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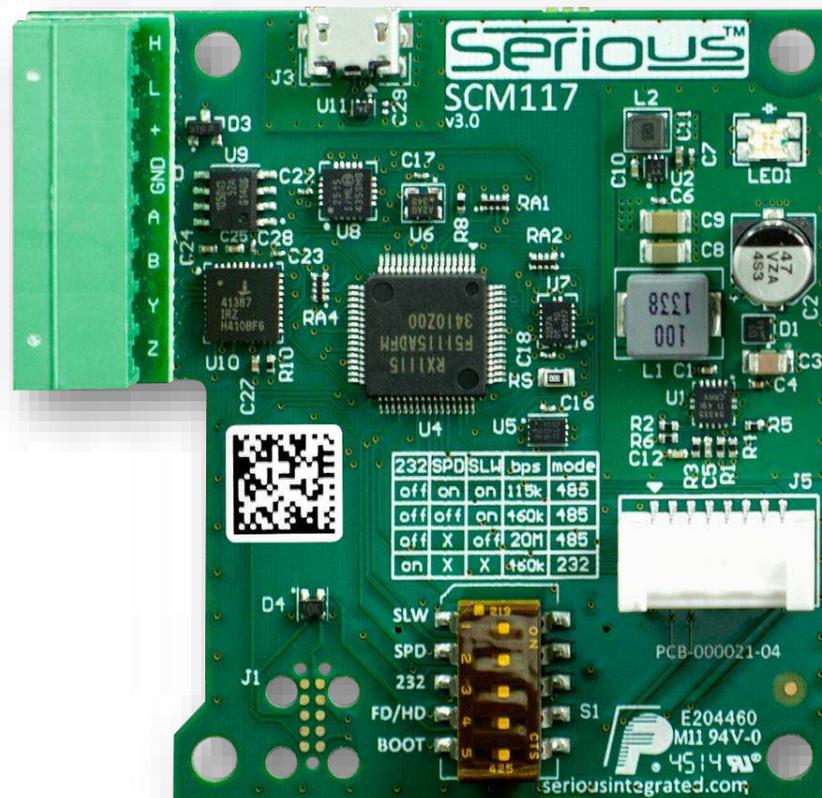
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SERIOUS™

SCM117

Technical Reference Manual



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DOCUMENT INFORMATION AND APPLICABLE PRODUCTS

CHANGE HISTORY AND APPLICABLE PRODUCTS

The following table summarizes major changes to this document and the applicable versions of the product corresponding to this document:

Doc Rev	Date	HW Rev	PCB Rev	Major Changes
A0	01 Oct 13	1.0	01	<ul style="list-style-type: none"> Initial advance version
A1	05 Oct 13	1.0	01	<ul style="list-style-type: none"> Added USB device, PCB edge sections Internal review complete PCB Edge replaced by TC2070
B0	28 Feb 14	2.0	02	<ul style="list-style-type: none"> Added SIM Pass-thru SHIP Programming Port (SPP) RX111 48 to 64 pin version to get back missing UART Removed SIM_PWRDWN# control USB and JST16 now only on A00 variant (not A01/A02) Noted 750kbps limit on CAN MCP2515 Fixed S1.4 half/full duplex polarity Added SIM_3V3_DOCK and SIM_3V3_DOCK sensing
B1	31 Mar 14	2.0	03	<ul style="list-style-type: none"> Updated with production photos
B2		2.0	03	<ul style="list-style-type: none"> Added section describing how to reset the attached SIM
C0	20 JAN 15	3.0	04	<ul style="list-style-type: none"> Updated content to reflect SCM117 v3.0 <ul style="list-style-type: none"> RSXXX & CAN connectors now Industrial Networking Connector +VIN_CAN and +VIN_UART now +VIN Debug connector now TC2050 and uses new RX FINE adapter Expanded explanations of bypass mode Expanded clarity of 2-wire RS4XX mode for PLC connections

DOCUMENT CONVENTIONS



This symbol indicates an advanced tip for hardware or software designers to extract interesting or unique value from the product.



Pay special attention to this note – items especially subject to change, or related to compatibility, functionality, and usage.



WARNING: You can damage your board, damage attached systems, overheat or cause things to catch fire if you do not heed these warnings.



Notes with this symbol are related to license and associated legal issues you need to understand to use this software. We're big believers in honoring license agreements, so please help the industry by respecting intellectual property ownership.



Some hardware features may be preconfigured or permanently reserved for use by the [SHIPEngine](#) software (the GUI management engine component of the [Serious Human Interface™ Platform](#)). Notes with this symbol indicate where the module comes pre-configured or uses these resources.

INTRODUCTION

The [SCM117 Serious Communications/Power Module](#) family is a series of flexible and production-worthy communications and power conversion accessory boards for use with Serious Integrated Modules (SIMs). The SCM117 can dock directly into newer SIMs such as the [SIM115](#), [SIM231](#), and [SIM535](#) forming a low profile and cost effective combination. With other SIMs, such as the [SIM110](#) and [SIM225](#), a simple wire harness can interconnect the SCM117 with the SIM.

The SCM117’s most basic functionality is to provide network physical layer transceivers from the network cabling (RS232, RS485, RS422, or CAN) to the SIM, as well as network power conversion from whatever voltage (+9-25VDC) is available on the network cabling to the 5VDC required by the SIM.



SCM117 v3.0 Docked into SIM231

The SCM117 family has numerous members, or “variants”, implementing all or a subset of the following hardware capabilities:

- ▶ Line transceivers for the RS232, RS422, RS485, and CAN protocols
- ▶ Renesas RX111 MCU for local protocol translation and control
- ▶ DC-DC converter for powering the SCM and attached SIM from most network-borne power

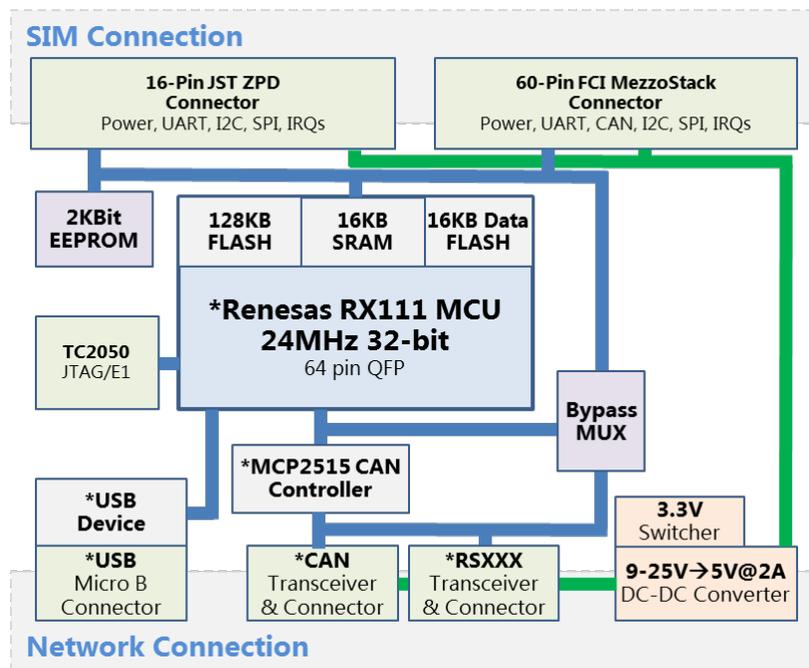
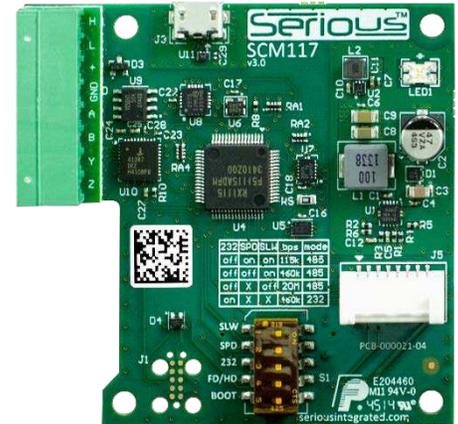
Variants without the RX111 MCU rely completely on the SIM to transmit and receive the specific protocol on the network, communicating directly through the network transceivers on the SCM117.

Variants with the RX111 MCU, in contrast, optionally place the RX111 in the middle of this conversation: the RX111 can communicate with the SIM using one protocol (for example, Modbus or SHIP Bridge) and another protocol on the network (for example, your own proprietary protocol).

HARDWARE OVERVIEW

The SCM117 family variants include some or all the following hardware features:

- ▶ Board-to-board direct attach to SIM115, SIM231, SIM535
- ▶ Wire-harness attach to all SIMs
- ▶ Installer-friendly, industrial connector
- ▶ Renesas RX111 MCU for protocol/network translation
- ▶ +9-25VDC to +5VDC @ 2A DC-DC converter
 - Powers both the SCM and attached host SIM
 - Accommodates Programmable Logic Controller (PLC) standard 24VDC power supplies
- ▶ Multi-mode RS232/RS422/RS485 transceiver
 - Half and full duplex
 - Differential and single ended operation
 - Switch selectable RS232 vs. RS4xx mode
 - Switch selectable slew rate control
- ▶ CAN transceiver
- ▶ MCP2515 CAN Controller (with RX111)
 - Up to 750kbps line rate
- ▶ -40 to +85C operating temperature



SCM117 Hardware Block Diagram

*options depend on variant

USAGE MODELS

The SCM117 is designed to operate in conjunction with, and as an accessory to, a [Serious Integrated Module \(SIM\)](#).

All SCM117 variants (family members) are designed to take 9-25V from an outside power source, often an industrial network, and convert it down to the 5V required by the SCM117 as well as the attached SIM.

The SCM117 also provides the appropriate network transceivers for CAN, RS485, RS422, and/or RS232, converting logic levels on the SIM/SCM to corresponding network levels.

SCM117 variants which have the Renesas RX111 MCU populated (e.g. variants A00, A01, and A02) are designed to act as intelligent protocol converters. This is the most common use of the SCM117. On one side of the RX111 MCU, the SCM117 communicates to the SIM using the Modbus or SHIPBridge protocol over SPI or UART. On the other side of the RX111 MCU, it communicates the appropriate messages to the OEM’s proprietary protocol on a CAN, RS232, or RS485 network.

Less commonly, variants without the RX111 MCU are designed to have the SIM operate the protocols directly and the SCM117 act purely as a network interface and power supply.



SIMs running the [SHIPEngine](#) software (the GUI management engine component of the [Serious Human Interface™ Platform](#)) can communicate using the Modbus or SHIPBridge protocols over the SPI or UART connecting the SIM to SCM117. The SCM117 can then translate this protocol to an OEM custom network protocol over CAN/RS232/422/485 using OEM custom software on the RX111 MCU.

CONNECTING SCM117 TO SIMS

In the most compact and common configuration when used with newer SIMs (e.g. SIM115, SIM231, and SIM535) the SCM117 can dock directly into the back of the SIM using a low profile board-to-board connector on the SIM and requiring no cable harness or special tools. This dock connector carries UART, SPI, I2C, RESET#, and input 5V power to the SIM as well as several other signals.

Four screws (provided) fasten the SCM117 and the SIM together.

In some systems configurations, and with SIMs without this docking connector (e.g. SIM225), some SCM117 variants have a 16-pin wire-harness-friendly JST connector that can be used to connect a subset of these signals to the target SIM.

NETWORK TRANSCEIVER + POWER USAGE MODEL

When the SCM117 variant has no MCU on-board it acts as a simple power source adapter – taking in +9-25V from the network and supplying 5V to the SIM – as well as the transceivers for the physical layers of CAN, RS422, RS485, and/or RS232. In this configuration, the SIM’s MCU is responsible for all network management including data and protocol generation/recognition.

On the network side, for example, you may have a standard RS485, half-duplex, 2-wire RS485 network driven by a Programmable Logic Controller (PLC) operating as a Modbus protocol master node. Typically, 24VDC will also be delivered from the PLC in order to power slave devices on the network. The SCM117-A03 variant has the RS422/485 transceivers available and can connect directly to this network configuration, converting the 24VDC on the network to the 5VDC required by the SCM as well as an attached SIM.



GUIs developed using the [Serious Human Interface™ Platform](#) can communicate directly from SIMs to Modbus networks, including a PLC, through an SCM117-A03 without RX111 MCU or an SCM117-A00 or A01 with the RX111 disabled in [bypass mode](#).

INTELLIGENT PROTOCOL TRANSLATION + POWER USAGE MODEL

Nearly all network topologies require some sort of power and communications physical layer transceiver between the network and the device on the network. All SCM117 variants perform this basic functionality. Some variants of the SCM117 family also include a Renesas RX111 MCU. The RX111 is part of a new breed of powerful yet inexpensive 32-bit MCUs, and includes extensive I/O including SPI, I2C, UARTs, and USB device.

With the addition of this inexpensive MCU, these SCM117 variants can also perform protocol translation between the SIM and your unique network. You can leverage the off-the-shelf [Serious Human Interface™ Platform](#) (SHIP) binary software engine on the SIM, which communicates via Modbus (or, with SHIP v5, the full-featured Serious SHIPBridge protocol) and still interoperate with your proprietary CAN, RS232, RS422, or RS485 network. *You* control all the software on the SCM117's RX111 MCU – forwarding, translating, and filtering messages between the SIM and your network.



The Micrium µC/OS-III kernel, µC/Modbus, and µC/CAN stacks have already been ported to the SIM117. Contact *Serious* for details.



There will be reference code available with the upcoming [Serious Human Interface™ Platform](#) version 5 release for the Serious Bridge Protocol.



The no-cost SHIPWare source code package downloadable from myserious.com includes the Micrium uC/OS-III kernel and a set of UART, SPI, I2C, and Modbus drivers you can use to write this protocol adaptation layer.

VARIANT OVERVIEW

The SCM117 is a family of communications/power modules. The family includes several standard members, or “variants”, with a specific subset of the family features. As of the time of this document’s date, the standard variants are:

Option	SCM117-	A00	A01	A02	A03	A04
SIM Connectivity						
60 pin board-to-board connector for power/I2C/SPI/UART connectivity		✓	✓	✓	✓	✓
16 pin wire harness connector for SIM Power/I2C/SPI/UART connectivity		✓				
Power						
+9-25VDC to 5V @ 1.5A DC-to-DC converter		✓	✓	✓	✓	✓
Local Processing						
Renesas RX111 MCU for protocol adaptation and management		✓	✓	✓		
MCP2515 CAN controller to 750kbps when RX111 is controlling the CAN transceiver		✓		✓		
Network Connectivity						
USB device circuitry		✓				
USB device micro-B connector		✓				
CAN transceiver with 4 pin connector		✓		✓		✓
RS232/485/422 multi-mode transceiver full/half duplex single/differential support slew rate control		✓	✓		✓	
Pluggable network connector size		8	6	4	6	4

APPLICABLE HOST PRODUCTS

The SCM117 does not operate in a stand-alone fashion; it must be physically attached to a [Serious Integrated Module](#). All SCM117 variants have the following compatibility/features as follows:

SCM117 Feature	SIM					
	110	115	205	225	231	535
Board-to-Board compatible		✓			✓	✓
Wire-to-Board compatible	✓	✓	✓	✓	✓	✓
Can power SIM	✓	✓	✓	✓	✓	✓
CAN (direct from SIM)		✓			✓	✓
RS485/422/232 (from SIM)	✓	✓	✓	✓	✓	✓

SCM117 VARIANTS WITH MCU

When the SCM117 variant includes the on-board Renesas RX111 MCU, the RX111 is typically responsible for protocol translation and network connection management. The following compatibility matrix shows which SCM117 additional features for these MCU-equipped variants are available when used with various SIMs:

SCM117 Feature	SIM					
	110	115	205	225	231	535
SIM to SCM RX111 UART	✓	✓	✓	✓	✓	✓
SIM to SCM RX111 I2C		✓			✓	✓
SIM to SCM RX111 SPI		✓			✓	✓
CAN (from SCM RX111/MCP2515)	✓	✓	✓	✓	✓	✓
RS485/422/232 (from SCM RX111)	✓	✓	✓	✓	✓	✓

SOFTWARE

SOFTWARE ON THE SERIOUS INTEGRATED MODULE

The SCM117 is designed to operate as an accessory to a [Serious Integrated Module](#) running a graphical user interface (GUI).

For GUI development in as little as a few days, the [Serious Human Interface™ Platform \(SHIP\)](#) offers PC-based GUI design tools and rapid GUI prototyping, development, and deployment. With minimal coding, you can create attractive and functional GUIs in a fraction of the time of traditional C-based development. Included in SHIP are communications facilities that can be used with the SCM117.

In SHIP Version 5 (SHIPv5), the Modbus protocol is available over UART and SPI connections to the SCM117. In addition to Modbus, the SIM can also communicate using the new SHIPBridge protocol. SHIPBridge affords much greater communications and control capability than Modbus, including over-the-wire GUI and SIM firmware updates and over-the-wire access to on-SIM file systems such as a thumb drive plugged into a SIM's USB port. See www.seriousintegrated.com/SHIP for details.

More traditional development of the SIM GUI, using graphics libraries in C in conjunction with an RTOS such as [Micrium uCOS-III](#), [Segger embOS](#) or [FreeRTOS](#), can enable more extensive use of the hardware features of the SIM and vast applications flexibility at the expense of significantly longer development time and higher R&D expense. *Serious* fully supports this development methodology with our partners: for more information see www.seriousintegrated.com/oob.

SOFTWARE ON THE SCM117

For SCM117 variants without an RX111 MCU, there is no software capability on the SCM117. For those variants with the RX111, development is easy and inexpensive using the no-cost Renesas e2Studio IDE and KPIT GNU compiler. For more information on setting up this environment see www.seriousintegrated.com/oob.

Developing for the RX111 requires both a debugger/programmer, such as the Renesas E1 or Segger J-Link as well as a [Tag-Connect TC2050 Cable with RX111 FINE Adapter](#). The SCM117 [Development Kits](#) includes both these items.



Reference source code for the SCM117 is available from *Serious*. Check the community forums for registered hardware owners at mySerious.com or [contact Serious](#).

ORDERING INFORMATION

DEVELOPMENT KITS

The [SCM117-A00-SJL-01](#) development kit contains everything (except the graphic/touch SIM) needed to develop with SCM117 family.



The kit contains:

- ▶ [SCM117-A00](#) module
 - Superset of all SCM117 features
 - Renesas RX111 MCU
 - MCP2515 CAN Controller, CAN Transceiver
 - RS232, RS485/422 Transceiver
 - +9-25V input power
- ▶ Debugging/Programming
 - [Segger J-Link Lite RX](#) JTAG debugger/programmer
 - [Tag-Connect TC2050 Cable with RX111 FINE Adapter](#) for connecting the J-Link or Renesas E1 debugger to the SCM117
- ▶ Lab use 12V power supply
 - 12V 10W wall power supply for lab use (EU/US voltage and plug compatibility)
 - Adapter has either stripped cable ends or includes barrel to screw terminal power jack adapter depending on availability
- ▶ Connectivity hardware
 - 16 pin wire harness (JST16 plug one end, tinned the other) for lab cable enabling
- ▶ Fasteners/Hardware
 - Board-to-board mounting screws (4x M3 Nylon) for docking SCM117 into a SIM or standalone use with standoffs
 - 10mm standoffs (4x 10mm M3 Nylon) for standalone use
 - Adhesive rubber feet (4) for standalone use

There is no specific kit that includes both a SIM and an SCM117, and you will want to order the SIM kit most appropriate for your application. For example, for 4.3" WQGA front panel applications, the SIM231-A01-R32ALM-01 (or the dev kit version SIM231-A01-DEV-01) may be a good choice.

STANDARD PRODUCTS

The [SCM117-A00-SJL-01](#) development kit contains everything (except the graphic/touch SIM) needed to develop with SCM117 family and is available only in a single unit package.

For production and larger quantities, the following standard SCM117 products are available:

Variant	Ordering Code			Distributor Inventory
	Individual Unit	10 Pack	50 Pack	
SCM117-A00		SCM117-A00-10	SCM117-A00-50	 
SCM117-A01		SCM117-A01-10	SCM117-A01-50	 
SCM117-A02		SCM117-A02-10	SCM117-A02-50	 
SCM117-A03		SCM117-A03-10	SCM117-A03-50	 
SCM117-A04		SCM117-A04-10	SCM117-A04-50	 

See the [variant table](#) for detailed information on features per variant.

SEMI-CUSTOM PRODUCTS

The [Serious Custom Services team](#) may be able to provide a customized version of the SCM117 for certain OEM designs, or even a product similar to the SCM117 that directly meets a unique interconnect need.

For example, the Services team could deliver an optimized dual RS485 over RJ45 version of the SCM117 under a customer-specific part number, but based on the SCM117 form factor and design, perhaps with a barrel jack power input.

Another example might be a semi-custom variant of the SCM117. Your design may require the SCM117-A02 feature-set but also need the USB device port. Serious could, for example, create an “SCM117-A06” or equivalent with this feature-set populated.

Contact your local [Serious Manufacturers Representative](#) or [Serious directly](#) for more information.

GETTING STARTED

CONNECTING THE SCM117 TO A SIM

There are two ways the SCM117 can connect to the SIM: through the direct board-to-board connector and using a connector with a wire harness.

! Ensure power is not connected to the SIM or SCM when connecting them together.

DOCKING: DIRECT BOARD-TO-BOARD ATTACH

For some SIMs (see the [Applicable Host Products](#) tables), for example the SIM231, the SCM117 can attach directly (both mechanically and electrically) to the SIM.

Orient the SCM117 such that the 60 pin connector on the back of the SCM aligns with the identical mating connector on the SIM. The connector can only be plugged in one way; it is polarized.

! Some SIMs may have multiple 60-pin connectors.
 Ensure you connect into the correct one or damage to the SIM and SCM may occur.
 Consult the Technical Reference Manual of the specific SIM if you are unsure.

When correctly aligned, you should see the 4 stand-offs/mounting holes on the SIM align perfectly with the corresponding mounting holes of the SCM:

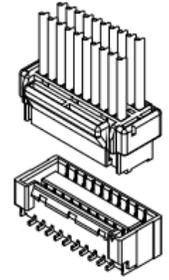


Using four machine screws gently fasten the SCM117 into the SIM's standoffs. These M3-0.50 screws should be no more than 6mm in length.

! Do not over tighten the screws or you may damage the SIM.
! Using screws longer than 6mm can damage the LCD on the SIM.

ATTACHMENT USING A WIRE HARNESS

Most SIMs have some form of wire harness compatible connector. For example the SIM225-A03 has a 7 pin [JST GH series connector](#) on the board which exposes the primary SIM UART as well as can supply power to the SIM. SIMs released prior to 2014 contain this 7-pin connector – consult the applicable Technical Reference Manuals for details and signal diagrams. More recent SIMS, such as the [SIM231](#), [SIM115](#), and [SIM535](#), have a slightly larger 16-pin [JST ZPD series connector](#) that goes beyond those signals present on the 7-pin version, adding I2C, SPI, interrupt signals, and more.



Both the 7-pin and 16-pin connectors are polarized and have a retention locking mechanism.

When using a wire harness to join the SCM to the SIM, the two boards are physically separated when mounted in your own enclosure. The four mounting holes on the SCM117 are designed for a M3 or #4 machine screws (see [Physical Characteristics](#)).

The SIM to SCM wire harness must be made to connect the appropriate signals between the two boards. See [Power/SIM Wire-to-Board Connector](#) for details and suggestions for this cable. [SCM117 development kits](#) contain a “JST16 to tinned-end” cable for experimentation in your lab.



Gently plug/unplug the wire harness connectors to avoid damage to the SIM/SCM.

POWERING THE SCM117+SIM

When the SCM117 is connected to the SIM (docked or via wire harness), the SCM is designed to power itself as well as the attached SIM.



Most SIMs have numerous ways to apply power; ensure the SCM is going to be the only power provider to avoid possible damage to the SCM, SIM, or attached power sources.

The simplest way to power the assembly is to wire the network supplied power (+9-25VDC 10W), such as a Programmable Logic Controller’s 24VDC power supply, into the power input terminals of the SCM117’s [Industrial Networking Connector](#).



Pay careful attention to the polarity of the power input. It is not protected against reverse voltage and miswiring will damage your SCM117 and any attached SIM.

[Development kits for the SCM117](#) may include a standard 110/220VAC wall power adapter to be used in the event that network power is unsuitable or unavailable in the lab environment. This standard wall adapter may have simple stripped ends for insertion into the [Industrial Networking Connector](#).

In some kits, the power supply may terminate in a common barrel plug that has no direct means of connecting to the SCM117. Using the Barrel Power Jack Adapter included in these kits you can attach jumper wires from the adapter to the power inputs on the SCM117.



SPECIFICATIONS

MAXIMUM OPERATING LIMITS

The SCM117 maximum operating power limits are as follows:

Specification	Permissible Range			Units
	Min	Typ	Max	
Power				
Input Voltage +VIN	9*		25*	VDC
Input Power +VIN			12*	W
Output Voltage to SIM (+5V)	4.75	5.00	5.25	VDC
Output Current to SIM (+5V)			2000*	mA



*preliminary and subject to final production characterization.

For detailed limits on the RS232/422/485 interface, consult the [Intersil ISL41387IRZ-T data sheet](#).

For detailed limits on the CAN interface, consult the Infineon [IFX1050GVIO data sheet](#).

AC TIMING CHARACTERISTICS

The AC timing characteristics at the module level are governed by the underlying AC timing characteristics of the individual components. Consult the component data sheets for more information.

NETWORK BIT RATES

When operated from the RX111, the CAN port driven by the MCP2515 is limited to a maximum network bit rate of 750kbps. When driven directly by the CAN port on the SIM (where possible), the CAN network rate is supported up to 1mbps depending on the capabilities of the SIM's CAN controller.

In practice, construction of software drivers and MCU workload (either on the SCM or SIM's MCU depending on which is driving/monitor the port) will control (and often limit) the effective maximum throughput.

ENVIRONMENTAL CHARACTERISTICS

Specification	Permissible Range			Units
	Min	Typical	Max	
Operating Temperature	-40	25	+85	C
Storage Temperature	-40	25	+85	C
Humidity			90% (@60C) Non-condensing	RH



This information is preliminary and subject to final production characterization.

PHYSICAL CHARACTERISTICS

The following table summarizes the key physical characteristics of the SCM117.

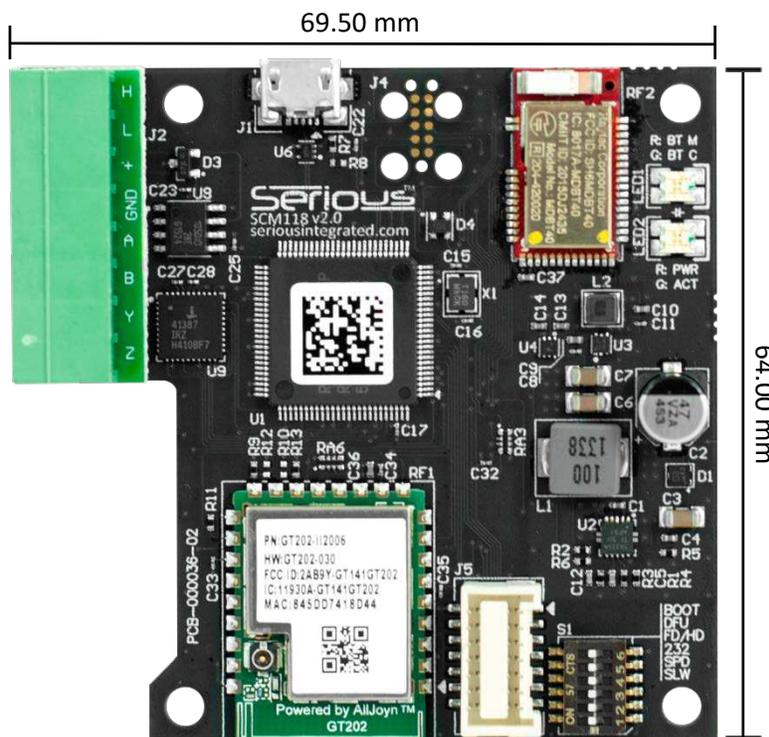
Specification	Variant(s)	Typical	Tolerance	Units
Width	All	69.5	0.4	mm
Height	w/USB Micro B	66	0.4	mm
	no USB Micro B	64	0.4	mm
Thickness	A00		0.4	mm
	A01,A02,A03,A04		0.4	mm
Board-to-Board inner dimension when docked	All	4.0	0.2	mm
Weight	A00			g
	A01			g
	A02			g
	A03			g
	A04			g



This information is preliminary and subject to final production characterization.



Mechanical drawings and 3D CAD STEP models are available for most production-focused SIMs and SCMs. Visit www.seriousintegrated.com/docs for more information.



POWER

The SCM117 must be powered from an external +9-25VDC power supply. This supply is efficiently regulated from the 9-25VDC input down to the 5VDC required by both the SCM as well as attached SIM. Locally on the SCM and SIM respectively are further regulation systems from 5V to other required voltages.

The SCM117 **cannot be powered from the SIM**. When SCM117 +9-25VDC input power is not present the SIM may still be able to operate from an external 5V supply to the SIM directly (e.g. the USB device port on a SIM231), however the SCM117 will be held in shutdown mode without the explicit presence of 9-25V input power.

+9-25VDC INPUT POWER

The SCM can accept +9-25VDC from the [Industrial Networking Connector](#), and on the schematics this power input is marked as +VIN and GND. The GND signal on the connector is common to the SIM/SCM system ground. For current and voltage limits on this input, see [Maximum Operating Limits](#).

+5V MAIN POWER RAIL

+VIN is delivered to the input of the main +9-25V buck DC-DC switching regulator capable of supplying up to 5.0V @ 2A (10W) to the +5V main power rail. This regulator typically operates at 90% efficiency and powers all the 5V needs on the SCM as well as supplies the main 5V power required to the attached SIM.

The network side of both the [CAN Transceiver](#) and the [Multi-mode RS232/422/485 Transceiver](#) are both powered by the +5V supply.

+3.3V REGULATION

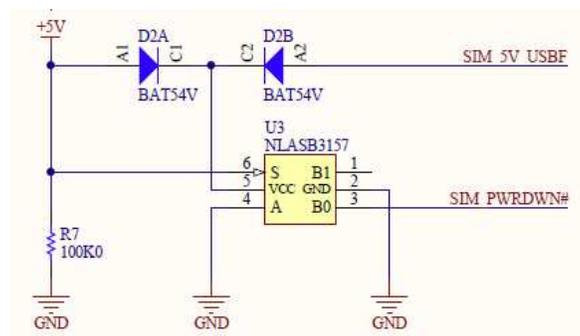
Several circuits on the SCM117 require 3.3V power. The SCM117 does not use the 3.3V supply generated and delivered from the SIM, but rather has its own independent regulator to convert +5V to the +3V3 power signal on the SCM.

SIM USB DEVICE POWER

Some SIMs, for example the SIM231, can be powered exclusively through their USB device port since these SIMs, operating standalone, require less than the 500mA@5V normally available from PC USB ports and powered hubs. It is a common practice with these SIMs to develop their GUIs when they are connected and powered in this fashion. On other (typically larger) SIMs such as the SIM535, the USB device port cannot power the SIM and that input is only used to detect the presence of a USB initial connection.

When the SCM117 is connected, however, even for SIMs that may support stand-alone USB powering, the combined power needs of the SCM117 and SIM is too great for the USB 500mA limit. Therefore, in the absence of the external +9-25VDC on the SCM117 to power the combination, the SIM is held in powerdown mode and will not operate.

This simple circuit (or equivalent), ensures that the SIM is held in power down mode until the external 9-25VDC power input is present.



CONTROLLING AND MONITORING THE SIM (RX111 VARIANTS ONLY)

SIM-RESET#

All SIM's have an open-drain, active-low reset circuit with a pull-up resistor ensuring that, on power-up, the SIM is reset briefly and then allowed to run.

Since the SCM117 is designed to provide power and network connectivity to the SIM, it can also control this SIM RESET circuit from the RX111 (if present). When the RX111 software asserts P26-SIM_RESET# (low, active), this SCM signal holds the SIM in RESET until it is de-asserted (high, inactive).

Most SIMs (consult the respective Technical Reference Manual) have a minimum 50mS self-reset period, enabling the RX111 on boot to assert P26-SIM_RESET# and hold the SIM in RESET before it has a chance to start running. The SCM can perform any necessary pre-boot operations (such as [reading the EEPROM in master mode](#) before switching to slave mode) and then, when appropriate, release the SIM's RESET.

P26-SIM_RESET# can also be monitored by RX111 software to see if the SIM self-resets.



If you use this P26-SIM_RESET# capability, do not configure this pin as a push-pull output to avoid potential conflicts with the on-SIM reset circuitry.

The recommended process for resetting the SIM is as follows:

1. Write "1" to the Open Drain Register PORT2.ODR1.B4 to make P26-SIM_RESET# an open drain pin (when made an output)
2. Write "0" to the Port Output Data Register PORT2.PODR.B6, so that when it is made an output it will reset the SIM
3. Write "1" to the Port Direction Register PORT2.PDR.B6 to make it an output
4. Wait 1mS; the SIM will start the self-reset process
5. Write "0" to the Port Direction Register PORT2.PDR.B6 to make it an input
6. The SIM, in the next 200mS, will come out of reset; you can monitor the Port Input Data Register (PORT2.PIDR.B6) to see when this happens

SIM POWER STATUS

The SIM is normally powered by the 5V supply from the SCM117.

The SIM then generates its internal 3.3V supply and makes a small portion of that 3.3V available on the [60 pin docking connector](#) as well as the [16 pin JST wire-to-board connector](#).

The status of these two 3.3V signals can be read on the RX111 via the signals SIM_3V3_DOCK (PH7) and SIM_3V3_JST16 (P03) respectively.

Normally, these signals will always read high since the SCM117 has no mechanism to directly control the SIM power.

However, in some rare configurations the SIM power (or power-down) may be controlled from some other mechanism and these signals allow for detection of a power-down state.

SIM↔SCM UART

The RX111 MCU's UART **SCI5** is connected to the SIM's UART present on the JST16 (**J4**) and 60 pin dock (**J1**) connectors with 3 signals:

JST16 J4 #	FCI60 J1 #	SIM UART Function
9	35	TXD Transmit Data
11	37	RXD Receive Data
13	40	TXE# Transmit Enable (half duplex only)

In [bypass mode](#) these signals are connected directly from the SIM to the SCM's RSXXX transceiver, completely bypassing the RX111 (if even present).

In non-bypass mode, this SIM UART is connected to the **SCI5** UART on the RX111 MCU and the RSXXX transceiver is connected to a different RX111 UART (**SCI12**). The RX111 sits in between the two connections, able to provide protocol translation and other intermediary services. For example, the RX111 could talk UART to the SIM, and CAN to the network with a completely different protocol. Or the RX111 could talk one baud rate with Modbus to the SIM as a slave, and another baud rate as a Modbus Master to the network.

In this non-bypass mode, the SIM's UART is connected to the RX111 as follows:

SIM UART Function	RX111
TXD Transmit Data	PC2/RXD5
RXD Receive Data	PC3/TXD5
TXE# Transmit Enable	PE4-SIM_TXE

Note that the TXE# signal incoming from the SIM in this mode is only monitored (if desired) by RX111 software. The actual RSXXX transceiver drive enable is controlled by a different RX111 port (**PE3/RTS12#-RSXXX_DE**).

SIM↔SCM SPI

Some SIMs (including SIM225, SIM115, SIM231, and SIM535) make an SPI port available for communication with external devices. Consult the specific SIM's TRM for availability and capabilities. When the SCM117 is put in [bypass mode](#) these signals are unused on the SCM117.

In non-bypass mode, these signals are connected to the RX111 MCU's SPI port "A". The 5 relevant signals from the SIM are as follows:

JST16 J4 #	FCI60 J1 #	Direction	SIM SPI Function	RX111
14	22	SCM↔SIM	SPI Clock	P15/RSPCKA-SIM_SPI_SCLK
12	24	SCM↔SIM	SPI Master Out, Slave In	PA6/MOS0A-SIM_SPI_MOSI
10	26	SCM⇒SIM	SPI Master In, Slave Out	PA3/MISIA-SIM_SPI_MISO
16	19	SCM↔SIM	SPI Slave Select #	PA4/SSLA0-SIM_SPI_SSEL
15	41	SCM⇒SIM	SPI/I2C IRQ#	PA1-SIM_IRQ#

The SIM must be the SPI master and the SCM117 the SPI slave. The SCM117 must only respond to SPI communications when the Slave Select is asserted (active low).



The [Serious Human Interface™ Platform](#) v5 release contains built-in support for this SPI communications port using a robust and light framing protocol supporting both Modbus and the Serious SHIPBridge Protocol over SPI. Out of the box, you can communicate from your SIM-based GUI over SPI to your RX111 software, including updating your GUI or SHIPEngine from the network via the RX111!

SIM ↔ SCM I2C

Some SIMs (including SIM225, SIM115, SIM231, and SIM535) make an I2C port available for communication with external devices. Consult the specific SIM's TRM for availability and capabilities. This I2C port is always connected to the SCM117's [EEPROM](#). There are no I2C pull-up resistors on the SCM117 – these are provided on the SIM. Therefore the I2C bus (and EEPROM) cannot be used when the SCM117's I2C signals are not connected to a SIM.

These signals are connected to the RX111 MCU's I2C port "0". The 3 relevant signals from the SIM are as follows:

JST16 J4 #	FCI60 J1 #	Direction	SIM I2C Function	RX111
6	39	SCM ↔ SIM	I2C Clock	PB0/SCL0-SIM_I2C_SCL
8	42	SCM ↔ SIM	I2C Data	P17/SDA0-SIM_I2C_SDA
15	41	SCM → SIM	SPI/I2C IRQ#	PA1-SIM_IRQ#

When the [SIM is not in reset](#), the SIM must be the I2C master and the SCM117's RX111 MCU the I2C slave.



The I2C bus may be shared on the SIM with many other devices; consult the specific SIM's TRM to ensure the slave address you use on the RX111 does not conflict with any other device on the SIM or the EEPROM on the SCM117.



The [Serious Human Interface™ Platform \(SHIP\)](#) does not currently use the I2C feature of the SCM117, however on most SIMs this I2C port is actively used for other devices from SHIP.

EEPROM

The SIM225 features a 2Kbit (256 byte) On Semiconductor [CAT34C02](#) EEPROM. The EEPROM is an I2C device on the SIM's I2C port and shares an I2C connection with many other devices on the SIM. There are no on-board I2C pull-ups on the SCM117 – the EEPROM is *only* accessible when the SIM and SCM are connected as the SIM provides the needed I2C pull-ups.

Since the SCM's RX111's I2C port to the SIM is designed to be an I2C *slave* device (to the SIM's I2C Master), this EEPROM is inaccessible in normal operation to the RX111 as the RX111 cannot master the I2C bus when the SIM is performing that function. However the RX111 can be operated in master mode temporarily when the SIM is in RESET# in order for the RX111 to access the EEPROM. Since the RX111 can control the SIM's RESET# line, the RX111 can hold the SIM in RESET on boot, read/write the EEPROM in master mode, flip the I2C to slave mode, then release the SIM from RESET.

Consult each SIM Technical Reference Manual for a list of the on-SIM I2C devices and their addresses. The EEPROM's address bits are hard coded on the module to 001 yielding a 7-bit I2C address of 0x51 with write command 0xA2 and read command 0xA3 . Consult the [CAT34C02 Data Sheet](#) for programming and hardware information.

SERIALIZATION AND VARIANT/VERSION IDENTIFICATION

The EEPROM contains a small one-time programmable (OTP) region. This region may contain factory-programmed information including the serial number of the unit as well as variant/version information.



Do not write to the EEPROM's OTP region.

This region is reserved for manufacturing and configuration information by *Serious*.

Writing to this area will **void your warranty** with Serious and may render the module unusable.

BYPASS MODE

On variants without the RX111 MCU (e.g. –A03, -A04), the transceivers are always logically directly connected to the corresponding ports on the SIM’s MCU. For example, the RSXXX transceiver on a SCM117-A03’s receive and transmit are connected to the SIM’s UART RxD and TxD pins respectively. In this model, the SIM’s UART flows directly through the transceiver to the network and SIM-based software must communicate appropriately.



The [Serious Human Interface™ Platform](#) v5 release contains built-in support for this UART through the transceiver using RAW, Modbus and *Serious* SHIPBridge Protocols



GUIs developed using the [Serious Human Interface™ Platform](#) can communicate **directly** from SIMs to Modbus networks, including a PLC, through an SCM117-A03 without RX111 MCU or an SCM117-A00 or A01 with the RX111 disabled in bypass mode.

Where supported on the SIM, the CAN transceiver is directly connected to the SIM’s MCU’s CAN port.

(TBD DIAGRAM)

When the RX111 MCU is present on the variant, the SIM’s SPI, UART, and I2C ports flow normally to matching dedicated ports on the RX111. An additional dedicated RX111 UART is connected to the RSXXX transceiver (on RSXXX-equipped variants), and an additional dedicated RX111 SPI port is connected through a CAN controller to a CAN transceiver (on CAN-equipped variants). In this model, the RX111 is the central “hub” managing all the various conversations (to the SIM and the external networks) via a users’ custom software. This is the most powerful usage model of the SCM117 where, for example, two conversations can be happening simultaneously with the SIM (e.g. SHIPBridge over SPI and Modbus over UART) and two conversations can be happening simultaneously to the networks (e.g. Modbus over RS485 and a user’s proprietary protocol over CAN) – with the RX111 software providing all interoperation and protocol/data translation and mapping.

(TBD DIAGRAM)

If the RX111 is present but you wish to experiment or use the SCM117 as if the RX111 were not (e.g. physically using a SCM117-A00 but wanting the RX111 disabled as if it were an SCM117-A03 or –A04), you can easily “bypass” the MCU and put the circuit in a configuration logically identical to the variants without the MCU.

Signals are routed in this “bypass mode” via a multiplexor controlled by the **P46-BYPASS#** signal. This signal is pulled low weakly, and when low the MCU is bypassed and the transceivers are logically directly connected to the SIM’s corresponding ports.

When no software on the MCU configures port **P46**, the port pin floats, and the system is in bypass mode via the pull-down resistor. This is the reset state on variants with the MCU. RX111 software can then configure and assert high the port pin, taking the board out of bypass mode and putting the RX111 MCU in the middle of the conversation(s).

When no RX111 is present on a variant, there is no way on the SCM117 to assert the **P46-BYPASS#** signal high.

Note that DIP Switch S1.5, when in the “ON” position, puts the MCU (on reset) into a special boot mode. In this mode, **P46-BYPASS#** is not configured, and the SCM117 will remain post-reset in bypass mode.



When you are uncertain if the RX111 MCU software configures and takes the SCM117 out of bypass mode, but you need to use the SCM117 in bypass mode, turn S1.5 ON. This ensures the board will remain in bypass mode regardless of what software is currently installed in the RX111 MCU.