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Instruction Execution Times

In This Appendix. . . .

Introduction

This appendix contains several tables that provide the instruction execution times for the DL330, DL330P, and DL340 CPUs. One thing you will notice is that many of the execution times depend on the type of data being used with the instruction. For example, some of the instructions have different execution times if you use a regular data register instead of a constant.

You'll also notice that some of the data instructions (such as DSTR) require differing amounts of execution time depending on the type of data. There are generally three options.

- Data Registers
- I/O Data Registers
- Constants

The following paragraphs may help you understand the differences between the register types.

Data Registers

Some data registers are primarily used to hold variable data and are considered true data registers. For example, the registers that store the timer or counter current values, or just regular variable data would be considered as a data register. Don't think that you cannot load a bit pattern into these types of registers, you can. It's just that their primary use is as a data register. The following locations are considered as data registers.

Type of Data	DL330	DL330P	DL340
Timer / Counter Current Values	R600 – R677	R600 – R677	R600 – R677
User Data Words	R400 – R563	R400 – R563	R400 – R563 R700 – R767

I/O Data Registers

You may recall that the I/O points are automatically mapped into data register locations. The following locations that contain this data are considered I/O registers and will take longer to execute with most instructions.

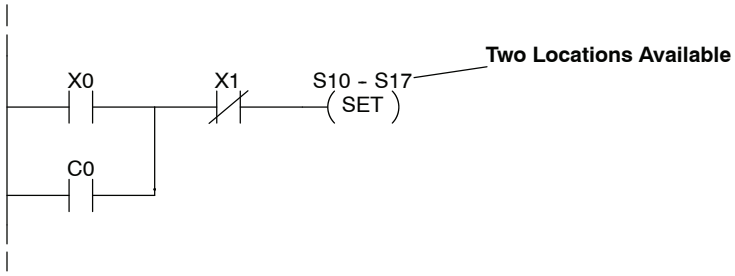
Type of Data	DL330	DL330P	DL340
I/O Points	R000 – R016* R070 – R 076	R000 – R016* R070 – R076	R000 – R017* R070 – R076

NOTE: 160 – 167 can be used as I/O in a DL330 or DL330P CPU under certain conditions. 160 – 177 can be used as I/O in a DL340 CPU under certain conditions. You should consult Chapter 4 to determine which configurations allow the use of these points.

These points are normally used as control relays. You cannot use them as both control relays and as I/O points. Also, if you use these points as I/O, you cannot access these I/O points as a Data Register reference.

How to Read the Tables

Some of the instructions can have more than one parameter so the table shows execution times that depend on the amount and type of parameters. For example, the when you use the SET instruction to set a range of stages in a DL330P CPU, the execution time depends on how many stages are being set by the instruction.



Instruction	Stage Instruction		Stage Instruction not activated by a Jump instruction (ex. power flow)
SET SG	26.3 + 13.1μs x (n-1)	18.8 μs	Does not apply
RST SG	26.3 + 13.1μs x (n-1)	18.8 μs	Does not apply

Execution depends on numbers of locations and types of data used

DL330 Instruction Execution Times

Basic Input Instructions

Instruction	Execute	Disabled by MCR
STR	6.6 µs	N/A
STR NOT	9.1 µs	N/A
AND	5.3 µs	N/A
AND NOT	8.4 µs	N/A
OR	6.6 µs	N/A
OR NOT	9.1 µs	N/A
STR T/C	10.3 µs	N/A
STR NOT T/C	12.8 µs	N/A
AND T/C	5.3 µs	N/A
AND NOT T/C	8.4 µs	N/A
OR T/C	6.6 µs	N/A
OR NOT T/C	9.1 µs	N/A
STR (Comparative Contact)	50.9 µs	N/A
STR NOT (Comparative Contact)	61.5 µs	N/A
AND (Comparative Contact)	59.1 µs	6.2 µs
AND NOT (Comparative Contact)	60.3 µs	6.2 µs
OR (Comparative Contact)	60.3 µs	6.2 µs
OR NOT (Comparative Contact)	62.5 µs	6.2 µs
AND STR	3.8 µs	N/A
OR STR	3.8 µs	N/A
MCR	5.0 µs	N/A
MCS	3.0 µs	N/A

Output Type Instructions

Instruction	Execute	Not Executed
OUT	7.5 µs	7.5 µs
SET OUT	10.0 µs	10.0 µs
SET	17.5 µs	17.5 µs
RST	9.3 µs	9.3 µs
SET OUT RST	19.3 µs	19.3 µs

Timer, Counters, and Shift Registers

Instruction	Execute w/ Constant	Execute w/ Data Register	Execute w/ I/O Register	Not Executed
TMR	90.9 µs	458.8 µs	700.0 µs	27.1 µs
CNT	92.9 µs	465.6 µs	706.8 µs	27.1 µs
SR	64.1 µs+16.6 µs times (# of shifts)			53.1 µs

Data Operations

Instruction		Execute w/ Data Register	Execute w/ I/O Register	Execute w/ Constant	Not Executed
DSTR	F50	80.7 µs	321.9 µs	14.3 µs	6.3 µs
DSTR1	F51	63.8 µs	140.9 µs	N/A	6.3 µs
DSTR2	F52	95.0 µs	172.2 µs	N/A	6.3 µs
DSTR3	F53	96.6 µs	173.8 µs	N/A	6.3 µs
DSTR5	F55	N/A	326.2 µs	N/A	6.3 µs
DOUT	F60	52.6 µs	329.4 µs	N/A	6.3 µs
DOUT1	F61	39.1 µs	160.1 µs	N/A	6.3 µs
DOUT2	F62	39.8 µs	116.0 µs	N/A	6.3 µs
DOUT3	F63	55.0 µs	108.1 µs	N/A	6.3 µs
DOUT5	F65	N/A	358.3 µs	N/A	6.3 µs
CMP<=>	F70	112.8 µs	354.0 µs	57.0 µs	6.3 µs
ADD	F71	456.8 µs	698.0 µs	262.0 µs	6.3 µs
SUB	F72	315.8 µs	557.0 µs	275.0 µs	6.3 µs
MUL	F73	290–2664 µs	497–2851 µs	223–2576 µs	6.3 µs
DIV	F74	742–2645 µs	1218–2851µs	720–2557 µs	6.3 µs
DAND	F75	103.7 µs	345.0 µs	55.6 µs	6.3 µs
DOR	F76	103.7 µs	345.0 µs	55.6 µs	6.3 µs
SHFR	F80	216 µs+13.4 µs times (# of shifts)			6.3 µs
SHFL	F81	220 µs+13.4 µs times (# of shifts)			6.3 µs
DECO	F82	56.3 µs	N/A	N/A	6.3 µs
ENCO	F83	282.0 µs	N/A	N/A	6.3 µs
INV	F84	30.0 µs	N/A	N/A	6.3 µs
BIN	F85	412.2 µs	N/A	N/A	6.3 µs
BCD	F86	746.0 µs	N/A	N/A	6.3 µs
FAULT	F20	114.0 µs	355.3 µs	72.2 µs	6.3 µs

DL330P Instruction Execution Times

Basic Input Instructions

Instruction	I/O, Control Relay		Stage		Timer / Counter	
	Executed	Not Executed	Executed	Not Executed	Executed	Not Executed
	* **	* **	* **	* **	* **	* **
STR	28.4 / 31.4µs	21.3 µs	25.6 / 30.9µs	22.2 µs	121.3/117.8µs	28.4 µs
STR NOT	28.4 / 31.4µs	21.3 µs	25.6 / 30.9µs	22.2 µs	121.3/117.8µs	28.4 µs
AND	13.4 / 20.0µs	13.4 / 20.0µs	13.4 / 20.0µs	13.4 / 20.0µs	123.1/119.6µs	20.3 µs
AND NOT	18.1 / 21.6µs	10.3 µs	18.1 / 21.6µs	10.3 µs	123.1/119.6µs	20.3 µs
OR	21.8 / 25.3µs	14.7 µs	21.8 / 25.3µs	14.7 µs	123.1/119.6µs	20.3 µs
OR NOT	20.6 / 24.1µs	14.7 µs	20.6 / 24.1µs	14.7 µs	123.1/119.6µs	20.3 µs

* Execution time when data type is ON. For example, STR 000 takes 28.4 µs if point 000 is on.

** Execution time when data type is OFF. For example, STR 000 takes 31.4 µs if point 000 is off.

Instruction	Executed	Not Executed
AND STR	25.9 µs	22.8 µs
OR STR	25.9 µs	22.8 µs

Output Type Instructions

Instruction	Execute	Not Executed
OUT	20.6 µs	20.6 µs
SET OUT	24.3 µs	16.6 µs
SET	24.3 µs	16.6 µs
RST	24.3 µs	16.6 µs
SET OUT RST	33.8 µs	29.4 µs

Timer, Counters, and Shift Registers

Instruction	Execute	Not Executed
TMR	92.8 µs	50.9 µs
CNT	97.5 µs	46.3 µs
RST CNT	25.9 µs	16.6 µs
SR	75.9 +11.5µs x (# of shifts)	41.9 µs

Stage Instructions

Instruction	Stage Instruction		Stage Instruction not activated by a Jump instruction (ex. power flow)	
	Executed	Not Executed	Executed	Not Executed
ISG	35.3 µs	20.0 µs	50.9 µs	30.6 µs
SG	35.3 µs	20.0 µs	50.9 µs	30.6 µs
JMP	28.4 µs	16.6 µs	Does not apply	
NJMP	40.3 µs	28.4 µs	Does not apply	
SET SG	26.3 + 13.1µs x (n-1)	18.8 µs	Does not apply	
RST SG	26.3 + 13.1µs x (n-1)	18.8 µs	Does not apply	

Data Operation Instructions

Instruction		Execute w/ Data Register	Execute w/ I/O Register	Execute w/ Constant	Not Executed
DSTR	F50	80.7 µs	321.9 µs	14.3 µs	6.3 µs
DSTR1	F51	63.8 µs	140.9 µs	N/A	6.3 µs
DSTR2	F52	95.0 µs	172.2 µs	N/A	6.3 µs
DSTR3	F53	96.6 µs	173.8 µs	N/A	6.3 µs
DSTR5	F55	N/A	326.2 µs	N/A	6.3 µs
DOUT	F60	52.6 µs	329.4 µs	N/A	6.3 µs
DOUT1	F61	39.1 µs	160.1 µs	N/A	6.3 µs
DOUT2	F62	39.8 µs	116.0 µs	N/A	6.3 µs
DOUT3	F63	55.0 µs	108.1 µs	N/A	6.3 µs
DOUT5	F65	N/A	358.3 µs	N/A	6.3 µs
CMP<=>	F70	112.8 µs	354.0 µs	57.0 µs	6.3 µs
ADD	F71	456.8 µs	698.0 µs	262.0 µs	6.3 µs
SUB	F72	315.8 µs	557.0 µs	275.0 µs	6.3 µs
MUL	F73	290-2664 µs	497-2851 µs	223-2576 µs	6.3 µs
DIV	F74	742-2645 µs	1218-2851µs	720-2557 µs	6.3 µs
DAND	F75	103.7 µs	345.0 µs	55.6 µs	6.3 µs
DOR	F76	103.7 µs	345.0 µs	55.6 µs	6.3 µs
SHFR	F80	216 µs+13.4 µs times (# of shifts)			6.3 µs
SHFL	F81	220 µs+13.4 µs times (# of shifts)			6.3 µs
DECO	F82	56.3 µs	N/A	N/A	6.3 µs
ENCO	F83	282.0 µs	N/A	N/A	6.3 µs
INV	F84	30.0 µs	N/A	N/A	6.3 µs
BIN	F85	412.2 µs	N/A	N/A	6.3 µs
BCD	F86	746.0 µs	N/A	N/A	6.3 µs
FAULT	F20	114.0 µs	355.3 µs	72.2 µs	6.3 µs

DL340 Instruction Execution Times

Basic Input Instructions

Instruction	Execute	Disabled by MCR
STR	0.875 µs	N/A
STR NOT	1.750 µs	N/A
AND	0.625 µs	N/A
AND NOT	1.5 µs	N/A
OR	1.125 µs	N/A
OR NOT	1.75 µs	N/A
STR T/C	0.875 µs	N/A
STR NOT T/C	1.75 µs	N/A
AND T/C	0.625 µs	N/A
AND NOT T/C	1.5 µs	N/A
OR T/C	1.125 µs	N/A
OR NOT T/C	1.75 µs	N/A
AND STR	0.75 µs	N/A
OR STR	0.75 µs	N/A
MCR	0.75 µs	N/A
MCS	1.125 µs	N/A

Comparative Contacts

Instructions	Execute w/ Data Register	Execute w/ I/O Register	Execute w/ Constant		Not Executed
			RAM	EE / UV	
STR	56.8 µs	95.0 µs	15.6 µs	15.6 µs	N/ A
STR NOT	56.8 µs	96.5 µs	15.6 µs	15.6 µs	N/A
AND	56.8 µs	95.0 µs	15.0 µs	15.0 µs	1.4 µs
AND NOT	56.8 µs	96.5 µs	15.6 µs	15.6 µs	1.4 µs
OR	56.8 µs	94.0 µs	15.6 µs	15.6 µs	1.4 µs
OR NOT	56.8 µs	94.0 µs	16.2 µs	16.2 µs	1.4 µs

Output Type Instructions

Instruction	Execute	Not Executed
OUT	1.188 µs	1.188 µs
SET OUT	1.563 µs	1.563 µs
SET	1.625 µs	1.4 µs
RST	1.625 µs	1.4 µs
SET OUT RST	7.5 µs	7.125 µs

Timer, Counters, and Shift Registers

Instructions	Execute w/ Data Register	Execute w/ I/O Register	Execute w/ Constant		Not Executed
			RAM	EE / UV	
TMR	68.1 µs	113.8 µs	22.5 µs	22.5 µs	15.7 µs
CNT	67.3 µs	97.9 µs	22.5 µs	22.5 µs	25.6 µs
SR	21.8 µs+3.8 µs times (# of shifts)				8.3 µs

Data Operation Instructions

Instruction		Execute w/ Data Register	Execute w/ I/O Register	Execute w/ Constant	Not Executed
DSTR	F50	29.4 µs	60.6 µs	10.6 µs	1.4 µs
DSTR1	F51	24.3 µs	39.4 µs	N/A	1.4 µs
DSTR2	F52	25.0 µs	40.6 µs	N/A	1.4 µs
DSTR3	F53	96.6 µs	39.4 µs	N/A	1.4 µs
DSTR5	F55	N/A	76.8 µs	N/A	1.4 µs
DOUT	F60	18.8 µs	53.8 µs	N/A	1.4 µs
DOUT1	F61	13.1 µs	33.1 µs	N/A	1.4 µs
DOUT2	F62	16.3 µs	23.1 µs	N/A	1.4 µs
DOUT3	F63	15.6 µs	23.1 µs	N/A	1.4 µs
DOUT5	F65	N/A	59.3 µs	N/A	1.4 µs
CMP<=>	F70	30.0 µs	61.8 µs	15.6 µs	1.4 µs
ADD	F71	77.5 µs	108.0 µs	63.0 µs	1.4 µs
SUB	F72	70.6 µs	101.8 µs	57.0 µs	1.4 µs
MUL	F73	71.8 – 540.0 µs	102.5 – 571.2 µs	58.7 – 526.8 µs	1.4 µs
DIV	F74	73.7 – 568.1 µs	104.3 – 598.7 µs	58.7 – 553.1 µs	1.4 µs
DAND	F75	29.3 µs	60.0 µs	15.6 µs	1.4 µs
DOR	F76	31.2 µs	62.5 µs	15.6 µs	1.4 µs
SHFR	F80	18.1 µs+2.5 µs times (# of shifts)			1.4 µs
SHFL	F81	18.1 µs+2.5 µs times (# of shifts)			1.4 µs
DECO	F82	15.6 µs	N/A	N/A	1.4 µs
ENCO	F83	47.5 µs	N/A	N/A	1.4 µs
INV	F84	6.8 µs	N/A	N/A	1.4 µs
BIN	F85	48.1 µs	N/A	N/A	1.4 µs
BCD	F86	88.7 – 326.0 µs	N/A	N/A	1.4 µs
FAULT	F20	28.8 µs	60.1 µs	15.0 µs	1.4 µs