

مرادل اجرای اتوماسیون با استفاده از PLC

مشخص کردن تعداد ورودی-خروجی

تخمین حجم برنامه و انتخاب PLC

نوشتن برنامه

شبیه سازی و عیبیابی

تست روی سیستم واقعی

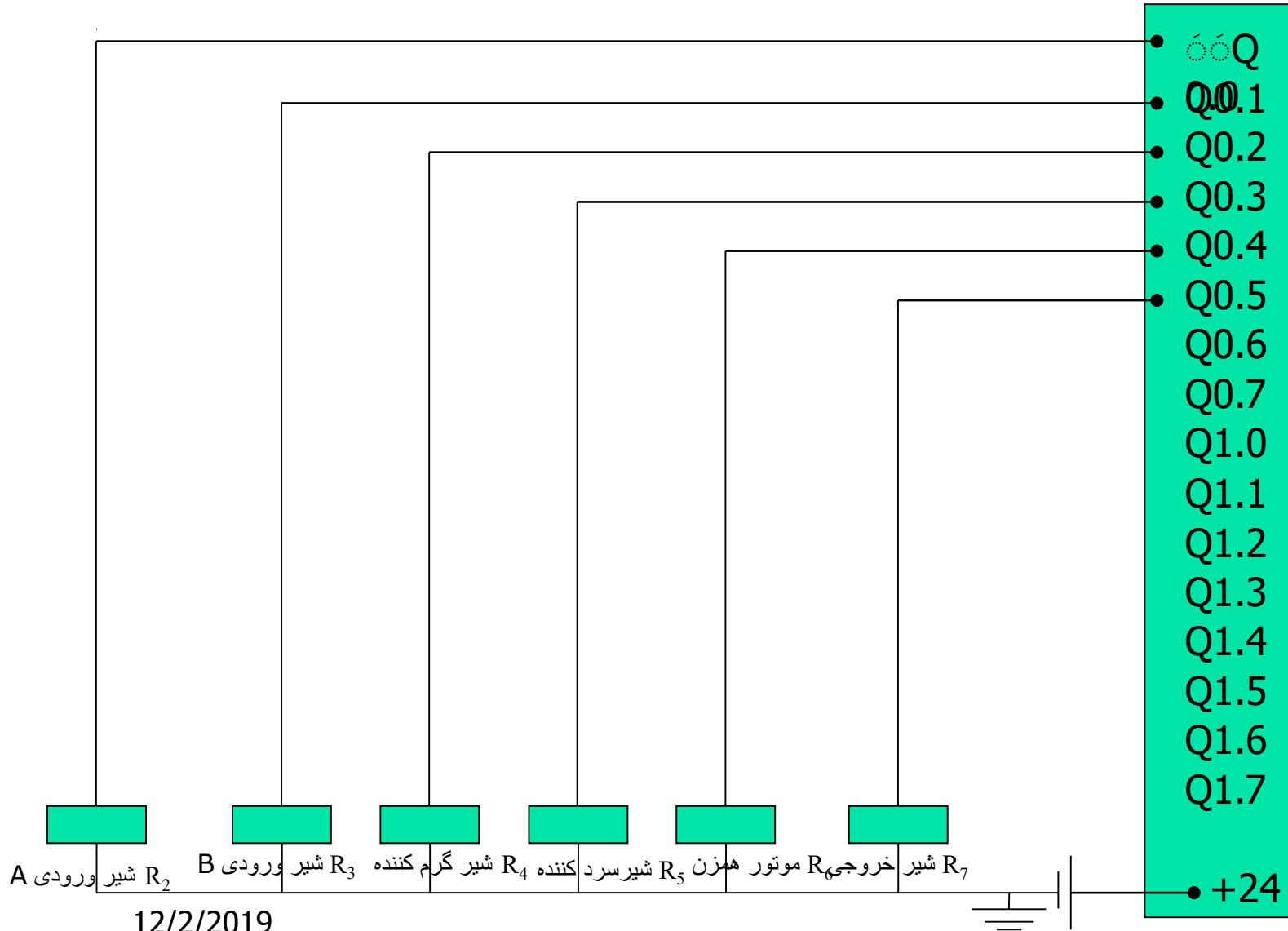
نظارت بر سیستم با استفاده از
نرم افزار مونیتورینگ

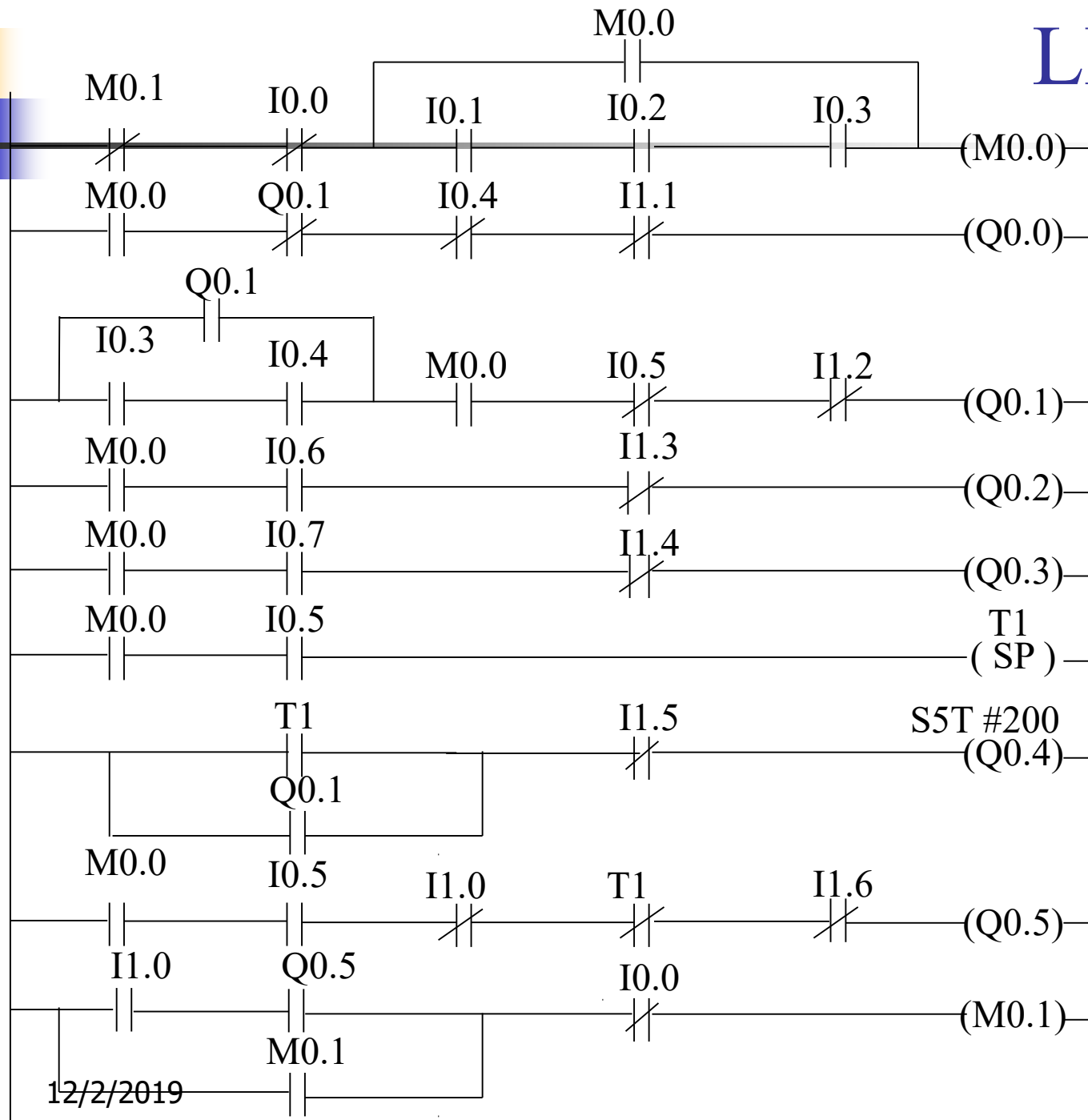
ورودهای سیستم نمونه

- نحوه اسم گذاری



خروجیهای سیستم نمونه







زبانهای برنامه نویسی PLC

استاندارد IEC 61131-3

زبان دیاگرام نردبانی (LD) LADDER DIAGRAM

Instruction List (IL) -یا (STL)

Function Block Diagram (FBD)

Sequential Function Chart (SFC)

Structured Text (ST)



دستورالعمل‌های زبان برنامه نویسی LADDER

1 Bit Logic Instructions

1.1	Overview of Bit Logic Instructions.....
1.2	XOR Bit Exclusive OR.....
1.3	---| |--- Normally Open Contact (Address).....
1.4	---| / |--- Normally Closed Contact (Address)
1.5	--|NOT|-- Invert Power Flow.....
1.6	---() Output Coil
1.7	---(#)--- Midline Output.....
1.8	---(R) Reset Coil
1.9	---(S) Set Coil
1.10	RS Reset-Set Flip Flop.....
1.11	SR Set-Reset Flip Flop.....
1.12	---(N)--- Negative RLO Edge Detection
1.13	---(P)--- Positive RLO Edge Detection.....
1.14	---(SAVE) Save RLO into BR Memory
1.15	NEG Address Negative Edge Detection.....
1.16	POS Address Positive Edge Detection
1.17	Immediate Read.....
1.18	Immediate Write

2 Comparison Instructions

- 2.1 Overview of Comparison Instructions
- 2.2 CMP ? I Compare Integer.....
- 2.3 CMP ? D Compare Double Integer
- 2.4 CMP ? R Compare Real.....

3 Conversion Instructions

- 3.1 Overview of Conversion Instructions.....
- 3.2 BCD_I BCD to Integer
- 3.3 I_BCD Integer to BCD
- 3.4 I_DINT Integer to Double Integer.....
- 3.5 BCD_DI BCD to Double Integer.....
- 3.6 DI_BCD Double Integer to BCD.....
- 3.7 DI_REAL Double Integer to Floating-Point.....
- 3.8 INV_I Ones Complement Integer
- 3.9 INV_DI Ones Complement Double Integer
- 3.10 NEG_I Twos Complement Integer
- 3.11 NEG_DI Twos Complement Double Integer.....
- 3.12 NEG_R Negate Floating-Point Number
- 3.13 ROUND Round to Double Integer.....
- 3.14 TRUNC Truncate Double Integer Part
- 3.15 CEIL Ceiling.....
- 3.16 FLOOR Floor

4 Counter Instructions

4.1	Overview of Counter Instructions.....
4.2	S_CUD Up-Down Counter.....
4.3	S_CU Up Counter.....
4.4	S_CD Down Counter.....
4.5	---(SC) Set Counter Value.....
4.6	---(CU) Up Counter Coil.....
4.7	---(CD) Down Counter Coil.....

5 Data Block Instructions

5.1	---(OPN) Open Data Block: DB or DI.....
-----	---

6 Logic Control Instructions

6.1	Overview of Logic Control Instructions.....
6.2	---(JMP)--- Unconditional Jump.....
6.3	---(JMP)--- Conditional Jump.....
6.4	---(JMPN) Jump-If-Not.....
6.5	LABEL Label.....

7 Integer Math Instructions

7.1	Overview of Integer Math Instructions.....
7.2	Evaluating the Bits of the Status Word with Integer Math Instructions
7.3	ADD_I Add Integer.....
7.4	SUB_I Subtract Integer
7.5	MUL_I Multiply Integer
7.6	DIV_I Divide Integer
7.7	ADD_DI Add Double Integer
7.8	SUB_DI Subtract Double Integer.....
7.9	MUL_DI Multiply Double Integer.....
7.10	DIV_DI Divide Double Integer
7.11	MOD_DI Return Fraction Double Integer.....

8 Floating Point Math

8.1	Overview of Floating-Point Math Instructions.....
8.2	Evaluating the Bits of the Status Word with Floating-Point Math Instructions
8.3	Basic Instructions.....
8.3.1	ADD_R Add Real.....
8.3.2	SUB_R Subtract Real.....
8.3.3	MUL_R Multiply Real.....
8.3.4	DIV_R Divide Real.....
8.3.5	ABS Establish the Absolute Value of a Floating-Point Number.....
8.4	Extended Instructions.....
8.4.1	SQR Establish the Square.....
8.4.2	SQRT Establish the Square Root.....
8.4.3	LN Establish the Natural Logarithm.....
8.4.4	EXP Establish the Exponential Value.....
8.4.5	SIN Establish the Sine Value.....
8.4.6	COS Establish the Cosine Value.....
8.4.7	TAN Establish the Tangent Value.....
8.4.8	ASIN Establish the Arc Sine Value.....
8.4.9	ACOS Establish the Arc Cosine Value.....
8.4.10	ATAN Establish the Arc Tangent Value.....



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9 Move Instructions

9.1 MOVE Assign a Value

10 Program Control Instructions

10.1 Overview of Program Control Instructions.....

10.2 --- (Call) Call FC SFC from Coil (without Parameters)

10.3 CALL_FB Call FB from Box

10.4 CALL_FC Call FC from Box.....

10.5 CALL_SFB Call System FB from Box

10.6 CALL_SFC Call System FC from Box.....

10.7 Call Multiple Instance

10.8 Call Block from a Library

10.9 Important Notes on Using MCR Functions.....

10.10 --- (MCR<) Master Control Relay On

10.11 --- (MCR>) Master Control Relay Off

10.12 --- (MCRA) Master Control Relay Activate

10.13 --- (MCRD) Master Control Relay Deactivate

10.14 --- (RET) Return

11 Shift and Rotate Instructions

11.1	Shift Instructions.....	.....
11.1.1	Overview of Shift Instructions .....	.....
11.1.2	SHR_I Shift Right Integer .....	.....
11.1.3	SHR_DI Shift Right Double Integer.....	.....
11.1.4	SHL_W Shift Left Word .....	.....
11.1.5	SHR_W Shift Right Word .....	.....
11.1.6	SHL_DW Shift Left Double Word.....	.....
11.1.7	SHR_DW Shift Right Double Word.....	.....
11.2	Rotate Instructions .....	.....
11.2.1	Overview of Rotate Instructions.....	.....
11.2.2	ROL_DW Rotate Left Double Word .....	.....
11.2.3	ROR_DW Rotate Right Double Word .....	.....

12 Status Bit Instructions

12.1	Overview of Statusbit Instructions.....
12.2	OV ---| |--- Exception Bit Overflow.....
12.3	OS ---| |--- Exception Bit Overflow Stored
12.4	UO ---| |--- Exception Bit Unordered.....
12.5	BR ---| |--- Exception Bit Binary Result.....
12.6	==0 ---| |--- Result Bit Equal 0.....
12.7	<>0 ---| |--- Result Bit Not Equal 0.....
12.8	>=0 ---| |--- Result Bit Greater Equal 0
12.9	<=0 --- --- Result Bit Less Equal 0.....
12.10	>0 --- --- Result Bit Greater Than 0
12.11	<0 --- --- Result Bit Less Than 0.....

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13 Timer Instructions

13.1	Overview of Timer Instructions
13.2	Location of a Timer in Memory and Components of a Timer
13.3	S_PULSE Pulse S5 Timer
13.4	S_PEXT Extended Pulse S5 Timer
13.5	S_ODT On-Delay S5 Timer.....
13.6	S_ODTS Retentive On-Delay S5 Timer.....
13.7	S_OFFDT Off-Delay S5 Timer.....
13.8	---(SP) Pulse Timer Coil
13.9	---(SE) Extended Pulse Timer Coil.....
13.10	---(SD) On-Delay Timer Coil
13.11	---(SS) Retentive On-Delay Timer Coil.....
13.12	---(SF) Off-Delay Timer Coil

14 Word Logic Instructions

14.1	Overview of Word Logic Instructions
14.2	WAND_W (Word) AND Word
14.3	WOR_W (Word) OR Word
14.4	WAND_DW (Word) AND Double Word.....
14.5	WOR_DW (Word) OR Double Word.....
14.6	WXOR_W (Word) Exclusive OR Word
14.7	WXOR_DW (Word) Exclusive OR Double Word

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1 Bit Logic Instructions

1.1	Overview of Bit Logic Instructions.....
1.2	A And.....
1.3	AN And Not.....
1.4	O Or.....
1.5	ON Or Not.....
1.6	X Exclusive Or
1.7	XN Exclusive Or Not.....
1.8	O And before Or.....
1.9	A(And with Nesting Open
1.10	AN(And Not with Nesting Open
1.11	O(Or with Nesting Open
1.12	ON(Or Not with Nesting Open
1.13	X(Exclusive Or with Nesting Open
1.14	XN(Exclusive Or Not with Nesting Open
1.15	) Nesting Closed.....
1.16	= Assign.....
1.17	R Reset.....
1.18	S Set.....
1.19	NOT Negate RLO.....
1.20	SET Set RLO (=1).....
1.21	CLR Clear RLO (=0).....
1.22	SAVE Save RLO in BR Register.....
1.23	FN Edge Negative.....
1.24	FP Edge Positive.....

2 Comparison Instructions

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2

Comparison Instructions

2.1	Overview of Comparison Instructions
2.2	? I Compare Integer (16-Bit)
2.3	? D Compare Double Integer (32-Bit).....
2.4	? R Compare Floating-Point Number (32-Bit).....

3

Conversion Instructions

3.1	Overview of Conversion Instructions.....
3.2	BTI BCD to Integer (16-Bit).....
3.3	ITB Integer (16-Bit) to BCD.....
3.4	BTD BCD to Integer (32-Bit)
3.5	ITD Integer (16 Bit) to Double Integer (32-Bit).....
3.6	DTB Double Integer (32-Bit) to BCD
3.7	DTR Double Integer (32-Bit) to Floating-Point (32-Bit IEEE-FP)....
3.8	INVI Ones Complement Integer (16-Bit)
3.9	INVD Ones Complement Double Integer (32-Bit)
3.10	NEGI Twos Complement Integer (16-Bit).....
3.11	NEGD Twos Complement Double Integer (32-Bit)
3.12	NEGR Negate Floating-Point Number (32-Bit, IEEE-FP)
3.13	CAW Change Byte Sequence in ACCU 1-L (16-Bit).....
3.14	CAD Change Byte Sequence in ACCU 1 (32-Bit)
3.15	RND Round
3.16	TRUNC Truncate
3.17	RND+ Round to Upper Double Integer
3.18	RND- Round to Lower Double Integer

Data Block Instructions

5.1	Overview of Data Block Instructions
5.2	OPN Open a Data Block
5.3	CDB Exchange Shared DB and Instance DB.....
5.4	L DBLG Load Length of Shared DB in ACCU 1
5.5	L DBNO Load Number of Shared DB in ACCU 1
5.6	L DILG Load Length of Instance DB in ACCU 1.....
5.7	L DINO Load Number of Instance DB in ACCU 1

Integer Math Instructions

7.1	Overview of Integer Math Instructions.....
7.2	Evaluating the Bits of the Status Word with Integer Math Instructions ...
7.3	+I Add ACCU 1 and ACCU 2 as Integer (16-Bit)
7.4	-I Subtract ACCU 1 from ACCU 2 as Integer (16-Bit)
7.5	*I Multiply ACCU 1 and ACCU 2 as Integer (16-Bit)
7.6	/I Divide ACCU 2 by ACCU 1 as Integer (16-Bit).....
7.7	+ Add Integer Constant (16, 32-Bit)
7.8	+D Add ACCU 1 and ACCU 2 as Double Integer (32-Bit).....
7.9	-D Subtract ACCU 1 from ACCU 2 as Double Integer (32-Bit).....
7.10	*D Multiply ACCU 1 and ACCU 2 as Double Integer (32-Bit).....
7.11	/D Divide ACCU 2 by ACCU 1 as Double Integer (32-Bit)
7.12	MOD Division Remainder Double Integer (32-Bit).....

6 Logic Control Instructions

6.1	Overview of Logic Control Instructions.....
6.2	JU Jump Unconditional
6.3	JL Jump to Labels.....
6.4	JC Jump if RLO = 1
6.5	JCN Jump if RLO = 0
6.6	JCB Jump if RLO = 1 with BR
6.7	JNB Jump if RLO = 0 with BR
6.8	JBI Jump if BR = 1
6.9	JNBI Jump if BR = 0.....
6.10	JO Jump if OV = 1.....
6.11	JOS Jump if OS = 1
6.12	JZ Jump if Zero
6.13	JN Jump if Not Zero
6.14	JP Jump if Plus
6.15	JM Jump if Minus
6.16	JPZ Jump if Plus or Zero
6.17	JMZ Jump if Minus or Zero.....
6.18	JUO Jump if Unordered.....
6.19	LOOP Loop.....

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Floating-Point Math Instructions

8.1	Overview of Floating-Point Math Instructions
8.2	Evaluating the Bits of the Status Word with Floating-Point Math Instructions
8.3	Floating-Point Math Instructions: Basic
8.3.1	+R Add ACCU 1 and ACCU 2 as a Floating-Point Number (32-Bit IEEE-FP)
8.3.2	-R Subtract ACCU 1 from ACCU 2 as a Floating-Point Number (32-Bit IEEE-FP)
8.3.3	*R Multiply ACCU 1 and ACCU 2 as Floating-Point Numbers (32-Bit IEEE-FP)
8.3.4	/R Divide ACCU 2 by ACCU 1 as a Floating-Point Number (32 Bit IEEE-FP)
8.3.5	ABS Absolute Value of a Floating-Point Number (32-Bit IEEE-FP).....
8.4	Floating-Point Math Instructions: Extended.....
8.4.1	SQR Generate the Square of a Floating-Point Number (32-Bit)
8.4.2	SQRT Generate the Square Root of a Floating-Point Number (32-Bit)
8.4.3	EXP Generate the Exponential Value of a Floating-Point Number (32-Bit)
8.4.4	LN Generate the Natural Logarithm of a Floating-Point Number (32-Bit) ...
8.4.5	SIN Generate the Sine of Angles as Floating-Point Numbers (32-Bit)
8.4.6	COS Generate the Cosine of Angles as Floating-Point Numbers (32-Bit)..
8.4.7	TAN Generate the Tangent of Angles as Floating-Point Numbers (32-Bit)
8.4.8	ASIN Generate the Arc Sine of a Floating-Point Number (32-Bit)
8.4.9	ACOS Generate the Arc Cosine of a Floating-Point Number (32-Bit)
8.4.10	ATAN Generate the Arc Tangent of a Floating-Point Number (32-Bit)

Load and Transfer Instructions

9.1	Overview of Load and Transfer Instructions.....
9.2	L Load.....
9.3	L STW Load Status Word into ACCU 1.....
9.4	LAR1 Load Address Register 1 from ACCU 1.....
9.5	LAR1 <D> Load Address Register 1 with Double Integer (32-Bit Pointer)..
9.6	LAR1 AR2 Load Address Register 1 from Address Register 2
9.7	LAR2 Load Address Register 2 from ACCU 1.....
9.8	LAR2 <D> Load Address Register 2 with Double Integer (32-Bit Pointer)..
9.9	T Transfer
9.10	T STW Transfer ACCU 1 into Status Word
9.11	CAR Exchange Address Register 1 with Address Register 2
9.12	TAR1 Transfer Address Register 1 to ACCU 1
9.13	TAR1 <D> Transfer Address Register 1 to Destination (32-Bit Pointer).....
9.14	TAR1 AR2 Transfer Address Register 1 to Address Register 2
9.15	TAR2 Transfer Address Register 2 to ACCU 1
9.16	TAR2 <D> Transfer Address Register 2 to Destination (32-Bit Pointer)....

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Program Control Instructions

10.1	Overview of Program Control Instructions.....
10.2	BE Block End.....
10.3	BEC Block End Conditional
10.4	BEU Block End Unconditional
10.5	CALL Block Call
10.6	Call FB.....
10.7	Call FC
10.8	Call SFB
10.9	Call SFC
10.10	Call Multiple Instance
10.11	Call Block from a Library
10.12	CC Conditional Call.....
10.13	UC Unconditional Call
10.14	MCR (Master Control Relay)
10.15	Important Notes on Using MCR Functions.....
10.16	MCR(Save RLO in MCR Stack, Begin MCR
10.17	)MCR End MCR.....
10.18	MCRA Activate MCR Area
10.19	MCRD Deactivate MCR Area

Shift and Rotate Instructions

11.1	Shift Instructions
11.1.1	Overview of Shift Instructions
11.1.2	SSI Shift Sign Integer (16-Bit).....
11.1.3	SSD Shift Sign Double Integer (32-Bit)
11.1.4	SLW Shift Left Word (16-Bit)
11.1.5	SRW Shift Right Word (16-Bit)
11.1.6	SLD Shift Left Double Word (32-Bit)
11.1.7	SRD Shift Right Double Word (32-Bit)
11.2	Rotate Instructions
11.2.1	Overview of Rotate Instructions.....
11.2.2	RLD Rotate Left Double Word (32-Bit).....
11.2.3	RRD Rotate Right Double Word (32-Bit).....
11.2.4	RLDA Rotate ACCU 1 Left via CC 1 (32-Bit).....
11.2.5	RRDA Rotate ACCU 1 Right via CC 1 (32-Bit).....

Timer Instructions

12.1	Overview of Timer Instructions
12.2	Location of a Timer in Memory and Components of a Timer
12.3	FR Enable Timer (Free)
12.4	L Load Current Timer Value into ACCU 1 as Integer.....
12.5	LC Load Current Timer Value into ACCU 1 as BCD.....
12.6	R Reset Timer.....
12.7	SP Pulse Timer
12.8	SE Extended Pulse Timer
12.9	SD On-Delay Timer
12.10	SS Retentive On-Delay Timer
12.11	SF Off-Delay Timer

Word Logic Instructions

13.1	Overview of Word Logic Instructions.....
13.2	AW AND Word (16-Bit).....
13.3	OW OR Word (16-Bit)
13.4	XOW Exclusive OR Word (16-Bit).....
13.5	AD AND Double Word (32-Bit).....
13.6	OD OR Double Word (32-Bit)
13.7	XOD Exclusive OR Double Word (32-Bit)

Accumulator Instructions

14.1	Overview of Accumulator and Address Register Instructions.....
14.2	TAK Toggle ACCU 1 with ACCU 2
14.3	POP CPU with Two ACCUs.....
14.4	POP CPU with Four ACCUs
14.5	PUSH CPU with Two ACCUs
14.6	PUSH CPU with Four ACCUs.....
14.7	ENT Enter ACCU Stack.....
14.8	LEAVE Leave ACCU Stack
14.9	INC Increment ACCU 1-L-L
14.10	DEC Decrement ACCU 1-L-L
14.11	+AR1 Add ACCU 1 to Address Register 1
14.12	+AR2 Add ACCU 1 to Address Register 2
14.13	BLD Program Display Instruction (Null).....
14.14	NOP 0 Null Instruction.....
14.15	NOP 1 Null Instruction.....