T-solution | Leader in Electrics & Automation
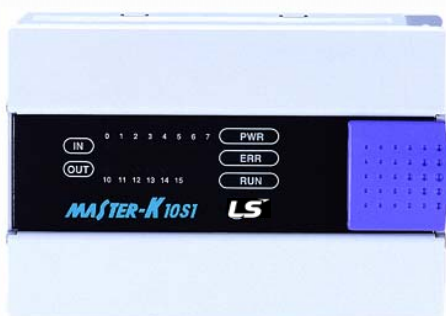
User Manual

MASTER-K10S1

Programmable Logic Controller

⚠ Safety Instructions

- Read this manual carefully before installing, wiring, operating, servicing or inspecting this equipment.
- Keep this manual within easy reach for quick reference.

LS Industrial Systems

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SAFETY PRECAUTIONS

SAFETY PRECAUTIONS

• Read this manual thoroughly before using LSIS equipment. Also, pay careful attention to safety and handle the module properly.
• Safety precautions are for using the product safely and correctly in order to prevent the accident and danger, so make sure to follow all directions in safety precautions.
• The precautions are divided into 2 sections, 'Warning' and 'Caution'. Each of the meaning is represented as follows;

⚠ 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 medium or slight personal injury or physical damage.

• The symbols which are indicated in the PLC and User's manual mean as follows;

⚠   This symbol means paying attention because of danger in specific situation.

⚡   This symbol means paying attention because of danger of electric shock.

• Store this manual in a safe place so that you can take it out and read it whenever necessary. Always forward it to end user.

SAFETY PRECAUTIONS

Design Precautions

⚠ Warning

▸ **Install a safety circuit external to the PLC that keeps the entire system safe even when there are problems with the external power supply or PLC module.Otherwise, serious trouble could result from erroneous output or erroneous operation.**

  - Outside the PLC, construct mechanical damage preventing interlock circuits such as emergency stop protective circuits, positioning upper and lower limits switches and interlocking forward/reverse operation.
When the PLC detects the following problems, it will stop calculation and turn off all output in case of watchdog timer error, module interface error, or other hardware errors.
However, one or more outputs could be turned on when there are problems that the PLC CPU cannot detect, such as malfunction of output device (relay, transistor, etc.) itself or I/O controller. Build a fail safe circuit exterior to the PLC that will make sure the equipment operates safely at such times. Also, build an external monitoring circuit that will monitor any single output that could cause serious trouble.

▸ **Make sure all external load connected to output does NOT exceed the rating of output module.**
Overcurrent exceeding the rating of output module could cause fire, damage or erroneous operation.

▸ **Build a circuit that turn on the external power supply when the PLC main module power is turned on.**
If the external power supply is turned on first, it could result in erroneous output or erroneous operation.

⚠ Caution

▸ **Do not bunch the control wires or communication cables with the main circuit or power wires, or install them close to each other. They should be installed 100mm (3.94inch) or more from each other.**
Not doing so could result in noise that would cause erroneous operation.

SAFETY PRECAUTIONS

Installation Precautions

⚠ Caution

▸ **Use the PLC in an environment that meets the general specification contained in this manual.**
   Using the PLC in an environment outside the range of the general specification could result in electric shock, fire, erroneous operation, and damage to or deterioration of the product.

▸ **Completely turn off the power supply before loading or unloading the module.**
   Not doing so could result in electric shock or damage to the product.

▸ **Make sure all modules are loaded correctly and surely.**
   Not doing so could cause a malfunction, failure, or drop.

▸ **Make sure I/O and extension connector are installed correctly.**
   Poor connection could cause an input or output failure.

▸ **When install the PLC in environment of much vibration, be sure to insulate the PLC from direct vibration.**
   Not doing so could cause electric shock, fire, and erroneous operation.

▸ **Be sure to there are no foreign substances such as conductive debris inside the module.**
   Conductive debris could cause fire, damage, or erroneous operation.

Wiring Precautions

⚠ Warning

▸ **Completely turn off the external power supply when installing or placing wiring**
   Not doing so could cause electric shock or damage to the product.

▸ **Make sure that all terminal covers are correctly attached.**
   Not doing so could result in electric shock.

SAFETY PRECAUTIONS

Wiring Precautions

⚠ Caution

▸ **Be sure that wiring is done correctly be checking the product's related voltage and the terminal layout.**
Incorrect wiring could result in fire, damage, or erroneous operation.

▸ **Tighten the terminal screws with the specified torque.**
If the terminal screws are loose, if could result in short circuits, fire, or erroneous operation.

▸ **Be sure to ground the FG or LG terminal to the protective ground conductor.**
Not doing so could result in erroneous operation.

▸ **Be sure there are no foreign substances such as sawdust or wiring debris inside the module.**
Such debris could cause fire, damage, or erroneous operation.

Startup and Maintenance Precautions

⚠ Warning

▸ **Do not touch the terminals while power is on.**
Doing so could cause electric shock or erroneous operation.

▸ **Switch all phases of the external power supply off when cleaning the module or retightening the terminal or module mounting screws.**
Not doing so could result in electric shock or erroneous operation.

▸ **Do not charge, disassemble, heat, place in fire, short circuit, or solder the battery.**
Mishandling of battery can cause overheating or cracks which could result in injury and fires.

SAFETY PRECAUTIONS

Startup and Maintenance Precautions

> ⚠ Caution

▶ **Do not disassemble or modify the modules.**
Doing so could cause trouble, erroneous operation, injury, or fire.

▶ **Switch all phases of the external power supply off before mounting or removing the module**
Not doing so could cause failure or malfunction of the module.

▶ **Use a cellular phone or walky-talky more than 30cm (11.81 inch) away from the PLC.**
Not doing so can cause a malfunction.

Disposal Precautions

> ⚠ Caution

▶ **When disposing of this product, treat it as industrial waste.**
Not doing so could cause poisonous pollution or explosion.

Warranty

• LSIS provides an 18 months warranty from the date of production.
• For troubles within the warranty period, LSIS will replace the entire PLC or repair the troubled parts free of charge except the following cases;
   ① the troubles caused by improper treatment or operation.
   ② the troubles caused by external devices.
   ③ the troubles caused by remodeling or repairing based on user's own discretion.
   ④ the troubles caused by natural disaster.
• This warranty is limited to the PLC itself only. It is not valid for the whole system which the PLC is attached.

■ Characteristics

- The user program is stored in a EEPROM, and no battery back-up is required.
- Data communication through RS232C and RS485 is available.
- K10S1 includes a high speed counter being applicable for a simple positioning system.
- K10S1 series are suitable for the control of small machinery having I/O points less than 14 .

■ Power Supplying to the PLC

- To prevent the PLC from an improper operation caused by the external noise, place a insulation transformer and/or a noise filter as shown in the right figure.
- Always install AC power cable and signal or data lines in separate ducts or bunches.
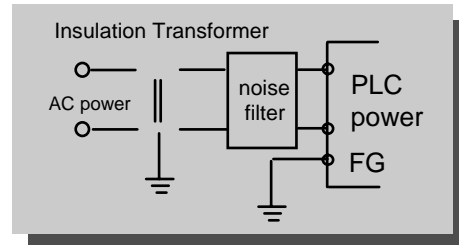
- The fuse in the DC power supply may be blown when the DC power is supplied in reverse polarity.
- Be careful to connect power source cable to the correct terminal.
Internal device of PLC may be damaged by the improper lead connections.
- Supplying power beyond rated voltage/frequency may damage internal devices.
- Grounding

<BEST>   <GOOD>   <POOR>
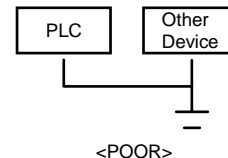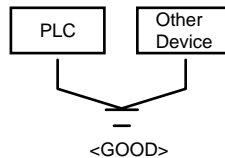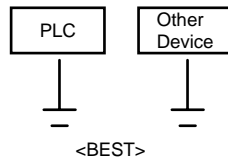
⚠ Caution

When you supply power to external DC24V devices from the power unit of K10S1, be careful not to exceed the maximum capacity of power unit.

(№ of inputs simultaneously ON X 7mA) + (№ of outputs simultaneously ON X 8mA) + (∑ current consumption of external DC24V devices)	<	The maximum capacity of power supply

Note) The maximum capacity
of power supply
K10S1 : 100mA

■ Specifications

• General Specifications

Power Supplies (47 ~ 63Hz)	K10S1 : 100~240VAC(Free Voltage)
& Consumption	7.4W
Dropout Tolerance	1/2 Cycle
DC Supply Output	0.1A
Withstanding Voltage	DC 500V 10MΩ
Grounding	Grounding resistance ≤ 100Ω
Noise Immunity	2000V, 1μs (Noise Simulator)
Vibration	KSC0903
Shock	KSC0905
Operation Temperature	0 ~ 55℃(32 ~ 131°F)
Storage Temperature	-25 ~ 75℃(-13 ~ 158°F)
Humidity	5 ~ 95% RH (Non-condensing), RH-2
Atmosphere	Free from corrosive gas
ESD Severity Level	Level ESD-3
Altitude	under 2000m

• Functional Specifications

Program control method	Cyclic execution of stored program
I/O Processing Method	Updated after each scan
No. of instructions	30 Basic instructions & 154 application instructions
Execution time	3.2~7.6 μs / step
Program capacity	800 steps
Memory device type	EEPROM (8kbyte)
Memory device range	P : I/O relay / P000 ~ P007 (8points for input)
	P010 ~ P015 (6points for output)
	M : Auxiliary relay / M000 ~ M15F (256points)
	K : Keep relay / K000 ~ K07F (128points)
	L : Link relay / L000 ~ L07F (128points)
	F : Special relay / F000 ~F15F (256points)
	T : 100ms timer / T000 ~ T031 (32points)
	10ms timer / T032 ~ T047 (16points)
	C : Counter / C000 ~ C015 (16points)
	D : Word(16bit) data register
	D000 ~ D063 (64word)
	S : Step controller / S00.00~S15.99(16X100steps)
Counter	Up-counter, Down-counter, Up/down-counter
	Ring Counter (preset range : 0 ~65535)
Timer	On delay-timer, Off delay-timer, Integrating timer,
	Monostable timer, Retriggerable timer
	(preset range : 0 ~ 65535)
High speed counter	1point, 8kpps, DC24V, Duty : 20 ~ 80%
Other functions	RS232C, RS485 communication

• I/O Specification

K10S1

Item	I/O	Input	Output
	Type	DC	Relay
Rated Voltage		DC24V	DC24V / AC110 ~ 220V
On : Operating Voltage		≥DC19V	-
Off : Operating Voltage		≤DC6V	-
Input Current		7± 2mA / point	-
Max. Output Current		-	1A / point, 3A / COM
On State Voltage Drop		-	≤3V
Off State Leakage Current		-	≤0.1mA
Off → On Response Time		≤5ms	≤10ms
On → Off Response Time		≤7ms	≤10ms
I/O Status Indicator		LED (Input : Green, Output : Red)	
Withstand Voltage		AC1500V, 1 minute	
Noise Immunity		2000Vpp, 1μs (Noise Simulator)	
Insulation Device		Photo Coupler	

Note)

• The expected life span of relay

  The relay used in MASTER-K10S1 is FUJI's RB1-E, and those manufacturer guarantee 10million times (mechanical) and 0.1 ~ 3million times (electrical) operation for their relays..

  The durability of relay depends on the type of external load. Therefore, we highly recommend customers to connect an external relay or SSR between PLC and large inductive load for improved reliability and maintenance of PLC. The capacity of external relay or SSR should be at least twice larger than the capacity of the load.

• All outputs will be turned off when interruptions of CPU control, voltage drops / interruptions, and/or power up/down occur.

• Improper terminal connection or overloads on I/O may cause a damage on the internal devices.

■ Memory Map

Bit Data Memory	Word Data Memory	Program Memory

	0 ~ F		0000 ~ FFFF		
P00 ⱱ P01	I/O Relays	D000 ⱱ D063	Word Data Register Area (64 words)		Parameter Setting Area
M00 ⱱ M15	Auxiliary Relays (256points)	T000 ⱱ T047	Timer Preset Value (48 word)		User Program Area (800 Steps)
K00 ⱱ K07	Keep Relays (128points)	T000 ⱱ T047	Timer Elapsed Value (48 word)		
L00 ⱱ L07	Link Relays (128points)	C000 ⱱ C015	Counter Preset Value (16 word)		
F00 ⱱ F15	Special Relays (256points)	C000 ⱱ C015	Counter Elapsed Value (16 word)		

• Retentive Area

K000 ~ K07F
L000 ~ L07F
T024 ~ T031
T044 ~ T047
C012 ~ C015
D048 ~ D063
S12.00 ~ S15.99

T000 ⱱ T031	100ms Timers (32points)
T032 ⱱ T047	10ms Timers (16points)
C000 ⱱ C015	Counters (16points)

	00 ~ 99
S00 ⱱ S15	Step Controller 16 X 100 steps S00.00 ~ S15.99

※ **The Integer Setting Range in Word Data Area**
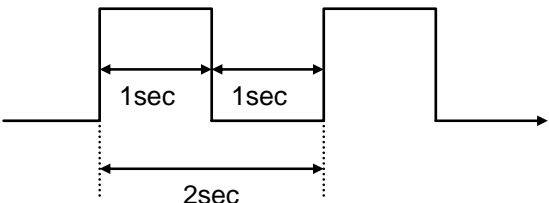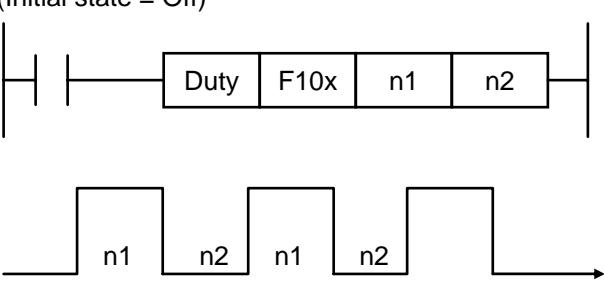0 ~ 65535 (Decimal) or 0 ~ hFFFF(Hex)
For Double Word Instruction,
0 ~ 4294967295 or 0 ~ hFFFFFFFF

■ Special Function Relay : F area
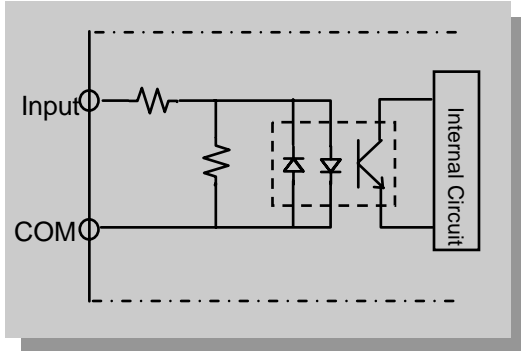
F relay is used as only input operand.

Relay	Name	Description
F000	RUN flag	Set when the PLC is on RUN mode.
F001	PGM flag	Set when the PLC is on PGM(program) mode.
F002	PAU flag	Set when the PLC is on PAU (pause) mode.
F010	Always on	Use as a dummy relay or initialization in user programs
F011	Always off	
F012	1 scan on	On during the first scan after PGM → RUN mode
F013	1 scan off	Off during the first scan after PGM → RUN mode
F014	Turnover per each scan	Repeat set / reset according to each scan during PLC is RUN mode.
F020 ~ F02F	Communication error information	• Related to SEND, RECV instructions only • Upper byte : The station No. where error occurred • Lower byte : error code • The error code of time out error : h20 • No error : h0000
F030	Serious error	Set in case of internal ROM error, 24V fail error.
F031	Light error	Set in case of WDT error, program error, I/O combination error, missing END/RET error.
F050 ~ F05F	Error code	• h0000 : No error • h0023 : Code error • h0014 : I/O error • h0024 : Missing END error • h0021 : Parameter error • h0025 : Missing RET error

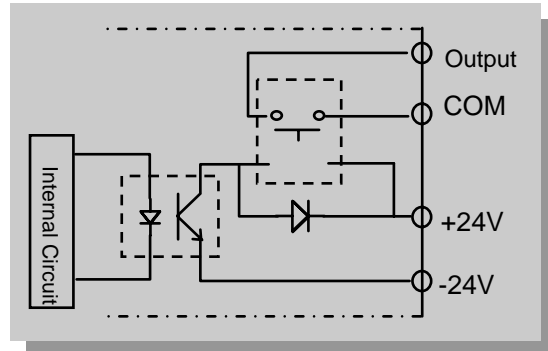| Relay	Name	Description
F060 ~ F06F	The step No. where error occurred	• The step No. where program error occurred in stored. • In case of branch instruction error, the destination step No. is stored.
F070 ~ F077	High speed counter output register	• HSCNT instruction : F070 ~ F077 • HSC instruction : use only F070 bit
F080 ~ F08F	PLC model	• K10S & K10S1 : h0031 • K60S : h0036 • K30S : h0033 • K100S : h0035
F090	20ms clock	There relays repeat On/Off with fixed time interval, and are operated only when the PLC is in RUN mode. Example) F094 : 2sec clock
F091	100ms clock	
F092	200ms clock	
F093	1sec clock	
F094	2sec clock	
F095	10sec clock	
F096	20sec clock	
F097	1 minute clock	
F100 ~ F103	User defined clock F100 : Clock 0 ~ F103 : Clock 3	These relays repeat On/Off based on a scan time. (Initial state = Off)

Relay	Name	Description
F110	Arithmetic error flag	Set when an arithmetic error occurred during operation
F111	Zero flag	Set when the result value is zero
F112	Carry flag	Set when carry / borrow occurs as a result of operation
F11A	On sending flag	These flags indicate the communication status when DIN / DOUT instructions are used.
F11C	On receiving flag	
F11E	Receive completion flag	
F11F	Communication error flag	• DIN, DOUT: Set when time-out error occurred. • SEND, RECV : Set when time-out error occurs or NAK massage is detected.
F120	<	These relays are set according to the result of compare instructions. (CMP, CMPP, DCMP, DCMPP)
F121	≤	
F122	=	
F123	>	
F124	≥	
F125	≠	
F130 ~ F135	AC power fail	The numbers of AC power fail occurred during RUN mode
F140 ~ F14F	Elapsed value of High speed counter	• HSCNT : The elapsed value of high speed counter is stored. • HSC : The low word of elapsed value of high speed counter is stored.
F150 ~ F15F	Preset value of High speed counter	• HSCNT : The preset value of high speed counter is stored. • HSC : The high word of elapsed value of high speed counter is stored.

■ I/O Circuit

DC 24V Input

Input

COM

Internal Circuit

Relay Output

Output

COM

+24V

-24V

Internal Circuit

■ External Connection

Speed Counter
+ −

Power : DC24V Output
+ −

| + HSC − | P00 | P01 | P02 | P03 | P04 | P05 | P06 | P07 | COM | + 24V − | OUT |

IN 0 1 2 3 4 5 6 7   ○ PWR
OUT 10 11 12 13 14 15   ○ ERR
○ RUN

MASTER-K10S1 LS

| 100~240VAC | AC | AC | FG | NC | COM1 | P10 | P11 | COM2 | P12 | P13 | COM3 | P14 | P15 |

Power : 100~240VAC   FG

14

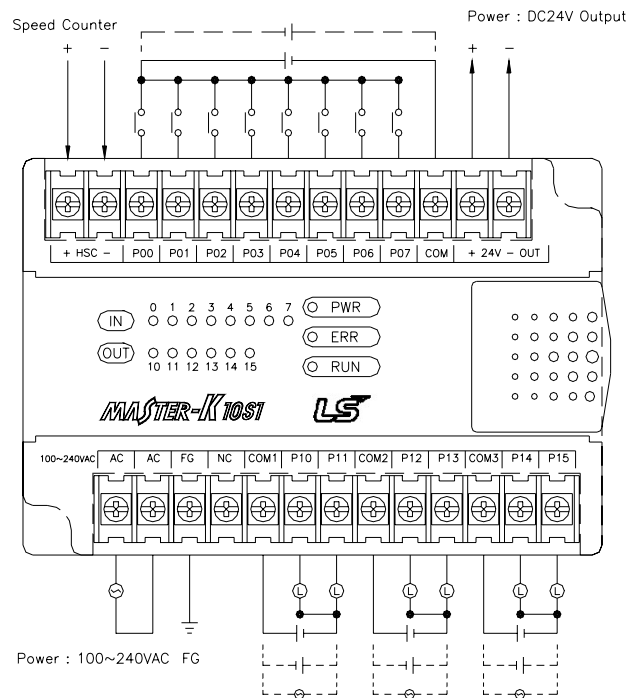# ■ RS485 COMMUNICATION
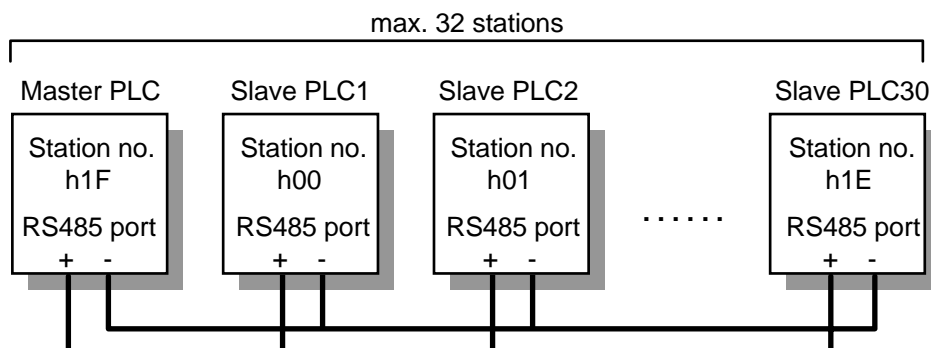
• General Specification

Instruction for RS485   SEND / RECV
                               Above instruction is used in sequence program of only
                               master PLC being designated as station no. h1F.
Communication Method   Asynchronous half duplex
Max. Linkable station number   32 stations(including self station)
Transmission speed   300 ~ 19200bps(selectable)
Transmission distance   Max. 1km(no repeater)
Preset of waiting time   Preset address = D060
 for Time Out Error   Preset value(x 10ms) = 0 ~ 255 (0ms ~ 2550ms)
                                 (Default preset value = 0(500ms),
                                   if preset value is equal or more than 255, waiting
                                   time is 2550ms.)

• Network System

max. 32 stations

Master PLC	Slave PLC1	Slave PLC2		Slave PLC30
Station no. h1F	Station no. h00	Station no. h01	······	Station no. h1E
RS485 port + -	RS485 port + -	RS485 port + -		RS485 port + -

• Instruction

SEND [FUN(159)]   :   Transmission data from master to slave
RECV [FUN(158)]   :   Receiving data from slave to master

Instruction Form   :

```
    ──┤ ├───────────[ SEND  St  S1  D1  n ]─

    ──┤ ├───────────[ RECV  St  D2  S2  n ]─
```

St : Station number of slave PLC to communicate.(This of master PLC is always h1F.)
S1 : Beginning address of word memory device of master PLC in which data to be
      transmitted to slave is stored.
D1 : Beginning address of word memory device of slave PLC in which data to be
      received from master will be stored.
S2 : Beginning address of word memory device of slave PLC in which data to be
   transmitted to master is stored.
D2 : Beginning address of word memory device of master PLC in which data to be
      received from slave will be stored.
n : The number of word data to be transmitted or received.(Hex. or Decimal)

Note

① When the transmitted data from master PLC is stored to P area of slave directly,
   the output data of P area of slave PLC may clear during operation mode of slave PLC
   changing(PROGRAM mode ↔ RUN mode) according to PLC operation system.
② The range of address(D1, S2) of word memory device for slave PLC in the SEND/RECV
   can not be exceed that of master PLC.

■ Dimension and Weight
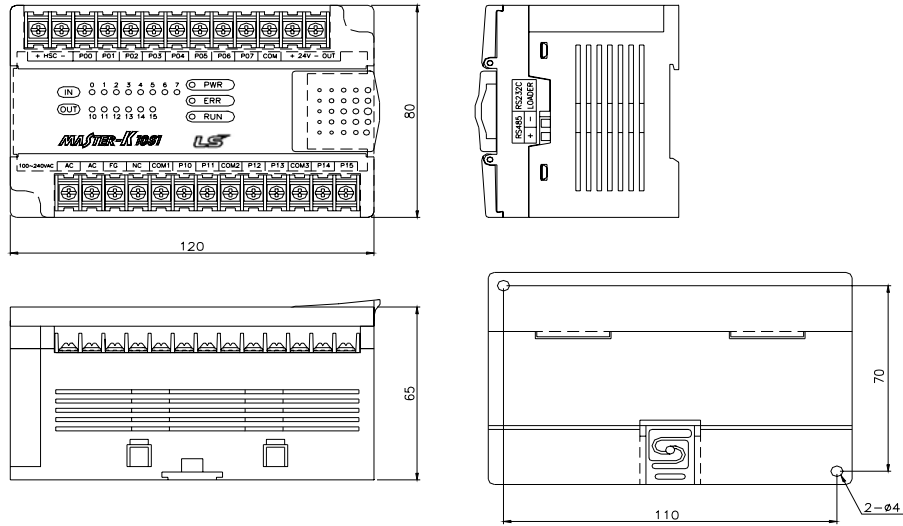
• Net Weight of K14P1-DRS = 350g

■ Other Technical Materials

• MASTER-K Programming Manual
• Graphic Loader (KGL) User's Manual
• Handy Loader (KLD-150S) User's Manual
• MASTER-K / PMU Communication Technical Materials

WARRANTY

1. Warranty Period
The warranty period for the purchased product is 18 months from the manufactured date**.**

2. Warranty Range
For problems that occur during the warranty period, a partial replacement or repair is available.
But the following cases are excluded from the warranty range.

(1) Problems caused by improper conditions, environment, or treatment other than that described in the user's manual.
(2) Problems caused by from another manufacturer's product.
(3) Modification or repair outside LSIS or the branches designated by LSIS.
(4) Used for a method other than the original intended method.
(5) Problems caused by unexpected reasons due to the level of the science technology at the time of the project release.
(6) In the cases that LSIS is not responsible for (such as natural disaster, fire etc.).

3. This warranty is valid only for the PLC unit body.
When using the product, consider the safety precautions for the system configuration or product application.

Leader in Electrics & Automation

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※ LS Industrial Systems constantly endeavors to improve its product so that
information in this manual is subject to change without notice.

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