2.4 GHz Band Wireless Unit

SWL31-ETMC
SWL31-R4ML

User's Manual
(Hardware Version)

Thank you for purchasing our 2.4 GHz Wireless Unit (hereinafter called "Wireless Unit").
For using the Wireless Unit correctly and safely, at first please read this manual carefully before using it to understand sufficiently its functions and performance.

Cautions

1. Do not copy this user's manual without permission.
2. Please note that descriptions in this manual may be changed without prior notification.

MITSUBISHI ELECTRIC SYSTEM & SERVICE

1. SAFETY PRECAUTIONS

(Please be sure to read them before using the product.)

Please carefully read this manual before using the product and pay full attention to safety in order to handle the product correctly.
Precautions given in this manual relate only to this product.
In this "1. SAFETY PRECAUTIONS," the safety precautions are ranked as "WARNING" and "CAUTION."

⚠ WARNING	Indicates that incorrect handling may cause hazardous conditions, resulting in death or severe injury.
⚠ CAUTION	Indicates that incorrect handling may cause hazardous conditions, resulting in moderate or minor injury or only material damage.

Note that the CAUTION level may lead to serious consequences according to the circumstances.
Be sure to follow the instructions of both levels since they are important to personal safety.

Please be sure to pass this manual on to the end users.
In addition, please keep it in a safe place so that you can read it when needed.

[WIRING PRECAUTIONS]

⚠ WARNING

- Be sure to block the power supply externally for all phases before wiring, otherwise an electric shock or product damage may occur.

⚠ CAUTION

- Check the rated voltage and terminal layout of the product and correctly execute wiring for the terminal block. A wrong rated power supply or wrong wiring may cause fires or breakdowns.
- Be careful not to let foreign matter such as sawdust or wire chips get inside the product. Fires, breakdowns and malfunctions may occur.

[DESIGN PRECAUTIONS]

⚠ WARNING

- An external safety circuit shall be installed to this product so that the whole system operates at the safety side, even if an abnormality of an external power supply has an abnormality, or a breakdown of this product. Erroneous output and malfunctions may cause an accident.
  (1) Interlock circuits for conflicting operations such as forward/backward rotation or for machine damage prevention such as upper/lower limits shall be configured outside of the product.
  (2) If this product detects a communication abnormality, it will stop operation and set all outputs to OFF/HOLD. In addition, if an input/output control section has an abnormality which cannot be detected by the microcomputer within this product, all outputs may be turned on. In such case, an external fail-safe circuit or mechanism shall be installed for this product so that the machine operates at the safe side.
  (3) Outputs may be set to on or off at all times depending on a breakdown of an output circuit transistor etc. For output signals which may cause serious accidents, an external monitoring circuit shall be installed.
- A fuse or other safety circuits shall be installed externally since smoke/fires may occur if a load current which is higher than the rated current or an over current by a load short circuit flows continuously for a long time.
- A circuit of the external power supply for input/output circuits shall be configured so that the power supply is turned on after the power supply for this product is turned on. If the external power supply is turned on first, erroneous output or malfunctions may cause an accident.

⚠ CAUTION

- Control wires and power supply cables shall not be bundled with the main circuit and power wires or be laid close to them. Separate them by 100 mm (3.9 in) or more. Noise may cause malfunction.
- An output circuit with a margin in the rated current shall be selected, because large currents (ten times greater than normal ones) may flow when the output is set to ON from OFF on control of lamp load or others at the output circuit.

[INSTALLATION PRECAUTIONS]

⚠ CAUTION

- This product shall be used with the environmental specifications described in this user's manual. If it used in an environment outside of the environmental specification range, electric shocks, fires, malfunctions, product damage, or degradation may occur.
- Do not directly touch the conductive section of this product. Malfunctions and breakdowns may occur.
- When installing the wireless unit, avoid the area around the processing machine. Noise and other factors may cause communication problems.
- The combination of antenna and wireless unit has been certified to comply with technical standards, so please do not combine it with an antenna of a different compatible model or an antenna made by another company.

[STARTING/MAINTENANCE PRECAUTIONS]

⚠ WARNING

- Do not touch terminals while the product is energized. An electric shock may occur.
- Be sure to block power supply externally for all phases before cleaning.
  If all phases are not blocked, an electric shock may occur.
  Tightening screws too much may damage the product causing it to fall.

⚠ CAUTION

- Do not disassemble or modify the product. Breakdowns, malfunctions, injuries, or fires may occur. Also, that is prohibited by the Radio Law.

[DISPOSAL PRECAUTIONS]

⚠ CAUTION

- When this product is disposed of, it shall be handled as industrial waste.

⚠ 警語

經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。
低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。
前項合法通信，指依電信法規定作業之無線電通信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

2. USER'S MANUAL

No.	Manual name	Manual No.
1	2.4 GHz Band Wireless Unit (SWL31-ETMC, SWL31-R4ML) User's Manual (Detailed Version)	X903150801
2	2.4 GHz Band Wireless Unit Setting Utility(SWL31-UT1) User's Manual	X903130102

OVERSEAS SUPPORT GROUP （JAPAN）
Mail ： osb.webmaster@melsc.jp

3. CHECKING PACKAGE

Open the package and check the package to see if the set you have ordered is included.

Set model name

(1) SWL31-ETMC

(2) SWL31-R4ML

No.	Item name	Set Contents	
		(1)	(2)
1	2.4 GHz Band Radio Unit SWL31-ETMC (Master Station)	1	—
2	2.4 GHz Band Radio Unit SWL31-R4ML (Slave Station)	—	1
3	DIN Rail Mounting Attachment DRT-1	1	1
4	Attachment Fixing Screws (Pan Tapping Screws M3 x 8)	1	1
5	User's Manual (Hardware Version)	1	1

※Antennas must be purchased separately, refer to 4. Antenna (sold separately)

4. Antenna (sold separately)

No.	Item name	
1	Pencil Type Antenna	SWL31-ANP
2	Flange Head Type Antenna (Cord 2 m (78.7 in)) ※	SWL31-ANT

※If you buy Flange Head Type Antenna, you will get Flange Head Type Antenna Fixture Set

5. WIRELESS UNIT INSTALLATION ENVIRONMENT

- Installation Environment

  Install the Wireless Unit avoiding the following environments.

  • A place with direct sun light

  • A place with extremely high humidity

  • A place with corrosive or inflammable gases

  • A place with intense electric field or ferromagnetic field occurrence

- Request on Installing Wireless Unit

  The Wireless Unit transmits/receives data using radio waves. For using it with stable communication status, install it paying attention on the following.

  • Install the antennas of the units which communicate parallel to each other as much as possible.

  • Place metallic plates and concrete walls away from the antenna as far as possible (0.3 m (11.8 in) at least).

  • Install the antenna at a place 1.5 m (59.1 in) or higher from the floor to prevent impact from moving objects (including human bodies).

  • When communications are checked with a temporal installation, the unit shall be installed on a control board or others which the unit is actually to be installed because communications are affected by the environment near the fixing part such as metal and concrete. (If the Wireless Unit is installed in a metallic control board, install the flange head antenna outside of the board.)

  • The Wireless Unit and antenna are indoor types.

    If they are used outdoors, place them avoiding water (rain, fog, snow, etc.) and direct sun light in a nonmetallic container such as a plastic case for outdoors.

    Impact of water on the communication distance is assumed for electric wave characteristics.

    In addition, if the plastic case has a metallic plate embedded, it shall not be used because it will be an obstruction and significantly affect the communication distance.

6. Certification standard

Available countries	Wireless certification standard
Japan	ARIB STD-33/T66
China	— *
Taiwan	NCC
Thailand	NBTC
Vietnam	MIC
USA	FCC part 15B
	FCC Part 15C
	FCC ID
Canada	ICES 003
	RSS 210
	IC ID
Australia	AS/NZS 4268
new Zealand	AS/NZS 4268

* Not subject to CCC certification, SRRC certification not required

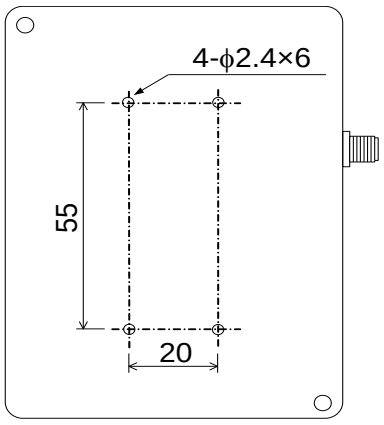
7. INSTALLATION & WIRING

7-1. Installation

The unit can be installed to the DIN rails (35 mm (1.38 in) with the DIN rail mounting attachment or installed with screws. (SWL31-ETMC and SWL31-R4ML can be installed with the same installation method.)

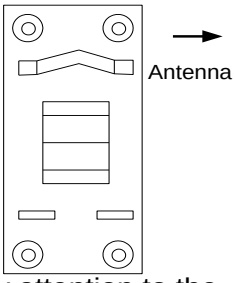
(1) Installing to the DIN rail

DIN rail Mounting Attachment Hole

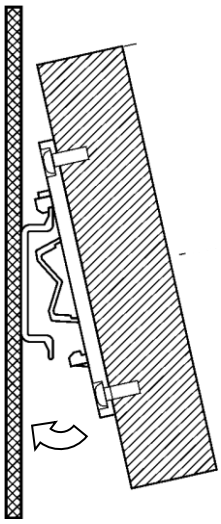


Rear of Unit

DIN rail Mounting Attachment



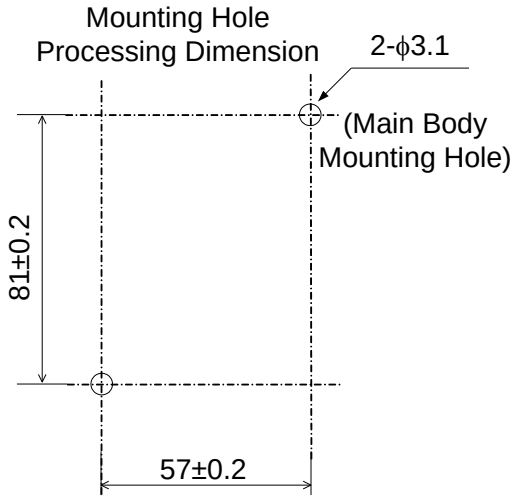
Pay attention to the mounting direction.



1) Install the DIN rail mounting attachment to the rear of the Wireless Unit with the M3 tapping screws (*1). (Screw tightening torque: 30 to 42 Ncm)
2) Hook the claw (upper side) of the DIN rail mounting attachment to the DIN rail.
3) Push the claw (lower side) until a clicking sound is heard.

*1: Use only the tapping screws packed together. If not, racing or damage may occur.

(2) Screwing



Fix the unit with two screws.

7-2. Wiring

For the terminal layout and conforming electric wire size, refer to "9-8. Terminal Block Specification."

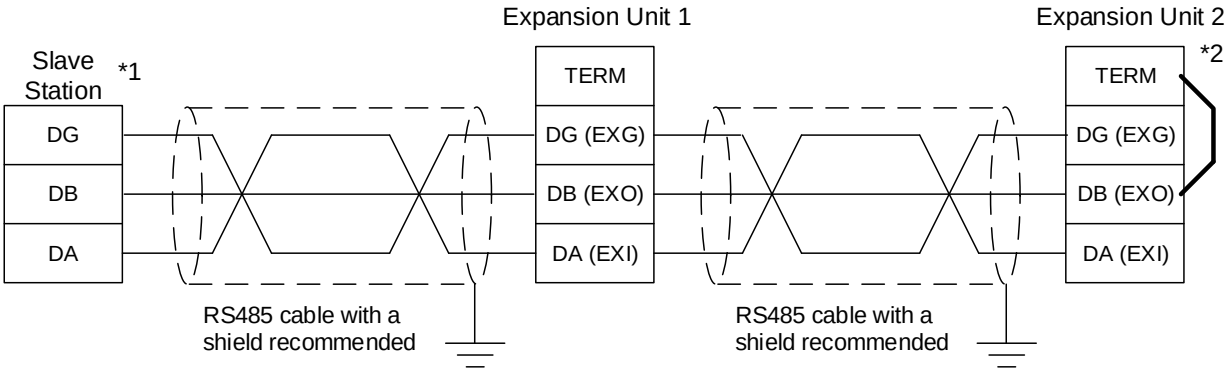
* To prevent induction noise, lay the power line and the signal line away from each other as far as possible. (It is recommended that they are away from each other 100 mm (3.94 in) or more.)

- Wiring Master Station
  (1) Connect the unit power supply.
  (2) Connect the FG terminal to the ground.

- Wiring Slave Station
  (1) Connect the unit power supply.
  (2) Connect the Expansion link.
  (3) Connect the I/O signal line.
  (4) Connect the error signal line.

- Wiring Expansion Unit (SWLEX-X16/SWLEX-XY16/SWLEX-AD4)
  (1) Connect the unit power supply.
  (2) Connect the signal line.
  (3) Connect the link cable to the slave station and Expansion unit.
  * Expansion unit link maximum communication distance: 1000 m (3280 ft)
  * For connection locations, refer to the figure below.

[Wiring Expansion Unit Link]

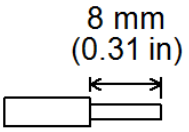


*1: A terminal resistor is implemented within the slave station.

*2: Connect TERM to DB (EXO) of the expansion unit connected to the terminal to use a terminal resistor within the unit.

[Screw-less Terminal Block Connection Method]

- Peel 8 mm (0.31 in) of the electric wire end as in the figure on the right.
- Insert the electric wire pressing the stopper with a screwdriver.
- Leave the screwdriver from the stopper to fix the electric wire.



8. INSTALLATION PROCEDURE & SET THE PARAMETERS

For details, refer to …

"2.4 GHz Band Wireless Unit (SWL31-ETMC, SWL31-R4ML) User's Manual (Detailed Version)"

"2.4 GHz Band Wireless Unit Setting Utility(SWL31-UT1) User's Manual"

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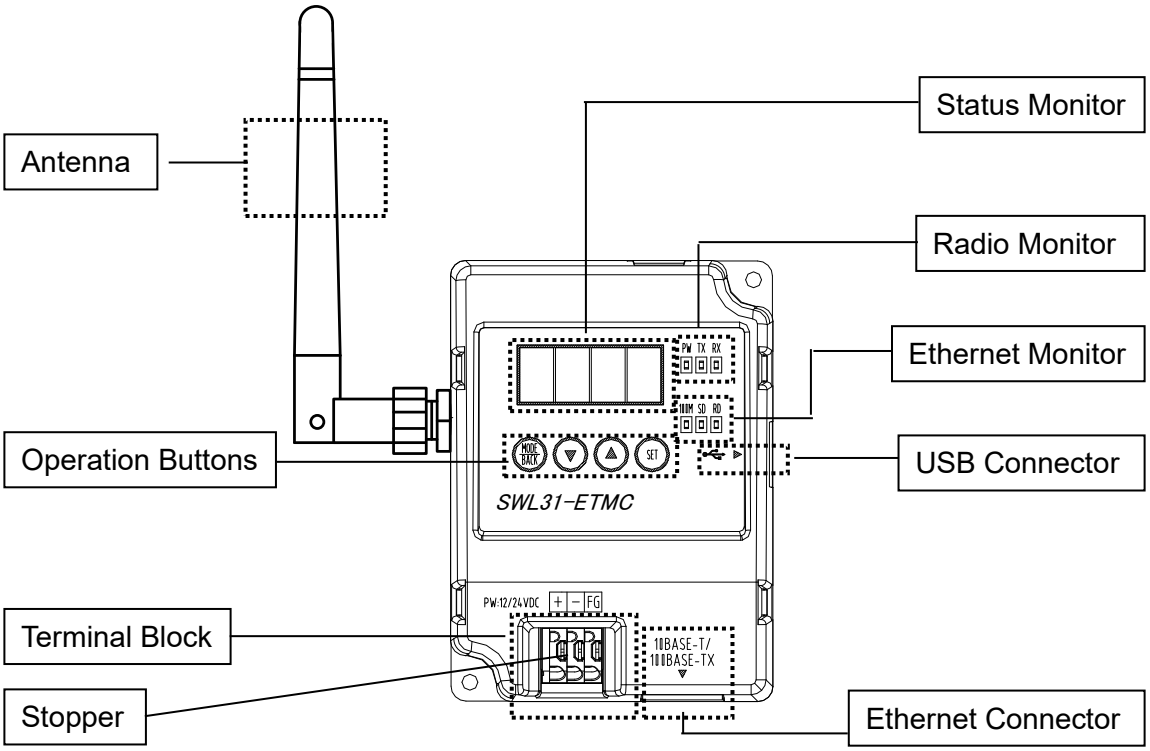
Mail ： osb.webmaster@melsc.jp

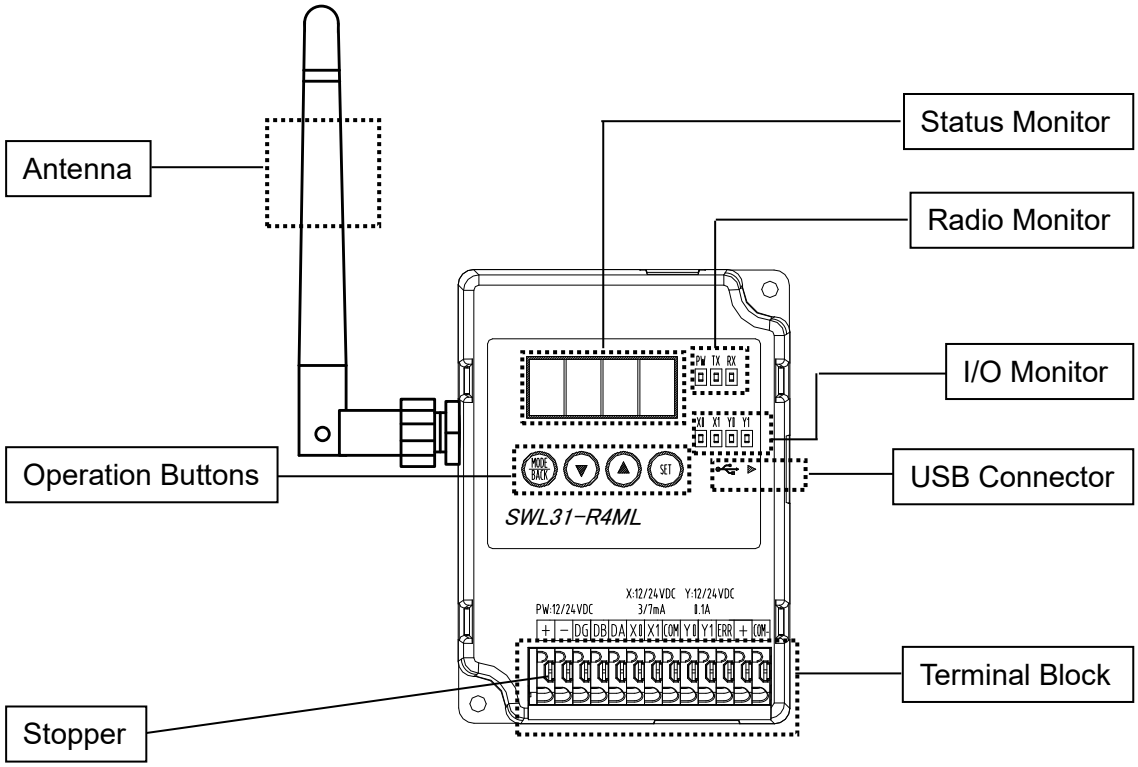
9. NAME/FUNCTION OF EACH SECTION

- SWL31-ETMC (Master Station)



Category	Name	Explanation
Antenna		A pencil type or flange head type (antenna)
Radio Monitor	PW	Lighting-on: Power on, normal communications Blinking: Power on, error occurred, parameter setting mode activated Lighting-off: Power off
	TX	Lighting-on while radio data are transmitted
	RX	Lighting-on while radio data are received
Status Monitor (Seven Segment)		Various displays with operation modes • In Normal Mode Normal communication: The channel number is displayed. Error occurred: The error number is displayed. • In Parameter Setting Mode: The parameter number is displayed. • In Radio Wave Intensity Mode: The radio wave intensity level is displayed.
Ethernet Monitor	100M	Lighting-on during 100BASE-TX communications
	SD	Lighting-on during data transmission
	RD	Lighting-on during data reception
Operation Buttons	MODE/BACK	Operation mode switching and hierarchy transfer in Parameter Setting Mode
	▼ (Down key)	Parameter no./value increase/decrease in Parameter Setting Mode
	▲ (Up key)	
	SET	Hierarchy transfer in Parameter Setting Mode
Terminal Block		Refer to Section 9-8 Terminal Block Specification.
Stopper		Press the stopper to insert an electric wire and leave it to fix the wire.
Ethernet Connector		A PLC is connected with an Ethernet cable for communications.
USB Connector		A PC is connected to the USB connector for using the Setting Utility (SWL31-UT1).

- SWL31-R4ML (Slave Station and Relay Station)



Category	Name	Explanation
Antenna		A pencil type or flange head type (antenna)
Radio Monitor	PW	Lighting-on: Power on, normal communications Blinking: Power on, error occurred, parameter setting mode activated Lighting-off: Power off
	TX	Lighting-on while radio data are transmitted
	RX	Blinking while radio link is connected
Status Monitor (Seven Segment)		Various displays with operation modes • In Normal Mode Normal communication: The channel number is displayed. Error occurred: The error number is displayed. • In Parameter Setting Mode: The parameter number is displayed. • In Radio Wave Intensity Mode: The radio wave intensity level is displayed.
I/O Monitor	X0, X1	Lighting-on when X0 or X1 signal is input to the terminal block
	Y0, Y1	Lighting-on when Y0 or Y1 signal is output from the terminal block
Operation Buttons	MODE/BACK	Operation mode switching and hierarchy transfer in Parameter Setting Mode
	▼ (Down key)	Parameter no./value increase/decrease in Parameter Setting Mode
	▲ (Up key)	
	SET	Hierarchy transfer in Parameter Setting Mode
Terminal Block		Refer to Section 9-8 Terminal Block Specification.
Stopper		Press the stopper to insert an electric wire and leave it to fix the wire.
USB Connector		A PC is connected to the USB connector for using the Setting Utility (SWL31-UT1).

10. SPECIFICATIONS

10-1. General Specifications

Item	Specifications	
Target Unit	SWL31-ETMC (Master Station)	SWL31-R4ML (Slave Station)
Operating Ambient Temperature	0 to +55 degrees C	
Operating Ambient Humidity	5 to 95%RH (No condensation)	
Storage Ambient Temperature	-10 to +65 degrees C	
Storage Ambient Humidity	5 to 95%RH (No condensation)	
Rated operational Voltage	12/24 V DC (10.2 to 26.4 V DC)	
Current Consumption	60 mA or lower (For 24 V DC)	55 mA or lower (For 24 V DC)
Rated Power	1.5 W	1.4 W
Noise Resistance	Noise voltage: 500 Vp-p, Noise width: 1 μs by a noise simulator with noise frequency of 45 Hz	
Vibration Resistance	Frequency: 10 to 150 Hz Acceleration: 9.8 m/s^2 No. of sweeps: Ten times each in X, Y and Z direction	
Shock Resistance	Acceleration: 147 m/s^2 No. of shocks: Three times each in X, Y and Z direction	
Operating Atmosphere	No dust or corrosive gas *1	
Weight	Approx. 130 g (with a pencil type antenna equipped)	

*1: The special corrosion proof coating cannot be supported since the radio characteristics change.

10-2. Radio Communication

Item	Specifications
Target Unit	SWL31-ETMC (Master Station) and SWL31-R4ML (Slave Station)
Communication Method	Polling system
Communication Topology	Mesh
Maximum No. of Relay Units	3 units
Operation Usage Frequency Band	ISM 2.4 GHz frequency band 2.405 GHz to 2.475 GHz (5.0 MHz interval)
No. of Frequency Channels	15 ch
Antenna Power	6.3 mW or lower
Communication Speed	250 kbps
Transmission Distance *1	Indoors: Approx. 60 m(197 ft)(prospect), Outdoors: Approx. 300 m(984 ft) (prospect)
Response Time *1	• For one slave station: Approx. 50 ms + 150 ms • For n units of slave station: Approx. 50 ms x n units + 150 ms

*1: The values are ones obtained when no relay unit exists. Also, they depend on surrounding environments such as obstacles.

10-3. Ethernet Communication

Item	Specifications
Target Unit	SWL31-ETMC (Master Station)
Interface	Ethernet (100BASE-TX, TCP/IP, and others, Connector: RJ-45) MC Protocol (3E frame client) MC Protocol (1E frame client)
Maximum Bit Number	Input 2048 points, Output 2048 points (system area included)
Maximum Word Number	Input 256 points, Output 256 points
Max No. of Slave Stations Connected	40 units (depends on the no. of Expansion units connected)

10-4. Slave Station Interface Specifications

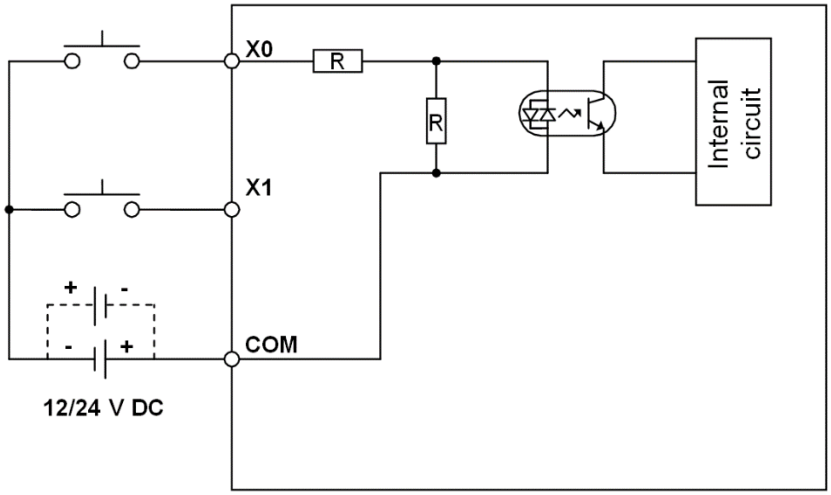
Item	Specifications
Target Unit	SWL31-R4ML (Slave Station)
Number of Bits Occupied (Only Slave Station)	Input: 16 bits/per unit Output: 16 bits/per unit
Number of Words Occupied (Only Slave Station)	Input: Max four words/per unit *1 Output: Max four words/per unit *1
Max No. of Bits Occupied (Expansion Units Included)	Input: 144 points (system area included) Output: 144 points (system area included)
Max No. of Words Occupied (Expansion Units Included)	Input: 36 points Output: 36 points
I/O Interface	Input 2 points/Output 2 points + Error output 1 point (Input 2 points can be switched to the pulse count 2ch/1ch.)
Pulse Count Function	Maximum two channels available 0 to 99999999 8 digits (Memory retention available at power failure) (A ring counter)

*1: Words are occupied when the pulse count function is used. (Two word occupation per channel)

10-5. Input Specifications

Item		Specifications
Target Unit		SWL31-R4ML (Slave Station)
Input Type		DC input (a plus common/minus common shared type)
Input Points		2 points
Insulation Method		Photocoupler insulation
Rated Input Voltage		12/24 V DC (+10/-15%, Ripple rate 5% or less)
Rated Input Current		Approx. 3 mA for 12 V DC, Approx. 7 mA for 24 V DC
ON Voltage/ON Current		8 V or higher/2 mA or higher
OFF Voltage/OFF Current		4 V or lower/1 mA or lower
Input Resistance		Approx. 3.3 kΩ
Response Time	OFF→ON	200 ms or less (One master and One slave station communication: no relay)
	ON→OFF	200 ms or less (One master and One slave station communication: no relay)
Common Type		2 points per common
Operation Display		ON display (LED)

External Connection Diagram



10-6. Pulse Count Specifications

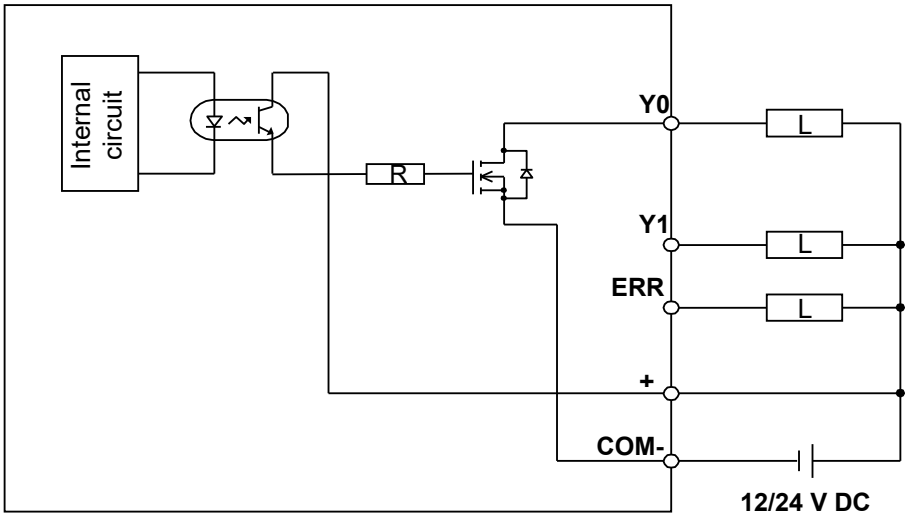
Item		Specifications
Number of Channels		2ch/1ch * Selectable with the parameter
Input Voltage Specifications		12/24 V DC
Minimum Input Pulse Width		30 Hz (ON: 16.7 ms, OFF: 16.7 ms) * When the machine contact output is used, the chattering time shall be considered.
Counter Type		Ring counter type
Number of Digits		1 to 8 digits
Default Setting		The count value can be set with other than 0 with the operation buttons of the slave station.
Reset Method	External Reset	Turning on the input terminal (X1) of the slave station resets the count. *** When 2ch is used, the external reset is unavailable.**
	Internal Reset	Commanding internal reset from the sequence program to the master station resets the count.

Note: If the pulse count is used the master station parameter for the word data of the PLC shall be set to Hold not to be cleared (to zero) at radio error.

10-7. Output Specifications

Item		Specifications
Target Unit		SWL31-R4ML (Slave Station)
Output Type		Transistor output (sync type)
Output Points		3 points (error output signal 1 point included)
Insulation Method		Photocoupler insulation
Rated Load Voltage		12/24 V DC (+10/-15%)
Maximum Load Current		0.1 A/1 point, 0.3 A/1 common (error output signal 1 point included)
Response Time	OFF→ON	200 ms or less (One master and One slave station communication: no relay)
	ON→OFF	200 ms or less (One master and One slave station communication: no relay)
Surge Killer		Zener diode
Fuse		None
External Power Supply	Voltage	12/24 V DC (+10/-15%) (Ripple rate 5% or less)
	Current	10 mA (for 24 V DC)
Common Type		3 points per common (error output signal 1 point included)

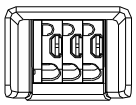
External Connection Diagram



10-8. Terminal Block Specifications

- Master Station (SWL31-ETMC)

[Terminal Block Diagram]



[Terminal Layout]

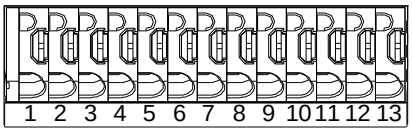
Item	Terminal no.	Silk notation	Specifications
Unit Power Supply +	1	+	Unit power supply (12 to 24 V DC)
Unit Power Supply -	2	-	
FG Terminal	3	FG	FG connection terminal

[Terminal Specifications]

Item	Specifications
Conforming Electric Wire Size	Single wire: φ0.8 mm(0.03 in) (AWG20), twisted wire 0.5 mm^2 (AWG20), strand diameter φ0.18 mm(0.007 in) or more
Standard Peeling Length	8 mm(0.31 in)
Recommended Conforming Tool	Flathead screwdriver Shaft diameter φ3 mm(0.11 in), cutting edge width 2.6 mm(0.1 in)

- Slave Station (SWL31-R4ML)

[Terminal Block Diagram]



[Terminal Layout]

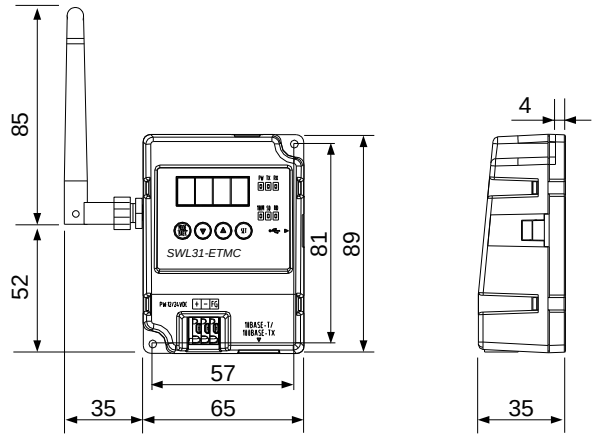
Item	Terminal no.	Silk notation	Specifications
Unit Power Supply +	1	+	Unit power supply (12 to 24 V DC)
Unit Power Supply -	2	-	
Expansion Unit Link DG	3	DG	Expansion link communication (RS485)
Expansion Unit Link DB	4	DB	
Expansion Unit Link DA	5	DA	
Input Signal X0	6	X0	Refer to 9-5. Input Specifications.
Input Signal X1	7	X1	
Input Signal Common COM	8	COM	
Output Signal Y0	9	Y0	Refer to 9-7. Output Specifications.
Output Signal Y1	10	Y1	
Error Output Signal	11	ERR	
Gate Power Supply +	12	+	
Output Signal Common COM -	13	COM-	

[Terminal Specifications]

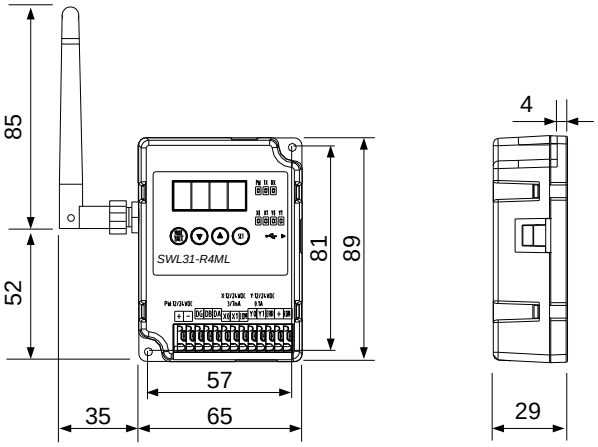
Item	Specifications
Conforming Electric Wire Size	Single wire: φ0.8 mm(0.03 in) (AWG20), twisted wire 0.5 mm^2 (AWG20), strand diameter φ0.18 mm(0.007 in) or more
Standard Peeling Length	8 mm(0.31 in)
Recommended Conforming Tool	Flathead screwdriver Shaft diameter φ3 mm(0.11 in), cutting edge width 2.6 mm(0.1 in)

10-9. Appearance Specifications

- SWL31-ETMC
  (Pencil Type Antenna implemented)

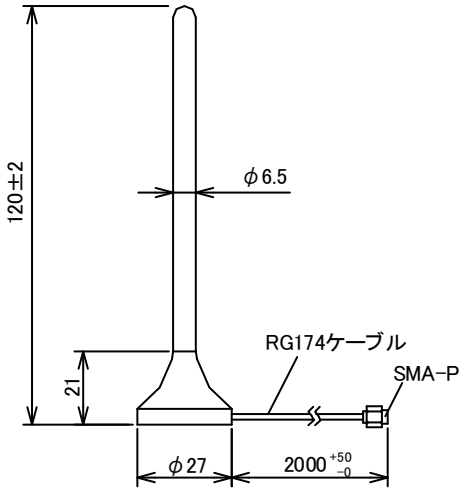


- SWL31-R4ML
  (Pencil Type Antenna implemented)



Unit [mm]

●SWL31-ANT (Flange Head Type Antenna)



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MITSUBISHI ELECTRIC SYSTEM & SERVICE
C&C CENTER OVERSEAS SUPPORT GROUP（JAPAN）
Mail ： osb.webmaster@melsc.jp

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