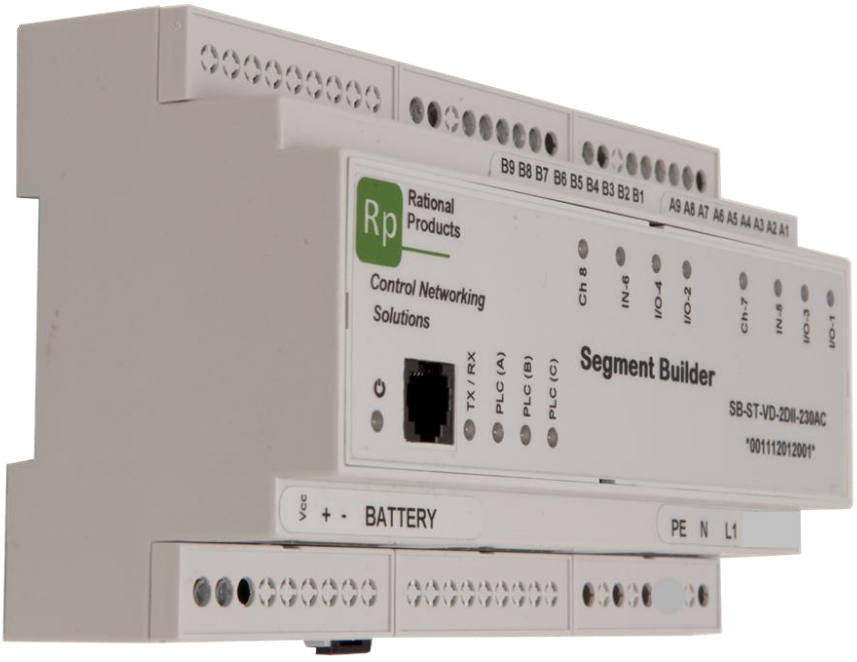
Rational Products

Control Networking Solutions

Segment Builder – Technical Folder

Version - 05

120620



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1 Scope

1.1 Product Overview

The Segment Builder (SB) is designed for a 3-Phases DIN PowerGate modem. The main purpose of this product will be to act as a Data logger and a power line modem. It will act as a master in a RHINO network. The SB includes a configurable RS-232, RS485 as well as RS-422 interface so that it can be interfaced to a PC. Then it becomes the physical interface to RHINO software applications. The SB can also be interfaced to other serial equipment.

Technical features

- 3 Phase power grid connection
- Single phase operation
- 8 programmable I/O's
- 3065 slave nodes
- 12260 Logging channels
- Real- time clock
- Astronomic clock
- GPS coordinates.

Applicable for :

- Energy Management (Master)
- Solar Monitoring
- Street light Controller
- Smart Micro Grids
    - * Pump stations
    - * Shopping Mall's
    - * Building Intelligence
    - * Industrial Buildings
    - * Customised controller
    - * Etc.....

2 Technology

2.1 Processor

A processor controls the communication of all interfaces of the SB and all I/O configurations. The processor manages incoming and outgoing data in the serial port and the power line through the PLC PROCESSOR IC.

2.2 Power Supply

The power supply accommodate the 120Vac and 220Vac power line.
A DC/DC switching power-supply is required to meet the efficiency requirements (refer to the Electrical specification). The power supply is specially designed to a very low noise level and must not interfere with the communication signal and decrease the communication performance.

2.3 Communication Interfaces

The SB include multiple serial interfaces:
RS232 interface as per RS232 standard
RS485 interface as per RS485 standard
Power line interface with the PLC Rhino IC

2.4 Programming Possibility

The SB have the possibility to program the application processor (LPC2106) with the RS232 communication port.

3 Hardware Requirements and features

This section lists the SB hardware requirements and features.

3.1 Indicators

The SB includes 5 bicolor LED:

Bicolor #1: Power Line Communication Phase 1
Bicolor #2: Power Line Communication Phase 2
Bicolor #3: Power Line Communication Phase 3
Bicolor #4: RS232/485 Communication
Bicolor #5: Power and diagnostic indication

Location of those LEDs is on the TOP of the unit to have a good visibility. The LED function works as described below:

LED #1-3:
When a power line carrier detect or message is decoded, the LED must flash GREEN
When a power line message is transmitted, the LED must flash RED.

LED #4:
When a serial message (232 or 485) is received, the LED must flash GREEN
When a serial message (232 or 485) is transmitted, the LED must flash RED.

LED#5:
The LED turn ON YELLOW when the control IC performs the initial SB self-test.
The LED turn ON RED when the control IC self-test fail.

Upon Failure with power line communication, Led related to the faulty phase must turn ON RED.

The LED should turn ON GREEN when the control IC succeeds.

Optional LED's are added to display information's of the I/O's (see I/O chapter 3.5).

3.2 Power Supply

The Power Supply is responsible for generating the required power to the various components of the circuit.

The build-in power supply support a variation voltage from 95 VAC to 265VAC.

The build-in power supply MUST provide enough current to cover all operating functionalities.

Table 1 — Power Supply Requirements

Version	Minimum (VAC)	Nominal (VAC)	Maximum (VAC)	Frequency (Hz)
120-240 VAC (N – L1)	105	120/220	265	50/60

3.3 Serial Interface

The SERIAL Interface is configurable through a mechanical means as RS-232/RS-485/RS-422;

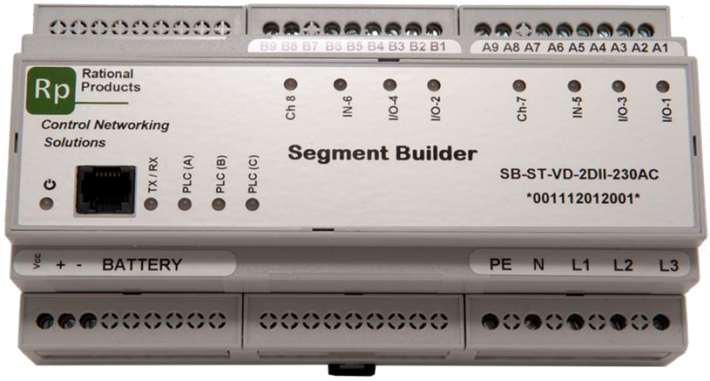
The serial interface is isolated from the principal source of power (power line network).

When configured as RS-232 interface, control pins of the RS-232 interface allow entering into a firmware update mode.

When configured as RS-485, the Serial port support half-duplex communication at up to 19,200 baud.

When configured as RS-485, it is possible to install an End-Of-Line (EOL) resistance without opening the enclosure.

3.4 Product connection overview



Bat Connector

- VCC (13 VDC)
- + Bat connection
- - Bat connection (com)

Chan 01	**I/0 1 :**	**A1 (+)** **A2 (-)**	**Chan 02**	**I/0 2 :**	**B1 (+)** **B2 (-)**
Chan 03	**I/0 3 :**	**A3 (+)** **A4 (-)**	**Chan 04**	**I/0 4 :**	**B3 (+)** **B4 (-)**
Chan 05	**IN 5 :**	**A5 (+)** **A6 (-)**	**Chan 06**	**IN 6 :**	**B5 (+)** **B6 (-)**
Chan 07	**Plug-In 7:**	**A7 (+ VCC)** **A8 (+)** **A9 (-) Com**	**Chan 08**	**Plug-In 8:**	**B7 (+ VCC)** **B8 (+)** **B9 (-) Com**

3.5 CPU Board I/O

The SB supports the following I/O configurations on the CPU board.

Configuration	I/O Number	I/O Type	Description	Type
	1	D	Digital I/O (200mA max)	Input-Output
	2	D	Digital I/O (200mA max)	Input-Output
	3	D	Digital I/O (16mA max)	Input-Output
	4	D	Digital I/O (16mA max)	Input-Output
	5	D	Digital input	Input
	6	D	Digital input	Input

The four (4) digital I/O's and the two (2) inputs are be configurable by the application.

Two additional channels (plug-in's) can be added into the SB, corresponding the application (see chapter 3.6).

3.6 Plug-in configuration

The SB supports the following I/O configurations. Such configuration will be performed at production level.

Configuration	I/O Number	I/O Type	Description	Type	Location
A	7	D	Digital input	Input	Plug-In
	8	D	Digital input	Input	Plug-In
B	7	T1	Temperature Sensor	Input	Plug-In
	8	T2	Temperature Sensor	Input	Plug-In
C	7	A	Analog Input	Input	Plug-In
	8	A	Analog Input	Input	Plug-In
D	7	A	Analog Input	Input	Plug-In
	8	A	Analog Output	Output	Plug-In
E	1	A	4/20mA Analog input	Input	Plug-In
	2	A	4/20mA Analog input	Input	Plug-In

Analog Outputs supports the 0-10V standard. The option of having the analog output configurable from 0-10V to 0-12V will be controlled by software.

3.7 Output Terminal

Eight (8) connection terminals.
Each terminal have screw connector to allow easy connection with external device.

Each terminal can be configured to count and log pulses, with all firmware functionality required for quick and easy interfacing to a pulse-generating device (such as an electronic water, gas or electric meter).
Each terminal can be configured as a standard digital input whose state can be monitored.
Four terminals can be configured as digital outputs, to control external power relays for example.
Includes a time stamp with each log entry.

3.8 Coupling Circuit

The SB MUST have its default coupling on each phase of the AC line.

3.9 AFE

The SB is conform corresponding to use an AFE that can deal with any Power-Line impedance. Furthermore it is protected against Power-Line surges.

3.10 Data Logging

The SB supports data logging capabilities with real time stamps.
The data logging option has enough log memory to store monitored data for one week when monitored data is sampled at every 5 minutes on a system with up to 3066 devices (slaves).

3.11 Real Time Clock

The SB has included a Real Time Clock capable of maintaining time for a minimum of 96 hours.

3.12 Surge Protection

The SB is properly protected against surge on the power line.

3.13 Power Line Performance Requirements

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The receiver is able to receive signal as small as 30dBuV (>100dB dynamic range) as a minimum performance.

3.14 Main Input connector:

This connector is used to connect the unit to the power line network. It supports both 120Vac and 220Vac voltage on the network.

For instance: in a 3 phase 230 / 400 Vac network, 230 Vac between Neutral and Line and 400 Vac between Line and Line.

Table 3-2: pin description

Pin Number	Name	Description	Note
1	LINE 3	LINE3 of the main	Must be connected to power line network
2	LINE 2	LINE2 of the main	Must be connected to power line network
3	LINE 1	LINE1 of the main	Must be connected to power line network
4	NEUTRAL	NEUTRAL of the main	Must be connected to power line network
5	EARTH	EARTH of the input main	Connect the earth to the low voltage GROUND to improve security. Can be connected or not.

By use of the SB in a single phase network : connect the Neutral and Line-1 .

3.15 I/O's Connectors

The connectors can accept wires with gage 14 AWG to facilitate installation.

3.16 Serial Connectors (RS232 and RS485)

The SB features serial connectors:
A RJ11 connector for the RS-232 interface is use to be compatible with earlier products of rational-Product.
A 3-terminal connector for the RS-485 interface is used to be compatible with earlier products of rational-Product.
The accessibility of the 485 interface is optional as it is not requested for a basic installation.
The RS232 connector is on the top side to facilitate accessibility.
For connection details, refer to tables below.

3.16.1 RS-232 Connector

The pin-out is the same as the DIN Logger family to be able to use the same communication cable. Below is the used pin-out:
Connector to use is a RJ11-6

Table 3-3: RS-232 connector pin description

Pin Number	Signal Name	Description	Direction
5	GND	Reference Ground	NA
2	TX	Transmit data.	Output
3	RX	Receive data.	Input

3.16.2 RS-485/ Connector

Communication is half-duplex.
The connector is chosen to allow addition of a termination resistance if required.

Table 3-4: RS-485 connector pin description

Pin Number	Signal Name	Description
1	A+	Data Receive/Transmit (+)
2	B-	Data Receive/Transmit (-)
3	GND	Signal ground

4 Electrical Requirements

This section lists the electrical requirements for the SB

4.1 General electrical requirements

Table 4-1: Electrical specifications

Parameter	Min.	Typ.	Max.	Units	Notes
Main AC Input Power		< 10		W	*Receiving mode* *Transmitting mode*
Main AC Input Voltage	95	120/220	265	VAC	
AC Power Line Frequency - RHINO (50-60 Hz power line)	45	50-60	65	Hz	*AC frequency must drift slowly as it is controlled by the main utility.*
Receiver Sensitivity	35	30		dBuV	
RHINO Signal Amplitude measured on the power line	4	6	8	Vpp	Power line impedance (Z) >= 8 Ω
Power Line Impedance Tolerance for the MIC	0	8	∞	Ohm	Short circuit protected. Output current controller.
RHINO Carrier Frequency B-band		105.5 118.7		kHz	
RHINO Carrier Frequency A-band				kHz	A-Band : Can be support with a new MIC (not included in this document)
Physical Layer					Factory protected
Automatic Baud Rate Negotiation	50	800	800	bps	Simultaneous Transmitting & receiving on the 3 phases at power cycle !
Operating Temperature	-25	-	70	°C	-
Storage Temperature	-30	-	85	°C	-
Humidity Non-Condensing	0	-	95	%	
RS232C output	±15	-	±15	V	

Parameter	Min.	Typ.	Max.	Units	Notes
RS485 output **voltage** **current**	±1.5		±3.3 250	V mA	

4.2 I/O's Electrical Specifications

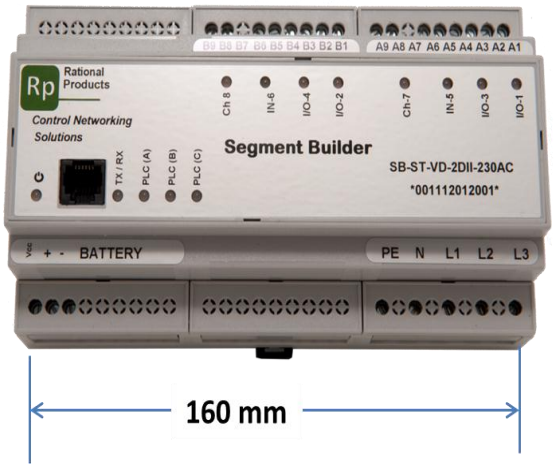
I/O	Description	Min	Max	Tolerance/precision	Comments
I	Digital input	-0.5 vdc	12.5 vdc	Threshold = min 4.5V (TBD) 2 mA Pull-up current source	Input impedance = 10 kOhm Dry contact configuration
O	Digital Output	-0.5 vdc	12.5 vdc	Max current sourced for 4 I/O's is 200mA.	

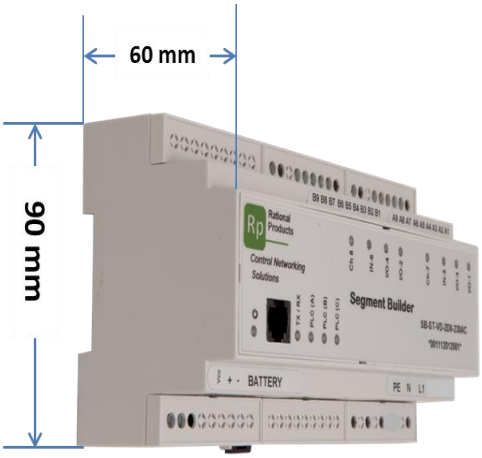
That means:

1. An input voltage lower than 4.5 Volt is a logic "0" !
2. An input Voltage higher than 4.5 volt should be a logical "1" !
3. An build-in window (uncertain area) is not a problem as long as this is lower than 1.5 Volt, that means between 4.5 and 6 volt !

5 Mechanical Info

Length: 160 mm
Width: 90 mm
Height: 58 mm (including DIN rail brackets);
Gross weight: 0.30 kg
Casing: DIN Rail





6 Regulatory specifications

The design meets the following requirements:

6.1 Safety Requirement

Table 6-1: Regulatory Requirements

Parameter	Requirement
Safety regulatory:	IEC 60950-1 particularly for :clearance, creepage and inflammability.
	European low voltage directive (73-23)

6.2 Emission Requirement

Table 6-2: Regulatory Requirements

Parameter	Requirement
Radiated and conducted emission:	EN50081-2 Radiated Emission Class A 40 dBμV/m for 30 MHz to 230 MHz 47 dBμV/m for 230 MHz to 1000 MHz EN50081-2 Conducted Emission Class A 66 dBμV for 0.15 MHz to 0.5 MHz 60 dBμV for 0.5 MHz to 5 MHz 60 dBμV for 5 MHz to 30 MHz
CENELEC General requirements frequency bands and electromagnetic disturbances	EN50065-1 1992 Class 134 (industrial) Signaling on low-voltage in frequency range 3 kHz to 148 kHz.

6.3 Immunity Requirement

Table 6-3: Regulatory Requirements

Parameter	Requirement
Immunity :	EN 61000-4-2 Electro Static Discharge EN 61000-4-5 Surge immunity test EN 61000-4-6 Immunity to conducted disturbances induced by radio-frequency fields EN 61000-4-11 Voltage variations immunity tests EN 61000-4-13 low frequency immunity on main

6.4 Environmental System Requirements

The following table lists the environmental system requirements of the SB.

Table 6-4: Environmental Requirements

Parameter	Requirement
Operating temperature	-25 to +70ºC (overall product) All components must be in this bracket (-25 to +80ºC)
Storage temperature	-30ºC to 85ºC

7 Production Requirements

Test points are added on the PCBs in order to do mass production test.

The SB works with all combinations of specified component tolerances.

The product is RoHS compliant.

END