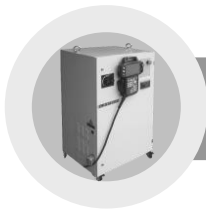




WARNING

**INSTALLATION SHOULD ONLY BE
PERFORMED BY QUALIFIED
INSTALLATION PERSONNEL AND MUST
CONFORM TO ALL NATIONAL AND
LOCAL CODES**



Hi5 Controller Function Manual

Embedded PLC





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Introduction



1. Introduction

Embedded PLC

Hi5 Controller's embedded PLC is a function that implements the common PLC's function on a Controller. As the below figure shows, by executing HRLadder on a PC or laptop that is connected to a Controller, it is enabled to compose/edit a Ladder program, to download it to a Controller, to upload the Ladder program that are being executed on a Controller, or to monitor the execution status of a Controller. Please refer to the additional function manual for HRLadder.

I/O connections on Hi5 controller can be connected to the upper process module and Fieldbus. Device Net slave modules can be connected by using DeviceNet master, which is embedded Fieldbus, and several devices can also be connected with hardwiring by using either BD580 or BD58A. The embedded PLC function controls the output signals that are connected as above with Ladder Logic.

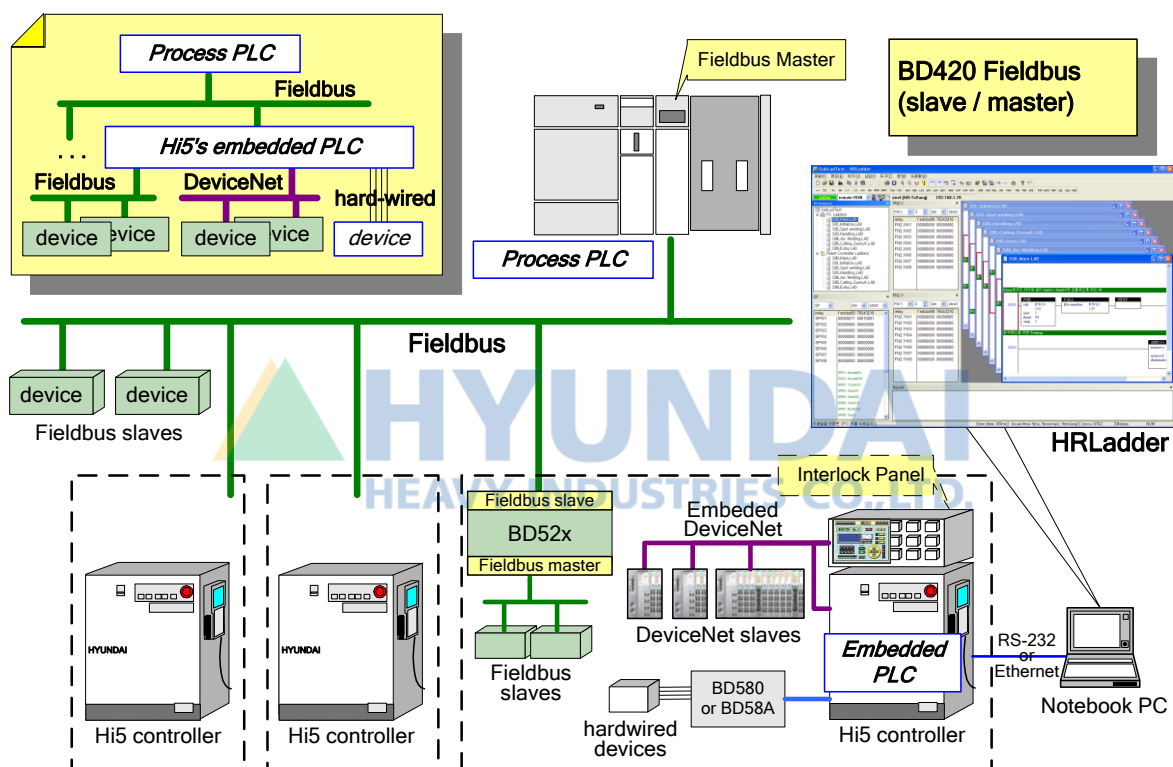


Figure 1.1 Hi5 I/O Connection



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**Controller
Set-up**



2. Controller Set-up

Embedded PLC

2.1. Embedded PLC mode Set-up

Embedded PLC's operating mode can be selected as one of <Off, Stop, R-Stop, R-Run, Run> from 『[F7]: Condition setting』 → 『[F1]: Apply condition』 → 『5: Embedded PLC mode』.

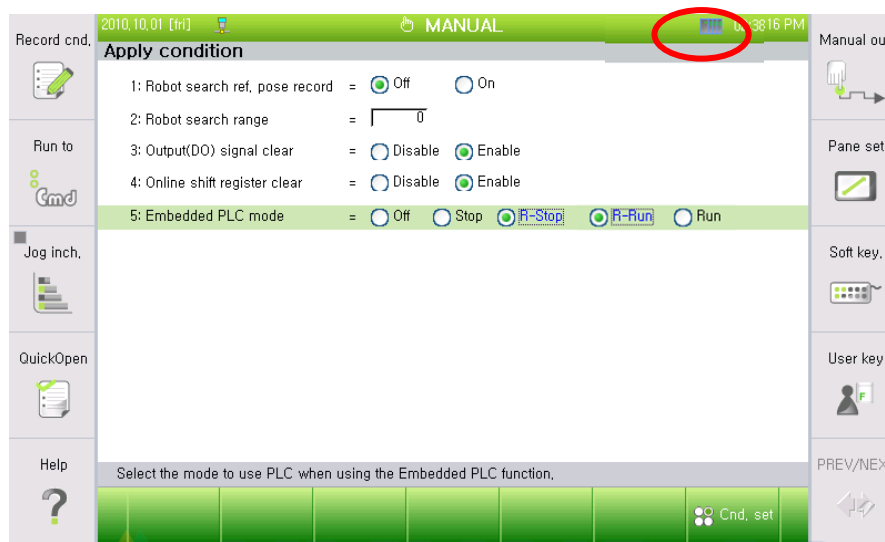


Figure 2.1 Embedded PLC Mode Set-up

Icon on the top right side of TP screen will indicate the selected mode. For example, if it is on [PLC=<R-Run>] or [PLC=<Run>] status, PLC icon as above will be displayed. If it is on [PLC=<Off>], the icon will be disappeared as below the figure. Also, if it is on [PLC=<STOP>] status, red color stop mark will be shown on the window.

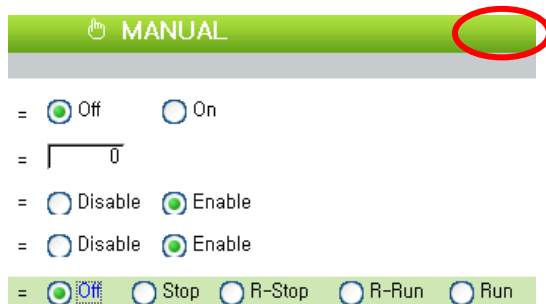


Figure 2.2 Embedded PLC Off Status

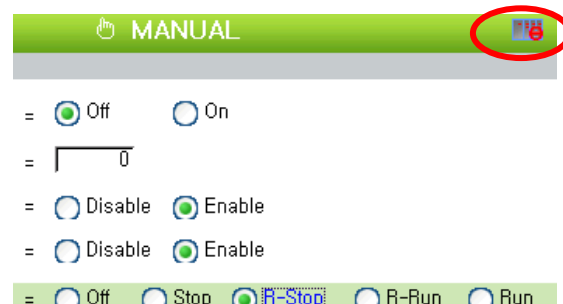


Figure 2.3 Embedded PLC Stop Status

- **Off**

Function of embedded PLC will be disabled. In this case, DO1~DO4096 that is Digital Output of Robot's Controller will be automatically outputted as Physical Output Y1~Y4096, and the Physical Output X1~X4096 will be automatically inputted as DI1~DI4096. Yet still the properties for each D1, d0, X and Y will be applied.

For example, if both of DO1 and Y1 is negative logic, when DO1=1 output is attempted the actual output value will be Y1=1, because 0 will be inputted as Y1 as DO1 is negative logic as well as the property of Y1.

- **R-Stop / Stop**

This function stops the operation of embedded PLC. R-Stop shows the Remote status that can be changed on HRLadder but the operation mode cannot be changed on HRLadder while in STOP setting. When embedded PLC is Stopped, DI, Y, R relay that are PLC's output signal will automatically set to 0. However if a condition that can output the value to Y output in HRBasic or other assigned (Expect PLC) is met, such as "SP11=On", Y output will retain the previous value.

- **R-Run / Run**

This function executes embedded PLC. R-Run indicates the Remote status that can be changed on HRLadder. Operating mode cannot be changed on HRLadder while it is on Run setting



2.2. Relay Condition Monitoring on Controller TP

Relay status monitoring is enabled from 『[F1]: Service』 → 『1: Monitoring』 → 『7: PLC relay data』 → 『1: PLC X Relay (External Input)』 → 『11: PLC SW Relay (System Memory)』 .

2.3. Embedded Scan Time

“Scan Time” will be indicated on lower status bar of HRLadder. Scan Time will be automatically increase (by 5msec), if the quantity of steps increase and it cannot be processed within 5msec.

2.4. Embedded PLC Allocated Execution Time Control

If there is a need to accelerate the embedded PLC Scan Time for special purpose, please request it to our engineer in order to control the allocated time for PLC on Hi5 Robot. There is a menu provided on a manual mode to control the allocated time 『[F2]: System』 → 『2: Control Parameter』 → 『1: Control environment setting』 → 『7: Embedded PLC execution time』 .

Embedded PLC execution time Set-up, refers to how much time for PLC process is allocated among the processes that needs to be handled by Robot Controller. The default value is 2.0/20[ms], but if too much value is assigned, the motion calculation for Robot's movement process may be disturbed. Please make sure to request our engineer to check the surplus resource of the system, and decide the time to be allocated.

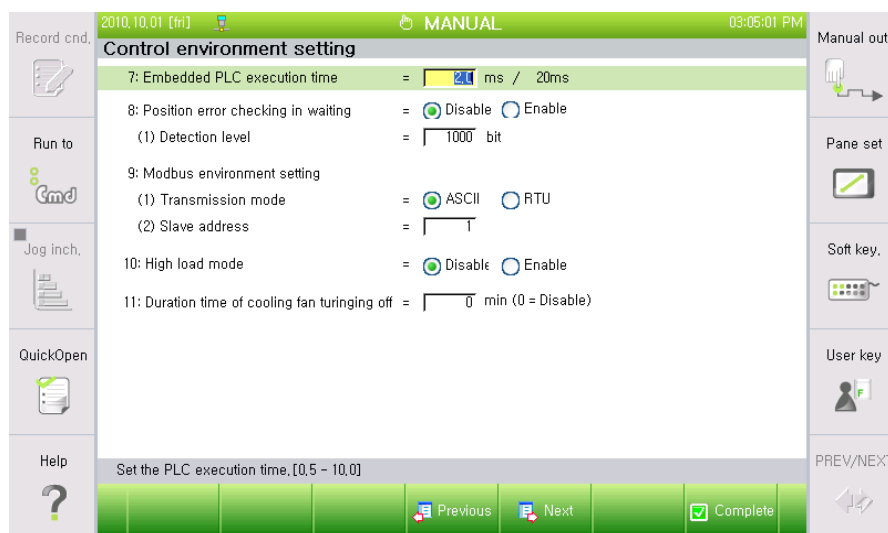


Figure 2.4 Embedded PLC Execution Time Set-up



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**Input / Output
Diagram**



3. Input / Output Diagram

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Input and Output Diagram of Hi5 Robot Controller is as below.

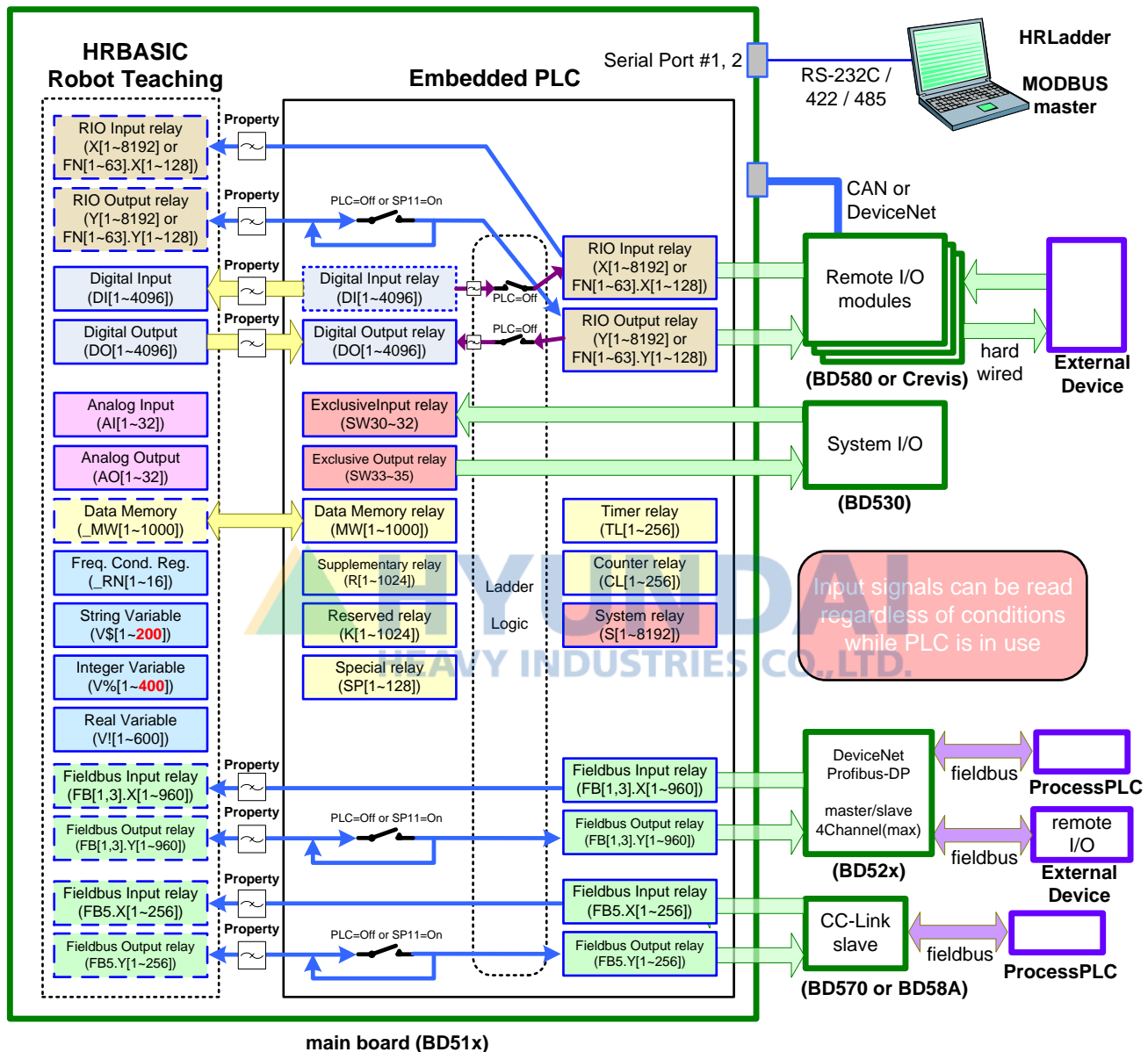


Figure 3.1 Input / Output Diagram

- System Memory from the above figure is reserved for special purpose. The purpose may change in future, depending on the Controller's version.



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**Relay
Specification**



4. Relay Specification

Embedded PLC

4.1. Relay Points

Table 4-1 Relay Points

Relay Title	Points	Relay(1bit)	Relay(Byte, Word)	(Long, FLoad)
Digital Input / Output Relay	Input 4096 points	DI1~4096	DIB1~512	DIL1~128
			DIW1~256	DIF1~128
	Output 4096 points	DO1~4096	DOB1~512	DOL1~128
			DOW1~256	DOF1~128
RIO Input / Output Relay (BD580/DeviceNet)	Input 8192 points 128 points per node (Max 64 node)	FN1~64.X1~128 (or X1~8192)	FN1~64.XB1~16 (or XB1~1024)	FN1~64.XL1~4 (or XL1~256)
			FN1~64.XW1~8 (or XW1~512)	FN1~64.XF1~4 (or XF1~256)
	Output 8192 points 128 points per node (MaX 64 node)	FN1~64.Y1~128 (or Y1~8192)	FN1~64.YB1~16 (or YB1~1024)	FN1~64.YL1~4 (or YL1~256)
			FN1~64.YW1~8 (or YW1~512)	FN1~64.YF1~4 (or YF1~256)
Fieldbus Relay (DeviceNet/ProFiBus-DP)	Input 960 points	FB1.X1 ~ 960	FB1.XB1 ~ 120	FB1.XL1 ~ 30
			FB1.XW1 ~ 60	FB1.XF1 ~ 30
	Output 960 points	FB1.Y1 ~ 960	FB1.YB1 ~ 120	FB1.YL1 ~ 30
			FB1.YW1 ~ 60	FB1.YF1 ~ 30
	Input 960 points	FB3.X1 ~ 960	FB3.XB1 ~ 120	FB3.XL1 ~ 30
			FB3.XW1 ~ 60	FB3.XF1 ~ 30
	Output 960 points	FB3.Y1 ~ 960	FB3.YB1 ~ 120	FB3.YL1 ~ 30
			FB3.YW1 ~ 60	FB3.YF1 ~ 30
Fieldbus Relay (CC-Link)	Input 256 points	FB5.X1 ~ 256	FB5.XB1 ~ 32	FB5.XL1 ~ 8
			FB5.XW1 ~ 16	FB5.XF1 ~ 8
	Output 256 points	FB5.Y1 ~ 256	FB5.YB1 ~ 32	FB5.YL1 ~ 8

4. Relay Specification

Relay Title	Points	Relay(1bit)	Relay(Byte, Word)	(Long, FLoat)
			FB5.YW1 ~ 16	FB5.YF1 ~ 8
Auxiliary Relay	1024 points	R1~1024	RB1~128	RL1~32
			RW1~64	RF1~32
Nonvolatile Relay	1024 points	K1~1024	KB1~128	KL1~32
			KW1~64	KF1~32
Special Relay	128 points	SP1~128	SPB1~16	SPL1~4
			SPW1~8	SPF1~4
Timer Relay	256 points	T1~256	TB1~1024	TL1~256
			TW1~512	TF1~256
Counter Relay	256 points	C1~256	CB1~1024	CL1~256
			CW1~512	CF1~256
Data Memory	16000 points	M1~16000	MB1~2000	ML1~500
			MW1~1000	MF1~500
System Memory	8192 points (Reserved)	S1~8192 (Reserved)	SB1~1024	SL1~256
			SW1~512	SF1~256

Reference) Relay Type: Byte=8bit, Word=16bit, Long=32bit, Float=(32bit)

4.2. Relay Description

For the each relay bit, byte, word, long and float type can be assigned by using prefix (B/W/L/F). For bit (T/C) of Timer and Counter, it is in activation when the value is 0, or else it is in deactivation.

- (1) Digital Input / Output Relay: It is a signal that can be used for HR Basic or various Input / Output allocations.
- (2) RIO Input / Output Relay:
They are signals that are under the category of Input / Output signals of BD580 board or Remote I/O board that is connected to the embedded Fieldbus.
- (3) Fieldbus Relay:
They are Input / Output signals of DecideNet or ProfiBus-DP that are connected to BD52X board, or CC-Link that is connected to BD570 or BD58A.
- (4) Auxiliary Relay: Auxiliary relay that is used by PLC program.
- (5) Nonvolatile Relay: This relay retain the On/Off status even if the power goes Off.
- (6) Special Relay: It is a relay that defined for special purposes.

Relay No.	Description	Others
SP01	Always On relay	Controller states
SP02	Always Off relay	
SP03	Relay that only goes On for scan of operation start	Internal timer
SP04	0.1 second clock (0.05 second On → 0.05 second Off)	
SP05	0.2 second clock (0.1 second On → 0.1 second Off)	
SP06	1 second clock (0.5 second On → 0.5 second Off)	
SP07	On when conversion of BCD operation is not valid	When TOD or FRD is executed.
SP08	On when “carry” exist among the operation result	When arithmetic command is executed
SP09	2 second clock (1 second On → 1 second Off)	Internal timer
SP10	4 second clock (2 second On → 2 second Off)	
SP11	If On, direct output to Y relay from application (HRBasic, assignment) except PLC is allowed.	

4. Relay Specification

Relay No.	Description	Others
SP12	On when Label is not constant	
SP13	On when quantity of Label is more than 100.	
SP14	On when Label is duplicated	
SP15	On when Label is less than 0 or there is no Label no. to Jump	
SP16	For Modbus Test purpose in Simulation status	
SP17	On when Scan Time exceeds 5 second (In this case, commands that listed after 5 seconds will not be executed).	
SP18	On when a Sub-ladder that is summoned by Call does not exist.	
SP19~SP128	Reserved	

- (7) Timer Relay:
It is a relay for timer operation and contact point will be On when the value is 0.
(It will be reserved when power goes out).
- (8) Counter Relay:
It is a relay for counter operation and contact point will be On when the value is 0.
(It will be reserved when power goes out).
- (9) Data Memory:
It is used when applied commands save or read certain Data, and it also can be used when huge amount of data is being exchanged with HRBasic because HRBasic can access to it. (It will be reserved when power goes out).
- (10) System Memory (Reserved): it is used for special purposes as below, and the purpose may be changed without notifying the users in the future.

No.	Description	Others
SW3	PLC Execution Mode (4: PLC OFF, 5: Program does not exist, 0:STOP, 1:R.STOP, 2:R.RUN, 3:RUN)	
SW4	Quantity of extended IO board	
SW5	Main SW Version 2nd + 1st	20.03-10v → &H03 14
SW6	I/O version +3rd of Main SW Version	20.03-10 → &H43 0A

No.	Description	Others
SW10	Scan time	
SW11	Assignment time	
SW12	Maximum Occupation Time	
SW13	Average Occupation Time	
SW14	Quantity of total steps of Ladder	
SW15	CHECKSUM of Ladder Program	Since Ver20.03-14
SW20	Current program No. of Controller	
SW21	Current step No. of Controller	
SW22	Current function No. of Controller	
SW23	Current main program No. of Controller	Since Ver20.03-14
SW24	FB1~FB4 active	0th~3rd bit
SW25	Reading Hilscher status Information (1~4) (1:FB1 Information, 2: FB2 Information)	(Since mv20.03-10)
SW26	LSB:Hilscher COM GlobalBits MSB: reserved	(Valid only for master)
SW27	LSB:Error node No. MSB:Error Code	(Valid only for master)
SW28	Bus error counter	(Valid only for master)
SW29	DeviceNet: Bus Off counter Profibus-DP: Time out counter	(Valid only for master)
SW30	Private Input 1	
SW31	Private Input 2	
SW33	Private Output 1	
SW34	Private Output 2	

4. Relay Specification

No.	Description	Others
SW37	LSB: For designated node No, slave_diag request for every 1 second.	
SW38	Return value for slave_diag request	
SW39	Station Status for the result of slave-diag request. LSB: StationStatus1 MSB: StationStatus2	
SW40	Robot position reading (0:None, 1:Current base coordinates, 2: Instruction base coordinate, 5: Current axis value, 6:Instructed axis value)	
SW41	Base coordinate: X value Axis coordinate: Axis 1 value	Unit: 1mm Unit: 1mm or 0.1deg
SW42	Base coordinate: Y value Axis coordinate: Axis 2 value	Unit: 1mm Unit: 1mm or 0.1deg
SW43	Base coordinate: Z value Axis coordinate: Axis 3 value	Unit: 1mm Unit: 1mm or 0.1deg
SW44	Base coordinate: RX value Axis coordinate: Axis 4 value	Unit: 0.1 deg Unit: 1mm or 0.1deg
SW45	Base coordinate: RY value Axis coordinate: Axis 5 value	Unit: 0.1 deg Unit: 1mm or 0.1deg
SW46	Base coordinate: RZ value Axis coordinate: Axis 6 value	Unit: 0.1 deg Unit: 1mm or 0.1deg
SW47~52	Additional axis location (T1~T6, only for Axis no.)	Unit 0.1 deg or 1mm Since version 32.04-01
SW60~69	Space for designating an indirect address	-1:SW61, -2:SW62,
SW70	Type of operation time (0:null,1:operation time (accumulative),2: total operation time) Caution) SW(n):MSW(higher), SW(n+1):LSW	
SW71~SW72	Run time (10msec unit)	
SW73~SW74	Cycle time (10msec unit)	
SW75	Quantity of cycle	
SW76~SW77	Welder 1 welding time (10msec unit)	
SW78	Welder 1 number of welding	
SW79~SW80	Welder 2 welding time (10msec unit)	

No.	Description	Others
SW81	Welder 2 number of welding	
SW82~SW83	Welder 3 welding time (10msec unit)	
SW84	Welder 3 number of welding	
SW85~SW86	Welder 4 welding time (10msec unit)	
SW87	Welder 4 number of welding	
SW88~SW89	Wait, DI wait time (10msec unit)	
SW90~SW91	Timer wait time (10msec unit)	
SW70	Type of operation time (0:null, 3: recent operation time, 4: total operation time) As adding recent operating time, Swap SW to use SL. SW(Odd No.):LSW(lower), SW(Even No.):MSW	Since Ver 30.18.00
SL36	Run time (10msec unit)	
SL37	Cycle time (10msec unit)	
SL38	Quantity of cycle	
SL39	Welder 1 welding time (10msec unit)	
SL40	Welder 1 number of welding	
SL41	Welder 2 welding time (10msec unit)	
SL42	Welder 2 number of welding	
SL43	Welder 3 welding time (10msec unit)	
SL44	Welder 3 number of welding	
SL45	Welder 4 welding time (10msec unit)	
SL46	Welder 4 number of welding	
SL47	Wait, DI wait Time (10msec unit)	

4. Relay Specification

No.	Description	Others
SL48	Timer wait time (10msec unit)	Unit: 10msec
SW70	Running time type (5: Running information (Arc)) SW swapping to allow SL to be used by adding the recent running time. In other words, SW(Odd number):LSW(Lower range), SW(Even number):MSW	V31.08.00 ~
SL36	Measuring time(Unit: 10msec)	
SL37	Cycle time (Unit: 10msec)	
SL38	Cycle count	
SL39	Arc welding execution time (Unit: 10msec). To be reset daily	
SL40	Arc welding execution date (Daily)	
SW81	Arc retry execution count	
SW82	Arc overlap execution count. 1:Arc Off	
SW83	Arc overlap execution count. 2:Wire Off	
SW84	Arc overlap execution count. 3:Limit Over	
SW85	Arc overlap execution count. 4:Gas Off	
SW86	Arc Overlap execution count. 5:Coolant Off	
SW87	Arc auto stick removal execution count	
SL45	Arc running time in 1 cycle	
SL46	Tip using time	
SL47	Tip using time limit	
SW100~SW109	Reserved in relation to Program Count	
SW110	Each axis speed Enable(on SW110=0xKLMN) N: resolution(1=10 times,2=100 times,3=1000 times) M: other option(b4:1=absolute value, b5: motor speed)	

No.	Description	Others
SW111~SW126	Speed (16 axis) of each axis (or motor)	
SW130~SW133	TP KEYPAD information	
SW135	Get Applet	
SW136	Set Applet	
SW140	FN Error BitMap1 (Node00~Node15)	1:Error
SW141	FN Error BitMap2 (Node16~Node31)	
SW142	FN Error BitMap3 (Node32~Node47)	
SW143	FN Error BitMap4 (Node48~Node63)	
SW144	FN Master State ^{*1)}	
SW145	Node No. for FN error information request	
SW146	Node State ^{*2)} for the above response	
SW150	Arc Welding Info	1=Enable(Digital Only)

^{*1)} Master State

0x8000(b15): 1(Used)

0x0100(b8): 1(Checking status: for 10 seconds after the Initialization & Rescan, after 2 seconds of exit from Node Set-up screen)

0x001F(b0~b4):

Master: b4: 1(RUN), 0(IDLE(PLC=STOP))

b0~b3: 0(RUNNING), 1(ResetOutOfBox), 2(InitOutOfBox), 3(ResetNormal),
4(InitNormal), 5(DupMacCheck), 6(NRFAult)

^{*2)} Node State

0x8000(b15): 1(Used Node)

0x4000(b14): 1(Unguaranteed Maker)

0x3000(b12~b13): NodeStatus(1:Standby,2:ConnectionFault,3:ConfigFault)

0x0800(b11): 1(Not IoMode)

0x03FF(b0~b9):

Slave: (Bit-field)

0x000(Online), 0x001(Offline), 0x002(IO Close), 0x004(InSizeErr),

0x008(OutSizeErr), 0x010(VenderMismatch), 0x020(TypeMismatch), 0x040(CodeMismatch),

0x080(CcvMismatch), 0x100(IoTooBig), 0x200(NoConnection)

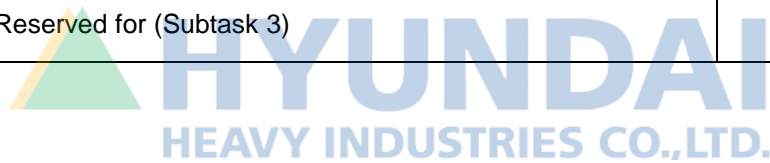
4. Relay Specification

No.	Description	Others
SW151	Arc Welding Real Current	
SW152	Arc Welding Real Voltage	
SW153	Arc Welder Error1	
SW154	Arc Welder Error2	
SW160	0x0001:Request Single 0x001X: processing, 0x0000: completed Other.; indicates Error status 0x002X: TimeOut Error	Results =>SW166 ~ SW179
SW161	EM Req: NodeID	
SW162	EM Req: Service	
SW163	EM Req: Class	
SW164	EM Req: Instance	
SW165	EM Req: Attribute	
SW166	EM Req/Rsp: Size of Data	Max. 26
SW167~SW179	EM Req/Rsp: Data(SB333~SB358)	Max. 26 bytes
SW180	GUN No. to acquire the consumption rate of SPOT GUN (0: invalid, 1~; GUN No.)	mv20.04-77 ~ mv30.32.33 ~
SW181	Moving tip consumption rate	
SW182	Fixed tip consumption rate	
SW183	Gun search state	
~SW189	Reserved for SPOT GUN	
SW190	MON_AXIS_CTRL_OFF	1 axis per Bit
SW195	Roller hemming welding force [N]	

system variable	slot4	300
system variable	slot5	Ex1 Sett refle

4. Relay Specification

No.	Description	Others
SW261	(Subtask 2) current program number	
SW262	(Subtask 2) current step number	
SW263	(Subtask 2) current function number	
~SW269	Reserved for (Subtask 2)	
SW270	(Subtask 3) generation state	
SW271	(Subtask 3) current program number	
SW272	(Subtask 3) current step number	
SW273	(Subtask 3) current function number	
~SW279	Reserved for (Subtask 3)	



4.3. Timer & Counter Relay

(1) Both timer and counter relay only support down-counting.

- Timer base can be set with 10msec unit by a user.
- Because the value of Timer is internally processed as 32bit value, so it can be count up to 2,147,483,647 [msec] (approximately 597hours).

(2) The values of Timer / Counter have meanings as below.

Value of Timer & Counter	Description
0	Contact Point On (=counting completed)
-1	Contact Point Off
Others	Contact Point Off ; timing & counting (processing)

(3) If Rung, which is connected to Timer / Counter relay, is deactivated.

- The value of TON: TL(Timer) becomes -1.
- The value of CTD: CL(Counter) is maintained.

(4) While Rung, which is connected to Timer / Counter relay, is activated.

- **TON**
If a value of TL is less than 0, initial value of TL is saved as "Timer base x preset x 10". If the value is greater than 0, it will be decreased by 5 for every 5msec.
- **CTD**
If a value of CL is less than 0, initial value of CL will be preset value.
If the value of CL is greater than 0, it will be decreased by 1 for each time when deactivation turns to activation.



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5

**Command
Specification**



5. Command Specification

Embedded PLC

5.1. Command list

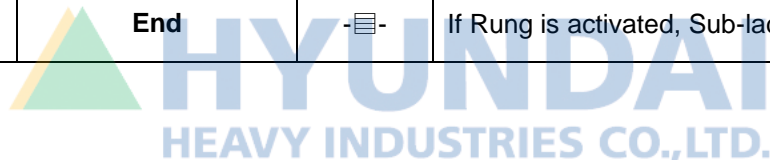
Table 5-1 Command table

Command				Description
No.	Mnemonic	Name	Symbol	
	RUNG	Rung		Represents rung.
	BST	Branch Start		Start of branch.
	BND	Branch End		End of branch.
	NXB	Nested Branch		Nested branch.
Logic examine command				Check result, if true Rung activation/(false: deactivation)
1	XIC	Examine if Closed		Examine if contact point is closed (A contact point)
2	XIO	Examine if Open		Examine if contact point is open (B contact point)
3	INV	Inverting		Inverting of Rung result.
4	EQU	Equal		Examine if equal(=).
5	NEQ	Not Equal		Examine if not equal.
6	LES	Less Than		Examine if less than (<).
7	GRT	Greater Than		Examine if greater than (>).
8	LEQ	Less Than or Equal		Examine if less than or equal (<=).
9	GEQ	Greater Than or Equal		Examine if greater than or equal (>=).
Output command				
10	OTE	Output Energize		Output Rung status (Activation:ON/Deactivation:OFF).
11	OTL	Output Latch		If Rung is activated, output is ON(high).
12	OTU	Output Unlatch		If Rung is activated, output is OFF(low).

5. Command Specification

Command				Description
No.	Mnemonic	Name	Symbol	
13	OSR	One Shot Rising	-(OSR)-	If Rung is activated, output is ON only for one scan.
14	RES	Reset	-(RES)-	If Rung is activated, reset the timer or counter.
Timer and counter command				
15	TON	Time On Delay	-[TON]-	Operate timer while Rung is in activation.
16	CTD	Count Down	-[CTD]-	Down-count Rung's activation (deactivation->activation).
Arithmetic command				
17	ADD	Add	-[ADD]-	If Rung is activated, (+) operation.
18	SUB	Subtract	-[SUB]-	If Rung is activated, (-) operation.
19	MUL	Multiply	-[MUL]-	If Rung is activated, (x) operation.
20	DIV	Divide	-[DIV]-	If Rung is activated, (/) operation.
21	POW	Power	-[POW]-	If Rung is activated, (^;power) operation.
Data conversion command				
22	TOD	Convert int. to BCD	-[TOD]-	If Rung is activated, convert into BCD.
23	FRD	Convert form BCD to int.	-[FRD]-	If Rung is activated, convert into Integer.
24	SEG	7' Segment	-[SEG]-	If Rung is activated, convert into 7' Segment value.
Move and copy command				
25	MOV	Move	-[MOV]-	If Rung is activated, copy one data.
26	COP	Copy data	-[COP]-	If Rung is activated, copy multiple data.
27	CCOP	Conditional Copy data	-[CCOP]-	Copy multiple data according to the Rung status.
Applied command				

Command				Description
No.	Mnemonic	Name	Symbol	
28	ROT	Rotating Output	-[Symbol]-	If Rung is activated, output in rotation.
Block control command				
29	FOR	For	-[Symbol]-	If Rung is activated, repeat execution until NEXT.
30	NEXT	Next	-[Symbol]-	If within repeat numbers, JUMP to FOR clause.
31	LBL	Label	-[Symbol]-	Designate location to Jump for Jump command.
32	JMP	Jump	-[Symbol]-	If Rung is activated, Jump to Label location. (if Label<0, Jump to -n number of Next).
33	CALL	Call	-[Symbol]-	If Rung is activated, call Sub-ladder.
34	END	End	-[Symbol]-	If Rung is activated, Sub-ladder end.



5.2. Available Operands

Table 5-2 Available Operands

<div></div> <div>inst</div>	Relay	Input		Output		Timer		Counter		Memory		Const (32bit) (L/F)
	Type	X,DO		Y,DI,R,K,SP		T		C		M,S		
	arg	n	(B,W,L,F)m	n	(B,W,L,F)m	n	(B,W,L,F)m	n	(B,W,L,F)m	n	(B,W,L,F)m	
XIC			x		x		x		x		x	x
XIO			x		x		x		x		x	x
EQU	sA	x		x		x		x		x		
	sB	x		x		x		x		x		
LES	sA	x		x		x		x		x		
	sB	x		x		x		x		x		
GRT	sA	x		x		x		x		x		
	sB	x		x		x		x		x		
LEQ	sA	x		x		x		x		x		
	sB	x		x		x		x		x		
GEQ	sA	x		x		x		x		x		
	sB	x		x		x		x		x		
OTF		x	x		x	x	x	x	x	x	x	x
OTL		x	x		x	x	x	x	x	x	x	x
OUT		x	x		x	x	x	x	x	x	x	x
OSR		x	x		x	x	x	x	x	x	x	x
RES		x	x	x	x		x		x	x	x	x
TON	tm	x	x	x	x		x	x	x	x	x	x
	bs	x		x		x		x		x		
	pst	x		x		x		x		x		
CTD	cnt	x	x	x	x	x	x	x	x	x	x	x
	pst	x		x		x		x		x		
ADD	sA	x		x		x		x		x		
	sB	x		x		x		x		x		
	dst	x	x	x		x		x		x		x
SUB	sA	x		x		x		x		x		
	sB	x		x		x		x		x		
	dst	x	x	x		x		x		x		x
MUL	sA	x		x		x		x		x		
	sB	x		x		x		x		x		
	dst	x	x	x		x		x		x		x

inst	Relay	Input		Output		Timer		Counter		Memory		Const (32bit) (L/F)
	Type	X,DO		Y,DI,R,K,SP		T		C		M,S		
	arg	n	(B,W,L,F)m	n	(B,W,L,F)m	n	(B,W,L,F)m	n	(B,W,L,F)m	n	(B,W,L,F)m	
DIV	sA	x		x		x		x		x		
	sB	x		x		x		x		x		
	dst	x	x	x		x		x		x		x
POW	sA	x		x		x		x		x		
	sB	x		x		x		x		x		
	dst	x	x	x		x		x		x		x
TOD	src	x	u	x	u	x	u	x	u	x	u	u
	dst	x	x	x	u	x	x	x	x	x	u	x
FRD	src	x	u	x	u	x	u	x	u	x	u	u
	dst	x	x	x	u	x	x	x	x	x	u	x
SEG	src	x	u	x	u	x	u	x	u	x	u	u
	dst	x	x	x	u	x	x	x	x	x	u	x
MOV	src	x		x		x		x		x		
	dst	x	x	x		x		x		x		x
COP	src					x		x				
	dst	x	x			x		x				x
	len	x		x		x		x		x		
CCOP	sA					x		x				
	sB					x		x				
	dst	x	x			x		x				x
	len	x		x		x		x		x		
ROT	st	x		x		x		x		x		
	cnt	x		x	x	x		x		x		
	tm	x	x	x	x		x	x	x	x	x	x
	rep	x		x		x		x		x		
	out	x	x	x		x	x	x	x	x		x
	rst		x		x		x		x	x	x	x
	tmp	x	x	x		x	x	x	x	x		x
FOR	idx	x	x	x		x	x	x	x	x		x
	init	x		x		x		x		x		
	final	x		x		x		x		x		
	step	x		x		x		x		x		
LRI	label	x	x	x	x	x	x	x	x	x	x	

5. Command Specification

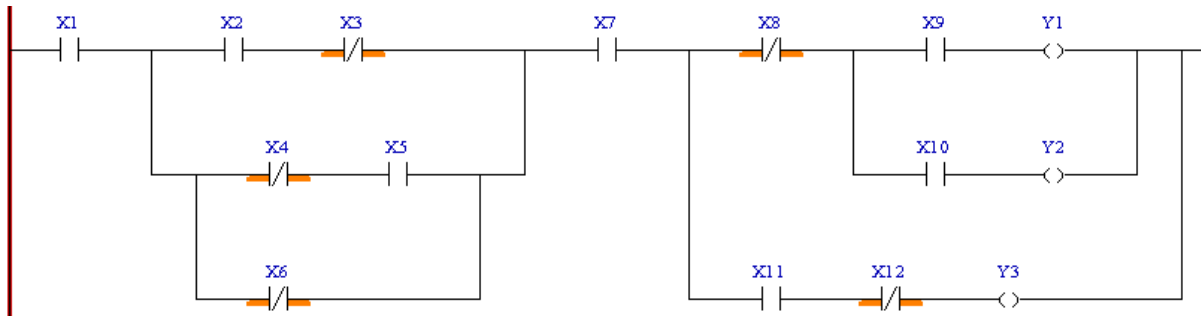
inst	Relay	Input		Output		Timer		Counter		Memory		Const (32bit) (L/F)
	Type	X,DO		Y,DI,R,K,SP		T		C		M,S		
	arg	n	(B,W,L,F)m	n	(B,W,L,F)m	n	(B,W,L,F)m	n	(B,W,L,F)m	n	(B,W,L,F)m	
JMP	label	x		x		x		x		x		
CALL	S file	x		x		x		x		x		

- (1) 'X' from the table represents unavailable.
- (2) Relay's n represents the number of bit. (B,W,L,F) are prefix that distinguish the types of Byte(8bit), Word(16bit), Long(32bit), Float, and m means the data number for each types. (Example, X1, XB2, XW2, XL2, XF2).
- (3) 'u' index from the table represents unsigned values.
- (4) So, the data size can be selected by selecting relay type (B, W, L, F) when the command's factor is being entered.
- (5) For COP(copy) and CCOP(conditional copy) commands, relay types of "src" and "dst" has to match unless the "src" is constant.
- (6) Opposing value of Byte(B), Word(W), or Long word(L) can be entered for bit value. For example, identical bit address such as X34=XB5/2=XW3/2=XL2/2 can be entered in various types.
- (7) Constant
Data size of constant is 32bit, and data types are binary, decimal and hexadecimal. Starts with &B refers to binary, &H refers to hexadecimal, and numbers without prefix refers to decimal. For example, 125 can be entered such as &H7D or &B01111101.
- (8) All relay's (B, W, L, F) without 'u' in the table will be considered as signed value.
For example, be cautious when moving B(8bit)value to W(16bit) in MOV command as it will expand the signed bit. If move RB(-1=&HFF) to RW, it will become 0xFFFF(-1), not &H00FF(255).
However TOD and FRD command that are related to BCD data, and SEG command that convert to 7' Segment data will be considered as unsigned value.
- (9) CALL/END/LBL/JMP command will be supported from the later version of mv30.50-00.

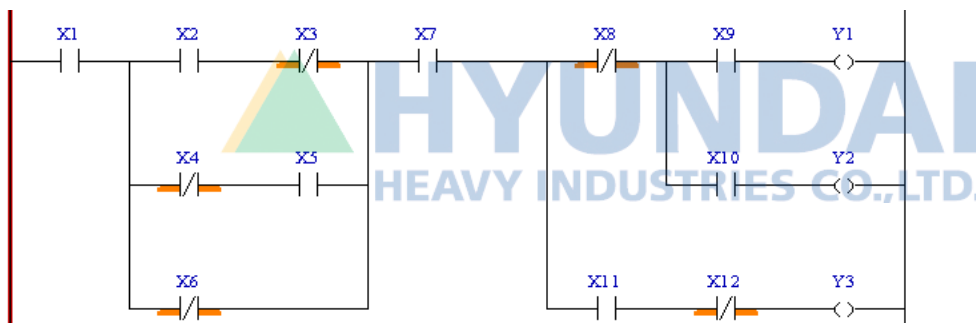
5.3. Relationship between Ladder Diagram and mnemonic

File that created with Ladder will be automatically converted to mnemonic and be transferred to the Controller.

(1) Ladder diagram



Or, by clicking the branch gap of HRLadder [], display as below.



(2) Mnemonic

```
SOR XIC X1 BST XIC X2 XIO X3 NXB BST XIO X4 XIC X5 NXB XIO X6 BND BND
XIC X7 BST XIO X8 BST XIC X9 OTE Y1 NXB XIC X10 OTE Y2 BND
NXB XIC X11 XIO X12 OTE Y3 BND
```



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6

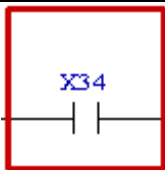
**Command
Description**



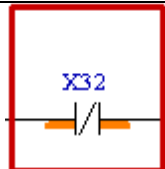
6. Command Description

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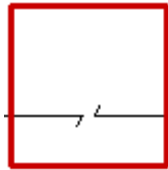
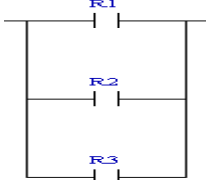

6.1. XIC(Examine if Closed): Examine Close

Symbol	Combination of Relay that can be used																												
<div><div>X34</div></div>	<table><tr><th>relay</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th>const</th></tr><tr><th>type</th><td>X, DO</td><td>Y, DI, R, K, SP</td><td>T</td><td>C</td><td>M, S</td><td>(32bit)</td></tr><tr><th>inst</th><th>arg.</th><td>n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td><td>(L/F)</td></tr><tr><td>XIC</td><td></td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr></table>	relay	Input	Output	Timer	Counter	Memory	const	type	X, DO	Y, DI, R, K, SP	T	C	M, S	(32bit)	inst	arg.	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	(L/F)	XIC		X	X	X	X	X
relay	Input	Output	Timer	Counter	Memory	const																							
type	X, DO	Y, DI, R, K, SP	T	C	M, S	(32bit)																							
inst	arg.	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	(L/F)																							
XIC		X	X	X	X	X																							
Description	If a value of factor is 1, Rung is activated and if the value is 0, Rung is deactivated.																												
Usage example	XIC(X2); XIC(DO2); XIC(Y2); XIC(DI2); XIC(R2); XIC(K2); XIC(SP1); XIC(T2); XIC(C2);																												
Input method	X18 can be entered as XB3/2, XW2/2, or XL1/2.																												


6.2. XIO(Examine if Open): Examine Open

Symbol	Combination of Relay that can be used																												
<div><div>X32</div></div>	<table><tr><th>relay</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th>const</th></tr><tr><th>type</th><th>X, DO</th><th>Y, DI, R, K, SP</th><th>T</th><th>C</th><th>M, S</th><th>(32bit)</th></tr><tr><th>inst</th><th>arg.</th><th>n : (B, W, L, F) m</th><th>n : (B, W, L, F) m</th><th>n : (B, W, L, F) m</th><th>n : (B, W, L, F) m</th><th>(L/F)</th></tr><tr><td>XIO</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr></table>	relay	Input	Output	Timer	Counter	Memory	const	type	X, DO	Y, DI, R, K, SP	T	C	M, S	(32bit)	inst	arg.	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	(L/F)	XIO	X	X	X	X	X	X
relay	Input	Output	Timer	Counter	Memory	const																							
type	X, DO	Y, DI, R, K, SP	T	C	M, S	(32bit)																							
inst	arg.	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	(L/F)																							
XIO	X	X	X	X	X	X																							
Description	If a value of factor is 0, Rung is activated and if the value is 1, Rung is deactivated.																												
Usage example	XIO(X2); XIO(DO2); XIO(Y2); XIO(DI2); XIO(R2); XIO(K2); XIO(SP1); XIO(T2); XIO(C2);																												
Input method	X18 can be entered as XB3/2, XW1/2 or XL1/2.																												

6.3. INV(Inverting): Inverting

Symbol	Description
	<p>It reverses the result until Rung (activate \leftrightarrow deactivate).</p> <p>This process implements $\neg(A \times B) = \neg A + \neg B$ or $\neg(A + B) = \neg A \times \neg B$ according to the law of De Morgan, so it can simply form AND logic without branches instead of using OR logic with many branches.</p> <p>Therefore, as $(R1 + R2 + R3) = \neg(\neg R1 \times \neg R2 \times \neg R3)$, both of two below logics will have same results.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  </div> <div style="text-align: center;">  </div> </div>

6.4. EQU(Equal): Examine Equal

Symbol																																							
Relay combination	<table><tr><th rowspan="2">inst</th><th>relay</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th rowspan="2">const (32bit) (L/F)</th></tr><tr><th>type</th><th>X, DO</th><th>Y, DI, R, K, SP</th><th>T</th><th>C</th><th>M, S</th></tr><tr><th>arg.</th><th>n</th><th>(B, W, L, F) m</th><th>n</th><th>(B, W, L, F) m</th><th>n</th><th>(B, W, L, F) m</th><th>n</th><th>(B, W, L, F) m</th></tr><tr><td rowspan="2">EQU</td><td>sA</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr><tr><td>sB</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr></table>	inst	relay	Input	Output	Timer	Counter	Memory	const (32bit) (L/F)	type	X, DO	Y, DI, R, K, SP	T	C	M, S	arg.	n	(B, W, L, F) m	n	(B, W, L, F) m	n	(B, W, L, F) m	n	(B, W, L, F) m	EQU	sA	X	X	X	X	X		sB	X	X	X	X	X	
inst	relay		Input	Output	Timer	Counter	Memory	const (32bit) (L/F)																															
	type	X, DO	Y, DI, R, K, SP	T	C	M, S																																	
arg.	n	(B, W, L, F) m	n	(B, W, L, F) m	n	(B, W, L, F) m	n	(B, W, L, F) m																															
EQU	sA	X	X	X	X	X																																	
	sB	X	X	X	X	X																																	
Factor	sA: 1st relay (or Number) to be compared sB: 2nd relay (or Number) to be compared																																						
Description	Compare two values and if they are equal, Rung will be activated.(Contact point activated)																																						
Usage example	EQU(XB3,100): If the value on XB3 is 100, Rung will be activated. EQU(XB3,RW4): If the value on both XB3 and RW4 are same, Rung will be activated.																																						

6.5. NEQ(Not Equal): Examine Not Equal

Symbol	<div><div>NEQ</div><div>source aXB3</div><div>0</div><div>source b100</div></div>																																							
Relay combination	<table><tr><th></th><th>relay</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th>const</th></tr><tr><th></th><th>type</th><td>X, DO</td><td>Y, DI, R, K, SP</td><td>T</td><td>C</td><td>M, S</td><td>(32bit)</td></tr><tr><th>inst</th><th>arg.</th><td>n (B, W, L, F) m</td><td>n (B, W, L, F) m</td><td>n (B, W, L, F) m</td><td>n (B, W, L, F) m</td><td>n (B, W, L, F) m</td><td>(L/F)</td></tr><tr><td rowspan="2">NEQ</td><td>sA</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr><tr><td>sB</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr></table>		relay	Input	Output	Timer	Counter	Memory	const		type	X, DO	Y, DI, R, K, SP	T	C	M, S	(32bit)	inst	arg.	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	(L/F)	NEQ	sA	X	X	X	X	X		sB	X	X	X	X	X	
	relay	Input	Output	Timer	Counter	Memory	const																																	
	type	X, DO	Y, DI, R, K, SP	T	C	M, S	(32bit)																																	
inst	arg.	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	(L/F)																																	
NEQ	sA	X	X	X	X	X																																		
	sB	X	X	X	X	X																																		
Factor	sA: 1st relay (or Number) to be compared sB: 2nd relay (or Number) to be compared																																							
Description	Compare two values and if they are not equal, Rung will be activated. (Contact point activated)																																							
Usage example	NEQ(XB3,100): if the value of XB is not 100, Rung will be activated. NEQ(XB3,RW4): if the value of XB3 is not equal to the value of RW4, Rung will be activated.																																							

6.6. LES(Less Than): Examine Less Than

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Symbol	<div><div>LES</div><div>source aXB3</div><div>0</div><div>source b100</div></div>																																					
Relay combination	<table><tr><td rowspan="2"></td><td>relay</td><td>Input</td><td>Output</td><td>Timer</td><td>Counter</td><td>Memory</td><td rowspan="2">const (32bit) (L/F)</td></tr><tr><td>type</td><td>X, DO</td><td>Y, DI, R, K, SP</td><td>T</td><td>C</td><td>M, S</td></tr><tr><td rowspan="2">inst</td><td>arg.</td><td>n (B, W, L, F) m</td><td>n (B, W, L, F) m</td><td>n (B, W, L, F) m</td><td>n (B, W, L, F) m</td><td>n (B, W, L, F) m</td><td></td></tr><tr><td>LES</td><td>sA</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr><tr><td></td><td>sB</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr></table>		relay	Input	Output	Timer	Counter	Memory	const (32bit) (L/F)	type	X, DO	Y, DI, R, K, SP	T	C	M, S	inst	arg.	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m		LES	sA	X	X	X	X			sB	X	X	X	X	X	
	relay		Input	Output	Timer	Counter	Memory	const (32bit) (L/F)																														
	type	X, DO	Y, DI, R, K, SP	T	C	M, S																																
inst	arg.	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m																																
	LES	sA	X	X	X	X																																
	sB	X	X	X	X	X																																
Factor	sA: 1st relay (or Number) to be compared sB: 2nd relay (or Number) to be compared																																					
Description	If sA is less than sB, Rung will be activated. (Contact point activated)																																					
Usage example	LES(XB3,100): If the value of XB3 is less than 100, Rung will be activated. LES(XB3,RW4): If the value of XB3 is less than the value of RW4, Rung will be activated.																																					

6.7. GRT(Greater Than): Examine Less Than

Symbol	<div><div>GRT</div><div>source aXB3</div><div>0</div><div>source b100</div></div>																																						
Relay combination	<table><tr><th rowspan="2">inst</th><th>relay</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th rowspan="2">const (32bit) (L/F)</th></tr><tr><th>type</th><td>X, DO</td><td>Y, DI, R, K, SP</td><td>T</td><td>C</td><td>M, S</td></tr><tr><th>arg.</th><td>n</td><td>(B, W, L, F) m</td><td>n</td><td>(B, W, L, F) m</td><td>n</td><td>(B, W, L, F) m</td><td>n</td><td>(B, W, L, F) m</td></tr><tr><td rowspan="2">GRT</td><td>sA</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr><tr><td>sB</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr></table>	inst	relay	Input	Output	Timer	Counter	Memory	const (32bit) (L/F)	type	X, DO	Y, DI, R, K, SP	T	C	M, S	arg.	n	(B, W, L, F) m	n	(B, W, L, F) m	n	(B, W, L, F) m	n	(B, W, L, F) m	GRT	sA	X	X	X	X	X		sB	X	X	X	X	X	
inst	relay		Input	Output	Timer	Counter	Memory	const (32bit) (L/F)																															
	type	X, DO	Y, DI, R, K, SP	T	C	M, S																																	
arg.	n	(B, W, L, F) m	n	(B, W, L, F) m	n	(B, W, L, F) m	n	(B, W, L, F) m																															
GRT	sA	X	X	X	X	X																																	
	sB	X	X	X	X	X																																	
Factor	sA: 1st relay (or Number) to be compared sB: 2nd relay (or Number) to be compared																																						
Description	If sA is greater than sB, Rung will be activated. (Contact point activated)																																						
Usage example	GRT(XB3,100): If the value of XB3 is greater than 100, Rung will be activated. GRT(XB3,RW4): If the value of XB3 is greater than the value of RW4, Rung will be activated																																						

6.8. LEQ(Less Than or Equal): Examine Less Than or Equal

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Symbol	<div><div>LEQ</div><div>source aXB3</div><div>0</div><div>source b100</div></div>																																							
Relay combination	<table><tr><th></th><th>relay</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th>const</th></tr><tr><th></th><th>type</th><th>X, DO</th><th>Y, DI, R, K, SP</th><th>T</th><th>C</th><th>M, S</th><th>(32bit)</th></tr><tr><th>inst</th><th>arg.</th><th>n : (B, W, L, F) m</th><th>n : (B, W, L, F) m</th><th>n : (B, W, L, F) m</th><th>n : (B, W, L, F) m</th><th>n : (B, W, L, F) m</th><th>(L/F)</th></tr><tr><td rowspan="2">LEQ</td><td>sA</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr><tr><td>sB</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr></table>		relay	Input	Output	Timer	Counter	Memory	const		type	X, DO	Y, DI, R, K, SP	T	C	M, S	(32bit)	inst	arg.	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	(L/F)	LEQ	sA	X	X	X	X	X		sB	X	X	X	X	X	
	relay	Input	Output	Timer	Counter	Memory	const																																	
	type	X, DO	Y, DI, R, K, SP	T	C	M, S	(32bit)																																	
inst	arg.	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	(L/F)																																	
LEQ	sA	X	X	X	X	X																																		
	sB	X	X	X	X	X																																		
Factor	sA: 1st relay (or Number) to be compared sB: 2nd relay (or Number) to be compared																																							
Description	If sA is less than sB or equal, Rung will be activated. (Contact point activated)																																							
Usage example	LEQ(XB3,100): If the value of XB3 is less than 100 or equal, Rung will be activated. LEQ(XB3,RW4): If the value of XB3 is less than the value of RW4 or equal, Rung will be activated.																																							

6.9. GEQ(Greater Than or Equal): Examine Greater Than or Equal

Symbol	<div><div>GEQ</div><div>source aXB3</div><div>0</div><div>source b100</div></div>																																							
Relay combination	<table><tr><th></th><th>relay</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th>const</th></tr><tr><th></th><th>type</th><th>X, DO</th><th>Y, DI, R, K, SP</th><th>T</th><th>C</th><th>M, S</th><th>(32bit)</th></tr><tr><th>inst</th><th>arg.</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>(L/F)</th></tr><tr><td rowspan="2">GEQ</td><td>sA</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr><tr><td>sB</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr></table>		relay	Input	Output	Timer	Counter	Memory	const		type	X, DO	Y, DI, R, K, SP	T	C	M, S	(32bit)	inst	arg.	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	(L/F)	GEQ	sA	X	X	X	X	X		sB	X	X	X	X	X	
	relay	Input	Output	Timer	Counter	Memory	const																																	
	type	X, DO	Y, DI, R, K, SP	T	C	M, S	(32bit)																																	
inst	arg.	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	(L/F)																																	
GEQ	sA	X	X	X	X	X																																		
	sB	X	X	X	X	X																																		
Factor	sA: 1st relay (or Number) to be compared sB: 2nd relay (or Number) to be compared																																							
Description	If sA is greater than sB or equal, Rung will be activated. (Contact point activated)																																							
Usage example	GEQ(XB3,100): If the value of XB3 is greater than 100 or equal, Rung will be activated. GEQ(XB3,RW4): If the value of XB3 is greater than the value of RW4 or equal, Rung will be activated.																																							

6.10. OTE(Output Energize): General Output

Symbol	Combination of Relay that can be used																												
<div><div><div>Y23</div><div><div></div></div></div></div>	<table><tr><th>relay</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th>const (32bit)</th></tr><tr><th>type</th><td>X, DO</td><td>Y, DI, R, K, SP</td><td>T</td><td>C</td><td>M, S</td><td>(L/F)</td></tr><tr><th>inst</th><th>arg.</th><td>n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td></tr><tr><td>OTE</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr></table>	relay	Input	Output	Timer	Counter	Memory	const (32bit)	type	X, DO	Y, DI, R, K, SP	T	C	M, S	(L/F)	inst	arg.	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	OTE	X	X	X	X	X	X
relay	Input	Output	Timer	Counter	Memory	const (32bit)																							
type	X, DO	Y, DI, R, K, SP	T	C	M, S	(L/F)																							
inst	arg.	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m																							
OTE	X	X	X	X	X	X																							
Description	Output signal will be depending on the Rung status. If Rung is activated, output signal will be On(high), if deactivated, output signal will be Off(low).																												
Factor Example	Y2; DI2; R2; K2; SP1;																												
Input Method	Y18 can be entered as YB3/2, YW2/2, or YL1/2.																												

6.11. OTL(Output Latch): Latch Output

Symbol	Combination of Relay that can be used.																												
<div><div><div>Y20</div><div>(L)</div></div></div>	<table><tr><th>relay</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th>const (32bit)</th></tr><tr><td>type</td><td>X, DO</td><td>Y, DI, R, K, SP</td><td>T</td><td>C</td><td>M, S</td><td>(L/F)</td></tr><tr><td>inst</td><td>arg. n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td><td>(L/F)</td></tr><tr><td>OTL</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr></table>	relay	Input	Output	Timer	Counter	Memory	const (32bit)	type	X, DO	Y, DI, R, K, SP	T	C	M, S	(L/F)	inst	arg. n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	(L/F)	OTL	X	X	X	X	X	X
relay	Input	Output	Timer	Counter	Memory	const (32bit)																							
type	X, DO	Y, DI, R, K, SP	T	C	M, S	(L/F)																							
inst	arg. n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	(L/F)																							
OTL	X	X	X	X	X	X																							
Description	If Rung is activated, output signal will be On(high). However, if Rung is deactivated, output will not change.																												
Factor Example	Y2; DI2; R2; K2; SP1;																												
Input Method	Y18 can be entered as YB3/2, YW2/2, or YL1/2.																												

6.12. OTU(Output Unlatch): Unlatch Output

Symbol	Combination of Relay that can be used																												
<div><div>Y21</div><div></div></div>	<table><tr><th>relay</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th>const (32bit)</th></tr><tr><th>type</th><td>X, DO</td><td>Y, DI, R, K, SP</td><td>T</td><td>C</td><td>M, S</td><td>(L/F)</td></tr><tr><th>inst</th><td>arg. n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td><td>(L/F)</td></tr><tr><td>OTU</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr></table>	relay	Input	Output	Timer	Counter	Memory	const (32bit)	type	X, DO	Y, DI, R, K, SP	T	C	M, S	(L/F)	inst	arg. n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	(L/F)	OTU	X	X	X	X	X	X
relay	Input	Output	Timer	Counter	Memory	const (32bit)																							
type	X, DO	Y, DI, R, K, SP	T	C	M, S	(L/F)																							
inst	arg. n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	(L/F)																							
OTU	X	X	X	X	X	X																							
Description	If Rung is activated, output signal will be Off(low). However, if Rung is deactivated, output will not change.																												
Usage Example	Y2; DI2; R2; K2; SP1;																												
Input Method	Y18 can be entered as YB3/2, YW2/2, or YL1/2.																												

6.13. OSR(One Shot Rising): One Shot Output

Symbol	Combination of Relay that can be used																												
<div><div><div>Y22</div><div>(OSR)</div></div></div>	<table><tr><th>relay</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th>const (32bit)</th></tr><tr><th>type</th><td>X, DO</td><td>Y, DI, R, K, SP</td><td>T</td><td>C</td><td>M, S</td><td>(L/F)</td></tr><tr><th>inst</th><td>arg. n (B,W,L,F) m</td><td>n (B,W,L,F) m</td><td>n (B,W,L,F) m</td><td>n (B,W,L,F) m</td><td>n (B,W,L,F) m</td><td>(L/F)</td></tr><tr><td>OSR</td><td>x x</td><td>x</td><td>x x</td><td>x x</td><td>x x</td><td>x</td></tr></table>	relay	Input	Output	Timer	Counter	Memory	const (32bit)	type	X, DO	Y, DI, R, K, SP	T	C	M, S	(L/F)	inst	arg. n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	(L/F)	OSR	x x	x	x x	x x	x x	x
relay	Input	Output	Timer	Counter	Memory	const (32bit)																							
type	X, DO	Y, DI, R, K, SP	T	C	M, S	(L/F)																							
inst	arg. n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	(L/F)																							
OSR	x x	x	x x	x x	x x	x																							
Description	If Rung is activated, output will be On(high) only for one scan. Therefore, when Rung becomes from deactivated to activated, relevant relay will be On, only for one scan.																												
Factor Example	Y2; DI2; R2; K2; SP1;																												
Input Method	Y18 can be entered as YB3/2, YW2/2, or YL1/2.																												

6.14. RES(Reset): Reset

Symbol	Combination of Relay that can be used																												
<div><div>T3</div><div>(RES)</div></div>	<table><tr><th>relay</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th>const (32bit)</th></tr><tr><th>type</th><td>X, DO</td><td>Y, DI, R, K, SP</td><td>T</td><td>C</td><td>M, S</td><td>(L/F)</td></tr><tr><th>inst</th><td>arg. n (B, W, L, F) m</td><td>n (B, W, L, F) m</td><td>n (B, W, L, F) m</td><td>n (B, W, L, F) m</td><td>n (B, W, L, F) m</td><td>(L/F)</td></tr><tr><td>RES</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr></table>	relay	Input	Output	Timer	Counter	Memory	const (32bit)	type	X, DO	Y, DI, R, K, SP	T	C	M, S	(L/F)	inst	arg. n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	(L/F)	RES	X	X	X	X	X	X
relay	Input	Output	Timer	Counter	Memory	const (32bit)																							
type	X, DO	Y, DI, R, K, SP	T	C	M, S	(L/F)																							
inst	arg. n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	(L/F)																							
RES	X	X	X	X	X	X																							
Description	If Rung is activated, output will be cleared(-1)																												
Factor Example	T2; C2;																												

6.15. TON(Time On Delay): Timer

Symbol	<div><div>TON</div><div><div>timer</div><div>T2 =0</div><div>TL 2=-1</div><div>timer base(1/100s)</div><div>100</div><div>preset</div><div>2</div></div></div>																																												
Relay combination	<table><tr><th rowspan="3">inst</th><th>relay</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th>const</th></tr><tr><th>type</th><td>X, DO</td><td>Y, DI, R, K, SP</td><td>T</td><td>C</td><td>M, S</td><td>(32bit)</td></tr><tr><th>arg.</th><td>n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td><td>n : (B, W, L, F) m</td><td>(L/F)</td></tr><tr><td rowspan="3">TON</td><td>tm</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr><tr><td>bs</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr><tr><td>pst</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr></table>	inst	relay	Input	Output	Timer	Counter	Memory	const	type	X, DO	Y, DI, R, K, SP	T	C	M, S	(32bit)	arg.	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	(L/F)	TON	tm	X	X	X	X	X	X	bs	X	X	X	X	X		pst	X	X	X	X	X	
inst	relay		Input	Output	Timer	Counter	Memory	const																																					
	type		X, DO	Y, DI, R, K, SP	T	C	M, S	(32bit)																																					
	arg.	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	(L/F)																																						
TON	tm	X	X	X	X	X	X																																						
	bs	X	X	X	X	X																																							
	pst	X	X	X	X	X																																							
Factor	tm: Designate the Timer Relay No. bs: Set Timer unit as relay or number (e.g. 100=1second unit, 10=0.1 second unit) pst: Set Preset value (Time [msec]=bs*pst*10) as relay or number																																												
Description	It will calculate the time that Rung is in active to set the time(bs x pst x 10) [msec]. After the time, corresponding timer relay will be On(high). However, if Rung is deactivated, it will set to Clear(-1 immediately Reference) The value of TL is 1msec unit.																																												
Usage example	TON(T2,100,5): Set T2 as (100x5x10[msec]=5[sec]) timer TON(T3,RW3,RW4): Set T3 as the value of (RW3)x(RW4)x10 with timer																																												

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6.16. CTD(Count Down): Counter

Symbol	<div><div>CTD</div><div>counter C2 =1 CL2=0 preset 100</div></div>																																							
Relay combination	<table><tr><td></td><td>relay</td><td>Input</td><td>Output</td><td>Timer</td><td>Counter</td><td>Memory</td><td>const</td></tr><tr><td></td><td>type</td><td>X, DO</td><td>Y, DI, R, K, SP</td><td>T</td><td>C</td><td>M, S</td><td>(32bit)</td></tr><tr><td>inst</td><td>arg.</td><td>n (B,W,L,F) m</td><td>n (B,W,L,F) m</td><td>n (B,W,L,F) m</td><td>n (B,W,L,F) m</td><td>n (B,W,L,F) m</td><td>(L/F)</td></tr><tr><td rowspan="2">CTD</td><td>cnt</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr><tr><td>pst</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr></table>		relay	Input	Output	Timer	Counter	Memory	const		type	X, DO	Y, DI, R, K, SP	T	C	M, S	(32bit)	inst	arg.	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	(L/F)	CTD	cnt	X	X	X	X	X	X	pst	X	X	X	X	X	X
	relay	Input	Output	Timer	Counter	Memory	const																																	
	type	X, DO	Y, DI, R, K, SP	T	C	M, S	(32bit)																																	
inst	arg.	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	(L/F)																																	
CTD	cnt	X	X	X	X	X	X																																	
	pst	X	X	X	X	X	X																																	
Factor	cnt: Designate the Counter Relay No. pst: Set Preset value as relay or number																																							
Description	Down-count the rise of Rung (deactivate to activated) If the corresponding value of CL is 0, counter will be On(high) and not count anymore. When Rung is activated, if the corresponding value of CL is negative number, the value of pst will be saved in CL. Reference) Even if Rung is deactivated, CL will not be Cleared(-1).																																							
Usage example	CTD(C2,100): Set C2 to Down-counter (100) CTD(C3,RW3): Set C3 to Down-counter as the value of (RW3)																																							

6.17. ADD(Add): Add

Symbol	<div><div>ADD</div><div>source aXB3</div><div>0</div><div>source b50</div><div>destinationRW3</div><div>0</div></div>																																																									
Relay combination	<table><tr><th rowspan="2">inst</th><th>relay</th><th colspan="2">Input</th><th colspan="2">Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th>const</th></tr><tr><th>type</th><th colspan="2">X, DO</th><th colspan="2">Y, DI, R, K, SP</th><th>T</th><th>C</th><th>M, S</th><th>(32bit)</th></tr><tr><th></th><th>arg.</th><th>n</th><th>(B,W,L,F) m</th><th>n</th><th>(B,W,L,F) m</th><th>n</th><th>(B,W,L,F) m</th><th>n</th><th>(B,W,L,F) m</th></tr><tr><td rowspan="3">ADD</td><td>sA</td><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td></tr><tr><td>sB</td><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td></tr><tr><td>dst</td><td>X</td><td>X</td><td>X</td><td></td><td>X</td><td></td><td>X</td><td>X</td></tr></table>	inst	relay	Input		Output		Timer	Counter	Memory	const	type	X, DO		Y, DI, R, K, SP		T	C	M, S	(32bit)		arg.	n	(B,W,L,F) m	n	(B,W,L,F) m	n	(B,W,L,F) m	n	(B,W,L,F) m	ADD	sA	X		X		X		X		sB	X		X		X		X		dst	X	X	X		X		X	X
inst	relay		Input		Output		Timer	Counter	Memory	const																																																
	type	X, DO		Y, DI, R, K, SP		T	C	M, S	(32bit)																																																	
	arg.	n	(B,W,L,F) m	n	(B,W,L,F) m	n	(B,W,L,F) m	n	(B,W,L,F) m																																																	
ADD	sA	X		X		X		X																																																		
	sB	X		X		X		X																																																		
	dst	X	X	X		X		X	X																																																	
Factor	sA: 1st relay (or Number) for the operation sB: 2nd relay (or Number) for the operation dst: Relay that will save the result																																																									
Description	If Rung is activated, add the value sA and sB, then save it to dst. If overflow occurs on operation result, set SP8=1.																																																									
Usage example	ADD(XB3,RB2,RW3): (RW3)=(XB3)+(RB2) ADD(XB3,RB2,RB2): (RB2)=(XB3)+(RB2) ADD(XB3,50,RW3): (RW3)=(XB3)+50																																																									

6.18. SUB(Subtract): Subtract

Symbol	<div><div>SUB</div><div>source aXB30</div><div>source b50</div><div>destinationRW30</div></div>																																																				
Relay combination	<table><tr><th rowspan="2">inst</th><th rowspan="2">relay type</th><th colspan="2">Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th rowspan="2">const (32bit) (L/F)</th></tr><tr><th>X, DO</th><th>Y, DI, R, K, SP</th><th>T</th><th>C</th><th>M, S</th></tr><tr><th>arg.</th><th>n</th><th>(B,W,L,F)</th><th>m</th><th>n</th><th>(B,W,L,F)</th><th>m</th><th>n</th><th>(B,W,L,F)</th><th>m</th></tr><tr><td rowspan="3">SUB</td><td>sA</td><td>X</td><td></td><td>X</td><td>X</td><td></td><td>X</td><td></td><td>X</td></tr><tr><td>sB</td><td>X</td><td></td><td>X</td><td></td><td></td><td>X</td><td></td><td></td></tr><tr><td>dst</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td><td>X</td><td></td><td>X</td></tr></table>	inst	relay type	Input		Output	Timer	Counter	Memory	const (32bit) (L/F)	X, DO	Y, DI, R, K, SP	T	C	M, S	arg.	n	(B,W,L,F)	m	n	(B,W,L,F)	m	n	(B,W,L,F)	m	SUB	sA	X		X	X		X		X	sB	X		X			X			dst	X	X	X	X		X		X
inst	relay type			Input		Output	Timer	Counter	Memory		const (32bit) (L/F)																																										
		X, DO	Y, DI, R, K, SP	T	C	M, S																																															
arg.	n	(B,W,L,F)	m	n	(B,W,L,F)	m	n	(B,W,L,F)	m																																												
SUB	sA	X		X	X		X		X																																												
	sB	X		X			X																																														
	dst	X	X	X	X		X		X																																												
Factor	sA: 1st relay (or Number) for the operation sB: 2nd relay (or Number) for the operation dst: Relay that will save the result																																																				
Description	If Rung is activated, subtract the value sB from the value of sA, then save it to dst.																																																				
Usage example	SUB(XB3,RB2,RW3): (RW3)=(XB3)-(RB2) SUB(XB3,RB2,RB2): (RB2)=(XB3)-(RB2) SUB(XB3,50,RW3): (RW3)=(XB3)-50																																																				

6.19. MUL(Multiply): Multiply

Symbol	<div><div>MUL</div><div>source aXB30</div><div>source b50</div><div>destinationRW30</div></div>																																																				
Relay combination	<table><tr><th rowspan="2">inst</th><th rowspan="2">relay type</th><th colspan="2">Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th rowspan="2">const (32bit) (L/F)</th></tr><tr><th>X, DO</th><th>Y, DI, R, K, SP</th><th>T</th><th>C</th><th>M, S</th></tr><tr><th>arg.</th><th>n</th><th>(B, W, L, F)</th><th>m</th><th>n</th><th>(B, W, L, F)</th><th>m</th><th>n</th><th>(B, W, L, F)</th><th>m</th></tr><tr><td rowspan="3">MUL</td><td>sA</td><td>X</td><td></td><td>X</td><td>X</td><td>X</td><td>X</td><td></td><td></td></tr><tr><td>sB</td><td>X</td><td></td><td>X</td><td>X</td><td>X</td><td>X</td><td></td><td></td></tr><tr><td>dst</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td><td>X</td></tr></table>	inst	relay type	Input		Output	Timer	Counter	Memory	const (32bit) (L/F)	X, DO	Y, DI, R, K, SP	T	C	M, S	arg.	n	(B, W, L, F)	m	n	(B, W, L, F)	m	n	(B, W, L, F)	m	MUL	sA	X		X	X	X	X			sB	X		X	X	X	X			dst	X	X	X	X	X	X		X
inst	relay type			Input		Output	Timer	Counter	Memory		const (32bit) (L/F)																																										
		X, DO	Y, DI, R, K, SP	T	C	M, S																																															
arg.	n	(B, W, L, F)	m	n	(B, W, L, F)	m	n	(B, W, L, F)	m																																												
MUL	sA	X		X	X	X	X																																														
	sB	X		X	X	X	X																																														
	dst	X	X	X	X	X	X		X																																												
Factor	sA: 1st relay (or Number) for the operation sB: 2nd relay (or Number) for the operation dst: Relay that will save the result																																																				
Description	If Rung is activated, multiply the value of sA with the value of sB, then save it to dst. If overflow occurs on operation result, set SP8=1.																																																				
Usage example	MUL(XB3,RB2,RW3): (RW3)=(XB3)x(RB2) MUL(XB3,RB2,RB2): (RB2)=(XB3)x(RB2) MUL(XB3,50,RW3): (RW3)=(XB3)x50																																																				

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6.20. DIV(Divide): Divide

Symbol	<div><div>DIV</div><div>source aXB3</div><div>0</div><div>source b50</div><div>destinationRW3</div><div>0</div></div>																																					
Relay combination	<table><tr><th rowspan="2">inst</th><th>relay type</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th>const (32bit)</th></tr><tr><th>arg.</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>(L/F)</th></tr><tr><td rowspan="3">DIV</td><td>sA</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr><tr><td>sB</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr><tr><td>dst</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr></table>	inst	relay type	Input	Output	Timer	Counter	Memory	const (32bit)	arg.	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	(L/F)	DIV	sA	X	X	X	X	X		sB	X	X	X	X	X		dst	X	X	X	X	X	X
inst	relay type		Input	Output	Timer	Counter	Memory	const (32bit)																														
	arg.	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	(L/F)																															
DIV	sA	X	X	X	X	X																																
	sB	X	X	X	X	X																																
	dst	X	X	X	X	X	X																															
Factor	sA: 1st relay (or Number) for the operation. sB: 2nd relay (or Number) for the operation. dst: Relay that will save the result																																					
Description	If Rung is activated, divide the value of sA with the value of sB, then save it to dst. If sB is 0, or overflow occurs on operation result, set SP8=1.																																					
Usage example	DIV(XB3,RB2,RW3): (RW3)=(XB3)/(RB2) DIV(XB3,RB2,RB2): (RB2)=(XB3)/(RB2) DIV(XB3,50,RW3): (RW3)=(XB3)/50																																					

6.21. POW(Power): Power

Symbol	<div><div>POW</div><div>source aXB3</div><div>source b3</div><div>destinationRW3</div></div>																																												
Relay combination	<table><tr><th rowspan="2">inst</th><th>relay</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th rowspan="2">const (32bit) (L/F)</th></tr><tr><th>type</th><th>X, DO</th><th>Y, DI, R, K, SP</th><th>T</th><th>C</th><th>M, S</th></tr><tr><th>arg.</th><th>n</th><th>(B, W, L, F) m</th><th>n : (B, W, L, F) m</th><th>n : (B, W, L, F) m</th><th>n : (B, W, L, F) m</th><th>n : (B, W, L, F) m</th><th></th></tr><tr><td rowspan="3">POW</td><td>sA</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr><tr><td>sB</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr><tr><td>dst</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr></table>	inst	relay	Input	Output	Timer	Counter	Memory	const (32bit) (L/F)	type	X, DO	Y, DI, R, K, SP	T	C	M, S	arg.	n	(B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m		POW	sA	X	X	X	X	X		sB	X	X	X	X	X		dst	X	X	X	X	X	X
inst	relay		Input	Output	Timer	Counter	Memory	const (32bit) (L/F)																																					
	type	X, DO	Y, DI, R, K, SP	T	C	M, S																																							
arg.	n	(B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m																																							
POW	sA	X	X	X	X	X																																							
	sB	X	X	X	X	X																																							
	dst	X	X	X	X	X	X																																						
Factor	sA: 1st relay (or Number) for the operation. sB: 2nd relay (or Number) for the operation. dst: Relay that will save the result																																												
Description	If Rung is activated, power the value of sA with the value of sB, then save it to dst. If overflow occurs on operation result, set SP8=1.																																												
Usage example	POW(2,3,RW3): (RW3)=2^3=2*2*2=8 POW(XB3,RB2,RW3): (RW3)=(XB3)^(RB2) POW(XB3,RB2,RB2): (RB2)=(XB3)^(RB2) POW(XB3,3,RW3): (RW3)=(XB3)^3																																												

6.22. TOD(Convert to BCD): Convert to BCD

Symbol	<div style="border: 2px solid red; padding: 5px; display: inline-block;"> <pre> TOD source XB3 0 destination RB2 0 </pre> </div>																																																										
Relay combination	<table border="1"> <thead> <tr> <th></th><th>relay</th><th colspan="2">Input</th><th colspan="2">Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th>const (32bit)</th></tr> <tr> <th></th><th>type</th><th colspan="2">X, DO</th><th colspan="2">Y, DI, R, K, SP</th><th>T</th><th>C</th><th>M, S</th><th>(L/F)</th></tr> <tr> <th>inst</th><th>arg.</th><th>n</th><th>(B,W,L,F) m</th><th>n</th><th>(B,W,L,F) m</th><th>n</th><th>(B,W,L,F) m</th><th>n</th><th>(B,W,L,F) m</th></tr> </thead> <tbody> <tr> <td>TOD</td><td>src</td><td>x</td><td>u</td><td>x</td><td>u</td><td>x</td><td>u</td><td>x</td><td>u</td></tr> <tr> <td></td><td>dst</td><td>x</td><td>x</td><td>x</td><td>u</td><td>x</td><td>x</td><td>x</td><td>u</td></tr> </tbody> </table>										relay	Input		Output		Timer	Counter	Memory	const (32bit)		type	X, DO		Y, DI, R, K, SP		T	C	M, S	(L/F)	inst	arg.	n	(B,W,L,F) m	n	(B,W,L,F) m	n	(B,W,L,F) m	n	(B,W,L,F) m	TOD	src	x	u	x	u	x	u	x	u		dst	x	x	x	u	x	x	x	u
	relay	Input		Output		Timer	Counter	Memory	const (32bit)																																																		
	type	X, DO		Y, DI, R, K, SP		T	C	M, S	(L/F)																																																		
inst	arg.	n	(B,W,L,F) m	n	(B,W,L,F) m	n	(B,W,L,F) m	n	(B,W,L,F) m																																																		
TOD	src	x	u	x	u	x	u	x	u																																																		
	dst	x	x	x	u	x	x	x	u																																																		
Factor	src: Source relay (or Number) dst: Destination relay																																																										
Description	<p>If Rung is activated, convert the value of src to BCD and save it to dst.</p> <p>This command is convenient when using a device that indicates value on 7' Segment with BCD type.</p> <p>If dst is byte(B) type, it will convert into 2 digits and if dst is word(W) type, it will convert into 4 digits.</p> <p>If the value of Src is greater than the converting digits, set SP7=1.</p>																																																										
Usage example	<p>TOD(XB3,RB2): Convert the value of XB3 to BCD and save it to RB2.</p> <p>(Reference, BCD(Binary Coded Decimal) refers to the number that can have a value of 0~9 range with 4bit code value. For BCD, A~F that can be represented with 4 bit (among 0~F) is not used.</p> <p>If (XB3)=&H7B(123), save &H23(34) into RB2, and set SP7=1 as &H7B(123)>&H63(99).</p>																																																										

6.23. FRD(Convert form BCD to Integer): Convert to Integer

Symbol	<div><div>FRD</div><div>sourceXB30</div><div>destinationRB30</div></div>																																	
Relay combination	<table><tr><th rowspan="2">relay type</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th>const</th></tr><tr><th>X, DO</th><th>Y, DI, R, K, SP</th><th>T</th><th>C</th><th>M, S</th><th>(32bit) (L/F)</th></tr><tr><th>inst</th><th>arg.</th><th>n (B, W, L, F) m</th><th>n (B, W, L, F) m</th><th>n (B, W, L, F) m</th><th>n (B, W, L, F) m</th><th></th></tr><tr><td rowspan="2">FRD</td><td>src</td><td>Xu</td><td>Xu</td><td>Xu</td><td>Xu</td><td>Xu</td></tr><tr><td>dst</td><td>Xx</td><td>Xu</td><td>Xx</td><td>Xx</td><td>Xu</td></tr></table>	relay type	Input	Output	Timer	Counter	Memory	const	X, DO	Y, DI, R, K, SP	T	C	M, S	(32bit) (L/F)	inst	arg.	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m		FRD	src	Xu	Xu	Xu	Xu	Xu	dst	Xx	Xu	Xx	Xx	Xu
relay type	Input		Output	Timer	Counter	Memory	const																											
	X, DO	Y, DI, R, K, SP	T	C	M, S	(32bit) (L/F)																												
inst	arg.	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m																													
FRD	src	Xu	Xu	Xu	Xu	Xu																												
	dst	Xx	Xu	Xx	Xx	Xu																												
Factor	src: Source relay (or Number) dst: Destination relay																																	
Description	<p>If Rung is activated, convert the value of src's BCD to integer and save it to dst. This command is convenient when accepting a value of cam switch that is BCD type output as input.</p> <p>If the value of src is not BCD, set SP7=1.</p> <p>Also, if src is word(W) type and dst is byte(B) type, the maximum value of converted src will be &H9999. Conversion result of integer will be 9999(&H270F) which will exceed the range of byte &Hff and overflow will occur. In this case, set SP7=1.</p>																																	
Usage example	FRD(XB3,RB2): Convert the value(BCD) of XB3 into integer and save it to RB2. If (XB3)=&H23(35), save 23=&H17 to RB2.																																	

6.24. SEG(7' Segment): Convert to 7' Segment value

Symbol	<div><div>SEG</div><div>sourceXB30</div><div>destinationRW30</div></div>																																																																						
Relay combination	<table><tr><th rowspan="2">inst</th><th rowspan="2">relay type</th><th colspan="2">Input</th><th colspan="2">Output</th><th colspan="2">Timer</th><th colspan="2">Counter</th><th colspan="2">Memory</th><th rowspan="2">const (32bit) (L/F)</th></tr><tr><th>X, DO</th><th>Y, DI, R, K, SP</th><th>T</th><th>C</th><th>M, S</th></tr><tr><th></th><th>arg.</th><th>n</th><th>m</th><th>n</th><th>m</th><th>n</th><th>m</th><th>n</th><th>m</th><th>n</th><th>m</th><th></th></tr><tr><th></th><th></th><th>(B,W,L,F)</th><th>(B,W,L,F)</th><th>(B,W,L,F)</th><th>(B,W,L,F)</th><th>(B,W,L,F)</th><th>(B,W,L,F)</th><th>(B,W,L,F)</th><th>(B,W,L,F)</th><th>(B,W,L,F)</th><th>(B,W,L,F)</th><th></th></tr><tr><td>SEG</td><td>src</td><td>X</td><td>u</td><td>X</td><td>u</td><td>X</td><td>u</td><td>X</td><td>u</td><td>X</td><td>u</td><td>u</td></tr><tr><td></td><td>dst</td><td>X</td><td>x</td><td>X</td><td>u</td><td>X</td><td>x</td><td>X</td><td>x</td><td>X</td><td>u</td><td>x</td></tr></table>	inst	relay type	Input		Output		Timer		Counter		Memory		const (32bit) (L/F)	X, DO	Y, DI, R, K, SP	T	C	M, S		arg.	n	m	n	m	n	m	n	m	n	m				(B,W,L,F)	(B,W,L,F)	(B,W,L,F)	(B,W,L,F)	(B,W,L,F)	(B,W,L,F)	(B,W,L,F)	(B,W,L,F)	(B,W,L,F)	(B,W,L,F)		SEG	src	X	u	X	u	X	u	X	u	X	u	u		dst	X	x	X	u	X	x	X	x	X	u	x
inst	relay type			Input		Output		Timer		Counter		Memory			const (32bit) (L/F)																																																								
		X, DO	Y, DI, R, K, SP	T	C	M, S																																																																	
	arg.	n	m	n	m	n	m	n	m	n	m																																																												
		(B,W,L,F)	(B,W,L,F)	(B,W,L,F)	(B,W,L,F)	(B,W,L,F)	(B,W,L,F)	(B,W,L,F)	(B,W,L,F)	(B,W,L,F)	(B,W,L,F)																																																												
SEG	src	X	u	X	u	X	u	X	u	X	u	u																																																											
	dst	X	x	X	u	X	x	X	x	X	u	x																																																											
Factor	src: Source relay (or Number) dst: Destination relay																																																																						
Description	If Rung is activated, convert the value of src into 7' Segment value (8bit) and save it to dst. If dst is word(W) type, save 2 of 7' Segment value (8bit) to dst.																																																																						
7' Segment Data	<div><div><pre>#define SEGM_A 0x01 #define SEGM_B 0x02 #define SEGM_C 0x04 #define SEGM_D 0x08 #define SEGM_E 0x10 #define SEGM_F 0x20 #define SEGM_G 0x40 #define SEGM_DP 0x80</pre></div><div></div></div> <div><pre>#define SEGD_0 (SEGM_A SEGM_B SEGM_C SEGM_D SEGM_E SEGM_F) #define SEGD_1 (SEGM_B SEGM_C) #define SEGD_2 (SEGM_A SEGM_B SEGM_G SEGM_E SEGM_D) #define SEGD_3 (SEGM_A SEGM_B SEGM_C SEGM_D SEGM_G) #define SEGD_4 (SEGM_B SEGM_C SEGM_F SEGM_G) #define SEGD_5 (SEGM_A SEGM_C SEGM_D SEGM_F SEGM_G) #define SEGD_6 (SEGM_A SEGM_C SEGM_D SEGM_E SEGM_F SEGM_G) #define SEGD_7 (SEGM_A SEGM_B SEGM_C) #define SEGD_8 (SEGM_A SEGM_B SEGM_C SEGM_D SEGM_E SEGM_F SEGM_G) #define SEGD_9 (SEGM_A SEGM_B SEGM_C SEGM_F SEGM_G) #define SEGD_A (SEGM_A SEGM_B SEGM_C SEGM_E SEGM_F SEGM_G) #define SEGD_B (SEGM_C SEGM_D SEGM_E SEGM_F SEGM_G) #define SEGD_C (SEGM_A SEGM_D SEGM_E SEGM_F) #define SEGD_D (SEGM_B SEGM_C SEGM_D SEGM_E SEGM_G) #define SEGD_E (SEGM_A SEGM_D SEGM_E SEGM_F SEGM_G) #define SEGD_F (SEGM_A SEGM_E SEGM_F SEGM_G)</pre></div>																																																																						
Usage example	SEG(XB3,RW3): Save the 7' Segment value that correspond to the value of XB3 into RW3. If (XB3)=(&H17), save &H0607 that combined the above SEGD_1(SEGM_B SEGM_C=0x02 0x04=0x06)=&H06 and SEGD_7(SEGM_A SEGM_B SEGM_C=0x01 0x02 0x04=0x07)=&H07 into RW3.																																																																						

6.25. MOV(Move): Move

Symbol	<div><div>MOV</div><div>source55</div><div>destinationRB2</div><div>0</div></div>																																								
Relay combination	<table><tr><th rowspan="2">relay type</th><th colspan="2">Input</th><th colspan="2">Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th rowspan="2">const (32bit) (L/F)</th></tr><tr><th>X, DO</th><th>Y, DI, R, K, SP</th><th>T</th><th>C</th><th>M, S</th></tr><tr><th>inst</th><th>arg.</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th></th></tr><tr><td rowspan="2">MOV</td><td>src</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr><tr><td>dst</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr></table>	relay type	Input		Output		Timer	Counter	Memory	const (32bit) (L/F)	X, DO	Y, DI, R, K, SP	T	C	M, S	inst	arg.	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m		MOV	src	X	X	X	X	X	X		dst	X	X	X	X	X	X	X
relay type	Input		Output		Timer	Counter	Memory	const (32bit) (L/F)																																	
	X, DO	Y, DI, R, K, SP	T	C	M, S																																				
inst	arg.	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m																																		
MOV	src	X	X	X	X	X	X																																		
	dst	X	X	X	X	X	X	X																																	
Factor	src: Source relay (or Number) dst: Destination relay																																								
Description	If Rung is activated, copy the value of scr into dst. If src is word(W) type, and dst is byte(B) type, only the lower byte of src value will be copied to dst. Also, all embedded PLC data is processed as a data with symbols. If src is byte(B) type, and the value is -1(&Hff), it will be copied to -1(&HFFFF) of dst. (&H00ff will be the value of 255).																																								
Usage example	MOV(BX3,RB2): Copy the value of XB3 into RB2. MOV(55,RB2): Copy 55 into RB2. MOV(-30,RB2): Copy -30 into RB2.																																								

6.26. COP(Copy data): Copy

Symbol	<div><div>COP</div><div><div>source</div><div>XB2</div><div>0</div></div><div><div>destination</div><div>YB3</div><div>0</div></div><div><div>length</div><div>3</div></div></div>																																												
Relay combination	<table><tr><th rowspan="2">inst</th><th>relay</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th rowspan="2">const (32bit) (L/F)</th></tr><tr><th>type</th><th>X, DO</th><th>Y, DI, R, K, SP</th><th>T</th><th>C</th><th>M, S</th></tr><tr><th>arg.</th><th>n</th><th>(B, W, L, F) m</th><th>n : (B, W, L, F) m</th><th>n : (B, W, L, F) m</th><th>n : (B, W, L, F) m</th><th>n : (B, W, L, F) m</th><th></th></tr><tr><td rowspan="3">COP</td><td>src</td><td></td><td></td><td>X</td><td>X</td><td></td><td></td></tr><tr><td>dst</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td><td>X</td></tr><tr><td>len</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr></table>	inst	relay	Input	Output	Timer	Counter	Memory	const (32bit) (L/F)	type	X, DO	Y, DI, R, K, SP	T	C	M, S	arg.	n	(B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m		COP	src			X	X			dst	X	X	X	X		X	len	X	X	X	X	X	
inst	relay		Input	Output	Timer	Counter	Memory	const (32bit) (L/F)																																					
	type	X, DO	Y, DI, R, K, SP	T	C	M, S																																							
arg.	n	(B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m	n : (B, W, L, F) m																																							
COP	src			X	X																																								
	dst	X	X	X	X		X																																						
	len	X	X	X	X	X																																							
Factor	src: Source relay or value to be filled with (const). dst: Destination relay len: Length relay (or Number).																																												
Description	<p>If Rung is activated, copy the values from src to dst as many as the number of len.</p> <p>If src is a number, src value will be filled as many as the number of len from dst. In this case, when the dst is bit type, if src number is 0, OFF or else ON will be filled.</p> <p>If src is relay, the data type of src and dst should match.</p> <p>For example, if src is bit, dst should be bit, if src is byte(B), dst should be byte(B), if src is word(W) then dst should be word(w) as well.</p> <p>If src+len is greater than the maximum number of src relay, or if dst+len is greater than the maximum number of dst relay, copy will only progress until the maximum number of relay.</p>																																												
Usage example	<p>Example for designated number of copy)</p> <p>COP(X2,Y3,4): Y3=X2, Y4=X3, Y5=X4, Y6=X5</p> <p>COP(XB2,YB3,3): YB3=XB2, YB4=XB3, YB5=XB4</p> <p>COP(XW2,YW3,2): YW3=XW2, YW4=XW3</p> <p>Example for filling up with the designated value(const))</p> <p>COP(0,Y3,4): Y3=OFF, Y4=OFF, Y5=OFF, Y6=OFF</p> <p>COP(1,Y3,4): Y3=ON, Y4=ON, Y5=ON, Y6=ON</p> <p>COP(25,Y3,4): Y3=ON, Y4=ON, Y5=ON, Y6=ON</p> <p>COP(25,YB3,3): YB3=25, YB4=25, YB5=25</p> <p>COP(&H55AA,YW3,2): YW3=&H55AA, YW4=&H55AA</p> <p>COP(0,MW3,50): MW3=0, MW4=0, MW5=0, MW6=0, ~, MW52=0</p>																																												

6.27. CCOP(Conditional Copy data): Conditional Copy

Symbol	<div><div>CCOP</div><div>source aX20</div><div>source bR50</div><div>destinationY30</div><div>length3</div></div>																																																			
Relay combination	<table><tr><th rowspan="2">inst</th><th>relay</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th rowspan="2">const (32bit) (L/F)</th></tr><tr><th>type</th><th>X, DO</th><th>Y, DI, R, K, SP</th><th>T</th><th>C</th><th>M, S</th></tr><tr><th>arg.</th><th>n</th><th>(B, W, L, F) m</th><th>n (B, W, L, F) m</th><th>n (B, W, L, F) m</th><th>n (B, W, L, F) m</th><th>n (B, W, L, F) m</th><th></th></tr><tr><td rowspan="4">CCOP</td><td>sA</td><td></td><td></td><td>X</td><td>X</td><td></td><td></td></tr><tr><td>sB</td><td></td><td></td><td>X</td><td>X</td><td></td><td></td></tr><tr><td>dst</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td><td>X</td></tr><tr><td>len</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr></table>	inst	relay	Input	Output	Timer	Counter	Memory	const (32bit) (L/F)	type	X, DO	Y, DI, R, K, SP	T	C	M, S	arg.	n	(B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m		CCOP	sA			X	X			sB			X	X			dst	X	X	X	X		X	len	X	X	X	X	X	
inst	relay		Input	Output	Timer	Counter	Memory	const (32bit) (L/F)																																												
	type	X, DO	Y, DI, R, K, SP	T	C	M, S																																														
arg.	n	(B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m	n (B, W, L, F) m																																														
CCOP	sA			X	X																																															
	sB			X	X																																															
	dst	X	X	X	X		X																																													
	len	X	X	X	X	X																																														
Factor	<p>sA: When Rung is activated, source relay to copy, or value to be filled with (const)</p> <p>sB: When Rung is activated, source relay to copy, or value to be filled with (const)</p> <p>dst: Destination relay</p> <p>len: Length relay (or Number).</p>																																																			
Description	<p>Depends on Rung status, copy the values from sA or sB to dst as many as the number of len.</p> <p>If src is a number, sA/sB value will be filled as many as the number of len from dst. In this case, when the dst is bit type, if sA/sB number is 0, OFF or else ON will be filled.</p> <p>If sA/sB is relay, the data type of sA/sB and dst should match.</p> <p>For example, if sA/sB is bit, dst should be bit, if sA/sB is byte(B), dst should be byte(B), if sA/sB is word(W) then dst should be word(w) as well.</p> <p>If (sA/sB)+len is greater than the maximum number of sA/sB relay, or if dst+len is greater than the maximum number of dst relay, copy will only progress until the maximum number of relay.</p>																																																			
Usage example	<p>Example for designated number of copy)</p> <p>CCOP(X2,R5,Y3,3): If Rung is activated, Y3=X2, Y4=X3, Y5=X4</p> <p style="padding-left: 40px;">If Rung is deactivated, Y3=R5, Y4=R6, Y5=R7</p> <p>CCOP(1,0,Y3,3): If Rung is activated, Y3=ON, Y4=ON, Y5=ON</p> <p style="padding-left: 40px;">If Rung is deactivated, Y3=OFF, Y4=OFF, Y5=OFF</p> <p>Reference)</p> <p>Please refer to COP command as the examples of factor usage is similar to COP command.</p>																																																			


6.28. ROT(Rotating Output): Rotating Output

Symbol	<div><div>ROT</div><table><tr><td>start relay</td><td>MW51</td></tr><tr><td></td><td>0</td></tr><tr><td>count</td><td>6</td></tr><tr><td>timer relay</td><td>T5</td></tr><tr><td></td><td>1</td></tr><tr><td>repeat time(1/100s)</td><td>200</td></tr><tr><td>out relay</td><td>MW58</td></tr><tr><td></td><td>0</td></tr><tr><td>reset relay</td><td>X3</td></tr><tr><td></td><td>0</td></tr><tr><td>temp relay</td><td>MW60</td></tr><tr><td></td><td>0</td></tr></table></div>	start relay	MW51		0	count	6	timer relay	T5		1	repeat time(1/100s)	200	out relay	MW58		0	reset relay	X3		0	temp relay	MW60		0																																																																																											
start relay	MW51																																																																																																																			
	0																																																																																																																			
count	6																																																																																																																			
timer relay	T5																																																																																																																			
	1																																																																																																																			
repeat time(1/100s)	200																																																																																																																			
out relay	MW58																																																																																																																			
	0																																																																																																																			
reset relay	X3																																																																																																																			
	0																																																																																																																			
temp relay	MW60																																																																																																																			
	0																																																																																																																			
Relay combination	<table><tr><th rowspan="2">inst</th><th rowspan="2">relay type</th><th colspan="2">Input</th><th colspan="2">Output</th><th colspan="2">Timer</th><th colspan="2">Counter</th><th colspan="2">Memory</th><th rowspan="2">const (32bit) (L/F)</th></tr><tr><th>X, DO</th><th>Y, DI, R, K, SP</th><th>T</th><th>C</th><th>M, S</th></tr><tr><th></th><th>arg.</th><th>n (B,W,L,F)</th><th>m</th><th>n (B,W,L,F)</th><th>m</th><th>n (B,W,L,F)</th><th>m</th><th>n (B,W,L,F)</th><th>m</th><th>n (B,W,L,F)</th><th>m</th></tr><tr><td rowspan="6">ROT</td><td>st</td><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td><td>X</td></tr><tr><td>cnt</td><td>X</td><td></td><td>X</td><td>X</td><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td><td>X</td></tr><tr><td>tm</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr><tr><td>rep</td><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td><td>X</td></tr><tr><td>out</td><td>X</td><td>X</td><td>X</td><td></td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td><td>X</td></tr><tr><td>rst</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr><tr><td>tmp</td><td>X</td><td>X</td><td>X</td><td></td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr></table>	inst	relay type	Input		Output		Timer		Counter		Memory		const (32bit) (L/F)	X, DO	Y, DI, R, K, SP	T	C	M, S		arg.	n (B,W,L,F)	m	n (B,W,L,F)	m	n (B,W,L,F)	m	n (B,W,L,F)	m	n (B,W,L,F)	m	ROT	st	X		X		X		X		X		X	cnt	X		X	X	X		X		X		X	tm	X	X	X	X	X	X	X	X	X	X	X	rep	X		X		X		X		X		X	out	X	X	X		X	X	X	X	X		X	rst	X	X	X	X	X	X	X	X	X	X	X	tmp	X	X	X		X	X	X	X	X	X	X
inst	relay type			Input		Output		Timer		Counter		Memory			const (32bit) (L/F)																																																																																																					
		X, DO	Y, DI, R, K, SP	T	C	M, S																																																																																																														
	arg.	n (B,W,L,F)	m	n (B,W,L,F)	m	n (B,W,L,F)	m	n (B,W,L,F)	m	n (B,W,L,F)	m																																																																																																									
ROT	st	X		X		X		X		X		X																																																																																																								
	cnt	X		X	X	X		X		X		X																																																																																																								
	tm	X	X	X	X	X	X	X	X	X	X	X																																																																																																								
	rep	X		X		X		X		X		X																																																																																																								
	out	X	X	X		X	X	X	X	X		X																																																																																																								
	rst	X	X	X	X	X	X	X	X	X	X	X																																																																																																								
tmp	X	X	X		X	X	X	X	X	X	X																																																																																																									
Factor	<p>st: Start relay cnt: Count relay (or Number). tm: Timer relay(1/100sec unit). rep: Relay that designates the repeat time (or Number). out: Relay that outputs the result. rst: Relay that resets the output status. tmp:Relay that indicates which value to output for the operation.</p>																																																																																																																			
Description	<p>If Rung is activated, the relay value which is not 0, between the range of st and cnt will repeatedly output to out relay for rep time. If a signal input to rst relay, fill 0 from st relay as many number as cnt and initialize the timer value with rep value. Also 0 will be the output for out relay. This command can be used conveniently in order to output the occurred error numbers within the designated time in case when there are many types of errors for only one device to output the error number.</p>																																																																																																																			
Usage example	<div><div><div> ----- (Error condition 1) -----[MOV(21,MW51)]---</div><div> ----- (Error condition 2) -----[MOV(22,MW52)]---</div><div> ----- (Error condition 3) -----[MOV(23,MW53)]---</div><div> ----- (Error condition 4) -----[MOV(24,MW54)]---</div><div> ----- (Error condition 5) -----[MOV(25,MW55)]---</div><div> ----- (Error condition 6) -----[MOV(26,MW56)]---</div><div> -----[ROT(MW51,6,T5,200,MW58,X3,MW60)]---</div><div> -----[TOD(MW58,YB3)]----- </div></div><p>Above logic saves the error number into MW51~MW56, if more than one error among the 1~6 error conditions occurs. With the ROT command, the occurred error number will be saved in MW58 for 2 seconds and it will be converted to BCD value by TOD command to be displayed rotationally on a output device that is connected to YB3.</p><p>If a signal is entered to X3 that is connected to the external error reset, the contents of MW51~MW56 which stored the error number will be cleared to 0, as well as the MW58 and MW60. 0 will be displayed on output device.</p></div>																																																																																																																			

6.29. FOR(FOR): Block Repeat

Symbol	<div><div>FOR</div><div>idx SW61</div><div>initial 1</div><div>final 256</div><div>step 1</div></div>																																											
Relay combination	<table><tr><th rowspan="2">inst</th><th>relay type</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th rowspan="2">const (32bit) (L/F)</th></tr><tr><th>arg.</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th></tr><tr><td rowspan="4">FOR</td><td>idx</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td></tr><tr><td>init</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr><tr><td>final</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr><tr><td>step</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td></td></tr></table>	inst	relay type	Input	Output	Timer	Counter	Memory	const (32bit) (L/F)	arg.	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	FOR	idx	X	X	X	X	X	X	init	X	X	X	X	X		final	X	X	X	X	X		step	X	X	X	X	X	
inst	relay type		Input	Output	Timer	Counter	Memory	const (32bit) (L/F)																																				
	arg.	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m																																						
FOR	idx	X	X	X	X	X	X																																					
	init	X	X	X	X	X																																						
	final	X	X	X	X	X																																						
	step	X	X	X	X	X																																						
Factor	<p>idx: Index relay. Init: Initial value relay or number. final: Final value relay or number step: Relay or number that will be used as step.</p>																																											
Description	<p>If Rung is activated, repeat the block from init to final by increasing the idx relay value with the value of step, until it reaches to NEXT. When FOR clause is executed, enter the init value to the idx. FOR/NEXT clause can be nested up to 10 times. → FOR() FOR() FOR()NEXT NEXT NEXT. If step>0, and init>final, then do not execute and jump to NEXT. If step<0, and init<final, then do not execute and jump to NEXT. Final and step only uses the initial value from the beginning of for clause, even if they are assigned as variable. In order to exit from the middle of FOR clause exceptionally, you may use JMP(negative number) command. (Refer to JMP command description). Caution) FOR command do not provide additional process for branches</p>																																											
Usage example	<p>FOR(RB10,1,4,1): Repeatedly execute until it reaches to NEXT command from RB10=1 to RB10=4 by increasing 1 each time. { --[FOR(SW61,1,256,1)]--[XIC(X-1)]--[OTL(Y-1)]--[NEXT]--}: Repeatedly execute {XIC(X-1), OTL(Y-1)} command from SW61=1 to SW61=256 by increasing 1 each time. Among X1~X256, only the Y relay number that correspond to High signal number will be output and Y output of not entered number will retain the previous status. It is because of that idx is using a relay for indirect addressing (SW61~SW69) and the X relay of XIC and the Y relay of OTL is "-1" which will apply the number of SW61 value. Reference) Indirect addressing refers to as below. For any types of relay, if the address is set to -1 ~ -9, the value that saved in SW61~SW69 will be designated for the relay address.</p>																																											

6.30. NEXT(NEXT): Block Next

Symbol	
Factor	None
Description	<p>It will operate as below according to the step of FOR command.</p> <p>If step>0, it will be repeatedly executed until the value of inx relay is less than, or equal to the value of final.</p> <p>If step<0, it will be repeatedly executed until the value of inx relay is greater than, or equal to the value of final.</p> <p>If NEXT clause is executed without FOR clause, NEXT command will be ignored.</p> <p>Cautions)</p> <p>Since the FOR/NEXT commands do not provide additional process for branches, if FOR command is written in one branch and if the NEXT is written in outside of the branch, or in another branch, the FOR command will not operate properly.</p>
Usage Example	Please refer to the usage example of FOR command.

6.31. LBL(Label): Label Designation

Symbol	<div><div>LBL</div><div>label 99</div></div>																												
Relay Combination	<table><tr><th>relay</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th>const</th></tr><tr><th>type</th><th>X, DO</th><th>Y, DI, R, K, SP</th><th>T</th><th>C</th><th>M, S</th><th>(32bit)</th></tr><tr><th>inst</th><th>arg.</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>(L/F)</th></tr><tr><td>LBL</td><td>label</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td></tr></table>	relay	Input	Output	Timer	Counter	Memory	const	type	X, DO	Y, DI, R, K, SP	T	C	M, S	(32bit)	inst	arg.	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	(L/F)	LBL	label	x	x	x	x	x
relay	Input	Output	Timer	Counter	Memory	const																							
type	X, DO	Y, DI, R, K, SP	T	C	M, S	(32bit)																							
inst	arg.	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	(L/F)																							
LBL	label	x	x	x	x	x																							
Factor	label: Designate label No. or a value (const) greater than 0.																												
Description	Designate a location of label to jump with JMP command LBL command will be designated the location regardless of activated/deactivated status. In the case when there is an identical number of LBL command in one file.																												
Usage Example	Please refer to the JMP command description, because it will be used with JMP command.																												

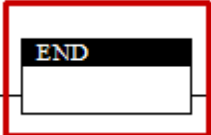

6.32. JMP(Jump): Jump

Symbol	<div><div>JMP</div><div>label 99</div></div>																																									
Relay Combination	<table><tr><th></th><th>relay type</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th>const (32bit)</th></tr><tr><th></th><th></th><th>X, DO</th><th>Y, DI, R, K, SP</th><th>T</th><th>C</th><th>M, S</th><th></th></tr><tr><th>inst</th><th>arg.</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>n (B,W,L,F) m</th><th>(L/F)</th></tr><tr><td>JMP</td><td>label</td><td>x</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr></table>											relay type	Input	Output	Timer	Counter	Memory	const (32bit)			X, DO	Y, DI, R, K, SP	T	C	M, S		inst	arg.	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	(L/F)	JMP	label	x	x	x	x	x	
	relay type	Input	Output	Timer	Counter	Memory	const (32bit)																																			
		X, DO	Y, DI, R, K, SP	T	C	M, S																																				
inst	arg.	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	n (B,W,L,F) m	(L/F)																																			
JMP	label	x	x	x	x	x																																				
Factor	label: Numeral(const) that is Label No. or relay																																									
Description	<p>If Rung is activated, it will jump to the location that has LBL command, which is identical with the value that is designated by label.</p> <p>It can be used as a function to exit from the middle of FOR clause exceptionally when label<0. (skip as the number of times designated as negative number)</p> <p>Caution1)</p> <p>In case when a location of label is upper than the JMP command and there is no condition before the JMP command, it can be fall into an infinite loop.</p> <p>In this case, scan time will exceed 5 seconds so it will set SP17=On.</p> <p>Caution2)</p> <p>In the case when exit from the FOR/NEXT block by using JMP(positive number), block control may cause an error, as there is no additional consideration. In this case, proceed to skip until the NEXT command by using JMP(negative number).</p>																																									
Usage Example	{ --[XIC(X21)]--[JMP(25)]--[.....]--[LBL(25)]--}: If X21 relay is 1, it will jump to the location where LBL(25) is by JMP(25)command. Even if LBL command is located in other Rung, it will operate normally.																																									

6.33. CALL(Call): Call Sub-ladder

Symbol	<div><div>CALL</div><div>file number 21</div></div>																																			
Relay Combination	<table><tr><th>relay</th><th>Input</th><th>Output</th><th>Timer</th><th>Counter</th><th>Memory</th><th>const (32bit)</th></tr><tr><th>type</th><td>X, DO</td><td>Y, DI, R, K, SP</td><td>T</td><td>C</td><td>M, S</td><td>(L/F)</td></tr><tr><th>inst</th><td>arg.</td><td>n</td><td>n</td><td>n</td><td>n</td><td>n</td></tr><tr><th></th><td>(B, W, L, F) m</td><td>(B, W, L, F) m</td><td>(B, W, L, F) m</td><td>(B, W, L, F) m</td><td>(B, W, L, F) m</td><td>(B, W, L, F) m</td></tr><tr><td>CALL</td><td>S_file</td><td>x</td><td>x</td><td>x</td><td>x</td><td></td></tr></table>	relay	Input	Output	Timer	Counter	Memory	const (32bit)	type	X, DO	Y, DI, R, K, SP	T	C	M, S	(L/F)	inst	arg.	n	n	n	n	n		(B, W, L, F) m	(B, W, L, F) m	(B, W, L, F) m	(B, W, L, F) m	(B, W, L, F) m	(B, W, L, F) m	CALL	S_file	x	x	x	x	
relay	Input	Output	Timer	Counter	Memory	const (32bit)																														
type	X, DO	Y, DI, R, K, SP	T	C	M, S	(L/F)																														
inst	arg.	n	n	n	n	n																														
	(B, W, L, F) m	(B, W, L, F) m	(B, W, L, F) m	(B, W, L, F) m	(B, W, L, F) m	(B, W, L, F) m																														
CALL	S_file	x	x	x	x																															
Factor	file number: Relay or number that designates Sub-ladder's file No.(1~99)																																			
Description	<p>If Rung is activated, it will call Sub-ladder with the number that is designated by file number.</p> <p>File names of Sub-Ladder can exist maximum of 99 between S01xxxx.LAD ~ S99xxxx.LAD, 'xxxx' in the file name can be named by a user, and it can be up to 15 characters..</p>																																			
Usage Example	<div><div><div>X23</div><div></div></div><div><div>FOR</div><div>idx RW1</div><div>init 1</div><div>final 99</div><div>step 1</div></div><div><div>CALL</div><div>file number RW1</div></div><div><div>NEXT</div><div></div></div></div> <p>If X23 signal is being received, the files from S01xxxx.LAD to S99xxxx.LAD will be called rotationally.</p> <p>From the result of CALL command's execution, if the Sub-Ladder of corresponding number does not exist, or if it exceeds the range of 1 ~ 99, it will set SP18=On. If it is executed normally, it will set SP18=Off. Therefore, it is able to detect error by using SP18 after calling in case when Sub-Ladder needs to exist..</p> <p>Arrange to use CALL command to call the Sub-ladder of 1 ~ 99 from the Main-ladder, and assign the Sub-ladder number for each applications. By doing that, and load only necessary Sub-ladder according to the application with the Controller, you can expect an effect that the corresponding ladder will be executed automatically.</p>																																			

6.34. END(End): Ladder End

Symbol	
Factor	None
Description	If Rung is activated, terminate the currently processing ladder. If the currently processing ladder is a Sub-ladder, it will return to the Main-ladder. If the currently processing ladder is Main-ladder, terminate the process and restart it from the beginning.
Usage Example	 <p>If initialization process is required, compose the initialization process as S01 Initialize.LAD file and arrange it to call No.1 from the Main-Ladder. Then add it to the first Rung in S01. Since SP3 is a relay that only goes On during the one scan of the beginning of operation, S01 will only be executed once. From the next scan, it will be returned from the first Rung.</p>





- **Head Office**

Tel. 82-52-202-7901 / Fax. 82-52-202-7900
1, Jeonha-dong, Dong-gu, Ulsan, Korea

- **A/S Center**

Tel. 82-52-202-5041 / Fax. 82-52-202-7960

- **Seoul Office**

Tel. 82-2-746-4711 / Fax. 82-2-746-4720
140-2, Gye-dong, Jongno-gu, Seoul, Korea

- **Ansan Office**

Tel. 82-31-409-4945 / Fax. 82-31-409-4946
1431-2, Sa-dong, Sangnok-gu, Ansan-si, Gyeonggi-do, Korea

- **Cheonan Office**

Tel. 82-41-576-4294 / Fax. 82-41-576-4296
355-15, Daga-dong, Cheonan-si, Chungcheongnam-do, Korea

- **Daegu Office**

Tel. 82-53-746-6232 / Fax. 82-53-746-6231
223-5, Beomeo 2-dong, Suseong-gu, Daegu, Korea

- **Gwangju Office**

Tel. 82-62-363-5272 / Fax. 82-62-363-5273
415-2, Nongseong-dong, Seo-gu, Gwangju, Korea

- **본사**

Tel. 052-202-7901 / Fax. 052-202-7900
울산광역시 동구 전하동 1번지

- **A/S 센터**

Tel. 82-52-202-5041 / Fax. 82-52-202-7960

- **서울 사무소**

Tel. 02-746-4711 / Fax. 02-746-4720
서울특별시 종로구 계동 140-2번지

- **안산 사무소**

Tel. 031-409-4945 / Fax. 031-409-4946
경기도 안산시 상록구 사동 1431-2번지

- **천안 사무소**

Tel. 041-576-4294 / Fax. 041-576-4296
충남 천안시 다가동 355-15번지

- **대구 사무소**

Tel. 053-746-6232 / Fax. 053-746-6231
대구광역시 수성구 범어 2동 223-5번지

- **광주 사무소**

Tel. 062-363-5272 / Fax. 062-363-5273
광주광역시 서구 농성동 415-2번지