

# Appendix F

## AutoMax Enhanced Ladder Language Execution Times and Memory Usage for AutoMax 7010 & 6011

Unless otherwise noted in the table or implied by the instruction itself, all block instruction execution times are based on non-indexed, 16-bit variables. Relay instruction execution times are based on simple Boolean variables. Using arrays increases the execution time of the instruction.

Category	Code	Title	7010 Execution Time (μs)		6011 Execution Time (μs)		Bytes of Memory
			True	False	True	False	
Relay	NOI	Normally Open Contact	0.4	0.4	1.5	1.5	6
	NCI	Normally Closed Contact	0.4	0.4	1.5	1.5	6
	PTI	Positive Transition Contact	0.8	0.8	3.0	3.0	6
	NTI	Negative Transition Contact	0.8	0.8	3.0	3.0	6
	ATI	Always True Contact	0.2	0.2	0.5	0.5	5
	AFI	Always False Contact	0.2	0.2	0.5	0.5	5
	CO	Coil	4.5	4.5	18.0	18.0	8
	SCO	Set (Latch) Coil	4.5	1.6	18.0	6.8	10
	RCO	Reset (Unlatch) Coil	4.5	1.6	18.0	6.8	10

## Appendix F (continued)

Category	Code	Title	7010 Execution Time ( $\mu$ s)		6011 Execution Time ( $\mu$ s)		Bytes of Memory
			True	False	True	False	
Branch	LNET	Start of Ladder Network	1.3	1.3	5.3	5.3	16
	BST	Branch Start	0.3	0.4	0.8	1.3	2
		(with ABND)	0.6	0.6	2.0	2.0	4
	NXB	Next Branch	0.3	0.4	0.8	1.3	2
		(with ABND)	0.8	0.8	2.5	2.5	4
	BND	Branch End	0.0	0.0	0.0	0.0	0
ABND	Always Branch End	0.6	0.6	2.0	2.0	5	
Counter	CTUD	Count Up	8.2	3.1	36.0	12.5	12
		Count Down	8.2	--	36.0	--	--
		Reset	6.7	--	29.3	--	--
		Load	7.2	--	32.0	--	--
Timers	TON	Timer On Delay	7.6	3.6	36.8	17.0	10
	TOF	Timer Off Delay	3.8	7.6	18.0	36.8	--
	TP	Timer Pulse	7.0	4.2	35.5	19.3	--
	RTO	Retentive Timer On	7.5	3.9	36.8	17.5	--
		Reset	4.1	--	19.3	--	--

## Appendix F (continued)

Category	Code	Title	7010 Execution Time ( $\mu$ s)		6011 Execution Time ( $\mu$ s)		Bytes of Memory
			True	False	True	False	
Compare	EQ2	2-Input Equal	5.4	1.9	21.0	7.3	17
	GE2	2-Input Greater or Equal	5.4	1.9	21.0	7.3	17
	GT2	2-Input Greater	5.4	1.9	21.0	7.3	17
	LE2	2-Input Less or Equal	5.4	1.9	21.0	7.3	17
	LT2	2-Input Less	5.4	1.9	21.0	7.3	17
	NE2	2-Input Not Equal	5.4	1.9	21.0	7.3	17
	EQ3	3-Input Equal	8.2	4.4	31.3	16.5	24
	GE3	3-Input Greater or Equal	8.2	4.4	31.3	16.5	24
	GT3	3-Input Greater	8.2	4.4	31.3	16.5	24
	LE3	3-Input Less or Equal	8.2	4.4	31.3	16.5	24
	LT3	3-Input Less	8.2	4.4	31.3	16.5	24
	NE3	3-Input Not Equal	8.5	4.4	32.5	16.5	24
	LIMIT	Clamp at Limits	9.7	4.4	36.5	16.5	28
MSK	Mask Compare	8.0	4.4	31.0	16.5	24	

## Appendix F (continued)

Category	Code	Title	7010 Execution Time ( $\mu$ s)		6011 Execution Time ( $\mu$ s)		Bytes of Memory
			True	False	True	False	
Compute	ABS	Absolute Value	5.7	1.9	22.0	7.3	17
	ADD2	2-Input Add	5.7	1.9	21.8	7.3	19
	ADD3	3-Input Add	10.0	4.4	38.3	16.5	26
		(32-bit)	14.3	--	59.5	--	--
	DIV	Divide	9.5	1.9	43.5	7.3	21
		(32-bit / 32-bit)	10.8	--	230.0	--	--
	MOD	Modulo	9.8	1.9	45.0	7.3	21
	MUL	Multiply	6.8	1.9	27.0	7.3	21
		(32-bit * 32-bit)	8.3	--	101.8	--	--
	MDV	Multiply Divide	13.0	4.4	57.3	16.5	26
		((32 * 32 = 64-bit) / 32-bit)	15.4	--	674.5	--	--
	NEG	Negate	5.5	1.9	21.3	7.3	17
	SQRT	Square Root	31.8	1.9	113.5	7.3	17
		(32-bit)	53.2	--	233.8	--	--
SUB	Subtract	5.8	1.9	22.3	7.3	19	

## Appendix F (continued)

Category	Code	Title	7010 Execution Time ( $\mu$ s)		6011 Execution Time ( $\mu$ s)		Bytes of Memory
			True	False	True	False	
Logical	AND	And	5.6	1.9	21.0	7.3	19
	NOT	Not	5.2	1.9	20.0	7.3	17
	OR	Or	5.6	1.9	21.0	7.3	19
	XOR	Exclusive Or	5.6	1.9	21.0	7.3	19
Convert	BCD_TO	Binary to BCD	13.5	1.9	64.5	7.3	17
		(32-bit to 8-digit)	20.9	--	115.0	--	--
	TO_BCD	BCD to Binary	13.6	1.9	76.3	7.3	17
		(8-digit to 32-bit)	23.4	--	147.0	--	--
Bit Move	MVB	Move Bits	37.9	29.2	157.8	114.8	40
	MOVE	Move Source to Destination	5.1	1.9	19.5	7.3	17
	MVM	Masked Move	6.8	1.9	26.3	7.3	21
Array	AR1	Unary Array Operation	--	5.5	--	21.8	183
		Single Scan (Length < 32768)	81.2 + (AR1 operation)	--	350.0 + (AR1 operation)	--	--
		Single Scan (Length > 32767)	81.2 + (AR1 operation)	--	555.0 + (AR1 operation)	--	--

## Appendix F (continued)

Category	Code	Title	7010 Execution Time ( $\mu$ s)		6011 Execution Time ( $\mu$ s)		Bytes of Memory
			True	False	True	False	
Array (Continued)	AR1 (Continued)	1st Scan Initialization (Length < 32768)	67.6	--	295.0	--	--
		1st Scan Initialization (Length > 32767)	67.6	--	500.0	--	--
		2nd through Nth Scan (AR1 Operation)	20.0 + (AR1 operation)	--	81.5 + (AR1 operation)	--	--
		NOT Scan	1.7 * words	--	8.5 * words	--	--
		ABS Scan	2.0 * words	--	10.0 * words	--	--
		NEG Scan	1.9 * words	--	9.3 * words	--	--
		SQRT Scan	29.3 * words	--	107.3 * words	--	--
		MOV Scan	1.6 * words	--	8.0 * words	--	--
	AR2	Binary Array Operation	--	5.5	--	21.8	223
		Single Scan (Length < 32768)	100.9 + (AR2 operation)	--	435.0 + (AR2 operation)	--	--

## Appendix F (continued)

Category	Code	Title	7010 Execution Time ( $\mu$ s)		6011 Execution Time ( $\mu$ s)		Bytes of Memory
			True	False	True	False	
Array (Continued)	AR2 (Continued)	Single Scan (Length > 32767)	100.9 + (AR2 operation)	--	635.0 + (AR2 operation)	--	--
		1st Scan Initialization (Length < 32768)	85.0	--	366.5	--	--
		1st Scan Initialization (Length > 32767)	85.0	--	570.3	--	--
		2nd through Nth Scan (AR2 operation)	22.3 + (AR2 operation)	--	89.8 + (AR2 operation)	--	
		AND,OR,XOR Scan	2.0 * words	--	9.5 * words	--	--
		ADD,SUB Scan	2.2 * words	--	10.3 * words	--	--
		MUL Scan	3.4 * words	--	16.8 * words	--	--
		DIV Scan	4.6 * words	--	26.8 * words	--	--
	ARC	Array Compare	--	5.5	--	21.8	186
		Single Scan (Length < 32768)	79.1 + (Compare Scan)	--	340.0 + (Compare Scan)	--	--

## Appendix F (continued)

Category	Code	Title	7010 Execution Time ( $\mu$ s)		6011 Execution Time ( $\mu$ s)		Bytes of Memory
			True	False	True	False	
Array (Continued)	AR2 (Continued)	Single Scan (Length > 32767)	79.1 + (Compare Scan)	--	545.0 + (Compare Scan)	--	--
		1st Scan Initialization (Length < 32768)	67.8	--	290.3	--	--
		1st Scan Initialization (Length > 32767)	67.8	--	494.0	--	--
		2nd through Nth Scan	17.7+	--	72.8+	--	--
		Compare Scan	0.8 * words	--	3.3 * words	--	--
	ASU	Array Shift Up	17.3 + 0.7 * words	12.7	68.8 + 3.3 * words	49.3	33
	ASD	Array Shift Down	17.3 + 0.7 * words	12.7	68.8 + 3.5 * words	49.3	33
Shift	SL	Shift Left	7.5	2.6	27.3	10.0	19
		(Boolean Array)	6.2 + 1.3 * bytes	3.0	24.3 + 4.3 * bytes	11.8	23

## Appendix F (continued)

Category	Code	Title	7010 Execution Time ( $\mu$ s)		6011 Execution Time ( $\mu$ s)		Bytes of Memory
			True	False	True	False	
Shift (Continued)	SR	Shift Right	7.5	2.6	27.3	10.0	19
		(Boolean Array)	7.7 + 1.3 * bytes	3.0	31.3 + 4.5 * bytes	11.8	23
	ROL	Circular Rotate Bits Left	8.3	2.6	32.5	10.0	21
		(Boolean Array)	11.3 + 1.6 * bytes	3.0	47.3 + 9.8 * bytes	11.8	29
	RL	Circular Rotate Bits Left	9.0	2.6	35.3	10.0	21
		(Boolean Array)	10.5 + 1.6 * bytes	3.0	44.5 + 9.8 * bytes	11.8	29
	ROR	Circular Rotate Bits Right	8.3	2.6	32.5	10.0	21
		(Boolean Array)	10.6 + 1.5 * bytes	3.0	46.0 + 9.3 * bytes	11.8	29
RR	Circular Rotate Bits Right	9.0	2.6	35.3	10.0	21	
	(Boolean Array)	11.4 + 1.5 * bytes	3.0	48.8 + 9.3 * bytes	11.8	29	
Control	SET	Set Event	76.0	2.8	311.0	11.5	11
	JMP	Jump	2.3	1.4	9.0	5.5	9
	LBL	Label	0.0	0.0	0.0	0.0	8+name

## Appendix F (continued)

Category	Code	Title	7010 Execution Time ( $\mu$ s)		6011 Execution Time ( $\mu$ s)		Bytes of Memory
			True	False	True	False	
I/O	IOR	Input Read	18.1	4.4	71.5	16.5	28
	IOW	Output Write	31.4	24.3	124.5	95.8	34
	IN	Immediate Input	7.0	3.0	28.0	12.8	12
	OUT	Immediate Output	4.3	2.9	16.8	11.5	12
Program	Fixed	System Overhead	--	117.0	--	479.0	8,650
	Variable	Local Boolean	0.0	--	0.0	--	6+name
		Local Boolean Array	0.0	--	0.0	--	46+name
		Local Integer	0.0	--	0.0	--	12+name
		Local Integer Array	0.0	--	0.0	--	46+name + 2*size
		Local Double Integer	0.0	--	0.0	--	16+name
		Local Double Integer Array	0.0	--	0.0	--	46+name + 4*size
		Local Counter or Timer	0.0	--	0.0	--	80+name
		Global Boolean	--	--	--	--	10+name
(Within Another Variable)	0.0	--	0.0	--	6+name		

## Appendix F (continued)

Category	Code	Title	7010 Execution Time ( $\mu$ s)		6011 Execution Time ( $\mu$ s)		Bytes of Memory
			True	False	True	False	
Program (Continued)	Variable (Continued)	Global Boolean Array	2.3 + 2.7 * words	--	12.3 + 11.8 * words	--	50+name
		Global Integer	2.6	--	12.3	--	16+name
		(Containing a Boolean)	3.5	--	16.0	--	14+name
		Global Integer Array	0.0	--	0.0	--	54+name
		Global Double Integer	2.6	--	15.5	--	18+name
		(Containing a Boolean)	3.5	--	20.5	--	14+name
		Global Double Integer Array	0.0	--	0.0	--	54+name
		Global Counter or Timer	9.0	--	50.8	--	74+name