

TSL3000 SCARA system TSL3100 6AXIS system

# **INSTRUCTION MANUAL**

## SIMPLE PLC FUNCTION MANUAL

## <u>Notice</u>

- Make sure that this instruction manual is delivered to the final user of Toshiba Machine's industrial robot.
- Before operating the industrial robot, read through and completely understand this manual.
- After reading through this manual, keep it nearby for future reference.

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## **Preface**

Structure of TH series robot and TSL3000 controller instruction manuals: These instruction manuals were published in parts according to the application and purpose, and the name and outline of each manual are as follows:

#### [Safety Manual]

This manual contains the important information to use the robot safety and correctly. Be sure to read through and understand this manual before operating the robot. Also, strictly observe the descriptions made there.

#### [Operator's Manual]

This manual deals with the TSL3000 controller operating procedures. Read through this manual before operating the robot, and refer to it as necessary.

#### [Robot Language Manual]

This manual refers to the robot language called "SCOL". When you have to create a program based on this language, read through the manual.

#### [Interface Manual]

This manual describes the external signals for the robot. Concerning the interface conditions between the robot and peripheral equipment, specifications, timing, etc., refer to the manual when necessary.

#### [Installation & Transport Manual]

This manual describes the transport, unpacking and installation of the robot and controller. Be sure to read through this manual before unpacking the shipment containing the robot.

#### [Maintenance Manual]

This manual deals with the daily and regular inspections to be made on the robot and controller. Read through this manual to use the robot safely over long years to come.

#### [Communication Manual]

This manual describes the serial communication between the robot controller and other equipment. Refer to this manual when connecting the robot controller with a host computer, optical sensor, etc., via a serial cable.

#### [User Parameter Manual]

This manual describes the setting of the robot controller. Read this manual when performing the setting of communication, I/O, motion condition, etc.

[Alarm Manual]

This manual describes the alarms, their causes, and remedies. Refer to this manual when an alarm occurs.

## Cautions on Safety

This manual contains the important information on the robot and controller to prevent injury to the operators and persons nearby, to prevent damage to assets and to assure correct use.

Make sure that the following details (indications and symbols) are well understood before reading this manual. Always observe the information that is noted.

[Explanation of indications]

Indication	Meaning of indication
	This means that "incorrect handling will lead to fatalities or serious injuries."
	This means that "incorrect handling may lead to personal injuries <sup>*1)</sup> or physical damage <sup>*2)</sup> .

- \*1) Injuries refer to injuries, burns and electric shocks, etc., which do not require hospitalization or long-term medical treatment.
- \*2) Physical damage refers to damages due to destruction of assets or resources.

[Explanation of symbols]

Symbol Meaning of symbol	
$\bigcirc$	This means that the action is prohibited (must not be done). Details of the actions actually prohibited are indicated with pictures or words in or near the symbol.
	This means that the action is mandatory (must be done). Details of the actions that must be done are indicated with pictures or words in or near the symbol.
	This means danger. Details of the actual danger are indicated with pictures or words in or near the symbol.
	This means caution. Details of the actual caution are indicated with pictures or words in or near the symbol.

[Operation]

$\bigcirc$	• During operation, NEVER enter the dangerous area of the robot. Otherwise, you will be injured seriously.		
Prohibited	<ul> <li>DO NOT leave in the working range any machinery or materials which will hinder the operation. If the equipment went wrong, a person nearby will be injured or involved in an accident.</li> </ul>		
	<ul> <li>Anyone other than the operator MUST NOT approach the equipment. Should he negligently touch the dangerous part of the equipment, he will get injured or involved in a serious accident.</li> </ul>		
	<ul> <li>NEVER perform an inappropriate operation which is not described in the instruction manual. Otherwise, the equipment will start by mistake, resulting in personal injury or serious accident.</li> </ul>		
Danger	• If you feel even a little that you are exposed to danger or that the equipment works abnormally, press the EMERGENCY stop pushbutton switch to stop the equipment. If the equipment is used as it is, you will be injured or involved in a serious accident. When this happens, ask our after-sale service agent for repair.		
	• During operation, be sure to close the equipment cover. Should the cover be opened during operation, you will be struck by an electric shock or get injured.		
	• Only a well-trained and qualified person is allowed to perform the operation. Should the equipment be operated improperly, it will start by mistake, causing a personal injury or serious accident.		
	• If the equipment has malfunctioned, turn the power off, identify and remove the cause of the abnormality, maintain the peripheral equipment and completely restore the malfunctioned equipment. Then start the equipment at a slow speed. If the equipment starts, leaving the abnormality, you will be involved in a serious accident.		

Prohibited	<ul> <li>DO NOT change the data of the system structure file. Otherwise, the robot will move abnormally, resulting in damage or an accident.</li> </ul>		
	• In principle, teaching operation should be performed outside the dangerous area of the robot. If it should be performed inevitably within the dangerous area, strictly observe the following matters.		
Mandatory	<ul> <li>(1) The teaching operation should always be performed by two (2) persons. One person performs the job and the other person watches outside the dangerous area. Also, both persons should try to prevent mis-operation with each other.</li> </ul>		
	(2) The operator should do the job in an attitude ready to press the EMERGENCY stop pushbutton switch at any time. Also, he should perform the job at a position from which he can evacuate immediately at the time of an emergency after confirming the robot working range and shields nearby.		
	(3) The supervisor should keep watch on the job at a position where he can see the entire robot system and operate the EMERGENCY stop pushbutton switch at the time of an emergency. Also, he should keep anyone from entering the dangerous area. Unless the operator or other person follows the instructions of the supervisor, an accident will be caused.		
	• If an abnormality has generated or the POWER LED lamp on the control panel remains off after the main power switch of the equipment was turned on, turn off the main power immediately and confirm the wiring. Otherwise, you will be struck by an electric shock or a fire will break out.		
	<ul> <li>Unless the robot operates toward a designated direction at manual guide, turn off the servo power. Otherwise, the robot will be damaged or you will be involved in an accident. When this happens, call us at the after-sale service agent.</li> </ul>		
	<ul> <li>Pushbutton operations on the control panel and teach pendant should be confirmed visually. Otherwise, you will be involved in an accident due to mis-operation.</li> </ul>		
	• After the power is turned on, be sure to reset a program to start an automatic operation. If the program is executed continuously, the robot will interfere with the peripheral equipment, resulting in damages or accidents.		

	• Before operating the equipment, perform the following inspection.		
	(1) Make sure that visual appearance of the robot, controller, peripheral equipment and cables are in good condition.		
Mandatory	(2) Make sure that no obstacle stands in or near the working range of the robot and peripheral equipment.		
	(3) Make sure that the emergency stop and other safety devices operate properly.		
	(4) Make sure that no abnormal noise or vibration is involved in the robot operation.		
	If the above prior inspection is skipped, the equipment will be damaged or you will be involved in an accident.		
	The speed of test operations is initially set at 25% of the maximum robot speed.		
Caution	The speed of automatic operation is initially set at 100% of the maximum robot speed.		

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#### Section 1 General Descriptions

Robot controller TSL3000 incorporates a simple programmable controller (hereinafter called the "TCmini").

Programs (DOUT commands) analyzed by the main unit and system output signals are once sent to the TCmini where they are processed and output to an external device. The TCmini also receives external input signals and transmits them to the main unit after processing. In other words, the TCmini can unrestrictedly determine the locations where input/output processing of robot programs by the main unit and system signals are to be input or output.

Also, the TCmini can directly respond to (or output) input signals sent from the external device. As the TCmini operates while the TSL3000 controller power is turned on, it is capable of performing I/O control, irrespective of robot program execution.

External input/output signals described in the Interface Manual refer to the operation of a standard sequence program. When you create this sequence program, you can design a more flexible system.

This manual deals with the TCmini.



TSL3000

#### Section 2 TCmini

The **TCmini** built in robot controller TSL3000 is a simple programmable controller resided in the robot, which can control external I/Os (21 inputs and 17 outputs), hand I/Os (8 inputs and 8 outputs) and extension I/Os (64 inputs and 64 outputs).

The TCmini is connected with the TSL3000 main unit via common RAM to transfer I/O data and status.

When this TCmini is connected with a remote I/O module via RS485 communication cable (EXTI/O), up to 64 each of inputs and outputs can be connected.

By connecting the TCPRG port (RS232C) on the TSL3000 front side with your personal computer, you can create, debug (I/O monitor) and transfer sequence programs, using **TCPRGOS**.



#### 2.1 Sequence Program

Sequence programs of the TCmini use graphical (or ladder) programming.



I/O processing in the TCmini is batch-refreshed. Before arithmetic operation of a sequence program, ON/OFF status of inputs is transferred to the data memory with results of preceding sequence operation transferred to outputs.

After the I/O processing, the sequence program is scanned sequentially from the top.

In the TCmini, scanning is executed by the CPU. If the program size increases, it takes more time to scan, resulting in delay of the input and output. Yardstick of the scanning time is about ten (10) msec per 1,000 basic commands (1 K words).

For details on the programming, see Section 7 of this manual.

#### 2.2 Instruction Words

The TCmini can use the following sixteen (16) instruction words.



In the TCmini, thirty-two (32) application instructions (or commands) can be used.



The application instruction comes with the following types.

- Transfer instruction
- Data conversion instruction
- BIN operation instruction
- Comparison instruction
- Bit operation instruction
- Subroutine instruction
- Pulse instruction

\* For further information on the instructions, see Section 7 of this manual.

#### 2.3 System Sequence and User Sequence

The PLC (TCmini) built in the TSL3000 has the following three (3) working areas and the sequence program capacity of each working area is 4 K words. The user can create sequence programs in areas 1 and 2 alone.



- Area 0: Standard sequence area (Cannot be changed.)
- Area 1: User's RAM area for debugging (RAM contents are cleared by power OFF and ON.)
- Area 2: User's flash memory area (The number of writing counts is limited to 50.)
- Area 3: User's RAM area same as Area 1. Due to battery backup, however, no sequence program will be cleared by power OFF and ON.
- \* The factory-setting is area 0, and the standard sequence is operating.
- The flash memory contents will not be cleared by power OFF and ON, but limitation is imposed on the writing counts (50 counts).
   <u>Completely debug a sequence program in area 1 (RAM), then transfer it to area</u> <u>2 (flash memory).</u>

#### 2.4 Change of Sequence Program Area

Changeover of working areas is performed by the user parameter. The sequence to be operated is changed over by changing the set value of [U11] I/O mode of the USER.PAR file to 0, 1, 2 or 3.

[U11] I/O mode (Setting of I/O operation mode)

#### [U11] I/O mode

```
{Default/User} (0: Default, 1: User RAM, 2: User FLASH 3: User backup RAM) = 0
```

In the TSL3000, I/Os specified in the program are processed for input or output. The storage location of this sequence program can be specified as shown below.

- Set value = 0 Standard sequence (Cannot be changed.)
  - = 1 User's RAM for debugging (User's created sequence area)
  - = 2 User's flash memory (User's created sequence area)
  - User's RAM for debugging (battery backup) (User's created sequence area)

#### 2.5 Procedures for Creating Sequence



#### Section 3 Inputs and Outputs

#### 3.1 Outline of Inputs and Outputs

The I/O common for the TSL3000 robot controller comes in the two (2) types; **Type N** which is compatible with that of the previous controller (SR7000) and **Type P** which is heteropolar. Either type can be selected at order entry. The extension I/O module is also provided with the two (2) types; TR48DIOCN (Type N) and TR48DIOC (Type P). Identify the type of your controller before reading this manual.

In the TSL3000, the input/output signals where sequence control is possible by the TCmini use the input and output ports shown below.



#### 3.2 External Input and Output (Type N)

The external input signals should be connected to connectors INPUT, OUTPUT, SYSTEM, and HAND on the rear side of the controller.

The external signals are assigned to I/O relays X000 ~ X02F, Y100 ~ Y12F of the TCmini, using an attached dummy connector. (For details, see Section 4 of this manual.) To connect them, use the dummy connector attached to the controller.



TSL3000 -	-	→ User side
	1	Y100(OUT1)
	14	Y101(OUT2)
	2	Y102(OUT3)
	15	Y103(OUT4)
	3	Y104(OUT5)
	16	Y105(OUT6)
Sink type ("-" common)	4	Y106(OUT7)
V100~V110	17	Y107(OUT8)
	5	P24V
	18	P24V
	6	Y108(OUT9)
<u>ک</u> د '	10	Y109(OUT10)
	7	Y10A(OUT11)
	20	Y10B(OUT12)
P24G	8	Y10C(OUT13)
	21	Y10D(OUT14)
Note 1: All of Y100~Y110 in the	0	Y10E(OUT15)
figure above are the	22	Y10F(OUT16)
transistor outputs.	10	P24V
	22	P24V
	11	Y110(OUT17)
	24	SVST A
	24	SVST B
	12	EMSST A
	20	EMSST B
	Case	<b></b>
/////		

Connector (OUTPUT)



#### Specifications of external input signals

Type of input:

Non-voltage contact input or transistor open collector input.

Example of application circuit and structure of input circuit:

Source type (plus common)



Contact (transistor) specifications:

Non-voltage contact specification		Transistor specification
Contact rating	24 VDC, 100 mA or over	Voltage between collector and emitter 30 V or over
Circuit current Minimum current	Approx. 7 mA 24 VDC, 1 mA	Current between collector and emitter 10 mA
Connected impedar	ice 100 Ω or less	Circuit current Approx. 7 mA Leak current between collector and emitter 100 µA

#### Specifications of external output signals

Type of output:

Transistor output

Example of application circuit and structure of output circuit:





• Electric rating:

Elect	ric rating	Caution
Rated voltage Rated current	24 VDC 100 mA (max.)	If the current which exceeds the rated output current is supplied, the output element may be damaged or the printed board may burn. To avoid this, be sure to use within the rated output current.

Type of connectors:

INPUT :	XM3A-3721 (Plug type connector) (OMRON)
:	XM2S-3711 (Connector cover) (OMRON)
OUTPUT :	XM3A-2521 (Plug type connector) (OMRON)
:	XM2S-2511 (Connector cover) (OMRON)
HAND(CN0):	XM3A-2521 (Plug type connector) (OMRON)
:	XM2S-2511 (Connector cover) (OMRON)

#### 3.3 External Input and Output (Type P)







#### Specifications of external input signals

Type of input:

Non-voltage contact input or transistor open collector input.

Example of application circuit and structure of input circuit:

Sink type (minus common)



• Contact (transistor) specifications:

Non-voltage contact specification		Transistor specification
Contact rating	24 VDC, 100 mA or over	Voltage between collector and emitter 30 V or over
Circuit current Minimum current	Approx. 7 mA 24 VDC. 1 mA	Current between collector and emitter 10 mA
Connected impedance		Circuit current Approx. 7 mA
	100 $\Omega$ or less	Leak current between collector and emitter 100 µA

## Type P



#### 3.4 Extension Input and Output (Option)

The TCmini can extend I/Os as necessary. TR48DIOCN and TR48DIOC are available as the exclusive I/O extension modules for the TSL3000. Also, our standard remote I/O module can be connected.

#### 3.4.1 Outline of TR48DIOCN/TR48DIOC

TR48DIOCN/TR48DIOC are exclusive I/O extension modules for the TSL3000, having 28 input signals and 20 output signals, respectively. In the TSL3000, up to two (2) stations can be extended, using TR48DIOCN/TR48DIOC modules. TR48DIOCN differs from TR48DIOC in the output specifications (source type/sink type).





#### 3.4.2 Connecting TR48DIOCN/TR48DIOC

The TR48DIOCN/TR48DIOC modules are connected as shown below.

When one (1) TR48DIOCN/TR48DIOC module is added:



When two (2) TR48DIOCN/TR48DIOC modules are added:



\* Connect an external power supply which can supply 24 V and 0 V power. At this time, the external power supply should be turned on prior to the TSL3000 power supply. (With the TSL3000 power ON, presence or absence of extension I/Os is judged.)
# 3.4.3 Setting of TR48DIOCN/TR48DIOC

Setting of station number and terminator For the TR48DIOCN/TR48DIOC module or modules connected, the station number and terminator should be specified.

• Setting of station number and terminator:

The switch (2 pins) located on the front top side of the TR48DIOCN/TR48DIOC module is used to indicate the slave station number setting (pin 1) and terminator setting (pin 2).



As shown in the figures above, set the station number for the TR48DIOCN/TR48DIOC module to the station number that is already set in the USER.PAR file.

For the terminator, when only one (1) TR48DIOCN/TR48DIOC module is used, set ON the terminator setting switch equipped on the module. When two (2) TR48DIOCN/TR48DIOC modules are used, see the figure in Para. 3.6.1 for example. As the TR48DIOCN/TR48DIOC module on the extreme right side as viewed from the controller front side is the terminal station in terms of cable wiring, set ON the terminator setting switch equipped on this module alone. Setting of user parameter:

To recognize an I/O extension module by the TCmini built in the TSL3000, setting of appropriate user parameter is necessary.

\* To designate the slave station number of the TSL3000, observe the following steps. Under [U12] of the USER.PAR (user parameter) file, you can find the following parameter setting related to the extension input and output.

[U12] Extend I/O setting {Use/Not Use} (0: Not Use, 1: Use) {Not Use} {Not Use}  $= 0 \quad 0 \quad 0 \rightarrow$  Corresponds to station 0.  $= 0 \quad 0 \quad 0 \rightarrow$  Corresponds to station 1.

If you wish to use only station 0 (i.e., one (1) TR48DIOCN module), for instance, change the underlined bit corresponding to station 0 to "1".

$$= \underline{1} \quad 0 \quad 0$$
$$= \underline{0} \quad 0 \quad 0$$

After saving the parameter file, turn off the controller power and on again. Then the above parameter becomes effective.

If you wish to use both stations 0 and 1 (i.e., two (2) TR48DIOCN modules), specify as follows and perform the same operation as above to make the parameter valid.

 $= \underline{1} \quad 0 \quad 0$  $= \underline{1} \quad 0 \quad 0$ 

# When using the TR48DIOCN/TR48DIOC module, careful precautions should be taken on the following matters.

- ① Make sure that the slave station number set in "USER.PAR" coincides with the station number setting of the TR48DIOCN/TR48DIOC module.
- When the TR48DIOCN/TR48DIOC module or modules are connected, set ON the terminator setting switch equipped on the TR48DIOCN/TR48DIOC module which is located on the extreme right side in terms of cable wiring when seen from the controller front side.

The switches (2 pins) provided on the front upper side of the TR48DIOC module represent pin 1 (upper) for slave station number setting and pin 2 (lower) for terminator setting.

Be sure to execute Items ① and ② above, irrespective of the presence or absence of external power supply. Otherwise, the system may not function normally or go wrong.

With the above setting, make sure that both the POWER and RUN LEDs on each TR48DIOCN/TR48DIOC module are illuminated.

# 3.4.4 TR48DIOCN Input and Output

#### Input circuit

TR48DIOCN input signals EI01 ~ EI28 (for station 0) and EI33 ~ EI60 (for station 1) should be connected to the INPUT connector on the front side of the module. The extension input signals thus connected are assigned to I/O relays X040 ~ X05B (for station 0) and X060 ~ X07B (for station 1) of the TCmini. (For details, see Section 4 of this manual.)



\* A bilateral photo coupler is used in the input circuit. The source type or sink type can be selected by means of INCOM\*. The source type is exemplified above.

# Specifications of TR48DIOCN input signals

Type of input:

Non-voltage contact input or transistor open collector input.

Example of application circuit and structure of input circuit:





Contact (transistor) specifications:

Non-voltage cont	act specification	Transistor sp	pecification			
Contact rating	24 VDC, 10 mA or over	Voltage between colle	ector and emitter 30 V or over			
Circuit current	Approx. 7 mA	Current between colle	ector and emitter			
Minimum current	24 VDC, 1 mA					
Connected impedance	e .	Circuit current	Approx. 7 mA			
	100 $\Omega$ or less	Leak current between collector and emitter 100 µA				

Type of connector:

XM3A–3721 (Plug type connector) OMRON XM2S–3711 (Connecter cover) OMRON

#### Output circuit

TR48DIOCN output signals EO01 ~ EO20 (for station 0) and EO33 ~ EO52 (for station 1) should be connected to the OUTPUT connector on the front side of the module. The extension output signals thus connected are assigned to I/O relays Y140 ~ Y153 (for station 0) and Y160 ~ Y173 (for station 1) of the TCmini. (For details, see Section 4 of this manual.)



#### Specifications of TR48DIOCN output signals

Type of output: Transistor output

Example of application circuit and structure of output circuit:





• Electric rating:

Ele	ectric rating	Caution
Rated voltage	24 VDC	If the current which exceeds the rated
Rated current	100 mA (max.)	element may be damaged or the printed board may burn. To avoid this, be sure to use within the rated output current.

Type of connector:

Pin type connector:	XM2A–2501 made by OMRON
Connector cover:	XM2S–2511 made by OMRON

# 3.4.5 TR48DIOC Input and Output

# Input circuit

TR48DIOC input signals EI01 ~ EI28 (for station 0) and EI33 ~ EI60 (for station 1) should be connected to the INPUT connector on the front side of the module. The extension input signals thus connected are assigned to I/O relays X040 ~ X05B (for station 0) and X060 ~ X07B (for station 1) of the TCmini. (For details, see Section 4 of this manual.)



#### Specifications of TR48DIOC input signals

The **input specifications of TR48DIOC** are the same as those of TR48DIOCN. For details, see the input specifications in Para. **3.8.4**.

#### Output circuit

TR48DIOC output signals EO01 ~ EO20 (for station 0) and EO33 ~ EO52 (for station 1) should be connected to the OUTPUT connector on the front side of the module. The extension output signals thus connected are assigned to I/O relays Y140 ~ Y153 (for station 0) and Y160 ~ Y173 (for station 1) of the TCmini. (For details, see Section 4 of this manual.)





# 3.4.6 Remote I/O Module

In addition to the TR48DIOC modules, the TCmini built in the TSL3000 can also connect our standard remote I/O modules which are shown in the table below.

Construction	Туре	Input spec.	No. of inputs	Output spec.	No. of outputs	Remarks
Unit	TR48DIOCN	DC24	28	DC24	20	Exclusively used for the robot. Internal power supply.
Unit	TR48DIOC	DC24	28	DC24	20	Exclusively used for the robot. Internal power supply.
Printed board	TR64DIRYC	DC24	32	Relay	32	I/O external power supply
Printed board	TR32DIRYC	DC24	16	Relay	16	
Printed board	TR32DIDOPC	DC24	16	DC24	16	"+" common
Printed board	TR32DIDONC	DC24	16	DC24	16	"–" common
Terminal block	TR16DIC	DC24	16		0	Slave station
Terminal block	TR16DIE	DC24	16		0	Extension
Terminal block	TR16DOPC		0	DC24	16	Slave station, "+" common
Terminal block	TR16DOPE		0	DC24	16	Extension, "+" common
Terminal block	TR16DONC		0	DC24	16	Slave station, "–" common
Terminal block	TR16DONE		0	DC24	16	Extension, "–" common
Terminal block	TR16AOC		0	AC100	16	Slave station
Terminal block	TR16AOE		0	AC100	16	Extension
Terminal block	TR16RYC		0	Relay	16	Slave station
Terminal block	TR16RYE		0	Relay	16	Extension



Conditions for selecting remote I/O module:

- Up to two (2) remote I/O modules can be connected.
  Alphabet "C" at the end of the type signifies the slave station, and a total of two (2) modules of this type can be connected.
- <sup>(2)</sup> The number of inputs and outputs per station is 0 ~ 32 each.
- ③ One (1) printed board serves as one (1) station.
- ④ For the terminal block type module, up to three (3) TR16\*\*E modules can be combined with a TR16\*\*C module serving as the slave station. Be sure to observe the restrictions in Item ②, however.

# 3.5 Field Bus Input and Output (Option)

Input and output signals of the field bus slave function (option) can also be controlled from the TCmini.

For details on how to connect to the fieldbus, see the Fieldbus Slave Operation Manual.

<u> </u>																
Bit	F	E	D	С	В	А	9	8	7	6	5	4	3	2	1	0
X20W	FI16	FI15	FI14	FI13	FI12	FI11	FI10	FI9	FI8	FI7	FI6	FI5	FI4	FI3	FI2	FI1
X21W	FI32	FI31	FI30	FI29	FI28	FI27	FI26	FI25	FI24	FI23	FI22	FI21	FI20	FI19	FI18	FI17
X22W	FI48	FI47	FI46	FI45	FI44	FI43	FI42	FI41	FI40	FI39	FI38	FI37	FI36	FI35	FI34	FI33
X23W	FI64	FI63	FI62	FI61	FI60	FI59	FI58	EI57	FI56	FI55	FI54	FI53	FI52	FI51	FI50	FI49
X24W	FI80	FI79	FI78	FI77	FI76	FI75	FI74	FI73	FI72	FI71	FI70	FI69	FI68	FI67	FI66	FI65
X25W	FI96	FI95	FI94	FI93	FI92	FI91	FI90	FI89	FI88	FI87	FI86	FI85	FI84	FI83	FI82	FI81
X26W	FI112	FI111	FI110	FI109	FI108	FI107	FI106	FI105	FI104	FI103	FI102	FI101	FI100	FI99	FI98	FI97
X27W	FI128	FI127	FI126	FI125	FI124	FI123	FI122	FI121	FI120	FI119	FI118	FI117	FI116	FI115	FI114	FI113

Input signals (128) from the field bus are assigned	ed to	to X200	) ~ X27F.
---	-------	---------	-----------

Output signals (128) to the field bus are assigned to Y300 ~ Y37F.

Bit	F	E	D	С	В	А	9	8	7	6	5	4	3	2	1	0
Y30W	FO16	FO15	FO14	FO13	FO12	FO11	FO10	FO9	FO8	FO7	FO6	FO5	FO4	FO3	FO2	FO1
Y31W	FO32	FO31	FO30	FO29	FO28	FO27	FO26	FO25	FO24	FO23	FO22	FO21	FO20	FO19	FO18	FO17
Y32W	FO48	FO47	FO46	FO45	FO44	FO43	FO42	FO41	FO40	FO39	FO38	FO37	FO36	FO35	FO34	FO33
Y33W	FO64	FO63	FO62	FO61	FO60	FO59	FO58	FO57	FO56	FO55	FO54	FO53	FO52	FO51	FO50	FO49
Y34W	F080	F079	F078	F077	F076	F075	F074	F073	F072	F071	F070	FO69	FO68	FO67	FO66	FO65
Y35W	FO96	FO95	FO94	FO93	FO92	FO91	FO90	FO89	F088	F087	F086	F085	F084	F083	F082	FO81
Y36W	FO112	FO111	FO110	FO109	FO108	FO107	FO106	FO105	FO104	FO103	FO102	FO101	FO100	FO99	FO98	FO97
Y37W	FO128	FO127	FO126	FO125	FO124	FO123	FO122	FO121	FO120	FO119	FO118	FO117	FO116	FO115	FO114	FO113

Data input (CC-Link→TCmini) \*CCLink only

Register	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0
D70*	FB	FB	FB	FB	FB	FB	FB	FB	FB	FB						
D70"	Rvvr 16	Rvvr 15	Rvvr 14	Rvvr 13	Rvvr 12	Rvvr 11	Rvvr 10	Rvvr 9	Rvvr 8	Rvvr 7	Rvvr 6	Rvvr 5	Rvvr 4	Rvvr 3	Rvvr 2	Rvvr 1
D71*		•	•									•	•			
D72*				Reserv	ed area											
D73*																

#### Data output (TCmini CC→Link) \*CCLink only

					/				<u> </u>							
Register	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0
D74*	FB RWw															
	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
D75*																
D76*				Reserv	ed area											
D77*																

FI1 ~ FI128



\*This function supports CC-Link only.

#### Section 4 Relays

#### 4.1 Input/Output Relays

Inputs to and outputs from the TCmini are assigned to X relays (X000 ~ X07F, X200 ~ X27F) and Y relays (Y100 ~ Y17F, Y300 ~ Y30F), respectively.

Bit	F	E	D	С	В	А	9	8	7	6	5	4	3	2	1	0
X00W	IN16	IN15	IN14	IN13	IN12	IN11	IN10	IN9	IN8	IN7	IN6	IN5	IN4	IN3	IN2	IN1
X01W	IN32	IN31	IN30	IN29	IN28	IN27	IN26	IN25	IN24	IN23	IN22	IN21	IN20	IN19	IN18	IN17
X02W	IN48	IN47	IN46	IN45	IN44	IN43	IN42	IN41	IN40	IN39	IN38	IN37	IN36	IN35	UFI2	UFI1
X03W	HI8	HI7	HI6	HI5	HI4	HI3	HI2	HI1	LI8	LI7	LI6	LI5	LI4	LI3	LI2	LI1
X04W	EI16	EI15	EI14	EI13	El12	EI11	EI10	El9	El8	EI7	El6	EI5	El4	EI3	El2	EI1
X05W	EI32	El31	EI30	EI29	El28	El27	EI26	EI25	EI24	EI23	EI22	El21	EI20	EI19	EI18	EI17
X06W	EI48	EI47	EI46	EI45	EI44	EI43	EI42	EI41	EI40	EI39	EI38	EI37	EI36	EI35	EI34	EI33
X07W	EI64	EI63	El62	El61	EI60	EI59	EI58	EI57	EI56	EI55	EI54	EI53	EI52	EI51	EI50	EI49
Y10W	OUT	OUT	OUT	OUT	OUT	OUT1	OUT									
Y11W	OUT3	OUT3	OUT3	OUT2	OUT1	OUT1	OUT1									
Y12W	OUT4	OUT3	OUT3	OUT3	OUT3	OUT3	UFO	UFO								
Y13W	HO8	HO7	HO6	HO5	HO4	HO3	HO2	HO1								
Y14W	EO16	EO15	EO14	EO13	EO12	EO11	EO10	EO9	EO8	EO7	EO6	EO5	EO4	EO3	EO2	EO1
Y15W	EO32	EO31	EO30	EO29	EO28	EO27	EO26	EO25	EO24	EO23	EO22	EO21	EO20	EO19	EO18	EO17
Y16W	EO48	EO47	EO46	EO45	EO44	EO43	EO42	EO41	EO40	EO39	EO38	EO37	EO36	EO35	EO34	EO33
Y17W	EO64	EO63	EO62	EO61	EO60	EO59	EO58	EO57	EO56	EO55	EO54	EO53	EO52	EO51	EO50	EO49
X20W	FI16	FI15	FI14	FI13	FI12	FI11	FI10	FI9	FI8	FI7	FI6	FI5	FI4	FI3	FI2	FI1
X21W	FI32	FI31	FI30	FI29	FI28	FI27	FI26	FI25	FI24	FI23	FI22	FI21	FI20	FI19	FI18	FI17
X22W	FI48	FI47	FI46	FI45	FI44	FI43	FI42	FI41	FI40	FI39	FI38	FI37	FI36	FI35	FI34	FI33
X23W	FI64	FI63	FI62	FI61	FI60	FI59	FI58	FI57	FI56	FI55	FI54	FI53	FI52	FI51	FI50	FI49
X24W	FI80	FI79	FI78	FI77	FI76	FI75	FI74	FI73	FI72	FI71	FI70	FI69	FI68	FI67	FI66	FI65
X25W	FI96	FI95	FI94	FI93	FI92	FI91	FI90	FI89	FI88	FI87	FI86	FI85	FI84	FI83	FI82	FI81
X26W	FI112	FI111	FI110	FI109	FI108	FI107	FI106	FI105	FI104	FI103	FI102	FI101	FI100	FI99	FI98	FI97
X27W	FI128	FI127	FI126	FI125	FI124	FI123	FI122	FI121	FI120	FI119	FI118	FI117	FI116	FI115	FI114	FI113
Y30W	FO16	FO15	FO14	FO13	FO12	FO11	FO10	FO9	FO8	FO7	FO6	FO5	FO4	FO3	FO2	FO1
Y31W	FO32	FO31	FO30	FO29	FO28	FO27	FO26	FO25	FO24	FO23	FO22	FO21	FO20	FO19	FO18	FO17
Y32W	FO48	FO47	FO46	FO45	FO44	FO43	FO42	FO41	FO40	FO39	FO38	FO37	FO36	FO35	FO34	FO33
Y33W	FO64	FO63	FO62	FO61	FO60	FO59	FO58	FO57	FO56	FO55	FO54	FO53	FO52	FO51	FO50	FO49
Y34W	FO80	F079	F078	F077	F076	F075	F074	F073	F072	F071	FO70	FO69	FO68	FO67	FO66	FO65
Y35W	FO96	FO95	FO94	FO93	FO92	FO91	FO90	F089	F088	F087	FO86	F085	FO84	FO83	F082	FO81
Y36W	FO112	FO111	FO110	FO109	FO108	FO107	FO106	FO105	FO104	FO103	FO102	FO101	FO100	FO99	F098	FO97
Y37W	FO128	FO127	FO126	FO125	FO124	FO123	FO122	FO121	FO120	FO119	FO118	FO117	FO116	FO115	FO114	FO113
Register	F	E	D	С	В	Α	9	8	7	6	5	4	3	2	1	0

X***	Represents an exclusive input relay which is connected to the standard
	input, panel input, hand input or extension input signal.
	The ON or OFF status is read at I/O processing in each scanning cycle.
	It can be used as the contact input information and data register source in
	the sequence program.
Y***	Signifies an exclusive output relay which is connected to the standard
	output, panel output, hand output or extension output signal.
	It serves as the destination of coil and data register in the sequence
	program, where operation result is written.
	The operation result can be used as the source of contact and data register
	in the sequence program.
	The operation result is transferred as the ON/OFF information to the output
	device at I/O processing in each scanning cycle.
	Relays reserved for future extension of the system functions. Values are
	undecided and cannot be used.

For further information on the input and output specifications, see Section 3.

# 4.2 Internal Relay

A total of 1024 relays (R000 ~ R7F) can be used as the internal relay.

Bit	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
R00W	R00F															R000
R01W																
R02W																
R03W																
R04W																
R05W																
R06W																
R07W																
R10W	R10F															R100
R11W																
R12W																
R13W																
R14W																
R15W																
R16W																
R17W																
R20W	R20F															R200
R21W																
R22W																
R23W																
R24W																
R25W																
R26W																
R27W																
R30W	R30F															R300
R31W																
R32W																
R33W																
R34W																
R35W																
R36W																
R37W																
R40W	R40F															R400
R41W																
R42W																
R43W																
R44W																
R45W																
R46W																
R47W																

R50W	R50F															R500
R51W																
R52W																
R53W																
R54W																
R55W																
R56W																
R57W																
R60W	R60F															R600
R61W																
R62W																
R63W																
R64W																
R65W																
R66W																
R67W																
R70W	R70F															R700
R71W																
R72W																
R73W																
R74W																
R75W																
R76W																
R77W																
Register	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0

R000 ~ R77F:

Serve as the destination of coil and data register in the user program, where operation result is written.

They can be used as a temporary storage of operation result which need not be output to the external device.

The operation result can be used as the source of contact and data register in the user program.

## 4.3 Interface Relay

The interface relay serves as the interface area for transferring signals with the main unit of the robot controller.

For details, see Section 6 of this manual.

Bit	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0
C00W/	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
GUUW	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
G01W	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
00111	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
G02W	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
G03W	DIN 64	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN			DIN	DIN	DIN	DIN	DIN 40
	64 DIN	63	62 DIN	61	60	59	58	57	50	55	54	53	52	51	50	49
G04W	DIN			DIN	DIN		DIN	DIN 100	DIN		DIN 100		DIN	DIN 102	DIN 102	DIN 101
G05W	132	131	130	129	128	127	126	125	124	123	122	121	120	110	118	117
	DIN			DIN	DIN			DIN		DIN	DIN					
G06W	148	147	146	145	144	143	142	141	140	139	138	137	136	135	134	133
	DIN	DIN		DIN	DIN	DIN		DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
G07W	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149
	DATA				DCONV	IMIT	MIT	OFS	HAND	HAND	HAND	HAND	HAND	HAND	HAND	HAND
G10W	_TRIG				TRIG	OFF	RST	MOD	IN8	IN7	IN6	IN5	IN4	IN3	IN2	IN1
044144	AL8-	AL8-	AL8-	AL8-	AL4-	AL4-	AL4-	AL4-	AL1-	AL1-	AL1-	AL1-	AL1-	AL1-	AL1-	AL1-
G11W	272	271	270	269	080	079	078	077	044	043	042	041	040	039	038	037
G12W					J_ MOV E	J_DI RECT		J_A	XIS		J_CC	ORD	J_SF	PEED	J_RE	МОТЕ
						-										
G13W			BZ_ RST	SV OFF	BREAK	LOW_ SPD	CYCLE	STOP	EX_ SVON	RUN	ALM RST	DO RST	CYC RST	STEP RST	PRG_ RST	STROBE
G13W G14W			BZ_ RST	SV OFF	BREAK	LOW_ SPD	CYCLE	STOP	EX_ SVON	RUN	ALM _RST	DO _RST	CYC _RST	STEP _RST	PRG_ RST	STROBE
G13W G14W ~			BZ_ RST	SV OFF Reserv	BREAK ed area	LOW_ SPD	CYCLE	STOP	EX_ SVON	RUN	ALM _RST	DO _RST	CYC _RST	STEP _RST	PRG_ RST	STROBE
G13W G14W ~ G16W			BZ_ RST	SV OFF Reserv	BREAK ed area	LOW_ SPD	CYCLE	STOP	EX_ SVON	RUN	ALM _RST	DO _RST	CYC _RST	STEP _RST	PRG_ RST	STROBE
G13W G14W ~ G16W	PANEL	PANEL	BZ_ RST	SV OFF Reserv PANEL	BREAK ed area	LOW_ SPD	CYCLE	STOP	EX_ SVON	RUN	ALM _RST	DO _RST	CYC _RST	STEP _RST	PRG_ RST	STROBE
G13W G14W ~ G16W G17W	PANEL BREAK	PANEL RUN	BZ_ RST PANEL SV	SV OFF Reserv PANEL EX_ SVON	BREAK ed area	LOW_ SPD	CYCLE PANEL PRG_ PST	STOP PANEL ALM PST	EX_ SVON	RUN	ALM _RST	DO _RST	CYC _RST	STEP _RST	PRG_ RST	STROBE
G13W G14W <u>~</u> G16W G17W	PANEL BREAK	PANEL RUN	BZ_ RST PANEL SV OFF	SV OFF Reserv PANEL EX_ SVON	BREAK ed area	LOW_ SPD PANEL DO _RST	CYCLE PANEL PRG_ RST	PANEL ALM _RST	EX_ SVON	RUN	ALM _RST	DO _RST	CYC _RST	STEP _RST	PRG_ RST	STROBE
G13W G14W G16W G17W G20W	PANEL BREAK DIN 316	PANEL RUN DIN 315	BZ_ RST PANEL SV OFF DIN 314	SV OFF Reserv PANEL EX_ SVON DIN 313	BREAK ed area DIN 312	PANEL DO _RST DIN 311	PANEL PRG_ RST DIN 310	PANEL ALM _RST DIN 309	EX_ SVON	RUN DIN 307	ALM _RST DIN 306	DO _RST DIN 305	CYC _RST DIN 304	DIN	PRG_ RST DIN 302	STROBE
G13W G14W G16W G17W G20W	PANEL BREAK DIN 316 DIN	PANEL RUN DIN 315 DIN	BZ_ RST PANEL SV OFF DIN 314 DIN	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN	BREAK ed area DIN 312 DIN	PANEL DO _RST DIN 311 DIN	PANEL PRG_ RST DIN 310 DIN	PANEL ALM _RST DIN 309 DIN	EX_ SVON DIN 308 DIN	RUN DIN 307 DIN	ALM _RST DIN 306 DIN	DO _RST DIN 305 DIN	CYC _RST DIN 304 DIN	STEP _RST DIN 303 DIN	PRG_ RST DIN 302 DIN	STROBE DIN 301 DIN
G13W G14W G16W G17W G20W G21W	PANEL BREAK DIN 316 DIN 332	PANEL RUN DIN 315 DIN 331	BZ_ RST PANEL SV OFF DIN 314 DIN 330	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329	BREAK ed area DIN 312 DIN 328	PANEL DO _RST DIN 311 DIN 327	CYCLE PANEL PRG_ RST DIN 310 DIN 326	PANEL ALM _RST DIN 309 DIN 325	EX_ SVON DIN 308 DIN 324	RUN DIN 307 DIN 323	ALM _RST DIN 306 DIN 322	DO _RST DIN 305 DIN 321	CYC _RST DIN 304 DIN 320	STEP _RST DIN 303 DIN 319	PRG_ RST DIN 302 DIN 318	DIN 301 JIN 317
G13W G14W G16W G17W G20W G21W	PANEL BREAK DIN 316 DIN 332 DIN	PANEL RUN 315 DIN 331 DIN	BZ_ RST PANEL SV OFF DIN 314 DIN 330 DIN	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN	BREAK ed area DIN 312 DIN 328 DIN	LOW_ SPD PANEL DO _RST DIN 311 DIN 327 DIN	PANEL PRG_ RST DIN 310 DIN 326 DIN	PANEL ALM _RST DIN 309 DIN 325 DIN	EX_ SVON DIN 308 DIN 324 DIN	RUN DIN 307 DIN 323 DIN	ALM _RST DIN 306 DIN 322 DIN	DO _RST DIN 305 DIN 321 DIN	CYC _RST DIN 304 DIN 320 DIN	STEP _RST DIN 303 DIN 319 DIN	PRG_ RST DIN 302 DIN 318 DIN	STROBE DIN 301 DIN 317 DIN
G13W G14W G16W G17W G20W G21W G22W	PANEL BREAK DIN 316 DIN 332 DIN 348	PANEL RUN 315 DIN 331 DIN 347	BZ_RST PANEL SV OFF DIN 314 DIN 330 DIN 346	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN 345	BREAK ed area DIN 312 DIN 328 DIN 344	LOW_ SPD PANEL DO _RST DIN 311 DIN 327 DIN 343	PANEL PRG_ RST DIN 310 DIN 326 DIN 342	PANEL ALM _RST DIN 309 DIN 325 DIN 341	EX_ SVON DIN 308 DIN 324 DIN 340	RUN DIN 307 DIN 323 DIN 339	ALM _RST DIN 306 DIN 322 DIN 338	DO _RST DIN 305 DIN 321 DIN 337	CYC _RST DIN 304 DIN 320 DIN 336	STEP _RST DIN 303 DIN 319 DIN 335	PRG_ RST DIN 302 DIN 318 DIN 334	STROBE DIN 301 DIN 317 DIN 333
G13W G14W G16W G17W G20W G21W G22W	PANEL BREAK DIN 316 DIN 332 DIN 348 DIN	PANEL RUN DIN 315 DIN 331 DIN 347 DIN	BZ_RST PANEL SV OFF DIN 314 DIN 330 DIN 346 DIN	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN 345 DIN	BREAK ed area DIN 312 DIN 328 DIN 344 DIN	PANEL DO _RST DIN 311 DIN 327 DIN 343 DIN	CYCLE PANEL PRG_ RST DIN 310 DIN 326 DIN 342 DIN	PANEL ALM _RST DIN 309 DIN 325 DIN 341 DIN	EX_ SVON DIN 308 DIN 324 DIN 340 DIN	RUN DIN 307 DIN 323 DIN 339 DIN	ALM _RST DIN 306 DIN 322 DIN 338 DIN	DO _RST DIN 305 DIN 321 DIN 337 DIN	CYC _RST DIN 304 DIN 320 DIN 336 DIN	STEP _RST DIN 303 DIN 319 DIN 335 DIN	PRG_ RST DIN 302 DIN 318 DIN 334 DIN	STROBE DIN 301 DIN 317 DIN 333 DIN
G13W G14W G16W G17W G20W G21W G22W G23W	PANEL BREAK DIN 316 DIN 332 DIN 348 DIN 364	PANEL RUN DIN 315 DIN 331 DIN 347 DIN 363	BZ_RST PANEL SV OFF DIN 314 DIN 330 DIN 346 DIN 362	SV OFF Reserv PANEL EX_ SVON JIN 313 DIN 329 DIN 345 DIN 361	BREAK ed area DIN 312 DIN 328 DIN 344 DIN 360	LOW_ SPD PANEL DO _RST DIN 311 DIN 327 DIN 343 DIN 359	CYCLE PANEL PRG_ RST DIN 310 DIN 326 DIN 342 DIN 358	PANEL ALM _RST DIN 309 DIN 325 DIN 341 DIN 357	EX_SVON DIN 308 DIN 324 DIN 340 DIN 356	RUN DIN 307 DIN 323 DIN 339 DIN 355	ALM _RST DIN 306 DIN 322 DIN 338 DIN 354	DO _RST DIN 305 DIN 321 DIN 337 DIN 353	CYC _RST DIN 304 DIN 320 DIN 336 DIN 352	STEP _RST DIN 303 DIN 319 DIN 335 DIN 351	PRG_ RST DIN 302 DIN 318 DIN 334 DIN 350	STROBE DIN 301 DIN 317 DIN 333 DIN 349
G13W G14W G16W G17W G20W G21W G22W G23W	PANEL BREAK DIN 316 DIN 332 DIN 348 DIN 364 DIN	PANEL RUN DIN 315 DIN 331 DIN 347 DIN 363 DIN	BZ_RST PANEL SV OFF DIN 314 DIN 346 DIN 362 DIN	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN 345 DIN 361 DIN	BREAK ed area DIN 312 DIN 328 DIN 344 DIN 360 DIN	LOW_ SPD PANEL DO _RST DIN 311 DIN 327 DIN 343 DIN 359 DIN	CYCLE PANEL PRG_ RST DIN 310 DIN 326 DIN 342 DIN 358 DIN	PANEL ALM _RST DIN 309 DIN 325 DIN 341 DIN 357 DIN	EX_ SVON DIN 308 DIN 324 DIN 340 DIN 356 DIN	RUN DIN 307 DIN 323 DIN 339 DIN 355 DIN	ALM _RST DIN 306 DIN 322 DIN 338 DIN 354 DIN	DO _RST DIN 305 DIN 321 DIN 337 DIN 353 DIN	CYC _RST DIN 304 DIN 320 DIN 336 DIN 352 DIN	STEP _RST DIN 303 DIN 319 DIN 335 DIN 351 DIN	PRG_ RST DIN 302 DIN 318 DIN 334 DIN 350 DIN	STROBE DIN 301 DIN 317 DIN 333 DIN 349 DIN
G13W G14W G16W G17W G20W G21W G22W G23W G24W	PANEL BREAK DIN 316 DIN 332 DIN 348 DIN 364 DIN 416	PANEL RUN DIN 315 DIN 331 DIN 347 DIN 363 DIN 415	BZ_RST PANEL SV OFF DIN 314 DIN 346 DIN 346 DIN 362 DIN 414	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN 345 DIN 361 DIN 413	BREAK ed area DIN 312 DIN 328 DIN 344 DIN 360 DIN 412	LOW_SPD PANEL DO_RST DIN 311 DIN 327 DIN 343 DIN 359 DIN 411	CYCLE PANEL PRG_ RST DIN 310 DIN 326 DIN 342 DIN 358 DIN 410	STOP PANEL ALM _RST DIN 309 DIN 325 DIN 341 DIN 357 DIN 409	EX_ SVON DIN 308 DIN 324 DIN 340 DIN 356 DIN 408	RUN DIN 307 DIN 323 DIN 339 DIN 355 DIN 407	ALM _RST DIN 306 DIN 322 DIN 338 DIN 354 DIN 406	DO _RST DIN 305 DIN 321 DIN 337 DIN 353 DIN 405	CYC _RST DIN 304 DIN 320 DIN 336 DIN 352 DIN 404	STEP _RST DIN 303 DIN 319 DIN 335 DIN 351 DIN 403	PRG_ RST DIN 302 DIN 318 DIN 334 DIN 350 DIN 402	STROBE DIN 301 DIN 317 DIN 333 DIN 349 DIN 401
G13W G14W G16W G17W G20W G21W G22W G23W G24W	PANEL BREAK DIN 316 DIN 332 DIN 348 DIN 364 DIN 416 DIN	PANEL RUN DIN 315 DIN 331 DIN 347 DIN 363 DIN 415 DIN	BZ_RST PANEL SV OFF DIN 314 DIN 346 DIN 346 DIN 362 DIN 414 DIN	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN 345 DIN 361 DIN 413 DIN	BREAK ed area DIN 312 DIN 328 DIN 344 DIN 360 DIN 412 DIN	LOW_SPD PANEL DO_RST DIN 311 DIN 327 DIN 343 DIN 359 DIN 411 DIN	CYCLE PANEL PRG_ RST DIN 310 DIN 326 DIN 342 DIN 358 DIN 410 DIN	STOP PANEL ALM _RST DIN 309 DIN 325 DIN 341 DIN 357 DIN 409 DIN	EX_SVON DIN 308 DIN 324 DIN 340 DIN 356 DIN 408 DIN	RUN DIN 307 DIN 323 DIN 339 DIN 355 DIN 407 DIN	ALM _RST DIN 306 DIN 322 DIN 338 DIN 354 DIN 406 DIN	DO _RST DIN 305 DIN 321 DIN 337 DIN 353 DIN 405 DIN	CYC _RST DIN 304 DIN 320 DIN 336 DIN 352 DIN 404 DIN	STEP _RST DIN 303 DIN 319 DIN 335 DIN 351 DIN 403 DIN	PRG_ RST DIN 302 DIN 318 DIN 334 DIN 350 DIN 402 DIN	STROBE DIN 301 DIN 317 DIN 333 DIN 349 DIN 401 DIN
G13W G14W G16W G17W G20W G21W G22W G23W G23W G24W	PANEL BREAK DIN 316 DIN 332 DIN 348 DIN 364 DIN 416 DIN 432	PANEL RUN 315 DIN 331 DIN 347 DIN 363 DIN 415 DIN 431	BZ_      RST        PANEL      SV        OFF      DIN        314      DIN        330      DIN        346      DIN        362      DIN        DIN      362        DIN      343	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN 345 DIN 361 DIN 413 DIN 429	BREAK ed area DIN 312 DIN 328 DIN 344 DIN 360 DIN 412 DIN 428	PANEL DO _RST DIN 311 DIN 327 DIN 343 DIN 343 DIN 411 DIN 427	CYCLE PANEL PRG_ RST DIN 310 DIN 326 DIN 342 DIN 358 DIN 410 DIN 426	STOP PANEL ALM _RST DIN 309 DIN 325 DIN 341 DIN 357 DIN 409 DIN 425	EX_ SVON DIN 308 DIN 324 DIN 340 DIN 356 DIN 408 DIN 424	RUN DIN 307 DIN 323 DIN 339 DIN 355 DIN 407 DIN 423	ALM _RST DIN 306 DIN 322 DIN 328 DIN 354 DIN 406 DIN 422	DO _RST DIN 305 DIN 321 DIN 327 DIN 353 DIN 405 DIN 421	CYC _RST DIN 304 DIN 320 DIN 336 DIN 352 DIN 404 DIN 420	STEP _RST DIN 303 DIN 319 DIN 351 DIN 403 DIN 403 DIN 419	PRG_ RST DIN 302 DIN 318 DIN 334 DIN 350 DIN 402 DIN 418	STROBE DIN 301 DIN 317 DIN 333 DIN 349 DIN 401 DIN 401
G13W G14W G16W G17W G20W G21W G22W G22W G23W G24W G25W	PANEL BREAK DIN 316 DIN 332 DIN 348 DIN 364 DIN 416 DIN 416 DIN 432 DIN	PANEL RUN 315 DIN 331 DIN 347 DIN 347 DIN 363 DIN 415 DIN 431 DIN	BZ_ RST        PANEL SV OFF        DIN        314        DIN        346        DIN        362        DIN        362        DIN        346        DIN        340        DIN        340        DIN        340        DIN        340	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN 345 DIN 361 DIN 413 DIN 413 DIN 429 DIN	BREAK ed area DIN 312 DIN 328 DIN 344 DIN 344 DIN 412 DIN 412 DIN 428 DIN	PANEL DO _RST DIN 311 DIN 327 DIN 343 DIN 343 DIN 411 DIN 411 DIN 427 DIN	CYCLE PANEL PRG_ RST DIN 310 DIN 326 DIN 342 DIN 342 DIN 358 DIN 410 DIN 426 DIN	STOP PANEL ALM _RST DIN 309 DIN 325 DIN 341 DIN 341 DIN 409 DIN 425 DIN	EX_ SVON DIN 308 DIN 324 DIN 340 DIN 350 DIN 408 DIN 424 DIN	RUN DIN 307 DIN 323 DIN 339 DIN 355 DIN 407 DIN 423 DIN	ALM _RST DIN 306 DIN 322 DIN 338 DIN 354 DIN 406 DIN 422 DIN	DO _RST DIN 305 DIN 321 DIN 337 DIN 353 DIN 405 DIN 421 DIN	CYC _RST DIN 304 DIN 320 DIN 336 DIN 336 DIN 404 DIN 404 DIN 420 DIN	STEP _RST DIN 303 DIN 319 DIN 335 DIN 403 DIN 403 DIN 419 DIN	PRG_ RST DIN 302 DIN 318 DIN 334 DIN 350 DIN 402 DIN 418 DIN	STROBE DIN 301 DIN 317 DIN 333 DIN 401 DIN 401 DIN 417 DIN
G13W G14W G16W G17W G20W G21W G22W G22W G23W G24W G25W G26W	PANEL BREAK DIN 316 DIN 332 DIN 348 DIN 348 DIN 416 DIN 416 DIN 432 DIN 448	PANEL RUN 315 DIN 331 DIN 347 DIN 363 DIN 415 DIN 431 DIN 431 DIN 447	BZ_        RST        PANEL        SV        OFF        DIN        314        DIN        346        DIN        362        DIN        414        DIN        430        DIN        446	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN 345 DIN 361 DIN 413 DIN 413 DIN 429 DIN 445	BREAK ed area DIN 312 DIN 328 DIN 344 DIN 344 DIN 412 DIN 412 DIN 428 DIN 444	PANEL DO _RST DIN 311 DIN 327 DIN 343 DIN 343 DIN 411 DIN 411 DIN 427 DIN 443	CYCLE PANEL PRG_ RST DIN 310 DIN 326 DIN 342 DIN 342 DIN 410 DIN 426 DIN 442	PANEL ALM _RST DIN 309 DIN 325 DIN 341 DIN 341 DIN 409 DIN 425 DIN 441	EX_ SVON DIN 308 DIN 324 DIN 340 DIN 350 DIN 408 DIN 408 DIN 424 DIN 440	RUN DIN 307 DIN 323 DIN 339 DIN 355 DIN 407 DIN 423 DIN 423 DIN 439	ALM _RST DIN 306 DIN 322 DIN 338 DIN 354 DIN 406 DIN 422 DIN 438	DO _RST DIN 305 DIN 321 DIN 337 DIN 405 DIN 405 DIN 421 DIN 437	CYC _RST DIN 304 DIN 320 DIN 336 DIN 336 DIN 404 DIN 404 DIN 420 DIN 436	STEP _RST DIN 303 DIN 319 DIN 335 DIN 403 DIN 403 DIN 403 DIN 419 DIN 435	PRG_ RST DIN 302 DIN 318 DIN 334 DIN 334 DIN 402 DIN 402 DIN 418 DIN 434	STROBE DIN 301 DIN 317 DIN 333 DIN 349 DIN 401 DIN 417 DIN 433
G13W G14W G16W G17W G20W G21W G22W G22W G23W G24W G25W G26W	PANEL BREAK DIN 316 DIN 332 DIN 348 DIN 348 DIN 416 DIN 416 DIN 432 DIN 448 DIN	PANEL RUN 315 DIN 331 DIN 347 DIN 347 DIN 415 DIN 431 DIN 431 DIN 447 DIN	BZ_        RST        PANEL        SV        OFF        DIN        314        DIN        346        DIN        362        DIN        414        DIN        430        DIN        446	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN 345 DIN 361 DIN 413 DIN 413 DIN 445 DIN	BREAK ed area DIN 312 DIN 328 DIN 344 DIN 344 DIN 412 DIN 412 DIN 412 DIN 412 DIN 412 DIN	PANEL DO _RST DIN 311 DIN 327 DIN 343 DIN 343 DIN 411 DIN 427 DIN 443 DIN	CYCLE PANEL PRG_ RST DIN 310 DIN 326 DIN 342 DIN 342 DIN 410 DIN 426 DIN 422 DIN 442 DIN	STOP PANEL ALM _RST DIN 309 DIN 325 DIN 341 DIN 341 DIN 409 DIN 425 DIN 425 DIN 441 DIN	EX_ SVON DIN 308 DIN 324 DIN 340 DIN 350 DIN 408 DIN 408 DIN 424 DIN 440 DIN	RUN DIN 307 DIN 323 DIN 339 DIN 355 DIN 407 DIN 423 DIN 439 DIN	ALM _RST DIN 306 DIN 322 DIN 338 DIN 406 DIN 422 DIN 438 DIN 438 DIN	DO _RST DIN 305 DIN 321 DIN 337 DIN 405 DIN 405 DIN 421 DIN 437 DIN	CYC _RST DIN 304 DIN 320 DIN 336 DIN 336 DIN 404 DIN 404 DIN 420 DIN 436 DIN	STEP _RST DIN 303 DIN 319 DIN 335 DIN 403 DIN 403 DIN 403 DIN 419 DIN 435 DIN	PRG_ RST DIN 302 DIN 318 DIN 334 DIN 330 DIN 402 DIN 402 DIN 418 DIN 434 DIN	STROBE DIN 301 DIN 317 DIN 333 DIN 401 DIN 401 DIN 417 DIN 433 DIN
G13W G14W G16W G17W G20W G21W G22W G22W G22W G23W G24W G25W G26W G27W	PANEL BREAK DIN 316 DIN 332 DIN 348 DIN 348 DIN 416 DIN 416 DIN 448 DIN 448 DIN 448	PANEL RUN 315 DIN 331 DIN 347 DIN 347 DIN 415 DIN 415 DIN 447 DIN 447	BZ_ RST        PANEL SV OFF        DIN        314        DIN        346        DIN        346        DIN        346        DIN        346        DIN        346        DIN        446        DIN        446	SV        OFF        Reserv        PANEL        EX_ SVON        DIN        313        DIN        345        DIN        345        DIN        345        DIN        345        DIN        445        DIN        461	BREAK ed area DIN 312 DIN 328 DIN 344 DIN 344 DIN 412 DIN 428 DIN 444 DIN 444 DIN 460	PANEL DO _RST DIN 311 DIN 327 DIN 343 DIN 343 DIN 411 DIN 427 DIN 443 DIN 443 DIN 459	CYCLE PANEL PRG_ RST DIN 310 DIN 326 DIN 342 DIN 342 DIN 410 DIN 410 DIN 426 DIN 442 DIN 442	STOP PANEL ALM _RST DIN 309 DIN 325 DIN 341 DIN 409 DIN 409 DIN 425 DIN 441 DIN 4457	EX_ SVON DIN 308 DIN 324 DIN 340 DIN 340 DIN 408 DIN 408 DIN 424 DIN 440 DIN 456	RUN DIN 307 DIN 323 DIN 339 DIN 335 DIN 407 DIN 407 DIN 423 DIN 439 DIN 439 DIN 455	ALM _RST DIN 306 DIN 322 DIN 338 DIN 406 DIN 422 DIN 438 DIN 438 DIN 454	DO _RST DIN 305 DIN 321 DIN 337 DIN 405 DIN 405 DIN 421 DIN 437 DIN 437	CYC _RST DIN 304 DIN 320 DIN 336 DIN 3352 DIN 404 DIN 420 DIN 436 DIN 436	STEP _RST DIN 303 DIN 319 DIN 335 DIN 403 DIN 403 DIN 403 DIN 435 DIN 435	PRG_ RST DIN 302 DIN 318 DIN 334 DIN 334 DIN 402 DIN 402 DIN 418 DIN 434 DIN 434	STROBE DIN 301 DIN 317 DIN 333 DIN 401 DIN 401 DIN 417 DIN 433 DIN 449

TCmini  $\rightarrow$  Robot controller main unit (G000 ~ G27F)

Rob	ot co	ntroll	er ma	ain ur	nit $\rightarrow$	TCmi	ini (ŀ	- 1000 -	- H27	Έ)	
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Bit	Г	Г	D	0	Р	٨	0	0	7	6	F	4	2	2	4	0
ы	F	E	D	U	В	A	9	8	1	6	5	4	3	2	Ĩ	0
	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
110000	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
H01W	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
	02	01	00	20	20		20	20		20			20	10	10	
H02W	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
_	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
110014/	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
HU3W	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49
	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
H04W	116	115	114	112	112	111	110	100	100	107	106	105	104	102	102	101
	110	115	114	115	112	111	110	109	100	107	100	105	104	103	102	101
	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
110370	132	131	130	129	128	127	126	125	124	123	122	121	120	119	118	117
H06W	148	147	146	145	144	143	142	141	140	139	138	137	136	135	134	133
H07W	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
_	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149
H10W/	DATA	DATA				TCP	MLT	OFS	HAND	HAND	HAND	HAND	HAND	HAND	HAND	HAND
111000	_ACK	_ERR				ERR	END	END	OUT8	OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1
H11W	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ
	FSW8	FSW7	FSW6	FSW5	FSW4	FSW3	FSW2	FSW1	PAR8	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1
H12W																
		EVT		DT	CVC		CVC		eve	EVT	EVT	INIT			<u>e</u> \/	EMC
H13W		EXI	ALARM		ST	ST		RUN		2320			TEACH	ACK	9V_ 9V_	
		Emer			_01	_01		KON	RDT	2320	510			<u> </u>	RDT	51
□14VV ~				Reserv	ed area											
H17W																
	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
H20W	316	315	314	313	312	311	310	309	308	307	306	305	304	303	302	301
110414/	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
HZIVV	332	331	330	329	328	327	326	325	324	323	322	321	320	319	318	317
H22W/	DOUT	DOUT	DOUT	DOUT	OUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
1122.00	348	347	346	345	344	343	342	341	340	339	338	337	336	335	334	333
H23W	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
	364	363	362	361	360	359	358	357	356	355	354	353	352	351	350	349
H24W	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
	416	415 DOUT	414 DOUT	413	412 DOUT	411 DOUT	410 DOUT	409	408	407	406	405	404	403	402	401 DOUT
H25W	432	431	430	420	428	427	426	425	424	323	422	421	420	110	118 JUUU	417
H26W	448	447	446	445	444	443	442	441	440	339	438	437	436	435	434	433
	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
H27W	464	463	462	461	460	459	458	457	456	355	454	453	452	451	450	449
Bit	F	F	D	С	В	А	9	8	7	6	5	4	3	2	1	0
21	•	-	-	5	-		,	5		5	~	•	, , ,	-	•	2

#### 4.4 Edge Relay

Bit	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0
E00W	E00F															E000
E01W																
E02W																
E03W																
E04W																
E05W																
E06W																
E07W																
E10W	E10F															E100
E11W																
E12W																
E13W																
E14W																
E15W																
E16W																
E17W																
Register	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0

A total of 256 edge relays (E000 ~ E17F) are available.

E<sup>\*\*\*</sup> Once the condition is ON, the edge relay turns on only for one (1) scan time. To turn on the relay again, set OFF the condition once, then ON.

#### 4.5 Latch Relay

A total of 128 latch relays (L000 ~ L07F) are available.

Bit	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0
LOOW	L00F															L000
L01W																
L02W																
L03W																
L04W																
L05W																
L06W																
L07W																
Register	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0

L\*\*\* Once the condition is ON, the latch relay remains on until the reset input is ON.

#### 4.6 Timer/Counter

 $T/C000 \sim T/C27F$  are the common relays of the timer and counter.

Relay T000 used as the timer cannot be used as the C000 counter. Select either one.

Bit	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0
T/C00W	T00F															T000
T/C01W							l.	Timor	(100 m	s) or c	ountor	l.	l.			
T/C02W										5) 01 0	Junier					
T/C03W																
T/C04W	T04F															T040
T/C05W																
T/C06W																
T/C07W																
T/C08W																
T/C09W								Timer	(10 m	s) or co	ounter					
T/C10W							I	l	1011	) or oc		I				
T/C11W																
T/C12W																
T/C13W																
T/C14W																
T/C15W																
T/C16W																
T/C17W																
T/C20W	T20F															T200
T/C21W																
T/C22W																
T/C23W								Time	er (100	ms) or o	counter					
T/C24W								1	,	,	1					
T/C25W																
T/C26W																
T/C27W																
Register	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0

- T\*\*\* 100 msec timer/10 msec timer
  Once the condition is ON, the timer relay decrements a value set on the timer every 100 ms or 10 ms. When the value has reached zero (0), the timer turns on.
- C\*\*\* The counter relay turns on when the number of pulses equal to a value set on the counter is input.When the counter reset input turns on, the counter value is reset to the set value.

# 4.7 Special Auxiliary Relay

A relay whose address starts with A signifies the special auxiliary relay.

Register	Address		Descriptions
Operation flag	A000	[Carry flag] operation in	: Turns on when the result of arithmetic ncludes a carry or borrow.
	A002	Overflow f	lag]: Turns on when the result of arithmetic ncludes an overflow.
	A006	[Zero flag]: operation is	Turns on when the result of arithmetic s zero (0).
	A007	[Sign flag]: operation r	Turns on when the MSB of arithmetic esult is "1".
Alarm flag	A016	Fuse blow	out detection flag.
Scan time	A03L	The scan ti "ms" under	me is displayed in BIN code and in units of the byte register address (A03L).
50 ms clock	A038	50 ms	50 ms clock pulse
pulse	A039	100 ms	The reference clock is 50 ms (A038).
	A03A	200 ms	
	A03B	400 ms	
	A03C	800 ms	50 ms
	A03D	1600 ms	
	A03E	3200 ms	
	A03F	6400 ms	
10 ms clock	A040	10 ms	10 ms clock pulse
pulse	A041	20 ms	The reference clock is 10 ms (A040).
	A042	40 ms	
	A043	80 ms	
	A044	160 ms	
	A045	320 ms	
	A046	640 ms	
	A047	1280 ms	

Register	Address		Descriptions
100 ms clock	A048	100 ms	100 ms clock pulse
pulse	A049	200 ms	The reference clock is 100 ms (A048).
	A04A	400 ms	
	A04B	800 ms	
	A04C	1600 ms	
	A04D	3200 ms	
	A04E	6400 ms	
	A04F	12800 ms	
1 s clock pulse	A050	1 s	1 s clock pulse
	A051	2 s	The reference clock is 1 s (A050).
	A052	4 s	
	A053	8 s	
	A054	16 s	
	A055	32 s	
	A056	64 s	
	A057	128 s	
10 s clock pulse	A058	10 s	10 s clock pulse
	A059	20 s	The reference clock is 10 s (A058).
	A05A	40 s	
	A05B	80 s	
	A05C	160 s	
	A05D	320 s	
	A05E	640 s	
	A05F	1280 s	

# Section 5 Registers

A total of 512 registers (D000 ~ D37F) are available for the TCmini.

# 5.1 Data Register

Register	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0
D00*	D00F															D000
D01*																
D02*									Data r	adistar	-					
D03*										- -	s _					
D04*																
D05*																
D06*																
D07*																
D10*	D10F															D100
D11*																
D12*									Data r	anister	s					
D13*										I						
D14*																
D15*																
D16*																
D17*																
D20*	D20F															D200
D21*																
D22*									Data re	aisters	s _					
D23*									I		I					
D24*																
D25*																
D26*				<u> </u>												
D27*																
D30*	D30F															D300
D31*																
D32*																
D33*								Data	reaist	ers (ba	ackup)	1	·			
D34*				<u> </u>									1			
D35*			ļ	'												
D36*																
D37*																
Register	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0

The data register is a word length (16-bit) register which cannot be specified as the byte (8-bit) register.

This is a word length (16-bit) which cannot be specified as the byte register.

The operation result is written as the destination in the user's program.

The operation result can be used as the source in the user's program.

Each time the data of D060 ~ D11F has been changed, it is written to the EEPROM and held there. Writing of up to one (1) million counts is possible. When using this register as the job register, take careful precautions. (Each time the data has been changed, writing of EEPROM is executed.)

# 5.2 Interface Register

The interface register serves as the interface area for transferring data with the main unit of the robot controller.

Register	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
D40*	PLC SS R08	PLC SS R07	PLC SS R06	PLC SS R05	PLC SS R04	PLC SS R03	PLC SS R02	PLC SS R01	PLC DATA R8	PLC DATA R7	PLC DATA R6	PLC DATA R5	PLC DATA R4	PLC DATA R3	PLC DATA R2	PLC DATA R1
D41*	PLC SL R08H	PLC SL R08L	PLC SL R07H	PLC SL R07L	PLC SL R06H	PLC SL R06L	PLC SL R05H	PLC SL R05L	PLC SL R 04H	PLC SL R04L	PLC SL R03H	PLC SL R03L	PLC SL R02H	PLC SL R02L	PLC SL R01H	PLC SL R01L
D42*				Deserve												
D43*				Reserv	ed area											
D44*				Reserv	ed area											
D45*																
D46*								DATA	_CMD							
D47*																USER
D50*				-	-	-	-	-		-	-	-	-	-	-	
D51*																
D52*																
D53*																
D54*				Reserv	ed area											
D55*																
D56*																
D57*																
D60*	PLC SS W08	PLC SS W07	PLC SS W06	PLC SS W05	PLC SS W04	PLC SS W03	PLC SS W02	PLC SS W01	PLC DATA W8	PLC DATA W7	PLC DATA W6	PLC DATA W5	PLC DATA W4	PLC DATA W3	PLC DATA W2	PLC DATA W1
D61*	PLC SL W08H	PLC SL W08L	PLC SL W07H	PLC SL W07L	PLC SL W06H	PLC SL W06L	PLC SL W05H	PLC SL W05L	PLC SL W04H	PLC SL W04L	PLC SL W03H	PLC SL W03L	PLC SL W02H	PLC SL W02L	PLC SL W01H	PLC SL W01L
D62*				_					PSN_ W8	PSN_ W7	PSN_ W6	PSN_ W5	PSN_ W4	PSN_ W3	PSN_ W2	PSN_ W1
D63*				Reserv	ed area				PSN_ J8	PSN_ J7	PSN_ J6	PSN_ J5	PSN_ J4	PSN_ J3	PSN_ J2	PSN_ J1
D64*									TRQ_	TRQ_	TRQ_	TRQ_	TRQ_	TRQ_	TRQ_	TRQ_
D65*										,						
D66*								DATA	_RESP							
D67*	AL10	AL09	AL08	AL07	AL06	AL05	AL04	AL03	AL02	AL01	ALNO	STEP				
Register	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0

For details, see Section 6.

## 5.3 Timer/Counter Current Value Register

P000 ~ P05F are the timer/counter current value registers. Current values can be referred to and set in the sequence program.

Register	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0
P00*																
P01*						Timer	current	values	(100 m	s)/count	er set v	alues				
P02*									(							
P03*																
P04*																
P05*																
P06*																
P07*																
P10*																
P11*					ті	imer cur	rent val	ues (10		unter cu	urrent va	alues –				
P12*																
P13*																
P14*																
P15*																
P16*																
P17*																
P20*																
P21*																
P22*																
P23*					Ті	mer cur	rent val	ues (10	ms)/co	unter cu	irrent va	alues _				
P24*						1		· · ·		1	1	1				
P25*																
P26*																
P27*																
Register	F	E	D	С	В	Α	9	8	7	6	5	4	3	2	1	0

P\*\*\* If used as the source in the user's program, the timer/counter current value can be read. (Backward timer and counter) If written as the destination in the user's program during counting, the current value can be changed. For the register used as the timer current value, the set value is equal to the current value at power ON, fall time (RUN  $\rightarrow$  STOP) or timer OFF. This is a word length (16-bit) register which cannot be specified as the byte register.

#### 5.4 Timer/Counter Set Value Register

V000 ~ V05F are the timer/counter set value registers. Current values can be referred to and set in the sequence program.

Register	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0
V00*																
V01*						Timor	eot valu			untor se	t value					
V02*						, inner			- ms//co			s <u> </u>				
V03*																
V04*																
V05*																
V06*																
V07*																
V10*																
V11*					Tio	I A A F A UFF	l ont volu	I 00 (10 r		I ntor our	I root vol					
V12*					1 11 1				ns//cou			ues				
V13*																
V14*																
V15*																
V16*																
V17*																
V20*																
V21*																
V22*																
V23*					— Tir	ner curr	ent valu	ies (10 i	- ms)/cou	inter cui	rent val	ues —				
V24*											l					
V25*																
V26*																
V27*																
Register	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0

V\*\*\* If used as the destination in the user's program, the set value can be changed.

The area not used as the timer/counter can be used as the register. This is a word length (16-bit) register which cannot be specified as the byte register.

#### Section 6 Robot Interface

Transfer of signals between the main unit of robot controller and TCmini is all performed through the interface relays and interface registers. Each interface register has signal input and output directions.

6.1 I Cmini $\rightarrow$ Main Unit of Robot Controller	6.1	TCmini $\rightarrow$	Main	Unit of	f Robot	Controller
---	-----	----------------------	------	---------	---------	------------

101		, mai						0000	01							
Bit	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0
G00W	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
G01W	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
G02W	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
G03W	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49
G04W	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
G05W	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
	132	131	130	129	128	127	126	125	124	123	122	121	120	119	118	117
G06W	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
	148	147	146	145	144	143	142	141	140	139	138	137	136	135	134	133
G07W	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149
G10W	DATA _TRIG				DCO NV TRIG	LMIT OFF	MLT RST	OFS MOD	HAND IN8	HAND IN7	HAND IN6	HAND IN5	HAND IN4	HAND IN3	HAND IN2	HAND IN1
G11W	AL8-	AL8-	AL8-	AL8-	AL4-	AL4-	AL4-	AL4-	AL1-							
	272	271	270	269	080	079	078	077	044	043	042	041	040	039	038	037
G12W					J_ MOVE	J_DI RECT		J_A	XIS		J_CC	ORD	J_SF	PEED	J_REI	MOTE
G13W			BZ_ RST	SV OFF	BREAK	LOW_ SPD	CYCLE	STOP	EX_ SVON	RUN	ALM RST	DO RST	CYC RST	STEP RST	PRG_ RST	STROBE
G14W ~ G16W												_	_			
G17W	PANEL BREAK	PANEL RUN	PANEL SV OFF	PANEL EX_ SVON		PANEL DO _RST	PANEL PRG_ RST	PANEL ALM _RST								
G20W	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
	316	315	314	313	312	311	310	309	308	307	306	305	304	303	302	301
G21W	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
	332	331	330	329	328	327	326	325	324	323	322	321	320	319	318	317
G22W	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
	348	347	346	345	344	343	342	341	340	339	338	337	336	335	334	333
G23W	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
	364	363	362	361	360	359	358	357	356	355	354	353	352	351	350	349
G24W	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
	416	415	414	413	412	411	410	409	408	407	406	405	404	403	402	401
G25W	DIN 432	DIN 431	DIN 430	DIN 429	DIN 428	DIN 427	DIN 426	DIN 425	DIN 424	DIN 423	DIN 422	DIN 421	DIN 420	DIN 419	DIN 418	DIN 417
G26W	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
	448	447	446	445	444	443	442	441	440	439	438	437	436	435	434	433
G27W	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
	404	400	402	401	400	459	400	40/	400	400	404	400	402	451	450	449

#### TCmini $\rightarrow$ Main unit of robot controller (G000 ~ G27F)

G000 ~ G27F:

Signifies an exclusive output relay which outputs a signal to the main unit of the robot controller.

It serves as the destination of coil and data register in the sequence program, where operation result is written.

The operation result can be used as the source of contact and data register in the sequence program.

The operation result ON/OFF is transferred to the output device at I/O processing of every scan cycle.

Relays in the shaded areas are reserved for future extension of the system functions. Values are undecided and cannot be used.

The five (5) signals of STOP, CYCLE, LOW\_SPD, BREAK and SVOFF are valid when they are low. Unless the signals are processed legally, the robot cannot be moved.

\* G108 to G10B are optional signals for specific customers.

#### DIN1 ~ 64, DIN101 ~ 164, DIN301 ~ 364, DIN401 ~ 464



# HANDIN1 ~ 8 (Hand Input Signal)

Address	G100 ~ G107

Direction

Function

TCmini  $\rightarrow$  Main unit of robot controller

Interface relay corresponding to the robot's DIN command. Except for the exclusive monitor display for the hand (Para. 12.3 of Operator's Manual), the function is the same as DIN\*\*\*.

Each signal corresponds to the DIN command as shown below.

Signal name	Relay address	Command
HANDIN1	G100	DIN201
HANDIN2	G101	DIN202
HANDIN3	G102	DIN203
HANDIN4	G103	DIN204
HANDIN5	G104	DIN205
HANDIN6	G105	DIN206
HANDIN7	G106	DIN207
HANDIN8	G107	DIN208



The width of a signal to be output should be 100 msec or over. If the signal width is too short, change in signal status may not be identified by the DIN command in some circumstances.

Remarks

Though the relay name is HANDIN (hand input signal), it is the output relay.

# DATA\_TRIG (Request trigger signal)

Address	G10F
Direction	TCmini $\rightarrow$ Robot main section
Function	This is the trigger signal for the Simple PLC data
	Set this signal to ON after DATA_CMD is set.
	Also, after the response (DATA_RESP) is read, set this signal to OFF.
Remarks	For details on the Simple PLC data communication function, see chapter 12.

- AL8–269 ~ 272 (Alarm of Level 8)
- AL4–077 ~ 080 (Alarm of Level 4)
- AL1–037 ~ 044 (Alarm of Level 1)

Address

AL8–269 ~ 272: G11C ~ G11F AL4–077 ~ 080: G118 ~ G11B AL1–037 ~ 044: G110 ~ G117

Direction

TCmini  $\rightarrow$  Main unit of robot controller

Function

Makes the robot in an ALARM state from the TCmini.

Signal name	Relay address	Robot status		
AL1-037	G110			
AL1-038	G111			
AL1-039	G112			
AL1-040	G113	Message		
AL1–041	G114	display		
AL1-042	G115			
AL1-043	G116			
AL1-044	G117			
AL4–077	G118			
AL4–078	G119	Motion		
AL4–079	G11A	stop		
AL4–080	G11B			
AL8–269	G11C			
AL8–270	G11D	Emergency		
AL8–271	G11E	stop		
AL8–272	G11F			

When alarm messages for respective alarms are registered in user parameters beforehand, any message can be displayed. For details, see the User Parameter Manual.


Remarks

Connect a signal relating to safety (such as emergency stop switch) to an external emergency stop signal processed by hardware (EMS1B ~ EMS1C, EMS2B ~ EMS2C).

- J\_MOVE (Jog operation)
- J\_REMOTE (JOG\_REMOTE selection)
- J\_SPEED (JOG\_SPEED selection)
- J\_COORD (JOG\_COORDINATE selection)
- J\_DIRECT (JOG\_Direction selection)
- J\_AXIS (JOG\_Guiding axis selection)

Address	J_MOVE: G12B
	J_REMOTE: G120,G121
	J_SPEED: G122,G123
	J_COORD: G124,G125
	J_DIRECT: G12A
	J_AXIS: G126 to G129

Direction

TCmini  $\rightarrow$  Robot main section

Function Jog operation is performed from TCmini.

This signal is enabled in EXT.SIG mode only.

While the J\_MOVE signal (G12B) is ON, the axis specified in the conditions below performs the jog operation.

The operating conditions and axis selection signal are determined at the rising of J\_MOVE.

Signal	J_REMOTE	J_SPEED	J_COORD	J_AXIS	S (Axis)		
name Value	(Guiding method)	(Guiding speed)	(Guiding coordinates)	SCARA	6-axis	(Direction)	(Operation)
00(0)	JOG	LOW	JOINT	Not used	Not used	Negative direction	STOP
01(1)	INCHING	MEDIUM	TOOL	1-axis (X)	1-axis (X)	Positive direction	MOVE
10(2)	Not used	HIGH	WORK	2-axis (Y)	2-axis (Y)		
11(3)	Not used	Not used	WORLD	3-axis (Z)	3-axis (Z)		
0100(4)				4-axis (C)	4-axis (A)		
0101(5)				5-axis (T)	5-axis (B)		
0110(6)				Not used	6-axis (C)		
0111(7)				Not used	Not used		
1000(8)				Not used	Not used		



Remarks

Operation does not change even if the operation conditions or axis selection signal is changed while J\_MOVE is ON. Be sure that you are always near the emergency stop switch when performing operation of this signal so that the emergency stop switch can be pressed immediately at any time.

## STROBE (Strobe Signal)

Address	G130
Direction	TCmini $\rightarrow$ Main unit of robot controller
Function	Selects a program registered in the robot controller from the TCmini. This signal is valid only in the EXT.SIG mode. The program number selected uses any consecutive "n" external digital input signals (max. four (4) signals) and is input by code.
Timing chart	
	IN***(X***)
	STROBE (G130)
	ACK (H132)
	RUN (G136)
	With the start of STROBE, the above digital signals are read to select an appropriate program. When the program has been selected, the ACK signal turns on. Set ON the RUN signal and execute the program.
Remarks	DO NOT input the STROBE signal together with the PRG_RST, CYC_RST, STEP_RST or DO_RST signal. Because the ACK signal is used in common, only the first signal which is input becomes valid and all other signals are
	If a file other than the current file is selected, the program is
	The program name and external select signal should be set in the USER.PAR file.



= 2 3

The selected program is set in the EXTRNSEL.PAR file.



- = "PROG0" = "PROG1"
- = "PROG2"
- = "PROG3"

When the setting is as shown above, a file is selected by the three (3) signals, starting from DIN2 (R201  $\sim$  R203).

ſ	DIN4	DIN3	DIN2	
	OFF	OFF	ON	Selection of PROG1
	OFF	ON	ON	Selection of PROG3

## PRG\_RST (Program Reset)

Address	G131
Direction	TCmini $\rightarrow$ Main unit of robot controller
Function	Resets an interrupted program to step 1 from the TCmini. Also resets the value of each variable to "0". This signal is operative only in the EXT.SIG mode.
Timing chart	
	AUTORUN (H138)
	PRG_RST (G131) ACK (H132)
Remarks	DO NOT input the PRG_RST signal together with the STROBE, CYC_RST, STEP_RST or DO_RST signal. Because the ACK signal is used in common, only the first signal which is input becomes valid and all other signals are invalid.

## STEP\_RST (Step Reset)

Address	G132
Direction	TCmini $\rightarrow$ Main unit of robot controller
Function	Resets an interrupted program to step 1 from the TCmini. The value of each variable used in the program remains intact. This signal is operative only in the EXT.SIG mode.
Timing chart	AUTORUN (H138)
	STEP_RST (G132) ACK (H132)
Remarks	DO NOT input the STEP_RST signal together with the STROBE, PRG_RST, CYC_RST, or DO_RST signal. Because the ACK signal is used in common, only the first signal which is input becomes valid and all other signals are invalid.

### CYC\_RST (Cycle Reset)



#### DO\_RST (Output Signal Reset)



The hand control signals (HANDOUT1 ~ 8) are not reset at all.

### ALM\_RST (Alarm Reset)

Address	G135
Direction	TCmini $\rightarrow$ Main unit of robot controller
Function	Resets from the TCmini an alarm which occurred in the robot controller.
	This signal is operative only in the EXT.SIG mode.
Timing chart	
	SYS_RDY (H137)
	ALARM (H13D)
	ALM_RST (H135)
Remarks	If an alarm of the emergency stop level in which servo ON is

If an alarm of the emergency stop level in which servo ON is not possible, or the "emergency stop ON" is output, alarm reset by ALM\_RST is not allowed.

#### **RUN (Startup)**



Set ON the RUN signal only after the SV\_RDY signal is ON and the robot is ready to operate. If the RUN signal is set ON while the SV\_RDY signal is OFF, the RUN signal is neglected.

#### EX\_SVON (External Servo ON)



It takes about 1.5 seconds from the servo ON to the time when the robot is actually ready to work (i.e., the time when the SV\_RDY signal is ON).

When setting on the RUN signal, etc., wait until SV\_RDY turns on.

To set ON this signal again just after the servo OFF, wait at least five (5) seconds.

STOP (Stop)

Address	G138
Direction	TCmini $\rightarrow$ Main unit of robot controller
Function	Stops executing a program registered in the robot controller from the TCmini.
	The program stops only after the current motion command has been executed while this signal was OFF (i.e., low).
	After the stop, the robot enters a STOP (CONT) state. The robot will not work even if this signal is set ON after stop of the robot motion.
	This signal is always operative, irrespective of the master mode selected by means of the MODE switch.
Timing chart	
	RUN (G136)
	AUTORUN (H138)
	Robot motion
	Note: Duration covering from the start of one motion command to just before the start of next motion command is called the"1 segment".
Remarks	<ol> <li>When the RUN command is executed after cancel of the stop, the program restarts from the step next to the interrupted step.</li> </ol>
	2. RUN signal input is ineffective at the input of stop signal.
	<ol> <li>Unless this signal is used, always set it ON in the sequence circuit.</li> </ol>
	G138 ( ) Always ON

#### **CYCLE (Cycle Operation Mode)**

#### G139 Address Direction TCmini $\rightarrow$ Main unit of robot controller Function Stops from the TCmini a program registered in the robot controller after current one (1) cycle operation has been executed during automatic operation. When this signal is OFF (i.e., low), cycle stop is affected. This signal is operative only in the EXT.SIG mode. Timing chart RUN (G136) AUTORUN (H138) CYCLE (G139) Robot motion 1 segment 1 segment 1 segment 1 cycle \* Duration covering from the start of one motion command to just before the start of next motion command is called the "1 segment". Duration from the top of the main program to the END command is called the "1 cycle". Remarks 1. When the RUN command is executed after cancel of the cycle operation mode, the continuous operation starts from the cycle next to the interrupted cycle. 2. Unless this signal is used, always set it ON in the sequence circuit.



### LOW\_SPD (Low Speed Command)

Address	G13A
71001000	
Direction	TCmini $\rightarrow$ Main unit of robot controller
Function	Causes the robot operation speed to low speed from the TCmini.
	The robot operates at a low speed while this signal is OFF (i.e., low).
	The robot operation speed in the low speed mode can be set by means of the parameter. (Initial set value: 25%)
	When this signal is OFF, the override value changes. When the signal is ON, the previously set value takes effect again.
	This signal is always effective, irrespective of the master mode selected by means of the MODE switch.
Timing chart	
	AUTORUN (H138)
	LOW_SPD (G13A)
	LOW_ST (H13A)
Remarks	1 During the low speed command, an override set in the
romano	parameter beforehand is affected on all motion speeds.
	<ol><li>Unless this signal is used, always set it ON in the sequence circuit.</li></ol>

## **BREAK (Deceleration and Stop)**

Address	G13B
Direction	TCmini $\rightarrow$ Main unit of robot controller
Function	Stops the robot motion from the TCmini.
	The robot slows down and stops at the same time that this signal is OFF (i.e., low).
	After the stop, the robot enters a STOP (RETRY) state.
	The robot will not work even if this signal is set ON after stop of the robot motion.
	This signal is always effective, irrespective of the master mode selected by means of the MODE switch.
Timing chart	RUN (G136)
	AUTORUN (H138)
	BREAK (G13B)
	Robot motion 1 segment 1 segment Slowdown and stop during motion command
	* Duration covering from the start of one motion command to just before the start of next motion command is called the"1 segment".
Remarks	1. When the RUN command is executed after cancel of the
	break, the program restarts from the step next to the interrupted step.
	<ol><li>RUN signal input is ineffective at the input of BREAK signal.</li></ol>
	<ol><li>Unless this signal is used, always set it ON in the sequence circuit.</li></ol>
	G13B
	Always ON

### SVOFF (Servo OFF)

Address	G13C
Direction	TCmini $\rightarrow$ Main unit of robot controller
Function	Turns off the servo driver main power from the TCmini.
	While this signal is OFF (i.e, low), the servo power is turned off.
	This signal is always effective, irrespective of the master mode selected by means of the MODE switch.
Timing chart	
	EX_SVON (G137) SV_RDY (H131) SVOFF (G13C)
Remarks	<ol> <li>While this signal is OFF, the servo power cannot be turned on in any mode.</li> </ol>
	<ol><li>Unless this signal is used, always set it ON in the sequence circuit.</li></ol>
	G13C () Always ON

## BZ\_RST (Buzzer Reset)

Address	G13D
Direction	TCmini $\rightarrow$ Main unit of robot controller
Function	Turns off the buzzer sound from TCmini when an alarm occurs This signal is always valid regardless of the master mode selected by the MODE switch.
Timing chart	
	Alarm trigger
	Buzzer sound
	BZ_RST (G13D)
Remarks	<ol> <li>While this signal is ON, the alarm sound is not emitted even if a new alarm occurs.</li> </ol>

							(			,						
Bit	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
H00W	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
H01W	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17
H02W	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
H03W	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49
H04W	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101
H05W	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
	132	131	130	129	128	127	126	125	124	123	122	121	120	119	118	117
H06W	DOUT	DOUT	DOUT	DOUT	OUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
	148	147	146	145	144	143	142	141	140	139	138	137	136	135	134	133
H07W	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149
H10W	DATA _ACK	DATA _ERR				TCP ERR	MLT END	OFS END	HAND OUT8	HAND OUT7	HAND OUT6	HAND OUT5	HAND OUT4	HAND OUT3	HAND OUT2	HAND OUT1
H11W	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ	SEQ
	FSW8	FSW7	FSW6	FSW5	FSW4	FSW3	FSW2	FSW1	PAR8	PAR7	PAR6	PAR5	PAR4	PAR3	PAR2	PAR1
H12W																
H13W		EXT ETHER	ALAR M	BT_ ALM	CYC _ST	LOW _ST	CYC _END	AUTO RUN	SYS_ RDY	EXT 232C	EXT SIG	INT	TEAC H	ACK	SV_ RDY	EMG_ ST
H14W ~ H17W				Reserv	ed area											
H20W	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
	316	315	314	313	312	311	310	309	308	307	306	305	304	303	302	301
H21W	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
	332	331	330	329	328	327	326	325	324	323	322	321	320	319	318	317
H22W	DOUT	DOUT	DOUT	DOUT	OUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
	348	347	346	345	344	343	342	341	340	339	338	337	336	335	334	333
H23W	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
	364	363	362	361	360	359	358	357	356	355	354	353	352	351	350	349
H24W	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
	416	415	414	413	412	411	410	409	408	407	406	405	404	403	402	401
H25W	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
	432	431	430	429	428	427	426	425	424	423	422	421	420	419	418	417
H26W	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
H27W	440	447	440	445	444	443	442	44 I	440	439	430	437	430	435	434	433
	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
	464	463	462	461	460	459	458	457	456	455	454	453	452	451	450	449
Bit	F	E	<u>.</u>	C	B	A	9	8	7	6	5	4	3	2	1	0

#### Main unit of robot controller $\rightarrow$ TCmini (H000 ~ H27F)

H000 ~ H27F:

Signifies an exclusive input relay which receives an output signal from the main unit of the robot controller.

The ON/OFF is read at I/O processing of every scan cycle.

This relay can be used as the source of contact input information and data register in the sequence program. It cannot be used as the coil.

Relays in the shaded areas are reserved for future extension of the system functions. Values are undecided and cannot be used.

\* H108 to H10A are optional signals for specific customers.

# DOUT1 ~ 64, DOUT101 ~ 164, DOUT301 ~ 364, DOUT401 ~ 464

Address	H000 ~ H07F, H200 ~ H27F
Direction	Main unit of robot controller $\rightarrow$ TCmini
Function	Interface relay corresponding to the robot's DOUT command.
	It turns on and off when the I/O status has changed by the DOUT command, or AUX (auxiliary signal) operation or I/O (external I/O signal display) operation through the teach pendant.
	This relay is output, irrespective of the master mode selected by means of the MODE switch.
Timing chart	
	Robot language DOUT(1) DOUT(-1) DOUT1 (R400)
Remarks	Though the relay name is DOUT, it is an input signal from the TCmini.

#### HANDOUT1 ~ 8

Address	H100 ~ H107			

Direction

Function

Main unit of robot controller  $\rightarrow$  TCmini

Interface relay corresponding to the robot's DOUT command.

It turns on and off when the I/O status has changed by the DOUT command, or AUX (auxiliary signal) operation or I/O (external I/O signal display) operation through the teach pendant.

HANDOUT1 ~ 8 cannot be reset by the DO\_RST signal or output signal reset operation through the teach pendant.

This relay can be turned on and off manually on the exclusive hand monitor screen. (See Para. 12.3 of Operator's Manual.)

Each signal corresponds to the DOUT command as shown below.

Signal name	Relay address	Command
HANDOUT1	H100	DOUT201
HANDOUT2	H101	DOUT202
HANDOUT3	H102	DOUT203
HANDOUT4	H103	DOUT204
HANDOUT5	H104	DOUT205
HANDOUT6	H105	DOUT206
HANDOUT7	H106	DOUT207
HANDOUT8	H107	DOUT208

This relay is output, irrespective of the master mode selected by means of the MODE switch.



### DATA\_ERR (Command Error Signal)

Address	H10E
Direction	Robot main section $\rightarrow$ TCmini
Function	This is the command error signal for the Simple PLC data communication function. If there is an error in the value that was set to DATA_CMD, this signal is set to ON.
	When DATA_TRIG is set to OFF, this signal is also set to OFF.
Notes	For details on the Simple PLC data communication function, see chapter 12.

# DATA\_ACK (Response Complete Signal)

Address	H10F
Direction	Robot main section $\rightarrow$ TCmini
	-
Function	This is the response complete signal for the Simple PLC data
	communication function. When setting of the DATA_RESP data is completed, this signal is set to ON.
	When DATA_TRIG is set to OFF, this signal is also set to OFF.
Remarks	For details on the Simple PLC data communication function, see
	chapter 12.

#### SEQPAR1 ~ 8

Address	H110 ~ H117
Direction	Main unit of robot controller $\rightarrow$ TCmini
Function	Interface relay corresponding to the robot's user parameter ([U13] Sequence parameter).
	When the power is turned on, parameter values are set in respective relays.
	If you form a circuit that allows access to this relay, the sequence motion can be changed by the user parameter, without changing over the sequence.
Use example	
	H110(SEQPAR1) Y100 H110(SEQPAR1) Y101 Y10 Y10
	The destination changes with the setting of user parameter [U13].
Remarks	The sequence parameter should be set in [U13] of USER.PAR. [U13] Sequence Parameter (User I/O mode only) = 0 0 0 0 0 0 0 0

Set in the order of **R510**, **R511**, **R512**, **R513**, **R514**, **R515**, **R516** and **R517**.

0 : OFF 1 : ON EMG\_ST

Address	H130
Direction	Main unit of robot controller $\rightarrow$ TCmini
	1
Function	This is an interface relay that indicates the state of the emergency stop pushbutton or the safety input contact.
	This is set to OFF when in an emergency stop state (8-014 or 8-017 has occurred).
	This relay is output, irrespective of the master mode selected by means of the MODE switch.
Timing chart	
	EMERGENCY stop pushbutton switch
	EMG_ST (H130)
Remarks	

SV\_RDY



Remarks

It takes about 1.5 seconds until RV\_RDY turns on after servo power ON. Keep five (5) seconds or over from the servo power OFF to the next servo power ON.

### ACK (Acknowledge)

Address	H132
Direction	Main unit of robot controller $\rightarrow$ TCmini
<b>–</b> .:	
Function	Interface relay indicating a response to the input of STROBE,
	PRG_RST, STEP_RST, CYC_RST and DO_RST.
	When one of these signals is input, the ACK signal is sent
	back to inform that the appropriate processing has finished.
Timing chart	
Ū	
	Program selection (I),
	ACK (H132)
Remarks	If two (2) or more signals shown above are input at the same
	time, only the signal which was input first is processed, then

If two (2) or more signals shown above are input at the same time, only the signal which was input first is processed, then the ACK signal is output.

TEACH	(Teach Mode ON)
INT	(Internal Automatic Mode ON)
EXTSIG	(External Automatic Signal Mode ON)
EXT 232C	(External automatic 232C Host Mode ON)
EXT ETHER	(External ETHER Host Mode ON)

Address	H133 ~ H136, H13E
	7
Direction	Main unit of robot controller $\rightarrow$ TCmini
	~
Function	Interface relay indicating the master mode status of the robot.
	The master mode can be changed over by means of the KEY switch equipped on the control panel.

In External Automatic (EXT) mode, the mode is selected by the user parameters.

Timing chart	
	Master mode TEACHING INTERNAL EXT.SIGNAL EXT.HOST TEACH switch
	TEACH (H133)
	INT (H134)
	EXT.SIG (H135)
	EXT.HOST (H136)

Remarks

## SYS\_RDY (System Ready)

Address	H137											
Direction	Main unit of robot controller $\rightarrow$ TCmini											
Function	Interface relay indicating a status in which the controller can be operated normally.											
	When the internal startup processing has finished following power ON, this signal turns on.											
	This relay is output, irrespective of the master mode selected by means of the MODE switch.											
Timing chart												
	Power ON											
	SYS_RDY (H137)											
	EX_SVON (G137)											
	SV_RDY (H131)											
Remarks												

## AUTORUN (Auto Mode ON)

Address	H138											
Direction	Main unit of robot controller $\rightarrow$ TCmini											
Function	Interface relay indicating that the robot is working in the automatic operation mode.											
	This signal remains on as long as the robot is working in the automatic operation mode.											
	Note: The automatic operation stated above signifies a status of program execution (RUN) in the INTERNAL (i.e., internal automatic mode), EXT.SIGNAL (i.e., external automatic signal mode) or EXT.HOST (i.e., external automatic host mode).											
Timing chart												
	SVON_ST (H131)											
	RUN (G136)											
	STOP (G138)											
	AUTORUN (H138)											
Remarks	This signal is not output during the TEACHING mode.											

## CYC\_END (Cycle End)

Address	H139
Direction	Main unit of robot controller $\rightarrow$ TCmini
Function	Interface relay indicating the finish of program execution.
	This signal turns on after the stop of 1-cycle automatic operation only when the cycle operation mode is selected and an automatic operation is executed.
	This relay is output, irrespective of the master mode selected by means of the MODE switch.
Timing chart	
	AUTORUN (H138)
	CYCLE (G139)
	CYC END (H139)
Remarks	This relay turns off when the program execution (RUN) mode takes effect.
	It turns on when the cycle operation has been stopped by the STOP, BREAK or ALARM signal.

## LOW\_ST (Low Speed Mode ON)

Address	H13A
Direction	Main unit of robot controller $\rightarrow$ TCmini
Function	Interface relay indicating that the robot is operating in the low speed mode.
	It turns on while the robot is working in the low speed mode by the input of LOW_SPD (interface relay).
	This relay is output, irrespective of the master mode selected by means of the MODE switch.
Timing chart	
	AUTORUN (H138)
	LOW_SPD (G13A)
	LOW_ST (H13A)
Remarks	

## CYC\_ST (Cycle Mode ON)

Address	H13B											
Direction	Main unit of robot controller $\rightarrow$ TCmini											
Function	Interface relay indicating that the robot is operating in the cycle mode.											
	It turns on while the robot is working in the cycle mode by the input of CYCLE (interface relay) or by the operation through the teach pendant.											
	This relay is output, irrespective of the master mode selected by means of the MODE switch.											
Timing chart												
	AUTORUN (H138)											
	CYCLE (G139)											
	CYC_ST (H13B)											
Remarks												

### BT\_ALM (Battery Alarm)

Remarks

Address	H13C										
Direction	Main u	nit of robot controller $\rightarrow$ TCmini									
Function	Turns on if a battery alarm has occurred in the robot controller.										
	The ba	ttery alarm comes in the following nine (9) kinds.									
	1-145	MAIN Battery alarm									
	1-401 Axis1 Enc Battery low (Battery Alarm)										
	<ul><li>1-402 Axis2 Enc Battery low (Battery Alarm)</li><li>1-403 Axis3 Enc Battery low (Battery Alarm)</li><li>1-404 Axis4 Enc Battery low (Battery Alarm)</li></ul>										
	1-405	Axis5 Enc Battery low (Battery Alarm)									
	1-406	Axis6 Enc Battery low (Battery Alarm)									
	1-407	Axis7 Enc Battery low (Battery Alarm)									
	1-408	Axis8 Enc Battery low (Battery Alarm)									

This relay is output, irrespective of the master mode selected by means of the MODE switch.



If the battery alarm has occurred, replace the battery immediately, referring to the Maintenance Manual.

### ALARM (Alarm)

Address	H13D												
Direction	Main unit of robot controller $\rightarrow$ TCmini												
Function	Interface relay indicating an error of level 2, 4 or 8 in the robot controller or robot.												
	However, this signal does not turn on when a 8-014 Emergency Stop or 8-017 Safety SW ON alarm has occurred.												
	This relay is kept ON during error detection and turns off after the error has been cleared.												
	For details on the errors, see the Operator's Manual.												
	This relay is output, irrespective of the master mode selecte by means of the MODE switch.												
Timing chart													
	AUTORUN (H138)												
	ALARM (H13D) $\leftarrow$ Error has been cleared.												
	SV_RDY (H131) * Servo OFF only when an error of level 8 occurred.												

Remarks

### 6.3 Interface Register

This is an interface area for transferring data with the main unit of the robot controller.

							/									
Register	F	Е	D	С	В	A	9	8	7	6	5	4	3	2	1	0
D40*	PLC SS	PLC SS	PLC SS	PLC SS	PLC SS	PLC SS	PLC SS	PLC SS	PLC DATA							
2.12	R08	R07	R06	R05	R04	R03	R02	R01	R8	R7	R6	R5	R4	R3	R2	R1
	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC
D41*	SL	SL	SL	SL	SL	SL	SL	SL	SL	SL	SL	SL	SL	SL	SL	SL
	R08H	R08L	R07H	R07L	R06H	R06L	R05H	R05L	R04H	R04L	R03H	R03L	R02H	R02L	R01H	R01L
D42*																
D43*	Reserved area															
D44*				Reserv	ed area											
D45*				TCGCI V.	suarca											
D46*	DATA_CMD															
D47*																USER

#### (Main unit of robot controller $\rightarrow$ TCmini)

DEAt																
D50*																
D51*																
D52*																
D53*				_												
D54*	Reserved area															
D55*																
D56*																
D57*																
	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC
D60*	SS	SS	SS	SS	SS	SS	SS	SS	DATA	DATA	DATA	DATA	DATA	DATA	DATA	DATA
	W08	W07	W06	W05	W04	W03	W02	W01	W8	W7	W6	W5	W4	W3	W2	W1
D04*	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC	PLC
D61*	SL WOQU	SL			SL WOGU	SL WOGI								SL		
	00011	WUOL	00711	WUTL	00001	WOOL	100511	WUJL	DQNI	DQNI	DON	DON	DSN	DSN	DON	DSN
D62*									W8	W7	W6	W5	W4	W3	W2	W1
Deet				Reserv	ed area	I			PSN	PSN	PSN	PSN	PSN	PSN	PSN	PSN
D63*										J7		J5	J4	J3	J2	J1
D0.4*									TRQ	TRQ	TRQ	TRQ	TRQ	TRQ	TRQ	TRQ
D64"										J7 <sup>-</sup>	J6 _	J5 _	J4 _	J3 _	J2 _	J1
D65*																
D66*								DATA	_RESP							
D67*	AL10	AL09	AL08	AL07	AL06	AL05	AL04	AL03	AL02	AL01	ALNO	STEP				
Register	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
## STEP

D674
Main unit of robot controller $\rightarrow$ TCmini
Used to indicate the line number of an active program. As the robot program is executed during execution of pre-analysis, the indicated line number may not coincide with real robot motion. This data can provide only a yardstick.
D675 ~ D67F
Main unit of robot controller $\rightarrow$ TCmini
<ul> <li>ALNO (D675) signifies the number of alarms currently generated.</li> <li>During alarm generation, relevant alarm number is indicated by AL01 (D136) ~ AL10 (D13F).</li> <li>Ex.) When the alarm of "8–014" has occurred: D675: 1</li> <li>D676: 8014 (decimal number)</li> </ul>

#### USER

Address	D470
Direction	TCmini $\rightarrow$ Main unit of robot controller
Function	Used to output a value to the 7-segment display on the user panel. The displayed value ranges from 0 to 65535.

#### PLCDATAR1 ~ 8

Address D400 ~ D407 Direction TCmini  $\rightarrow$  Main unit of robot controller Transfers ladder operation result and other data to the main Function unit of the robot controller. Transferred data can be referred to by the robot program. In the robot program, values can be read by system variables PLCDATAR1 ~ 8. A value written in PLCDATAR\* should be 0 ~ 65535. If it exceeds this range, it cannot be transferred accurately. Example: TCmini register D400 Robot program PLCDATAR1 100 A=PLCDATAR1 0x0064 (Decimal Result A=100 Decimal format format) (100)PLCDATAW1 ~ 8 Address D600 ~ D607 Direction Main unit of robot controller  $\rightarrow$  TCmini Function The TCmini can receive the operation results of the robot program. In the robot program, values can be written to system variables PLCDATAW1 ~ 8. A value written in PLCDATAW\* should be 0 ~ 65535. If it exceeds this range, it cannot be transferred accurately. Example: TCmini register D600 Robot program PLCDATAW1 0x0014 PLCDATAW1=20 Decimal format (20)

#### PSN\_W1 ~ 8

Address	D620 ~ D627
Direction	Main unit of robot controller $\rightarrow$ TCmini
Function	Current position in the world coordinate system of robot can be received by the TCmini.
	This value is an integer in the range of –32768 ~ 32767 mm (deg). All fractions are ignored.
PSN_J1 ~ 8	
Address	D630 ~ D637
Direction	Main unit of robot controller $\rightarrow$ TCmini
Function	Current position in the joint coordinate system of robot can be received by the TCmini.
	This value is an integer in the range of $-32768 \sim 32767$ mm (deg). All fractions are ignored.
TRQ_J1 ~ 8	
Address	D640 ~ D647

Direction

Function

Main unit of robot controller  $\rightarrow$  TCmini

Each axis torque value of the robot can be received with TCmini. The value is an integer of -32768 ~ 32767 in every 0.1%. The value of less than 0.1% is rounded down.

#### PLCSLR01L to 08L and PLCSLR01H to 08H



Direction

 $TCmini \rightarrow Robot main section$ 

Function

This transfers ladder calculation results and other data to the robot main section.

The transferred data can be referenced by the robot program.

Setting a value to two consecutive registers enables reading of 32-bit integers by the robot program system variables and **PLCSLR01 to 08**.

Example:



#### PLCSLW01L to 08L and PLCSLW01H to 08H

Address	D610 to D61F				
Direction	Robot main section $\rightarrow$ TCmini				
Function	Robot program calculation results and other data can be received by TCmini.				
	In the robot program, 32-bit integers can be written to two consecutive registers by the system variables and <b>PLCSLW01 tc</b>				
Example:					
	TCmini register D611 D610 PLCSLW01 PLCSLW01				
Robot progra	Im <u>N 0x0001 0x1170</u>				
PLCSLW01=70	D000 Decimal format (70000)				

#### PLCSSR01 to 08



PLCSSW01 to 08

Address	D608 to D60F				
	-				
Direction	Robot main section $\rightarrow$ TCmini				
Function	Robot program calculation results and other data can be received by TCmini.				
In the robot program, values can be written by the system variables and <b>PLCSSW01 to 08</b> . Set the values to be written by PLCSSW** in the range from -32768 to 32767. Be aware that values outside this range cannot be transferred properly.					
Example:	TCmini register D608				
Robot pro	ogram 0xFFF6 Decimal format (-10)				

# DATA\_CMD (Command Set Register)

A 1 1	D460 to D46E
Address	
Direction	TCmini $\rightarrow$ Robot main section
Function	This is the command register of the Simple PLC data
	communication function.
	Set a command corresponding to the data that you want to obtain.
	For details on the Simple PLC data communication function, see chapter 12.

# DATA\_RESP (Command Response Register)

Address	D660 to D66F
	1
Direction	Robot main section $\rightarrow$ TCmini
Function	This is the command response register of the Simple PLC data
	The response to the command that was set is saved.
	For details on the Simple PLC data communication function, see chapter 12.

# Section 7PLC Language7.1Sequence Program

The TCmini supports sequence programs made according to the graphical programming method. They can be created by the user in any format.



### I/O processing

Batch refreshing of inputs and outputs is used for I/O processing.

(Before starting arithmetic operation, the input ON/OFF state is transferred to the data memory, and the arithmetic result of the data memory is transferred to the output device.)

### Execution of user's program

On completion of I/O processing, the user's program is sequentially operated from the leading circuit.

The operation is as follows:

- Sequentially on a circuit basis.
- From left to right on a column basis within one (1) circuit. (The input part is first operated, then the output part is processed .)
- The operation continues to the P. END instruction (program end instruction).
   The P. END instruction is automatically included at the end of the user's program.
   Thus only actually used words of the user's program are operated.
- Note 1: The coil instruction is written into the data memory every time the operation is executed and has an influence on the subsequent contacts. However, the output state remains unchanged until the output processing is executed in the pack after completion of entire operation.

Note 2: State change of the contact written before the coil occurs in the scan next to the one in which the coil state changed.





Coil R000 is turned on with delay of one (1) scan after X000 is ON.

If the order of the left circuit is replaced, R000 is turned on in the same scan as X000 ON.

As known from the above, if the circuit order is replaced, the operation result may differ.

## 7.2 Program Capacity and Length of Instruction Word

The TCmini instruction has 16 bits as the basic length. According to the type of instruction, five (5) types of word length (1-word, 2-word, 3-word, 4-word and 5-word) are available for the instruction length.

The program memory is Approx. 4000 words and secured according to each instruction.

#### 1-word instruction



#### 2-word instruction

Note: In addresses E000 ~ E03F, two (2)-word instructions are set.



3-word	instruction
<u>0 11010</u>	

F*035	F*036	F*040	F*041
Increment	Decrement	Arithmetic left shift	Left rotate
F*042	F*043	F*049	F*058
Right shift	Right rotate	Subroutine start	Subroutine call
F*059	F*063		
Subroutine return	1-scan ON		
4-word instruction			
F*000	F*001	F*002	F*010
Data transfer	Constant set	High-order 8 bits	$BIN\toBCD$
		data transfer	conversion
			without sign
]	]		
F*011	F*012	F*013	F*045
$BCD\toBIN$	$BIN\toBCD$	$BCD\toBIN$	$4 \rightarrow 16$ decoder
conversion	conversion	conversion	
without sign	with sign	with sign	

# 5-word instruction

F*006	F*009	F*020	F*021
Block transfer by constant designation	Data extraction and distribution	BIN addition	BIN addition with carry
F*022	F*023	F*024	F*025
BIN subtraction	BIN subtraction with borrow	BIN multiplication without sign	BIN division without sign
F*032	F*033	F*034	F*037
Logical product	Logical sum	Exclusive logical sum	Comparison without sign
F*038	F*047		
Comparison with sign	Bit test by constant designation		

#### 7.3 Address

#### (1) Relay address

The relay address consists of a relay number following the function division symbol.

The I/O relay address corresponds to actual relay mounted position, and the other relays correspond to physically absent devices. The relay address is assigned for each I/O number (1 bit).

* *	* *	Relay No. 1st digit (0 ~ F) Relay No. 2nd digit (0 ~ 7) Relay No. 3rd digit (0 ~ F) Function division symbol	Hexadecimal number Octal number Hexadecimal number (X, Y, R, T, C, L, E, A)		
The function division symbol is an uppercase letter.					

#### (2) Data register address

The data register address is represented in the same manner as the relay address.

The relay address is assigned on a number (1 bit) basis while the data register address is assigned on a word (16-bit) basis.

* *	* *		Register Register Register Functior	No. 1 No. 2 No. 3 divisio	st digit (0 ~ F nd digit (0 ~ rd digit (0 ~ I on symbol	F) Hexa 7) Octa F) Hexa (D, V, P)	adecimal number al number adecimal number
	The fur	ction di	vision s	ymbol	is an uppe	rcase lett	er.
Data reg	ister con	figuratior	ı				
MSB 15				87			LSB 0

(3) Byte register address and word register address of relay area

The relay area can be used as a byte register on an eight (8)-number basis and as a word register on a 16-number basis.

For the register address, relay number 1st digit of the relay address signifies the register type instead.



## (4) Indirect register address

In the indirect register, an address can be identified by the specified register content (data) and a content under this address can be handled as the word data. The function division symbol at the head of the indirect register address is represented by a small letter (data register or relay register) and the remaining data of the same address are expressed in the same manner as in the data register address.



Data value (Hex.)	Corresponding address	Data value (Hex.)	Corresponding address	Data value (Hex.)	Corresponding address
D reg	gister	X/Y re	egister	E regi	ister
0000H (0001H)	D000	3000H (3001H)	X/Y00W	3480H (3481H)	E00W
0002H (0003H)	D001	3002H (3003H)	X/Y01W	3482H (3483H)	E01W
A		*		3484H (3485H)	E02W
001EH (001FH)	D00F	300EH (300FH)	X/Y07W	3486H (3487H)	E03W
0020H (0021H)	D010	3010H (3011H)	X/Y10W		
		× ×	le l		
00FEH (00FFH)	D07F	301EH (301FH)	X/Y17W		
0100H (0101H)	D100	R ree	gister		
*	¥	3100H (3101H)	R00W		
01FEH (01FFH)	D17F	3102H (3103H)	R01W		
P reç	gister	*	¥		
1000H (1001H)	P000	310EH (310FH)	R07W		
1002H (1003H)	P001	3110H (3111H)	R10W		
~	5	*			
101EH (101FH)	P00F	311EH (311FH)	R17W		
1020H (1021H)	P010	T/C re	egister		
*	*	3180H (3181H)	T/C00W		
10BEH (10BFH)	P05F	3182H (3183H)	T/C01W		
V reg	gister	*	*		
1800H (1801H)	V000	31BAH (318BH)	T/C05W		
1802H (1803H)	V001	L register			
~	¥	31C0H (31C1H)	LOOW		
181EH (181FH)	V00F	31C2H (31C3H)	L01W		
1820H (1821H)	V010	A reg	gister		
*	*	31E0H (31E1H)	A00W		
18BEH (18BFH)	V05F	*	¥		
		31FCH (31FDH)	A16W		

# Correspondence table of data value and indirect address

A register signified by the indirect register is identified from the correspondence table given in Para. 7.3 (4) above. As data values and addresses are arranged consecutively for each register, this function is very useful for a program requiring table processing.

Example: Assume that positioning parameter information consisting of four (4) words per block is set in registers D000 to D043. To set in registers D050 to D053 the four (4)-word positioning information corresponding to the parameter number (0 ~ 16) input in external input register X00L, program as follows.

<Positioning information table>



<Descriptions on program>

- [1] The parameter number (X00L) is multiplied by the number of bytes per block (in this example, 4 words = 8) to identify a relative address from the table.
- [2] Four (4)-word data are transferred in block into D050 and after, taking the data value set in D05F as the start address (in this example, either of D000 ~ D043).

## 7.4 Configuration of Instruction Word

As the TCmini uses the ladder symbolic direct input method for the programming language, it has the instructions corresponding to the circuit diagram.

#### Configuration of 1-word instruction

Function division symbol	Address		
$\downarrow$	$\downarrow$		
X: Input Y: Output	000 ~ 17F Note: If X and Y cannot be automatically identified because they share the		
	same address, Z is displayed.		
R: Internal relay	000 ~ 17F		
R: Interface relay	200 ~ 57F		
L: Latch	000 ~ 01F		
C: Counter	Note: Same addresses cannot be shared by T and C.		
A: Special auxiliary relay	000 ~ 16F		
Y: Output	000 ~ 17F		
R: Internal relay	000 ~ 17F		
R: Interface relay	200 ~ 37F		
L: Latch	000 ~ 01F		
L: Latch reset	000 ~ 01F		
T: Timer C: Counter	000 ~ 05F Note: Same addresses cannot be shared by T and C		
	Function division symbol↓X:InputY:OutputR:Internal relayR:Interface relayL:LatchT:TimerC:CounterA:Special auxiliary relayY:OutputR:Internal relayR:Interface relayL:LatchT:TimerC:CounterT:Interface relayL:LatchL:Latch resetT:TimerC:Counter		

С	C: Counter reset	000 ~ 05F
()		Note: Same addresses
R		can be shared by
		T and C.
	None	None
l		
(P, END)		

# Configuration of 2-word instruction

Instruction code	Function division symbol	Address
$\Downarrow$	$\Downarrow$	$\Downarrow$
E —_( )	E: Differentiating relay	000 ~ 03F

## 7.4.1 Contact

(a) Serial connection operation



The operation serially connected to the operation result so far is made (logical product: AND).



Result A=

X000

X001

(b) Branch-connected operation



The operation branch-connected (in parallel) with the operation result so far is made (logical sum: OR).

# 7.4.2 Unconditional Connection

(a) Unconditional connection



The operation result so far is operated serially, serially and in parallel, and in parallel.



Y051



#### 7.4.3 Blank

(a) Blank

·
---

Corresponds to the part enclosed by dotted line in the figure. It can be ignored at programming. This instruction is effective to delete an instruction at circuit



#### 7.4.4 Internal Relay

correction.

Symbol	——( <sup>R1</sup> )—	X000 X001 R000
Function	Turned ON when the input signal is ON.	
Executing	The input signal must be	
condition	ON.	
R1 range	R000 ~ R17F (256 Nos.)	When inputs X000 and X001 are
	R200 ~ R37F (Interface relay)	turned ON or when X002 is turned ON, R000 is turned ON.

# 7.4.5 Latch Relay

Symbol	Latch condition Reset input ( L1 ( ) ( R )	X000 L000 ()
Function	Kept ON until the reset input is ON when the latch condition is turned ON.	When X000 is ON with X001 set OFF, L000 is ON and this state is held until X001 is ON.
Executing condition	The latch condition must be turned ON with the reset input OFF.	x000
L1 range	L000 ~ L01F (32 Nos.)	X001
Power failure backup function	Power failure can't be backed up through the entire area. Depending on the parameter, it is possible to make do memory.	L000

Note: At program loading, compulsively set a required latch relay.

<Power failure backup and input>



In the circuit shown left, as the " / - " input contact is used for the reset input, the power may not be backed up due to time lag between input power OFF and PC power OFF.

#### 7.4.6 Timer

Symbol	T1 K2 ───( )─┤	X000 T000 0050
Function	Relay T1 is turned ON after the time specified by constant K2 has passed.	T000 is ON five (5) seconds after X000 is ON.
Executing condition	The input signal must be ON.	x000
T1 range (BIN)	T000 ~ T05F (96 Nos.) 0.1 ~ 3276.7 sec. Note: Shared with counter address.	T0005 sec
Set value K2 range	1 ~ 65535 1H ~ FFFFH (BIN data)	The timer set value is set in a program, which can be changed
Timer set value register	V000 ~ V05F (96 Nos.) Shared with counter.	through data transfer to V000 to V05F.
Timer current value register	P000 ~ P05F (96 Nos.) Shared with counter.	Backward timer

• OFF delay timer circuit





When X000 is ON, R000 is ON. X000 is OFF. One (1) second after the set time on T000 following X000 OFF, R000 is OFF.

It should be noted that R000 is ON for the T000 set time after the PC runs by power ON.

ON/OFF delay timer circuit



When X000 is ON, R000 is turned ON three (3) seconds after the set time of T000. R000 is OFF two (2) seconds after the set time of T001 following X000 OFF.

The timer is of a backward type and the current value is equal to the set value at start and zero (0) at ON.

# 7.4.7 Counter

Symbol	Counter input C1 K2 Reset input ()	X000 C000 0003
Function	Relay C1 is turned ON when pulses are input by the number specified by constant K2.	x000
Executing condition	When the counter input rises from OFF to ON.	X001
C1 range	C000 ~ C05F (96 Nos.) Note: Shared with timer address.	C000
Set value K2 range	1 ~ 32767 1H ~ FFFFH (BIN data)	The counter set value is set in a program, which can be changed
Counter set value register	V000 ~ V05F (96 Nos.) Shared with timer.	through data transfer to V000 to V05F.
Counter current value register	P000 ~ P05F (96 Nos.) Shared with timer.	Backward counter

The counter current value register is set to zero (0) at program loading. Reset the counter coil to the set value.

Large-capacity counter circuit





# 7.5 Standard Application Instruction

The TCmini has a total of thirty-two (32) kinds of application instructions. In the user's program, up to 512 application instructions can be used.

#### 7.5.1 Selection of Executing Condition

The TCmini allows selection of the condition for executing an application instruction. When executing the application instruction while the condition is set ON, write "FL\*\*\*" (L: level). To execute the application instruction at start, write "FE\*\*\*" (E: edge).

Example:



When condition X000 is ON, data is transferred from D100 to D000 at each scanning.



Only in one (1) scan in which condition X000 has changed from OFF to ON, data is transferred from D100 to D000.

### 7.5.2 Arbitrary Setting of Argument

In the TCmini application instruction, the type of argument (i.e., direct register, indirect register or constant) can be selected arbitrarily. (However, the type of argument is predetermined for some application instructions.)

Example:

# 7.5.3 Numeric Expression

#### (1) Binary code

A numeric value represented by two (2) states of "0" (OFF) and "1" (ON) is called the binary code.

In a decimal number, a number increases to  $0, 1, 2, \dots 8, 9$ . When it reaches 10, it is carried. In a binary number, a number next to 1 is carried to 10. Binary number 10 corresponds to 2 in the decimal notation.

Decimal number	0	1	2	3	4	5	6	7	8
Binary number	0	1	10	11	100	101	110	111	1000

When the decimal number is compared with the binary number, binary numbers corresponding to 2, 4 and 8 in decimal notation are carried.

The decimal number is carried when it is 1, 10, 100 and 1000. When these numbers are expressed in power, they are  $10^0$  (= 1),  $10^1$  (= 10),  $10^2$  (= 100) and  $10^3$  (= 1000). These are called the "significance" of each digit of decimal numbers. From the above table, each digit of binary number is as shown below.



Each digit has the significance of 2. Each digit of binary number is called the "bit". A set of eight (8) bits is called the "byte", and a set of 16 bits is called the "word". In the TCmini, an eight (8)-bit length register is called the "byte register". Now let's investigate the range of byte numeric values. When all eight (8) bits are 1, a byte is the maximum value.



Summing up the significances of each bit,

$$2^{0} + 2^{1} + 2^{2} + 2^{3} + 2^{4} + 2^{5} + 2^{6} + 2^{7}$$
  
= 1 + 2 + 4 + 8 + 16 + 32 + 64 + 128  
= 255

Likewise, a word (16 bits) is as follows:

1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
215	214	213	212	211	210	29	2 <sup>8</sup>	27	26	25	24	2 <sup>3</sup>	22	21	20
32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1

Summing up the significances of all bits, it can be expressed as a decimal number of  $0 \sim 65535$ . Each register of the TCmini can handle the numeric values in binary notation of this range.

Additionally, the set value and current value of timer and counter are processed as the binary number.

(2) Negative expression of binary number (Expression of complement of 2)

In Para. (1) above, all binary numbers are positive. Then how is a negative binary number expressed? If the binary number is decreased one by one,

1	1	1	7
1	1	0	6
1	0	1	5
1	0	0	4
•		  1	2
		I	3
	1	0	2
		1	1
		0	0

From the above, you can see that a borrow takes place at the time of  $4 \rightarrow 3$  and  $2 \rightarrow 1$  in decimal notation.

If there is a "1" at a position higher by one when decreasing 1 from 0, the expression is as follows:



Let's compare 1 with -1.



All bits of -1 are reversed  $(1 \rightarrow 0)$  and -1 added with 1 becomes 1. On the contrary, reverse all bits of 1, then add 1. The result is -1.



This operation is called taking the complement of 2, which is used for conversion from positive to negative and vice versa.

In the above example, the highest-order digit is 1 when the number is negative and 0 when it is positive. This highest-order digit is called the "sign bit", and four (4) bits in the above example can be expressed as a decimal number of –8 to 7.

For a word (16 bits), the expression is as shown below.



It can handle a decimal number of -32768 ~ 32767.

The TCmini can handle the numeric numbers in this range as a signed binary number. The programmer and CRT programmer can specify the numeric values in this range as a decimal number. In the CPU, a specified numeric value is converted into a signed binary number and processed. A signed binary number is handled only in the word register, and the byte register handles a word as a positive integer (0 ~ 255).

## (3) Hexadecimal number

When 0 and 1 of binary number are arranged, the expression becomes longer and is difficult to read. To solve this problem, four (4) bits are taken as one (1) unit. A hexadecimal number has four (4) bits, and a carry takes place at 16 after  $2^0 + 2^1 + 2^2 + 2^3 = 1 + 2 + 4 + 8 = 15$ . It uses numbers 0 to 9 and alphabets A to F.

Binary number	Decimal number	Hexa-decima I number	Binary number	Decimal number	Hexa-decima I number
0000	0	0	1000	8	8
0001	1	1	1001	9	9
0010	2	2	1010	10	A
0011	3	3	1011	11	В
0100	4	4	1100	12	С
0101	5	5	1101	13	D
0110	6	6	1110	14	E
0111	7	7	1111	15	F

# Example: A word (16 bits) can be expressed by a four (4) digit number in hexadecimal notation.



# (4) Binary coded decimal (BCD)

In the decimal number, 10 comes after 0, 1,  $\cdots$  9 and a carry takes place. A number having the function carrying 9 to 10 like the binary number is called the binary coded decimal (BCD).

Decimal number	Binary number	BCD	
0	0		0
1	1		1
2	10		10
3	11		11
4	100		100
5	101		101
6	110		110
7	111		111
8	1000		1000
9	1001		1001
10	1010	1	0000
11	1011	1	0001
:	:		:
99	1100011	1001	1001

Carry

A binary number is classified by four (4) bits, and combinations of 1010 or more (1010 ~ 1111) are banned to cause a carry.

Each bit is expressed in the range of 0 to 9 of decimal number.

Example:



Thus, the BCD expression can be regarded as a variation of hexadecimal number. The BCD numeric value can also be specified in hexadecimal notation. (Only 0 to 9 for each digit.)

The content of the register in which BCDs are stored can be displayed in hexadecimal notation.

(5) Negative expression of binary coded decimal (BCD)

A negative of BCD is handled as a sign + absolute value. In the TCmini, it can be

handled in the two (2) instructions of  $F^*012$  (BIN  $\rightarrow$  BCD conversion with sign)

and  $F^*013$  (BCD  $\rightarrow$  BIN conversion with sign).

The negative is set as the sign digit to "13 (1101)", the value not found in the BCD expression, and handled only as a long word (32-bit, BCD eight (8) digits). The eighth (8th) digit is assigned for the sign digit.

This is because the word (BCD, four (4) digits) is exceeded as a result of BCD conversion when the word numeric range is –32768 to 32767.

Example: Signed BIN to BCD conversion by F\*012



## 7.5.4 Operation Flag

(1) Type

The following four (4) types of flags are assigned to the relays (special auxiliary relays) to use the operation result in the coming operation.

Relay address	Flag name	Function
A000	Carry flag	Turned ON if there is a carry or borrow as a result of operation.
A002	Overflow flag	Turned ON if there is an overflow as a result of operation.
A006	Zero flag	Turned ON if the operation result is zero (0).
A007	Sign flag	Turned ON when the MSB (i.e., highest-order bit) of the word register is 1 as a result of operation.

(2) Instruction with change in operation flag

In the following ten (10) kinds of instructions, the flag changes with the operation result.

Туре	Code	Function	
BIN operation	F*010	$BIN \rightarrow BCD$ conversion	
	F*020	BIN addition	
	F*021	BIN addition with carry	
	F*022	BIN subtraction	
	F*023	BIN subtraction with borrow	
	F*025	BIN division	
Bit shift	F*040	Arithmetic left shift	
	F*041	Left rotate	
	F*042	Right shift	
	F*043	Right rotate	

The flag will not change in other than the above instructions.
#### (3) Cautions on flag

The carry flag and zero flag may change illegally when operated by the byte register. Example:



In the operation between byte registers, high-order eight (8) bits of word register are taken as zero (0) and operated as the byte register. Thus, even if the byte register is specified for the destination and a result error is checked by the carry bit, a carry will not take place at the seventh (7th) bit, but the 15th bit becomes the carry flag. In the example above, the carry flag is zero (0).

The sign flag indicates the state of the highest-order bit (15th bit) of the word register. Therefore, the positive or negative sign flag makes sense only when the range of numeric values is handled as a signed binary code (–32768 ~ 32767) by the user. (4) Available range of operation flag

A flag in the user's program maintains its state during the time from a flag operating instruction to the next flag operating instruction.



Note: If a flag operating instruction is not encountered to the program end, the flag keeps its state until another flag operating instruction appears first in the program during the next scan.

(5) Flag holding

Through the flag state is maintained until the next flag operating instruction, it is changed thereafter.

When the flag state must be held during one (1) scan cycle, move and hold it at the coil (internal relay, output relay, etc.).



R000 can maintain the flag state in one (1) scan cycle until the flag state is changed by the next [1] FL020 instruction. However, when X000 is turned OFF, the flag state of the flag operating instruction located in the circuit before [1] prevails.

To monitor and confirm the flag state through the peripheral equipment, it is convenient to make self backup or use a latch relay. If held by the coil, the flag state can be maintained only in one (1) scan cycle.



### 7.5.5 Order of Execution

If the standard application instruction is programmed as a multi-output under the same operating condition, it is executed in the order of top to down in the circuit diagram. Thus it is possible to transfer the operation result to the next operation.



#### When R000 is ON:



Register D000 is used as the temporary operation result storing register.

#### 7.5.6 **Descriptions on Standard Application Instruction**

- F\*000
  - Data Transfer

		A	rgumer	nt								
Symbol	Code	Ag.1	Ag.2	Ag.3	X000	FL000	MOV					
MOV	F*000	D <sub>1</sub>	$D_2$			— ſмо∨ }—	D005←D001					
		d <sub>1</sub>	d <sub>2</sub>			C J						
Function	Transfers	the cont	ent of t	he	When input X	000 is ON, the	content of register					
	register s	pecified	by Ag.2	D001 is transferred to register D005.								
	register s	becified	by Ag.1	•								
Content of	رD,	) (D	.)		D001 0 0	0 1 0 0 1 0	0 1 0 0 1 0 0 0					
operation	MOV d	$\left  \leftarrow \right _{d_2}^{D_2}$	2		MSB		LSB					
	("	<u>رمع</u>	J	_	$\downarrow$							
Range of	Direct reg	ister: E	Intire ra	nge								
argument 1	Indirect re	egister:	Entire I	range								
Range of	Direct reg	ister: E	Intire ra	nge								
argument 2	Indirect re	egister:	Entire I	range								
After operation					Both the word	I register and b	oyte register can					
<ul> <li>Ag.1 content</li> </ul>	Data spec	cified by	Ag.2.		transfer the da	ata.						
<ul> <li>Ag.2 content</li> </ul>	Unchange	ed										
<ul> <li>Flag</li> </ul>	Unchange	ed										

When register D<sub>1</sub> is the byte register (R00H, Y01L, etc.) and register D<sub>2</sub> is the ٠ word register (R00W, Y01W, etc.),



When register  $D_1$  is the word register and register  $D_2$  is the byte register,



When X000 has turned ON from OFF, the eight (8)-bit data of R02L is transferred to the low-order eight (8) bits of D000. The high-order eight (8)-bit data is zero-cleared.

				R	00	4		R00L						LSB		
R02W								0	0	1	0	1	1	1	0	
$\downarrow$ MSB $\downarrow$ $\downarrow$												$\downarrow$				
D000	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1

Note: For data transfer of two (2) words or more, use the block transfer instruction by F\*006 or F\*008.

When the indirect register is used,



When X000 is ON, the content of D100 is transferred to the address which is identified as per the data set in D002. (If #100H is set in D002, D100 is the address.)

F*001
1 001

Constant Set

		ŀ	Argumen	nt	
	Code	Ag.1	Ag.2	Ag.3	
Symbol					X000 FE001 SET
SET	F*001	D <sub>1</sub>	K <sub>2</sub>		
		d <sub>1</sub>			
Function	Stores the	e consta	nt speci	fied by	When input X000 has turned ON from OFF, binary
	Ag.2 in the register specified by				constant 1120 is stored in register D100.
	Ag.1.				
Content of	6	<b>`</b>			Constant 0 0 0 0 0 1 0 0 1 1 0 0 0 0 0 0
operation	$ $ SET $\begin{bmatrix} D_1 \\ . \end{bmatrix} \leftarrow K_2$				(1120) MSB   LSB
	رd₁	J -			· · · · · · · · · · · · · · · · · · ·
Range of	Direct reg	gister:	Entire ra	nge	-
argument 1	Indirect re	egister:	Entire I	range	
Range of	Constant	: -3270	68 ~ 327	'67	
argument 2					(1120)
After operation					When the register is the byte register, the
<ul> <li>Ag.1 content</li> </ul>	Value of o	constant	K <sub>2</sub>		low-order eight (8)-bit data of the constant is stored
<ul> <li>Ag.2 content</li> </ul>	Unchang	ed			in the register. (The high-order eight (8)-bit data
Flag	Unchang	ed			of the constant is ignored.)

• When register D<sub>1</sub> is the byte register,





High-Order 8-Bit Data Transfer

		ŀ	Argumen	t	
<b>.</b>	Code	Ag.1	Ag.2	Ag.3	X000 EE002   (H)D005←
Symbol					
MOV	F*002	D <sub>1</sub>	D <sub>2</sub>		
		d <sub>1</sub>	d <sub>2</sub>		
Function	Transfers	the low	-order ei	ight	When input X000 is ON, the low-order eight (8)-bit
	(8)-bit da	ta of the	register		data of register D013 is transferred to the
	specified	by Ag.2	to the		high-order eight (8) bits of register D005.
	high-orde	er eight (	8) bits of	f the	
	register s	pecified	by Ag.1	•	
Content of	(D1)	. ΓD <sub>2</sub>	٦		
operation	d₁	$) \leftarrow \begin{vmatrix} z_2 \\ d_2 \end{vmatrix}$	(L)		MSB LSB
		(12	)		
Range of	Direct reg	gister: I	Entire ra	nge	K
argument 1	Indirect re	egister:	Entire I	range	
Range of	Direct reg	gister: I	Entire ra	nge	D100 0 1 1 1 0 1 0 1 0 0 0 1 0 1 1 1
argument 2	Indirect re	egister:	Entire I	range	/
After operation					
<ul> <li>Ag.1 content</li> </ul>	The high-	order ei	ght (8) b	its are	The low-order eight (8) bits of D005 remain
	set as the	e low-ord	ler eight	(8)	unchanged after operation.
	bits of the	e data va	lue spe	cified	
	by Ag.2.				
Ag.2 content	Unchang	ed			
• Flag	Unchang	ed			

### • When register D<sub>2</sub> is the byte register,



F*006
-------

Block Transfer (Constant Designation)

		ŀ	Argumer	nt	
	Code	Ag.1	Ag.2	Ag.3	X000 FL006   MOV D000←
Symbol					
MOV	F*006	D <sub>1</sub>	D <sub>2</sub>	K <sub>3</sub>	
		d <sub>1</sub>	d <sub>2</sub>		
Function	Transfers	s block d	ata of co	onstant	When input X000 is ON, the two (2)-word data
	K3 word	from reg	isters he	aded	stored in registers (R03W, R04W) headed by
	by the on	e specit	ied by A	g.2 to	register R03W is transferred to register D000 and
	registers	headed	by the c	ne	after (D000, D001).
Contant of	specified	by Ag.1			
Content of	$ D_2 $ $ D_2+1 $	[ D	$^{2+K_{3}-1}$		R03W 0 0 0 0 1 1 0 0 0 1 1 0 1
operation			+K <sub>3</sub> -1 J		
	(D) (D			14 45	R04W 1 1 0 1 0 0 0 1 0 1 0 1 0 1 1 1
	$\begin{bmatrix} D_1 \\ d \end{bmatrix} \begin{bmatrix} D_1 + i \\ d + i \end{bmatrix}$	$\begin{bmatrix} D_1 + \\ d_1 \end{bmatrix}$	$\binom{2}{2} - \binom{D_1}{D}$	FK3-1	
	(u <sub>1</sub> ) (u <sub>1</sub> +1	J Cu <sub>1</sub> +	$2^{-2}$ (D <sub>1</sub> -	-13-12	Constant 002 (2 words)
Range of	Direct reg	gister:	Entire ra	nge	
argument 1	(word	d design	ation)	-	
	Indirect r	egister:	Entire	range	
	(word	d design	ation)		D001 1 1 0 1 0 0 0 1 0 1 0 1 0 1 1 1 1
Range of	Direct reg	gister:	Entire ra	nge	
argument 2	(word	d design	ation)		
	Indirect r	egister:	Entire	range	
<u> </u>	(word	design	ation)		
Range of	Constant	: 0~2	55		If the designation is outside the register area, data
argument 3					transfer is not performed.
After operation	Data vali		ind by A	~ 0	Note: Even if the bute register is enceified for the
• Ag.1 content		ie specii	ieu by A	g.∠.	Note: Even if the byte register is specified for the
• Ag.2 content	Unchang	ed			register takes offect
<ul> <li>Ag.5 content</li> <li>Elad</li> </ul>	Unchang	eu od			
• riag	Unchang	eu			

If the same addresses are used both for the source and destination registers,

a) When register  $D_1$  address > register  $D_2$  address,

X00	00	FL006	Ν
		{ MOV ]	

MOV D001← (K)D000 K=004

After operation, the same value is set in D000 to D004.



b) When register  $D_1$  address < register  $D_2$  address,

 X000
 FL006
 MOV D000←

 [MOV]
 (K)D001 K=004

After operation, the content of each register is transferred into the registers with an address number just preceding the number of the source register, respectively.





Data Extraction and Distribution

		ŀ	Argumer	nt										
	Code	Ag.1	Ag.2	Ag.3	X000 FL009   D000 D010									
Symbol	=+000													
IDX	F*009	$D_1$	$D_2$	$D_3$										
		d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	-									
Function	Offsets th	ne 2-byte	e data of	the										
	table hea	ided by t	he Ag.2											
	register b	by the low	w-order I	byte of										
	the Ag.3	register	and tran	sters	When register $D020 = 0204H$ , the data are									
	the result	t to the ta	able hea	ded by	extracted and distributed as shown below.									
	the data	register	which of	ISEIS										
	of the Ag	3 regist	gn-ordei er	byte	D020 02 04									
Content of	$(D_2) + (0)$	ר (D <sub>3</sub> (L)) ר												
operation	$d_2$	d <sub>3</sub> (L))												
•	$\downarrow$				D000 Lower 8 bits D010 Lower 8 bits									
	( D <sub>1</sub> ) + (	ך ((D <sub>3</sub> (H))			Higher 8 bits Higher 8 bits									
	ld₁ l(	d₃(H)) J			D001 Lower 8 bits ← D011 Lower 8 bits									
Pange of	Direct rev	nictor:	Entiro ra	200	Higher 8 bits									
argument 1	Indirect r	anister.	Entire i	rande										
Range of	Direct red	nister:	Entire ra	nde										
argument 2	Indirect r	eaister:	Entire i	range	Higher 8 bits									
Range of	Direct red	aister:	Entire ra	nae	-									
argument 3	Indirect r	eaister:	Entire	range										
After operation					-									
Ag.1 content	Operation	n result												
Ag.2 content	Unchang	ed												
Ag.3 content	Unchang	ed												
Flag	Unchang	ed												

Transferred data is the two (2) bytes.

When register  $D_2$  is the byte register, the high-order byte of  $D_1$  becomes zero (0). When register  $D_1$  is the byte register, the low-order byte of the data read is written.



F*010
-------

 $BIN \rightarrow BCD$  Conversion (Unsigned)

		ŀ	Argumer	nt									
	Code	Ag.1	Ag.2	Ag.3	X000 FL010   BCD Y03W ←								
Symbol		_	_	_									
BCD	F*010	D <sub>1</sub>	D <sub>2</sub>										
		d <sub>1</sub>	d <sub>2</sub>										
Function	Converts	the uns	igned Bl	N data	When input X000 is ON, the data of register V000								
	of registe	r specifi	ed by Ag	g.2 into	(timer T000 set value) is converted into the BCD								
	the BCD	data and	d stores	in the	data and stored in register Y03W (Y03F ~ Y030).								
	register s	pecified	by Ag.1	•									
Content of	(D, `	1	(n, )		V000 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0								
operation	$ $ BIN $ _{d_2}^{D_2}  \rightarrow BCD  _{d_1}^{D_1} $				MSB LSB								
	( <sup>4</sup> 2 )	)			$\bot$								
Range of	Direct reg	gister:	Entire ra	nge									
argument 1	Indirect r	egister:	Entire I	range									
Range of	Direct reg	gister:	Entire ra	nge	Y03W 0 0 0 0 0 1 0 1 0 1 0 1 1 0								
argument 2	Indirect r	egister:	Entire I	range									
After operation					When the binary data of register $D_2$ is larger than								
<ul> <li>Ag.1 content</li> </ul>	Operation	n result			9999, a code other than BCD is stored in the								
<ul> <li>Ag.2 content</li> </ul>	Unchang	ed			highest-order position of the BCD, and normal								
Flag	Overflow	is ON w	hen the	$D_2$	conversion is not performed.								
	binary da	ta is lar	per than	9999.									

• When registers D<sub>1</sub> and D<sub>2</sub> are the byte registers,



- Note: If the X00L value X00L Y01L exceeds 99, the third 78 7 8 0 1 0 0 1 1 1 0 0 0 1 0 1 1 1 (3rd) digit and above are 0 ignored.
- When register  $D_1$  is the word register and register  $D_2$  is the byte register,



One (1)-byte binary data of X00H is converted into the BCD data and stored in D003.

X00H →				D003													
209		0				2			0			9					
1 1 0 1 0 0 0 1		0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1

F*011
-------

 $BCD \rightarrow BIN$  Conversion (Unsigned)

		Argument										
	Code	Ag.1	Ag.2	Ag.3		X00	0	FL01	1	BIN	D050 ↔	_
Symbol						11	•		้า			0014
BIN	F*011	D <sub>1</sub>	D <sub>2</sub>	—					J		BCD X	0200
		d <sub>1</sub>	d <sub>2</sub>									
Function	Converts	the unsi	igned BO	CD	Wh	en in	put X	000 is O	N, the	BCD	data of	register
	data of re	gister sp	Decified	by Ag.2	X02	2W is	conv	erted int	o the	BIN d	ata and	stored in
	into the E	SIN data	and stor	es in	D05	50.						
	the regist	er speci	fied by A	\g.1.				0	2		5	6
Content of	(D	٦	( D		VO	2/1/					0 1 0	1 1 0
operation	BCD d	$\rightarrow BIN$			~0	200	00				0 1 0	
	(u <sub>2</sub>	J	(u <sub>1</sub> )				MSB		$\checkmark$			LSB
Range of	Direct reg	gister: I	Entire ra	nge								
argument 1	Indirect r	egister:	Entire I	range	_	[						
Range of	Direct reg	gister:	Entire ra	nge	D	)50	0 0 0	0 0 0	0 1	0 0 0	000	0 0 0
argument 2	Indirect r	egister:	Entire I	range	(2	56)						
After operation												
Ag.1 content	Operation	n result										
Ag.2 content	Unchang	ed										
• Flag	Unchang	ed										

• When registers D<sub>1</sub> and D<sub>2</sub> are the byte registers,



One (1)-byte BCD data of X02H is converted into the BIN data and stored in R05L.



• When register  $D_1$  is the word register and register  $D_2$  is the byte register,

X000	FL011	BIN R04H	←
-	{ BIN }	BCD	X03W

Two (2)-byte BCD data of X03W is converted into the BIN data and the low-order one (1) byte is stored in R04H.

	X03W														
0 2						5				4					
0	0	0	0	0	0	1	0	0	1	0	1	0	1	0	0



Note: If the X03W value exceeds 256, the low-order eight (8) bits that were converted into the BIN data are stored in R04H.

F*012
-------

 $BIN \rightarrow BCD$  Conversion (Signed)

		ŀ	Argumer	ıt	
<b>a</b>	Code	Ag.1	Ag.2	Ag.3	X000 FL012   BCD D055 ←
Symbol					
BCD	F*012	D <sub>1</sub>	D <sub>2</sub>		
		d <sub>1</sub>	d <sub>2</sub>		
Function	Converts	the sign	ed BIN	data of	When input X000 is ON, the signed BIN data of
	register s	pecified	by Ag.2	into	register D070 is converted into the signed BCD
	the BCD	data and	d stores	in the	data, and the low-order four (4)-digit data is stored
	register s	pecified	by Ag.1		in register D055 and the high-order one (1) digit
					and a sign are stored in register D056.
Content of	(D, <sup>1</sup>	)	(D₁ D	₁+1)	(Low-order 4 digits)
operation	BIN d	$  \rightarrow BCI$		+ 1	D070 1 0 0 1 1 1 0 1 1 1 1 1 1 1 1 1 1
	( <sup>U2</sup> .	)	(u), u	•••	(-25089)
Range of	Direct reg	gister:	Entire ra	nge	$50^{4}89$
argument 1	Indirect r	egister:	Entire I	range	D055 0 1 0 1 0 0 0 1 0 0 0 1 0 0 1 0 0 1
		_			(High-order 1 digit)
Range of	Direct reg	gister:	Entire ra	nge	- 0 0 2
argument 2	Indirect r	egister:	Entire i	range	
After operation		_			When the high-order four (4)-bit data of register
<ul> <li>Ag.1 content</li> </ul>	Operation	n result			D1+1 is 1101, it signifies the negative value. If
<ul> <li>Ag.2 content</li> </ul>	Unchang	ed			0000, it represents the positive value.
<ul> <li>Flag</li> </ul>	Unchang	ed			

• When registers  $D_1$  and  $D_2$  are the byte registers,

X000	FL012	BCD Y05L	.←
	—{ BCD }—	BIN	R03L

The register  $D_1$  data is four (4) bytes if it is the byte register or word register.

R03L		YO	6H	YC	6L	Y0	5H	YO	5L
195	$\rightarrow$	0	0	0	0	0	1	9	5
1 1 0 0 0 0 1 1		0000	0000	0000	0000	0000	0001	1001	0 1 0 1

• When register  $D_1$  is the word register and register  $D_2$  is the byte register,

X000 FL012   BCD D010 ←       [BCD]   BIN R04L								
R04H	D011		D0	10				
195 →	0 0 0	0	0 1	9	5			
1 1 0 0 0 0 1 1	000000000000000	00000	0000001	10010	1 0 1			

F*013
-------

 $BCD \rightarrow BIN$  Conversion (Signed)

		1	Argumer	nt	
Symbol	Code	Ag.1	Ag.2	Ag.3	X000 FL013   BIN D010 ←
BIN	F*013	D <sub>1</sub> d <sub>1</sub>	D <sub>2</sub> d <sub>2</sub>		│
Function	Converts of registe the BIN c register s	the sigr r specifi lata and pecified	ed BCD ed by Ag stores ir by Ag.1	data g.2 into n the	When input X000 is ON, the signed BCD data of registers D200 and D201 is converted into the signed BIN data and stored in register D010.
Content of operation	$BCD \begin{pmatrix} D_2, \\ d_2, \end{pmatrix}$	$D_2 + 1$ $d_2 + 1$	$\rightarrow BIN$	$\begin{pmatrix} D_1 \\ d_1 \end{pmatrix}$	D200 1 0 0 0 1 0 0 0 1 0 0 1 0 0 0 1 0 0 0 1 0
Range of argument 1	Direct reg	gister: egister:	Entire ra Entire i	nge range	D201 1 1 0 1 0 0 0 0 0 0 0 0 0 0 1
Range of argument 2	Direct reg Indirect re	gister: egister:	Entire ra Entire i	nge range	MSB D010 1 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
After operation					MSB: 1 when negative and 0 when positive.
<ul> <li>Ag.1 content</li> <li>Ag.2 content</li> <li>Flag</li> </ul>	Operation Unchang Unchang	n result ed ed			+32767 or smaller than –32768, the data is not converted into the BIN code legally.

• When registers  $D_1$  and  $D_2$  are the byte registers,

X000	FL013	BIN R05L ↔	_
$\vdash$	—_{ BIN }	BCD	X02L

The signed BCD data of X02L, X02H, X03L and X03H are converted into the signed BIN data and stored in register R05L.

X0	3H	X03	BL	X0	2H	X0	2L	R05L		
_	0	0	0	0	1	0	$3 \rightarrow$	-103		
1 1 0 1	0000	00000	0000	0000	0001	0000	0 0 1 1	1 0 0 1 1 0 0 1		

• When register  $D_1$  is the word register and register  $D_2$  is the byte register,

Even if register  $D_2$  is the byte register or word register, four (4)-byte data is converted.

F\*020

**BIN Addition** 

		ŀ	Argumer	nt	
	Code	Ag.1	Ag.2	Ag.3	
Symbol					│ X000 FL020 │ BIN D000 ←
BIN	F*020	D <sub>1</sub>	D <sub>2</sub>	$D_3$	MOV D001 + D002
		d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	
			K <sub>2</sub>	K <sub>3</sub>	-
Function	Adds the	BIN dat	a of regi	ster	When input X000 is ON, the BIN data of register
	specified	by Ag.2	and BIN	l data	D001 is added to the BIN data of register D002,
	of registe	er specifi	ed by Ag	g.3 and	which is then stored in register D000.
	stores the	e sum in	register	•	
Contont of	specified	by Ag.1			
Content of			) <sub>3</sub> ]	(D₁ )	(5641)
operation	BIN d <sub>2</sub>		$ _3 \rightarrow B$	liN d₁	+
	(K <sub>2</sub> )	۱ (۲	K₃ J		
Range of	Direct red	nistor:	Entiro ra	nae	D002[0 0 0 0 1 0 0 1 0 0 0 1 1 0]
argument 1	Indirect r	enister:	Entire i	rande	(1158)
Range of	Direct red	aister:	Entire ra	nae	
argument 2	Indirect r	eaister:	Entire	range	
5	Constant	:	68 ~ 327	767 767	(6799)
Range of	Direct reg	gister: I	Entire ra	nge	(0100)
argument 3	Indirect r	egister:	Entire I	range	A000
	Constant	: -327	68 ~ 327	767	
After operation					
<ul> <li>Ag.1 content</li> </ul>	Operation	n result			If the word register is used for either register $D_2$ or
Ag.2 content	Unchang	ed			$D_3$ and the byte register is used for register $D_1$ , the
• Ag.3 content	Unchang	ed			sum of low-order eight (8) bits is stored in $D_1$ and
Carry flag	A000: I	urned O	N when	a	the high-order eight (8) bits are ignored.
	carry	takes p	ace as a	a result	
• Zoro flog		Furned C		the	
2 Zero nag		ation res	ult is zei	(0)	
Sign flag	A007· T	Furned O	N when	the	
Signing	MSB	is 1 as a	a result o	of	
	opera	ation			

- When registers  $D_1$  and  $D_2$  are the byte registers,

1	X000	FL020	BIN E03L ←
-		—( BIN )—	R04L + X01L

The BIN data of R04L and X01L are added and the low-order one (1) byte is stored in E03L.

If a carry takes place (i.e., the data exceeds 256), the carry flag will not turn ON.

R04L		X01L						E03L										
198 + 211					$\rightarrow$				15	53								
1 1 0 0 0 1 1 0		1	1	0	1	0	0	1	1		1	0	0	1	1	0	0	1

If the registers  $D_2$  and  $D_3$  are the byte registers, they are operated as the word register whose high-order eight (8) bits are zero (0).

F*021
-------

### Carried BIN Addition

		ŀ	Argumen	nt	
	Code	Ag.1	Ag.2	Ag.3	
Symbol	<b>-</b> +004			_	X000 FL021   BIN D110 ←
BIN	F*021	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	( BIN ) D00F + C + D120
		u <sub>1</sub>	U2 Ka	K <sub>a</sub>	
Function	Adds the	BIN dat	a of regi	ster	When input X000 is ON, the BIN data of register
	specified	by Ag.2	, BIN da	ta of	D00F, BIN data of register D120 and carry flag
	register s	pecified	by Ag.3	and	(A000) are added, which is then stored in register
	carry flag	and sto	res the s	sum in	D110.
Content of		peciliea	by Ag. T		D00F00101100000010010
operation	$\begin{bmatrix} D_2 \\ d \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \end{bmatrix}$	$\begin{bmatrix} D_3 \\ d \end{bmatrix} + C$	$\rightarrow BIN$		(11282)
•	K <sub>2</sub>	u <sub>3</sub>   K <sub>2</sub>	,	(a₁ )	+
	(12) (				
Range of Direct register: Entire range					(4932)
Range of	Direct rec	egister:	Entire ra	nge	+
argument 2	Indirect re	eaister:	Entire	ande	A000 1
	Constant	: -327	68 ~ 327	67	(Carry flag)
Range of	Direct reg	gister:	Entire ra	nge	↓
argument 3	Indirect r	egister:	Entire I	ange	
After operation	Constant	327	08 ~ 321	67	
Ag.1 content	Operation	n result			(10213)
Ag.2 content	Unchang	ed			A000 0
<ul> <li>Ag.3 content</li> </ul>	Unchang	ed			If the word register is used for either register $\overline{D_2}$ or
<ul> <li>Carry flag</li> </ul>	A000: T	urned C	N when	a	$D_3$ and the byte register is used for register $D_1$ , the
carry takes place as a result					sum of low-order eight (8) bits is stored in $D_1$ and the high order eight (8) bits are ignored
Zero flag	A006· T	urned C	N when	the	the high-order eight (o) bits are ignored.
Zoro nag	opera	ation res	ult is zer	o (0).	
Sign flag	A007: T	urned C	N when	the	
	MSB	is 1 as a	a result o	of	
	opera	ation.			

• When adding the binary data of one (1) word or over,

X000	FL020	BIN D100 ← D000 + D010	←	Addition of low-order one (1) word data.
	( BIN ) FL021 —{ BIN }—	BIN D101 ← D001 + C + D011	←	Addition of high-order one (1) word data.

In the above circuit, BIN data of 0 ~ 4294967295 is stored in D100 (low-order word) and D101 (high-order word).

F*022

BIN Subtraction

		ŀ	Argumen	nt	
	Code	Ag.1	Ag.2	Ag.3	
Symbol					│ X000 FL022 │ BIN D030 ←
BIN	F*022	D <sub>1</sub>	$D_2$	D <sub>3</sub>	BIN - D112 + D020
		d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	
			K <sub>2</sub>	K <sub>3</sub>	_
Function	Figures c	out the di	fference		When input X000 is ON, the BIN data of register
	between	the BIN	data of r	egister	D020 is subtracted from the BIN data of register
	specified	by Ag.2	and BIN	Idata	D112, which is then stored in register D030.
	of registe	r specifi	ed by Ag	g.3 and	
	stores the	e result i	n registe	er	D112 0 1 1 0 0 0 1 0 0 0 1 1 0 0 0 1 0 0
Ocatont of	specified	by Ag.1			(25140)
Content of	$ D_2 $		<sup>3</sup> ) <sup>1</sup>	س (D₁ )	-
operation	$BIN d_2$	- BIN d	3  → B	liN d₁	
	[ [K <sub>2</sub> ]	ſĸ	3		D0200011100000101010001
Pango of	Direct red	nictor:	Entiro ro	000	(12449)
argument 1	Indirect r	gister. i	Entiro	nge	$\downarrow$
Range of	Direct rec	nistor:	Entire ra	nde	- MSB LSB
argument 2	Indirect r	enister	Entire i	rande	D030[0 0 1 1 0 0 0 1 1 0 0 1 0 0 1 1]
argument 2	Constant	· _327(		767	(12691)
Range of	Direct red	nister:	Entire ra	nae	
argument 3	Indirect r	egister:	Entire	range	A000 [0]
5	Constant	: –327(	68 ~ 327	'67	
After operation					
Ag.1 content	Operation	n result			If the word register is used for either register $D_2$ or
<ul> <li>Ag.2 content</li> </ul>	Unchang	ed			$D_3$ and the byte register is used for register $D_1$ , the
<ul> <li>Ag.3 content</li> </ul>	Unchang	ed			low-order eight (8) bits of the result are stored in
<ul> <li>Carry flag</li> </ul>	A000: T	urned O	N when	а	$D_1$ and the high-order eight (8) bits are ignored.
	borro	w takes	place as	sa	
	resul	t of oper	ation.		
<ul> <li>Zero flag</li> </ul>	A006: T	urned O	N when	the	
	opera	ation res	ult is zer	ю (0).	
<ul> <li>Sign flag</li> </ul>	A007: T	urned O	N when	the	
	MSB	is 1 as a	a result o	ot	
	opera	ation.			

			The BIN data of X04L is subtracted
	FL022	BIN R20L $\leftarrow$ R03H – X04I	from the BIN data of R03H, and the
1 11	()		difference is stored in R20L.

If a borrow takes place as a result of operation, the carry flag turns ON.

R03H		X04L					R20L											
57	-	108					$\rightarrow$	-51										
0 0 1 1 1 0 0 1		0	1	1	0	1	1	0	0		1	1	0	0	1	1	0	1

• When obtaining the absolute operation result,



F*023	,
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#### Borrowed BIN Subtraction

		ŀ	Argumer	nt				
<b>•</b> • • •	Code	Ag.1	Ag.2	Ag.3				
Symbol	E*000	D	D	<b>D</b>	$1 \downarrow \downarrow$			
DIIN	F 023	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>				
		<b>u</b> <sub>1</sub>	K <sub>2</sub>	K <sub>3</sub>				
Function	Subtracts register s carry flag register s stores the specified	the BIN pecified from the pecified e differe by Ag.1	I data of by Ag.3 e BIN da by Ag.2 nce in re	and ata of and gister	When input X000 is ON, the BIN data of register D044 and carry flag (A000) are subtracted from the BIN data of register D051, and the difference is stored in register D003. D05101010101101010000			
Content of	$\left( D_{2} \right)$	$\left(D_3\right)$		( n. )	(22312)			
operation	$\begin{bmatrix} d_2 \\ K_2 \end{bmatrix}^-$	$\begin{bmatrix} d_3 \\ K_3 \end{bmatrix}^{-0}$	$C \rightarrow BIN$	$\begin{bmatrix} D_1 \\ d_1 \end{bmatrix}$	D0440010001100010010			
Range of	Direct reg	gister:	Entire ra	nge	(8994)			
argument 1	Indirect r	egister:	Entire	range				
Range of	Direct reg	gister:	Entire ra	nge				
argument 2	Constant	egister: -327	Entire i 68 ~ 327	range 767	MSB LSB			
Range of	Direct reg	gister:	Entire ra	inge	D003 0 0 1 1 0 1 0 0 0 0 0 0 1 0 1			
argument 3	Indirect r	egister:	Entire i	range	(13317)			
	Constant	: -327	68 ~ 327	767				
After operation								
Ag.1 content	Operation	n result			If the word register is used for either register $D_2$ or			
• Ag.2 content	Unchang	eu od			$D_3$ and the byte register is used for register $D_1$ , the low-order eight (8) bits of the result are stored in			
Carry flag		urned C	N when	а	$D_{4}$ and the high-order eight (8) bits are ignored			
early nag	borro	w takes	place as	sa	Data of $0 \sim 65535$ is also available.			
	resul	t of oper	ation.					
<ul> <li>Zero flag</li> </ul>	A006: T	urned C	N when	the				
	opera	ation res	ult is zei	ro (0).				
<ul> <li>Sign flag</li> </ul>	A007: T	urned C	N when	the				
	INISB ODOR	is Tas a	a result (	ונ				
	opera	auon.						

### • When subtracting the binary data of one (1) word or over,

X000	FL022	BIN D100 ← D010 – D000	←	Subtraction of low-order one (1)-word data.
	FL023	BIN D101 ← D011 − C − D011	~	Subtraction of high-order one (1)-word data.

It should be noted that if a borrow takes place in the subtraction of high-order one (1)-word data, the data is illegal.



### Unsigned BIN Multiplication

		ŀ	Argumen	t	
<b>•</b> • • •	Code	Ag.1	Ag.2	Ag.3	x000 FL024   BIN D105 ←
Symbol	Etco (				
BIN	F*024	$D_1$	$D_2$	$D_3$	
		d <sub>1</sub>	d <sub>2</sub>	d <sub>3</sub>	
Function	Figuros o	ut the p	K <sub>2</sub>	K <sub>3</sub>	When input X000 is ON, the RIN data of register
FUNCTION	RIN data	of rogict	or cooci	fied by	D04E is multiplied by the BIN data of register
	Ag 2 and	BIN dat	e speci	neu by	D04P is multiplied by the Bin data of register
	Ay.2 and	by A a 3	a or regr	Siei	register D105 and the high-order 1-word data in
	result in r	Dy Ay.J	and stor	by	register D106
	Ag 1	cylster t	specified	Бу	
Content of					D04F00010100000001010
operation		$A_3 \rightarrow B$	IN. 101, 1		(5130)
		3	, [a <sub>1</sub> , α	ı₁+1 J	×
	$\left[ \left[ K_{2} \right] \right] \left[ K_{2} \right$	3			D01B000000000000101100
Range of	Direct reg	gister:	Entire ra	nge	(44)
argument 1	Indirect r	egister:	Entire I	range	↓
Range of	Direct reg	gister:	Entire ra	nge	MSB LSB
argument 2	Indirect r	egister:	Entire I	range	D1060000000000000000000111
	Constant	: 0~6	5535		High-order one word
Range of	Direct req	gister:	Entire ra	nge	D10501111000011101110000
argument 3	Indirect r	egister:	Entire i	ange	(225720) Low-order one word
After energian	Constant	: 0~6	5535		
	Operation	o roquit			Mixed use of byte register and word register is
• Ag.1 content	Uperation	ad			register or word register) is opposited for register
• Ag.2 content	Unchang	eu			D four (4) but data is stored in register D
• Ag.s content	Unchang	ed			$D_1$ , rour (4)-byte data is stored in register $D_1$ .
• riay	Unchang	eu			

• When all registers are the byte registers,



5	F*025
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# Unsigned BIN Division

		ŀ	Argumen	nt			
	Code	Ag.1	Ag.2	Ag.3			
BIN	F*025	D.	Da	Da			
Dirt	1 020	d₁	$d_2$	$d_2$			
		~1	$\tilde{K}_2$	K <sub>3</sub>			
Function	Divides the specified data of real and store remainder by Ag.1.	he BIN d by Ag.2 egister sp es the qu er in regis	ata of re by the E becified otient ar sters spe	egisters BIN by Ag.3 nd ecified	When input X000 is ON, the four (4)-byte BIN data of register D101 and register D102 is divided by the two (2)-byte BIN data of register D05F, and the quotient and remainder are stored in registers D005 and D006, respectively.		
Content of operation	$ \begin{pmatrix} D_2, D_2 + d_2, d_2 + d_2, d_2 + d_2 \\ K_2 \end{pmatrix} $	$ \begin{pmatrix} 1 \\ d \\ k \end{pmatrix} / \begin{pmatrix} D \\ d \\ K \\ d_1 + \end{pmatrix} $	$ \begin{pmatrix} P_3 \\ B_3 \\ B_3 \end{pmatrix} \rightarrow \begin{pmatrix} D \\ d \\ d \end{pmatrix} $ (quotients)	$\left( \begin{array}{c} D_1 \\ D_1 \end{array} \right)$	$\begin{array}{c c c c c c c c c c c c c c c c c c c $		
Range of	Direct reg	gister:	Entire ra	nge	MSB LSB		
argument 1	Indirect r	egister:	Entire	range	D005 0 0 0 0 0 0 1 0 0 1 0 0 0 0 0		
Range of	Direct reg	gister:	Entire ra	nge	(Quotient 288)		
argument z	Constant	· 0 ~ 6	5535	ange	D006 0 1 0 1 0 0 1 1 1 1 1 0 0 0 1		
Range of	Direct red	gister:	Entire ra	nge	(Remainder 20961)		
argument 3	Indirect r	egister:	Entire ı	range			
	Constant	: 0~6	5535				
After operation							
Ag.1 content	Operation	n result			Even if either register (byte register or word		
<ul> <li>Ag.2 content</li> <li>Ag.2 content</li> </ul>	Unchang	ed			register) is specified for registers $D_1$ and $D_2$ , they		
<ul> <li>Ag.3 content</li> <li>Flag</li> </ul>	Unchang	ed ed			Data of $0 \sim 65535$ are available		
. 149	Shonang						

 Values of dividends D<sub>2</sub>, D<sub>2</sub>+1 can exceed 16 bits, but quotient D<sub>1</sub> must be less than 16 bits. • When all registers D<sub>1</sub>, D<sub>2</sub>, D<sub>3</sub> are the byte registers,

Two (2)-word BIN data of X04H, X04L, X03H and X03L is divided by the data of R01H, and the quotient is stored in Y015H and Y05L and the remainder in Y16H and Y16L.



F*032
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2 Logical Product (AND)

	ŀ	Argumen	nt	
Code	Ag.1	Ag.2	Ag.3	
<b>F</b> *000				
F^032		D <sub>2</sub>	D <sub>3</sub>	
	u <sub>1</sub>	U2 Ko	U3 Ko	
Figures of (AND) of specified stores the	but the lo BIN data by Ag.2 e result i	gical pro a of regist and Ag. n registe	oduct sters 3 and er	When input X000 is ON, the logical product of BIN data of registers D001 and D002 is figured out and the result is stored in register D000.
	<u>איני. ו</u> ה			D001001100011000
$\begin{bmatrix} D_2 \\ d_2 \\ K_2 \end{bmatrix}^{\wedge} \begin{bmatrix} \\ \end{bmatrix}$	$\begin{bmatrix} D_3\\d_3\\K_3 \end{bmatrix} \rightarrow \Big $	$\begin{bmatrix} D_1\\ d_1 \end{bmatrix}$		$ \begin{array}{c} & & & & \\          D002 \boxed{0} \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \ 0 \$
Direct reg	gister:	Entire ra	nge	
Indirect re	egister:	Entire i	range	_
Direct reg	gister:	Entire ra	nge	
Indirect re Constant	egister: : –327	ا Entire 227 ~ 68	range '67	
Direct reg	gister:	Entire ra	nge	When either register $D_2$ or $D_3$ is the word register
Indirect re	egister:	Entire	range	and register $D_1$ is the byte register, the logical
Constant	: -327	68 ~ 327	67	product of low-order eight (8) bits is figured out
Operation	n result			bits are ignored
Unchang	ed			
Unchang	ed			Symbol ABC
Unchang	ed			
				AND truth table $A$ $C$
	Code F*032 Figures c (AND) of specified stores the specified $\begin{pmatrix} D_2 \\ d_2 \\ K_2 \end{pmatrix} \land \begin{pmatrix} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	CodeAg.1F*032 $D_1$ $d_1$ Figures out the lo (AND) of BIN data specified by Ag.2 stores the result i specified by Ag.1 $\begin{pmatrix} D_2 \\ d_2 \\ d_2 \\ K_2 \end{pmatrix} \land \begin{pmatrix} D_3 \\ d_3 \\ d_3 \\ K_3 \end{pmatrix} \rightarrow$ Direct register: Indirect register: Indirect register: Indirect register: Indirect register: Indirect register: Constant: -3270Direct register: Operation result Unchanged Unchanged Unchanged	CodeArgumer Ag.1Ag.2F*032 $D_1$ $D_2$ $d_1$ $d_2$ $d_1$ $d_2$ $K_2$ Figures out the logical pro (AND) of BIN data of regis specified by Ag.2 and Ag. stores the result in register specified by Ag.1. $\begin{pmatrix} D_2 \\ d_2 \\ d_2 \\ K_2 \end{pmatrix} \land \begin{pmatrix} D_3 \\ d_3 \\ K_3 \end{pmatrix} \rightarrow \begin{pmatrix} D_1 \\ d_1 \end{pmatrix}$ Direct register:Entire ra Indirect register:Indirect register:Entire ra Indirect register:Direct register:Entire ra Indirect register:Direct register:Entire ra Indirect register:Indirect register:Entire ra Indirect register:Direct register:Entire ra Indirect register:Direct register:Entire ra Indirect register:Direct register:Entire ra Indirect register:Direct register:Entire ra Indirect register:Operation result Unchanged Unchanged UnchangedUnchanged Unchanged	CodeAg.1Ag.2Ag.3F*032 $D_1$ $D_2$ $D_3$ $d_1$ $d_2$ $d_3$ $d_1$ $d_2$ $d_3$ $K_2$ $K_3$ Figures out the logical product(AND) of BIN data of registersspecified by Ag.2 and Ag.3 andstores the result in registerspecified by Ag.1. $\begin{pmatrix} D_2 \\ d_2 \\ K_2 \end{pmatrix} \land \begin{pmatrix} D_3 \\ d_3 \\ K_3 \end{pmatrix} \rightarrow \begin{pmatrix} D_1 \\ d_1 \end{pmatrix}$ Direct register:Entire rangeIndirect register:Entire rangeUnchangedUnchangedUnchangedUnchangedUnchangedUnchanged



F*033
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Logical Sum (OR)

		Argument			
<b>•</b> • • •	Code	Ag.1	Ag.2	Ag.3	
Symbol	<b>E</b> *000	<b>_</b>	<b>_</b>	<b>_</b>	$X000$ FL033 OR D10F $\leftarrow$
UR	F*033	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	
		<b>u</b> <sub>1</sub>	K <sub>2</sub>	D <sub>3</sub>	
Function	Figures o	out the lo	gical su	m (OR)	When input X000 is ON, the logical sum of BIN
	of BIN da	ta of reg	jisters sp	pecified	data of registers D110 and D112 is figured out and
	by Ag.2 a	ina Ag.3 Pagistar 9	and stol	by	the result is stored in register DTOF.
	Ag.1.	cylster t	speemed	Бу	
Content of	$\left( D_{2} \right) \left( \right)$	D°J	( <sub>م</sub>		
operation	$d_2$ $\vee$	$d_3 \rightarrow d_3$	$d_1$		D112 1 0 0 1 0 0 1 1 0 1 1 1 0 1 0 1
	[K₂ ] [	K₃∫			
Range of	Direct reg	gister:	Entire ra	nge	MSB LSB
argument 1	Indirect re	egister:	Entire	ange	D10F 1 0 1 1 0 0 1 1 0 1 1 1 1 1 0 1
Range of argument 2	Direct reg	Jister:	Entire ra	nge	
	Constant	: –327	68 ~ 327	'67	
Range of	Direct register: Entire range				
argument 3	Indirect register: Entire range				
After operation	Constant	527	50 ~ 521	07	When either register $D_2$ or $D_3$ is the word register
<ul> <li>Ag.1 content</li> </ul>	Operation	n result			and register $D_1$ is the byte register, the logical sum
Ag.2 content	Unchang	ed			of low-order eight (8) bits is figured out and stored
<ul> <li>Ag.3 content</li> <li>Flag</li> </ul>	Unchang	ea ed			in register D <sub>1</sub> . The high-order eight (8) bits are
ridg	ononang	ou -			
					Symbol ABC
					$ _{B} Z C 011$



F*034
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Exclusive Logical Sum (XOR)

		ŀ	Argumen	t	
	Code	Ag.1	Ag.2	Ag.3	
Symbol	E*024	<b>D</b>	<b>_</b>	<b>D</b>	$\begin{array}{c c} X000 & FL034 & D10D \leftarrow \\ \hline \\ 1 & 1 & 1 \\ \hline \\ 1 & 1 \\ 1 & 1 \\ 1$
XUR	F 034	D <sub>1</sub>	D <sub>2</sub>	D <sub>3</sub>	
		u <sub>1</sub>	K <sub>2</sub>	K <sub>3</sub>	
Function	Figures of	out the ex	clusive	logical	When input X000 is ON, the exclusive logical sum
	sum (XO	R) of BIN	V data of		of BIN data of registers D103 and D102 is figured
	registers	specifie	d by Ag.	2 and	out and the result is stored in register D10D.
	Ag.3 and	stores t	he result	in	
Contont of	register s	pecified	by Ag.1		D103 0 0 1 1 1 0 1 0 0 0 1 0 1 1 0 0
content of	$\left( \begin{array}{c} D_2 \end{array} \right)$	$\begin{bmatrix} D_3 \end{bmatrix}$	$(D_1)$		€
operation		$d_3 \rightarrow$	[d₁ ]		D102 0 1 1 0 1 1 0 1 0 1 0 1 1 0 1 0 1 0
	[K <sub>2</sub> ]	(K <sub>3</sub> )			$\downarrow$
Range of	Direct reg	gister:	Entire ra	nge	
argument 1	Indirect r	egister:	Entire I	ange	
Range of	Direct reg	gister:	Entire ra	nge	
argument 2	Indirect r	egister:	Entire I	ange	
Dongo of	Constant	: <u>-327</u>	08 ~ 321 Entiro ro	67	-
Range of	Indirect re	gister. I	Entiro I	nge	
argument 5	Constant	-327		ange '67	
After operation	Conotant	. 021	00 02.	01	
Ag.1 content	Operation	n result			Symbol ABC
Ag.2 content	Unchang	ed			
Ag.3 content	Unchang	ed			XOR truth table
• Flag	Unchang	ed			
					B
	1				





Increment

		Argument			
	Code	Ag.1	Ag.2	Ag.3	$ $ x000 FE035   INC D015 $\leftarrow$ D + 1
Symbol		_			
INC	F*035	D <sub>1</sub>			
		d <sub>1</sub>			
Function	Incremen	ts the B	N data d	of	When input X000 has turned ON from OFF, the
	register s	pecified	by Ag.1	and	BIN data of register D015 is incremented and
	stores in	register	specified	d Ag.1.	stored in register D015.
Content of		(n	`		
operation	$  U_1   + $	$1 \rightarrow \begin{bmatrix} D \\ J \end{bmatrix}$	1		D015 0 0 0 0 1 0 0 1 0 0 1 1 0 0 1 1 1 0 0 1
	(a₁ )	ʻ (d₁	J		(2329)
Range of	Direct rec	nister:	Entire ra	nae	$\downarrow$
argument 1	Indirect re	aister:	Entire	range	MSB LSB
After operation		- 9		5.1.95	D015 0 0 0 1 0 0 1 0 0 1 0 0 1 1 0 0 1 1 0
Aa.1 content	Low-orde	r four (4	) diaits c	of	(2330)
	operation	result	,		
Flag	Unchang	ed			The data ranges from -32768 to 32767.



Decrement

		ŀ	Argumen	nt	
	Code	Ag.1	Ag.2	Ag.3	
Symbol					
DEC	F*036	D <sub>1</sub>			
		d <sub>1</sub>			
Function	Decreme	nts the E	3IN data	of	When input X000 has turned ON from OFF, the
	register s	pecified	bv Aq.1	and	BIN data of register D070 is decremented and
	stores in	register	specified	d Ag.1.	stored in register D070.
Content of	( ۲۵	. (D	L)		
operation	$\begin{bmatrix} -1 \\ d_1 \end{bmatrix} = 2$	$1 \rightarrow \begin{bmatrix} \mathbf{D}_1 \\ \mathbf{d}_1 \end{bmatrix}$	J		(3140)
Range of	Direct reg	gister:	Entire ra	nge	$\downarrow$
argument 1	Indirect re	egister:	Entire I	range	MSB LSB
After operation					D070 0 0 0 0 1 1 0 0 0 1 0 0 0 1 1
<ul> <li>Ag.1 content</li> </ul>	Low-orde	r four (4	) digits c	of	(3139)
	operation	result			
<ul> <li>Flag</li> </ul>	Unchang	ed			The data ranges from -32768 to 32767.

• Forward/backward counter as per increment or decrement (signed BIN data)

X000	FE035 { INC }	INC D000 ← D + 1	V ir
X001	FE036 { DEC }	DEC D000 ← D – 1	T 3

When X000 is ON, the counter value increments. Likewise, when X001 is ON, the counter value decrements. The data ranges from –32768 to 32767.

1	E*007
	F"037

## Unsigned Comparison

			Argument	t						
Symbol	Code	Ag.1	Ag.2	Ag.3	-   v	000	EI 037			
CMP	F*037	$D_1$	$D_2$	$B_3$				$D005 \rightarrow R050$		
		d₁	d <sub>2</sub>			11				
E	0	κ <sub>1</sub>	K <sub>2</sub>							
Function	Compare	s the BI	IN data of	with		en input X	JUU IS ON, arad with t	the BIN data of register		
	the RIN d	ata of r	a by Ay. I Paister sn	ecified		10 is compa	result is c	ne bin data of register		
	by Aq 2 t	hen sto	res the re	sult in	R05	5, and inc		diput into relay reood,		
	relav B3.			out in						
Content of	(n)					010000	0 0 1 0	0 1 0 0 1 0 0 0 1 1		
operation	$  d_1   \leftrightarrow$	$ D_2 $	$\rightarrow B_3$		(	2339)				
	K.	K <sub>a</sub>					1001			
	(N <sup>1</sup> )					005 <u>00</u>				
Range of	Direct reg	jister:	Entire rar	nge	(	9752)		J.		
argument 1	Indirect re	egister:	Entire ra	ange		R050:ON. R051:OFF				
Pango of	Direct rec	$0 \sim 0$	50034 Entiro ror		_			,		
argument 2	Indirect re	anister.	Entire ra	ande	Whe	en the BCI	) data are	compared both are		
argument 2	Constant	$0 \sim 6$	5534	unge	rega	arded as th	ne BIN dat	a.		
Range of	Relay: E	Entire ra	ange		If ei	ther registe	er D₁ or D₂	is the byte register, the		
argument 3	,		0		data	a of the byt	e register	is taken as the 16-bit data		
After operation					who	se high-or	der eight (	(8) bits are zero (0) and		
<ul> <li>Ag.1 content</li> </ul>	Unchange	ed			com	pared.				
Ag.2 content	Unchange	ed								
<ul> <li>Ag.3 content</li> </ul>								1		
	K When	elay ad	Idress	^^	4	<b>A a 1 a</b>	A ~ 1.			
	is or	1 D <sub>3</sub>	is odd	Ag.	1 =	Ag.1 < Ag.2	Ag.1>			
	num	ber	number	Αţ	y.∠	⊼y.∠	⊼y.∠			
	B		B <sub>2</sub> –1		1	1	0			
	B <sub>3</sub> +	-1	<u> </u>	-	1	0	0	1		
Flag	Unchange	ed	Ŭ	I		1	1			

#### Comparison of byte register with word register (BIN data) ٠

FL037 X000

 $\mathsf{CP} \ \mathsf{D000} \Leftrightarrow \mathsf{R02H} \to \mathsf{R105}$ 

	(CMP)
1	

D000	R02H	Result	R104	R105
(72)	(202)	<	1	0
	1100 1010			
(202)	(202)	=	1	1
0000 0000 1100 1010	1100 1010			
(2304)	(174)	>	0	0
0000 1001 0000 0000	1010 1110			

F*038
-------

## Signed Comparison

	/	Argumen								
	Code	Ag.1	Ag.2	Ag.3						
Symbol	<b>-</b> *000			_	_   `	K000	FL038	$  CP D105 \Leftrightarrow$		
СМР	F^038	D <sub>1</sub>		$B_3$		┥┝───	-{ CMP}-	$\square$ S D005 $\rightarrow$ R047		
		u₁ K₄	K <sub>2</sub>							
Function	Compares	s the Bl	N data o	f	Whe	en input X(	000 is ON	, the BIN data of register		
	register s	pecified	by Ag.1	with	D10	5 is comp	ared with t	the BIN data of register		
	the BIN da	ata of re	egister sp	pecified		5, and the	result is c	output into relay R046,		
	by Ag.2, the into relay	nen out B3	puts the	result	R04	-7.				
Content of		<u> </u>	<u>ר</u>		- C	0105 0 0	0 0 1 1	0 0 0 1 0 0 1 0 0		
operation	$ \mathbf{n}_1 $	$\leftrightarrow   \frac{n_2}{d_2}$	$\rightarrow B_3$		(	3140) MOD				
		$D_2$	s		Г		0 1 1 0			
Pango of		ictor:	Entiro ro	ngo	- (	6241)				
argument 1	Indirect reg	aister.	Entire ra	ande	Ň	$\downarrow$				
a.g.	Constant:	-327	678 ~ 32	767				R047·OFF		
Range of	Direct reg	ister:	Entire ra	nge						
argument 2	Indirect re	egister:	Entire r	ange	Whe	When the BCD data are compared, they are regarded as the BIN data				
Range of	Relay: En	tire ran	ae	101	If ei	ther registe	er D₁ or D	is the byte register, the		
argument 3			<b>.</b>		data	a of the byt	e register	is taken as the 16-bit data		
After operation		_			who	se high-or	der eight	(8) bits are zero (0) and		
Ag.1 content	Unchange	ed			com	pared.				
<ul> <li>Ag.2 content</li> <li>Ag.3 content</li> </ul>	Unchange	eu								
, igio contoni	R	elay ad	dress					]		
	Wher	n B <sub>3</sub>	When B	₃ Ag	g.1 =	Ag.1 <	Ag.1>			
	is ev	en	is odd	A	\g.2	Ag.2	Ag.2			
	numi	ber	number		1	1	0	-		
	B <sub>3</sub>	.1	D3-1 B-		1	0	0	-		
• Flog		n Da	<b>D</b> 3		1	U	U			
• riag	Unchange	eu								

• Comparison of byte register with word register (BIN data)

D180	R03H	Result	R010	R011
(-73) 1 1 1 1 1 1 1 1 1 1 0 1 1 0 1 1 1	(153) 1001 1001	<	1	0
(-174) 1 1 1 1 1 1 1 1 0 1 0 1 0 1 0	(184) 1011 1000	<	1	0
(-3140) 1 1 1 1 1 0 0 1 1 1 0 1 1 1 1 0 0	(83) 0101 0011	<	1	0
(206) 0000 0000 1100 1110	(206) 1 1 0 0 1 1 1 0	=	1	1
(456) 0000 0001 1100 1000	(226) 1 1 1 0 0 0 1 0	>	0	0



Arithmetic Left Shift

		ŀ	Argumen	it						
	Code	Ag.1	Ag.2	Ag.3		00	FE040	I S		070
Symbol						1				010
SLA	F*040	D <sub>1</sub>							C←	$\leftarrow 0$
		d <sub>1</sub>								
Function	Shifts the	e data of	register		When i	nput X	000 has turi	ned Of	N from	OFF, the
	specified	by Ag.1	by one	(1) bit	data of	registe	er D070 is sl	hifted I	by one	(1) bit to the
	to the left	and set	s the mo	osť	left, the	e MŠB i	is set in A00	0 and	LSB is	s set to zero
	significar	nt bit (MS	SB) in the	e carry	(0).					
	flag.	,	,	,	. ,					
Content of	(D	)			A000	D07	0			
operation	$C \leftarrow \begin{bmatrix} D_1 \\ d_1 \end{bmatrix}$	(← 0				101	10001	110		$001 \leftarrow 0$
	(a)	)							/	
Range of	Direct reg	gister: I	Entire ra	nge		MSB	1			LSB
argument 1	Indirect r	egister:	Entire ı	ange			$\checkmark$			
After operation					A000	) D07	70			
Ag.1 content	Data shif	ted by or	ne (1) bit	to the	1	011	00011	101	000	10
0	left.				Ľ	• . .				
<ul> <li>Carry flag</li> </ul>	A000: 5	Status of	MSB of	Ag.1	When r	egister	$D_1$ is the by	yte reg	gister, t	the
	befor	e shifted	Ι.	-	high-or	der eig	ht (8) bits a	re broi	ught in	to zero (0)
<ul> <li>Other flags</li> </ul>	A006, A0	07: Un	changed	t	and shi	ifted.	As a result,	the ca	arry flag	g is turned
Ŭ			Ũ		OFF.				•	-

• When register D<sub>1</sub> is the byte register,



• Example of using register as one (1)-word length shift register:



### F\*041

Left rotation

		ŀ	Argumen	nt			
	Code	Ag.1	Ag.2	Ag.3	L X000	FF041 I	RI D007
Symbol							
RL	F*041	D <sub>1</sub>				─ <u></u> ( RL )──	$C \leftarrow C$
		d <sub>1</sub>					
Function	Shifts the	e data of	register		When input X	000 has turned	d ON from OFF, the
	specified	by Ag.1	by one	(1) bit	data of registe	er D007 is shift	ted by one (1) bit to the
	to the left	and set	s the ca	rry flag	left, the A000	data is set in t	he LSB, then the MSB
	in the lea	st signifi	cant bit	(LSB),	in A000.		
	then the	MSB in t	he carry	flag.		17	
Content of	ſŋ	)					
operation	$C \leftarrow \begin{bmatrix} D_1 \\ d \end{bmatrix}$	← C					
	[u₁	J					个
Range of	Direct reg	gister:	Entire ra	nge	MSB		LSB
argument 1	Indirect r	egister:	Entire I	range		$\downarrow$	
After operation							
<ul> <li>Ag.1 content</li> </ul>	Data shif	ted by or	ne (1) bit	t to the	A000 D00	07	
	left. LSI	B is the v	alue of	carry	0 0 1	0 0 1 0 0 0	1 1 1 1 0 0 1 1
	flag befor	re shifted	d.				
<ul> <li>Carry flag</li> </ul>	A000: S	Status of	MSB of	Ag.1	When registe	r D1 is the byte	e register, the
	befor	e shifted	ł.	-	high-order eig	ght (8) bits are	brought into zero (0)
<ul> <li>Other flags</li> </ul>	A006, A0	07: Un	changed	ł	and shifted.	After operation	n, the carry flag data
-			•		turns OFF.		

• When register D<sub>1</sub> is the byte register,



• When shifting one (1) word or more to the left,



• Example of using register as two (2)-word shift register:





X003:

Reset signal

Right Shift

		ŀ	Argumen	ıt				
Symbol	Code	Ag.1	Ag.2	Ag.3	X000	FE042	SRL D	011
SRL	F*042	D <sub>1</sub>					0 -	$\rightarrow \rightarrow C$
		d <sub>1</sub>					· ·	, , C
Function	Shifts the	data of	register		When input X	000 has turned	d ON from	OFF, the
	specified	by Ag.1	by one	(1) bit	data of regist	er D011 is shift	ed by one	(1) bit to the
	to the rigl	nt and se	ets the L	SB in	right, the LSE	3 is set in A000	and MSB	is set to
	the carry	flag.			zero (0).			
Content of	(D	ר			D011			A000
operation	$0 \rightarrow \begin{vmatrix} D_1 \\ d \end{vmatrix}$	$  \rightarrow C$					1 1 0 0 0	
	(u1	)						
Range of	Direct reg	gister: I	Entire ra	nge	INI2R			LSB
argument 1	Indirect re	egister:	Entire I	range		1		
After operation						$\checkmark$		
<ul> <li>Ag.1 content</li> </ul>	Data shift	ted by or	ne (1) bit	t to the	D011			A000
	right.				0 1 0	0 0 1 1 1 0	0 1 1 0 0	$0   0   \rightarrow   1  $
<ul> <li>Carry flag</li> </ul>	A000: S	Status of	LSB of A	Ag.1				
	befor	e shifted	l.		When registe	r D1 is the byte	register, t	the
<ul> <li>Other flags</li> </ul>	A006, A0	07: Un	changed	k	high-order eig	ght (8) bits are	brought in	to zero (0)
					and shifted to	the right.		

• When register D<sub>1</sub> is the byte register,



• Example of using register as bi-directional one (1)-word length shift register:





Right Rotation

		Argument					
	Code	Ag.1	Ag.2	Ag.3	L X000	FE043   RI	R D010
Symbol							
RR	F*043	D <sub>1</sub>					$C \rightarrow \rightarrow C$
		d <sub>1</sub>					
Function	Shifts the data of register				When input X000 has turned ON from OFF, the		
	specified by Ag.1 by one (1) bit to the right and sets the carry flag data in the MSB, then sets the LSB in the carry flag.			(1) bit	data of register D010 is shifted by one (1) bit to the		
				arry	right, the A000 data is set in the MSB, then the		
				LSB in A000.			
				A000 D010			
Content of	ſD	)			$1 \rightarrow 0 1$	1 0 0 1 1 1 0 0	0 1 0 1 0 1 0
operation	$ C \rightarrow  _{d}^{D_1}  \rightarrow C$						
	[u₁	J					
Range of	Direct register: Entire range			nge	IVISD		LOD
argument 1	Indirect register: Entire range					. .	
After operation						¥ 10	
<ul> <li>Ag.1 content</li> </ul>	Data shifted by one (1) bit to the			t to the			
	right. M	ISB is the	e value o	of carry	0 10	1 1 0 0 1 1 1 0	0 1 0 1 0 1
	flag before shifted.				When register $D_1$ is the byte register, the		
<ul> <li>Carry flag</li> </ul>	A000: 5	Status of	LSB of /	Ag.1	high-order eig	ht (8) bits are brou	ught into zero (0)
	before shifted.				and shifted. Therefore, the carry flag data in MSB		
<ul> <li>Zero flag</li> </ul>	A006: S	Status of	LSB of /	Ag.1	has no meanii	ng.	, ,
Ĵ	befor	re shifted	l.	-		-	
<ul> <li>Sign flag</li> </ul>	A007: L	Jnchang	ed				

• When register D<sub>1</sub> is the byte register,



• When shifting one (1) word or more to the right,


• Example of using register as bi-directional two (2)-word length shift register:



F*045	$4 \rightarrow 16$ Decoder
-------	----------------------------

			٨		
		1	Argumen	nt	
	Code	Ag.1	Ag.2	Ag.3	
Symbol					
DCD	F*045	D <sub>1</sub>	D <sub>2</sub>		
		d <sub>1</sub>	$d_2$		
Function	Decodes	the low-	order fo	ur (4)	When input X000 is ON, the low-order four (4)-bit
	bits of red	aister so	ecified h	v Aa.2	data of register D00F is decoded and stored in
	into 16 bi	ts and s	tores in i	reaister	register D010 as the 16-bit data.
	specified	by Aq.1		- 3	
Content of	(- )	<u></u>			lanored
operation			D <sub>1</sub>		.g
oporation	(D₂ J →		l₁ J		
Pange of	Direct rov	victor:	- Entiro ro	nao	
argument 1		yisiel.		nye	(12) MSB LSB
	Direct			ange	
Range of	Direct reg	gister:	Entire ra	nge	$\checkmark$
argument 2	indirect r	egister:	Entire	ange	
After operation					D010 0001100000000000000000000000000000
Ag.1 content	Operation	n result			15 87 0
Ag.2 content	Unchang	ed			
• Flag	Unchang	ed			When register $D_1$ is the byte register, the low-order
					eight (8) bits of the decoded result are stored in
					register D <sub>1</sub> .
					If the data of register $D_2$ is 8 or over, zero (0) is
					stored.
				0	8
	>00000				
				1	9
1 0 0 0 0 1 -	→0000	0000	0000	0010	9 0 1001 $\rightarrow$ 000001 000000
				2	
	>00000				
				3	11
3 0 0 0 1 1 -	→0000	0000	0000	1000	11  0  1  0  1  0  0  0  0  0
			4		12

- $\begin{array}{c} 6 & 14 \\ \hline 0 & 0 & 1 & 1 \\ 6 & 0 & 0 & 1 & 1 \\ \hline 0 & 0 & 0 & 0 & 0 & 0 \\ \hline 7 & 7 & 1 & 1 \\ \hline 0 & 1 & 1 & 1 \\ \hline 0 & 1 & 1 & 0 \\ \hline 15 & 16 \\ \hline \end{array}$



Bit Test (Constant Designation)

		Argument		nt	
	Code	Ag.1	Ag.2	Ag.3	X000 FL047   TEST D022 BIT
Symbol					
TST	F*047	D <sub>1</sub>	K <sub>2</sub>	B <sub>3</sub>	$[1] [131] [011 \rightarrow R015$
		d <sub>1</sub>			_
Function	Stores in	relay sp	ecified b	oy Ag.3	When input X000 is ON, the status of Bit 11 of the
	the bit of	the data	in regis	ter	data in register D022 is stored in relay R015.
	specified	by Ag.1	, which i	s at a	
	position s	specified	by cons	stant	D022 0 0 1 0 1 0 0 1 1 1 1 0 0 0 0 0
Contont of	NZ.				15 11 87 0
content of	$\left( D_{1} \right)$	, D			
operation	d <sub>1</sub>	$\rightarrow D_3$			
	$\begin{bmatrix} d_1 \end{bmatrix} (K_2)$	2)			K <sub>2</sub> = 11
Range of	Direct register: Entire range				
argument 1	Indirect register: Entire range			range	R015 = ON
Range of	Constant	: 0~1	5	0	-
argument 2					
Range of	Range of Relay: Entire range			When register D is the byte register the	
argument 3			when register $D_1$ is the byte register, the		
After operation				high-order eight (8) bits are brought into zero (0)	
Ag.1 content Unchanged					
Ag.2 content	Ag.2 content Unchanged		and tested.		
<ul> <li>Ag.3 content</li> </ul>	Status of	specifie	d bit		
<ul> <li>Flag</li> </ul>	Unchang	ed			



Subroutine Start



Note: When programming a subroutine program, include the subroutine start instruction at the top and the subroutine return instruction at the end of a program.

Example:



When you have to repeat the same processing in the program, register it beforehand as a subroutine, and you can execute it by calling this subroutine, when necessary. Thus, you can reduce the number of program steps and make the program easy-to-see.

Data from the subroutine start instruction ( $F^*049$ ) to the subroutine return instruction ( $F^*059$ ) is registered as one (1) subroutine. Up to thirty-two (32) subroutines can be registered.

Set a subroutine number in the argument of subroutine start instruction. Likewise, set the subroutine number in the argument of subroutine return instruction.

To call a registered subroutine, use the subroutine call instruction (F\*058).

Cautions on use of subroutine:

Though there is not any limitation on the call of another subroutine from one subroutine (i.e., nesting), DO NOT execute the same subroutine. Otherwise, the system will operate incorrectly.



Subroutine Call

		1	Argumer	nt	
Symbol	Code	Ag.1	Ag.2	Ag.3	When input X000 is ON, the subroutine program
CAL	F*058	K <sub>1</sub>			010 is executed.
Function	Executes	the sub	routine		
	program	defined	by the co	onstant	X000 FL058   CAL 010
	specified	by Ag.1			
Content of	CAL K <sub>1</sub>				
operation					
Range of	Constant	: 0~3	2		Main program
argument 1					
					FL049 SBR 010
					FL059 RET 010
After operation					
Aa 1 content	Inchang	ed			
, ig. i content	Chonang	Cu -			



Subroutine Return/Program End

		Argument		nt	
Symbol	Code	Ag.1	Ag.2	Ag.3	The end of subroutine program 20 is executed.
RET	F*059	K <sub>1</sub>			
Function	Specifies subroutin by the co	the end e progra nstant o	of the am desig f Ag.1.	inated	FL049 020 (SBR)
Content of operation	RET				
Range of argument 1	Constant	: 0~3	2		
					FL059 020 (RET)
After operation <ul> <li>Ag.1 content</li> </ul>	Unchang	ed			

STE 85368



1-Scan ON

		Argument		nt	X000 FF000
	Code	Ag.1	Ag.2	Ag.3	
Symbol					
EDG	FE063	B <sub>1</sub>			
Function	Turns ON	the rela	ay specif	ied by	When input X000 has turned ON from OFF, relay
	Ag.1 duri	ng one (	1) scan.	-	E000 is turned ON, which is turned OFF after this
Content of operation	B <sub>1</sub> : ON				instruction is executed in the next scan.
Range of argument 1	Relay: E	Relay: Entire range			I/O User's program processing I/O
After operation <ul> <li>Ag.1 content</li> <li>Flag</li> </ul>	Turned O scan. Unchang	ON relay B₁ for one (1) jed			processing     processing       X000 ON     FE063       Program end       E000

Note: This instruction works exactly in the same manner as differentiating relay E\*\*\*.



In terms of the processing speed, differentiating relay E<sup>\*\*\*</sup> is faster than this instruction. It is recommended, therefore, to use differentiating relay E<sup>\*\*\*</sup> where possible.

This instruction cannot be used as FL063.

## 7.6 Programming

The PLC may perform the operation slightly different from the actual relay circuit because it successively reads data from the program memory and performs instructions one by one. Additionally, a run-around preventing diode is not required, which is needed for the relay board, and the number of auxiliary contacts is unlimited.

Design the circuit efficiently by fully understanding the difference in circuit design between the PLC and relay board.

## 7.6.1 Limitation on Creating Circuit

(1) One (1) circuit must consist of (11 columns  $\times$  1 output)  $\times$  11 lines or less as shown below.



(2) Current in the same circuit only flows from left to right. It will not flow from right to left. That is, the circuit includes a one-way diode at each contact.



Current flows in the direction shown by
 the full-line arrow mark, but not in the dotted-line arrow mark direction.

For the current below, the current in the dotted-line arrow mark direction is not existent.







(4) The pair coil is considered as one (1) circuit.

The counter and latch are considered as one (1) circuit, including the reset condition. It is not possible to include another coil between the pair coil.





(Pair coil error occurs.)

### 7.6.2 Influence by Program Sequence

The PLC performs operation from the top to the end (P. END instruction) of the program repeatedly. (Cyclic scanning operation system)

For this reason,

- (a) The operation is performed from the top to bottom of the program for each circuit (i.e., each circuit block with AND and OR connections).
- (b) The operation is performed from the left to right for each column in one (1) circuit. (The operation of the input part is performed before the operation of the output part.)
- (1) When the program sequence is changed, the operation may differ.



In program [1] above, R000 and R100 are turned ON within the same scan when X000 is turned ON. In program [2], however, R100 is turned ON one (1) scan later. This is because the status of contact R000 is changed one (1) scan later due to the presence of contact R000 before coil R000. Generally, the status of the contact programmed before the coil is changed at the next scan to the one in which the coil state changed. There is a programming technique to use such scan delay constructively.

Example:



This is an oscillation circuit which repeats ON and OFF every scan.

(2) If an interlock is made in one (1) circuit, malfunction may result in.



Even if an interlock is made mutually in the above circuit, SOL1 and SOL2 repeat ON and OFF every scan when PB1 and PB2 are pressed at the same time.

This is because the operation is performed from the left to right in the same circuit according to the principle in Item (b) of Para. 7.6.2. To prevent malfunction, the circuit must be divided into the two (2) parts.



When PB1 and PB2 are pressed at the same time, the circuit in which priority is given to SOL1 is formed.

(3) If an application instruction with change in flag status is used together with a flag contact in the same circuit, the flag result is incorrectly reflected.



The above is the circuit to output an error as a result of operation (overflow) to R000. As the input part is operated before the output part according to the principle in Item (b) of Para. 7.6.2, the carry result after addition is not reflected. It is necessary to divide the circuit into the two (2) parts.



For the application instruction that performs operation with carry, however, multi-output circuits pose no problem because the flag is processed automatically and internally.

## 7.6.3 Influence by Input/Output Processing

The input/output relay can be used as a byte or word register. When it is used as a source or destination, however, all data are read and written in and out of the data memory. At the time when the application instruction has been executed, the result will not be output to the I/O device.

The final result of the operation is processed in batch and exchanged between the I/O device and data memory. At this time, the result is actually output to the I/O device.

## 7.6.4 Promoting Programming Efficiency

The TCmini need not consider stacks unlike the PLC with serial Boolean algebra processing system, because it has the special direct ladder-diagram input system. When the characteristics are fully understood, however, a program becomes more efficient with fewer instruction words.

(1) How to count the number of instruction words

The following sections necessary for constructing a circuit are counted as one (1) word.



Each section enclosed by dotted line is counted as one (1) word. The line required for constructing a circuit as marked "\*" is also counted as one (1) word. In the above example, there are 13 words.

(2) Generally, if the circuit is left-down, a program becomes efficient with fewer number of instruction words.



[1] Left-down circuit, 7 words



[2] Middle-down circuit, 8 words

[3] Right-down circuit, 10 words

Left-down circuit [1] shown above is more efficient than circuits [2] and [3]. The number of instruction words of circuit [1], [2] and [3] is seven (7), eight (8) and ten (10), respectively.

All input instructions including the contact and connection ones are counted as one (1) word or two (2) words.

The output (coil) instructions including the application instruction are counted as one (1) word to five (5) words. For details, see Para. 7.2.

The following circuits require fewer words when formed left-down.



## Section 8 TCPRGOS

TCPRGOS–W(E) is the sequence program development tool which operates on your personal computer.

### 8.1 Operating Environment of TCPRGOS

Items		Conditions			
CPU	Personal computer incorporating CPU whose capacity is Pentium 200 MHz or over (Use of Pentium II 233 MHz or over is recommended.).				
Operating system	Windows98 or W	indowsNT 4.0/2000/XP			
Hard disk capacity	Free space of 20	M byte or over			
Minimum available memory	Windows98:	16 MB or over (Use of 32 MB or over is recommended.)			
	WindowsNT:	32 MB or over			
	Windows 2000:	128 MB or over			
	Windows XP:	256 MB or over			
CD drive	Required for insta	alling TCPRGOS.			
Display	Display that can be connected with computer and designed for Windows98 or WindowsNT with resolution of $640 \times 480$ dots or over. (Recommendable resolution is $1024 \times 768$ dots or over.)				
RS232C serial communication port	One (1) port				
Others	Keyboard, mouse, printer, FD, modem (for remote maintenance system) that can be connected with computer and designed for Windows98 or WindowsNT.				

#### 8.2 Connection

Connect the TSL3000 TCPRG port with the COM port of your personal computer, using a 9-pin cross cable.



PC COM port

TSL3000 TCPRG port



#### 8.3 How to Install the TCPRGOS



This paragraph describes the setup procedures when the floppy drive is set as the "A" drive.

• Start up the Explorer and double-click "SETUP.EXE" in the "A" drive.



• The TCPRGOS–W(E) V\*.\*\* Installer starts. Press the [Next] button.



• Now, execute the operation according to the directions of the Installer.

Choose Destination Locatio							
	Setup will install TCPRGOS-W(E) in the following folder.						
	To install to this folder, click Next.						
	To install to a different folder, click Browse and select another folder.						
	You can choose not to install TCPRGOS-W(E) by clicking Cancel to						
	exit Setup.						
	Destination Folder						
	C:\Program Files\TCPRGOS-W(E)						
	< <u>B</u> ack <u>Next</u> > Cancel						
Select Program Folder							
Select Program Folder							
	Setup will add program icons to the Program Folder listed below. You may type a new folder name, or select one from the existing Folders						
	list. Click Next to continue.						
	Program Folders:						
	Program Folders:						
	Existing Folders:						
	Accessories						
<b>2.0</b>	Explzh Online Services						
	StartUp						
	< <u>B</u> ack <u>N</u> ext> Cancel						
Tromus we minister	100 mil						
TCPRGOS-W(E)	V1.20						
	ng ma Maridagagan wini Ang gon Ma						
	- UN						
	Casal						
3.9							

• Click the [Finish] button, and the TCPRGOS–W(E) has been installed.

	Since has finaled copying flex to your computer
	Bathre you can use the program, you must rechart Windows or your computer
	<sup>10</sup> <u>Nex.</u> I want to restart my computer now)     No. I will restart my computer later
	Females any data from their drives, and then click Finish to complete salap
12	Frish

8.4	Starting the TCPRGOS	
	Starting TCPRGOS–W	
	① Double-click the TCPRGOS-W icon  on the desktop.	
	② The TCPRGOS–W starts.	
	TCPRGOS-W(E) File View Operation O Communication C Tool Help O Tool bar: To use the system command easily, the menu or button is displayed. The command can be started by only clicking the button. User message bar: A specified message is displayed from the PLC side to the personal computer.	
	0 2 3 4 5	
	TCCLI M1 Disconnect	
	<ul> <li>Status bar: Information on current system connection status, message from application to user, etc. is displayed.</li> <li>① Connected PLC model is displayed.</li> <li>② Connection method is displayed, which is specified in communication setup.</li> <li>③ Connection/disconnection status is displayed.</li> <li>④ Connected PLC number is displayed.</li> <li>④ RUN/STOP status of PLC is displayed.</li> </ul>	

## 8.5 Creating a Circuit

- Creating a New Ladder Program and Saving in a File
  - ★ Program to be created.

00000	x000 	¥100 ()-
		T000 00032
00001	R000 -1/1	FL035 D000 (INC)- D1 + 1
00002	x200 	L000
3	R100 	L000 ( B )
00003		END >

- 8.5.1 Start of New Ladder Editor
  - ① Click [New] from the [File] menu.

When the pull-down	e [File] menu n menu appe	is clicked, the ears.
$\sim$		
TO- GUS-W(	E)	
File(E) View(⊻)	Operation( <u>O</u> )	
New( <u>N</u> )	Ctrl+N	Click here.
Open( <u>O</u> )	Ctrl+O	
Transfer( <u>I</u> )		
Compare( <u>E</u> )		
Setup Printer( <u>R</u> )		
Latest File		
Quit Application	$\boxtimes$	

② As the [New] dialog box appears, click [Ladder Program] from the [New] box.



③ The ladder editor starts newly.



### 8.5.2 Creation of Circuit

① Point [Normal Open Contact] from the [Insert] menu, then click [AND].



② The symbol of normal open contact is entered at the cursor position and the contact address input dialog box appears.



③ Move the cursor to the contact address edit box and enter "X000". Then click the [OK] button.



④ The normal open contact of address X000 is entered.



© Click [Coil] from the [Insert] menu.

Insert (I)	Operatio	on (O)	Communicati	ion (C)	Tc	
A conta B conta	ct (A) ct (B)	Ctrl+9 Ctrl+9	ihift+A ihift+B	)	•	Click here.
Coil (C) Connec	t line (O)	5 or C Ctrl+9	trl+Shift+C ihift+Space	)		
Cell (E) Line (L) Column	(M)	9 or Sj Ctrl+I Shift+	pace nsert or Shift: Insert	+Enter		

6 The symbol of coil is entered and the coil input dialog box appears.



© Enter "Y100" in the coil address edit box and click the [OK] button.

Input coil address	-lst ( <u>1</u> ):	- 2nd ( <u>2</u> );	3rd ( <u>3</u> ):
After enter address, o	ring the coil lick here.	OK	Cancel

<sup>®</sup> The following circuit is created.



# **One Point Advice**

• Cursor movement

If a desired position is clicked by means of the mouse, the cursor moves to that position. The cursor can also move vertically and horizontally by means of the arrow keys. The symbol other than coil is entered at the cursor position.

⊙ Address change

When the mouse is moved to an already entered contact or coil and double-clicked, the address input dialog box appears. Move the cursor to the edit box where the address is to be entered, modify the address, then click the [OK] button.

#### 8.5.3 Input of Perpendicular Line Symbol

① Point [Connecting Line] from the [Insert] menu and click [Perpendicular].



2 The symbol of perpendicular line is entered.



- 8.5.4 Input of Timer in Coil
  - ① Click [Coil] from the [Insert] menu.



- ② The symbol of coil is entered and the coil address input dialog box appears.
- ③ Enter "T000" in the coil address.

Input coil address				×			
Address ( <u>A</u> ):	lst ( <u>1</u> ):	- 2nd As th one ente	As the timer is the coil which has one (1) argument, the edit box entering argument takes effect.				
	AD H	ADH	ADH				
		OK	Cancel				

④ Click the first argument edit box to move the cursor.

Input coil address
Address (A): lst (1): 2nd (2): 3rd (3): When the [Constant] button signifying the application of argument of T000 is checked, the buttons for selecting the decimal input or hexadecimal input for constant become operative. In this example, the decimal input is effective. To select the hexadecimal input, click the H button by means of the mouse. OK Cancel

- Input coil address X Address (<u>A</u>): \_lst (<u>1</u>):-- 2nd (<u>2</u>): --3rd (<u>3</u>):-32 TOOO AD H ADH A D H After entering the argument, click Cancel here. 0K
- S Enter "32" in the first argument and click the [OK] button.

6 The following circuit is created.



- 8.5.5 Input of Function Command in Coil
  - ① Point [Normal Close Contact] from the [Insert] menu and click [AND].



② The symbol of normal close contact is entered and the contact address input dialog box appears. Enter the contact address "R000".



③ The normal close contact of R000 is entered.



④ Click [Coil] from the [Insert] menu and the coil address input dialog box appears.



S The symbol of coil is entered and the coil address input dialog box appears.

6 Enter "FL035" in the coil address, and move the cursor to the first argument edit box.



⑦ Enter "D000" in the first argument.

I	nput coil address			×
	Address (A):	lst ( <u>1</u> ):	2nd ( <u>2</u> ):	-3rd ( <u>3</u> ):
	1722	pood	1	
		ADH	A D H	A D H
	-( INC )-	Dl 🔸	<b>-</b> D1 +	- 1
Enter the argu click here.	ument, and		0K	Cancel

<sup>®</sup> The following circuit is created.

🗊 La	lder Program1			_ 🗆 ×
NEW		¥100		
		, <sup>7000</sup> –	00032	
NEW	R000 	FL035 (INC)-	D000 D1 🔶 D1	+ 1
NEW				
0000		( end )		



#### 8.5.6 Input of Pair Coil

① Point [Normal Open Contact] from the [Insert] menu and click [AND].

Insert (I)	Operatio	on (O)	Communica	ation (C)	Тс	ool (T)	Wind	dow (Y
A conta	ict (A)	Ctrl+S	ihift+A		۶I	AND	)( <u>A</u> )	1
B conta	ct (B)	Ctrl+9	ihift+B		۲	OR(	1	3
Coil (C)		5 or C	trl+Shift+C		1	4 6	8	2 <u>CM</u>
Connec	t line (0)	Ctrl+9	ihift+Space		F	لتر	Ē	
Cell (E)		9 or S	pace			c ط	lick h	nere.
Line (L)		Ctrl+I	nsert or Shif	t+Enter				
Column	(M)	Shift+	Insert					

② The symbol of normal open contact is entered and the contact address input dialog box appears. Enter "X200" in the contact address.



③ The normal open contact of X200 is entered.



④ Click [Coil] from the [Insert] menu.

Insert (I)	Operatio	on (O)	Communication (C)	) Te	
A conta	act (A)	Ctrl+9	5hift+A	►	Click here.
B conta	ict (B)	Ctrl+9	5hift+B	+	$\geq$
Coil (C)		5 or C	trl+Shift+C		ſ
Connec	t line (0)	Ctrl+9	Shift+Space	•	
Cell (E)		9 or S	pace		
Line (L)		Ctrl+I	insert or Shift+Ente	r	
Column	(M)	Shift+	Insert		

S The symbol of coil is entered and the coil address input dialog box appears. Enter "L000" in the coil address.

	Address (A): -	-lst ( <u>1</u> ):	-2nd ( <u>2</u> ):	- 3rd ( <u>3</u> ):
	Iroool	ADH	ADH	A D H
Enter click	r the coil address and here.		OK	Cancel

© The following circuit is created.

🎜 La	dder p	rogram1			_ [	'×
00000			00032			
мак Мак		When the pair coil is entered, a line of latch reset is inserted automatically. This is also applied for other pair coils.	<sup>0000</sup> +-	01	+	1
00001		As this is the same circuit, "NEW" is not attached.				

- 8.5.7 Change of Connecting Cine with Contact
  - ① Move the mouse to the head of the latch reset and click. The cursor moves to the head position.



2 Point [Normal Close Contact] from the [Insert] menu and click [AND].

Insert (I)	Operatio	on (O)	Communication (C)	Т	ool (T)	Window	10
A contac	:t (A)	Ctrl+S	ihift+A	►	u#[-:	81 <b>@</b> 1	
B contac	:t (B)	Ctrl+S	ihift+B	×	ANE	D(A) 2	
Coil (C)		5 or C	trl+Shift+C		OR(	(0) 4	
Connect	line (0)	Ctrl+S	hift+Space	F		1 12	
Cell (E)		9 or Sp	pace		<b>HP</b> (		_
Column (	(M)	Ctrl+I Shift+	nsert or Shift+Enter Insert		C	lick	

③ The symbol of normal close contact is entered and the contact address input dialog box appears. Enter "R100" in the contact address.



④ The normal close contact is inserted at a place where the connecting line was input and the circuit is changed as shown below.



### 8.5.8 Renumber of Circuits

① Click [Renumber] from the [View] menu.



2 Words [NEW] are cleared and the circuits are renumbered.

🚏 Ladder program1			_	
	~```}	00073		
N000	-( )- PL035	0000		
		UI 7	 +	•
x100 →/1→ <b></b>	-( R )-			
00003	-**°+			
The circuits are renumbered.				
#### 8.5.9 Saving in File

① Click [Close] from the [File] menu.

File (F) Edit (E) View (V) Inse	ert (I) – Oper	
New (N)	Ctrl+N	
Open (0)	Ctrl+0	Click here.
Close (C)		
Save (S)	Ctrl+S	
Save as (A)		
Output in text (I)		
Convert to Intelhexa (L)		
Transfer (T)	Ctrl+T	
∀erify (E)		
Comment (M)	•	
Specify address map file (D)		
Print (P)	Ctrl+P	
Set page (U)		
Print preview (V)		
Printer setup (R)		
Latest file		
Exit application (X)		

② As the following message box appears, click the [YES] button.



	3	The following	file s	saving	dialog	box	appears.
--	---	---------------	--------	--------	--------	-----	----------

Specify the saving folder. Click the -button, and the saving folder can be found.	
Save As	? 🗙
Save in: 🔄 Tmp	
에 Ladder.tsq 에 Tc200-t4.Tsq	
	Enter a file name to be saved. When the dialog box is opened, the file name used in the ladder editor is shown. (In this example, "ladder program1.tsq".) This indicates that the file name was
1	changed to test.tsq .
File <u>n</u> ame: test.tsq	Save
Save as type: Ladder Program (*.tsq)	

④ Click the [Save] button. The ladder editor is closed and the created circuit is saved in the file of "test.tsq".

1.00

### 8.5.10 Opening of Existing File

① Click [Open] from the [File] menu.



2 The following [Open] dialog box appears.

Open	?	×
Look <u>i</u> n:	🔁 Tmp 💽 🖻 🔛 🧱	
		1
File <u>n</u> ame:	<u>O</u> pen	
Files of type:	Project (*.tpj) Cancel	

③ Change the type of file to "Ladder Program".

File name:		
r no ridino.	1	open
Files of type:	Ladder program (*.tsq)	Cancel
	Ladder program (*.tsq) Editor program (*.tld) Address map (*.tam) Comment (*.tcm) Link table (*.tlk) Remote I/O table (*.rio)	
	Task table (*.ttk) Register data (*.tdt) File register data (*.tfr) Extend I/O table (*.eid	Move the mouse pointer to 💽 and click. As the list box appears, click the "Ladder Program" by means of the mouse.

④ Select "test.tsq" among the displayed ladder programs.

Open	? ×
Look in: 🔄 Tmp 💽 🖻 📸 🏢	
I Ladder.tsq I To200+4 Tog	
Click by means of the mouse.	
Selected file name is shown.	
File <u>n</u> ame: testtsqQpen	
Files of type: Ladder Program (*.tsq)	

© Click the [Open] button, and the file of "test.tsq" is opened.

#### 8.5.11 Modifying and Saving of Existing Circuit

① Move the cursor to the circuit of the latch reset.

00001	R000	FL035 (INC) D1 + D1 +	1
00002	x200	L000	
	R100	L000 ( R )	

② Point [Delete] from the [Edit] menu and click [Line].

Edit (E)	$\text{View}\left( \forall \right)$	Insert (I)	Operation (O)	Communicati	on (C)	Tool (T)	Wind	
Cut (1 Copy Paste	") (⊂) (P)		Ctrl+X Ctrl+C Ctrl+V	21 12 RA	Lnk Ri 	8   [┯] <u>-</u> -	ے ا 1	
<ul> <li>Absolution</li> <li>Logical</li> </ul>	ute addres: al address r	s mode (B) node (I)		₩ <u>⊒⊦</u>	²₩−  ³	רו <u>ן</u> און א	6	
Searc Searc Searc Repla	h (F) h previous h next (N) ce (L)	(R)	<b>Ctrl+F</b> Shift∓F3 F3 <b>Ctrl+H</b>					
Jump	(G)		Ctrl+G					
Insert	(I)		Insert					
Input LF (E)	address (A	ı)	Enter Enter				Clic	k here.
Delete	e (D)		۰.	Cell (E)	Delete		$\mathbb{N}$	
Comm Circuit	ent (0) : comment	(U)	Alt+Enter Ctrl+Enter	Line (L) Column (C) Circuit (I)	Ctrl+D Shift+I Ctrl+S	elete Delete hift+Delet	e	
Chang	je data (M)	)	Enter					

#### ③ The specified line is deleted.



- ④ Move the mouse pointer to circuit number 0002 and click (circuit selection).
- 🚏 TCPRGOS-W(J) test.tsq \_ 🗆 × File (F) Edit (E) View (V) Insert (I) Operation (O) Communication (C) Tool (T) Window (W) Help (H) Cut (T) 0 🞽 🐒 🛤 Rắ Luế Rã #8 Eã 💡 灯 Copy (C) **1** ✓ Absolute address mode (B) ¥⊒⊩ ᠯ⊦ᢪ#∄₽₩₩₹>°\_`\_°I #⁄ £3 Logical address mode (I) 🗊 test.tsq \_ 🗆 🗙 Search (F)... Ctrl+E Search previous (R) Shift+F3 ¥200 00000 ····· 00 Replace (L)... Ctrl+H лооо --1/1-РЬ035 (IXC)-0 0 0 00001 Jump (G)... Ctrl+G LOOD ¥200 00002 Insert (I) Insert ×100 −1/1 1000 ( R )-Input address (A)... Enter ЕНО 00003 LF (E) Enter Delete Delete (D) Cell (E) Ctrl+Delete Line (L) Comment (O)... Alt+Enter Column (C) Shift+Delete Circuit comment (U)... Ctrl+Enter Click here. Circuit (I) Ctrl+Shift+Delete
- S Point [Delete] from the [Edit] menu and click [Circuit].

6 The circuit of circuit number 0002 is deleted.



- File (F) Edit (E) View (V) Insert (I) Oper New (N)... Ctrl+N Click here. Open (O)... Ctrl+O Close (C) Save (S) Ctrl+S Save as (A)... Output in text (I)... Convert to Intelhexa (L)... Transfer (T),... Ctrl+T Verify (E)... Comment (M) ۲ Specify address map file (D)... Print (P)... Ctrl+P Set page (U)... Print preview (V)
- ⑦ Click [Save] from the [File] menu.

8 The file of "test.tsq" is overwritten.



#### 8.6 Transferring Circuit

- 8.6.1 Check for Communication Setup
  - ① Click [Option] from the [Communication] menu.



<sup>2</sup> The following communication setup dialog box appears.

Configration	
Connect	
€ COM1 direct ( <u>F</u> )	Property (P)
C COM2 direct ( <u>S</u> )	
C COM3 direct ( <u>T</u> )	Time out (I)
🔿 Modem ( <u>M</u> )	When the [Property] button is clicked, the detailed setup dialog box of specified port
Phone	appears. Transfer speed (bit/sec), data bit, parity, stop
C ISA board 1( <u>B</u> )	No board bit and flow control can be specified.
C ISA board 2( <u>0</u> )	No board
C ISA board 3( <u>A</u> )	No board
C ISA board $4(\underline{R})$	No board
Connect ( <u>C</u> )	0K Cancel
[Connect] button:Connects[OK] button:For only c[Cancel] button:Stops con	after communication setup. communication setup. nmunication setup.

## **Caution** !

The baud rate is changed over automatically. Select the connection method alone. Normally, the property need not be changed.

#### 8.6.2 Connection

 Click [Connect] from the [Communication] menu, and the PLC is connected with the personal computer.

Check for the status bar on the bottom of th window.	e Indicates that the PLC is stopped. While the PLC is running, "RUN" is displayed.
Connected.	TCCUH COM1 Connect 00 STOP //
In	dicates that the PLC is connected.

## **Caution** !

Baud rate that can be connected is recognized automatically, and the connected baud rate is displayed on the status bar.

#### 8.6.3 Transfer

① Click [Transfer] from the [File] menu.

File (F)	Edit (E)	View (V)	Insert (I)	Oper
New (	(N)		Ctrl+	N
Open	(0)		Ctrl+	0
Close	(C)			
Save	(5)		Ctrl+	5
Save	as (A)			
Outp	ut in text	(I)		
Conv	ert to Inte	elhexa (L),		
Trans	;fer (T)		Ctrl+	T
Verify	/ (E)			
Comn	nent (M)			•
Speci	fy addres	s map file (	D)	
Print	(P)		Ctrl+	Р
Set p	age (U)			

2 When the following transfer dialog box appears, click the [OK] button.

Transfer			×
Direction( <u>D</u> ):	PC-> Equipment	Currently active file name of ladder program is displayed.	
Area( <u>A</u> ):	Usual Area	Click the [Reference] button, and specify another file.	
File Name( <u>N</u> ):	C:\TMP\test.tsq		Reference( <u>B</u> )
Program sizes	: 9 words Indicates the size	of OK	Cancel
		J Clic	k here.

③ Transfer starts. During the transfer, the following transfer progress dialog box appears.



When the transfer has finished, the transfer finish message box appears.
 Click the [OK] button then.



# Caution !

While the TCmini is running, the following message box appears. Select [No] because data change is not possible while the TCmini is running.

TCPRGOS	-W(J) 🔀
?	Cannot translate when PLC is running. Stop PLC and translate?
	Yes <u>N</u> o

## 8.7 Online Operation

- 8.7.1 Start Online Ladder Editor
  - ① Click [Ladder Editor] from the [Tool] menu.



② Data transfer from the PLC to the personal computer starts and transfer progress dialog box is displayed.



③ When the transfer has finished, the transfer progress dialog box disappears and the online ladder editor starts.

📅 TCPRGOS-W(J) - test.tsg [online]
File (E) Edit (E) View (Y) Insert (I) Operation (Q) Communication (C) Tool (I) Window (W) Help (H)
D ≥ ♥ ๗ ๚ ๚
▋▓ॿॿॣॣॗॾॾॾॾॾॾॾॾॾॾॾॾॾॾ
Image: set of the set of
TCmini COM1 CON 00 STOP

## **Caution** !

In an offline state or other situation where it cannot be determined whether the result is X000 or Y000, it appears as Z000. Then, when an online connection is established and the PLC information is obtained, X or Y is set. (However, there is no problem with leaving this as Z.)

#### 8.7.2 Change of Online Ladder Editor Circuit

- ★ Modification can be made in the same manner as the offline ladder editor. To change the coil address, observe the following steps.
- ① Move the cursor to the coil (Z100) of circuit number 0000.

🗊 tes	t.tsq - Usual Area - [Online]	
0000		Z100 Move here.
		00032
0001	R000	FL035 D000 
0002		( END )

### 2 Click [Input Address] from the [Edit] menu.

dit (E) View (V) Insert (I)	Operation (O)	
Cut (T)	Ctrl+X	
Copy (C)	Ctrl+C	
Paste (P)	Ctrl+∀	
Absolute address mode (B)		
Logical address mode (1)		
Search (F)	Ctrl+F	
Search previous (R)	Shift+F3	
Search next (N)	F3	
Replace (L)	Ctrl+H	
Jump (G)	Ctrl+G	
Insert (I)	Insert	Click here.
Input address (A)	Enter	
LF (E)	Enter	
Delete (D)	•	
Comment (O)	Alt+Enter	
Circuit comment (U)	Ctrl+Enter	
Change data (M)	Enter	

③ As the coil address input dialog box appears, change the coil address to "Y200".

Input coil address	×
Address ( <u>A</u> ):	Replace with "Y200". (2): 3rd (3):
¥100	
	After changing the coil address, click here.
	OK Cancel

- ④ The coil address is changed.
- © Click [Write to PLC] from the [Operation] menu.

Operation (O)	Communica	ation (C)	Tool (T
RUN(R) STOP(S)		Ctrl+Shil Ctrl+Shil	ft+R ft+S
Force-set (O Force-reset (	) (F)	C	
Set/Reset (1	) (W)	Space Ctrl+W	
Reload (L)		Ctrl+R	
Clear error ( Clear user m	E) essage (U)		
Change I/O	(I)		

6 As the following message box appears, click the [YES] button.



- The transfer progress dialog box is displayed and writing to PLC starts.
   When it has finished, the transfer progress dialog box is cleared.
- <sup>®</sup> Click [Reload] from the [Operation] menu.





- The online ladder editor is closed and the transfer progress dialog box appears. Then the transfer starts.
- When the transfer has finished, the transfer progress dialog box is closed and the online ladder editor starts again.

#### 8.8 Monitor

#### 8.8.1 Selection of Monitor Mode

① Click [Monitor Mode] from the [View] menu.



2 The monitor mode replaces the edit mode.



- 8.8.2 Designation of PLC RUN or STOP and Compulsive Setting of Contact
  - ① Click [RUN] from the [Operation] menu.



② As the following message box appears, click the [YES] button to run the PLC.

	TCPRGOS-W(E)
Click here.	Run PLC. OK?
	Yes No

③ Make sure that the cursor is located at the normal open contact of "Z000" in circuit number 0000. Then click [Force-set] from the [Operation] menu.



④ As the following message box appears, click the [YES] button.



S The normal open contact of "Z000" in circuit number 0000 is compulsively set.



© Click [STOP] from the [Operation] menu to stop the PLC.

Operation (O)	Communica	tion (C)	Tool (T)		
RUN(R)	RUN(R)				Click here.
STOP(S)		Ctrl+Shif	t+S 🚽	$\prec$	
Force-set (C Force-reset Set/Reset (T	) (F) )	Space			
Write to PLC Reload (L)	(W)	Ctrl+W Ctrl+R			
Clear error ( Clear user m	E) essage (U)				
Change I/O	(I)				

⑦ The normal close contact is set and monitored as shown below.



<sup>®</sup> Click [RUN] from the [Operation] menu.

Operation (O)	Communication (C)	Tool (T)	
RUN(R)	Ctrl+Shif	it+R	Click here.
STOP(S)	Ctrl+Shif	ft+S	
Force-set (O) Force-reset (F Set/Reset (T)	) Space		
Write to PLC (\ Reload (L)	W) Ctrl+W Ctrl+R		
Clear error (E) Clear user mes	sage (U)		
Change I/O (I)	ha		

As the following message box appears, click the [YES] button to run the
 PLC.
 \_\_\_\_\_\_



Monitoring is performed as shown below.



### 8.8.3 Quit of Monitor Mode

① Click [Edit Mode] from the [View], and the monitor mode terminates with the edit mode selected.



## Caution !

In the monitor mode, editing of a circuit (modification, addition, deletion, etc.) is not allowed. Edit after selecting the edit mode. A modified circuit cannot be monitored unless written to the PLC. After writing it to the PLC, read and call the latest online ladder editor.

## One Point Advice

○ Changeover of decimal/hexadecimal notation

The notation comes in two (2) types; decimal notation and hexadecimal notation.

To change over the notation, click [Decimal] or [Hexadecimal] from the [View] menu. The menu item marked with " $\sqrt{}$ " on the left side is the currently selected notation.

Example of hexadecimal notation:

	T000 00032
0000 <b>1</b>	FL035 ↓ INC → D000 02691← D1 + 1
0002	<b>(</b> END <b>)-</b>
•	•

#### 8.9 Monitoring Register Data

- 8.9.1 Start of Online Register Editor
  - ① Click [Register Editor] from the [Tool] menu.



#### 2 The online register editor starts.

<b>З° ТСР</b>	RGOS	-W(J) - Re	egister	data	[onli	ne]													-	. 🗆 🗙
File (E)	Edit(	<u>E)</u> View (	/) Op	eration	$(\underline{0})$	Comn	nunica	tion ((	E) T	iool (]	) Wi	ndow	(₩)	Help ( <u>H</u> )						
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- 8.9.2 Compulsive Setting of Device
  - Z Register data [online] \_ 🗆 × 98 dcH dcL dcW HEX ٠ 0 151 074 26806 974A 0 000 000 00000 0000 ň 000 000 00000 0000 D003 Ū 🕅 Ū Ū 000 000 0000 00000 D004 🛛 0 Ù 000 000 00000 0000 Click here. ŌŌŌ D005 

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  - ① Click Bit E of D002 by means of the mouse and move the cursor.

2 Click [Set] from the [Edit] menu.



③ As the following message dialog appears, click the [OK] button.



④ Bit E of D000 is set compulsively.

🔀 Register data - [online]				_ 🗆 ×
FEDCBA9876543210	dcH dcL	dcW	HEX	<b></b>
	102 196	26308	66C4	
	000 000	00000	0000	
▶002 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	064 000	16384	4000	
▶0030000000000000000000000000000000000	000 000	00000	0000	
D004 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	000 000	00000	0000	
	000 000	00000	0000	

- 8.9.3 Modification of Word Data Specified by Address
  - ① Move the mouse pointer to the hexadecimal data area of D002, then click.

🔀 Register data - [online]			
FEDCBA9876543210	dcH dcL	dcW	HEX
	208 218	-12070	doda 🗖
<b>₽001</b> 0000000000000000000000000000000000	000 000	00000	0000
▶ 002 0 ■ 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	064 000	16384	4000
┃ ₽003 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	000 000	00000	0000
	000 000	00000	0000
<b>▶</b> ⊅005 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	000 000	00000	0000 Click here.
<b>D00e 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</b>	000 000	00000	<sup>0000</sup> Selected data are
	000 000	00000	<sup>0000</sup> displayed inversely.
	000 000	00000	0000
	000 000	00000	0000

2 Click [Change Data] from the [Edit] menu.

Edit(E) V	iew (V)	Operation (O)	Com
Jump(G	)		•
Set (O)		Shift+Inse	rt
Reset(F	·)	Shift+Dele	te
Set/Res	et (E)	Space	
Change	data (M	l) Enter	/

③ The following [Change Data] dialog box appears. Change the data to "FFFF" and click the [OK] button.

	Modify Data	×	After changing
The current value is	Data(D): [0 - FFFF]		the data, click
displayed as the initial		ок	nere.
value. Replace with	4000	Cancol	
"FFFF".			

④ The data are changed.

Z <sup>8</sup> Register (	data - [online]		
FED	C B A 9 8 7 6 5 4 3 2 1 0	dcH dcL dcW	HEX 🔺
▶000 0 ∎ 0		087 187 22459	57BB 🗖
D001 0 0 0 1	000000000000000	000 000 00000	0000
D002 🛢 🛢 🛢 🛛		255 255 -00001	FFFF
D003 0 0 0 1	000000000000000	000 000 00000	0000
D004 0 0 0 1	000000000000000	000 000 00000	0000
D005 0 0 0 1	000000000000000	000 000 00000	0000
D006 0 0 0 1	000000000000000	000 000 00000	0000
D007 0 0 0 1	000000000000000	000 000 00000	0000
D008 0 0 0 1	0000000000000000	000 000 00000	0000
∎ D009 [] [] [] [] [] [] [] [] [] [] [] [] []	0000000000000000	000 000 00000	0000
🛛 ποοι Π Π Π Ι		000 000 00000	0000

## 8.10 Quitting the TCPRGOS

- 8.10.1 Exit from Active Editor
  - ① Click [Close] from the [File] menu. The active editor terminates.

File (F) Edit(E) View	(V) Operation	
New (N)	Ctrl+N	Click here.
Open (O)	Ctrl+O	
Close (C)	Chiles	
Save as (A)	Curro	
Transfer (T)	Ctrl+T	
Verify (E)		
Print (P)	Ctrl+P	
Set page (U)		
Print preview (V)		
Printer setup (R)		
1 test.tsq		
2 Ladder program1 b	sa	

② Repeat Step ① above and quit all editors (online ladder editor, online register editor, offline ladder editor ("test.tsq")).



### 8.10.2 Quit of TCPRGOS-W

① Click [Quit Application] from the [File] menu. The TCPRGOS–W terminates to close the window.



## Caution !

You need not quit the TCPRGOS–W after closing all active editors. You can quit by only clicking [Quit Application] from the [File] menu with the editors opened. When change was made in any editor, appropriate message box appears to ask whether each change should be saved or not.

#### 8.11 How to Uninstall

Before uninstalling the TCPRGOS–W(E), delete the registered OCX file. Otherwise, unnecessary key is left in the registry.

Deletion of registered OCX file

Double-click and execute "Unregist.bat" in the install directory.

When the system displays a message box, register or deletion of OCX file has finished.

Uninstall the **TCPRGOS–W(E)** by selecting [Control panel] – [Add or delete application].

### Section 9 Advice of Sequence Program Creation

This section describes some sample circuits which you can refer to when creating a sequence program. Also refer to the standard ladder sequences in Section 11.

## 9.1 Turning ON/OFF External Output by DOUT Command



H000 turns on and off by the DOUT(1) and DOUT(-1) commands, respectively.

As Y100 operates, interlocked with H100 ON/OFF, the H000 state can be output to an external device, interlocked with the DOUT command.

(The H000 state can be output to any destination by changing the output relay address.)

## 9.2 Input of External Signal by DIN Command



The G000 state is read by means of DIN(1) and DIN(-1) commands.

As G000 operates, interlocked with X000 ON/OFF, the X000 state can be read by the robot's DIN1 command.

(Any input destination can be ready by the DIN(1) command by changing the input relay address.)

## 9.3 Output of AUTORUN Signal to External Device



H138 is the interface relay indicating that the robot is working in the automatic operation. This state is output to an external device. (It can be output to any output designation by changing the output relay address.)

## 9.4 Generating Alarm in TS1000 by External Signal



When external input IN3 (X002) turns on, G110 turns on accordingly. When G110 turns on, an alarm (1–037) is generated in the robot controller.

(The alarm can be generated by any input by changing the input relay address.)

## 9.5 Output of Value to Control Panel



The content of D600 is transferred to D470 by extension instruction (or command) FL006. The FL command executes a command as per the signal state. In this example, as the signal is always ON, data is transferred in each scanning. In D600, a value written to system variable PLCDATAW1 (robot language) by the robot program is stored. In the above program, this value is transferred to D470 which is the exclusive register indicating a 7-segment value of the control panel. By changing the source register, any data such as constant and sequence operation result can be displayed.

## 9.6 Change of Output Destination by Sequence Parameter



H110 is the relay which can be turned on and off by user parameter of TS3000. When "1" (ON) is specified for appropriate parameter, DOUT(1) turns on Y100. When "0" (OFF) is set, DOUT(1) turns on Y101. When SEQPARA\* of H110 ~ H117 is used, you can change the sequence motion by the robot parameter without changing the ladder sequence.

## 9.7 Fault Signal Turns On Even When Emergency Stop Pushbutton Was Pressed



The ALARM (H13D) signal is set to ON when an alarm occurs. However, the fault signal does not turn on when the emergency stop pushbutton is turned on (8-014 occurs). By also monitoring the EMSST state, the states when an alarm occurs or when an emergency stop pushbutton was pressed can be output.

## 9.8 Starting the Robot by an Input Signal from Fieldbus



When (X200) in the input from a fieldbus connection is set to ON, G136 turns on, and the robot program runs.

## 9.9 Circuit Generating 1 Pulse at Power ON



Just after the power is turned on, R000 turns on in the initial scanning. As R001 is ON in the 2nd scanning, R000 turns off.

This can be realized by one (1) command when F\*63 is used.

## 9.10 Circuit Generating 1 Pulse at Start



At the start of input X000, one (1) pulse is generated.

Note: If the PLC starts running while X000 is ON, R000 turns on in the 1st scanning.

## 9.11 Circuit Generating 1 Pulse at Fall (1)



With the fall of input X000, one (1) pulse is generated.

Caution: When X000 is OFF, R000 turns on in the 1st scanning after power ON. (Necessary measures are taken in Para. 9.10.) If the PLC starts running while X000 is OFF, R000 turns on in the 1st scanning.

## 9.12 Circuit Generating 1 Pulse at Fall (2)



With the fall of input X000, one (1) pulse is generated. R000 will not turn on at power ON.

## 9.13 Self-Holding Circuit (Priority Is Given to Reset)



When X000 is turned on once while X001 is OFF, output R000 turns on, which is kept even after X000 is OFF. When X001 turns on, R000 turns off.

## 9.14 Self-Holding Circuit (Priority Is Given to Set)



When X000 is turned on once while X001 is OFF, output R000 turns on, which is kept even after X000 is OFF. When X001 turns on, R000 turns off. If X000 is ON while X001 is ON, R000 turns on.

### 9.15 Interlock Circuit



Either X000 or X001 whose circuit turns on first is ON, and the other circuit will not turn on. When both circuits are turned on at the same time, the upper circuit (Y100) turns on by the scanning system. Useful for the motor CW/CCW circuit.

#### 9.16 Alternate Circuit



Every time input X000 has turned on, output R001 is reversed. Thus, an alternate output can be given, using the normal open contact of the momentary switch.

## 9.17 Non-Modal Timer Circuit



When input X000 turns on, R000 turns on for the time set on the timer. If the ON time of input X000 is shorter than the timer-set value, the ON time of R000 is identical with the ON time of X000.

#### 9.18 Non-Modal Start Timer Circuit



When input X000 turns on, R000 turns on for the time set on the timer.
## 9.19 Circuit Turning ON and OFF at Predetermined Intervals



A050 is the special auxiliary relay which repeats ON and OFF at one (1)-second intervals.

A051 is the special auxiliary relay which repeats ON and OFF at two (2)-second intervals.

#### 9.20 Step Sequence Circuit



When X000 turns on, R000 turns on accordingly. When X001 is ON, R001 is ON with R000 OFF. When X002 is ON, R002 is ON with R001 OFF.

### Section 10 Troubleshooting

#### 10.1 Robot Servo Will Not Turn ON

- Is interface relay SVOFF (R33C) turned on?
  When the SVOFF signal turns off, the servo turns off. Design the sequence and external circuit, therefore, so that interface relay SVOFF can be turned on.
- Is the alarm (8–014 Emergency Stop SW ON) generated? If this alarm is generated, make sure that the EMERGENCY stop pushbutton switch is not pressed. In addition to this, make sure that the TP or TP jumper connector is connected.

Wiring of the EMERGENCY stop switch is the special line. Perform check on the wiring of EMS\*\* and EMA\*\* pin connected to the EMS connector.



#### 10.2 Program Cannot Run

- ① Is the program selected?
- ② Is the servo ON?
- Is interface relay STOP (R338) ON?
  When the STOP signal turns off, the robot stops. Design the sequence and external circuit, therefore, so that interface relay STOP can be turned on.
- Is interface relay BREAK (R33B) ON?
  Like the STOP signal, when the BREAK signal turns off, the robot slows down and stops.

#### **10.3 Sequence Program Cannot Be Transferred by TCPRGOS**

The sequence program areas which can be used by the user are areas 1 and 2. Change the sequence area, referring to Para. 2.4.

#### **10.4 Sequence Program Is Cleared at Power ON**

Sequence program area 1 is the RAM area for debugging. The sequence program is cleared after the power is turned off, then on again. To use the sequence program after debugging (check of operation), transfer it to program area 2 beforehand.

#### 10.5 TCPRGOS Will Not Start

Are the specifications of your personal computer identical with those of the TCPRGOS? (See Para. 8.1.)

If the TCPRGOS will not operate just after it is installed, the DLL file version may be old. When this is the case, install the newest DLL file according to the following procedures.

 Quit all other applications, then make sure that the following files are present in the system directory.

MFC42.DLL	MFC42LOC.DLL	MSVCRT.DLL
CMCTLJP.DLL	COMCTL32.OCX	

② Confirm the version of each file. If it is older than the version below, delete the file.

File name	Version
MFC42.DLL	5.0.000
MFC42LOC.DLL	5.0.000
MSVCRT.DLL	5.00.7303
CMCTLJP.DLL	5.01.4319
COMCTL32.OCX	5.01.4319

Right-click a relevant file and select [Property]. When the dialog window is displayed, select the version information tag and check for the version.

③ Install the TCPRGOS software again, referring to Para. 8.3.

### 10.6 Extension I/O Does Not Operate (Malfunctions)

- The extension I/O RUN lamp is off.
  See Para. 3.8 and check the connection and user parameter settings.
- ② The extension I/O sequence is defined twice.



In the above figure, the X000 input is output to Y140 at **A**, and the state of R440 to R47F is transferred (output) to Y140 to Y17F at **B**. As a result, the R440 state is output to Y140, and the **A** circuit result is not output.

To prevent this problem, the B circuit must be deleted, but this will also delete the transfer to Y141 to Y17F. Therefore, a separate circuit needs to be added.

#### 10.7 Sequence-Related Alarm Occurred in TSL3000

#### 8-227 PLC STOP

Possible Cause: The sequence of the PLC remains stopped.

Remedies: If the sequence program has been stopped intentionally from the TCPRGOS, there is no problem at all. Turn the power off, then on again, or start the sequence program from the TCPRGOS.

This alarm may occur if the hardware went wrong or an error was found in the sequence program. When this happens, the following alarm  $(1-^{***})$  is also generated at the same time. Identify and remove the cause of the error to start the PLC.

#### 1–164 PLC Backup data error

Possible Cause:	The sequence program of TCmini has been destroyed.
Remedy:	Transfer the program again, using the TCPRGOS. If a backup RAM (domain 3) is used, set to domain 1, and turn
	the power off, then on again to transfer the program.

#### 1–166 PLC Remote unit error

Possible Causes:	1	The setting of connecting the extension I/O unit is not							
		identical with the user parameter setting.							
	2	Wiring of the cable is done incorrectly.							
	3	The connected I/O unit will not operate normally.							
Remedies:	1	Perform check on the user parameter setting. (See Para.							
		3.7.3.)							
	2	Connect the cable. (See Para. 3.7.2.)							
	3	If the external power supply is used, turn on the power of							
		the extension I/O unit before the controller power.							
		If the I/O unit has malfunctioned, contact our after-sale							
		service agent in your territory.							

#### 1–169 PLC Undefined label

- Possible Cause: The label used in the sequence program is not defined.
- Remedy: Correct the sequence program, using the TCPRGOS.

#### 1–170 PLC Invalid command

- Possible Cause: An illegal command (i.e., instruction word) is used in the sequence program.
- Remedy: Correct the sequence program, using the TCPRGOS.

#### 1–173 PLC Overlap label

- Possible Cause: Duplicate definition of the label used in the sequence program.
- Remedy: Correct the sequence program, using the TCPRGOS.

Section 11



Standard ladder sequence program

\*Explanations of typical circuits are shown below.

- The external input (input connector pin no. 1) contact X000 is connected to the G000 (DIN1) coil, and the robot program "DIN(1)" input is set.
- ② The hand input (hand pin no. 1) contact X038 is connected to the G100 (DIN201) coil, and the robot program "DIN(201)" input is set.



③ The robot program "DOUT(1)" output coil H000(DOUT1) is connected to the Y100 (OUT1) coil and output to an external output (output connector pin no. 1).

# TSL3000 Robot Controller



- ④ The extension input (EI1 to EI64) is used as the robot program "DIN (101 to 164)" input.
- S The robot program "DOUT (101 to 164)" is output to the extension output (EO1 to EO64).
- 6 The fieldbus input (FI1 to FI112) is used as the robot program "DIN (301 to 364) and DIN (401 to 448)" input.
- The robot program "DOUT (301 to 364) and DOUT (401 to 448)" is output to the fieldbus output (FO1 to FO112).



When H118 is OFF, the fieldbus input (FI113) contact X270 is connected to the G270 (DIN449) coil, the robot program "DIN(449)" input is set, the external input (input connector pin no. 25) contact X008 is connected to the G130 (strobe) coil, and the system signal "STROBE" input is set.

When H118 is ON, the fieldbus input (FI113) contact X270 is connected to the G130 (strobe) coil, and the system signal "STROBE" input is set. At this time, the external input (input connector pin no. 25) is disabled.

- When H118 is OFF, the fieldbus input (FI114) contact X271 is connected to the G271 (DIN450) coil, the robot program "DIN(450)" input is set, the external input (input connector pin no. 7) contact X009 is connected to the G131 (PRG\_RST) coil, and the system signal "PRG\_RST input is set.
  When H118 is ON, the fieldbus input (FI114) contact X271 is connected to the G131 (PRG\_RST) coil, and the system signal "PRG\_RST" input is set. At this time, the external input (input connector pin no. 7) is disabled.
  When connected to the touch panel, the touch panel input (PANEL\_PRG\_RST) contact G179 is connected to the G131 (PRG\_RST) coil, and the system signal "PRG\_RST) coil, and the system signal "PRG\_RST" input is set.
- \* The H118 signal is switched on and off by the user parameter [U35] setting. For details, see the User Parameter Operation Manual.





When H118 is OFF, the fieldbus input (FI124) contact X27B is connected to the G27B (DIN460) coil, the robot program "DIN(460)" input is set, the external input (input connector pin no. 32) contact X013 is connected to the G13B (break) coil, and the system signal "BREAK" input is set.

When H118 is ON, the fieldbus input (FI124) contact X27B is connected to the G13B (break) coil, and the system signal "BREAK" input is set. At this time, the external input (input connector pin no. 32) is disabled.

When connected to the touch panel, the touch panel input (PANEL\_BREAK) contact G17F is connected to the G13B (BREAK) coil, and the system signal "BREAK" input is set.



- <sup>①</sup> When H118 is OFF, the fieldbus input (FI126) contact X27D is connected to the G27D (DIN462) coil, and the robot program "DIN(462)" input is set. When H118 is ON, the fieldbus input (FI126) contact X27D is connected to the G13D (BZ\_RST) coil, and the system signal "BZ\_RST" input is set.
- <sup>12</sup> When H118 is OFF, the fieldbus input (FI127) contact X27E is connected to the G27E (DIN463) coil, and the robot program "DIN(463)" input is set.
- <sup>(3)</sup> When H118 is OFF, the robot program "DOUT(449)" output coil H270(DOUT449) is connected to the Y370(FIELDBUSOUT113) coil and is output to the fieldbus output (FO113).

When H118 is ON, the system signal "EMG\_ST" output coil H130 (EMG\_ST) is connected to the Y370(FIELDBUSOUT113) coil and is output to the fieldbus output (FO113).

When H118 is OFF, the robot program "DOUT(450)" output coil H271(DOUT450) is connected to the Y371(FIELDBUSOUT114) coil and is output to the fieldbus output (FO114), and the system signal "SV\_RDY" output coil H131(SV\_RDY) is connected to the Y109(OUT10) coil and is output to the external output (output connector pin no. 19).

When H118 is ON, the system signal "SV\_RDY" output coil H131 (SV\_RDY) is connected to the Y371(FIELDBUSOUT114) coil and is output to the fieldbus output (FO114).





Touch Panel Connection

The standard ladder sequence includes contacts where operation can be performed from a touch panel.

When the G130 to G13D coils are operated from a touch panel, a conflict occurs with the input from the SYSTEM connector, and they do not operate properly, and so operate the coils shown below.

For the output signals to the touch panel, refer directly to H130 to H13E.

I ouch panel input assignments	
Touch panel input (address)	Signal name (address)
PANEL_ALM_RST (G178)	ALM_RST (Alarm reset) (G135)
PANEL_PRG_RST (G179)	PRG_RST (Program reset) (G131)
PANEL_DO_RST (G17A)	DO_RST (Output signal reset)
	(G134)
PANEL_EX_SVON (G17C)	EX_SVON (External input servo
	ON) (G137)
PANEL_SV_OFF (G17D)	SV_OFF (Servo OFF) (G13C)
PANEL_RUN (G17E)	RUN (Run) (G136)
PANEL_BREAK (G17F)	BREAK (Decelerate and stop)
	(G13B)

. . . . . nonal input agaignment

#### Section 12 Simple PLC Data Communication Function

In the Simple PLC data communication function, commands are set to the register for obtaining and setting the robot current position and teaching point position. The Simple PLC data communication function has two types of operation: command mode and monitor mode. Operation can be selected based on the command to be written. In command mode, one reply is sent to a command. In monitor mode, the latest data for a command is constantly saved. (The data remains saved until the next command is issued.)

#### 12.1 Monitor Mode

In monitor mode, the controller constantly saves the latest value to DATA\_RESP (comment response register) for the command that was set to DATA\_CMD (command set register).

#### 12.1.1 Monitor Mode Register

#### DATA\_CMD (Command set register) D460 to D46F

This is the command register for the Simple PLC data communication function. Set the command corresponding to the data that you want to obtain.

#### DATA\_RESP (Command response register) D660 to D66F

This is the command response register for the Simple PLC data communication function. The response to the command that was set is saved.

#### 12.1.2 Monitor Mode Operation Sequence



- ① Set the command to DATA\_CMD (command set register).
- ② The controller saves the response to the command in DATA\_RESP (command response register).
- <sup>③</sup> The latest response data is constantly saved. (The data remains saved until the next command is issued.)

#### 12.1.3 Monitor Mode Command List

#### Joint coordinate current position acquire command (Monitor mode): E310

#### DATA\_CMD (Command set register) TCmini→Robot

D46*	F	E	D	С	В	А	9	8	7	6	5	4	3	2	1	0
Value															0	0x E310

Register	Item	Setting value
D460	Command	0xE310
	(Hexadecimal format)	
D461	Task	0 (Always specify 0)
D462 to D46F	Not used	0

#### DATA\_RESP (Command response register) Robot→TCmini

D66*	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
SCARA		5-axis joint coordinate current position 5-axis joint coordinate current position 5-axis joint coordinate current position		2-axis joint coordinate current position current			-axis joint coordinate current position			0	0x E310					
6-axis	6-axis joint coordinate current position										position					

Register	Item	Response value
D660	Command (Hexadecimal	0xE310
	format)	
D661	Task	0 (Always 0)
D662	Not used	0
D663	Orientation (CONFIG)	0: FREE/1:LEFTY/2:RIGHTY (SCARA) 0 to 22222 (6-axis)*
D664, D665	1-axis joint coordinate current position	Value of 1-axis joint coordinate current position×1000
D666, D667	2-axis joint coordinate current position	Value of 2-axis joint coordinate current position×1000
D668, D669	3-axis joint coordinate current position	Value of 3-axis joint coordinate current position×1000
D66A, D66B	4-axis joint coordinate current position	Value of 4-axis joint coordinate current position×1000
D66C, D66D	5-axis joint coordinate current position	Value of 5-axis joint coordinate current position×1000
D66E, D66F	Not used (SCARA) 6-axis joint coordinate current position (6-axis)	0 (SCARA) Value of 6-axis joint coordinate current position×1000 (6-axis)

#### World coordinate current position acquire command (Monitor mode): E311

DAT																
D46*	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
Value															0	0x E311

#### d act register) TOmini Debet

Register	Item	Setting value							
D460	Command	0xE311							
	(Hexadecimal format)								
D461	Task	0 (Always specify 0)							
D462 to D46F	Not used	0							

#### DATA\_RESP (Command response register) Robot→TCmini

D66*	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
SCARA			Wc T-coor curi posi	orld dinate rent ition	Wo C-coor cur pos	orld dinate rent ition	World Z-coordinate		World Y-coordinate		World X-coordinate		Orientatio		0	0x
6-axis	is World C-coordinate B-c current position		Wo B-coor curi posi	orld rdinate rent ition	Wo A-coor cur pos	orld dinate rent ition	curi posi	rent ition	curi posi	rent ition	cur pos	rent ition	n		0	E311

Register	Item	Response value
D660	Command (Hexadecimal format)	0xE311
D661	Task	0 (Always 0)
D662	Not used	0
D663	Orientation (CONFIG)	0:FREE/1:LEFTY/2:RIGHTY (SCARA) 0 to 22222 (6-axis)*
D664, D665	World X-coordinate current	Value of world X-coordinate current
,	position	position×1000
D666, D667	World Y-coordinate current	Value of world Y-coordinate current
	position	position×1000
D668, D669	World Z-coordinate current	Value of world Z-coordinate current
	position	position×1000
	World C-coordinate current	Value of world C-coordinate current
	position (SCARA)	position×1000 (SCARA)
DOOA, DOOD	World A-coordinate current	Value of world A-coordinate current
	position (6-axis)	position×1000 (6-axis)
	World T-coordinate current	Value of world T-coordinate current
	position (SCARA)	position×1000 (SCARA)
D000, D00D	World B-coordinate current	Value of world B-coordinate current
	position (6-axis)	position×1000 (6-axis)
	Not used (SCARA)	0 (SCARA)
D66E, D66F	World C-coordinate current	Value of world C-coordinate current
	position (6-axis)	position×1000 (6-axis)

#### Workpiece coordinate current position acquire command (Monitor mode): E312

DAT	DATA_CMD (Command set register) I Cmini-Robot															
D46*	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
Value															0	0x E312

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Register	Item	Setting value
D460	Command (Hexadecimal format)	0xE312
D461	Task	0 (Always specify 0)
D462 to D46F	Not used	0

#### DATA\_RESP (Command response register) Robot→TCmini

D66*	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
SCARA			Work T-coor curi posi	piece dinate rent ition	Work C-coo cur pos	piece rdinate rent ition	Work Z-coor	piece dinate	Work Y-coor	piece dinate	Work X-cool	piece rdinate	Orientatio		0	0x
6-axis	Workpiece C-coordinate current position Current Current Current Current Current		piece rdinate rent ition	Work A-coor cur pos	piece dinate rent ition	curi posi	rent ition	curi posi	rent ition	cur pos	rent ition	n		0	E312	

Register	Item	Response value
D660	Command (Hexadecimal format)	0xE312
D661	Task	0 (Always 0)
D662	Not used	0
D663	Orientation (CONFIG)	0:FREE/1:LEFTY/2:RIGHTY (SCARA) 0 to 22222 (6-axis)*
D664, D665	Workpiece X-coordinate current	Value of workpiece X-coordinate current
	position	position×1000
D666, D667	Workpiece Y-coordinate current	Value of workpiece Y-coordinate current
	position	position×1000
D668, D669	Workpiece Z-coordinate current	Value of workpiece Z-coordinate current
	position	position×1000
D66A, D66B	Workpiece C-coordinate current	Value of workpiece C-coordinate current
	position (SCARA)	position×1000 (SCARA)
	Workpiece A-coordinate current	Value of workpiece A-coordinate current
	position (6-axis)	position×1000 (6-axis)
D66C, D66D	Workpiece T-coordinate current	Value of workpiece T-coordinate current
	position (SCARA)	position×1000 (SCARA)
	Workpiece B-coordinate current	Value of workpiece B-coordinate current
	position (6-axis)	position×1000 (6-axis)
D66E, D66F	Not used (SCARA)	0 (SCARA)
	Workpiece C-coordinate current	Value of workpiece C-coordinate current
	position (6-axis)	position×1000 (6-axis)

#### 12.2 Command Mode

In command mode, a command is set to DATA\_CMD (Command set register), and when DATA\_TRIG (Request trigger signal) is turned on, the robot sends a response to this command. (1-shot command)

Compared to monitor mode, command mode enables the execution of data writing and other complex commands.

#### 12.2.1 Command Mode Register

#### DATA\_TRIG (Request trigger signal) G10F

This is the trigger signal of the Simple PLC data communication function. After DATA\_CMD is set, set this signal to ON. Also, after the response (DATA\_RESP) is read, set this signal to OFF.

#### DATA\_ACK (Response completion signal) H10F

This is the response completion signal of the Simple PLC data communication function. When setting of the DATA\_RESP data is completed, this signal turns on. When DATA\_TRIG is set to OFF, this signal is also set to OFF.

#### DATA\_ERR (Command error signal) H10E

This is the command error signal of the Simple PLC data communication function. If an error is found in the value that was set to DATA\_CMD, this signal is set to ON. When DATA\_TRIG is set to OFF, this signal is also set to OFF.

#### DATA\_CMD (Command set register) D460 to D46F

This is the command register of the Simple PLC data communication function. Set a command corresponding to the data that you want to obtain.

#### DATA\_RESP (Command response register) D660 to D66F

This is the command response register of the Simple PLC data communication function. The response to the command that was set is saved.

### 12.2.2 Command Mode Operation Sequence



- ① Set the command to DATA\_CMD (Command set register).
- When setting of DATA\_CMD is completed, set DATA\_TRIG (Request trigger signal) to ON.
- ③ The controller saves the response to the command in DATA\_RESP (Command response register).
- When data saving to DATA\_RESP is completed, the controller turns on the DATA\_ACK signal.
- © Check that the DATA\_ACK signal is turned on, and read the response data.
- 6 After the reading process is completed, set the request trigger signal to OFF.
- If an error occurred in the written command data, the command error signal is set to ON. (An error code is saved to the command response register when the command data is normal, but the command could not be executed due to the controller state.)

#### 12.2.3 Command Mode Command List

#### Joint coordinate current position acquire command (Command mode): E300

#### DATA\_CMD (Command set register) TCmini→Robot

D46*	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
Value															0	0x E300

Register	Item	Setting value
D460	Command	0xE300
	(Hexadecimal format)	
D461	Task	0 (Always specify 0)
D462 to D46F	Not used	0

### DATA\_RESP (Command response register) Robot→TCmini

D66*	F	E	D	С	В	А	9	8	7	6	5	4	3	2	1	0
SCARA		$\nearrow$	5-axis	s joint	4-axis	s joint	3-axis	s joint	2-axis	s joint	1-axis	s joint				
6-axis	6-axis coorc curr posi	s joint linate rent ition	coord cur pos	dinate rent ition	coord cur pos	linate rent ition	coorc curi posi	linate rent ition	coord cur pos	linate rent ition	coord cur pos	linate rent ition	Orientatio n	Error code	0	0x E300

Register	Item	Response value
D660	Command (Hexadecimal format)	0xE300
D661	Task	0 (Always 0)
D662	Error code (Hexadecimal format)	0x0000: Normal operation 0x1000: Command error (H10E is ON)
D663	Orientation (CONFIG)	0:FREE/1:LEFTY/2:RIGHTY (SCARA) 0 to 22222 (6-axis)*
D664, D665	1-axis joint coordinate current position	Value of 1-axis joint coordinate current position×1000
D666, D667	2-axis joint coordinate current position	Value of 2-axis joint coordinate current position×1000
D668, D669	3-axis joint coordinate current position	Value of 3-axis joint coordinate current position×1000
D66A, D66B	4-axis joint coordinate current position	Value of 4-axis joint coordinate current position×1000
D66C, D66D	5-axis joint coordinate current position	Value of 5-axis joint coordinate current position×1000
D66E, D66F	Not used (SCARA) 6-axis joint coordinate current position (6-axis)	0 (SCARA) Value of 6-axis joint coordinate current position×1000 (6-axis)

#### World coordinate current position acquire command (Command mode) : E301

DAT	DATA_CMD (Command set register) I Cmini→Robot															
D46*	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
Value															0	0x E301

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Register	Item	Setting value
D460	Command (Hexadecimal format)	0xE301
D461	Task	0 (Always specify 0)
D462 to D46F	Not used	0

#### DATA RESP (Command response register) Robot -> TCmini

D66*	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
SCARA		World T-coordinate current position		orld rdinate rent ition	Wo C-coor curr pos	orld rdinate rent ition	Wc Z-coor	orld	Wo Y-coor	orld rdinate	Wo X-cool	orld dinate	Orientatio	Error		0x
6-axis	World W C-coordinateB-coo current cu position pos		Wo B-coor curi posi	orld rdinate rent ition	Wo A-cooi curi pos	orld dinate rent ition	curi posi	ent tion	curi posi	rent ition	cur pos	rent ition	n	code	0	E301

Register	Item	Response value
D660	Command (Hexadecimal format)	0xE301
D661	Task	0 (Always 0)
D662	Error code (Hexadecimal format)	0x0000: Normal operation
		0x1000: Command error (H10E is ON)
D663	Orientation (CONFIG)	0:FREE/1:LEFTY/2:RIGHTY (SCARA)
		0 to 22222 (6-axis)*
D664, D665	World X-coordinate current	Value of world X-coordinate current
	position	position×1000
D666, D667	World Y-coordinate current	Value of world Y-coordinate current
	position	position×1000
D668, D669	World Z-coordinate current	Value of world Z-coordinate current
	position	position×1000
	World C-coordinate current	Value of world C-coordinate current
	position (SCARA)	position×1000 (SCARA)
D00A, D00B	World A-coordinate current	Value of world A-coordinate current
	position (6-axis)	position×1000 (6-axis)
	World T-coordinate current	Value of world T-coordinate current
	position (SCARA)	position×1000 (SCARA)
D00C, D00D	World B-coordinate current	Value of world B-coordinate current
	position (6-axis)	position×1000 (6-axis)
	Not used (SCARA)	0 (SCARA)
D66E, D66F	World C-coordinate current	Value of world C-coordinate current
	position (6-axis)	position×1000 (6-axis)

\*For details on the 6-axis robot orientation (CONFIG) notation, see section 12.3.

#### Workpiece coordinate current position acquire command (Command mode): E302

#### DATA\_CMD (Command set register) TCmini→Robot

D46*	F	E	D	С	В	А	9	8	7	6	5	4	3	2	1	0
Value															0	0x E302

Register	Item	Setting value
D460	Command	0xE302
	(Hexadecimal format)	
D461	Task	0 (Always specify 0)
D462 to D46F	Not used	0

# DATA\_RESP (Command response register) Robot→TCmini

D66*	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
SCARA			Work T-cooi cur pos	piece dinate rent ition	Work C-coor curi posi	piece dinate rent ition	Workpiece Z-coordinate		Workpiece Y-coordinate		Workpiece X-coordinate		Orienta	Error	0	0x
6-axis	Work C-coor cur pos	piece rdinate rent ition	e Workpiece e B-coordinate current position		Work A-coor curi posi	piece dinate rent tion	curi posi	ent tion	curi posi	rent ition	cur pos	rent ition	tion	code	0	E302

Register	Item	Response value
D660	Command (Hexadecimal format)	0xE302
D661	Task	0 (Always 0)
D662	Error code (Hexadecimal format)	0x0000: Normal operation 0x1000: Command error (H10E is ON)
D663	Orientation (CONFIG)	0:FREE/1:LEFTY/2:RIGHTY (SCARA) 0 to 22222 (6-axis)*
D664, D665	Workpiece X-coordinate current position	Value of workpiece X-coordinate current position×1000
D666, D667	Workpiece Y-coordinate current position	Value of workpiece Y-coordinate current position×1000
D668, D669	Workpiece Z-coordinate current position	Value of workpiece Z-coordinate current position×1000
D66A, D66B	Workpiece C-coordinate current position (SCARA) Workpiece A-coordinate current position (6-axis)	Value of workpiece C-coordinate current position×1000 (SCARA) Value of workpiece A-coordinate current position×1000 (6-axis)
D66C, D66D	Workpiece T-coordinate current position (SCARA) Workpiece B-coordinate current position (6-axis)	Value of workpiece T-coordinate current position×1000 (SCARA) Value of workpiece B-coordinate current position×1000 (6-axis)
D66E, D66F	Not used (SCARA) Workpiece C-coordinate current position (6-axis)	0 (SCARA) Value of workpiece C-coordinate current position×1000 (6-axis)

\* For details on the 6-axis robot orientation (CONFIG) notation, see section 12.3.

#### Teaching point write command: C2C1

#### DATA\_CMD (Command set register) TCmini→Robot

D46* F E D C B A 9 8 7 6 5 4 3 2 1 0

SCARA			Teaching point data T-coordinate value	Teaching point data C-coordinate value	Teaching point data	Teaching point data	Teaching point data	Orientatio	0	Table	0x
6-axis	Teac point C-coor val	ching data dinate ue	Teaching point data B-coordinate value	Teaching point data A-coordinate value	Z-coordinate value	Y-coordinate value	X-coordinate value	n	0	r	C2C1

Register	Item	Setting value
D460	Command (Hexadecimal format)	0xC2C1
D461	Table number	1 to 999(Specify 1 when the teaching data name is "P001")*1
D462	Task	0 (Always specify 0)
D463	Orientation (CONFIG)(Hexadecimal format)	0:FREE/1:LEFTY/2:RIGHTY (SCARA) 0 to 22222 (6-axis)*2
D464, D465	Teaching point data X-coordinate value	Value of teaching point data X-coordinate value×1000
D466, D467	Teaching point data Y-coordinate value	Value of teaching point data Y-coordinate value×1000
D468, D469	Teaching point data Z-coordinate value	Value of teaching point data Z-coordinate value×1000
D46A, D46B	Teaching point data C-coordinate value (SCARA) Teaching point data A-coordinate value (6-axis)	Value of teaching point data C-coordinate value×1000 (SCARA) Value of teaching point data A-coordinate value×1000 (6-axis)
D46C, D46D	Teaching point data T-coordinate value (SCARA) Teaching point data B-coordinate value (6-axis)	Value of teaching point data T-coordinate value×1000 (SCARA) Value of teaching point data B-coordinate value×1000 (6-axis)
D46E, D46F	Not used (SCARA) Teaching point data C-coordinate value (6-axis)	0 (SCARA) Value of teaching point data C-coordinate value×1000 (6-axis)

\*1 The table number indicates the number of the teaching point data in the file selected as the execution file.
 Teaching point data names must be created in the range from P001 to P999 in the file selected as the execution file and registered as teaching point data.

#### DATA\_RESP (Command response register) Robot→TCmini

		· · · ·														
D66*	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
Value													0	Error code	Table numbe r	0x C2C1

Register	Item	Response value
D660	Command (Hexadecimal	0xC2C1
	format)	
D661	Table number	1 to 999
D662	Error code (Hexadecimal format)	0x0000: Normal operation 0x1000: Command error (H10E is ON) 0x2001: Program execution in progress 0x2002: Outside teaching point name range (1 to 999) 0x2003: Teaching point name does not exist 0x2004: Teaching point write failed
D663	Task	0 (Always 0)
D664 to D66F	Not used	0

#### Teaching point data acquire command: C3C1

#### **DATA\_CMD (Command set register)** TCmini→Robot

D46*	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
Value														0	Table numbe r	0x C3C1

Register	Item	Setting value
D460	Command	0xC3C1
	(Hexadecimal format)	
D/61	Table number	1 to 999 (Specify 1 when the teaching point
D401	Table Humber	data name is "P001")*1
D462	Task	0 (Always specify 0)
D463 to	Notucod	0
D46F	Not used	0

\*1 The table number indicates the number of the teaching point data in the file selected as the execution file.

Teaching point data names must be created in the range from P001 to P999 in the file selected as the execution file and registered as teaching point data.

If a teaching point name does not exist, 0 is returned for the teaching point data.

				nanu	resp	01130	regi	SICI				п				
D66*	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0
SCARA			Teac point T-coor va	ching data rdinate lue	Tead point C-cod e va	ching t data ordinat alue	Teac point	ching data	Teac point	ching data	Teac point	ching data	Orientatio	Error	Table	0x
6-axis	Teac point C-coo e va	ching data ordinat alue	Teac point B-coo e va	ching data ordinat alue	Teac point A-cool va	ching t data rdinate lue	Ż-coo e va	ordinat alue	Y-coor val	rdinate lue	X-coo va	rdinate lue	n	code	r	C3C1

#### DATA\_RESP (Command response register) Robot→TCmini

Register	Item	Response value
D660	Command (Hexadecimal format)	0xC3C1
D661	Table number	1 to 999
D662	Error code (Hexadecimal format)	0x0000: Normal operation 0x1000: Command error (H10E is ON) 0x2002: Outside teaching point name range (1 to 999)
D663	Orientation (CONFIG)	0:FREE/1:LEFTY/2:RIGHTY (SCARA) 0 to 22222 (6-axis)*2
D664, D665	Teaching point data X-coordinate value	Value of teaching point data X-coordinate value×1000
D666, D667	Teaching point data Y-coordinate value	Value of teaching point data Y-coordinate value×1000
D668, D669	Teaching point data Z-coordinate value	Value of teaching point data Z-coordinate value×1000
D66A, D66B	Teaching point data C-coordinate value (SCARA) Teaching point data A-coordinate value (6-axis)	Value of teaching point data C-coordinate value×1000 (SCARA) Value of teaching point data A-coordinate value×1000 (6-axis)
D66C, D66D	Teaching point data T-coordinate value (SCARA) Teaching point data B-coordinate value (6-axis)	Value of teaching point data T-coordinate value×1000 (SCARA) Value of teaching point data B-coordinate value×1000 (6-axis)
D66E, D66F	Not used (SCARA) Teaching point data C-coordinate value (6-axis)	0 (SCARA) Value of teaching point data C-coordinate value×1000 (6-axis)

#### 12.3 6-axis Robot Orientation (CONFIG) Notation

The 6-axis robot orientation (CONFIG) notation appears as "0", "1102", "21111", or similar based on the integer values shown in the table below.

Shoulder	Elbow	Wrist orientation	4-axis	6-axis
orientation	orientation		(Rot4)	(Rot6)
0:FREE(x)	0:FREE(x)	0:FREE(x)	0:FREE(x)	0:FREE(x)
1:LEFTY(L)	1:ABOVE(A)	1:NFLIP(N)	1:SINGLE4(S)	1:SINGLE6(S)
2:RIGHTY(R)	2:BELOW(B)	2:FLIP(F)	2:DOUBLE4(D)	2:DOUBLE6(D)

Examples:

0 indicates FREE / FREE / FREE / FREE / FREE (xxxxx).

1102 indicates FREE / ABOVE / FLIP / FREE / DOUBLE6 (xAFxD).

21111 indicates LEFTY / ABOVE / NFLIP / SINGLE4 / SINGLE6 (LANSS).

22010 indicates RIGHTY / BELOW / FREE / SINGLE4 / FREE (RBxSx).

22222 indicates RIGHTY / BELOW / FLIP / DOUBLE4 / DOUBLE6 (RBFDD).

### Section 13 Appendix

List of Relays

I/O

Bit	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
X00W	IN16	IN15	IN14	IN13	IN12	IN11	IN10	IN9	IN8	IN7	IN6	IN5	IN4	IN3	IN2	IN1
X01W	IN32	IN31	IN30	IN29	IN28	IN27	IN26	IN25	IN24	IN23	IN22	IN21	IN20	IN19	IN18	IN17
X02W	IN48	IN47	IN46	IN45	IN44	IN43	IN42	IN41	IN40	IN39	IN38	IN37	IN36	IN35	UFI2	UFI1
X03W	HI8	HI7	HI6	HI5	HI4	HI3	HI2	HI1	LI8	LI7	LI6	LI5	LI4	LI3	LI2	LI1
X04W	EI16	EI15	EI14	EI13	EI12	EI11	EI10	El9	El8	EI7	El6	EI5	El4	EI3	El2	El1
X05W	EI32	El31	EI30	EI29	EI28	EI27	EI26	EI25	EI24	EI23	El22	EI21	EI20	EI19	EI18	EI17
X06W	EI48	EI47	EI46	EI45	EI44	EI43	EI42	EI41	EI40	EI39	EI38	EI37	EI36	EI35	EI34	EI33
X07W	EI64	EI63	El62	El61	EI60	EI59	EI58	EI57	EI56	EI55	EI54	EI53	EI52	EI51	EI50	EI49
Y10W	OUT16	OUT15	OUT14	OUT13	OUT12	OUT11	OUT10	OUT9	OUT8	OUT7	OUT6	OUT5	OUT4	OUT3	OUT2	OUT1
Y11W	OUT32	OUT31	OUT30	OUT29	OUT28	OUT27	OUT26	OUT25	OUT24	OUT23	OUT22	OUT21	OUT20	OUT19	OUT18	OUT17
Y12W	OUT48	OUT47	OUT46	OUT45	OUT44	OUT43	OUT42	OUT41	OUT40	OUT39	OUT38	OUT37	OUT36	OUT35	UFO2	UFO1
Y13W	HO8	HO7	HO6	HO5	HO4	HO3	HO2	HO1								
Y14W	EO16	EO15	EO14	EO13	EO12	EO11	EO10	EO9	EO8	EO7	EO6	EO5	EO4	EO3	EO2	EO1
Y15W	EO32	EO31	EO30	EO29	EO28	EO27	EO26	EO25	EO24	EO23	EO22	EO21	EO20	EO19	EO18	EO17
Y16W	EO48	EO47	EO46	EO45	EO44	EO43	EO42	EO41	EO40	EO39	EO38	EO37	EO36	EO35	EO34	EO33
Y17W	EO64	EO63	EO62	EO61	EO60	EO59	EO58	EO57	EO56	EO55	EO54	EO53	EO52	EO51	EO50	EO49
X20W	FI16	FI15	FI14	FI13	FI12	FI11	FI10	FI9	FI8	FI7	FI6	FI5	FI4	FI3	FI2	FI1
X21W	FI32	FI31	FI30	FI29	FI28	FI27	FI26	FI25	FI24	FI23	FI22	FI21	FI20	FI19	FI18	FI17
X22W	FI48	FI47	FI46	FI45	FI44	FI43	FI42	FI41	FI40	FI39	FI38	FI37	FI36	FI35	FI34	FI33
X23W	FI64	FI63	FI62	FI61	FI60	FI59	FI58	FI57	FI56	FI55	FI54	FI53	FI52	FI51	FI50	FI49
X24W	FI80	FI79	FI78	FI77	FI76	FI75	FI74	FI73	FI72	FI71	FI70	FI69	FI68	FI67	FI66	FI65
X25W	FI96	FI95	FI94	FI93	FI92	FI91	FI90	FI89	F188	FI87	FI86	FI85	FI84	FI83	FI82	FI81
X26W	FI112	FI111	FI110	FI109	FI108	FI107	FI106	FI105	FI104	FI103	FI102	FI101	FI100	FI99	FI98	FI97
X27W	FI128	FI127	FI126	FI125	FI124	FI123	FI122	FI121	FI120	FI119	FI118	FI117	FI116	FI115	FI114	FI113
Y30W	FO16	FO15	FO14	FO13	FO12	F011	FO10	FO9	FO8	FO7	FO6	FO5	FO4	FO3	FO2	FO1
Y31W	FO32	FO31	FO30	FO29	FO28	FO27	FO26	FO25	FO24	FO23	FO22	FO21	FO20	FO19	FO18	F017
Y32W	FO48	FO47	FO46	FO45	FO44	FO43	FO42	FO41	FO40	FO39	FO38	FO37	FO36	FO35	FO34	FO33
Y33W	FO64	FO63	F062	FO61	FO60	FO59	FO58	F057	FO56	FO55	FO54	FO53	FO52	FO51	FO50	FO49
Y34W	F080	F079	F078	F077	F076	F075	F074	F073	F072	F071	F070	FO69	F068	F067	F066	FO65
Y35W	FO96	FO95	FO94	FO93	FO92	FO91	FO90	F089	F088	F087	F086	F085	F084	F083	F082	FO81
Y36W	FO112	FO111	FO110	FO109	FO108	FO107	FO106	FO105	FO104	FO103	FO102	FO101	FO100	F099	F098	F097
Y37W	FO128	FO127	FO126	FO125	FO124	FO123	F0122	FO121	FO120	FO119	FO118	F0117	FO116	FO115	FO114	FO113

#### Internal relays

Bit	F	E	D	С	В	Α	9	8	7	6	5	4	3	2	1	0
R00W																
R01W																
R02W																
R03W																
R04W																
R05W																
R06W																
R07W																
R10W																
R11W																
R12W																
R13W																
R14W																
R15W																
R16W																
R17W																
R20W																
R21W		+														
R22W																
R23W																
R24W		+														
R25W		••••••														
R26W		•••••														
R27W																
R30W																
R31W		+														
R32W		+														
R33W		+														
R34W		+														
R35W		+														
R36W		•••••														
R37W		•••••														
R40W																
R41W																
R42W		+			<u> </u>		1			<u> </u>			<u> </u>			
R43W		+			<u> </u>		1			<u> </u>			<u> </u>			
R44W		+			<u> </u>		1			<u> </u>			<u> </u>			
R45W		+			<u> </u>		1			<u> </u>			<u> </u>			
R46W/		<u>+</u>			<u> </u>	<u> </u>							<u> </u>			
R47\//		<u> </u>			+								<b> </b>			
R50\//																
R51M		<u> </u>														
R51W R52W/		<u> </u>			<u> </u>								<u> </u>			
R52W		<b> </b>			<u> </u>	<u> </u>										
		<b>+</b>			+	<u> </u>				<u> </u>						
		<b> </b>			<b> </b>	<u> </u>										
ROOW		<b> </b>			<b> </b>	<u> </u>										
		<b> </b>			<b> </b>											
K5/W									_							
Bit	F	E	D	C	В	А	9	8	7	6	5	4	3	2	1	0

#### Internal relays

Bit	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0
R60W																
R61W																
R62W																
R63W																
R64W																
R65W																
R66W																
R67W																
R70W																
R71W																
R72W																
R73W																
R74W																
R75W																
R76W																
R77W																

Bit	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0
G00W	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
	16	15	14	13	12	11	10	9	8		6	5	4	3	2	
G01W	JIN 32	DIN 31	20 20	20 20	28	27	26	25	24	23	22	21	20	10	18 18	DIN 17
	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
G02W	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33
G03W/	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
0030	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49
G04W	DIN 116	DIN	DIN	DIN	DIN	DIN	DIN 110	DIN 100	DIN	DIN 107	DIN	DIN	DIN 104	DIN 102	DIN 102	DIN 101
		DIN	DIN	DIN				DIN	DIN				DIN	DIN		
G05W	132	131	130	129	128	127	126	125	124	123	122	121	120	119	118	117
COEW	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN	DIN
GUUW	148	147	146	145	144	143	142	141	140	139	138	137	136	135	134	133
G07W	DIN 164	DIN 163	DIN 162	DIN 161	DIN 160	DIN 159	DIN 158	DIN 157	DIN 156	DIN 155	DIN 154	DIN 153	DIN 152	DIN 151	DIN 150	DIN 149
	104	100	102	101	DCON	100	100	107	100	100	104	100	102	101	100	140
G10W	DATA				V		MLT	OFS			HAND		HAND	HAND	HAND	
					TRIG	OFF	ROI	NOD	IINO	IIN7	INO	IND	11114	INS	IINZ	
G11W	AL8-	AL8-	AL8-	AL8-	AL4-	AL4-	AL4-	AL4-	AL1-	AL1-	AL1-	AL1-	AL1-	AL1-	AL1-	AL1-
	272	2/1	270	269	080	079	078	077	044	043	042	041	040	039	038	037
G12W					J_ MOV	J_DI		.1 A	XIS				J SE	PEED	I RE	MOTE
01211	E RECT								/10		0_00		0_01			
G13W			BZ_	SV		LOW_	CYCLE	STOP	EX_	RUN	ALM	DO	CYC	STEP	PRG_	STROBE
G13W			BZ_ RST	SV OFF	BREAK	LOW_ SPD	CYCLE	STOP	EX_ SVON	RUN	ALM _RST	DO _RST	CYC _RST	STEP _RST	PRG_ RST	STROBE
G13W G14W			BZ_ RST	SV OFF	BREAK	LOW_ SPD	CYCLE	STOP	EX_ SVON	RUN	ALM _RST	DO _RST	CYC _RST	STEP _RST	PRG_ RST	STROBE
G13W G14W ~			BZ_ RST	SV OFF Reserv	BREAK ved area	LOW_ SPD	CYCLE	STOP	EX_ SVON	RUN	ALM _RST	DO _RST	CYC _RST	STEP _RST	PRG_ RST	STROBE
G13W G14W ~ G16W	DANIEL	DANIEL	BZ_ RST	SV OFF Reserv	BREAK	LOW_ SPD	CYCLE	STOP	EX_ SVON	RUN	ALM _RST	DO _RST	CYC _RST	STEP _RST	PRG_ RST	STROBE
G13W G14W ~ G16W G17W	PANEL	PANEL	BZ_ RST PANEL SV	SV OFF Reserv PANEL EX_	BREAK	LOW_ SPD	CYCLE PANEL PRG_	STOP PANEL ALM	EX_ SVON	RUN	ALM _RST	DO _RST	CYC _RST	STEP _RST	PRG_ RST	STROBE
G13W G14W G16W G17W	PANEL BREAK	PANEL RUN	BZ_ RST PANEL SV OFF	SV OFF Reserv PANEL EX_ SVON	BREAK	LOW_ SPD	CYCLE PANEL PRG_ RST	STOP PANEL ALM _RST	EX_ SVON	RUN	ALM _RST	DO _RST	CYC _RST	STEP _RST	PRG_ RST	STROBE
G13W G14W G16W G17W G20W	PANEL BREAK DIN 316	PANEL RUN DIN 315	BZ_ RST PANEL SV OFF DIN 314	SV OFF Reserv PANEL EX_ SVON DIN 313	BREAK ved area	LOW_ SPD	PANEL PRG_ RST DIN 310	STOP PANEL ALM _RST DIN 309	EX_ SVON	RUN DIN 307	ALM _RST DIN 306	DO _RST DIN 305	CYC _RST DIN 304	STEP _RST DIN 303	PRG_ RST DIN 302	STROBE
G13W G14W G16W G17W G20W	PANEL BREAK DIN 316 DIN	PANEL RUN DIN 315 DIN	BZ_ RST PANEL SV OFF DIN 314 DIN	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN	DIN 312 DIN	PANEL DO _RST DIN 311 DIN	PANEL PRG_ RST DIN 310 DIN	PANEL ALM _RST DIN 309 DIN	EX_ SVON DIN 308 DIN	RUN DIN 307 DIN	ALM _RST DIN 306 DIN	DO _RST DIN 305 DIN	CYC _RST DIN 304 DIN	STEP _RST DIN 303 DIN	PRG_ RST DIN 302 DIN	STROBE DIN 301 DIN
G13W G14W ~ G16W G17W G20W G21W	PANEL BREAK DIN 316 DIN 332	PANEL RUN DIN 315 DIN 331	BZ_ RST PANEL SV OFF DIN 314 DIN 330	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329	DIN 312 DIN 328	LOW_ SPD PANEL DO _RST DIN 311 DIN 327	PANEL PRG_ RST DIN 310 DIN 326	STOP PANEL ALM _RST DIN 309 DIN 325	EX_ SVON DIN 308 DIN 324	RUN DIN 307 DIN 323	ALM _RST DIN 306 DIN 322	DO _RST DIN 305 DIN 321	CYC _RST DIN 304 DIN 320	STEP _RST DIN 303 DIN 319	PRG_ RST DIN 302 DIN 318	STROBE DIN 301 DIN 317
G13W G14W G16W G17W G20W G21W	PANEL BREAK DIN 316 DIN 332 DIN	PANEL RUN DIN 315 DIN 331 DIN	BZ_ RST PANEL SV OFF DIN 314 DIN 330 DIN	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN	DIN 312 DIN 328 DIN	LOW_ SPD	CYCLE PANEL PRG_ RST DIN 310 DIN 326 DIN	PANEL ALM _RST DIN 309 DIN 325 DIN	EX_ SVON DIN 308 DIN 324 DIN	RUN DIN 307 DIN 323 DIN	ALM _RST DIN 306 DIN 322 DIN	DO _RST DIN 305 DIN 321 DIN	CYC _RST DIN 304 DIN 320 DIN	STEP _RST DIN 303 DIN 319 DIN	PRG_ RST DIN 302 DIN 318 DIN	STROBE DIN 301 DIN 317 DIN
G13W G14W G16W G17W G20W G21W G22W	PANEL BREAK DIN 316 DIN 332 DIN 348	PANEL RUN DIN 315 DIN 331 DIN 347	BZ_ RST PANEL SV OFF DIN 314 DIN 330 DIN 340	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN 345	DIN 312 DIN 328 DIN 344	LOW_ SPD PANEL DO _RST DIN 311 DIN 327 DIN 343	PANEL PRG_ RST DIN 310 DIN 326 DIN 342	PANEL ALM _RST DIN 309 DIN 325 DIN 341	EX_ SVON DIN 308 DIN 324 DIN 324	RUN DIN 307 DIN 323 DIN 339	ALM _RST DIN 306 DIN 322 DIN 338	DO _RST DIN 305 DIN 321 DIN 337	CYC _RST DIN 304 DIN 320 DIN 336	STEP _RST DIN 303 DIN 319 DIN 335	PRG_ RST DIN 302 DIN 318 DIN 334	STROBE DIN 301 DIN 317 DIN 333
G13W G14W G16W G17W G20W G21W G22W G22W	PANEL BREAK DIN 316 DIN 332 DIN 348 DIN 348	PANEL RUN DIN 315 DIN 331 DIN 347 DIN 347	BZ_ RST PANEL SV OFF DIN 314 DIN 330 DIN 346 DIN 346	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN 345 DIN 345	DIN 312 DIN 328 DIN 344 DIN 260	LOW_ SPD PANEL DO _RST DIN 311 DIN 327 DIN 343 DIN 343	PANEL PRG_ RST DIN 310 DIN 326 DIN 342 DIN 342 DIN 342	PANEL ALM _RST DIN 309 DIN 325 DIN 341 DIN 341	EX_ SVON DIN 308 DIN 324 DIN 340 DIN 340	RUN DIN 307 DIN 323 DIN 339 DIN 339	ALM _RST DIN 306 DIN 322 DIN 338 DIN 338	DO _RST DIN 305 DIN 321 DIN 337 DIN 337	CYC _RST DIN 304 DIN 320 DIN 336 DIN 336	STEP _RST DIN 303 DIN 319 DIN 335 DIN 335	PRG_ RST DIN 302 DIN 318 DIN 334 DIN 334 DIN 250	STROBE DIN 301 DIN 317 DIN 333 DIN 3240
G13W G14W G16W G17W G20W G21W G22W G22W	PANEL BREAK DIN 316 DIN 332 DIN 348 DIN 364 DIN	PANEL RUN DIN 315 DIN 331 DIN 347 DIN 363 DIN	BZ_ RST PANEL SV OFF DIN 314 DIN 330 DIN 346 DIN 362 DIN	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN 345 DIN 361 DIN	DIN 312 DIN 328 DIN 344 DIN 360 DIN	LOW_ SPD PANEL DO _RST DIN 311 DIN 327 DIN 343 DIN 359 DIN	PANEL PRG_ RST DIN 310 DIN 326 DIN 342 DIN 342 DIN 358	PANEL ALM _RST DIN 309 DIN 325 DIN 341 DIN 357 DIN	EX_ SVON DIN 308 DIN 324 DIN 340 DIN 350 DIN	RUN DIN 307 DIN 323 DIN 339 DIN 355 DIN	ALM _RST DIN 306 DIN 322 DIN 338 DIN 354 DIN	DO _RST DIN 305 DIN 321 DIN 337 DIN 353 DIN	CYC _RST DIN 304 DIN 320 DIN 336 DIN 352 DIN	STEP _RST DIN 303 DIN 319 DIN 335 DIN 351 351	PRG_ RST DIN 302 DIN 318 DIN 334 DIN 330 DIN	STROBE DIN 301 DIN 317 DIN 333 DIN 349 DIN
G13W G14W G16W G17W G20W G21W G22W G23W G24W	PANEL BREAK DIN 316 DIN 332 DIN 348 DIN 364 DIN 416	PANEL RUN DIN 315 DIN 331 DIN 347 DIN 363 DIN 415	BZ_ RST PANEL SV OFF DIN 314 DIN 330 DIN 346 DIN 346 DIN 362 DIN 414	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN 345 DIN 345 DIN 361 DIN 413	DIN 312 DIN 328 DIN 344 DIN 360 DIN 412	LOW_ SPD PANEL DO _RST DIN 311 DIN 327 DIN 343 DIN 359 DIN 411	CYCLE PANEL PRG_ RST DIN 310 DIN 326 DIN 342 DIN 358 DIN 410	PANEL ALM _RST DIN 309 DIN 325 DIN 341 DIN 357 DIN 409	EX_ SVON DIN 308 DIN 324 DIN 340 DIN 356 DIN 408	RUN DIN 307 DIN 323 DIN 339 DIN 355 DIN 407	ALM _RST DIN 306 DIN 322 DIN 338 DIN 354 DIN 406	DO _RST DIN 305 DIN 321 DIN 337 DIN 353 DIN 405	CYC _RST DIN 304 DIN 320 DIN 336 DIN 352 DIN 404	STEP _RST DIN 303 DIN 319 DIN 3351 DIN 403	PRG_ RST DIN 302 DIN 318 DIN 334 DIN 350 DIN 402	STROBE DIN 301 DIN 317 DIN 333 DIN 349 DIN 401
G13W G14W G16W G17W G20W G21W G22W G23W G24W	PANEL BREAK DIN 316 DIN 332 DIN 348 DIN 348 DIN 364 DIN 416 DIN	PANEL RUN DIN 315 DIN 331 DIN 347 DIN 363 DIN 415 DIN	BZ_ RST PANEL SV OFF DIN 314 DIN 330 DIN 346 DIN 346 DIN 346 DIN 414 DIN	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN 345 DIN 345 DIN 345 DIN 345 DIN 345 DIN 345 DIN	DIN 312 DIN 328 DIN 344 DIN 360 DIN 412 DIN	LOW_ SPD PANEL DO _RST DIN 311 DIN 327 DIN 343 DIN 359 DIN 411 DIN	CYCLE PANEL PRG_ RST DIN 310 DIN 326 DIN 342 DIN 358 DIN 410 DIN	PANEL ALM _RST DIN 309 DIN 325 DIN 341 DIN 357 DIN 409 DIN	EX_ SVON DIN 308 DIN 324 DIN 340 DIN 356 DIN 408 DIN	RUN DIN 307 DIN 323 DIN 339 DIN 355 DIN 407 DIN	ALM _RST DIN 306 DIN 322 DIN 338 DIN 354 DIN 406 DIN	DO _RST DIN 305 DIN 321 DIN 337 DIN 353 DIN 405 DIN	CYC _RST DIN 304 DIN 320 DIN 336 DIN 352 DIN 404 DIN	STEP _RST DIN 303 DIN 335 DIN 351 DIN 403 DIN	PRG_ RST DIN 302 DIN 318 DIN 334 DIN 350 DIN 402 DIN	STROBE DIN 301 DIN 317 DIN 333 DIN 349 DIN 401 DIN
G13W G14W G16W G17W G20W G21W G22W G23W G23W G24W	PANEL BREAK DIN 316 DIN 332 DIN 348 DIN 364 DIN 416 DIN 432	PANEL RUN DIN 315 DIN 331 DIN 347 DIN 363 DIN 415 DIN 431	BZ_ RST PANEL SV OFF DIN 314 DIN 330 DIN 346 DIN 346 DIN 342 DIN 414 DIN 430	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN 345 DIN 345 DIN 361 DIN 413 DIN 429	PREAK red area DIN 312 DIN 328 DIN 344 DIN 360 DIN 412 DIN 428	LOW_ SPD PANEL DO _RST DIN 311 DIN 327 DIN 343 DIN 359 DIN 411 DIN 427	PANEL PRG_ RST DIN 310 DIN 326 DIN 326 DIN 342 DIN 358 DIN 410 DIN 426	STOP PANEL ALM _RST DIN 309 DIN 325 DIN 341 DIN 357 DIN 409 DIN 425	EX_ SVON DIN 308 DIN 324 DIN 340 DIN 356 DIN 408 DIN 424	RUN DIN 307 DIN 323 DIN 355 DIN 407 DIN 423	ALM _RST DIN 306 DIN 322 DIN 338 DIN 354 DIN 406 DIN 422	DO _RST DIN 305 DIN 321 DIN 353 DIN 405 DIN 421	CYC _RST DIN 304 DIN 320 DIN 336 DIN 352 DIN 404 DIN 420	STEP _RST DIN 303 DIN 319 DIN 351 DIN 403 DIN 403 DIN 419	PRG_ RST DIN 302 DIN 318 DIN 334 DIN 350 DIN 402 DIN 418	STROBE DIN 301 DIN 317 DIN 333 DIN 349 DIN 401 DIN 417
G13W G14W G16W G17W G20W G21W G22W G22W G23W G24W G25W G26W	PANEL BREAK DIN 316 DIN 332 DIN 348 DIN 364 DIN 416 DIN 432 DIN	PANEL RUN DIN 315 DIN 331 DIN 347 DIN 363 DIN 415 DIN 431 DIN	BZ_ RST PANEL SV OFF DIN 314 DIN 330 JIN 346 DIN 346 DIN 362 DIN 414 DIN 430 DIN	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN 345 DIN 361 DIN 413 DIN 413 DIN 429 DIN	PREAK red area DIN 312 DIN 328 DIN 344 DIN 360 DIN 412 DIN 428 DIN 428 DIN	LOW_ SPD PANEL DO _RST DIN 311 DIN 327 DIN 343 DIN 359 DIN 411 DIN 427 DIN	PANEL PRG_ RST DIN 310 DIN 326 DIN 342 DIN 358 DIN 410 DIN 426 DIN 410	PANEL ALM _RST DIN 309 DIN 325 DIN 341 DIN 357 DIN 409 DIN 425 DIN 425	EX_ SVON DIN 308 DIN 324 DIN 340 DIN 356 DIN 408 DIN 424 DIN 424	RUN DIN 307 DIN 323 DIN 355 DIN 407 DIN 423 DIN	ALM _RST DIN 306 DIN 322 DIN 338 DIN 354 DIN 406 DIN 422 DIN 422 DIN	DO _RST DIN 305 DIN 321 DIN 337 DIN 353 DIN 405 DIN 421 DIN	CYC _RST DIN 304 DIN 320 DIN 336 DIN 352 DIN 404 DIN 404 DIN 420 DIN	STEP _RST DIN 303 DIN 319 DIN 351 DIN 403 DIN 403 DIN 419 DIN	PRG_ RST DIN 302 DIN 318 DIN 334 DIN 350 DIN 402 DIN 418 DIN 418	STROBE DIN 301 DIN 317 DIN 333 DIN 349 DIN 401 DIN 417 DIN 417 DIN
G13W G14W G16W G17W G20W G21W G22W G22W G23W G24W G25W G26W	PANEL BREAK DIN 316 DIN 332 DIN 348 DIN 364 DIN 416 DIN 432 DIN 432 DIN 432 DIN	PANEL RUN DIN 315 DIN 331 DIN 347 DIN 363 DIN 415 DIN 431 DIN 431 DIN 431	BZ_ RST PANEL SV OFF DIN 314 DIN 330 DIN 346 DIN 346 DIN 346 DIN 346 DIN 342 DIN 414 DIN 430 DIN 414	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 329 DIN 345 DIN 361 DIN 413 DIN 413 DIN 429 DIN 413	PREAK red area DIN 312 DIN 328 DIN 344 DIN 360 DIN 412 DIN 428 DIN 428 DIN 428 DIN	LOW_ SPD PANEL DO _RST DIN 311 DIN 327 DIN 343 DIN 359 DIN 411 DIN 427 DIN 427 DIN 427	PANEL PRG_ RST DIN 310 DIN 326 DIN 342 DIN 358 DIN 410 DIN 426 DIN 426 DIN 420 DIN 420 DIN	STOP PANEL ALM _RST DIN 309 DIN 325 DIN 341 DIN 357 DIN 409 DIN 425 DIN 425 DIN 425	EX_ SVON DIN 308 DIN 324 DIN 340 DIN 356 DIN 408 DIN 408 DIN 424 DIN 424 DIN 356	RUN DIN 307 DIN 323 DIN 355 DIN 407 DIN 423 DIN 423 DIN 423 DIN 423	ALM _RST DIN 306 DIN 322 DIN 338 DIN 354 DIN 406 DIN 422 DIN 422 DIN 422 DIN	DO _RST DIN 305 DIN 321 DIN 353 DIN 405 DIN 405 DIN 421 DIN 421 DIN 421	CYC _RST DIN 304 DIN 320 DIN 336 DIN 352 DIN 404 DIN 420 DIN 420 DIN 420	STEP _RST DIN 303 DIN 335 DIN 351 DIN 403 DIN 403 DIN 419 DIN 419 DIN 419 DIN	PRG_ RST DIN 302 DIN 318 DIN 334 DIN 350 DIN 402 DIN 418 DIN 418 DIN 418 DIN 418	STROBE DIN 301 DIN 317 DIN 333 DIN 349 DIN 401 DIN 417 DIN 417 DIN 417
G13W G14W G16W G17W G20W G21W G22W G22W G22W G22W G25W G25W G26W G27W	PANEL BREAK DIN 316 DIN 348 DIN 348 DIN 364 DIN 416 DIN 432 DIN 448 DIN 448 DIN 448	PANEL RUN DIN 315 DIN 331 DIN 347 DIN 363 DIN 415 DIN 431 DIN 431 DIN 431 DIN 447 DIN 463	BZ_ RST PANEL SV OFF DIN 314 DIN 346 DIN 346 DIN 362 DIN 414 DIN 430 DIN 414 DIN 446 DIN 446	SV        OFF        PANEL        EX_        SVON        DIN        313        DIN        345        DIN        361        DIN        361        DIN        361        DIN        413        DIN        445        DIN        445        DIN        461	E        BREAK        red area        DIN        312        DIN        328        DIN        344        DIN        360        DIN        412        DIN        428        DIN        444        DIN        444        DIN        444        DIN        460	LOW_ SPD PANEL DO _RST DIN 311 DIN 327 DIN 343 DIN 359 DIN 411 DIN 427 DIN 427 DIN 427 DIN 459	CYCLE PANEL PRG_ RST DIN 310 DIN 326 DIN 342 DIN 358 DIN 410 DIN 426 DIN 426 DIN 426 DIN 428	STOP PANEL ALM _RST DIN 309 DIN 325 DIN 341 DIN 357 DIN 409 DIN 425 DIN 425 DIN 425 DIN 425	EX_ SVON DIN 308 DIN 324 DIN 340 DIN 356 DIN 408 DIN 424 DIN 424 DIN 424 DIN 426	RUN DIN 307 DIN 323 DIN 355 DIN 407 DIN 423 DIN 423 DIN 423 DIN 425	ALM _RST DIN 306 DIN 322 DIN 338 DIN 354 DIN 406 DIN 422 DIN 422 DIN 438 DIN 454	DO _RST DIN 305 DIN 321 DIN 337 DIN 353 DIN 405 DIN 421 DIN 437 DIN 437	CYC _RST DIN 304 DIN 320 DIN 336 DIN 352 DIN 404 DIN 420 DIN 420 DIN 420 DIN 420 DIN 420	STEP _RST DIN 303 DIN 335 DIN 351 DIN 403 DIN 403 DIN 419 DIN 435 DIN 451	PRG_ RST DIN 302 DIN 318 DIN 334 DIN 402 DIN 402 DIN 418 DIN 434 DIN 434 DIN 434	STROBE DIN 301 DIN 317 DIN 333 DIN 349 DIN 401 DIN 417 DIN 417 DIN 433 DIN 449
G13W G14W G16W G17W G20W G21W G22W G22W G23W G23W G24W G25W G25W G26W G27W	PANEL BREAK DIN 316 DIN 348 DIN 348 DIN 416 DIN 432 DIN 432 DIN 448 DIN 448 F	PANEL RUN DIN 315 DIN 331 DIN 347 DIN 363 DIN 415 DIN 431 DIN 431 DIN 447 DIN 447 E	BZ_ RST PANEL SV OFF DIN 314 DIN 346 DIN 346 DIN 346 DIN 414 DIN 430 DIN 414 DIN 430 DIN 414 DIN 420 DIN	SV OFF Reserv PANEL EX_ SVON DIN 313 DIN 345 DIN 345 DIN 345 DIN 345 DIN 413 DIN 413 DIN 413 DIN 413 DIN 429 DIN 445 C	BREAK        ved area        DIN        312        DIN        328        DIN        344        DIN        360        DIN        412        DIN        428        DIN        444        DIN        460        R	LOW_ SPD PANEL DO _RST DIN 311 DIN 327 DIN 343 DIN 359 DIN 411 DIN 427 DIN 411 DIN 427 DIN 443 A DIN 359	CYCLE PANEL PRG_ RST DIN 310 DIN 326 DIN 342 DIN 358 DIN 410 DIN 426 DIN 426 DIN 426 DIN 426 DIN 428 OIN	STOP PANEL ALM _RST DIN 325 DIN 341 DIN 357 DIN 409 DIN 425 DIN 425 DIN 425 DIN 425 DIN 425 DIN 425 DIN 425 DIN 357	EX_ SVON DIN 308 DIN 324 DIN 340 DIN 408 DIN 424 DIN 424 DIN 424 DIN 426 7	RUN DIN 307 DIN 323 DIN 339 DIN 355 DIN 407 DIN 423 DIN 423 DIN 439 DIN 439 DIN 455 6	ALM _RST DIN 306 DIN 322 DIN 338 DIN 406 DIN 422 DIN 422 DIN 438 DIN 454	DO _RST DIN 305 DIN 321 DIN 353 DIN 405 DIN 421 DIN 421 DIN 437 DIN 453 4	CYC _RST DIN 304 DIN 320 DIN 336 DIN 404 DIN 420 DIN 420 DIN 420 DIN 420 DIN 420 2 3	STEP _RST DIN 303 DIN 319 DIN 335 DIN 403 DIN 419 DIN 419 DIN 451 2	PRG_ RST DIN 302 DIN 318 DIN 334 DIN 402 DIN 402 DIN 418 DIN 434 DIN 434 DIN 434 A 350	STROBE DIN 301 DIN 317 DIN 333 DIN 401 DIN 417 DIN 417 DIN 433 DIN 449 0

TCmini  $\rightarrow$  Main unit of robot controller (G000 ~ G27F)

Note: G108~ G10B are optional signals for specific customers.
					, .		1			/						1
Bit	F	E	D	С	В	A	9	8	7	6	5	4	3	2	1	0
HOOW	DOUT 16	DOUT 15	DOUT 14	DOUT 13	DOUT 12	DOUT 11	DOUT 10	DOUT 9	DOUT 8	DOUT 7	DOUT 6	DOUT 5	DOUT 4	DOUT 3	DOUT 2	DOUT 1
H01W	DOUT 32	DOUT 31	DOUT 30	DOUT 29	DOUT 28	DOUT 27	DOUT 26	DOUT 25	DOUT 24	DOUT 23	DOUT 22	DOUT 21	DOUT 20	DOUT 19	DOUT 18	DOUT 17
H02W	DOUT 48	DOUT 47	DOUT 46	DOUT 45	DOUT 44	DOUT 43	DOUT 42	DOUT 41	DOUT 40	DOUT 39	DOUT 38	DOUT 37	DOUT 36	DOUT 35	DOUT 34	DOUT 33
H03W	DOUT 64	DOUT 63	DOUT 62	DOUT 61	DOUT 60	DOUT 59	DOUT 58	DOUT 57	DOUT 56	DOUT 55	DOUT 54	DOUT 53	DOUT 52	DOUT 51	DOUT 50	DOUT 49
H04W	DOUT 116	DOUT 115	DOUT 114	DOUT 113	DOUT 112	DOUT 111	DOUT 110	DOUT 109	DOUT 108	DOUT 107	DOUT 106	DOUT 105	DOUT 104	DOUT 103	DOUT 102	DOUT 101
H05W	DOUT 132	DOUT 131	DOUT 130	DOUT 129	DOUT 128	DOUT 127	DOUT 126	DOUT 125	DOUT 124	DOUT 123	DOUT 122	DOUT 121	DOUT 120	DOUT 119	DOUT 118	DOUT 117
H06W	DOUT 148	DOUT 147	DOUT 146	DOUT 145	OUT 144	DOUT 143	DOUT 142	DOUT 141	DOUT 140	DOUT 139	DOUT 138	DOUT 137	DOUT 136	DOUT 135	DOUT 134	DOUT 133
H07W	DOUT 164	DOUT 163	DOUT 162	DOUT 161	DOUT 160	DOUT 159	DOUT 158	DOUT 157	DOUT 156	DOUT 155	DOUT 154	DOUT 153	DOUT 152	DOUT 151	DOUT 150	DOUT 149
H10W	DATA _ACK	DATA _ERR				TCP ERR	MLT END	OFS END	HAND OUT8	HAND OUT7	HAND OUT6	HAND OUT5	HAND OUT4	HAND OUT3	HAND OUT2	HAND OUT1
H11W	SEQ FSW8	SEQ FSW7	SEQ FSW6	SEQ FSW5	SEQ FSW4	SEQ FSW3	SEQ FSW2	SEQ FSW1	SEQ PAR8	SEQ PAR7	SEQ PAR6	SEQ PAR5	SEQ PAR4	SEQ PAR3	SEQ PAR2	SEQ PAR1
H12W																
H13W		EXT ETHER	ALARM	BT_ ALM	CYC _ST	LOW _ST	CYC _END	AUTO RUN	SYS_ RDY	EXT 232C	EXT SIG	INT	TEACH	ACK	SV_ RDY	EMG_ ST
H14W				_						_	-				_	_
∼ H17W				Reserv	ed area											
H20W/	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
112000	316	315	314	313	312	311	310	309	308	307	306	305	304	303	302	301
H21W	332	2001 331	330	329	228	327	326	2001 325	2001 324	2001 323	322	2001 321	320	219 319	218 JOUI	2001 317
110014/	DOUT	DOUT	DOUT	DOUT	OUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
H22VV	348	347	346	345	344	343	342	341	340	339	338	337	336	335	334	333
H23W	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT	DOUT
	364	363	362	361	360	359	358	357	356	355	354	353	352	351	350	349
H24W	416	415	414	413	412	411	410	409	408	407	406	405	404	403	402	401
H25W	DOUT 432	DOUT 431	DOUT 430	DOUT 429	DOUT 428	DOUT 427	DOUT 426	DOUT 425	DOUT 424	DOUT 423	DOUT 422	DOUT 421	DOUT 420	DOUT 419	DOUT 418	DOUT 417
H26W	DOUT 448	DOUT 447	DOUT 446	DOUT 445	DOUT 444	DOUT 443	DOUT 442	DOUT 441	DOUT 440	DOUT 439	DOUT 438	DOUT 437	DOUT 436	DOUT 435	DOUT 434	DOUT 433
H27W	DOUT 464	DOUT 463	DOUT 462	DOUT 461	DOUT 460	DOUT 459	DOUT 458	DOUT 457	DOUT 456	DOUT 455	DOUT 454	DOUT 453	DOUT 452	DOUT 451	DOUT 450	DOUT 449
Bit	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0

## Main unit of robot controller $\rightarrow$ TCmini (H000 ~ H27F)

Note: H108~ H10A are optional signals for specific customers.

Bit	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0
E00W																
E01W																
E02W																
E03W																
E04W																
E05W																
E06W																
E07W						1	1		Edae	relavs	1	1	1	1		
E10W						1	1	1	Luge	loidy5	1	1	1	1		
E11W																
E12W																
E13W																
E14W																
E15W																
E16W																
E17W																
LOOW																
L01W																
L02W																
L03W						I	I	I	l atch	rolave	I	I	I	I 		
L04W						I	I	I	Laten	Telays	I	I	1	I		
L05W																
L06W																
L07W																
T/C00W																
T/C01W							I	Timera	: (100 i	ne)/coi	Inters	I	I 			
T/C02W							I	miner		113// 000		I	1			
T/C03W																
T/C04W																
T/C05W																
T/C06W																
T/C07W																
T/C08W																
T/C09W								<b>-</b>			۱ ۰		I			
T/C10W								Time	rs (10 i	ns)/coi	unters					
T/C11W																
T/C12W																
T/C13W																
T/C14W																
T/C15W																
T/C16W																
T/C17W																

Bit	F	E	D	С	В	Α	9	8	7	6	5	4	3	2	1	0
T/C20W																
T/C21W																
T/C22W																
T/C23W								Tim	ners (1(	00 ms)/	counte	ers				
T/C24W							I	1	IU.U.U.U.U.U.U.U.U.U.U.U.U.U.U.U.U.U.U.	Je me <i>j,</i>	Jocarre					
T/C25W																
T/C26W																
T/C27W																
A00W									Sign flag	Zero flag				Over- flow		Carry flag
A01W										Fuse flag						
A02W																
A03W	6400 ms	3200 ms	1600 ms	800 ms	400 ms	200 ms	100 ms	50 ms			S	Scan tir	me (ms	6)		
A04W	12800 ms	6400 ms	3200 ms	1600 ms	800 ms	400 ms	200 ms	100 ms	1280 ms	640 ms	320 ms	160 ms	80 ms	40 ms	20 ms	10 ms
A05W	1280 s	640 s	320 s	160 s	80 s	40 s	20 s	10 s	128 s	64 s	32 s	16 s	8 s	4 s	2 s	1 s

## List of Registers

Register	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
D00*																
D01*																
D02*								Data re								
D03*							_	Data re	gisters	5 —						
D04*																
D05*																
D06*																
D07*																
D10*																
D11*																
D12*								Data ra	aiotora							
D13*								Data re	gisters	;						
D14*																
D15*																
D16*																
D17*																
D20*																
D21*																
D22*								Data re	aistars							
D23*									gistera	, <u> </u>						
D24*																
D25*																
D26*																
D27*																
D30*																
D31*																
D32*																
D33*							Da	ta roai	- ctore (h	ackun	\ \					
D34*								la regi:			)					
D35*																
D36*																
D37*																

PLC         PLC <th>Register</th> <th>F</th> <th>Е</th> <th>D</th> <th>С</th> <th>В</th> <th>А</th> <th>9</th> <th>8</th> <th>7</th> <th>6</th> <th>5</th> <th>4</th> <th>3</th> <th>2</th> <th>1</th> <th>0</th>	Register	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
PLC         PLC <td>D40*</td> <td>PLC SS R08</td> <td>PLC SS R07</td> <td>PLC SS R06</td> <td>PLC SS R05</td> <td>PLC SS R04</td> <td>PLC SS R03</td> <td>PLC SS R02</td> <td>PLC SS R01</td> <td>PLC DATA R8</td> <td>PLC DATA R7</td> <td>PLC DATA R6</td> <td>PLC DATA R5</td> <td>PLC DATA R4</td> <td>PLC DATA R3</td> <td>PLC DATA R2</td> <td>PLC DATA R1</td>	D40*	PLC SS R08	PLC SS R07	PLC SS R06	PLC SS R05	PLC SS R04	PLC SS R03	PLC SS R02	PLC SS R01	PLC DATA R8	PLC DATA R7	PLC DATA R6	PLC DATA R5	PLC DATA R4	PLC DATA R3	PLC DATA R2	PLC DATA R1
D42*         Reserved area           D43*         Reserved area           D44*         DATA_CMD           D46*         DATA_CMD           D47*         USE           D50*         DATA_CMD           D51*         DATA_CMD           D52*         SS SS         SS SS         SS SS SS SS SS SS SS         SS SS SS SS SS SS SS SS SS SS SS SS SS	D41*	PLC SL R08H	PLC SL R08L	PLC SL R07H	PLC SL R07L	PLC SL R06H	PLC SL R06L	PLC SL R05H	PLC SL R05L	PLC SL R04H	PLC SL R04L	PLC SL R03H	PLC SL R03L	PLC SL R02H	PLC SL R02L	PLC SL R01H	PLC SL R01L
D43*         Reserved area           D44*         DATA_CMD           D45*         DATA_CMD           D46*         DATA_CMD           D47*         USE           D50*         DATA_CMD           D51*         DS3*           D53*         Reserved area           D55*         DATA_CMD           D56*         DATA_CMD           D56*         Colspan="2">USE           D56*         Reserved area           D66*         SS_SS_SS_SS_SS_SS_SS_SS_SS_SS_SS_SS_SS_	D42*				Deeem												
D44*         Reserved area           D46*         DATA_CMD           D47*         USE           D50*         DSTA_CMD           D51*         DSTA_CMD           D52*         DSTA_CMD           D53*         Reserved area           D55*         DS6*           D56*         DS7*           D60*         SS         S	D43*				Reserv	ed area											
D45*         DATA_CMD           D46*         DATA_CMD           D47*	D44*				Reserv	ed area											
D46*         DATA_CMD           D47*         USE           D50*         USE           D50*         Reserved area           D53*         Reserved area           D54*         Reserved area           D55*         SS           D56*         SS           D56*         SS           D56*         SS           D56*         SS           D56*         SS           D56*         SS           D60*         SS           SS         SS           SS         SS           SS         SS           SS         SS           SS         SS           D61*         PLC         PLC         PLC           PLC         PLC         PLC         PLC         PLC           D61*         SL         SL         SL         SL         SL           SL         SL         SL         SL         SL         SL         SL           D61*         PLC	D45*																
D47*         USE           D50*         D51*           D52*         D53*           D54*         Reserved area           D55*         D56*           D56*         PLC         PLC <t< td=""><td>D46*</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>_CMD</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>	D46*								_CMD								
D50*         D51*           D52*         D53*           D53*         Reserved area           D54*         Reserved area           D55*         PLC           D56*         PLC           D57*         PLC           D60*         SS           SS         SS           SS         SS           SS         SS           SS         SS           M08         W07           W08         W07           W08         W07           W08         W07           PLC         PLC           W08         W07H           W08         W07H	D47*			-					-	-		_	_		-	_	USER
D51*         D52*           D53*         D53*           D54*         Reserved area           D55*         D56*           D57*         PLC         <	D50*																
D52*         D53*         Reserved area	D51*																
D53*         Reserved area           D55*         D56*         D56*           D57*	D52*																
D54*         Reserved area           D55*         D56*           D57*           D60*         SS         SS <td>D53*</td> <td></td> <td></td> <td></td> <td>-</td> <td></td>	D53*				-												
D55*         D56*           D57*         D60*         PLC         PLC </td <td>D54*</td> <td></td> <td></td> <td></td> <td>Reserv</td> <td>ed area</td> <td></td>	D54*				Reserv	ed area											
D56*         D57*           D60*         PLC         PLC <td>D55*</td> <td></td>	D55*																
D57*         PLC         PLC <td>D56*</td> <td></td>	D56*																
D60*         PLC         PLC <td>D57*</td> <td></td>	D57*																
Wood         Wood <th< td=""><td>D60*</td><td>PLC SS W08</td><td>PLC SS W07</td><td>PLC SS W06</td><td>PLC SS W05</td><td>PLC SS W04</td><td>PLC SS W03</td><td>PLC SS W02</td><td>PLC SS W01</td><td>PLC DATA W8</td><td>PLC DATA W7</td><td>PLC DATA W6</td><td>PLC DATA W5</td><td>PLC DATA W4</td><td>PLC DATA W3</td><td>PLC DATA W2</td><td>PLC DATA W1</td></th<>	D60*	PLC SS W08	PLC SS W07	PLC SS W06	PLC SS W05	PLC SS W04	PLC SS W03	PLC SS W02	PLC SS W01	PLC DATA W8	PLC DATA W7	PLC DATA W6	PLC DATA W5	PLC DATA W4	PLC DATA W3	PLC DATA W2	PLC DATA W1
D62*         PSN_         PSN_ <th< td=""><td>D61*</td><td>PLC SL W08H</td><td>PLC SL W08L</td><td>PLC SL W07H</td><td>PLC SL W07L</td><td>PLC SL W06H</td><td>PLC SL W06L</td><td>PLC SL W05H</td><td>PLC SL W05L</td><td>PLC SL W04H</td><td>PLC SL W04L</td><td>PLC SL W03H</td><td>PLC SL W03L</td><td>PLC SL W02H</td><td>PLC SL W02L</td><td>PLC SL W01H</td><td>PLC SL W01L</td></th<>	D61*	PLC SL W08H	PLC SL W08L	PLC SL W07H	PLC SL W07L	PLC SL W06H	PLC SL W06L	PLC SL W05H	PLC SL W05L	PLC SL W04H	PLC SL W04L	PLC SL W03H	PLC SL W03L	PLC SL W02H	PLC SL W02L	PLC SL W01H	PLC SL W01L
D63*         NO         N	D62*									PSN_							
D64*         TRQ_ IRQ_ IRQ_ IRQ_ IRQ_ IRQ_ IRQ_ IRQ_ I	D63*				Reserv	ed area				PSN_ J8	PSN_ J7	PSN_ J6	PSN_ J5	PSN_ J4	PSN_ J3	PSN_ J2	PSN_ J1
D65* D66* D66* DATA_RESP D67* AL10 AL09 AL08 AL07 AL06 AL05 AL04 AL03 AL02 AL01 ALNO STEP	D64*									TRQ_							
D66*	D65*																
Db/" AL10 AL09 AL08 AL07 AL06 AL05 AL04 AL03 AL02 AL01 AL00 STEP	D66*		AL 00	AL 00	AL 07	AL 00	41.05		DATA		AL 0.1		OTER				
Register F F D C B A 9 8 7 6 5 4 3 2 1 0	D67" Register	AL10 F	AL09 F	D ALU8	ALU7 C	ALU6 B	ALU5	AL04	AL03	AL02	ALU1 6	ALNO 5	51EP 4	3	2	1	0

Register	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0
D70*	FB RWr 16	FB RWr 15	FB RWr 14	FB RWr 13	FB RWr 12	FB RWr 11	FB RWr 10	FB RWr 9	FB RWr 8	FB RWr 7	FB RWr 6	FB RWr 5	FB RWr 4	FB RWr 3	FB RWr 2	FB RWr 1
D71*																
D72*				Reserv	ed area											
D73*																
D74*	FB RWw 16	FB RWw 15	FB RWw 14	FB RWw 13	FB RWw 12	FB RWw 11	FB RWw 10	FB RWw 9	FB RWw 8	FB RWw 7	FB RWw 6	FB RWw 5	FB RWw 4	FB RWw 3	FB RWw 2	FB RWw 1
D75*																
D76*				Reserv	ed area											
D77*																
Register	F	Е	D	С	В	А	9	8	7	6	5	4	3	2	1	0

Register	F	Е	D	С	В	Α	9	8	7	6	5	4	3	2	1	0
P00*																
P01*						Timoro	i 		100 ma	lagunta		t voluos	1			
P02*						Timer c										
P03*																
P04*																
P05*																
P06*																
P07*																
P10*																
P11*					Т	ïmer cu	rrent va	lues (10	- ) ms)/cc	ounter c	urrent va	alues —				
P12*						+					+	+				
P13*																
P14*																
P15*																
P16*																
P17*																
P20*																
P21*																
P22*																
P23*					— т	īmer cu	rrent va	lues (10	) ms)/cc	ounter c	urrent v	alues —				
P24*																
P25*																
P26*																
P27"																
Register	F	E	D	С	В	A	9	8	7	6	5	4	3	2	1	0

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