Date: May 9, 2025

RENESAS TECHNICAL UPDATE

TOYOSU FORESIA, 3-2-24, Toyosu, Koto-ku, Tokyo 135-0061, Japan
Renesas Electronics Corporation

Product Category	MPU/MCU		Document No.	TN-RL*-A0143A/E	Rev.	1.00
Title	Correction for Incorrect Description Notice RL78/G16 Descriptions in the User's Manual: Hardware Rev. 1.20 Changed		Information Category	Technical Notification		
Applicable Product	RL78/G16 Group	Lot No. All lots	Reference Document	RL78/G16 User's Manual: Hardware Rev. 1.20 R01UH0890EJ0120 (Jan. 2024)		

This document describes misstatements found in the RL78/G16 User's Manual: Hardware Rev. 1.20 (R01UH0980EJ0120).

Corrections

Applicable Item	Applicable Page	Contents
1.1 Features	Page 24	Description added
2.2.2 Pins for each product (pins other than port pins)	Page 60	Description added
Table 4-8. Setting Examples of Registers and Output Latches When Using Pin Function	Page 155, Page 156	Incorrect descriptions revised
Table 15-1. CTSU Specifications	Page 700	Description added
CTSU Control Register 0 (CTSUCR0)	Page 705	Incorrect descriptions revised
15.4.1 Principles of measurement operation	Page 737	Description added
Figure 15-32. CTSU Initial Setting Flowchart	Page 741	Description added
15.5 Usage Notes	Page 760	Description added

Document Improvement

The above corrections will be made for the next revision of the User's Manual: Hardware.

Corrections in the User's Manual: Hardware

No.	Corrections and Applicable Items			Pages in this document for corrections
	Document No.	English	R01UH0896EJ0100	
1	1.1 Features		Page 24	Page 3
2	2.2.2 Pins for each product (pins other than port pins)		Page 60	Page 3
3	Table 4-8. Setting Examples of Registers and Output Latches When Using Pin Function		Page 155, Page 156	Page 4, Page 5
4	Table 15-1. CTSU Specifications		Page 700	Page 6
5	CTSU Control Register 0 (CTSUCR0)		Page 705	Page 6
6	15.4.1 Principles of measurement operation		Page 737	Page 7
7	Figure 15-32. CTSU Initial Setting Flowchart		Page 741	Page 7
8	15.5 Usage Notes		Page 760	Page 8

Incorrect: Bold with underline; Correct: Gray hatched

Revision History

RL78/G13A Correction for incorrect description notice

Document Number	Issue Date	Description
TN-RL*-A0143A/E	May 9, 2025	First edition issued Corrections No.1 to No.8 revised (this document)

1. 1.1 Features (Page 24)

Incorrect:

Capacitive touch sensing unit (CTSUb)

- 15 channels
- Self-capacitance method: A single pin configures a single key, supporting up to 15 keys
- Mutual capacitance method: A key can be created with a matrix configuration by selecting transmit/receive pins from 15 pins.

Correct:

Capacitive touch sensing unit (CTSUb)

- 15 channels
- Self-capacitance method: A single pin configures a single key, supporting up to 15 keys
- Mutual capacitance method: A key can be created with a matrix configuration by selecting transmit/receive pins from 15 pins. Up to 16 keys are supported.

2. 2.2.2 Pins for each product (pins other than port pins) (Page 60)

Incorrect:

2.2.2 Pins for each product (pins other than port pins)

Function Name	I/O	Function
ANI0 to ANI10	Input	A/D converter analog input (see **Figure 11-22 Internal Equivalent Circuit of ANIn Pin**).
TS00 to TS14	I/O	Capacitance measurement pin (touch pin)
TSCAP	—	**LPF connection pin**
VCOUT0, VCOUT1	Output	Comparator output

Correct:

2.2.2 Pins for each product (pins other than port pins)

Function Name	I/O	Function
ANI0 to ANI10	Input	A/D converter analog input (see **Figure 11-22 Internal Equivalent Circuit of ANIn Pin**).
TS00 to TS14	I/O	Capacitance measurement pin (touch pin)
TSCAP	—	Pin for connecting a power supply capacitor for use in measuring electrostatic capacitance. Connect this pin to Vss via a capacitor (10 nF). Also, use a capacitor with good characteristics, since it is used to stabilize internal voltage.
VCOUT0, VCOUT1	Output	Comparator output

3. Table 4-8. Setting Examples of Registers and Output Latches When Using Pin Function (Page 155, Page 156)

Incorrect:
(page 155)

Table 4-8. Setting Examples of Registers and Output Latches When Using Pin Function (1/14)

Pin Name	Used Function		PIORr	POMp	PMCq	PMn	Pm	TSSELt	Alternate Function Output		32-pin	24-pin	20-pin	16-pin	10-pin
	Function Name	I/O							SAU Output Function	Other than SAU					
P00	P00	Input	—	×	—	1	×	—	×	×	✓	✓	✓	✓	✓
		Output	—	0	—	0	0/1	—	TxD0/SO00 = 1 (SCK11/SCL11) = 1 Note 1 SDA11 = 1 Note 3	(TO02) = 0 (SCLA0) = 0 (RTC1HZ) = 0 Note 1					
		N-ch open drain output	—	1	—	0	0/1	—							
	SO00	Output	PIOR21 = 0 PIOR20 = 0	0/1	—	0	1	—	(SCK11/SCL11) = 1 Note 1 SDA11 = 1 Note 3	(TO02) = 0 (SCLA0) = 0 (RTC1HZ) = 0 Note 1	✓	✓	✓	✓	✓
	TxD0	Output		0/1	—	0	1	—			✓	✓	✓	✓	✓
	INTP6	Input	PIOR53 = 0 PIOR52 = 0	×	—	1	×	—	×	×	✓	✓	✓	✓	✓
	(TI02)	Input	PIOR06 = 0 PIOR05 = 0 PIOR04 = 1	×	—	1	×	—	×	×	✓	✓	✓	✓	✓
	(TO02)	Output		0	—	0	0	—	×	(SCLA0) = 0 (RTC1HZ) = 0 Note 1	✓	✓	✓	✓	✓
	(SI11)	Input	PIOR24 = 1 PIOR23 = 0 PIOR22 = 1	×	—	1	×	—	×	×	✓	✓	—	—	—
	(SDA11)	I/O		1	—	0	1	—	TxD0/SO00 = 1 (SCK11/SCL11) = 1 Note 1	(TO02) = 0 (SCLA0) = 0 (RTC1HZ) = 0 Note 1	✓	✓	—	—	—
	(SCK11)	Input	PIOR24 = 0 PIOR23 = 0 PIOR22 = 1	×	—	1	×	—	×	×	✓	✓	✓	✓	—
		Output		0/1	—	0	1	—	TxD0/SO00 = 1 SDA11 = 1 Note 3	(TO02) = 0 (SCLA0) = 0 (RTC1HZ) = 0 Note 1					
	(SCL11)	Output		0/1	—	0	1	—			✓	✓	✓	✓	—
	(SCLA0)	I/O	PIOR33 = 1 PIOR32 = 0	1	—	0	0	—	TxD0/SO00 = 1 (SCK11/SCL11) = 1 Note 1 SDA11 = 1 Note 3	(TO02) = 0 (RTC1HZ) = 0 Note 1	✓	✓	✓	✓	✓
	(RTC1HZ)	Output	PIOR67 = 0 PIOR66 = 1	0	—	0	0	—	×	(TO02) = 0 (SCLA0) = 0	✓	✓	✓	✓	—

Correct:

Table 4-8. Setting Examples of Registers and Output Latches When Using Pin Function (1/14)

Pin Name	Used Function		PIORr	POMp	PMCq	PMn	Pm	TSSELt	Alternate Function Output		32-pin	24-pin	20-pin	16-pin	10-pin
	Function Name	I/O							SAU Output Function	Other than SAU					
P00	P00	Input	—	×	—	1	×	—	×	×	✓	✓	✓	✓	✓
		Output	—	0	—	0	0/1	—	TxD0/SO00 = 1 (SCK11/SCL11) = 1 Note 1 SDA11 = 1 Note 3	(TO02) = 0 (SCLA0) = 0 (RTC1HZ) = 0 Note 1					
		N-ch open drain output	—	1	—	0	0/1	—							
	SO00	Output	PIOR21 = 0 PIOR20 = 0	0/1	—	0	1	—	(SCK11/SCL11) = 1 Note 1 SDA11 = 1 Note 3	(TO02) = 0 (SCLA0) = 0 (RTC1HZ) = 0 Note 1	✓	✓	✓	✓	✓
	TxD0	Output		0/1	—	0	1	—			✓	✓	✓	✓	✓
	INTP6	Input	PIOR53 = 0 PIOR52 = 0	×	—	1	×	—	×	×	✓	✓	✓	✓	✓
	(TI02)	Input	PIOR06 = 0 PIOR05 = 0 PIOR04 = 1	×	—	1	×	—	×	×	✓	✓	✓	✓	✓
	(TO02)	Output		0	—	0	0	—	×	(SCLA0) = 0 (RTC1HZ) = 0 Note 1	✓	✓	✓	✓	✓
	(SI11)	Input	PIOR24 = 1 PIOR23 = 0 PIOR22 = 1	×	—	1	×	—	×	×	✓	✓	—	—	—
	(SDA11)	I/O		1	—	0	1	—	TxD0/SO00 = 1 (SCK11/SCL11) = 1 Note 1	(TO02) = 0 (SCLA0) = 0 (RTC1HZ) = 0 Note 1	✓	✓	—	—	—
	(SCK11)	Input	PIOR24 = 0 PIOR23 = 0 PIOR22 = 1	×	—	1	×	—	×	×	✓	✓	✓	✓	—
		Output		0/1	—	0	1	—	TxD0/SO00 = 1 SDA11 = 1 Note 3	(TO02) = 0 (SCLA0) = 0 (RTC1HZ) = 0 Note 1					
	(SCL11)	Output		0/1	—	0	1	—			✓	✓	✓	✓	—
	(SCLA0)	I/O	PIOR32 = 1	1	—	0	0	—	TxD0/SO00 = 1 (SCK11/SCL11) = 1 Note 1 SDA11 = 1 Note 3	(TO02) = 0 (RTC1HZ) = 0 Note 1	—	—	✓	✓	✓
			PIOR33 = 1 PIOR32 = 0								✓	✓	—	—	—
	(RTC1HZ)	Output	PIOR67 = 0 PIOR66 = 1	0	—	0	0	—	×	(TO02) = 0 (SCLA0) = 0	✓	✓	✓	✓	—

Incorrect:
(page 156)

Table 4-8. Setting Examples of Registers and Output Latches When Using Pin Function (2/14)

Pin Name	Used Function		PIORr	POMp	PMCq	PMn	Pm	TSSELt	Alternate Function Output		32-pin	24-pin	20-pin	16-pin	10-pin
	Function Name	I/O							SAU Output Function	Other than SAU					
P01	P01	Input	—	×	0	1	×	0	×	×	✓	✓	✓	✓	✓
		Output	—	0	0	0	0/1	0	SDA00 = 1 (SO11) = 1 Note 3 (SDA11) = 1 Note 1	TO02 = 0 (TO01) = 0 (SDAA0) = 0					
		N-ch open drain output	—	1	0	0	0/1	0							
	ANI0	Analog input	—	×	1	1	×	0	×	×	✓	✓	✓	✓	✓
	TS00	I/O	×	×	×	1	0	1	×	×	✓	✓	✓	✓	✓
	SI00	Input	PIOR21 = 0 PIOR20 = 0	×	0	1	×	0	×	×	✓	✓	✓	✓	✓
	RxD0	Input		×	0	1	×	0	×	×	✓	✓	✓	✓	✓
	SDA00	I/O		1	0	0	1	0	(SO11) = 1 Note 3 (SDA11) = 1 Note 1	TO02 = 0 (TO01) = 0 (SDAA0) = 0	✓	✓	✓	✓	✓
	INTP5	Input	PIOR51 = 0 PIOR50 = 0	×	0	1	×	0	×	×	✓	✓	✓	✓	✓
	(TI01)	Input	PIOR03 = 1 PIOR02 = 1	×	0	1	×	0	×	×	✓	✓	✓	✓	✓
	(TO01)	Output		0	0	0	0	0	×	TO02 = 0 (SDAA0) = 0	✓	✓	✓	✓	✓
	TI02	Input	PIOR06 = 0 PIOR05 = 0 PIOR04 = 0	×	0	1	×	0	×	×	✓	✓	✓	✓	✓
	TO02	Output		0	0	0	0	0	×	(TO01) = 0 (SDAA0) = 0	✓	✓	✓	✓	✓
	(SI11)	Input	PIOR24 = 0 PIOR23 = 0 PIOR22 = 1	×	0	1	×	0	×	×	✓	✓	✓	✓	—
	(SDA11)	I/O		1	0	0	1	0	SDA00 = 1 (SO11) = 1 Note 3	TO02 = 0 (TO01) = 0 (SDAA0) = 0	✓	✓	✓	✓	—
	(SDAA0)	I/O	PIOR33 = 1 PIOR32 = 0	1	0	0	0	0	×	TO02 = 0 (TO01) = 0	✓	✓	✓	✓	✓
	(SO11)	I/O	PIOR24 = 1 PIOR23 = 0 PIOR22 = 1	0/1	0	0	1	0	SDA00 = 1 (SDA11) = 1 Note 1	TO02 = 0 (TO01) = 0 (SDAA0) = 0	✓	✓	—	—	—

Correct:

Table 4-8. Setting Examples of Registers and Output Latches When Using Pin Function (2/14)

Pin Name	Used Function		PIORr	POMp	PMCq	PMn	Pm	TSSELt	Alternate Function Output		32-pin	24-pin	20-pin	16-pin	10-pin
	Function Name	I/O							SAU Output Function	Other than SAU					
P01	P01	Input	—	×	0	1	×	0	×	×	✓	✓	✓	✓	✓
		Output	—	0	0	0	0/1	0	SDA00 = 1 (SO11) = 1 Note 3 (SDA11) = 1 Note 1	TO02 = 0 (TO01) = 0 (SDAA0) = 0					
		N-ch open drain output	—	1	0	0	0/1	0							
	ANI0	Analog input	—	×	1	1	×	0	×	×	✓	✓	✓	✓	✓
	TS00	I/O	×	×	×	1	0	1	×	×	✓	✓	✓	✓	✓
	SI00	Input	PIOR21 = 0 PIOR20 = 0	×	0	1	×	0	×	×	✓	✓	✓	✓	✓
	RxD0	Input		×	0	1	×	0	×	×	✓	✓	✓	✓	✓
	SDA00	I/O		1	0	0	1	0	(SO11) = 1 Note 3 (SDA11) = 1 Note 1	TO02 = 0 (TO01) = 0 (SDAA0) = 0	✓	✓	✓	✓	✓
	INTP5	Input	PIOR51 = 0 PIOR50 = 0	×	0	1	×	0	×	×	✓	✓	✓	✓	✓
	(TI01)	Input	PIOR03 = 1 PIOR02 = 1	×	0	1	×	0	×	×	✓	✓	✓	✓	✓
	(TO01)	Output		0	0	0	0	0	×	TO02 = 0 (SDAA0) = 0	✓	✓	✓	✓	✓
	TI02	Input	PIOR06 = 0 PIOR05 = 0 PIOR04 = 0	×	0	1	×	0	×	×	✓	✓	✓	✓	✓
	TO02	Output		0	0	0	0	0	×	(TO01) = 0 (SDAA0) = 0	✓	✓	✓	✓	✓
	(SI11)	Input	PIOR24 = 0 PIOR23 = 0 PIOR22 = 1	×	0	1	×	0	×	×	✓	✓	✓	✓	—
	(SDA11)	I/O		1	0	0	1	0	SDA00 = 1 (SO11) = 1 Note 3	TO02 = 0 (TO01) = 0 (SDAA0) = 0	✓	✓	✓	✓	—
	(SDAA0)	I/O	PIOR32 = 1	1	0	0	0	0	×	TO02 = 0 (TO01) = 0	—	—	✓	✓	✓
			PIOR33 = 1 PIOR32 = 0								✓	✓	—	—	—
	(SO11)	I/O	PIOR24 = 1 PIOR23 = 0 PIOR22 = 1	0/1	0	0	1	0	SDA00 = 1 (SDA11) = 1 Note 1	TO02 = 0 (TO01) = 0 (SDAA0) = 0	✓	✓	—	—	—

4. Table 15-1. CTSU Specifications (Page 700)

Incorrect:

Table 15-1. CTSU Specifications

Item		Description
Operating clock		f_{CLK}, $f_{CLK}/2$ or $f_{CLK}/4$
Pins	TS00 to TS14	Electrostatic capacitance measurement pins (15 channels)
	TSCAP	LPF (low-pass filter) connection pin We recommend connecting a 10-nF capacitor.

Correct:

Table 15-1. CTSU Specifications

Item		Description
Operating clock Note		f_{CLK}, $f_{CLK}/2$ or $f_{CLK}/4$
Pins	TS00 to TS14	Electrostatic capacitance measurement pins (15 channels)
	TSCAP	LPF (low-pass filter) connection pin We recommend connecting a 10-nF capacitor.

Note1. The measurement accuracy of the capacitive sensing unit (CTSUb) depends on the accuracy of the operating clock. Do not select the subsystem clock (f_{SUB}) as the CPU/peripheral hardware clock (f_{CLK}).

5. CTSU Control Register 0 (CTSUCR0) (Page 705)

Incorrect:

Figure 15-5. Format of CTSU Control Register 0 (CTSUCR0) (2/3)

CTSUSNZ	CTSU suspension enable Note3
0	Suspension is disabled.
1	Suspension is enabled.

This bit enables or disables suspension when an external trigger (an interval interrupt signal from the 12-bit interval timer) is selected (the CTSUCAP bit = 1).

Setting this bit drives the CTSU hard macro into the suspended state, which decreases power consumption during the wait state. The suspended state refers to the state in which the capacitor of the external low-pass filter connected to the TSCAP pin is not being charged.

The CTSU state changes as follows depending on the register setting.

Correct:

Figure 15-5. Format of CTSU Control Register 0 (CTSUCR0) (2/3)

CTSUSNZ	CTSU suspension enable Note3
0	Suspension is disabled.
1	Suspension is enabled.

Setting this bit to 1 drives the CTSU into the suspended state, which decreases power consumption during the wait state for measurement. The suspended state refers to the state in which the capacitor of the external low-pass filter connected to the TSCAP pin is not being charged.

The CTSU state changes as follows depending on the register setting.

6. 15.4.1 Principles of measurement operation (Page 737)

Incorrect:

15.4.1 Principles of measurement operation

(omitted)

Current flows to the **switched capacitor filter** by switching between charging and discharging in steps (1) and (2). At this time, the value of electrostatic capacitance varies depending on whether a finger is in close proximity, so the flowing current changes. A clock is generated by supplying the control current, which is proportional to the amount of the current flowing through the **switched capacitor filter**, from the circuit that generates the TSCAP power supply to the **ICO**. The counter is used to measure the clock frequency which changes depending on whether a finger is in close proximity, and the value read from the counter is used by software to determine contact with a finger (Figure 15-30).

Correct:

15.4.1 Principles of measurement operation

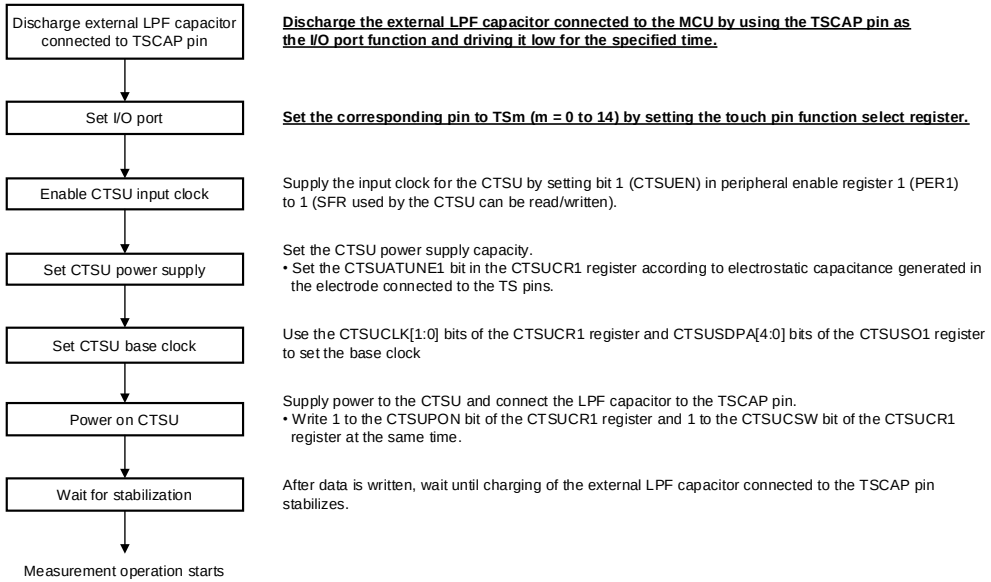
(omitted)

Current flows to the switched capacitor by switching between charging and discharging in steps (1) and (2). At this time, the value of electrostatic capacitance varies depending on whether a finger is in close proximity, so the flowing current changes. A clock is generated by supplying the control current, which is proportional to the amount of the current flowing through the switched capacitor, from the circuit that generates the TSCAP power supply to the current controlled oscillator (ICO). The counter is used to measure the clock frequency which changes depending on whether a finger is in close proximity, and the value read from the counter is used by software to determine contact with a finger (Figure 15-30).

7. Figure 15-32. CTSU Initial Setting Flowchart (Page 741)

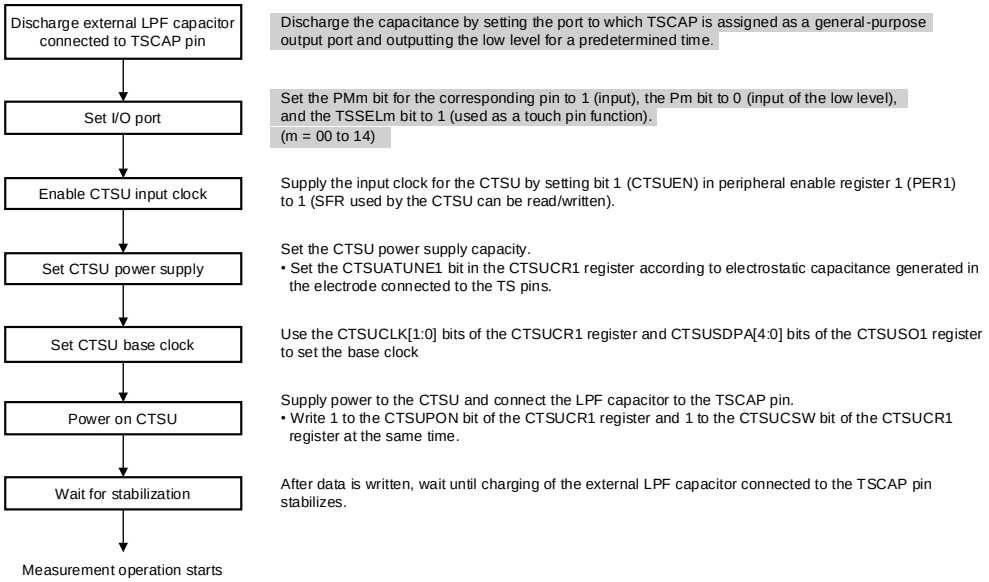
Incorrect:

Figure 15-32. CTSU Initial Setting Flowchart



Correct:

Figure 15-32. CTSU Initial Setting Flowchart



8. 15.5 Usage Notes (Page 760)

Incorrect:

Not applicable

Correct:

7) Points to note on noise countermeasures

Fluctuations in the V_{DD} power supply due to noise or other factors may lead to variation in the results of measurement. In addition, the application of ripple noise to the V_{DD} power supply may change (decrease) the control current of the capacitive sensing unit and in turn decrease the measured values of the electrostatic capacitance, depending on the frequency band of the ripple noise. For details, refer to the application note, **Capacitive Touch Ripple Noise Prevention Guide (R30AN0453)**.

Take note of these points when designing the power supply circuit.

8) Evaluation of detection by the capacitive sensing unit

The final stages of product development require operating the system under conditions close to those at the time of product shipment to judge the validity of the results of detection by the touch sensor. “QE for Capacitive Touch” (a development assistance tool for capacitive touch sensors) is provided for use in evaluation. Monitor the states in the measurement of capacitance and evaluate them thoroughly. If the expected results are not obtained, use the “QE for Capacitive Touch” tool to adjust and re-evaluate the CapTouch parameters (mainly the touch thresholds).

9) Memory occupancy

The amount of memory required to run the capacitive sensing unit depends on the configuration of the buttons. For details, refer to the following application notes.

- RL78 Family CTSU Module Software Integration System (R11AN0484)
- RL78 Family TOUCH Module Software Integration System (R11AN0485)