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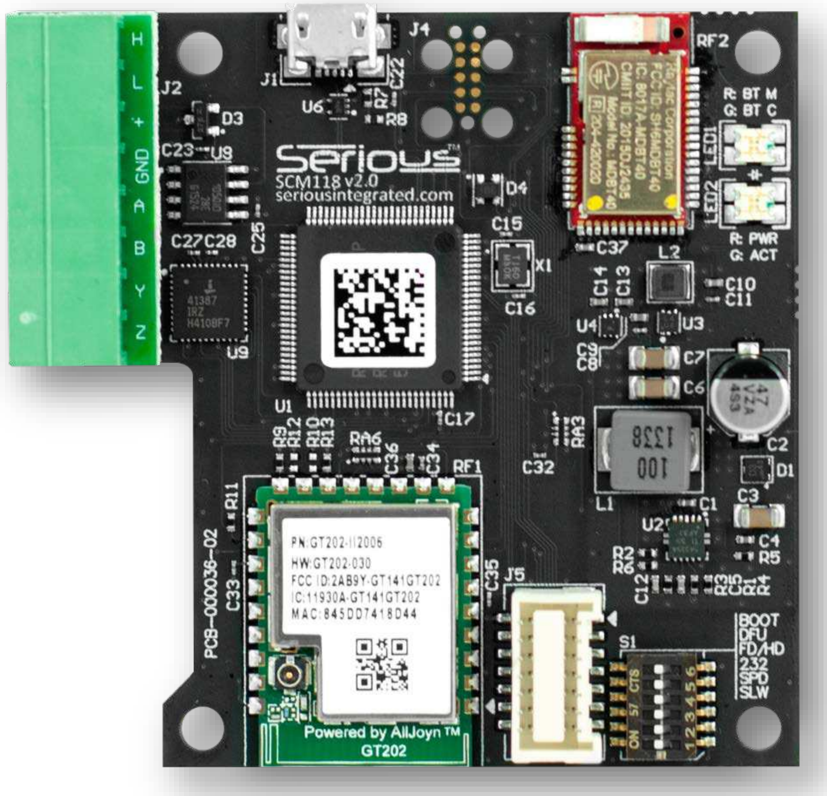
SCM118

Technical Reference Manual



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TRADEMARKS AND COPYRIGHTS

CONTENTS

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	20 Aug 15	**2.0**	**02**	Initial advance information version
A1	01 Sep 15	**2.0**	**02**	Numerous typos corrected

DOCUMENT CONVENTIONS

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

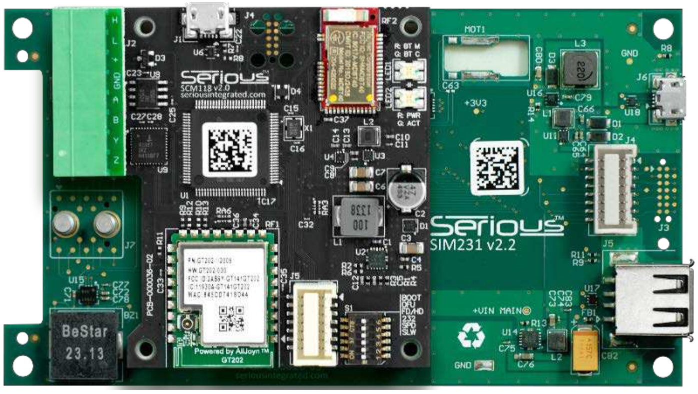
Pay special attention to this note – items especially subject to change, or related to compatibility, functionality, and usage.

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 SCM118Serious 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 SCM118 can dock directly into third generation (Gen3) SIMs such as the SIM115, SIM231, and SIM535as well as Gen4 SIMs forming a low profile and cost effective combination.

The SCM118 has two essential functions in the system: to provide connectivity among a collection of disparate communications interfaces, and to adapt incoming system/network +9-25VDC power to the required 5VDC required by the SCM and its attached SIM.

The SCM118 family has numerous members, or "variants". All variants have the following features:

- Renesas RX113 MCU for local protocol translation and control
- USB device port for programming, updates, and PC connectivity
- DC-DC converter for powering the SCM and attached SIM from most network-borne power
- 14 wire GPIO connector for off-board control/monitoring (including ADC, DAC, I2C/SPI/UART)

Specific SCM118 variants will include a combination of these connectivity options:

- RS232/422/485
- CAN
- WiFi 802.11 b/g/n
- Bluetooth

Architecturally, the SCM118's on-board MCU sits in between the external networks and the Serious Integrated Module, performing the role of an independent communications hub. The MCU on the SCM118 is an open programming environment, supported by off-the-shelf no-cost GNU C compilers and the e² studio eclipse-based IDE from Renesas.

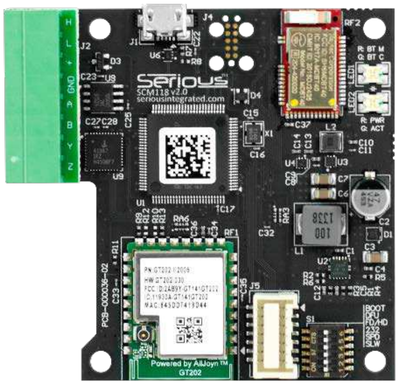
For designs needing less computing resources and focused specifically on CAN and/or RS232/422/485 connectivity, the Serious Communications Module 117 (SCM117) is available.

For a complete list of available communications modules and front panel Serious Integrated Modules (SIMs), see www.seriousintegrated.com/SCMs and www.seriousintegrated.com/SIMs respectively.

RELATED PRODUCTS

Serious has several new and upcoming communications daughter-cards designed to dock into the back of the Gen3 SIMs (SIM115, 231, 535) as well as the upcoming Gen4 SIM families.

SCM208



The upcoming Serious Communications Module 208 (SCM208) family adds significantly increased processing power, memory, and connectivity options beyond that of the SCM117 and SCM118, including:

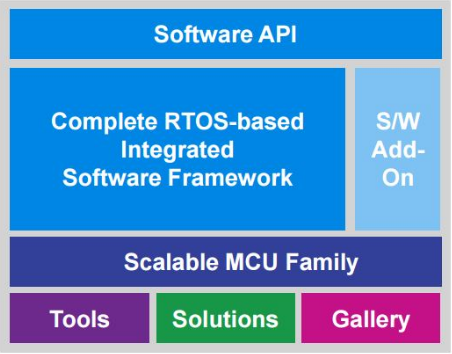
- More processing and memory capabilities
  - Renesas Synergy S7G2 240MHz Cortex-M4 MCU with 4MB Flash and 512kB RAM
  - Up to 128MB QSPI NOR Serial FLASH
- SC117/118-compatible networking, GPIO, and power inputs
  - RS232/422/485 and CAN industrial network connectivity
  - DC-DC converter for powering the SCM and attached SIM
  - JST14 off-board analog/digital GPIO connector
  - WiFi 802.11 b/g/n
  - Bluetooth Low Energy
- 10/100 Ethernet connectivity
  - Optional 802.3af-compliant 1500V isolated Power-over-Ethernet (PoE)

A full software source-code infrastructure, including RTOS, BSPs, Drivers, SHIPBridge & Modbus stacks, WiFi, and Bluetooth stacks are available from *Serious* and Micriµm, enabling a common core knowledge base and code-set across all *Serious* SCM products.

The SCM208 comes pre-licensed with the Renesas Synergy™ Platform – an innovative new approach to highly-connected software development, including pre-developed certified building blocks (including RTOS, stacks, drivers, BSP, and middleware). See the Synergy website for more details.

For more information on the SCM208, contact *Serious*.

A **complete** and **qualified** platform that **accelerates** embedded development, inspiring **innovation** and enabling **differentiation**

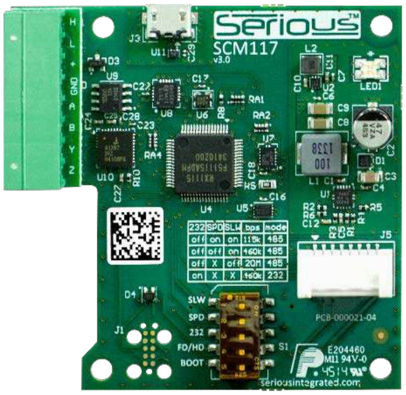


SCM117

The Serious Communications Module 117 (SCM117) family is a series of flexible and production-worthy communications and power conversion accessory boards with less processing and I/O capabilities than the SCM118 at a lower cost point. SCM117 family has numerous members, or “variants”, implementing all or a subset of the following:

- Renesas RX113 MCU for local protocol translation and control
- RS232/422/485 and CAN industrial network connectivity
- DC-DC converter for powering the SCM and attached SIM

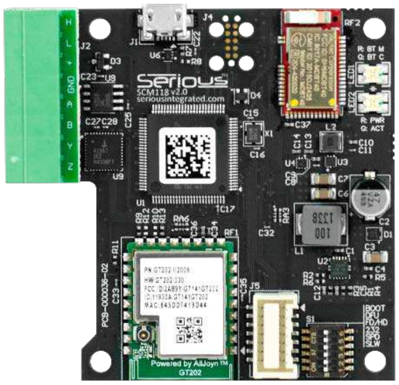
Some SCM117 variants do not include the RX113 MCU, enabling SIM direct connectivity to Modbus or SHIPBridge-compatible networks over RS232/422/485.



For more information on the SCM117, see the *Serious* website.

HARDWARE OVERVIEW

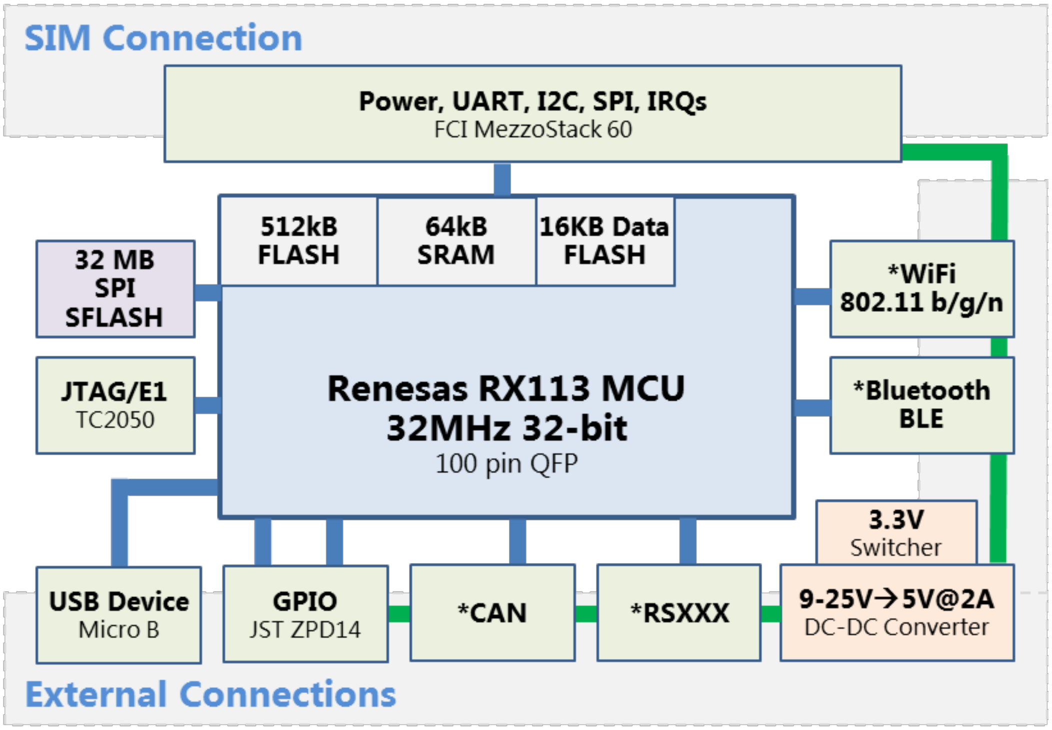
All SCM118 family variants include these hardware features:



- Board-to-board direct attach to Serious Integrated Modules (SIMs)
  - Gen3 SIMs (SIM115, 231, 535)
  - Gen4 SIMs (SIM25x, SIM55x, and 10.1” SIM85x)
- Renesas RX113 MCU for protocol translation and control
- USB FS device port for programming/updates, and PC connectivity
- 9-25VDC input power conversion for powering the SCM and SIM
- 14 wire GPIO for off-board control/monitoring (ADC, DAC, I2C/SPI/UART)
- -40 to +85C operating temperature

Depending on the specific variant, some or all these connectivity options are available:

- WiFi 802.11 b/g/n (Qualcomm QCA4002)
- Bluetooth BLE (Nordic Semiconductor nRF51)
- Multi-mode RS232/RS422/RS485 on an installer-friendly industrial plug-type connector
  - Half and full duplex
  - Differential and single ended operation
  - Switch selectable RS232 vs. RS4xx mode
  - Switch selectable slew rate control
- CAN transceiver on an installer-friendly industrial plug-type connector
  - Up to 1 Mbps line rate



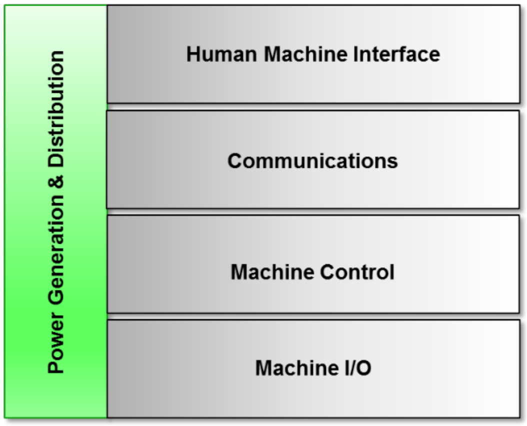
SCM118 Hardware Block Diagram

*options depend on variant

USAGE MODELS

Most OEM systems architectures can be represented as functional stack with four layered ingredients:

- The Human Machine Interface, traditionally lights and buttons, and now moving to intelligent graphic/touch LCD panels
- A communications hub handling all communications between the HMI and machine as well as externally to the cloud and industrial/enterprise networks
- Intelligent machine control, including sequencing and safety algorithms for monitoring and controlling the low level machine I/O
- Low-level machine I/O, including actuators, sensors and controls that affect the physical operation of the system



Alongside these four ingredients is the power generation and distribution system, often 12 or 24VDC supplied initially by 110/220VAC wall power.

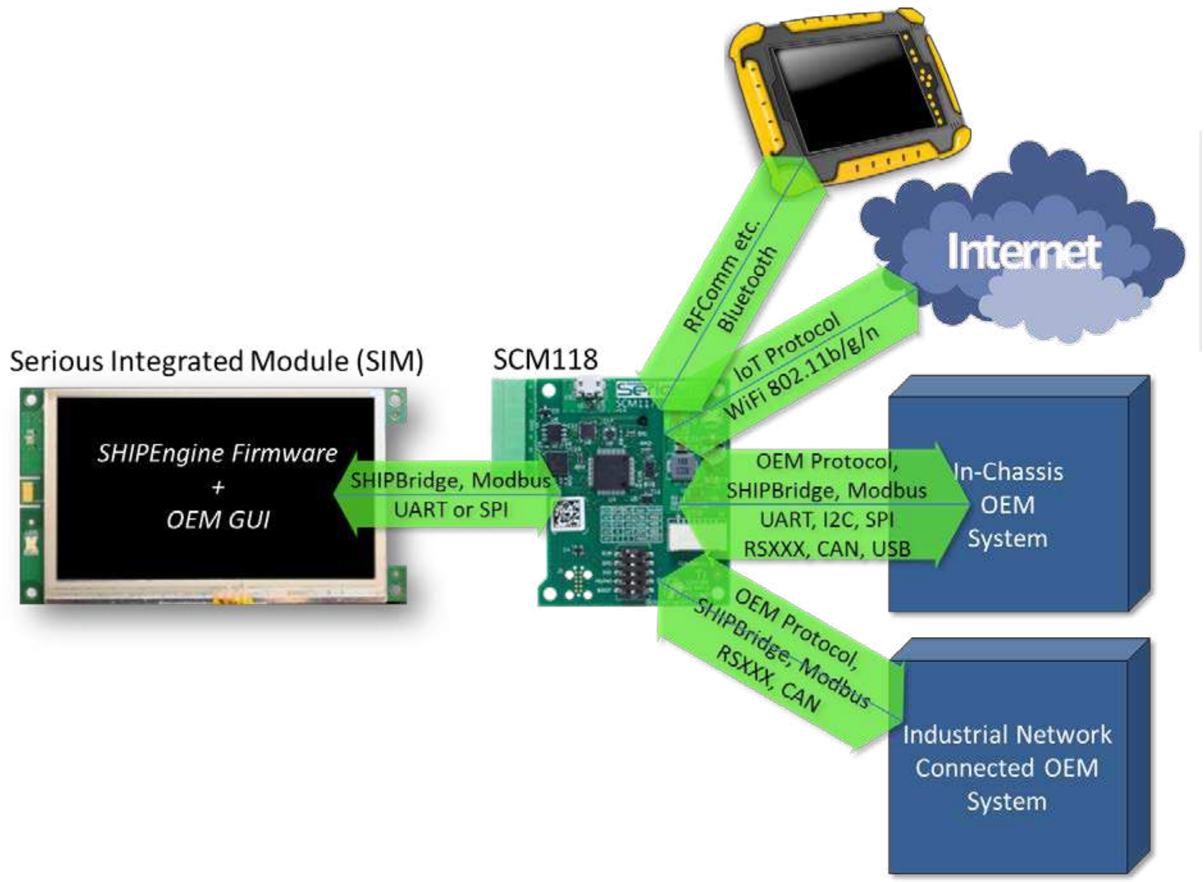
Serious Integrated Modules (SIMs) are off-the-shelf complete solutions to the HMI front panel, including no-cost rapid GUI development tools and software by *Serious* – the Serious Human Interface™ Platform (SHIP). SHIP is not a traditional low-level C-based programming environment, but rather a high level rapid user experience (UX) development system that abstracts the designer from the complexity of developing modern UX solutions. There is no faster and more effective way to develop, deploy, maintain, and evolve a scalable front panel HMI solution than with SIMs and SHIP enabling technologies.

Serious Communications Modules (SCMs) are off-the-shelf hardware solutions to the communications layer of the stack. The software on SCMs is designed to be highly tuned to the OEM's specific system and communications needs, and traditional C-based development supported by *Serious* reference software and third party partner software infrastructure, such as complete software stacks from Micriμm, make software development for SCMs far easier than ground-up custom OEM designs.

The Serious Communications Module 118 (or SCM118) is an intelligent communications hub which directly docks onto Generation 3 SIMs (SIM115, 231, 535) as well as upcoming Gen4 SIMs and provide industrial, wireless, and GPIO smart connectivity to an OEM's system.

All SCM118 variants (family members) are designed to take 9-25VDC from an outside power source, often an industrial network or in-chassis power supply, and convert it down to the 5V required by the SCM as well as the attached SIM. An industry-standard 3.5mm industrial screw-terminal plug-type connector makes the creation and maintenance of wire harnesses straightforward and reliable.

With the on-board RX113 MCU, the SCM118 can perform protocol translation between the SIM and your unique networks, whether those networks are inside your chassis (for example, using RS232 to interconnect the SIM with our machine controller) or remotely through wireless, CAN, or industrial network.



You control all the software on the SCM118's RX113 MCU – forwarding, translating, and filtering the GUI data and any other data between the SIM and your network, and between different networks. For example, you can implement an IoT connector on the SCM118 in order to monitor and control your machine from an internet-based control panel. In this case, messages from the cloud, received via the WiFi module on the SCM118 into the RX113 MCU, can then be manipulated into control and status requests to the in-chassis machine. The SIM need not be aware of this message traffic; your custom software on the SCM118 can perform many tasks in its role as a communications hub.

The Serious Human Interface™ Platform (SHIP) binary software engine on the SIM enables GUIs to communicate via Modbus or the full-featured *Serious* SHIPBridge protocol to a *Serious*-provided driver on the SCM118. Upcoming example code for the SCM118 will demonstrate how, over an IoT connection, to update the GUI and all firmware on the SIM as well as the firmware on the SC118 from the web – complete "push" updates to the embedded system.

SOFTWARE

The SCM118 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 SCM118.

In SHIP Version 5 (SHIPv5), the Modbus protocol is available over UART and SPI connections to the SCM118. 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/SHIPBridge for details.

Developing for the RX113 MCU requires both a debugger/programmer, such as the Renesas E1 or Segger J-Link as well as a Tag-Connect TC2050 Cable with RX113 FINE Adapter. The SCM118 Development Kits include both these items.

Reference source code for the SCM118 is available from *Serious.* Check the community forums for registered hardware owners at mySerious.com or contact *Serious*.

The Micriµm µC/OS-III kernel, µC/Modbus, and µC/CAN stacks have already been ported to the SIM118. Contact *Serious* for details.

VARIANTS

The SCM118 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:

SCM118-	A00	A01	A02
Core Features			
60-pin board-to-board SIM docking connector	✓	✓	✓
+9-25VDC to 5V @ 2A(max) DC-to-DC converter	✓	✓	✓
Renesas RX113 MCU	✓	✓	✓
USB device w/micro-B connector	✓	✓	✓
GPIO/Analog IO JST14 connector	✓	✓	✓
SPI NOR Serial Flash	64MB	32MB	32MB
Industrial Networking			
CAN	✓	✓	✓
RS232/485/422	✓	✓	✓
Pluggable network connector size	8		
Wireless Networking			
Bluetooth Low Energy	✓		
WiFi 802.11 b/g/n	✓	✓	

Serious can support semi-custom or new variants of our SCMs, including the SCM118. See Semi-Custom Products for details.

ORDERING INFORMATION

DEVELOPMENT KITS

The SCM118-A00-SJL-01 development kit contains everything (except the graphic/touch SIM) needed to develop with SCM118 family.

The kit contains:

- SCM118-A00 module
    - Superset of all SCM118 features: RX113 MCU, CAN, RSXXX, WiFi, Bluetooth
    - +9-25V input power
- Debugging/Programming
    - Segger J-Link Lite RX JTAG debugger/programmer
    - Tag-Connect TC2050 Cable with RX113 FINE Adapter for connecting the J-Link (or Renesas E1) debugger to the SCM118
- Lab use12V 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
    - 14 pin wire harness (JST14 plug one end, tinned the other) for lab development with the GPIO ports
- Fasteners/Hardware
    - Board-to-board mounting screws (4x M3 Nylon) for docking SCM118 into a SIM
    - 10mm standoffs (4x 10mm M3 Nylon)and rubber feet for undocked use

There is no specific kit that includes both a SIM and an SCM118, 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 SCM118-A00-SJL-01 development kit contains everything (except the graphic/touch SIM) needed to develop with SCM118 family and is available only in a single unit package.

For production and larger quantities, the following standard SCM118products are available:

	Ordering Code			
Variant	Individual Unit	10 Pack	50 Pack	**Distributor Inventory**
SCM118-A00	**SCM118-A00-01**	**SCM118-A00-10**	**SCM118-A00-50**	
SCM118-A01		**SCM118-A01-10**	**SCM118-A01-50**	
SCM118-A02		**SCM118-A02-10**	**SCM118-A02-50**	
SCM118-A03		**SCM118-A03-10**	**SCM118-A03-50**	
SCM118-A04		**SCM118-A04-10**	**SCM118-A04-50**	

Included with each non-development kit production module are the four (4)

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 SCM118for certain OEM designs, or even a product similar to the SCM118 that directly meets a unique interconnect need.

For example, the services team could deliver an optimized dual RS485 over RJ45 version of the SCM118 under a customer-specific part number, but based on the SCM118 form factor and design, perhaps with a different power input connector.

Another example might be a semi-custom variant of the SCM118. Your design may require the SCM118-A02 feature-set but need larger memory; *Serious* could, for example, create an “SCM118-A06” or equivalent with this feature-set populated.

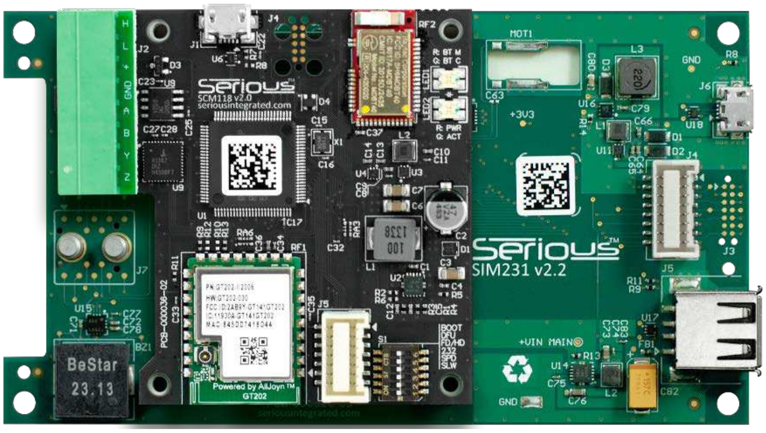
Contact your local *Serious* Manufacturers Representative or *Serious* directly for more information.

Many OEMs build their own custom daughter-cards, or contract with the *Serious* Services team to design and manufacture custom or semi-custom SCMs. It is possible to create a single daughter card that can dock into numerous SIMs, including all Gen3 and Gen4 SIMs. Consult the respective Technical Reference Manuals (TRMs) to validate a compatible footprint: there are slight differences in the physical and electrical characteristic for daughter cards across different SIMs.

ASSEMBLING THE SCM+SIM

Ensure the SCM and SIM are not powered when connecting them together.

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



Do not mate the two boards unless they are well-aligned; you will irreparably damage the board-to-board connectors.

The development kit includes nylon screws for easy assembly/removal; production units include stainless steel screws with a special nylon patch to ensure they stay assembled even in higher vibration environments; these nylon-patch screws are meant to be used only once or twice in a production usage model as the nylon wears down after removal and reduces their effectiveness.

Gently push the SCM with fingers on the four hole-areas to mate the connectors until the SCM's PCB touches the surface of all four standoffs. Using the four machine screws (provided) fasten the SCM118 into the SIM's standoffs. TheseM3-0.50 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.

POWERING THE SCM+SIM

When the SCM is connected to the SIM, 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 SCM'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 SCM and any attached SIM.

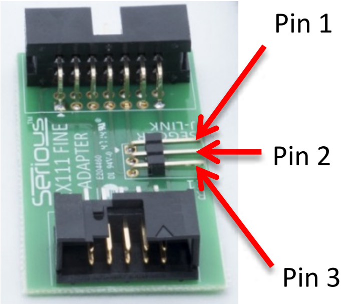
Development kits for the SCM may include a standard 110/220VAC wall power adapter to be used in the event that network power is unsuitable or unavailable in the lab environment. This standard wall adapter will has a barrel plug; using the Barrel Power Jack Adapter included in the dev kit, attach jumper wires from the adapter to the power inputs on the SCM's Industrial Networking Connector.

ATTACHING THE PROGRAMMER/DEBUGGER

Software developers will need access to the MCU's programming/debug port. Normally a Renesas E1 or one of the many models of Segger J-Link programmer/debugger devices will be used with Renesas or IAR tools for software development.

Connecting the programmer/debugger to the SCM is accomplished using a Tag-Connect TC2050-IDC cable, available separately from Tag-Connect or Digi-Key and included in all SCM118 Development Kits.

One end of the TC2050 has spring-loaded pogo pins such that when inserted into the SCM118 makes electrical contact between the cable and the PCB. Built-in retention "legs" hold the connector firmly in place during debugging. Gently squeeze the leg-housing, then insert the legs into the four holes surrounding the landing pattern on the SCM118' to remove the connector from the board.

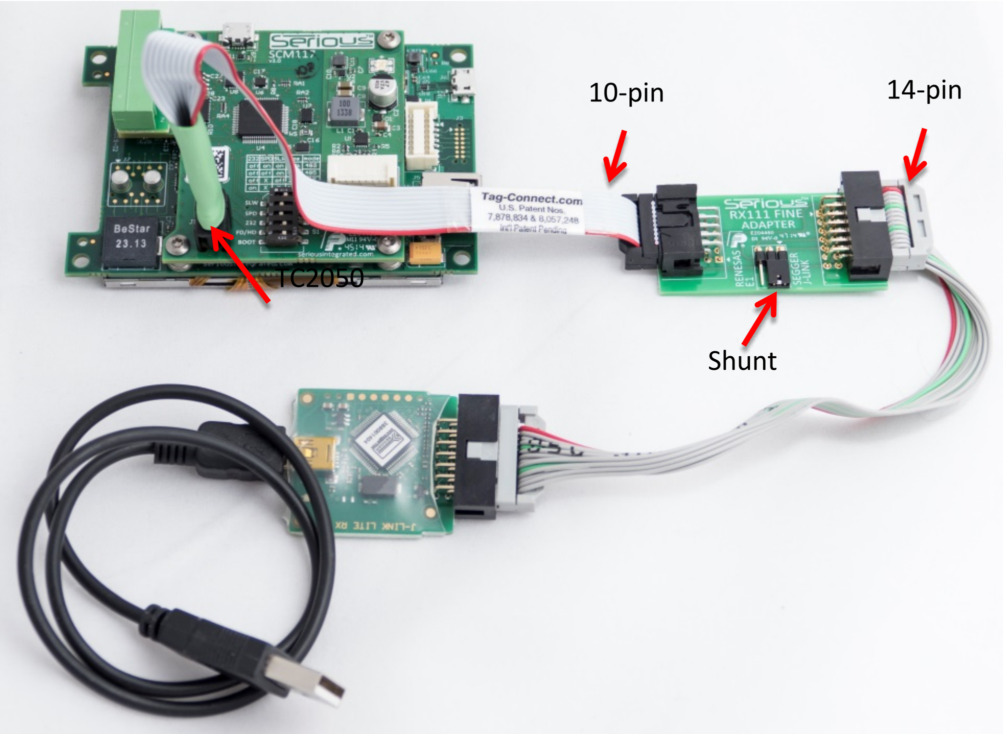


The other end of the TC2050 has a standard 0.1" female 10 pin IDC connector, unlike the 14-pin IDC connection on the Segger J-Link and Renesas E1 debuggers. Included in all SCM118 Development Kits is a small adapter board, the *Serious* RX113 FINE Adapter, which interconnects the 10 pin TC2050 cable to the E1 or J-Link 14-pin IDC connector. This adapter works for both the RX113 and RX113 MCUs on the SCM117 and SCM118 respectively.

Debugger	Shunt on Pins 1-2	Shunt on Pins 2-3
Segger J-Link LITE RX	X	
Segger J-Link EDU		X
Segger J-Link BASE		X
Segger J-Link PLUS		X
Segger J-Link PRO		X
Segger J-Link ULTRA+		X
Renesas E1		X

In addition to adapting the two connector types, the Adapter has an onboard shunt that is used to select the wiring configuration required by specific debuggers; see the table to determine the correct position.

⚠ **WARNING**: Incorrect shunt/jumper placement on the FINE Adapter may damage your SCM, debugger, and/or any other attached devices; place the jumper in the correct position before attaching the TC2050 to the SCM and the debugger.



SOFTWARE DEVELOPMENT ENVIRONMENT

Renesas provides a fully featured, downloadable, eclipse-based IDE and GNU toolchain at no cost. These are fully unlocked tools including all optimization capabilities and without artificial code-size limits.

To prepare for software development, download and install the e² studio IDE which includes:

- the eclipse-based e² studio IDE,
- drivers for the Segger J-Link LITE RX debugger,
- GNU tools required for compilation, linking, and debugging,
- starter/template projects for the RX113 MCU

Using Renesas example code for drivers and firmware, you can start right away to develop code.

Reference source code for the SCM118 is available from *Serious.* Check the community forums for registered hardware owners atmySerious.com or contact *Serious*.

The Micriμm μC/OS-III kernel, μC/Modbus, and μC/CAN stacks have already been ported to the SIM118. Contact *Serious* for details.

SPECIFICATIONS

MAXIMUM OPERATING LIMITS

The SCM118 maximum operating power limits are as follows:

Specification	Permissible Range Min	Typ	Max	Units
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.

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.

MAXIMUM BIT RATES

The following are the maximum bit rates/throughput achievable through each connectivity interface:

Connectivity	Max Throughput Transceiver	Controller	RX113
CAN (via MCP2515/SPI)	1 Mbps IFX1050GVIO	1 Mbps MCP2515	TBD SCI SPI[1]
RS232	650kbps ISL41387	TBD SCI SPI[1]	
RS422/485	20 Mbps ISL41387	TBD SCI SPI[1]	
WiFi 802.11 b/g/n	10 Mbps QCA4002		TBD SCI SPI[1]
Bluetooth Smart & Low Energy	2Mbps nRF51		TBD SCI UART[1]
SIM UART			TBD SCI UART[1]
SIM SPI			TBD RSPI
SIM I2C			400kHz SCI I2C[1]

[1]RX113 MCU Serial Communications Interface in SPI Master, UART, or I2C mode as appropriate
[2]All SIMs configure and use this I2C port at 400 kHz

The limit of each interface is the lowest value of the transceiver, controller, and interconnect. In practice, construction of software drivers and overall MCU workload will control (and often limit) the effective maximum throughput.

ENVIRONMENTAL CHARACTERISTICS

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

HANDLING AND CARE

Observe the following handling and care guidelines.

HANDLING

Do not attempt to disassemble the module or solder components or wires to the module; this may render your board non-functional and void your warranty.

As with all electronic subsystems and circuits, observe proper ESD handling procedures.

STORAGE

Follow these basic precautions when storing un-installed SCMs for extended periods:

1. Store SCMs in the original factory packaging whenever possible. The sealed polyethylene antistatic bags or the antistatic trays are designed for long term storage.
2. Store the SCM sub-packs where they will not be subjected to high heat, sunlight, or high humidity conditions. Recommended storage temperatures should be kept between 0C and +40C, with relative humidity below 80%.
3. Desiccant should not be required if properly sealed and room temperature ambient temperatures are maintained.

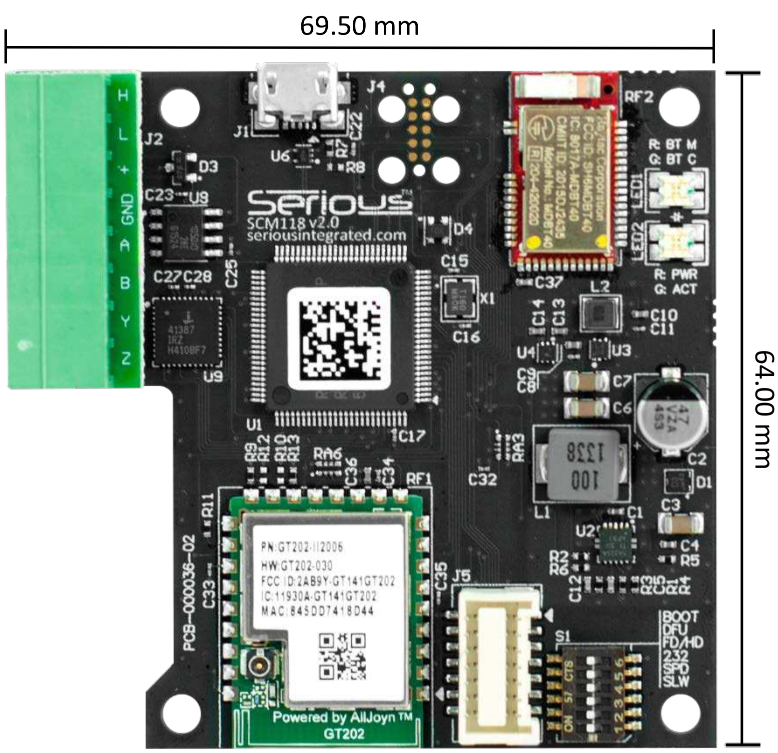
PHYSICAL CHARACTERISTICS

The following table summarizes the key physical characteristics of the SCM118.

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		TBD	mm
	A01,A02,A03,A04		TBD	mm
Board-to-Board inner dimension when docked	All	4.0	0.2	mm
Weight	A00		TBD	g
	A01		TBD	g
	A02		TBD	g
	A03		TBD	g
	A04		TBD	g

*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.



FASTENERS

AllGen3 and Gen4 SIMs include a 60-Pin FCI board-to-board expansion connector (the FCI60 Dock Connector) for direct-dock connection of daughter-cards including SCMs such as the SC117, SCM118, and the upcoming SCM208. In addition to the connector, these SIMs have four M3 threaded standoffs (PennEngineering® SMTSO-M3-4-ET or similar) to firmly support and attach the SCM at the correct 4mm board-to-board distance.

For prototyping, any M3-0.5x6mm pan head or cap socket screw can be used to attach the SCM to the SIM. SCM118 development kits include nylon screws for easy assembly and removal in the lab environment. Production units include four screws that comply with the following minimum specifications:

Parameter	Recommendation
Material	Stainless A1-50 or better
Size	M3-0.5 x 6mm
Head	Cap Socket (hex) or Pan Head 6-lobe/5-lobe/Torx®
Patch	Nylon Patch per Specification IFI-524 2002 *Test Procedure for the Performance of Metric Nonmetallic Resistant Element Prevailing Torque Screws* Specification — N·m — inch·lbs Maximum Prevailing Torque: 0.60 5.31 Minimum First Removal Prevailing Torque 0.14 1.24
Insertion Torque	Recommended: 0.60 N·m (5.3 inch·lbs) Maximum: 0.70 N·m (6.2 inch·lbs)

Small quantities of this type of screw can be readily purchased from McMaster-Carr (93705A813). Production volumes are readily available from many suppliers, including part number . 30C60MRPS/ NPAT from North State Fastener, Inc.

Do not apply excessive torque to daughter card screws into the threaded standoffs or they may tear from the PCB and permanently damage the SIM.

Do not use screws longer than recommended or the screw may apply force to the back side of the LCD panel and permanently damage it.

POWER SUBSYSTEM

The SCM118 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 SCM118 **cannot be powered from the SIM**. When SCM118 +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 SCM118 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 AND 3.3V REGULATION

`+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.

LED1 Green will light when the +5V main power rail is active.

The network side of both the [CAN] and the [RS232/422/485] transceivers are both powered by the +5V supply.

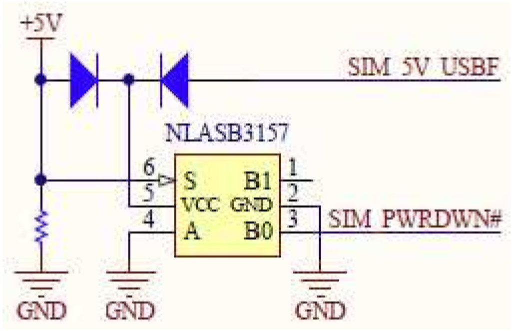
Several circuits on the SCM118 require 3.3V power. The SCM118 does not use the 3.3V supply generated and delivered from the SIM, but rather has its own independent regulator to convert `+5V` to the `+3V3` power signal on the SCM.

SIM USB DEVICE POWER

Some SIMs, for example the SIM231, can be powered through their USB device port since these SIMs need less than the 500mA@5V normally available from PC USB ports/powered hubs. It is a common to develop GUIs for these SIMs connected/ 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 SCM is connected, however, even for SIMs that may support stand-alone USB powering, the combined power needs of the SCM and SIM is too great for the USB 500mA limit. Therefore, in the absence of the external +9-25VDC on the SCM118 to power the combination, the SIM is held in power down mode and will not operate.

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



CONTROLLING AND MONITORING THE SIM

SIMRESET CONTROL

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 SCM118 is designed to provide power and network connectivity to the SIM, it can also control this SIM reset circuit from the RX113. When the RX113 software asserts **P26-SIM_RESET#** (low, active), this SCM signal holds the SIM in reset until it is de-asserted (high, inactive).

Port	MCU Mode	PSEL	FCI60 Pin	Schematic Net Name	Operation
P26	GPO	-	3	P26-SIM_RESET#	SIM FCI60.3 RESET# control to SIM

Most SIMs (consult the respective Technical Reference Manual) have a minimum 50mS self-reset period, enabling the RX113 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 and then, when appropriate, release the SIM to run.

P26-SIM_RESET# can also be monitored by RX113 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 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. Monitor the Port Input Data Register (**PORT2.PIDR.B6**) to see when the SIM leaves reset over the next 200mS

SIM POWER STATUS

The SIM is normally powered by the 5V supply from the SCM118.The SIM then generates its internal 3.3V supply and makes a small portion of that 3.3V available on the FCI60 Dock Connector. The status of this 3.3V signals can be read on the RX113 via the **PH7/SIM_3V3_DOCK** signal:

Port	MCU Mode	PSEL	FCI60 Pin	Schematic Net Name	Operation
PH7	GPI	-	46	PH7/SIM_3V3_DOCK	SIM FCI60.46 3V3 present

Normally, this signals will always read high since the SCM118 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.