RIBPM413-BC

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Installation Guide

The RIBPM413-BC is a BACnet revenue grade energy sub-meter intended for power metering when used with Listed 333 mV current transformers. This document contains installation information, safety guidelines, and BACnet details.

PACKAGE CONTENTS:

Bulletin B2646
RIBPM413-BC sub-meter
4" Mounting Track, MT212-4
Three pluggable screw terminals –
to be used for making field connections
1. 10-pin – Voltage Inputs
2. 6-pin – Currents Transducer Inputs
3. 3-pin – BACnet MS/TP Communications

PRODUCT FEATURES:

- RIBPM413-BC requires no external power source to operate
- Works with all UL or ETL Listed 333 mV current transformers
- BACnet MS/TP
- Automatic correction for field CTs mounted in reverse
- Capable of NET metering
- Complies with Buy American Provisions of ARRA Section 1605

ENVIRONMENT: *Indoor use only*

Operating Temperature:	-4°F to 158°F
Storage Temperature:	-40°F to 185°F
Relative Humidity:	5% to 95% (non-condensing)
Operating Altitude:	Up to 2,000m

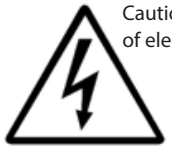
SAFETY GUIDELINES: *The following instructions are for qualified personnel only. To reduce the risk of electrical shock and personal injury, do not perform the following, or any additional tasks not stated, unless you are qualified to do so.*

- **WARNING**: Measurement Category III (do not exceed)
- **AVERTISSEMENT:** Catégorie de mesure III (ne pas dépasser)
- Only qualified personnel or *licensed electricians* should perform the installation of this product.
- Follow all applicable national and local electric codes.
- Verify the product will be used within its specifications.
- For use with Listed Energy-Metering Current Transformers.
- Avoid ESD while working with the RIBPM413-BC by being properly grounded during installation.
- The RIBPM413-BC is suitable for indoor installations only.

WARNING SYMBOLS: The following symbols may be found on the product.

Caution: Documentation must be consulted in all cases where this symbol is marked

Attention: La documentation doit être consultée dans tous les cas où ce symbole est marqué



Caution: Possibility of electric shock

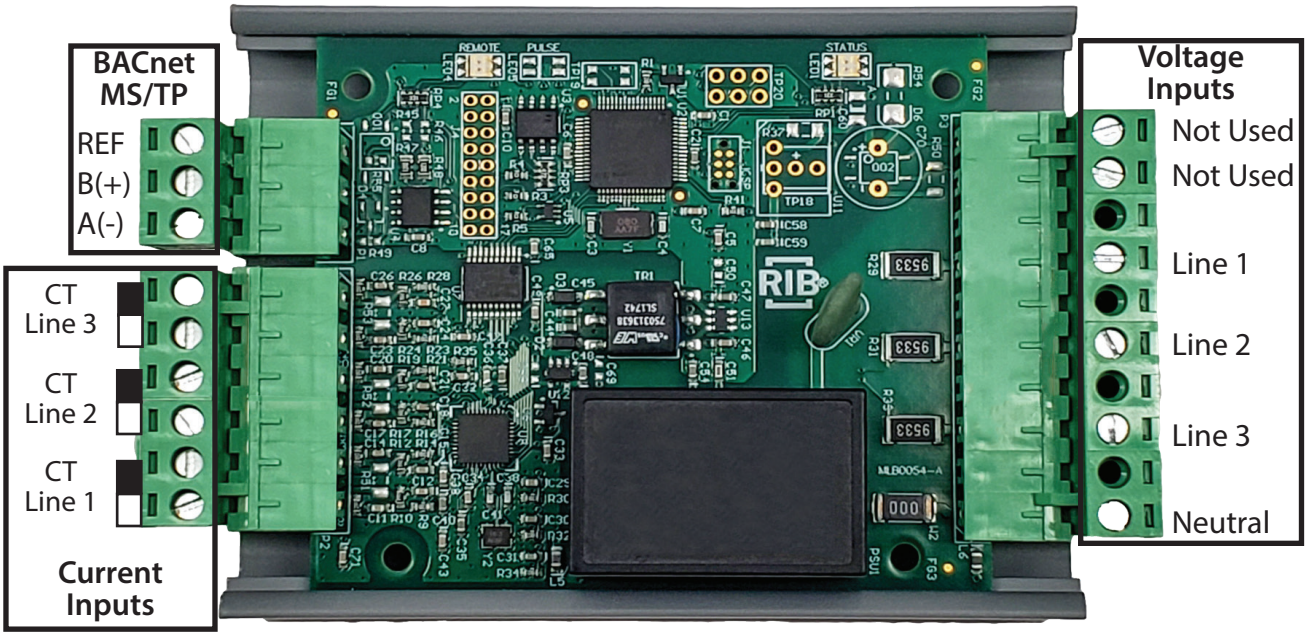
Attention: possibilité de choc électrique

INSTALLATION GUIDELINES: ***Warning**: To reduce the risk of electric shock, always open or disconnect circuit from power-distribution system (or service) of building before installing or servicing current transformers. The safety of any system incorporating this device is the responsibility of the assembler of the system. If the equipment is used outside the specifications in this document, the protection provided by the equipment may be impaired. **Avertissement**: Pour réduire le risque de choc électrique, ouvrez ou déconnectez toujours le circuit du système de distribution électrique (ou du service) du bâtiment avant d'installer ou d'entretenir des transformateurs de courant.*

- Use Copper conductors **ONLY**
- Use only Listed conduits and glands.
- It is recommended to use separate conduit for voltage and current wiring.
- Mount RIBPM413-BC as close as possible to the panel/load being metered.
- Position the RIBPM413-BC so that the label may be read from the upright position.
- The Current Transformers may not be installed in equipment where they exceed 75% of the wiring space of any cross-sectional area within the equipment.
- Restrict installation of current transformers in an area where it would block ventilation openings.
- Restrict installation of current transformers in an area of breaker arc venting.
- Not suitable for Class 2 wiring methods. Not intended for connection to Class 2 equipment.
- Secure Current Transformers and ensure the conductors do not directly contact live terminals.
- Listed 2 Amp fast-blow fuses must be installed between the Voltage inputs of the RIBPM413-BC and the metered load (Recommend Bussman KTK-R-2 or equivalent).
- Use 12 to 14 AWG wire for the voltage connections with 300 V or 600 V insulation (depending on installation).
- **A Listed 600 V circuit-breaker or disconnect switch must be installed between the RIBPM413-BC and the load** being metered. It must be easy to operate in the installation and easy to reach. The breaker/disconnect must be clearly marked as the "Disconnect Device" for the RIBPM413-BC.

COMMUNICATIONS INTERFACE: RIBPM413-BC is a BACnet MS/TP device.

- Use 18-22 AWG, shielded, twisted pair cable.
- If the RIBPM413-BC is the end of line (EOL) device on an MS/TP trunk, a 120 Ω resistor should be connected between B (+) and A (-) on the BACnet MS/TP terminals.
- BACnet parameters are changed via a BACnet interface.
- Default communication parameters are:
  - Dev. ID: 277050, MAC Address: 50, Baud Rate: 38400, Parity: None, Data Bits: 8, Stop Bits: 1
  - This is notated as: 38400, N, 8, 1, #50



CONNECTING MULTIPLE LOADS: The RIBPM413-BC allows for multiple loads to be metered at once, by connecting multiple sets of CTs parallel one another. When metering multiple loads, adhere to the following guidelines:

- Use like CTs of the same current rating and from the same manufacturer.
- Use a full set of CTs for each load.
- Ensure the pair of wires from each CT are twisted, and all CTs are terminated at the pluggable terminal.
- A maximum of three loads can be metered at once.
- Measured phase current will be the sum of all loads on that phase.
- The CT_Secondary (AV-8006) rating must be set to the CT_Rating (AV-8005) * Number of CT sets
  i.e. If the CTs used are rated for 50 Amps, and there are 2 loads being metered:
  50 Amps x 2 Set of CTs = 100 Amps
  CT_Secondary = 100 Amps

FIELD CONNECTIONS: *CTs should be connected to the same circuit as the voltage connections. Use supplied pluggable terminal blocks for field connections.*

- Intended for Category III installation
- **Voltage Inputs:** 120 – 277 Vac; Neutral Required
  - 1-Phase, 2-Wire
  - 1-Phase, 3-Wire
  - 3-Phase, 4-Wire
- **Current Inputs:**
  - Listed 333 mV CTs ONLY
- **BACnet® MS/TP:**
  - Use 18-22 AWG, 2-core, shielded twisted pair cable.

LED DEFINITIONS: There are two LEDs on the RIBPM413-BC – **Status** and **Remote**

- **Status LED** – The Status LED consists of two flashes.
  -The first flash is a heartbeat that indicates the device is ON, and the color of the flash indicates the direction of energy. These flashes are approximately 2 seconds apart.
  Green – Energy is being consumed
  Amber – Energy is being generated
  -The second flashes color and duration indicate the total current level for all phases, relative to the total service current. This flash will occur between heartbeat flashes.
  Green – A green flash for up to ½ second indicates 5-80% of total service current
  Amber – An amber flash for about ¾ second indicates 80-100% of total service current
  Red – A red flash for about 1 second indicates greater than 100% of total service current
- **Remote LED** – The Remote LED is an indicator of BACnet MS/TP communications.
  Green – The Remote LED flashes green when data is being received.
  Amber – The Remote LED flashes amber when data is being transmitted.

CLEANING: The RIBPM413-BC is not intended to be cleaned by the user.

Communication Details

Every networked BACnet® device must have a unique Device ID, and devices on the same sub-net must have a unique MAC Address. If the RIBPM413-BC is the end of line (EOL) device on an MS/TP trunk, a 120 Ω resistor should be connected between B(+) and A(-) on the BACnet MS/TP terminals.

BACnet® Object Overview:

The RIBPM413-BC supports the following object types:

Object Type	Abbreviation
• Device	DE
• Analog_Input	AI
• Analog_Output	AO
• Analog_Value	AV
• Date_Time_Value	DT

Communications Objects:

Object_Name	Range	Default	Object_ID
Baud_Rate	9600-115200	38400	AV-8060
Device_ID	1-4194303	277050	AV-8062
MAC_Address	1-127	50	AV-8064
Max_Master	1-127	127	AV-8065

The Objects listed in the following pages will begin with one of the above abbreviations and be followed by a unique Object_ID number. The Object_Name property of each Object will tell what it represents, and the Present_Value property will contain the value. Depending on the level of utilization of the RIBPM413-BC, not all measurement objects will be applicable.

Device Object Details:

Property Identifier	Description and/or Value	R/W
Object_Identifier	Object Identifier consists of the object type (Device) and the Device ID (1 – 4,194,302) *Default:* Device, 277050	W
Object_Name	*Default:* RIB: *Serial Number*	R
Object_Type	DEVICE	R
System_Status	OPERATIONAL	R
Vendor_Name	Functional Devices, Inc	R
Vendor_Identifier	277	R
Model_Name	RIBPM413-BC	R
Firmware_Revision	3.0a-1.0300	R
Application_Software_Version	3.1800 (or similar)	R
Description	*Default:* The RIB is a 3-Phase, 4-Quadrant revenue grade sub-meter (*63 characters max*)	W
Protocol_Version	1	R
Protocol_Revision	14	R
Protocol_Services_Supported	*See RIBPM413-BC PICS*	R
Protocol_Object_Types_Supported	{ AnalogInput, AnalogValue, DateTime Value, Device }	R
Object_List	List of all Objects	R
Max_APDU_Length_Accepted	300	R
Segmentation_Supported	Segmented - Both	R
Max_Segments_Accepted	8	R
Local_Time	Set by Time Synchronization HH:MM:SS.SS	R
Local_Date	Set by Time Synchronization Weekday, DD-Month-YYYY	R
UTC_Offset	Number of minutes between local time and UTC *Default:* 0 (-840 – 720)	W
Daylight_Savings_Status	*Default:* 0 (1 = True, 0 = False)	W
APDU_Segment_Timeout	Time in ms *Default:* 5000 (0 – 65535)	W
APDU_Timeout	Time in ms *Default:* 10000 (0 – 65535)	W
Number_Of_APDU_Retries	*Default:* 3 (0 – 10)	W
Max_Master	*Default:* 127 (1 – 127)	W
Max_Info_Frames	1	R
Device_Address_Binding	*Default:* Empty	R
Database_Revision	1	R
Property_List	List of enumerations for supported properties	R

Power and Energy Object Details:

The resolution of Power and Energy registers can be modified by writing the *Present_Value* property of the *EnerPowDivider* Object (AV-8023). A finer resolution provides more accurate readings but will decrease the amount of time before the register overflows. The table below shows the recommended resolution for differing power ranges. The *EnerPowDivider* will default to 10,000, which is suitable for most 50A to 1600A applications. If the service being metered is significantly less or more, it may be advisable to set a different *EnerPowDivider*.

Total Power			Register Resolution	*EnerPowDivider*	Energy Roll Over
		< 10 kW	0.1 W	**100**	99,999.9999 kWh
>= 10 kW	and	< 100 kW	1 W	**1,000**	999,999.999 kWh
>= 100 kW	and	< 1 MW	10 W	**10,000**	9,999,999.99 kWh
>= 1 MW	and	< 10 MW	100 W	**100,000**	99,999,999.9 kWh
>= 10 MW	and	< 100MW	1 kW	**1,000,000**	999,999,999 kWh
>= 100 MW	and	< 1 GW	10 kW	**10,000,000**	9,999,999,990 kWh
>= 1 GW	and	< 10 GW	100 kW	**100,000,000**	99,999,999,900 kWh

Power Factor:

The *Present_Value* of the Power Factor objects (PF_1, PF_2, PF_3 and PF_All) will range from -1.000 to +1.000. A positive Power Factor value indicates power is being consumed, and a negative value indicates power is being generated. The sign does not indicate leading or lagging. This must be determined by the sign of the values in the *PowerQ* objects or the *ACosPF* objects.

AC Measurement Objects:

Object_Name	Units	Object_ID
Volt_LN_1	V	AI-5501
Volt_LN_2	V	AI-5502
Volt_LN_3	V	AI-5503
Volt_LN_Ave	V	AI-5504
Volt_LL_12	V	AI-5505
Volt_LL_23	V	AI-5506
Volt_LL_31	V	AI-5507
Volt_LL_Ave	V	AI-5508
Curr_1	A	AI-5513
Curr_2	A	AI-5514
Curr_3	A	AI-5515
Curr_Ave	A	AI-5516
Curr_Tot	A	AI-5517
Curr_N	A	AI-5518
Freq_1	Hz	AI-5521
Freq_2	Hz	AI-5522
Freq_3	Hz	AI-5523
Freq_Ave	Hz	AI-5524
PowerP_1 (Active)	kW	AI-5525
PowerP_2	kW	AI-5526
PowerP_3	kW	AI-5527
PowerP_Tot	kW	AI-5528

AC Measurement Objects:

Object_Name	Units	Object_ID
PowerS_1 (Apparent)	kVA	AI-5529
PowerS_2	kVA	AI-5530
PowerS_3	kVA	AI-5531
PowerS_Tot	kVA	AI-5532
PowerQ_1 (Reactive)	kVAR	AI-5533
PowerQ_2	kVAR	AI-5534
PowerQ_3	kVAR	AI-5535
PowerQ_Tot	kVAR	AI-5536
PF_1	None	AI-5551
PF_2	None	AI-5552
PF_3	None	AI-5553
PF_All	None	AI-5554
ACosPF_1	deg	AI-5563
ACosPF_2	deg	AI-5564
ACosPF_3	deg	AI-5565
ACosPF_All	deg	AI-5566
Volt_UB_LN_1	%	AI-5571
Volt_UB_LN_2	%	AI-5572
Volt_UB_LN_3	%	AI-5573
Volt_UB_LN_Worst	%	AI-5574

AC Measurement Objects:

Object_Name	Units	Object_ID
Volt_UB_LL_12	%	AI-5575
Volt_UB_LL_23	%	AI-5576
Volt_UB_LL_31	%	AI-5577
Volt_UB_LL_Worst	%	AI-5578
Curr_UB_1	%	AI-5579
Curr_UB_2	%	AI-5580
Curr_UB_3	%	AI-5581
Curr_UB_Worst	%	AI-5582

Measurement Net Counter Objects:*

Object_Name	Units	Object_ID
EnergyP_1	kWh	AI-7001
EnergyP_2	kWh	AI-7002
EnergyP_3	kWh	AI-7003
EnergyP_Total	kWh	AI-7004
EnergyS_1	kWh **	AI-7005
EnergyS_2	kWh **	AI-7006
EnergyS_3	kWh **	AI-7007
EnergyS_Total	kWh **	AI-7008
EnergyQ_1	kVARh	AI-7009
EnergyQ_2	kVARh	AI-7010
EnergyQ_3	kVARh	AI-7011
EnergyQ_Total	kVARh	AI-7012

***Consumed Net Energy values are positive.**
Generated Net Energy values are negative.

****kVAH not supported, units are kWh**

Measurement Split Counter Objects:

Object_Name	Units	Object_ID
EnergyP_Tot_Imp	kWh	AI-7013
EnergyP_Tot_Exp	kWh	AI-7014
EnergyQ_Tot_Imp	kVARh	AI-7015
EnergyQ_Tot_Exp	kVARh	AI-7016

Power Resolution Object:

The *EnerPowDivider* object is discussed at the top of page 4

Object_Name	Units	Object_ID
EnerPowDivider	None	AV-8023

CT Objects:

CT_Ratings holds the current rating for the CTs used with the meter. **ALL** CTs must have the same rating. *CT_Secondary* is used if multiple loads are metered. *See **Connecting Multiple Loads** on page 2.*

Object_Name	Units	Object_ID
CT_Ratings	A	AV-8005
CT_Secondary	A	AV-8006

Demand Objects:

Object_Name	Units	Object_ID
Total Active Demand		
DmdP_Tot	kW	AI-5629
Maximum Total Active Demand		
DmdP_Tot_Max	kW	AI-6229
Maximum Demand Time Stamp		
DmdP_TotTime	None	DT-7029

DmdP_Tot is a moving average of the total active power in the demand interval period (15 min). The above objects are updated every minute.

Resetting the Maximum Demand:

DmdP_Tot_Max and *DmdP_TotTime* can be reset by writing to the objects below. *DEV_Command* must be written to first, then write to *DEV_Command_Hi*. The value to write is shown in the *Value* column.

Object_Name	Value	Object_ID
DEV_Command	0	AV-20001
DEV_Command_Hi	61442	AV-20101

Note: Immediately after a reset, *DmdP_Tot_Max* will be set to the current *DmdP_Tot*, and the *DmdP_TotTime* will be set to the current time.

Time and Daylight Savings Properties:

The RIBPM413-BC will maintain the synchronized time if the device has power. If power is lost and restored, the clock will be restored to a time just before power loss. The items in the table below are all properties of the Device Object, and the time and date can be set using BACnet **TimeSynchronization-B (DM-TS-B)** or **UTCTimeSynchronization-B (DM-UTC-B)**.

Property_Name	Value
Local_Time	HH:MM:SS.ss
Local_Date	Weekday, DD-Month-YYYY
UTC_Offset	*Default:* 0 (-840 – 720)
Daylight_Savings_Status	*Default: 0* (1=TRUE, 2=FALSE)

Note: The value of *UTC_Offset* is the number of minutes between local time and UTC.