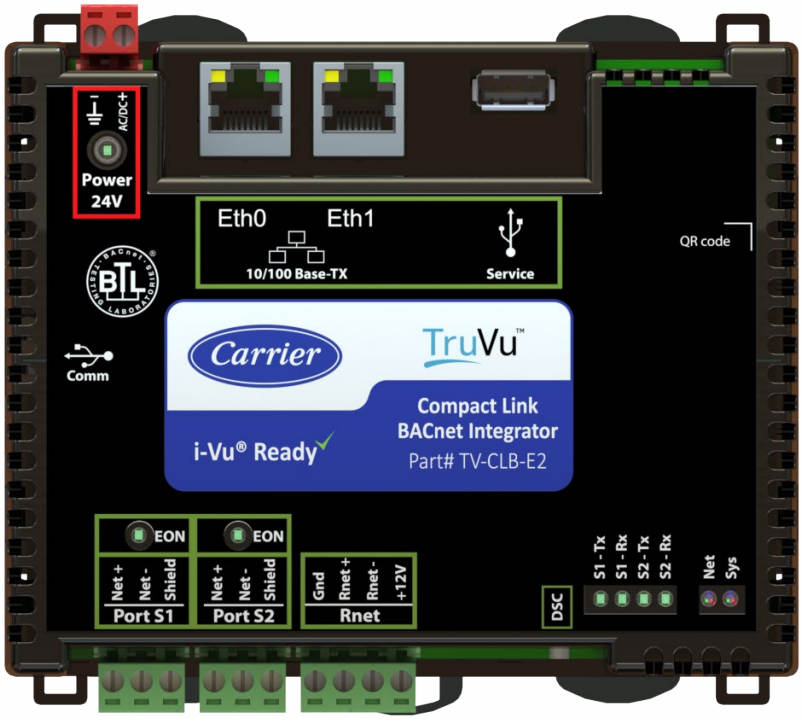
PPD M-Bus Integration Guide

for TruVu™ Controllers (drv_gen5)



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Important changes are listed in **Document revision history** at the end of this document.

Contents

Overview

You can use Carrier® TruVu™ controllers to integrate M-Bus device(s) with your i-Vu® system.

Carrier®	
Controllers	TruVu™ gateways
Driver	drv_gen5_108-06-20206.driverx or later
Read/write capability	Can read from the third-party equipment
Ports	S1 and/or S2
Third party	
Supported equipment	Any device that supports the standard M-Bus protocol. **NOTE** Variable Data Structure messages are supported. Fixed Data Structure messages are not supported.
Network media type	EIA-485 (2-wire) to M-Bus Level Converter
Quantity of devices you can physically connect to the Carrier® controller	40 devices per port (with M-Bus-RS485 level converter).
Quantity of M-Bus integrated points	400 points per port

Before-you-begin checklist

You need the following items, information, and skills for the integration process:

- M-Bus device's user manual
- A points list, if available from the M-Bus device representative or website, for each M-Bus device that includes register addresses and read capabilities.
- The addresses and baud rates of the M-Bus devices
- M-Bus-to-RS485 Level Converter for each port on which M-Bus devices will be connected

  WARNING Always connect the M-Bus device to the controller using the level converter.

  Connecting the M-Bus device directly to the controller can damage the controller.
- A port pinout/configuration of the M-Bus-to-RS485 Level Converters and M-Bus devices. Pinouts are usually available from the third-party manufacturer's representative or website.
- Verification that all communication properties have been set on the M-Bus devices
- Verification that all communication properties have been set on the M-Bus-to-RS485 Level Converters
- Verification of communications through the port where the Carrier® controller connects
- Experience creating control programs in the Snap® application
- Experience installing, wiring, setting up and downloading to the Carrier® controller

The integration process

Follow the steps in this document to integrate one or more third-party M-Bus devices into a i-Vu® system using the Carrier® controller. To install and network the Carrier® controller, see the controller's T*echnical Instruction*s.

1 Download the Gen5 driver.

NOTES

- If you already have control programs that work with our legacy M-Bus driver, you can include those programs in this download and skip integration steps 4-6
- If your M-Bus devices are connected to Port S2, the address prefix for each network microblock in the legacy control programs must be changed from "*mbus://*" to *mbus2://*

2 Set up the M-Bus driver properties

3 Connect the Carrier® controller to the third-party device

4 Discover points on the third-party device

5 Create a control program in the SNAP® application

6 Download the control programs

7 Verify the integration is set up correctly

1 Download the driver

The M-Bus PPD is available with drv_gen5_108-06-20206.driverx or later. To get and download the latest driver, see the controller's *Technical Instructions*. In the i-Vu® interface, download the driver and control programs to the Carrier® controller.

If you already have control programs that work with our legacy M-Bus driver, you can include those programs in this download and skip integration steps 4-6.

NOTE If your M-Bus devices are connected to Port S2, the address prefix for each network microblock in the legacy control programs must be changed from "*mbus://*" to *mbus2://*".

2 Set up the M-Bus driver properties

The driver properties can be configured in either the:

- Controller's Service Port setup pages - See *Appendix D* page 21.

  or

- i-Vu® driver page - Select the controller's driver on the i-Vu® **Network** tree

1 On the **Protocols** tab, select the M-Bus tab then select the **Enabled** checkbox.

2 Click **Restart**.

3 On the **Connections** tab, select the port that the M-Bus devices are connected to. Port S1 and Port S2 can be used to simultaneously connect to independent M-Bus networks.

4 On the **Port S1** and/or **Port S2** tab:

a) Select "M-Bus" from the **Protocol** drop-down.

NOTE If your controller has a **Port S1 Configuration** rotary switch, set it to 4 to use M-Bus on Port S1. There is no rotary switch for Port S2.

b) Set the protocol properties:

Baud Rate	Select the baud rate that the devices connected to this port are set to. Valid range: 300-38400 (default: 2400)
Parity	Select the parity according to the third-party manufacturer's documentation. No, Even, or Odd (default: Even)
Data Bits	Select the data bits according to the third-party manufacturer's documentation. 8 or 9 (default: 8)
Stop Bits	Select the stop bits according to the third-party manufacturer's documentation. 1 or 2 (default: 1)
Response Timeout	Number of milliseconds the device waits for a response from the M-Bus device after sending a command. **NOTE** Set this value to a higher value when the device is configured for a slower baud rate. For example, for 300 baud the recommended **Response Timeout** is 10000 milliseconds (10 seconds). Valid range: 100-20000 milliseconds (default: 1000
Interpacket Delay	Number of milliseconds the device waits after a successful command before sending another command to the M-Bus device. Valid range: 20-10000 (default: 20)
Max Retries	Number of attempts to resend a command after receiving an invalid (or no) response, before the command is deemed unsuccessful. Valid range: 0-10 (default: 3)

Use Fastest Refresh Rate	All the points on a device are polled at the same time. By default, the slowest refresh rate assigned to the points on the device is used. Select this option to use the fastest refresh rate.
Back Off Period	Number of seconds the device waits before attempting to connect to an M-Bus device after the last connection failure. During commissioning, the parameter can be adjusted to as low as 1 second to minimize the effect of the timer. During normal operation, always set the parameter equal to or greater than the default value. Valid range: 1-600 (default: 300)

5 If using the controller's Service Port to configure the properties:

a) If the **Restart** button is displayed, restart the controller.

b) On the i-Vu® **Network** tree, select the controller and **Upload** parameters from the controller.

6 If you used the controller's driver pages on the i-Vu® **Network** tree, select the controller and **Download** parameters to the controller.

3 Connect the Carrier® controller to the third-party device

NOTE TruVu™ controller(s) have various combinations and names of ports and might not have rotary switches.

Use the following steps to connect the Carrier® controller through the RS485-to-M-Bus level converter to the M-Bus network:

1 Turn off the Carrier® controller's power.

2 If your controller has a **Port S1 configuration** rotary switch, set it to 4 to use M-Bus on Port S1. There is no rotary switch for Port S2.

3 Consult the RS485-to-M-Bus level converter’s manufacturer instruction s for power requirements and wire specifications needed to connect the converter to its power source.

4 Configure the RS485-to-M-Bus level converter according to the manufacturer's instructions.

NOTE When using the manufacturer's configuration software, ensure that all associated public inbound firewall rules are enabled for UDP and TCP.

5 Wire the RS485-to-M-Bus level converter to the third-party device.

a) Consult the RS485-to-M-Bus level converter's manufacturer instructions to determine connector location and polarity.

b) Consult the M-Bus device's manufacturer instructions for power requirements and wire specifications needed to connect the device to its power source.

c) Consult the M-Bus device's manufacturer instructions to determine connector location and polarity.

d) These wiring instructions are found at the M-Bus Physical Layer Specifications web page:

"A two-wire standard telephone cable (JYStY N20.8 mm) is used as the transmission medium for the M-Bus. The maximum distance between a slave and the repeater is 350 m; this length corresponds to a cable resistance of up to 29 W. This distance applies for the standard configuration having Baud rates between 300 and 9600 Baud, and a maximum of 250 slaves. The maximum distance can be increased by limiting the Baud rate and using fewer slaves, but the bus voltage in the Space state must at no point in a segment fall below 12 V, because of the remote powering of the slaves. In the standard configuration the total cable length should not exceed 1000 m, in order to meet the requirement of a maximum cable capacitance of 180 nF."

e) To verify the connection between the level converter and the 3rd party device, use Relay’s “ MBSheet ” M-Bus network readout software. MBSheet software is available for download on Relay’s website.

NOTE You must use a USB-to-RS485 converter to access the M-Bus network from your PC. Always use a shield wire when connecting to the RS485 port of the level converter.

6 Wire the Carrier® controller to the RS485-to-M-Bus level converter.

WARNING Always connect the M-Bus device to the controller through the level converter.

Connecting the M-Bus device directly to the controller could damage the controller.

NOTE The communications trunk "shield" must have single-point grounding.

Use:

24 AWG twisted, shielded pair cable for up to 200 feet (60.96 meters)

or

22 AWG twisted, shielded pair cable for up to 2000 feet (609.6 meters)

Use controller port...	Wire controller terminal...	...to level converter RS485 terminal...
S1 or S2	Net +	+
	Net -	-
	Shield	Shield

7 Verify that the two ends of the RS485 communications trunk are properly terminated (**End of Net?** switch for both ports S1 and S2 may be used to terminate the controller end).

8 Check the communications wiring for shorts and grounds.

9 Turn on Carrier® controller's power.

NOTES

- If you cannot verify the connections on the M-Bus device, contact the third-party representative.
- To reduce communication and data errors, terminate each end of an EIA-485 network with a resistor whose value equals the network's characteristics impendace. Some third-party manufacturers provide a built-in resistor that is enabled or disabled with a jumper. Make sure that only devices at the end of a network have termination enabled. Carrier® controllers provide this by setting the **End of Net?** switch to "YES".

  NOTE For controllers without a physical **End of Net?** switch, **End of Network?** is configured:

  - By accessing the controller's service port and setting the **End of Network Command** to "Yes"
  - In i-Vu®, under **Device** > **BACnet Router Properties**, set the **End of Network Command** to "Yes"

  EXAMPLE If an EIA-485 2-wire network's characteristic impedance is 120 Ohms, terminate the network by placing a 120 Ohm resistor across the **Net+** and **Net-** connectors of the controller and a 120 Ohm resistor across the **+** and **-** connectors of the furthest third-party device.

4 Discover points

Use the Discover Points feature to create a CSV file that contains a row for every available point on a selected M-Bus device.

Point discovery is only available on the controller's Service Port setup pages - See *Appendix C* page 20. It is not available on the i-Vu® driver page.

To discover points on a device:

1 On the **Protocols** tab, select the M-Bus tab then select the **Enabled** checkbox.

2 Identify the device to be discovered:

Device Address	Enter the primary address of the M-Bus device to be discovered.
Serial Port	Select the port that the device to be discovered is connected to.

3 Click **Discover** to create the CSV file in your PC's default Download folder.

The resulting CSV file contains three columns of data that are separated by semi-colons:

1 **Specified Address** - This is the fully specified address to be copied into the **Address** field of a network microblock in your control program.

NOTE For some devices, you will see duplicate addresses in the CSV file. This happens when the device does not provide the information needed to uniquely identify those points. Consult the third-party manufacturer's documentation to determine the correct point to use, then use that point's **Indexed Address** in your control program.

2 **Indexed Address** – This address represents the same point as the **Specified Address** but uses the indexed address format from the legacy M-Bus integration. This form of the address can be copied into your program instead of the **Specified Address**.

3 **Description** – Describes the point by providing the value of each parameter of the **Specified Address**:

Parameter	Notes
Value description	Examples: ENERGY, VOLUME, POWER **NOTE** For points designated as MANUFACTURER_SPECIFIC, consult the third-party manufacturer's documentation to determine the correct point to use, then use that point's **Indexed Address** in your control program. Also, manufacturer specific values cannot be scaled by the driver. The microblock's value will equal the raw value sent from the device. Therefore, your control program must handle the appropriate scaling after reading from the device. Refer to the third-party manufacturer's documentation for scaling information.
Function	Examples: INST, MAX, MIN, ERR

Parameter	Notes
Units	Examples: s (seconds), m^3 (meters cubed) **NOTE** Certain values are converted to kilos to avoid reading in a value too large for the microblock. A microblock can store numbers up to 32 bits. The values that are converted are: W (watt), Var (volt-ampere-reactive), Wh (watt-hour), Varh (volt-ampere-reactive-hour), VA (volt-ampere), Vah (volt-ampere-hour), j (joule), jh (joule-hour). The CSV file will show the corrected units: kW, kVar, kWh, kVarh, kVA, kVah, kj, kjh).
Storage number	Number representing the storage table in the device that contains the desired data. A meter can contain several storages, e.g., to store historical time series data. Storage number 0 represents a current value.
Tariff number	Indicates the tariff number of this data field. The data of tariff 0 is usually the sum of all other tariffs
Subunit number	Number representing the subunit from which the value generates. Subunits can be used by the manufacturer to distinguish between different "sources" of the same measure.

5 Create a control program in the SNAP® application

When you create your control program, use a Network I/O microblock for each third-party point.

To...	This network point type...	Use this microblock.
Read	AI - Physical analog input on a controller	ANI ANI2

Formatting an M-Bus microblock address

Use the information below to format a valid address in each microblock that you use to read a third-party point.

TIP To extend the battery life on battery powered M-Bus devices, configure long refresh times to decrease the load on the device.

CAUTION When integrating third-party devices into the i-Vu® system, most communication problems are caused by incorrect data or typing errors in the microblock's **Address** field. To ensure you are using the correct value in the **Address** field, use the M-Bus PPD's point discovery feature (see *Discover points* (page 9)).

To read a point, use one of the following address formats:

1 **Indexed Address:**

mbus://device address/data index (for Port S1)
mbus2://device address/data index (for Port S2)

Example: mbus://12/1

URL Parameter	Description	Valid Range
Device address	Number representing the primary address set on the M-Bus device	1-250
Data index	Number representing the position of the desired point in the device's data storage area. Some M-Bus tools index the points starting with 1 instead of zero. In that case, you must subtract 1 from that index for this parameter. Use the M-Bus PPD's discovery feature for best results (see *Discover points* (page 9)).	0-127

2 **Specified Address:**

mbus://device address/value description/storage number/function/tariff/subunit (for Port S1)

mbus2://device address/ value description/storage number/function/tariff/subunit (for Port S2)

Example: mbus2://2/0/2/INST/3/0

URL Parameter	Description	Valid Range
Device address	Number representing the primary address set on the M-Bus device	1-250
Value description	Number representing the type of value. E.g., energy, temperature, volume, etc.	Valid values can be found in Appendix B
Storage number	Number representing the storage table in the device that contains the desired data. A meter can contain several storages, e.g., to store historical time series data. Storage number 0 represents a current value.	0-9999
Function	String representing the type of data desired.	Possible values: "INST" - Instantaneous value MAX - Max value MIN - Min value ERR - Error state
Tariff	Indicates the tariff number of this data field. The data of tariff 0 is usually the sum of all other tariffs.	0-999
Subunit	Number representing the subunit from which the value generates. Subunits can be used by the manufacturer to distinguish between different "sources" of the same measure.	0-999

Editing a microblock address

You can edit a microblock address in the following places:

- In the SNAP® Property Editor
- In the i-Vu® interface, on the microblock's **Properties** page > **Details** tab
- In the i-Vu® interface, on the control program's **Properties** page > **Network Points** tab

6 Download the control programs

1. In SiteBuilder's **Geographic** tree, add equipment for each of your control programs.
2. On the **Network** tree, assign the equipment to the controller by dragging each equipment from the **Geographic** tree and dropping it on the controller in the **Network** tree.
3. Click  .
4. In the i-Vu® interface, download the control programs to the Carrier® controller.

See the "Managing third-party points and feature licenses" section of the controller's *Technical Instructions* for instructions on how to ensure you have adequate FlexPoints licensed for your integration.

7 Verify the integration is set up correctly

1 On the i-Vu® **Geographic** tree, select the control program for the Carrier® controller.

2 Select the **Properties** page > **Network Points** tab.

If...	Then...
You see the point value you expect with no errors in the **Error** column	You have successfully established communication with the third-party device.
All points show question marks instead of values	The i-Vu® application is not communicating with the Carrier® controller or the control program. Troubleshoot the controller's communications. See the controller's *Technical Instructions*.
Error message appears	Do one of the following actions based on the code or description in the **Error** column. • **Communications Disabled for this Microblock** On the **Network Points** tab (or the microblock's **Properties** page > **Details** tab), enable the microblock's **Comm Enabled** field. • **No protocol support** Verify that the **Address** in the microblock has the correct prefix: ○ For Port S1: mbus:// ○ For Port S2: mbus2:// • **Unlicensed Point** You have configured more integration points than are licensed for this controller. See the Managing third-party points and feature licenses section of the controller's Technical Instructions for instructions on how to purchase additional points. • All other errors: See *Appendix A* (page 9) for troubleshooting information for displayed error codes.
A value is incorrect	Verify that: • The **Address** in the microblock is correct. • The retrieved value is scaled properly, if necessary. For example, scaled from Celsius to Fahrenheit. Refer to the M-Bus documentation or the controller's *Technical Instructions* for scaling information.

If...	Then...
A device takes longer to come on-line	During each polling cycle, the M-Bus PPD sends a "soft reset" message (NKE) to each M-Bus device before sending the normal read (REQ_UD) message. The NKE message ensures communication synchronization before polling begins. **NOTE** Some older M-Bus devices may not successfully process the NKE reset message. For those devices, the reset message will be sent according to the configured number of retries only at startup and during "Back off period" management. If the reset procedure fails but the normal read is successful, the NKE message will not be sent to these devices in subsequent polling cycles to avoid unnecessary delays.

If the above solutions do not resolve the problem, gather the following information for Technical Support:

- Screenshots of the driver configuration pages:
  - **Protocols** > **M-Bus** tab
  - **Control Programs** tab
  - **Connections** > **Port S1/S2** tab
- Log files downloaded from the driver's **Advanced** > **Diagnostics** tab.
- A screenshot of the **Properties** page > **Network Points** tab showing addresses and errors.
- All information from a controller Modstat copied into a text file. Right-click the Modstat, then select **Select All**. Press Ctrl+C to copy the information, then open Notepad and paste the information into a text file.
- Technical instructions for the third-party device, if available.

Appendix A - Error codes and messages

PPD Error Codes

Error Message	Possible Causes and Solutions
1 - Address Error - Invalid Device Address	Valid range for M-Bus primary address is a number between 1 - 250. Any other values outside that range will generate this error.
2 - Address Error - Data Index	Valid range for M-Bus data index is a number between 0 - 127. Any other values outside that range will generate this error.
3 - Address Error - Invalid Storage Number	Valid range for M-Bus storage number is between 0 - 9999. Any other values outside that range will generate this error.
4 - Address Error - Invalid Function	Function parameter not supported. See Formatting an M-Bus device address for list of supported types.
5 - Address Error - Invalid Tariff Index	Valid range for M-Bus tariff index is a number between 0 - 999. Any other values outside that range will generate this error.
6 - Address Error - Invalid Subunit Index	Valid range for M-Bus subunit index is a number between 0 - 999. Any other values outside that range will generate this error.
7 - Address Error - Invalid Value Description	See *Appendix B* (page 15) – Supported Value Descriptions for the list of valid values.
11 - Comm Error - Point not found	The point configured in the microblock address is not found on the third-party device. Ensure the point is correctly configured in the Address of the network microblock. Ensure that the configured point is exposed by the device.
12- Comm Error - Device offline	Communication with the third-party device cannot be established. Check the following: The device address is correctly specified in the Address of the network microblock. The device is wired correctly and powered on. The serial port configuration correctly reflects the device configuration. The M-Bus level converter is working correctly.
13 Comm Error - Serial port not configured	An error occurred during serial port initialization. Serial port cannot be used by the M-Bus protocol. Ensure the port is configured correctly. If it is, this may indicate a hardware problem on the controller.
14- Comm Error - Serial port is unavailable	Serial port indicated by the microblock address has not been assigned to the M-Bus protocol. Ensure that the correct protocol prefix for the desired port ("mbus" or "mbus2") is specified in the Address of the network microblock, and that the desired port is assigned to the M-Bus protocol.
15 Comm Error – Point not supported	Point specified is not a numeric value. Only numeric values are supported.

General Error Codes

Error Code/Message	Possible Causes/Solutions
Protocol disabled or unsupported	The protocol defined in the signature of the address is either unsupported by the controller or disabled. To enable a protocol that is available on the controller: On the **Network** tree, click on the controller's driver, then select the **Protocols** tab, and then select the desired protocol tab (e.g. BACnet, Modbus, etc.) to enable. **NOTE** Enabling protocols requires a controller restart.
Initializing	This point is either: • In the process of being validated • Queued up for the initial read or write attempt to the third party device, • In the process of its initial read or write attempt to the third party device • Waiting for the initial response from the third party device. Once the startup process has completed, this error should switch to **No Error** or a different error that will identify any problems that may have occurred.".
No Error	The microblock is not in error. No solution needed.
Communications Disabled for this Microblock	The microblock's communications are not currently enabled. Enable the microblock's communications by checking the box under **Com Enable** in i-Vu®.
Not Linked	The microblock was not successfully linked to the object to which it is addressed. Ensure that the address is entered correctly and that the object the microblock is addressed to is functioning properly.
Programmer Error – Invalid MB State	The data integrity of the microblock was compromised. This is the default error code if none of the other errors apply. If this error is persistent, contact Technical Support to let them know there is a defect to address.
Undefined Client Microblock Error	An error occurred while the microblock was attempting to write a value. This is the default error code when something goes wrong trying to write a value over the network. If this error is persistent, contact Technical Support to let them know there is a defect to address.
Device Offline – Temporary Backoff	The device hosting the object that the microblock is attempting to interact with is not powered on. Ensure that the device hosting the object, in which the microblock is addressed to, is powered on and functioning properly.

Appendix B - Supported Value Descriptions

Use the value in the Description ID column of this table as the Value Description in your microblock Address when using the Specified Address format.

Description ID	Description
0	Energy
1	Volume
2	Mass
3	On time
4	Operating time
5	Power
6	Volume flow
7	Volume flow ext
8	Mass flow
9	Flow temperature
10	Return temperature
11	Temperature difference
12	External temperature
13	Pressure
16	Voltage
17	Current
18	Averaging duration
19	Actuality duration
20	Fabrication number
21	Model version
23	Hardware version
24	Firmware version
25	Error flags
28	Operating time battery
31	Reactive energy
32	Temperature limit
33	Max power
34	Reactive power

35	Relative humidity
36	Frequency
39	Address
41	Manufacturer specific **NOTE** For manufacturer specific points, consult the third-party manufacturer's documentation to determine the correct **Indexed Address** to use in your control program. Also, manufacturer specific values cannot be scaled by the driver. The microblock's value will equal the raw value sent from the device. Therefore, your control program must handle the appropriate scaling after reading from the device. Refer to the third-party manufacturer's documentation for scaling information.
44	Apparent energy
50	Other software version
52	Error mask
54	Digital input
55	Baud rate
56	Digital output
57	Response delay time
58	Retry
59	First storage number cyclic
61	Last storage number cyclic
62	Size storage block
63	Storage interval
65	Duration last readout
67	Tariff duration
70	Number stops
71	Last cumulation duration
73	Parameter activation state
74	Control signal
75	Week number
76	Day of week
77	Remaining battery lifetime
79	Cumulation counter
80	Reset counter

Appendix C - Recommended accessories

- Level converters

  NOTE These are the only level converters that have been verified to work correctly with the M-Bus PPD.

  - ADFweb
  - Relay
- Relay MBSheet – M-Bus network readout software

Appendix D - Configuring the driver parameters by using the Service Port

You can set many driver parameters locally from the controller by using the **Service Port's** web-based controller setup interface. You can set operational parameters, such as port and communications' protocol settings, without the need to connect the i-Vu® application to the Carrier controller. Any parameters set locally through this interface take effect immediately. To connect to the controller setup pages, some Carrier controllers have an Ethernet Service Port, and some have a USB Service Port.

WARNING After setting parameters locally through the Service Port interface and then connecting the controller to the i-Vu® application, proceed carefully, as follows:

In the i-Vu® application, you must **upload** the parameters that you set locally BEFORE you **download** memory or parameters. Downloading, without uploading first, overwrites all the settings you made through the **Service Port**. Uploading first preserves those parameters.

NOTE There are a few parameters that can **only** be set through the **Service Port**, such as the controller's IP address, and these are not overwritten by a memory or parameter download from the i-Vu® application.

For more information on connecting to the Service Port, see the "Connecting to the router through the Service Port" and the "Connecting to the router through the Gig-E Port" sections of the controller's Technical Instructions.

Appendix E - Module status field descriptions

Property	Description
M-Bus Protocol Details	For each port: ▪ Number of data packets transmitted and received by the integrator ▪ Number of communication errors and timeouts (no response)

Document revision history

Important changes to this document are listed below. Minor changes such as typographical or formatting errors are not listed.

Date	Topic	Change description	Code*
		No updates yet	

* For internal use only