UCI-108 remote configuration is performed by GPU commands</i>
S3	Item name: Description: Possible values:	Lower SmartLink Flexconn filter address Read or set the lowest address of the Flexconn filter range. The UCI-108 passes all Flexconn messages within this range when in SMARTLINK mode. 0..1899 (default 0)
S4	Item name: Description: Possible values:	Upper SmartLink Flexconn filter address Read or set the upper address of the Flexconn filter range. The UCI-108 passes all Flexconn messages within this range when in SMARTLINK mode. 0..1899 (default 1899)
Modbus tunnel <i>Note: these Items are only applicable when the operational Mode is configured as MODBUSTUNNEL.</i>		
TT	Item name: Description: Possible values:	Modbus Tunnel UCI device type. Read or set the RS port type to be used in MODBUSTUNNEL mode. Assigned as HOST it is set as 'host' UCI-108, the UCI RS port is connected to a Modbus RTU Master. Assigned as FIELD it is set as 'field' UCI-108, the RS port is connected to the Modbus RTU Slave Device(s). <i>Note: changing the Modbus tunnel device type during operation will effect handling messages. It is advised to perform a reset (item US or hardware reset) after changing this item.</i> HOST, FIELD (default HOST)
TA	Item name: Description:	Modbus Tunnel Host Filter add address. This command adds a Modbus slave address to the list of accepted addresses to pass by the Modbus tunnel 'host' UCI to the BPM field bus.

	Possible values: Examples:	01..99 and ALL item TA=02 or RZTA=02
TD	Item name: Description: Possible values: Examples:	Modbus Tunnel Host Filter delete address. This command removes a Modbus slave address from the list of accepted addresses to pass by the Modbus tunnel 'host' UCI to the BPM field bus. 01..99 and ALL item TD=02 or RZTD=02
TQ	Item name: Description: Possible values: Examples:	Modbus Tunnel Host Filter Query Request Modbus address status in the list of accepted addresses. In case of a specified address (as in "TQ01") the return value is "TQ01ENABLED" or "TQ01DISABLED". 01..99 item TQ02 or RZTQ02
TM	Item name: Description: Examples:	Modbus Tunnel Host Filter Mask Read or write a hex representation of the accepted address map for Modbus Tunnel 'host' UCI. Each bit in the 26 digit hex number represents a Modbus slave addresses to pass. The most right digit represents addresses 3..0. The second most left digit represents the addresses 99..96. The most left digit is always zero (0). The default value of the Host filter mask is 0FFFFFFFFFFFFFFFFFFFFFFFFF, all Modbus addresses are in the list and passed by the 'host' UCI. Although it enables to read or write the filter mask at once it is recommended to use items TA, TD and TQ to add/remove or query individual Modbus filter addresses. RZTM will reply e.g. with RZTM08000000000000000000000002 within the list accepted addresses of 1 and 99. RZTM=0FFC00000000000000000000602 sets the mask for Modbus addresses 1, 9, 10 and 90..99 to pass through.
T2	Item name: Description:	Modbus Tunnel Field Second Address. Read or set the Modbus Field Tunnel Second Address of the 'field' UCI. The Modbus Tunnel 'field' UCI can handle up to 3 Modbus slave devices by comparing the

	Possible values:	destination address of the Modbus Tunnel request. The 'field' UCI will also respond to 'RX', 'RZSV' and 'RZUI' on this address. 01..99 and DISABLED (default DISABLED)
T3	Item name: Description: Possible values:	Modbus Tunnel Field Third Address. Read or set the Modbus Field Tunnel Second Address of the 'field' UCI. The Modbus Tunnel 'field' UCI can handle up to 3 Modbus slave devices by comparing the destination address of the Modbus Tunnel request. The 'field' UCI will also respond to 'RX', 'RZSV' and 'RZUI' on this address. 01..99 and DISABLED (default DISABLED)
Field Device Location		
LT	Item name: Description: Possible values:	Field Device Location Expiration time-out Used to keep the registration of connected Field Devices per field port updated. In case there is no request/reply to/from the Field device within the time-out period the entry is deleted. Requests for a Field Device not registered in the list will be broadcasted on all field ports in a multi UCI node. 10..1000 seconds (default 300)
LN	Item name: Description: Possible values:	Field Device Location Expiration No-Response count Number of consecutive failed communications the information considering on which field port the Field Device is found is deleted. 1..9 (default 3)
PET		
<i>Note: these Items are only applicable when the operational Mode is configured as PET.</i>		
PH	Item name: Description: Possible values:	PET Host port Read or set which port is the Host port when in PET mode. <i>Note: changing the host port type during operation will effect handling messages. It is advised to perform a reset (item US or hardware reset) after changing this item.</i> RS and BPM (default RS)
F1	Item name: Description:	PET Lower GPU filter address. Read or set the lower address of the GPU filter range.

	Possible values:	The UCI-108 passes all GPU messages within this range. 0..99 (default 0)
F2	Item name: Description: Possible values:	PET Upper GPU filter address. Read or set the upper address of the GPU filter range. The UCI-108 passes all GPU messages within this range. 0..99 (default 99)
F3	Item name: Description: Possible values:	PET Lower Flexconn filter address Read or set the lowest address of the Flexconn filter range. The UCI-108 passes all Flexconn messages within this range. 0..1899 (default 0)
F4	Item name: Description: Possible values:	PET Upper Flexconn filter address Read or set the upper address of the Flexconn filter range. The UCI-108 passes all Flexconn messages within this range. 0..1899 (default 1899)

Cache

Note: these Items are only applicable when the operational Mode is configured as PET, SMARTLINK or MODBUSTUNNEL

AE	Item name: Description: Possible values:	Cache Enable/disable Read or set the Caching Mode state. ENABLED, DISABLED (default DISABLED)
AT	Item name: Description: Possible values:	Cache Time-out Read or set the number of seconds a response will be cached. 5..60 (default 30)

Readonly Items

UI	Item name: Description: Returned values:	UCI-108 Identification information Returns the identification information and firmware version A string formatted as: UCI-108 x.y <mode> <gpu address> <tag> x.y indicating the firmware version number
UD	Item name: Description:	DIP switch position This item returns 6 digits indicating the positions of the 6 DIP switches. A '1' indicates the ON position, a '0'

	Returned values:	indicates the OFF position. A string formatted as for example: 001000
UE	Item name: Description: Return values:	Environmental conditions. Returns the power supply voltage (V) and internal temperature (degrees Celcius). A string formatted as: U=<current voltage>:<min. voltage>:<max voltage>;T=<current temperature>:<min. temperature>:<max. temperature>;
UH	Item name: Description: Returned values:	Memory Allocation Information Returns the number of free items in the various memory pools. A string formatted as: xx:xx:xx:xx:xx
UJ	Item name: Description: Returned values:	System Statistics Historical Data. A string formatted as: RH=<run hours>;RS=<number of resets>;WS=<number of watchdog resets>;U=<min. voltage>:<max. voltage>;T=<min. temperature>:<max. temperature>;
UP	Item name: Description: Returned values:	UCI-108 Processor information Returns the processor serial number 96-bit unique ID (hexadecimal)
UR	Item name: Description: Returned values:	Runtime information Returns the uptime A string formatted as RT=<days>:<hours>:<minutes>:<seconds>
SV	Item name: Description: Returned values:	Software Version Returns the same result as with item 'UI'. See item 'UI' <i>Note: used to same abbreviation to be compliant with this common known GPU item.</i>
EG	Item name: Description: Returned values:	Get Configuration Information Returns meta information about the stored configuration. It consists of the Configuration Id, Version Id and the Configuration Changed Counter.

		<key>:<version>:<ccc>
LD	<p>Item name:</p> <p>Description:</p> <p>Returned values:</p>	<p>Field Device Location Data</p> <p>UCI and Port where the Field Device is located and QA data.</p> <p>The request needs the address of the Field Device as a parameter.</p> <p>GPU: RZLD02 (must be 2 characters)</p> <p>Flexconn: RZLD0164 (must be 4 characters)</p> <p><address:uci:port:adcOut1:adcOut2> (adc values in mV)</p>
LW	<p>Item name:</p> <p>Description:</p> <p>Returned values:</p>	<p>Field Device Location of device with weakest signal.</p> <p>Read Field Device Location of device with weakest signal.</p> <p><address:uci:port:adcOut1:adcOut2> (adc values in mV)</p>
XG	<p>Item name:</p> <p>Description:</p> <p>Returned values:</p>	<p>Get Communication Statistics.</p> <p>Return message counts, error counts and elapsed time.</p> <p>ET=dd:hh:mm:ss;GPUB=msg:err;GPUR=msg:err;FLXB=msg:err;FLXR=msg:err;MODR=msg:err;</p> <p>GPU[B R]: GPU messages on BPM or RS port</p> <p>FLX[B R]: Flexconn messages on BPM or RS port</p> <p>msg: message count</p> <p>err: error count</p>
AG	<p>Item name:</p> <p>Description:</p> <p>Returned values:</p>	<p>Cache Statistics.</p> <p>Read cache statistics. They are collected using a period determined by the current Cache Timeout setting.</p> <p><min present:max present:added:updated:removed:aged:requests:hits></p>
BN	<p>Item name:</p> <p>Description:</p> <p>Returned values:</p>	<p>Measure BPM Host Port Noise Level</p> <p>Start a BPM Noise level measurement on the BPM Host Port of a remote UCI-108 device and respond the results. See chapter 4.9 and 7 for more details.</p> <p><adcOut1_noise:adcOut2_noise:adcOut1_Request:adcOut2_Request> in mV</p>
BL	<p>Item name:</p> <p>Description:</p> <p>Returned values:</p>	<p>BPM Field Port Noise Level</p> <p>Returns the measured noise level on a UCI configured with a BPM as field port. The noise level is internally measured on a regular base.</p> <p><adcOut1_noise:adcOut2_noise> in mV</p>

Command Items		
UL	<p>Item name:</p> <p>Description:</p> <p>Possible values:</p> <p>Example:</p>	<p>Terminal New-line characters</p> <p>The New-line characters used by the UCI-108 in terminal mode in order to print the lines one below the other in the PC terminal screen.</p> <p>CR, LF, CRLF (default CRLF)</p> <p>RZUL will return RZULCRLF</p> <p>RZUL=CR will set the New-line character to CR</p>
US	<p>Item name:</p> <p>Description:</p> <p>Returned values:</p> <p>Example:</p>	<p>Reset System</p> <p>The UCI-108 will restart immediately. No response will be given on this command.</p> <p>Requires the confirmation parameter.</p> <p>-</p> <p>RZUS=YES</p>
ER	<p>Item name:</p> <p>Description:</p> <p>Returned values:</p> <p>Example:</p>	<p>Configuration Reset</p> <p>The UCI-108 will clear the current configuration and will set all configuration the factory defaults. The UCI-108 will reset after processing command. Requires a restart.</p> <p>Requires the confirmation parameter.</p> <p>-</p> <p>RZER=YES</p>
XR	<p>Item name:</p> <p>Description:</p> <p>Returned values:</p> <p>Example:</p>	<p>Reset Communication statistics</p> <p>All communication statistics including it's elapse time will be reset.</p> <p>Requires the confirmation parameter.</p> <p>-</p> <p>RZXR=YES</p>

Note: the UCI-108 can be managed this way on it's GPU Device Address in MODEM and PET operational mode. In SMARTLINK mode this can be done using it's CIU GPU address and thus only on the Host port (the RS one).

5.6 Configuration Item Consistency

Item values can only configured by Remote management via the Host port:

- In PET mode either the RS or BPM port can be the Host port but the other one will then automatically become the Field Port.
- In SMARTLINK mode the RS port is always the Host port and the BPM port is always the Field port.
- In MODBUSTUNNEL mode the BPM port is always the Host port of the 'field' UCI-108.

Some Item values are not applicable in certain combinations. This depends on the UCI-108 operational mode and Host port and Field port configuration, see also the notes in Table 6 Item list.

5.7 Multi UCI-108 node

5.7.1 Access of command line interpreter

In a multi UCI-108 node configuration the command line interpreter of each node is accessible from the other nodes via the communication bus formed by the DIN rail bus connector. This allows to add a (temporary) node with RS port in TERMINAL mode while having the RS ports of the other nodes in operational mode.

To go to the command line interpreter of another node give the command `cu n` where n is the UCI-108 node address set by the DIP-switch to go to. To go back to the Terminal of the node in TERMINAL mode press `Ctrl-D [Enter]`.

Tip: reserve a spare DIN rail backplane position for a temporarily UCI-108 used for commissioning and service purposes. Make this UCI-108 node fixed as the Fourth node making it work in every UCI-108 multi node.

5.7.2 Remote Items configuration

The remote configuration of each individual UCI-108 in a multi UCI-108 node configuration using the read/write Items is performed via one of its Host ports.

The UCI-108 with the Host port is configured by using Items addressed by its own (CIU-) GPU Device address. For the other nodes the Item requests can be 'redirected'. This is done by addressing the nodes using `>n` where n is the final node to address.

For example: there are 4 UCI-108s (node addresses 1..4) and the Host port used for remote configuration is connected to the 2nd node.

To set the tag of the 2nd one (with e.g. GPU Device Address 98) the message to send is:

```
98RZUT=UCI_0002
```

To set the tag on the first node the message to send is:

```
98RZ>1UT=UCI_0001
```

On success the response will be:

```
98RZ<1UT=UCI_0001&
```

For the last node it would be

```
98RZ>4UT=UCI_0004
```

and on success the response will be:

```
98RZ<4UT=UCI_0004&
```

6 Commissioning

Commissioning of the UIC-108 is done locally via a PC terminal program connected to the RS232 port or after configuring the basic mode remotely by Engauge. This chapter describes examples in a step by step approach for the most commonly used UCI-108 fieldbus setups.

6.1 Entering RS port to TERMINAL Mode

To enter the RS port in TERMINAL Mode:

- Power off the UCI-108.
- Connect a PC terminal emulator via a RS232 cable to the RS serial port (**GNDiso/RX/TX**) and set the RS switch in RS232 position. See 3.3 RS232/RS485 serial bus.
- Enable the UCI-108 in Terminal mode by setting DIP switch **TERM** in the **ON** position, see 5.1 Front Panel and Switches.
- Start a terminal program connected to the appropriate serial port. Communication parameters 115200 baud, 8 data bits, 1 stop bit, no parity, no flow control.
- Power on the UCI-108 and wait for the prompt in the terminal emulator.

To leave TERMINAL Mode:

- Power off the UCI-108.
- Set the **TERM** DIP-switch in the **OFF** position and set the RS switch into the RS232 or RS485 position so it matches the RS serial port of the Host or Field.
- Disconnect the PC terminal emulator cable and connect the RS serial and BPM cables.
- Power on the UCI-108.

6.2 Commissioning MODEM mode

Message on the one port are passed to the other port. There is no difference in Host nor Field port.

Example instructions for basic configuration:

- Enter the TERMINAL mode (see section 6.1)
- Show and check the current configuration settings by entering the command:
`config show`
- If applicable, set the UCI-108 to factory default configuration values. The UCI-108 will reset after this command.
`config reset`

- If applicable, set the New-line character (default CRLF) for the terminal mode to match the PC terminal application.

```
item UL=[CR|LF|CRLF]
```

- Configure the UCI-108 mode by entering the command:
`config setup`
- The current active mode is showed by the asterisk * behind one of the options.

```
Select UCI-108 Mode:
1. Modem *
2. PET Host on RS port
3. PET Host on BPM port
4. SmartLink
5. Modbus Tunnel Host
6. Modbus Tunnel Field
Enter choice:
```

- Select the mode 'Modem' by selecting option 1 followed by 'enter-key'.
- A list of options to configure this mode is shown.

```
Setup Modem:
1. UCI-108 GPU address = 99          [00..99]
2. UCI-108 Tag         = UCI_0001 (8 ASCII characters)
3. BPM port baudrate   = 1200        [1200|2400|4800]
4. BPM receiver gain   = 8           [1..8]
5. RS port baudrate    = 38400       [1200|2400|4800|9600|19200|38400|57600|115200]
Enter choice:
```

- Select an option followed by the 'enter-key' to modify the value if applicable. Repeat this procedure until all configuration items are completed.
- Leave the menu by the 'enter-key'. The UCI-108 will reset after this command.
- Leave the TERMINAL mode (see section 6.1).

6.3 Commissioning PET mode with host on RS port

Requests are forwarded from the Host port to the Field port bus. Responses received on the Field port are returned on the Host port. The Field port is active as master for the fieldbus. The Field port Time-out is used to wait for a response of a Field Device.

Instructions for basic configuration:

- Enter the TERMINAL mode (see section 6.1)
- Show and check the current configuration settings by entering the command:
`config show`
- If applicable, set the UCI-108 to factory default configuration values. The UCI-108 will reset after this command.
`config reset`
- If applicable, set the New-line character (default CRLF) for the terminal mode to match the PC terminal application.
`item UL=[CR|LF|CRLF]`
- Configure the UCI-108 mode by entering the command:
`config setup`
- The current active mode is showed by the asterisk * behind one of the options.

```
Select UCI-108 Mode:
1. Modem *
2. PET Host on RS port
3. PET Host on BPM port
```

```

4. SmartLink
5. Modbus Tunnel Host
6. Modbus Tunnel Field

```

Enter choice:

- Select the mode 'PET Host on RS port' by selecting option 2 followed by 'enter-key'.
- A list of options to configure this mode is shown.

Setup PET Host on RS port:

```

1. UCI-108 GPU address      = 99      [00..99]
2. UCI-108 Tag              = UCI_0001 (8 ASCII characters)
3. BPM port baudrate        = 1200      [1200|2400|4800]
4. BPM receiver gain        = 8        [1..8]
5. BPM port timeout         = 250      (ms) [10..2000]
6. RS port baudrate         = 38400     [1200|2400|4800|9600|19200|38400|57600|115200]
7. RS port turnaround delay = 1        (ms) [0..100]
8. PET filter GPU lower addr. = 00      [0..99]
9. PET filter GPU higher addr. = 99      [0..99]
10. PET filter Flexconn lower addr. = 0000    [0..1899]
11. PET filter Flexconn higher addr. = 1899    [0..1899]
12. Cache enable/disable    = DISABLED [ENABLED|DISABLED]
14. Cache timeout           = 30        (s) [5..60]

```

Enter choice:

- Select an option followed by the 'enter-key' to modify the value if applicable. Repeat this procedure until all configuration items are completed.
- Leave the menu by the 'enter-key'. The UCI-108 will reset after this command.
- Leave the TERMINAL mode (see section 6.1).

6.4 Commissioning PET mode with host on BPM port

Requests are forwarded from the Host port to the Field port bus. Responses received on the Field port are returned on the Host port. The Field port is active as master for the fieldbus. The Field port Time-out is used to wait for a response of a Field Device.

Instructions for basic configuration:

- Enter the TERMINAL mode (see section 6.1)
- Show and check the current configuration settings by entering the command:
config show
- If applicable, set the UCI-108 to factory default configuration values. The UCI-108 will reset after this command.
config reset
- If applicable, set the New-line character (default CRLF) for the terminal mode to match the PC terminal application.
item UL=[CR|LF|CRLF]
- Configure the UCI-108 mode by entering the command:
config setup
- The current active mode is showed by the asterisk * behind one of the options.

Select UCI-108 Mode:

```

1. Modem *
2. PET Host on RS port
3. PET Host on BPM port
4. SmartLink
5. Modbus Tunnel Host
6. Modbus Tunnel Field

```

Enter choice:

- Select the mode 'PET Host on RS port' by selecting option 3 followed by 'enter-key'.
- A list of options to configure this mode is shown.

```
Setup PET Host on BPM port:
 1. UCI-108 GPU address      = 99      [00..99]
 2. UCI-108 Tag              = UCI_0001 (8 ASCII characters)
 3. BPM port baudrate        = 1200     [1200|2400|4800]
 4. BPM receiver gain        = 8         [1..8]
 5. BPM port turnaround delay = 10      (ms) [0..100]
 6. RS port baudrate         = 38400    [1200|2400|4800|9600|19200|38400|57600|115200]
 7. RS port timeout          = 600      (ms) [10..2000]
 8. PET filter GPU lower addr. = 00      [0..99]
 9. PET filter GPU higher addr. = 99     [0..99]
10. PET filter Flexconn lower addr. = 0000 [0..1899]
11. PET filter Flexconn higher addr. = 1899 [0..1899]
12. Cache enable/disable     = DISABLED [ENABLED|DISABLED]
13. Cache timeout            = 30       (s) [5..60]
Enter choice:
```

- Select an option followed by the 'enter-key' to modify the value if applicable. Repeat this procedure until all configuration items are completed.
- Leave the menu by the 'enter-key'. The UCI-108 will reset after this command.
- Leave the TERMINAL mode (see section 6.1).

6.5 Commissioning SMARTLINK Mode

This configuration allows to connect a Host with a RS serial port to one or multiple Field Devices. Only requests from the Host addressed to the UCI will be handled. In SMARTLINK mode the UCI-108 needs to have a CIU GPU address and a Flexconn address so it can be addressed by the Host. The Field port Time-out is used to wait for a response of a Field Device. The Flexconn lower and upper filter addresses are used to determine which Flexconn messages will be forwarded by the UCI.

Instructions for basic configuration:

- Enter the TERMINAL mode (see section 6.1)
- Show and check the current configuration settings by entering the command:
config show
- If applicable, set the UCI-108 to factory default configuration values. The UCI-108 will reset after this command.
config reset
- If applicable, set the New-line character (default CRLF) for the terminal mode to match the PC terminal application.
item UL=[CR|LF|CRLF]
- Configure the UCI-108 mode by entering the command:
config setup
- The current active mode is showed by the asterisk * behind one of the options.

```
Select UCI-108 Mode:
 1. Modem *
 2. PET Host on RS port
 3. PET Host on BPM port
 4. SmartLink
 5. Modbus Tunnel Host
 6. Modbus Tunnel Field
Enter choice:
```

- Select the mode 'SmartLink' by selecting option 4 followed by 'enter-key'.
- A list of options to configure this mode is shown.

```
Setup SmartLink:
  1. UCI-108 GPU address      = 99      [00..99]
  2. UCI-108 Tag              = UCI_0001 (8 ASCII characters)
  3. BPM port baudrate        = 1200     [1200|2400|4800]
  4. BPM receiver gain        = 8        [1..8]
  5. BPM port timeout         = 250      (ms) [10..2000]
  6. RS port baudrate         = 38400    [1200|2400|4800|9600|19200|38400|57600|115200]
  7. RS port turnaround delay = 1      (ms) [0..100]
  8. SmartLink ACK handshake  = ENABLED [ENABLED|DISABLED]
  9. SmartLink CIU address    = 0        [0..9]
 10. SmartLink Flexconn address = 1900 [1900..1999]
 11. SmartLink lower filter addr. = 0000 [0..1899]
 12. SmartLink higher filter addr. = 1899 [0..1899]
 13. Cache enable/disable      = DISABLED [ENABLED|DISABLED]
 14. Cache timeout            = 30       (s) [5..60]
```

Enter choice:

- Select an option followed by the 'enter-key' to modify the value if applicable. Repeat this procedure until all configuration items are completed.
- Leave the menu by the 'enter-key'. The UCI-108 will reset after this command.
- Leave the TERMINAL mode (see section 6.1).

6.6 Commissioning MODBUSTUNNEL Mode

This configuration allows to connect a Modbus RTU master to one or multiple Modbus slave Field Device(s) over the BPM fieldbus for concurrently use with the Tank Management application and or integration in the CIU888. Modbus slave Field Device addresses are mapped to GPU addresses and share the same GPU address space.

Instructions for basic configuration of 'host' UCI-108:

- Enter the TERMINAL mode (see section 6.1)
- Show and check the current configuration settings by entering the command:
config show
- If applicable, set the UCI-108 to factory default configuration values. The UCI-108 will reset after this command.
config reset
- If applicable, set the New-line character (default CRLF) for the terminal mode to match the PC terminal application.
item UL=[CR|LF|CRLF]
- Configure the UCI-108 mode by entering the command:
config setup
- The current active mode is showed by the asterisk * behind one of the options.

```
Select UCI-108 Mode:
  1. Modem *
  2. PET Host on RS port
  3. PET Host on BPM port
  4. SmartLink
  5. Modbus Tunnel Host
  6. Modbus Tunnel Field
Enter choice:
```

- Select the mode 'Modbus Tunnel Host' by selecting option 5 followed by 'enter-key'.
- A list of options to configure this mode is shown.

```
Setup Modbus Tunnel Host:
  1. UCI-108 GPU address      = 99          [00..99]
  2. UCI-108 Tag              = UCI_0001      (8 ASCII characters)
  3. BPM port baudrate        = 1200         [1200|2400|4800]
  4. BPM receiver gain        = 8            [1..8]
  5. BPM port timeout         = 250          (ms) [10..2000]
  6. RS port baudrate         = 38400        [1200|2400|4800|9600|19200|38400|57600|115200]
  7. RS port turnaround delay = 1           (ms) [0..100]
  8. Modbus host filter mask  = 0FFFFFFFFF (hex mask)
  9. Cache enable/disable     = DISABLED     [ENABLED|DISABLED]
  10. Cache timeout           = 30           (s) [5..60]
Enter choice:
```

- Select an option followed by the 'enter-key' to modify the value if applicable. Repeat this procedure until all configuration items are completed.
- Leave the menu by the 'enter-key'. The UCI-108 will reset after this command.
- Leave the TERMINAL mode (see section 6.1).

Instructions for basic configuration of 'field' UCI-108:

- Enter the TERMINAL mode (see section 6.1)
- Show and check the current configuration settings by entering the command:
config show
- If applicable, set the UCI-108 to factory default configuration values. The UCI-108 will reset after this command.
config reset
- If applicable, set the New-line character (default CRLF) for the terminal mode to match the PC terminal application.
item UL=[CR|LF|CRLF]
- Configure the UCI-108 mode by entering the command:
config setup
- The current active mode is showed by the asterisk * behind one of the options.

```
Select UCI-108 Mode:
  1. Modem *
  2. PET Host on RS port
  3. PET Host on BPM port
  4. SmartLink
  5. Modbus Tunnel Host
  6. Modbus Tunnel Field
Enter choice:
```

- Select the mode 'Modbus Tunnel Field' by selecting option 6 followed by 'enter-key'.
- A list of options to configure this mode is shown.

Setup Modbus Tunnel Field:

```
  1. UCI-108 GPU address      = 99          [00..99]
  2. UCI-108 Tag              = UCI_0001      (8 ASCII characters)
  3. BPM port baudrate        = 1200         [1200|2400|4800]
  4. BPM receiver gain        = 8            [1..8]
  5. BPM port turnaround delay = 10          (ms) [0..100]
  6. RS port baudrate         = 38400        [1200|2400|4800|9600|19200|38400|57600|115200]
  7. RS port timeout         = 600          (ms) [10..2000]
  8. Modbus field 2nd slave address = DISABLED [1..99]
  9. Modbus field 3rd slave address = DISABLED [1..99]
  10. Cache enable/disable     = DISABLED     [ENABLED|DISABLED]
  11. Cache timeout           = 30           (s) [5..60]
Enter choice:
```

- Select an option followed by the 'enter-key' to modify the value if applicable. Repeat this procedure until all configuration items are completed.
- Leave the menu by the 'enter-key'. The UCI-108 will reset after this command.
- Leave the `TERMINAL` mode (see section 6.1).

6.7 Use case: Monitor BPM fieldbus

This mode allows to connect a UCI-108 at a certain spot on the BPM fieldbus to monitor the BPM message traffic and signal strength of each received message.

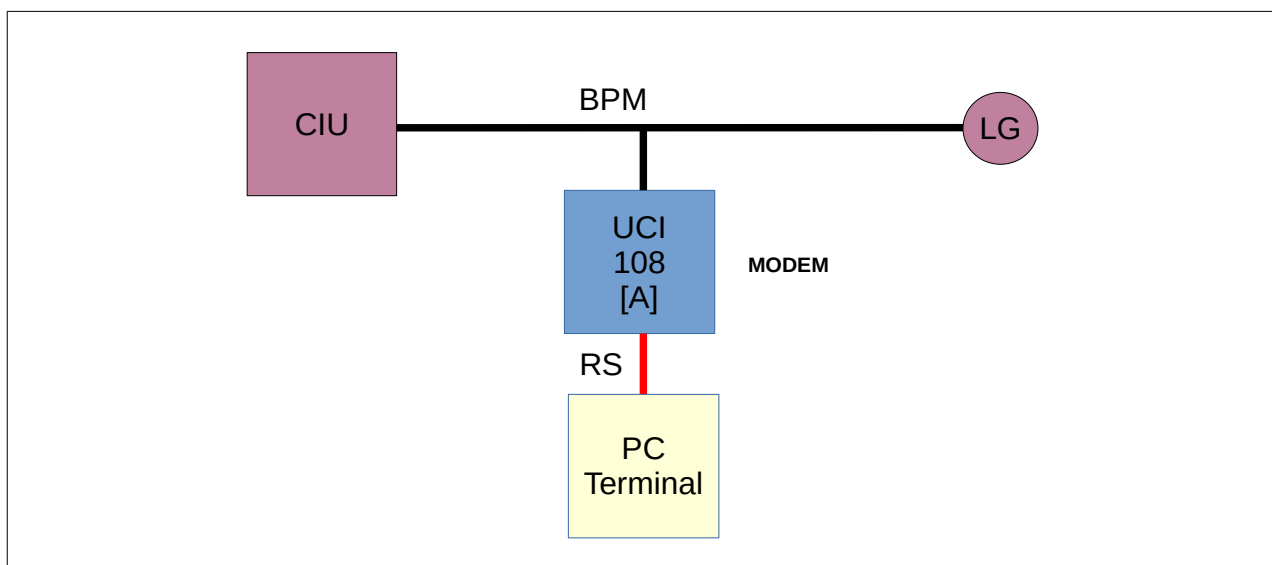
- Set all address DIP switches of UCI-108[A] to 'OFF'.
- Commissioning can be performed in two ways:
 - By the command `config setup` following the menu options and modifying the applicable values. Enter the values of the yellow marked cells in colom A of Tabel 7 as configuration example.
 - Or by the command `item <Item>=<Value>` for each relevant Item to be modified, see yellow marked cells in colom A of Tabel 7.

<code>item UM=MODEM</code>	(Set the mode, is the default value)
<code>item UA=90</code>	(Set the UCI-108 GPU Device Address)
<code>item UT=Unit---A</code>	(Set the UCI-108 tag name)
<code>item BB=1200</code>	(Set the BPM baud rate, is the default value)
<code>item BG=8</code>	(Set the BPM gain, is the default value)
<code>item RB=115200</code>	(Set the RS port baud rate)
<code>item US=YES</code>	(Reset the UCI-108)

Notes:

- Use command `item item ER=YES` in case you first want to restore the UCI-108 to default configuration settings before commissioning.
- In MODEM mode there is no Host or Field port present. So the port turnaround delay and port timeout settings are not applicable.
- The cache functionality is in MODEM mode not available and disabled.

Table 7: Relevant items (in yellow) for use case 'Monitor BPM fieldbus'



Use case: Monitor BPM network				
UCI Item configuration settings				
UCI-108 Unit		A		
Address DIP switch		off		
Common items				
Mode	UM	MODEM		
UCI-108 GPU address	UA	90		
UCI-108 Tag	UT	Unit---A		
BPM items				
BPM port baudrate	BB	1200 (default)		
BPM receiver gain	BG	8 (default)		
BPM port turnaround delay	BD	n.a.		
BPM port timeout	BT	n.a.		
RS items				
RS port baudrate	RB	115200		
RS port turnaround delay	RD	n.a.		
RS port timeout	RT	n.a.		
SmartLink items				
ACK handshake	SA	n.a.		
SmartLink CIU address	SG	n.a.		
SmartLink Flexconn address	SF	n.a.		
SmartLink lower filter addr.	S3	n.a.		
SmartLink higher filter addr.	S4	n.a.		
Modbus tunnel items				
Modbus Tunnel UCI Device type	TT	n.a.		
Modbus Host Filter add address	TA	n.a.		
Modbus Host Filter delete address	TD	n.a.		
Modbus Host Filter Query	TQ	n.a.		
Modbus Host Filter Mask	TM	n.a.		
Modbus Field Second Address	T2	n.a.		
Modbus Field Third Address	T3	n.a.		
Field Device Location items				
Field Device expiration time	LT	n.a.		
Field Device expiration count	LN	n.a.		
PET items				
PET Host port	PH	n.a.		
PET Filter GPU lower addr.	F1	n.a.		
PET Filter GPU higher addr.	F2	n.a.		
PET Filter Flexconn lower addr.	F3	n.a.		
PET Filter Flexconn higher addr.	F4	n.a.		
Cache items				
Cache	AE	n.a.		
Cache timeout	AT	n.a.		

6.8 Use case: Insert network segment

In this example the BPM traffic is 'tunneled' over a network segment using another physical layer and/or protocol.

- Set all address DIP switches of UCI-108[A] to 'OFF'.
- The commissioning can be performed in two ways:
 - By the command `config setup` following the menu options and modifying the applicable values. Enter the values of the yellow marked cells in colom A of Tabel 8 as configuration example.
 - By entering the command `item <Item>=<Value>` for each relevant Item to be modified, see yellow marked cells colom A of Tabel 8.

```

item UM=PET           (Set the UCI-108 mode)
item UA=97            (Set the UCI-108 GPU Device Address)
item UT=Unit---A      (Set the UCI-108 tag name)
item BB=1200          (Set the BPM baud rate, is the default value)
item BG=8             (Set the BPM gain, is the default value)
item BD=10            (Set the BPM turnaround delay time, is the default value)
item RB=115200        (Set the RS port baud rate)
item RT=850           (Set the RS port time out, see notes)
item PH=BPM           (Set the PET Host port to BPM)
item AE=ENABLED       (Enable the cache, see notes)
item AT=30            (Set cache timeout, the default value)
item US=YES           (Reset the UCI-108)

```

- Set all address DIP switches of UCI-108[B] to 'OFF'.
- The commissioning can be performed in two ways:
 - By the command `config setup` following the menu options and modifying the applicable values. Enter the values of the yellow marked cells in colom B of Tabel 8 as configuration example.
 - By entering the command `item <Item>=<Value>` for each relevant Item to be modified, see yellow marked cells colom B of Tabel 8.

```

item UM=PET           (Set the UCI-108 mode)
item UA=98            (Set the UCI-108 GPU Device Address)
item UT=Unit---B      (Set the UCI-108 tag name)
item BB=1200          (Set the BPM baud rate, is the default value)
item BG=8             (Set the BPM gain, is the default value)
item BT=250           (Set the BPM port time out, is the default value)
item RB=115200        (Set the RS port baud rate)
item RD=1             (The default value)
item PH=RS            (Set the PET Host port to RS, is the default value)
item AE=ENABLED       (Enable the cache, see notes)
item AT=30            (Set cache timeout, the default value)
item US=YES           (Reset the UCI-108)

```

Notes:

- Use command item `item ER=YES` in case you first want to restore the UCI-108 to default configuration settings before commissioning.
- The caches of both the UCI-108[A] and UCI-108[B] are ENABLED to optimize the response time to the Host (CIU) for the requests in the foreground scan.
- The UCI-108[A]_{RS Field port time-out} has to cover at least the delays caused by the network segment, the message relaying by the UCI-108[B] and the UCI-108[B]_{BPM port timeout}. Use formula:

$$\text{UCI-108 [A]}_{\text{RS port timeout}} \geq 2 * T_{\text{delay network segment}} + 2 * \text{Max}(\text{UCI-108[B]}_{\text{BPM request/reply time @ baudrate : UCI-108[B]}_{\text{BPM port timeout}}) + \text{UCI-108[B]}_{\text{BPM port timeout}}$$
For this example: $\text{UCI-108[A]}_{\text{RS port timeout}} \geq 2 * 50 + 2 * \text{Max}(250 : 250) + 250 = 100 + 2 * 250 + 250 = 850 \text{ ms}$. Set UCI-108[A]_{RS port timeout} to at least 850 ms.
- The **CIU BPM Field port time out setting** has to be set to minimal the UCI-108 [A] RS Field port timeout. Add a margin to avoid time out by large request/reply messages, set in this case to 1000 ms.
- For good initialization of the cache set the cache timeout to at least 2,5 times the total scanning period (including overhead by scanning timeouts). In this example it is set to the 30 seconds (max 60 seconds).
- The Field Device Location and Filter items are applicable in this mode. The default values are used in the example.

Table 8: Relevant items (in yellow) for use case 'Insert Network Segment'

<p>Use case: Insert network segment</p>				
IMPORTANT: Set the CIU880/888 BPM field port timeout to 1000 ms				
UCI Item configuration settings				
UCI-108 Unit		A	B	
Address DIP switch		off	off	
Common items				
Mode	UM	PET	PET	
UCI-108 GPU address	UA	97	98	

UCI-108 Tag	UT	Unit---A	Unit---B	
BPM items				
BPM port baudrate	BB	1200 (default)	1200 (default)	
BPM receiver gain	BG	8 (default)	8 (default)	
BPM port turnaround delay	BD	10 (default)	n.a.	
BPM port timeout	BT	n.a.	250 (default)	
RS items				
RS port baudrate	RB	115200	115200	
RS port turnaround delay	RD	n.a.	1 (default)	
RS port timeout	RT	850	n.a.	
SmartLink items				
ACK handshake	SA	n.a.	n.a.	
SmartLink CIU address	SG	n.a.	n.a.	
SmartLink Flexconn address	SF	n.a.	n.a.	
SmartLink lower filter addr.	S3	n.a.	n.a.	
SmartLink higher filter addr.	S4	n.a.	n.a.	
Modbus tunnel items				
Modbus Tunnel UCI Device type	TT	n.a.	n.a.	
Modbus Host Filter add address	TA	n.a.	n.a.	
Modbus Host Filter delete address	TD	n.a.	n.a.	
Modbus Host Filter Query	TQ	n.a.	n.a.	
Modbus Host Filter Mask	TM	n.a.	n.a.	
Modbus Field Second Address	T2	n.a.	n.a.	
Modbus Field Third Address	T3	n.a.	n.a.	
Field Device Location items				
Field Device expiration time	LT	300 (default)	300 (default)	
Field Device expiration count	LN	3 (default)	3 (default)	
PET items				
PET Host port	PH	BPM	RS (default)	
PET Filter GPU lower addr.	F1	0 (default)	0 (default)	
PET Filter GPU higher addr.	F2	99 (default)	99 (default)	
PET Filter Flexconn lower addr.	F3	0 (default)	0 (default)	
PET Filter Flexconn higher addr.	F4	1899 (default)	1899 (default)	
Cache items				
Cache	AE	ENABLED	ENABLED	
Cache timeout	AT	30 (default)	30 (default)	

6.9 Use case: Extend BPM network

In this example the BPM fieldbus with a maximum of connected Field devices is extended by placing a dual UCI-108 node at the end of the fieldbus. New Field devices can be connected at the extended BPM fieldbus.

- Set the UCI-108[A] Address DIP switch to AD-1.
- The commissioning can be performed in two ways:
 - By the command `config setup` following the menu options and modifying the applicable values. Enter the values of the yellow marked cells in colom A of Table 9 as configuration example.
 - By entering the command `item <Item>=<Value>` for each relevant Item to be modified, see yellow marked cells colom A of Table 9.

<code>item UM=PET</code>	(Set the UCI-108 mode)
<code>item UA=93</code>	(Set the UCI-108 GPU Device Address)
<code>item UT=Unit---A</code>	(Set the UCI-108 tag name)
<code>item BB=1200</code>	(Set the BPM baud rate, is the default value)
<code>item BG=8</code>	(Expected to be set to most sensitive, the default value)
<code>item BD=10</code>	(The default value)
<code>item PH=BPM</code>	(Set the PET Host port to BPM)
<code>item AE=ENABLED</code>	(Enable the cache, see notes)
<code>item AT=30</code>	(Set cache timeout, the default value)
<code>item US=YES</code>	(Reset the UCI-108)

- Set the UCI-108[B] Address DIP switch to AD-2.
- The commissioning can be performed in two ways:
 - By the command `config setup` following the menu options and modifying the applicable values. Enter the values of the yellow marked cells in colom B of Table 9 as configuration example.
 - By entering the command `item <Item>=<Value>` for each relevant Item to be modified, see yellow marked cells colom B of Table 9.

<code>item UM=PET</code>	(Set the UCI-108 mode)
<code>item UA=94</code>	(Set the UCI-108 GPU Device Address)
<code>item UT=Unit---B</code>	(Set the UCI-108 tag name)
<code>item BB=1200</code>	(Set the BPM baud rate, is the default value)
<code>item BG=8</code>	(The default value)
<code>item BT=250</code>	(Set the BPM port timeout, the default value)
<code>item PH=RS</code>	(Set the PET Host port to RS, is the default value)
<code>item AE=DISABLED</code>	(Disable the cache, see notes)
<code>item US=YES</code>	(Reset the UCI-108)

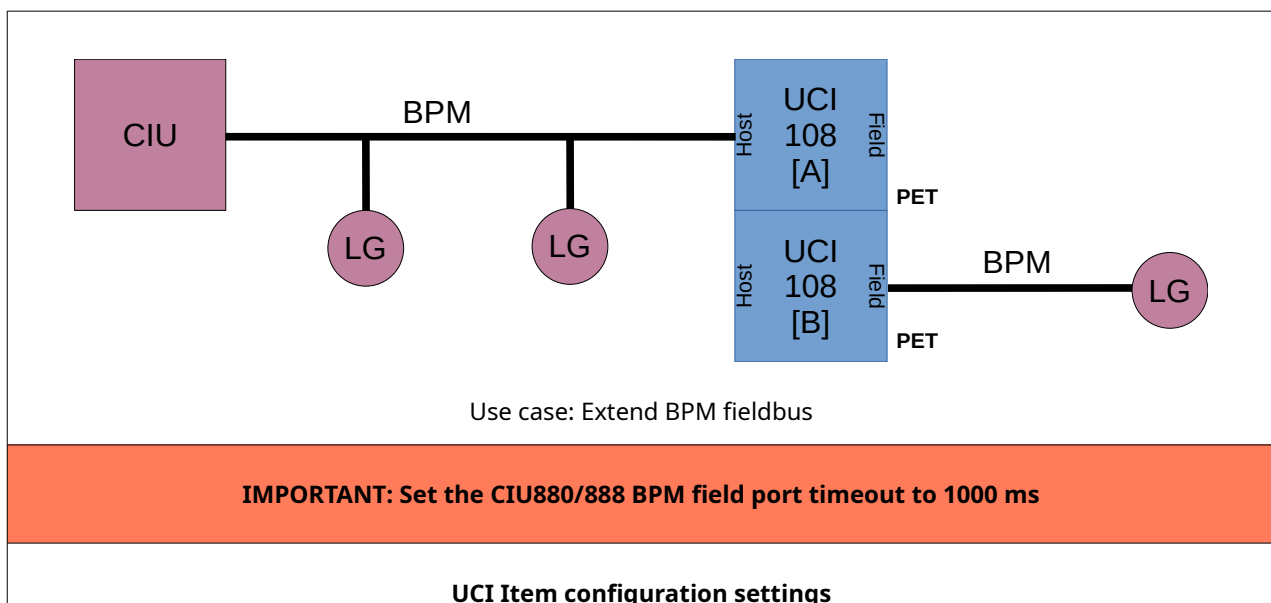
Notes:

- Use command item `item ER=YES` in case you first want to restore the UCI-108 to default configuration settings before commissioning.
- The two UCI-108s are connected to each other by means of the DIN rail bus connector.
- The cache of UCI-108[A] is ENABLED to optimize the response time to the Host (CIU) for the requests in the foreground scan.
- The **CIU BPM Field port time out** has to cover the delay caused the message relaying of the UCI-108[A] and UCI-108[B], the $UCI-108[B]_{BPM \text{ port timeout}}$ and the internal bus communication delay. Use formula:

$$CIU_{BPM \text{ Field port time out}} \geq 2 * \text{Max}(UCI-108[B]_{BPM \text{ request/reply time @ baudrate}} : UCI-108[B]_{BPM \text{ port timeout}}) + UCI-108[B]_{BPM \text{ port timeout}} + 20.$$

For this example: $CIU_{BPM \text{ Field port time out}} \geq 2 * \text{Max}(250 : 250) + 250 + 20 = 2 * 250 + 250 + 20 = 770 \text{ ms}$. Add a margin to avoid time out by large request/reply messages, set the CIU BPM Field port time out setting in this case to **1000 ms**.
- For good initialization of the cache set the cache timeout to at least 2,5 times the total scanning period (including overhead by scanning timeouts). In this example it is set to the 30 seconds (max 60 seconds).
- The free RS port of UCI-108[B] can be used to connect a PC terminal application for commissioning the UCI-108 node, monitor the BPM messages or the Honeywell-Enraf Engauge tool. Configure therefore also the items for RS Host port. The Engauge COM port timeout has to be set to $\geq 1000 \text{ ms}$. The cache feature is disabled to enable the reception of the latest response.
- The Field Device Location and Filter items are applicable in this mode. The default values are used in the example.

Table 9: Relevant items (in yellow) for use case 'Extend BPM fieldbus'



UCI-108 Unit		A	B	
Address DIP switch		AD-1=ON	AD-2=ON	
Common items				
Mode	UM	PET	PET	
UCI-108 GPU address	UA	93	94	
UCI-108 Tag	UT	Unit---A	Unit---B	
BPM items				
BPM port baudrate	BB	1200 (default)	1200 (default)	
BPM receiver gain	BG	8 (default)	8 (default)	
BPM port turnaround delay	BD	10 (default)	n.a.	
BPM port timeout	BT	n.a.	250 (default)	
RS items				
RS port baudrate	RB	38400 (default)	115200	
RS port turnaround delay	RD	n.a.	1 (default)	
RS port timeout	RT	250 (default)	n.a.	
SmartLink items				
ACK handshake	SA	n.a.	n.a.	
SmartLink CIU address	SG	n.a.	n.a.	
SmartLink Flexconn address	SF	n.a.	n.a.	
SmartLink lower filter addr.	S3	n.a.	n.a.	
SmartLink higher filter addr.	S4	n.a.	n.a.	
Modbus tunnel items				
Modbus Tunnel UCI Device type	TT	n.a.	n.a.	
Modbus Host Filter add address	TA	n.a.	n.a.	
Modbus Host Filter delete address	TD	n.a.	n.a.	
Modbus Host Filter Query	TQ	n.a.	n.a.	
Modbus Host Filter Mask	TM	n.a.	n.a.	
Modbus Field Second Address	T2	n.a.	n.a.	
Modbus Field Third Address	T3	n.a.	n.a.	
Field Device Location items				
Field Device expiration time	LT	300 (default)	300 (default)	
Field Device expiration count	LN	3 (default)	3 (default)	
PET Filter items				
PET Host port	PH	BPM	RS (default)	
PET Filter GPU lower addr.	F1	0 (default)	0 (default)	
PET Filter GPU higher addr.	F2	99 (default)	99 (default)	
PET Filter Flexconn lower addr.	F3	0 (default)	0 (default)	
PET Filter Flexconn higher addr.	F4	1899 (default)	1899 (default)	
Cache items				
Cache	AE	ENABLED	DISABLED (default)	
Cache timeout	AT	30 (default)	30 (default)	

6.10 Use case: Connect host(s) to multiple BPM fieldbuses

In this example the UCI-108 provides access to multiple BPM fieldbuses for a host application or for a CIU as 'Downlink'. The setup is configured as dual UCI-108 node to join multiple hosts and split to multiple BPM fieldbuses. See Table 10 for configuration of the required Items.

- Set the UCI-108[A] Address DIP switch to AD-1.
- The commissioning can be performed in two ways:
 - By the command `config setup` following the menu options and modifying the applicable values. Enter the values of the yellow marked cells in colom A of Table 10 as configuration example.
 - By entering the command `item <Item>=<Value>` for each relevant Item to be modified, see yellow marked cells colom A of Table 10.

<code>item UM=SMARTLINK</code>	(Set the UCI-108 mode)
<code>item UT=Unit---A</code>	(Set the UCI-108 tag name)
<code>item BB=1200</code>	(Set the BPM port baudrate, the default value)
<code>item BG=8</code>	(Set the BPM gain, the default value)
<code>item BT=250</code>	(Set the BPM port time out, the default value)
<code>item RB=38400</code>	(Set the RS port baudrate, the default value)
<code>item RD=1</code>	(The default value)
<code>item SA=ENABLED</code>	(Set the ACK handshake, the default value)
<code>item SG=1</code>	(Set the CIU address)
<code>item SF=1901</code>	(Set the Flexconn address)
<code>item AE=ENABLED</code>	(Enable the cache, see notes)
<code>item AT=30</code>	(Set cache timeout, the default value)
<code>item US=YES</code>	(Reset the UCI-108)

- Set the UCI-108[B] Address DIP switch to AD-2.
- The commissioning can be performed in two ways:
 - By the command `config setup` following the menu options and modifying the applicable values. Enter the values of the yellow marked cells in colom B of Table 10 as configuration example.
 - By entering the command `item <Item>=<Value>` for each relevant Item to be modified, see yellow marked cells colom B of Table 10.

<code>item UM=PET</code>	(Set the UCI-108 mode)
<code>item UA=98</code>	(Set the UCI-108 GPU Device Address)
<code>item UT=Unit---B</code>	(Set the UCI-108 tag name)
<code>item BB=1200</code>	(Set the BPM port baudrate, the default value)
<code>item BG=8</code>	(Set the BPM gain, the default value)
<code>item BT=250</code>	(Set the BPM port time out, the default value)
<code>item RB=155200</code>	(Set the RS port baudrate)
<code>item RD=1</code>	(The default value)

`item PH=RS` (Set the PET Host port to RS, the default value)
`item AE=DISABLED` (Disable the cache, see notes)
`item US=YES` (Reset the UCI-108)

Notes:

- Use command `item ER=YES` in case you first want to restore the UCI-108 to default configuration settings before commissioning.
- The two UCI-108s are connected to each other by means of the DIN rail bus connector.
- It is recommended to enable the cache of UCI-108[A] to optimize the response time to the Host application or CIU for requests in the foreground scan.
- For good initialization of the cache set the cache timeout to at least 2,5 times the total scanning period (including overhead by scanning timeouts). In this example it is set to the 30 seconds (max 60 seconds).
- The free RS port of UCI-108[B] can be used to connect a PC terminal application for commissioning the UCI-108 node, monitor the BPM messages or the Honeywell-Enraf Engauge tool. Configure therefore also the items for RS Host port. The Engauge COM port timeout has to be set to ≥ 1000 ms. The cache feature is disabled to enable the reception of the latest response.
- The Field Device Location and Filter items are applicable in both modes. The default values are used in the example.

Table 10: Relevant items (in yellow) for use case 'Connect host(s) to multiple BPM fieldbuses'

<p>Use case: Connect host(s) to multiple BPM fieldbuses</p>				
UCI Item configuration settings				
UCI-108 Unit		A	B	
Address DIP switch		AD-1=ON	AD-2=ON	
Common items				
Mode	UM	SMARTLINK	PET	
UCI-108 GPU address	UA	n.a.	98	

UCI-108 Tag	UT	Unit---A	Unit---B	
BPM items				
BPM port baudrate	BB	1200 (default)	1200 (default)	
BPM receiver gain	BG	8 (default)	8 (default)	
BPM port turnaround delay	BD	n.a.	n.a.	
BPM port timeout	BT	250 (default)	250 (default)	
RS items				
RS port baudrate	RB	38400 (default)	115200	
RS port turnaround delay	RD	1 (default)	1 (default)	
RS port timeout	RT	n.a.	n.a.	
SmartLink items				
ACK handshake	SA	ENABLED (default)	n.a.	
SmartLink CIU address	SG	1	n.a.	
SmartLink Flexconn address	SF	1901	n.a.	
SmartLink lower filter addr.	S3	0 (default)	n.a.	
SmartLink higher filter addr.	S4	1899 (default)	n.a.	
Modbus tunnel items				
Modbus Tunnel UCI Device type	TT	n.a.	n.a.	
Modbus Host Filter add address	TA	n.a.	n.a.	
Modbus Host Filter delete address	TD	n.a.	n.a.	
Modbus Host Filter Query	TQ	n.a.	n.a.	
Modbus Host Filter Mask	TM	n.a.	n.a.	
Modbus Field Second Address	T2	n.a.	n.a.	
Modbus Field Third Address	T3	n.a.	n.a.	
Field Device Location items				
Field Device expiration time	LT	300 (default)	300 (default)	
Field Device expiration count	LN	3 (default)	3 (default)	
PET Filter items				
PET Host port	PH	n.a.	RS (default)	
PET Filter GPU lower addr.	F1	n.a.	0 (default)	
PET Filter GPU higher addr.	F2	n.a.	99 (default)	
PET Filter Flexconn lower addr.	F3	n.a.	0 (default)	
PET Filter Flexconn higher addr.	F4	n.a.	1899 (default)	
Cache items				
Cache	AE	ENABLED	DISABLED (default)	
Cache timeout	AT	30 (default)	30 (default)	

6.11 Use case: Join two BPM buses into one BPM bus

In this example the requests on the BPM fieldbus from two individual CIUs addressing the same Field Devices are forwarded to a single BPM fieldbus. This can be of use in CIU migration projects. It is a different variant of using multi hosts. In this example three UCI-108s are connected to form a multi UCI-108 node.

Set the Address DIP switch for each UCI-108 at the right position and configure each UCI-108 according the settings in Table 11.

Use the command `config setup` following the menu options `config setup` or `item <Item>=<Value>` in the command line interpreter as explained in the previous examples for the applicable values not having the default setting.

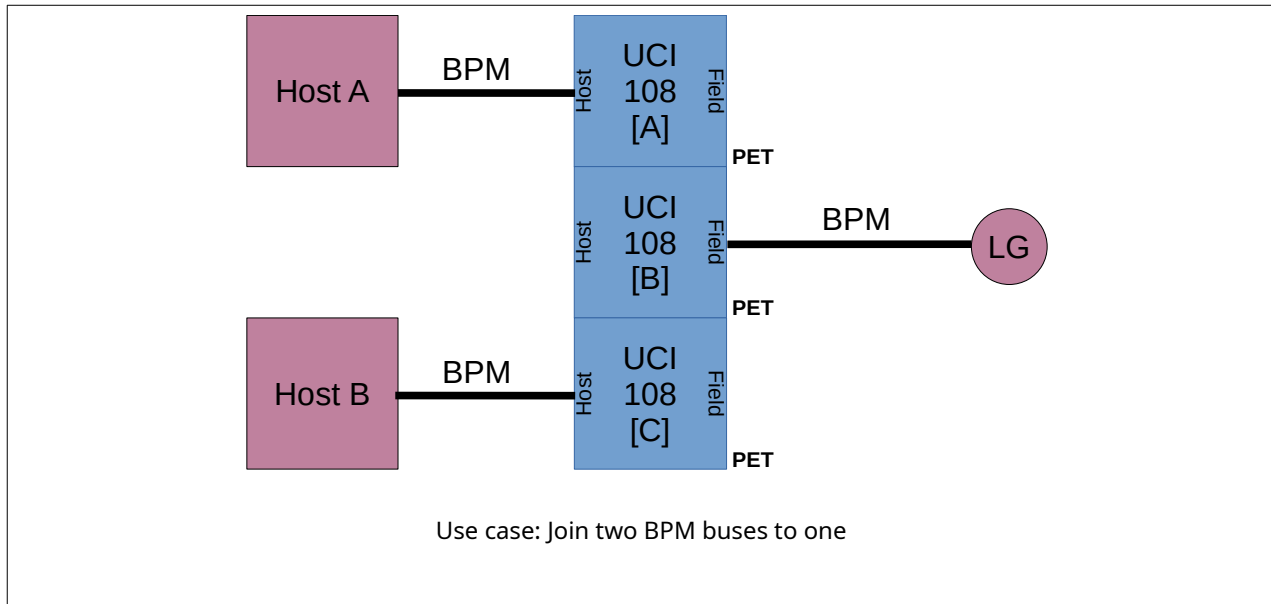
Notes:

- Use command `item item ER=YES` in case you first want to restore the UCI-108 to default configuration settings before commissioning.
- The three UCI-108s are connected to each other by means of the DIN rail bus connector.
- The **CIU BPM Field port time out setting** of both CIUs has to cover the delay caused by message relaying of the UCI-108 [A], UCI-108 [B] and UCI-108[C], the $UCI-108[B]_{BPM \text{ port timeout}}$ and the internal bus communication delay. Use formula:

$$CIU_{BPM \text{ Field port time out}} \geq 2 * \text{Max}(UCI-108[B]_{BPM \text{ request/reply time @ baudrate}} : UCI-108[B]_{BPM \text{ port timeout}}) + UCI-108[B]_{BPM \text{ port timeout}} + 20).$$
 For this example: $CIU_{BPM \text{ Field port time out}} \geq 2 * \text{Max}(250 : 250) + 250 + 20 = 2 * 250 + 250 + 20 = 770 \text{ ms}$. Add a margin to avoid time out by large request/reply messages, set the CIU BPM Field port time out setting in this case to **1000 ms**.
- The delay can be reduced by increasing the BPM baudrate of the BPM fieldbuses. E.g. to 4800 baud from the CIUs to the UCI-108[A] and UCI-108[C] and 2400 baud to the Field Devices at UCI-108[B].
- It is recommended to enable the cache of UCI-108[A] and UCI-108[C] to optimize the response time to the CIUs for the requests in the foreground scan.
- For good initialization of the cache set the cache timeout to at least 2,5 times the total scanning period (including overhead by scanning timeouts). In this example it is set to the 30 seconds (max 60 seconds).
- The free RS port of UCI-108[B] can be used to connect a PC terminal application for commissioning the UCI-108 node, monitor the BPM messages or the Honeywell-Enraf Engauge tool. Configure therefore also the items for RS Host port. The Engauge COM port timeout has to be set to $\geq 1000 \text{ ms}$. The cache feature is disabled to enable the reception of the latest response.

- The Field Device Location and Filter items are applicable in this mode. The default values are used in the example.

Table 11: Relevant items (in yellow) for use case 'Join two BPM buses to one'



IMPORTANT: Set the CIU880/888 BPM field port timeout to 1000 ms

UCI Item configuration settings				
UCI-108 Unit		A	B	C
Address DIP switch		AD-1=ON	AD-2=ON	AD-3=ON
Common items				
Mode	UM	PET	PET	PET
UCI-108 GPU address	UA	95	96	97
UCI-108 Tag	UT	Unit---A	Unit---B	Unit---C
BPM items				
BPM port baudrate	BB	1200 (default)	1200 (default)	1200 (default)
BPM receiver gain	BG	8 (default)	8 (default)	8 (default)
BPM port turnaround delay	BD	10 (default)	n.a.	10 (default)
BPM port timeout	BT	n.a.	250 (default)	n.a.
RS items				
RS port baudrate	RB	38400 (default)	115200	38400 (default)
RS port turnaround delay	RD	n.a.	1 (default)	n.a.
RS port timeout	RT	250 (default)	n.a.	250 (default)
SmartLink items				
ACK handshake	SA	n.a.	n.a.	n.a.
SmartLink CIU address	SG	n.a.	n.a.	n.a.
SmartLink Flexconn address	SF	n.a.	n.a.	n.a.
SmartLink lower filter addr.	S3	n.a.	n.a.	n.a.
SmartLink higher filter addr.	S4	n.a.	n.a.	n.a.

Modbus tunnel items				
Modbus Tunnel UCI Device type	TT	n.a.	n.a.	n.a.
Modbus Host Filter add address	TA	n.a.	n.a.	n.a.
Modbus Host Filter delete address	TD	n.a.	n.a.	n.a.
Modbus Host Filter Query	TQ	n.a.	n.a.	n.a.
Modbus Host Filter Mask	TM	n.a.	n.a.	n.a.
Modbus Field Second Address	T2	n.a.	n.a.	n.a.
Modbus Field Third Address	T3	n.a.	n.a.	n.a.
Field Device Location items				
Field Device expiration time	LT	300 (default)	300 (default)	300 (default)
Field Device expiration count	LN	3 (default)	3 (default)	3 (default)
PET Filter items				
PET Host port	PH	BPM	RS (default)	BPM
PET Filter GPU lower addr.	F1	0 (default)	0 (default)	0 (default)
PET Filter GPU higher addr.	F2	99 (default)	99 (default)	99 (default)
PET Filter Flexconn lower addr.	F3	0 (default)	0 (default)	0 (default)
PET Filter Flexconn higher addr.	F4	1899 (default)	1899 (default)	1899 (default)
Cache items				
Cache	AE	ENABLED	DISABLED (default)	ENABLED
Cache timeout	AT	30 (default)	30 (default)	30 (default)

6.12 Use case: Modbus tunnel for PLC application

In this example the UCI-108 Modbus tunnel feature is used to run a proprietary PLC application with remote Modbus RTU slave devices over the BPM fieldbus concurrently with Tank Management Application. It is a special case of 'Join multiple hosts to one or multiple BPM fieldbus(es)'.

In this example the CIU request the level gauge connected on the BPM fieldbus, the PCL requests the Modbus level gauges connected to the two 'field' UCI-108s.

Set the Address DIP switch for each UCI-108 at the right position and configure each UCI-108 according the settings in Table 12.

Expected precondition: the item configuration is in factory defaults, see notes.

Use the command `config setup` following the menu options `config setup` or `item <Item>=<Value>` in the command line interpreter as explained in the previous examples for the applicable values not having the default setting.

Notes:

- Use command `item item ER=YES` in case you first want to restore the UCI-108 to default configuration settings before commissioning.
- The UCI-108[A] and UCI-108[B] are connected to each other by means of the DIN rail bus connector.
- Due to the PLC Modbus connection the 'host' UCI-108[B] does not have an operational GPU Device Address.
- The caches of UCI-108's are ENABLED to optimize the response time to the hosts for the requests in the foreground scan.
- The Modbus RTU slave address is one or two addresses higher than its 'field' UCI-108 GPU Device address. The address of Modbus RTU level gauge device connected to UCI-108[C] has to be set to UCI-108[C] GPU device address+1. In this case $90+1=91$.
- The address of Modbus RTU remote I/O slave connected to UCI-108[D] has to be configured to be set to UCI-108[D] GPU device address+1. In this case $92+1=93$.
- The **CIU BPM Field port time out** has to cover the delay caused the message relaying of UCI-108[A], the 'host' UCI-108[B], the 'field' UCI-108[C or D], the UCI-108[B]_{BPM port timeout}, the maximum 'field' UCI-108[C or D]_{RS port time out} and the internal bus communication delay. Use formula:

$$\text{CIU}_{\text{BPM Field port time out}} \geq 2 * \text{Max}(\text{UCI-108[B]}_{\text{BPM request/reply time @ baudrate}} : \text{UCI-108[B]}_{\text{BPM port timeout}}) + \text{UCI-108[B]}_{\text{BPM port timeout}} + \text{UCI-108[C/D]}_{\text{RS port timeout}} + 20).$$

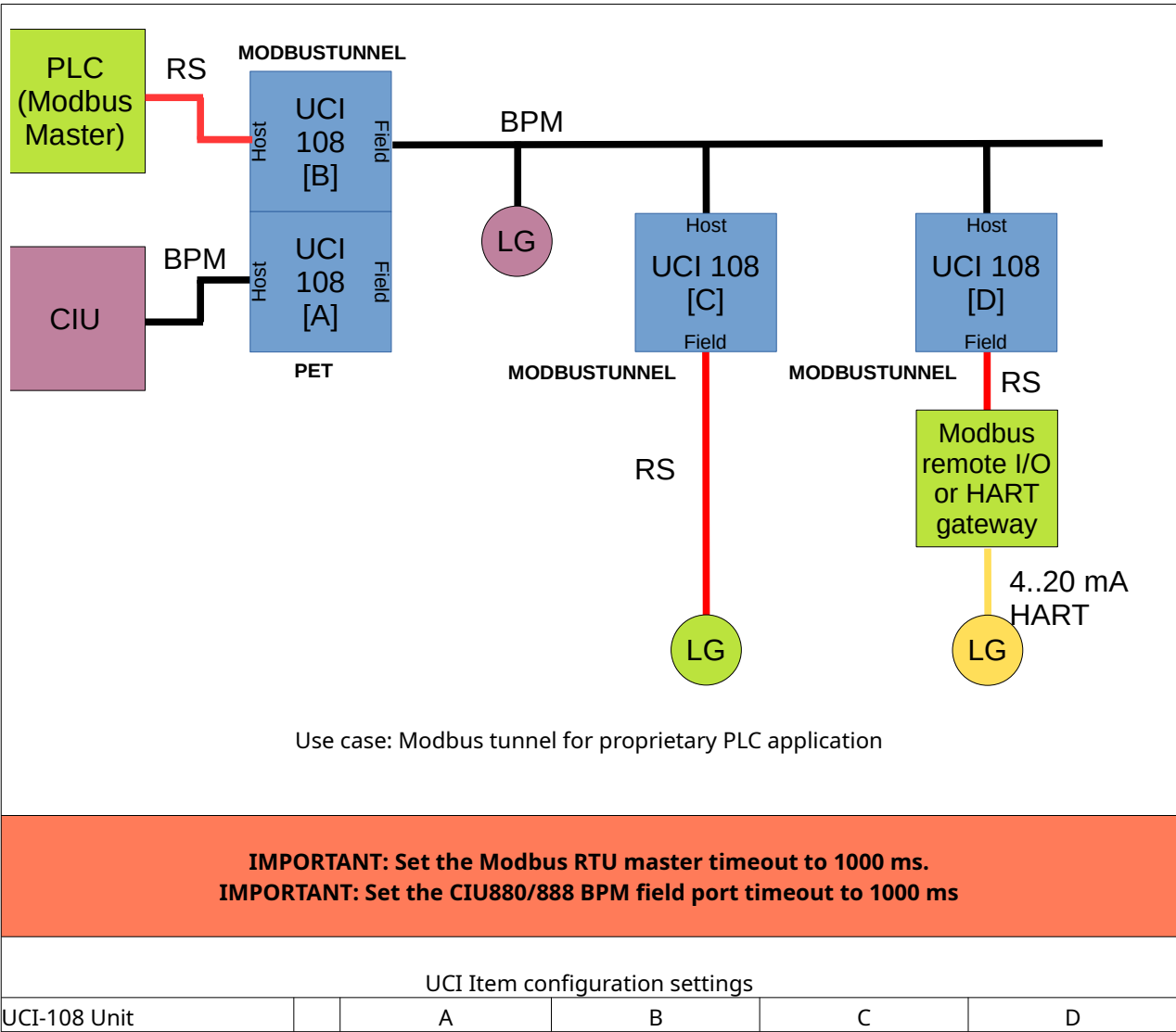
Modbus messages over the BPM fieldbus are approximately 1,4 time larger than the average GPU message. An average Modbus register request/reply message over the BPM fieldbus requires 330 ms at 1200 baud.

For this example: $CIU_{BPM \text{ Field port time out}} \geq 2 * \text{Max}(330 : 200) + 200 + 100 + 20 = 2 * 330 + 200 + 100 + 20 = 980 \text{ ms}$. Set the CIU BPM Field port time out setting in this case to **1000 ms**.

The $CIU888_{BPM \text{ Field port time out}}$ can be reduced by increasing the BPM baudrate and reducing the $UCI-108[B]_{BPM \text{ time out}}$ and the 'field' $UCI-108[C \text{ or } D]_{RS \text{ port time out}}$.

- The same value of the $CIU_{BPM \text{ Field port time out}}$ is applicable for the timeout setting of the PLC Modbus RTU master.
- For good initialization of the cache set the cache timeout to at least 2,5 times the total scanning period (including overhead by scanning timeouts). In this example it is set to the 30 seconds (max 60 seconds).
- The Field Device Location and Filter items are applicable for UCI-108[A] in this mode but not used in the example.

Table 12: Relevant items for use case 'Modbus tunnel for proprietary PLC application'



Address DIP switch		AD-1=ON	AD-2=ON	off	off
Common items					
Mode	UM	PET	MODBUSTUNNEL	MODBUSTUNNEL	MODBUSTUNNEL
UCI-108 GPU address	UA	50	51	90	92
UCI-108 Tag	UT	Unit---A	Unit---B	Unit---C	Unit---D
BPM items					
BPM port baudrate	BB	1200 (default)	1200 (default)	1200 (default)	1200 (default)
BPM receiver gain	BG	8 (default)	8 (default)	8 (default)	8 (default)
BPM port turnaround delay	BD	10 (default)	n.a.	10 (default)	10 (default)
BPM port timeout	BT	n.a.	250 (default)	n.a.	n.a.
RS items					
RS port baudrate	RB	38400 (default)	115200	38400 (default)	38400 (default)
RS port turnaround delay	RD	n.a.	1 (default)	n.a.	n.a.
RS port timeout	RT	200	n.a.	100	100
SmartLink items					
ACK handshake	SA	n.a.	n.a.	n.a.	n.a.
SmartLink CIU address	SG	n.a.	n.a.	n.a.	n.a.
SmartLink Flexconn address	SF	n.a.	n.a.	n.a.	n.a.
SmartLink lower filter addr.	S3	n.a.	n.a.	n.a.	n.a.
SmartLink higher filter addr.	S4	n.a.	n.a.	n.a.	n.a.
Modbus tunnel items					
Modbus Tunnel UCI Device type	TT	n.a.	HOST (default)	FIELD	FIELD
Modbus Host Filter add address	TA	n.a.	ALL	n.a.	n.a.
Modbus Host Filter delete address	TD	n.a.	--	n.a.	n.a.
Modbus Host Filter Query	TQ	n.a.	--	n.a.	n.a.
Modbus Host Filter Mask	TM	n.a.	--	n.a.	n.a.
Modbus Field Second Address	T2	n.a.	n.a.	DISABLED (default)	DISABLED (default)
Modbus Field Third Address	T3	n.a.	n.a.	DISABLED (default)	DISABLED (default)
Field Device Location items					
Field Device expiration time	LT	300 (default)	300 (default)	300 (default)	300 (default)
Field Device expiration count	LN	3 (default)	3 (default)	3 (default)	3 (default)
PET Filter items					
PET Host port	PH	BPM	n.a.	n.a.	n.a.
PET Filter GPU lower addr.	F1	0 (default)	n.a.	n.a.	n.a.
PET Filter GPU higher addr.	F2	99 (default)	n.a.	n.a.	n.a.
PET Filter Flexconn lower addr.	F3	0 (default)	n.a.	n.a.	n.a.
PET Filter Flexconn higher addr.	F4	1899 (default)	n.a.	n.a.	n.a.
Cache items					
Cache	AE	ENABLED	ENABLED	ENABLED	ENABLED
Cache timeout	AT	30 (default)	30 (default)	30 (default)	30 (default)

6.13 Use case: Modbus tunnel for gauge integration in CIU888

In this example the UCI-108 Modbus tunnel feature is used to integrate (low cost) level gauges, pressure and temperature sensors in the CIU888. The CIU888 has the feature to map Modbus variables to the internal database variables level, temperature, pressure etc. to enable this.

To make use of this feature an additional CIU888 RS field port is installed which has to be configured for poll strategy as a group with the CIU888 BPM field port in sequential mode. In this configuration the CIU888 BPM and RS fieldbus do not run concurrently, the devices on the BPM fieldbus and the RS fieldbus are alternating requested. In the example drawing the CIU888 BPM port request for GPU/Flexconn field devices, the CIU888 RS port request for Modbus devices.

Set the Address DIP switch for each UCI-108 at the right position and configure each UCI-108 according the settings in Table 13.

Expected precondition: the item configuration is in factory defaults, see notes.

Use the command `config setup` following the menu options `config setup` or `item <Item>=<Value>` in the command line interpreter as explained in the previous examples for the applicable values not having the default setting.

Notes:

- Use command `item item ER=YES` in case you first want to restore the UCI-108 to default configuration settings before commissioning.
- Due to the PLC Modbus connection the 'host' UCI-108[A] does not have an operational GPU Device Address.
- The cache of the 'host' UCI-108[A] must be **DISABLED** to prevent accessing the BPM fieldbus by the UCI-108[A] caused by queued cache requests during the period the CIU888 uses the BPM field port.
- The cache of the 'field' UCI-108[B or C] are **ENABLED** to get a faster response.
- The Modbus RTU slave address is one or two addresses higher than its 'field' UCI-108 GPU Device address. The address of Modbus RTU level gauge device connected to UCI-108[B] has to be set to UCI-108[B] GPU device address+1. In this case $90+1=91$.
- The address of Modbus RTU remote I/O slave connected to UCI-108[C] has to be configured to be set to UCI-108[C] GPU device address+1. In this case $92+1=93$.
- The **CIU888 RS Field port time out** has to cover the delay caused by the message relaying of the 'host' UCI-108[A], the 'field' UCI-108[B or C], the UCI-108[A]_{BPM} port timeout settings and the maximum 'field' UCI-108[B or C]_{RS} port time out setting. Use formula:

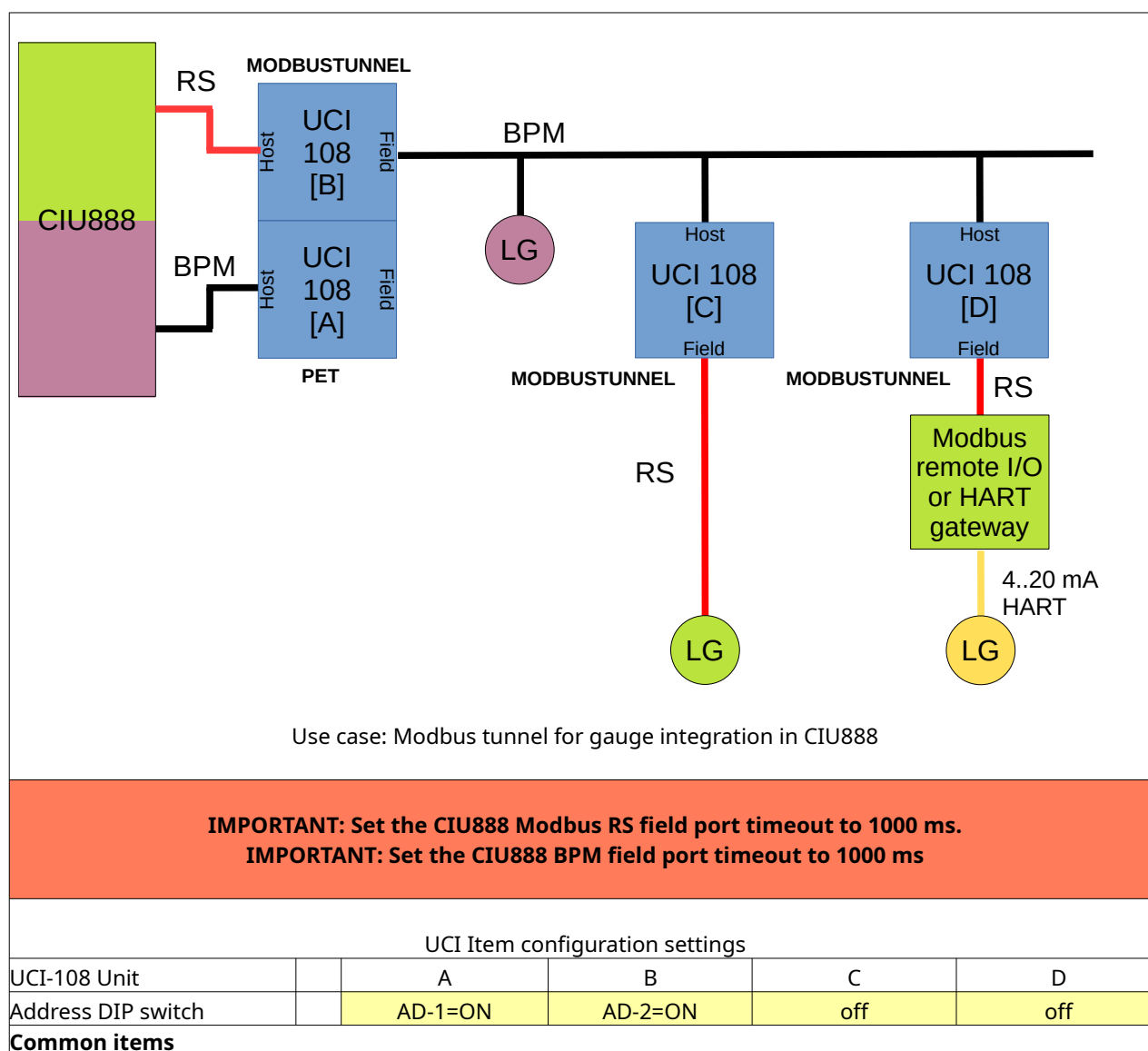
$$\text{CIU888}_{\text{RS Field port time out}} \geq \text{UCI-108[A]}_{\text{BPM request/reply time @ baudrate}} + \text{UCI-108[A]}_{\text{BPM port timeout}} + \text{UCI-108[B/C]}_{\text{RS port timeout}}$$

An average Modbus register request/reply message over the BPM fieldbus requires 330 ms at 1200 baud. For this example: $\text{CIU888}_{\text{RS Field port time out}} \geq 330 + 250 + 100 = 680$ ms. Add a margin to avoid time out by large request/reply messages, set the $\text{CIU888}_{\text{RS Field port time out}}$ setting in this case to **1000 ms**.

The $\text{CIU888}_{\text{RS Field port time out}}$ can be reduced by increasing the BPM baudrate and reducing the $\text{UCI-108[A]}_{\text{BPM time out}}$ and the 'field' $\text{UCI-108[B or C]}_{\text{RS port time out}}$.

- For good initialization of the cache set the cache timeout to at least 2,5 times the total scanning period (including overhead by scanning timeouts). In this example it is set to the 30 seconds (max 60 seconds).
- The Field Device Location items are applicable for the MODBUSTUNNEL mode but not used in the example.

Table 13: Relevant items for use case 'Modbus tunnel for gauge integration in CIU888'



Mode	UM	PET	MODBUSTUNNEL	MODBUSTUNNEL	MODBUSTUNNEL
UCI-108 GPU address	UA	50	51	90	92
UCI-108 Tag	UT	Unit---A	Unit---B	Unit---C	Unit---D
BPM items					
BPM port baudrate	BB	1200 (default)	1200 (default)	1200 (default)	1200 (default)
BPM receiver gain	BG	8 (default)	8 (default)	8 (default)	8 (default)
BPM port turnaround delay	BD	10 (default)	n.a.	10 (default)	10 (default)
BPM port timeout	BT	n.a.	250 (default)	n.a.	n.a.
RS items					
RS port baudrate	RB	38400 (default)	115200	38400 (default)	38400 (default)
RS port turnaround delay	RD	n.a.	1 (default)	n.a.	n.a.
RS port timeout	RT	200	n.a.	100	100
SmartLink items					
ACK handshake	SA	n.a.	n.a.	n.a.	n.a.
SmartLink CIU address	SG	n.a.	n.a.	n.a.	n.a.
SmartLink Flexconn address	SF	n.a.	n.a.	n.a.	n.a.
SmartLink lower filter addr.	S3	n.a.	n.a.	n.a.	n.a.
SmartLink higher filter addr.	S4	n.a.	n.a.	n.a.	n.a.
Modbus tunnel items					
Modbus Tunnel UCI Device type	TT	n.a.	HOST (default)	FIELD	FIELD
Modbus Host Filter add address	TA	n.a.	ALL	n.a.	n.a.
Modbus Host Filter delete address	TD	n.a.	--	n.a.	n.a.
Modbus Host Filter Query	TQ	n.a.	--	n.a.	n.a.
Modbus Host Filter Mask	TM	n.a.	--	n.a.	n.a.
Modbus Field Second Address	T2	n.a.	n.a.	DISABLED (default)	DISABLED (default)
Modbus Field Third Address	T3	n.a.	n.a.	DISABLED (default)	DISABLED (default)
Field Device Location items					
Field Device expiration time	LT	300 (default)	300 (default)	300 (default)	300 (default)
Field Device expiration count	LN	3 (default)	3 (default)	3 (default)	3 (default)
PET Filter items					
PET Host port	PH	BPM	n.a.	n.a.	n.a.
PET Filter GPU lower addr.	F1	0 (default)	n.a.	n.a.	n.a.
PET Filter GPU higher addr.	F2	99 (default)	n.a.	n.a.	n.a.
PET Filter Flexconn lower addr.	F3	0 (default)	n.a.	n.a.	n.a.
PET Filter Flexconn higher addr.	F4	1899 (default)	n.a.	n.a.	n.a.
Cache items					
Cache	AE	ENABLED	ENABLED	ENABLED	ENABLED
Cache timeout	AT	30 (default)	30 (default)	30 (default)	30 (default)

6.14 Notes

When doing a Site Scan, for example using Honeywell-Enraf Engauge, a UCI-108 is transparent (e.g. will not be seen) when used in MODEM and PET mode. When used in SMARTLINK mode it will be detected as a SmartLink device.

7 Diagnosing BPM fieldbus

The example in the figure below shows a setup to determine the BPM signal strength and noise level on location B. On this location B communication issues are expected due to signal attenuation or noise injection on the BPM fieldbus cable.

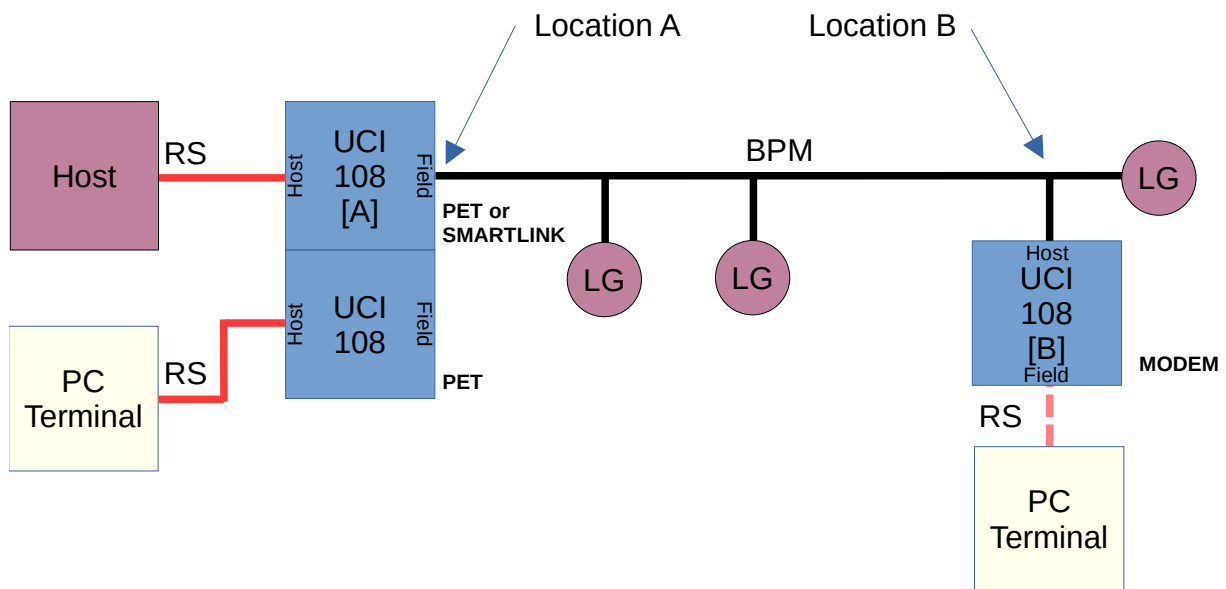


Figure 16: Measuring BPM fieldbus signal strength

Configure the setup as follows:

- UCI-108[A] is configured for use in multi UCI node making use of the DIN rail bus connector.
 - Set the node address to 1 by setting DIP switch 3 to 'ADDR 1'.
 - Configure UCI-108[A] in mode=SMARTLINK or mode=PET.
 - Configure UCI-108[A] as described in the previous chapter.
- UCI-108 is temporarily added at location A as command terminal in the multi UCI node configuration.
 - Set the node address to 4 by setting the DIP switch to 'ADDR 4'.
 - Set the UCI-108 in terminal mode by setting DIP switch 1 to 'TERM'. It will communicate to the PC Terminal program at 115k2 baud data format 8N1.
 - Configure UCI-108 in mode=PET.
- UCI-108[B] is temporarily added on location B in the field.
 - Set the UCI-108[B] in terminal mode by setting DIP switch 1 to 'TERM'. It will communicate to the PC Terminal program at 115k2 baud data format 8N1.

- Configure UCI-108[B] in mode=MODEM.
- Assign UCI-108[B] with GPU address e.g. 90 (to be used in the example)

Tip: reserve a spare DIN rail backplane position for a temporarily UCI-108 used for commissioning and service purposes. Make this UCI-108 node fixed as the Fourth node making it work in every UCI-108 multi node.

Different scenario's can be executed to locate the possible issues related to the BPM signal strength:

- On location A:
 - Switch prompt to UCI-108[A] terminal via the UCI-108 by the command `cu 1`. The prompt will show `UCI-108 [1]>`.
 - Issue the command `item LW` at the UCI-108[A] command prompt. This item shows the signal strength of the field instrument with the weakest received reply message. It will respond with `LW<address:uci:port:adcOut1:adcOut2>` detailed below:
 - `address` is the GPU address of the 'weakest' field instrument connected to the multi UCI node.
 - `uci` is the uci node address in the multi UCI node to which the 'weakest' field instrument is connected.
 - `port` is the port type to which the 'weakest' field instrument is connected. Is always `B` for BPM.
 - `adcOut1` the ADC value in mV before the Programmable Gain Amplifier (PGA). Recommended practical value has to be above 75 mV.
 - `adcOut2` the ADC value in mV before after the PGA. Optimum value would be around 2000 mV. In case higher mV values the PGA has to be lowered. First by querying the current value with the command `gpu 90RZBG` and then lower the value by one with the command `gpu 90RZBG=<new value>`.
- On location A:
 - Issue the command `item BL` at the UCI-108[A] command prompt. This item shows the noise level at location A for an idle BPM field bus. It will respond with `<adcOut1_noise:adcOut2_noise>` detailed below:
 - `adcOut1_noise` the ADC value in mV before the Programmable Gain Amplifier (PGA). Recommended practical value is below 50 mV.
 - `adcOut2_noise` the ADC value in mV before after the PGA.
- On location A:
 - Issue the command `gpu 90RZBN` at the UCI-108[A] command prompt. The UCI-108[B] is remotely addressed for item BN, measure BPM Noise level. It will response with `<adcOut1_noise:adcOut2_noise>` detailed below:

- `adcOut1_noise` the ADC value in mV before the Programmable Gain Amplifier (PGA). Recommended practical value is below 50 mV.
- `adcOut2_noise` the ADC value in mV before after the PGA.
- This item may be used for UCI-108s in the modes MODEM, PET or MODBUSTUNNEL with BPM port connected as host port to the BPM field bus.
- On location B:
 - Issue the command `msgmon` in the command line interpreter. The signal strength of received requests from location A to the field instruments (and their responses by the field instruments) are shown. The BPM fieldbus message are tagged with two measurements values, see Paragraph 4.7.2 for the format. These values can be used for further analysis.

8 Updating Firmware

Updating firmware can be done by booting into the UCI-108 bootloader and downloading the new firmware using the YModem protocol.

8.1 On Windows

Connect an YModem capable terminal program to the UCI-108s RS port in RS232 mode. The communication parameters are 115200 baud, 8 data bits, 1 stop bit, no parity, no flow control.

This procedure has been tested with TeraTerm version 4.85 (SVN #5727). Newer versions might not work due to bugs in TeraTerms YModem implementation.⁸

To boot the UCI-108 in it's bootloader set the **TERM** DIP-switch in the **On** position and press the **Reset Button** for more then 5 seconds.

The terminal emulator will then show a menu looking like:

```
uci-108-bootloader 0.4. [370023001650305030343020]
MSG: Console Activated.

Current Application Image Status: present and valid.
Released version 0.4, length: 95160, [D0355F7E]

--- Firmware Maintenance Menu ---
1: Download image to the internal Flash
2: Execute the application
```

Type **1** and press **Enter** and the terminal will show:

```
Waiting for the firmware file to be sent ...
(send 'a' to abort)
```

Then launch the YModem transfer (on TeraTerm use **File | Transfer | YModem | Send** and select the firmware file to flash.

When done the result will be printed ("Programming completed." or an error message). The menu will reappear and the new firmware version should be shown.

⁸ Exalon Delft can supply you with a copy of this software. Another solution is using a macro to launch the transfer.

8.2 On Linux or MacOS

Also on Linux and MacOS any YModem capable serial terminal program can be used.

There are also various command line utilities that can do the job. For example one could use **picocom** in combination with the **sb** tool (from the **lrzsz** package) the following way:

```
picocom -b 115200 -r -l -s "sb -k -vv" --imap lfcrLf /dev/ttyUSB0
```

Take care to use the correct serial port device.

To start a file transfer press **Ctrl-A Ctrl-S** and select the file to transfer.

9 Appendix: Firmware release changelog

<i>Release</i>	<i>Date</i>	<i>Changes</i>
2.1.1	2023-8	<p>Added: command config setup. Enables quick configuration by menu option selection.</p> <p>Added: UCI restarts with factory defaults after command config reset.</p> <p>Added: item BL 'BPM Field Port Noise Level'.</p> <p>Added: show response timeouts in command gpu and the command msgmon.</p> <p>Added: show tunneled modbus frames in command msgmon.</p> <p>Added: command msgmon indicates if the message is a request or a response.</p> <p>Added: enhanced terminal mode with Tab-completion.</p> <p>Bug fix: show correct Flexconn address in the SmartLink X-record response</p> <p>Bug fix: command gpu does not start the message monitor anymore. Only the response is printed.</p> <p>Bug fix: handling '-' character in item values</p> <p>Changed: stricter item value checking.</p>
2.1.0	2023-3	<p>Added: all terminal commands and items have been made case insensitive.</p> <p>Added: command 'config show'.</p> <p>Added: command 'config showall'.</p> <p>Added: command 'config items'.</p> <p>Changed: increased command line input buffer to enable 'clipboard paste' of multiple item commands</p> <p>Changed: the screen with active configuration overview.</p> <p>Changed: default cache timeout (item AT) is increased from 10 to 30 seconds.</p> <p>Removed: item BP 'BPM Port type' (became superfluous).</p> <p>Removed: item RP 'RS port type' (became superfluous).</p> <p>Bug fix: show actual Flexconn address in the X-record when in SMARTLINK mode.</p> <p>Added: Modbus tunnel host filter feature for the Modbus tunnel 'host' UCI. Added items TA, TD, TQ and TM to read and modify the filter settings.</p> <p>Changed: replaced item TA 'Modbus Tunnel Number of Addresses' functionality into 'Modbus Tunnel Host Filter add address'.</p> <p>Added: Support for up to three Modbus slave addresses at the 'field' UCI. Added items T2 and T3 to set or read the second and third Modbus slave address.</p>

Release	Date	Changes
		<p>Added: Modbus tunnel 'field' UCI will also respond to 'RX', 'RZSV' and 'RZUI' on its extra addresses (T2 and T3).</p> <p>Changed: Modbus tunnel maximum supported Modbus frame length increased from 60 to 128 bytes.</p> <p>Removed: item FE Filter Enabled state (became superfluous).</p> <p>Added: item PH to set PET Host port type.</p> <p>Added: time synchronized in UCI multi node setup for correct time stamping.</p> <p>Added: item UL to set the End of Line sequence.</p>
2.0.1	2022-9	Bug fix: processing of the BPM request/reply messages during heavy communication load.
2.0.0	2022-8	<p>Added: Modbus tunnel feature</p> <p>Added: Command bpmreq is renamed into gpu. The terminal command gpu can also be given to an RS field port in a Multi node configuration.</p> <p>Added: Improved error message on item UT if TAG name is not exactly 8 characters.</p> <p>Added: Made terminal command case insensitive.</p> <p>Added: Item LW for requesting the weakest measured BPM signal on BPM fieldbus.</p> <p>Added: Item BN also returns the signal levels of the request itself.</p> <p>Added: Cache statistics.</p> <p>Changed: Extended the maximum cache time out value from 30 to 60 seconds.</p> <p>Changed: Default RS field port time out setting from 250 to 600 ms.</p> <p>Changed: Default BPM gain setting from 5 to 8.</p> <p>Bug fix: processing of corrupted GPU messages.</p>
1.0	2022-6	<p>Bug fix: Corrected field port time out processing</p> <p>Bug fix: Store reply from previous request in cache while interrupted by new request</p> <p>Added: command cu in help function</p> <p>Added: command item help to show available items</p> <p>Changed: replaced commas to \t characters in command msgmon output</p> <p>Changed: Textual changes in configuration overview</p> <p>Removed: unused items MB and MR</p>
0.7	2022-5	<p>Changed: renamed UCI modes + corresponding items</p> <p>Bug fixes</p>
0.6	2022-3	Added: Signal strength- and noise level measurements feature
0.5	2022-3	Bug fixes
0.4	2022-2	Added: Multi Node feature

<i>Release</i>	<i>Date</i>	<i>Changes</i>
		Bug fixes
0.3	2021-11-29	Added: Fast Responses (caching) feature
0.2	2021-11-03	Initial Release