

# ARM® Instruction Set

## Quick Reference Card

Key to Tables	
{cond}	Refer to Table <b>Condition Field</b> . Omit for unconditional execution.
<Operand2>	Refer to Table <b>Flexible Operand 2</b> . Shift and rotate are only available as part of Operand2.
<fields>	Refer to Table <b>PSR fields</b> .
<PSR>	Either CPSR (Current Processor Status Register) or SPSR (Saved Processor Status Register)
{S}	Updates condition flags if S present.
C*, V*	Flag is unpredictable in Architecture v4 and earlier, unchanged in Architecture v5 and later.
Q	Sticky flag. Always updates on overflow (no S option). Read and reset using MRS and MSR.
GE	Four Greater than or Equal flags. Always updated by parallel adds and subtracts.
x, y	B meaning half-register [15:0], or T meaning [31:16].
<immed_8r>	A 32-bit constant, formed by right-rotating an 8-bit value by an even number of bits.
{X}	RsX is Rs rotated 16 bits if X present. Otherwise, RsX is Rs.
<prefix>	Refer to Table <b>Prefixes for Parallel instructions</b>
<p_mode>	Refer to Table <b>Processor Modes</b>
R13m	R13 for the processor mode specified by <p_mode>

{endianness}	Can be BE (Big Endian) or LE (Little Endian).
<a_mode2>	Refer to Table <b>Addressing Mode 2</b> .
<a_mode2P>	Refer to Table <b>Addressing Mode 2 (Post-indexed only)</b> .
<a_mode3>	Refer to Table <b>Addressing Mode 3</b> .
<a_mode4L>	Refer to Table <b>Addressing Mode 4 (Block load or Stack pop)</b> .
<a_mode4S>	Refer to Table <b>Addressing Mode 4 (Block store or Stack push)</b> .
<a_mode5>	Refer to Table <b>Addressing Mode 5</b> .
<reglist>	A comma-separated list of registers, enclosed in braces { and }.
<reglist-PC>	As <reglist>, must not include the PC.
<reglist+PC>	As <reglist>, including the PC.
{!}	Updates base register after data transfer if ! present.
+/-	+ or -. (+ may be omitted.)
§	Refer to Table <b>ARM architecture versions</b> .
<iflags>	Interrupt flags. One or more of a, i, f (abort, interrupt, fast interrupt).
{R}	Rounds result to nearest if R present, otherwise truncates result.

Operation	§	Assembler	S updates	Q	Action
<b>Arithmetic</b>					
Add		ADD{cond}{S} Rd, Rn, <Operand2>	N Z C V		Rd := Rn + Operand2
with carry		ADC{cond}{S} Rd, Rn, <Operand2>	N Z C V		Rd := Rn + Operand2 + Carry
saturating	5E	QADD{cond} Rd, Rm, Rn		Q	Rd := SAT(Rm + Rn)
double saturating	5E	QDADD{cond} Rd, Rm, Rn		Q	Rd := SAT(Rm + SAT(Rn * 2))
Subtract		SUB{cond}{S} Rd, Rn, <Operand2>	N Z C V		Rd := Rn – Operand2
with carry		SBC{cond}{S} Rd, Rn, <Operand2>	N Z C V		Rd := Rn – Operand2 – NOT(Carry)
reverse subtract		RSB{cond}{S} Rd, Rn, <Operand2>	N Z C V		Rd := Operand2 – Rn
reverse subtract with carry		RSC{cond}{S} Rd, Rn, <Operand2>	N Z C V		Rd := Operand2 – Rn – NOT(Carry)
saturating	5E	QSUB{cond} Rd, Rm, Rn		Q	Rd := SAT(Rm – Rn)
double saturating	5E	QDSUB{cond} Rd, Rm, Rn		Q	Rd := SAT(Rm – SAT(Rn * 2))
Multiply					
and accumulate	2	MUL{cond}{S} Rd, Rm, Rs	N Z C*		Rd := (Rm * Rs)[31:0]
unsigned long	2	MLA{cond}{S} Rd, Rm, Rs, Rn	N Z C*		Rd := ((Rm * Rs) + Rn)[31:0]
unsigned accumulate long	M	UMULL{cond}{S} RdLo, RdHi, Rm, Rs	N Z C* V*		RdHi, RdLo := unsigned(Rm * Rs)
unsigned double accumulate long	6	UMAAL{cond} RdLo, RdHi, Rm, Rs	N Z C* V*		RdHi, RdLo := unsigned(RdHi + RdLo + Rm * Rs)
Signed multiply long	M	SMULL{cond}{S} RdLo, RdHi, Rm, Rs	N Z C* V*		RdHi, RdLo := signed(Rm * Rs)
and accumulate long	M	SMLAL{cond}{S} RdLo, RdHi, Rm, Rs	N Z C* V*		RdHi, RdLo := signed(RdHi, RdLo + Rm * Rs)
16 * 16 bit	5E	SMULxy{cond} Rd, Rm, Rs			Rd := Rm[x] * Rs[y]
32 * 16 bit	5E	SMULWy{cond} Rd, Rm, Rs			Rd := (Rm * Rs[y])[47:16]
16 * 16 bit and accumulate	5E	SMLAxy{cond} Rd, Rm, Rs, Rn		Q	Rd := Rn + Rm[x] * Rs[y]
32 * 16 bit and accumulate	5E	SMLAWy{cond} Rd, Rm, Rs, Rn		Q	Rd := Rn + (Rm * Rs[y])[47:16]
16 * 16 bit and accumulate long	5E	SMLALxy{cond} RdLo, RdHi, Rm, Rs			RdHi, RdLo := RdHi, RdLo + Rm[x] * Rs[y]
Dual signed multiply, add	6	SMUAD{X}{cond} Rd, Rm, Rs		Q	Rd := Rm[15:0] * RsX[15:0] + Rm[31:16] * RsX[31:16]
and accumulate	6	SMLAD{X}{cond} Rd, Rm, Rs, Rn		Q	Rd := Rn + Rm[15:0] * RsX[15:0] + Rm[31:16] * RsX[31:16]
and accumulate long	6	SMLALD{X}{cond} RdHi, RdLo, Rm, Rs		Q	RdHi, RdLo := RdHi, RdLo + Rm[15:0] * RsX[15:0] + Rm[31:16] * RsX[31:16]
Dual signed multiply, subtract	6	SMUSD{X}{cond} Rd, Rm, Rs		Q	Rd := Rm[15:0] * RsX[15:0] – Rm[31:16] * RsX[31:16]
and accumulate	6	SMLSd{X}{cond} Rd, Rm, Rs, Rn		Q	Rd := Rn + Rm[15:0] * RsX[15:0] – Rm[31:16] * RsX[31:16]
and accumulate long	6	SMLSLD{X}{cond} RdHi, RdLo, Rm, Rs		Q	RdHi, RdLo := RdHi, RdLo + Rm[15:0] * RsX[15:0] – Rm[31:16] * RsX[31:16]
Signed most significant word multiply	6	SMMUL{R}{cond} Rd, Rm, Rs			Rd := (Rm * Rs)[63:32]
and accumulate	6	SMMLA{R}{cond} Rd, Rm, Rs, Rn			Rd := Rn + (Rm * Rs)[63:32]
and subtract	6	SMMLS{R}{cond} Rd, Rm, Rs, Rn			Rd := Rn – (Rm * Rs)[63:32]
Multiply with internal 40-bit accumulate	XS	MIA{cond} Ac, Rm, Rs			Ac := Ac + Rm * Rs
packed halfword	XS	MIAPH{cond} Ac, Rm, Rs			Ac := Ac + Rm[15:0] * Rs[15:0] + Rm[31:16] * Rs[31:16]
halfword	XS	MIAXy{cond} Ac, Rm, Rs			Ac := Ac + Rm[x] * Rs[y]
Count leading zeroes	5	CLZ{cond} Rd, Rm			Rd := number of leading zeroes in Rm

# ARM Addressing Modes

## Quick Reference Card

Operation		\$	Assembler	S updates	Q	GE	Action
Parallel arithmetic	Halfword-wise addition	6	<prefix>ADD16{cond} Rd, Rn, Rm			GE	Rd[31:16] := Rn[31:16] + Rm[31:16], Rd[15:0] := Rn[15:0] + Rm[15:0]
	Halfword-wise subtraction	6	<prefix>SUB16{cond} Rd, Rn, Rm			GE	Rd[31:16] := Rn[31:16] – Rm[31:16], Rd[15:0] := Rn[15:0] – Rm[15:0]
	Byte-wise addition	6	<prefix>ADD8{cond} Rd, Rn, Rm			GE	Rd[31:24] := Rn[31:24] + Rm[31:24], Rd[23:16] := Rn[23:16] + Rm[23:16], Rd[15:8] := Rn[15:8] + Rm[15:8], Rd[7:0] := Rn[7:0] + Rm[7:0]
	Byte-wise subtraction	6	<prefix>SUB8{cond} Rd, Rn, Rm			GE	Rd[31:24] := Rn[31:24] – Rm[31:24], Rd[23:16] := Rn[23:16] – Rm[23:16], Rd[15:8] := Rn[15:8] – Rm[15:8], Rd[7:0] := Rn[7:0] – Rm[7:0]
	Halfword-wise exchange, add, subtract	6	<prefix>ADDSUBX{cond} Rd, Rn, Rm			GE	Rd[31:16] := Rn[31:16] + Rm[15:0], Rd[15:0] := Rn[15:0] – Rm[31:16]
	Halfword-wise exchange, subtract, add	6	<prefix>SUBADDX{cond} Rd, Rn, Rm			GE	Rd[31:16] := Rn[31:16] – Rm[15:0], Rd[15:0] := Rn[15:0] + Rm[31:16]
	Unsigned sum of absolute differences and accumulate	6	USAD8{cond} Rd, Rm, Rs				Rd := Abs(Rm[31:24] – Rs[31:24]) + Abs(Rm[23:16] – Rs[23:16]) + Abs(Rm[15:8] – Rs[15:8]) + Abs(Rm[7:0] – Rs[7:0]) Rd := Rn + Abs(Rm[31:24] – Rs[31:24]) + Abs(Rm[23:16] – Rs[23:16]) + Abs(Rm[15:8] – Rs[15:8]) + Abs(Rm[7:0] – Rs[7:0])
Move	Move		MOV{cond}{S} Rd, <Operand2>	N Z C			Rd := Operand2
	NOT		MVN{cond}{S} Rd, <Operand2>	N Z C			Rd := 0xFFFFFFFF EOR Operand2
	PSR to register	3	MRS{cond} Rd, <PSR>				Rd := PSR
	register to PSR	3	MSR{cond} <PSR>_<fields>, Rm				PSR := Rm (selected bytes only)
	immediate to PSR	3	MSR{cond} <PSR>_<fields>, #<immed_8r>				PSR := immed_8r (selected bytes only)
	40-bit accumulator to register	XS	MRA{cond} RdLo, RdHi, Ac				RdLo := Ac[31:0], RdHi := Ac[39:32]
Logical	register to 40-bit accumulator	XS	MAR{cond} Ac, RdLo, RdHi				Ac[31:0] := RdLo, Ac[39:32] := RdHi
	Copy	6	CPY{cond} Rd, <Operand2>				Rd := Operand2
	Test		TST{cond} Rn, <Operand2>	N Z C			Update CPSR flags on Rn AND Operand2
Compare	Test equivalence		TEQ{cond} Rn, <Operand2>	N Z C			Update CPSR flags on Rn EOR Operand2
	AND		AND{cond}{S} Rd, Rn, <Operand2>	N Z C			Rd := Rn AND Operand2
	EOR		EOR{cond}{S} Rd, Rn, <Operand2>	N Z C			Rd := Rn EOR Operand2
	ORR		ORR{cond}{S} Rd, Rn, <Operand2>	N Z C			Rd := Rn OR Operand2
	Bit Clear		BIC{cond}{S} Rd, Rn, <Operand2>	N Z C			Rd := Rn AND NOT Operand2
	Compare negative		CMP{cond} Rn, <Operand2>	N Z C V			Update CPSR flags on Rn – Operand2
Saturate			CMN{cond} Rn, <Operand2>	N Z C V			Update CPSR flags on Rn + Operand2
	Signed saturate word, right shift left shift	6	SSAT{cond} Rd, #<sat>, Rm{, ASR <sh>}			Q	Rd := SignedSat((Rm ASR sh), sat). <sat> range 0-31, <sh> range 1-32.
	Signed saturate two halfwords	6	SSAT16{cond} Rd, #<sat>, Rm			Q	Rd := SignedSat((Rm LSL sh), sat). <sat> range 0-31, <sh> range 0-31.
							Rd[31:16] := SignedSat(Rm[31:16], sat), Rd[15:0] := SignedSat(Rm[15:0], sat). <sat> range 0-15.
	Unsigned saturate word, right shift left shift	6	USAT{cond} Rd, #<sat>, Rm{, ASR <sh>}			Q	Rd := UnsignedSat((Rm ASR sh), sat). <sat> range 0-31, <sh> range 1-32.
	Unsigned saturate two halfwords	6	USAT16{cond} Rd, #<sat>, Rm			Q	Rd := UnsignedSat((Rm LSL sh), sat). <sat> range 0-31, <sh> range 0-31.
							Rd[31:16] := UnsignedSat(Rm[31:16], sat), Rd[15:0] := UnsignedSat(Rm[15:0], sat). <sat> range 0-15.

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Operation		\$	Assembler	Action	Notes
<b>Pack</b>	Pack halfword bottom + top	6	PKHBT{cond} Rd, Rn, Rm{, LSL #<sh>}	Rd[15:0] := Rn[15:0], Rd[31:16] := (Rm LSL sh)[31:16]. sh 0-31.	
	Pack halfword top + bottom	6	PKHTB{cond} Rd, Rn, Rm{, ASR #<sh>}	Rd[31:16] := Rn[31:16], Rd[15:0] := (Rm ASR sh)[15:0]. sh 1-32.	
<b>Signed extend</b>	Halfword to word	6	SXTH{cond} Rd, Rm{, ROR #<sh>}	Rd[31:0] := SignExtend((Rm ROR (8 * sh))[15:0]). sh 0-3.	
	Two bytes to halfwords	6	SXTB16{cond} Rd, Rm{, ROR #<sh>}	Rd[31:16] := SignExtend((Rm ROR (8 * sh))[23:16]), Rd[15:0] := SignExtend((Rm ROR (8 * sh))[7:0]). sh 0-3.	
	Byte to word	6	SXTB{cond} Rd, Rm{, ROR #<sh>}	Rd[31:0] := SignExtend((Rm ROR (8 * sh))[7:0]). sh 0-3.	
<b>Unsigned extend</b>	Halfword to word	6	UXTH{cond} Rd, Rm{, ROR #<sh>}	Rd[31:0] := ZeroExtend((Rm ROR (8 * sh))[15:0]). sh 0-3.	
	Two bytes to halfwords	6	UXTB16{cond} Rd, Rm{, ROR #<sh>}	Rd[31:16] := ZeroExtend((Rm ROR (8 * sh))[23:16]), Rd[15:0] := ZeroExtend((Rm ROR (8 * sh))[7:0]). sh 0-3.	
	Byte to word	6	UXTB{cond} Rd, Rm{, ROR #<sh>}	Rd[31:0] := ZeroExtend((Rm ROR (8 * sh))[7:0]). sh 0-3.	
<b>Signed extend with add</b>	Halfword to word, add	6	SXTAH{cond} Rd, Rn, Rm{, ROR #<sh>}	Rd[31:0] := Rn[31:0] + SignExtend((Rm ROR (8 * sh))[15:0]). sh 0-3.	
	Two bytes to halfwords, add	6	SXTAB16{cond} Rd, Rn, Rm{, ROR #<sh>}	Rd[31:16] := Rn[31:16] + SignExtend((Rm ROR (8 * sh))[23:16]), Rd[15:0] := Rn[15:0] + SignExtend((Rm ROR (8 * sh))[7:0]). sh 0-3.	
	Byte to word, add	6	SXTAB{cond} Rd, Rn, Rm{, ROR #<sh>}	Rd[31:0] := Rn[31:0] + SignExtend((Rm ROR (8 * sh))[7:0]). sh 0-3.	
<b>Unsigned extend with add</b>	Halfword to word, add	6	UXTAH{cond} Rd, Rn, Rm{, ROR #<sh>}	Rd[31:0] := Rn[31:0] + ZeroExtend((Rm ROR (8 * sh))[15:0]). sh 0-3.	
	Two bytes to halfwords, add	6	UXTAB16{cond} Rd, Rn, Rm{, ROR #<sh>}	Rd[31:16] := Rn[31:16] + ZeroExtend((Rm ROR (8 * sh))[23:16]), Rd[15:0] := Rn[15:0] + ZeroExtend((Rm ROR (8 * sh))[7:0]). sh 0-3.	
	Byte to word, add	6	UXTAB{cond} Rd, Rn, Rm{, ROR #<sh>}	Rd[31:0] := Rn[31:0] + ZeroExtend((Rm ROR (8 * sh))[7:0]). sh 0-3.	
<b>Reverse bytes</b>	In word	6	REV{cond} Rd, Rm	Rd[31:24] := Rm[7:0], Rd[23:16] := Rm[15:8], Rd[15:8] := Rm[23:16], Rd[7:0] := Rm[31:24]	
	In both halfwords	6	REV16{cond} Rd, Rm	Rd[15:8] := Rm[7:0], Rd[7:0] := Rm[15:8], Rd[31:24] := Rm[23:16], Rd[23:16] := Rm[31:24]	
	In low halfword, sign extend	6	REVSH{cond} Rd, Rm	Rd[15:8] := Rm[7:0], Rd[7:0] := Rm[15:8], Rd[31:16] := Rm[7] * &FFFF	
<b>Select</b>	Select bytes	6	SEL{cond} Rd, Rn, Rm	Rd[7:0] := Rn[7:0] if GE[0] = 1, else Rd[7:0] := Rm[7:0] Bits[15:8], [23:16], [31:24] selected similarly by GE[1], GE[2], GE[3]	
<b>Branch</b>	Branch		B{cond} label	R15 := label	label must be within ±32Mb of current instruction.
	with link		BL{cond} label	R14 := address of next instruction, R15 := label	
	and exchange	4T,5	BX{cond} Rm	R15 := Rm, Change to Thumb if Rm[0] is 1	Cannot be conditional. label must be within ±32Mb of current instruction.
	with link and exchange (1)	5T	BLX label	R14 := address of next instruction, R15 := label, Change to Thumb	
	with link and exchange (2)	5	BLX{cond} Rm	R14 := address of next instruction, R15 := Rm[31:1] Change to Thumb if Rm[0] is 1	
	and change to Java state	5J, 6	BXJ{cond} Rm	Change to Java state	
<b>Processor state change</b>	Change processor state	6	CPSID <iflags> {, #<p_mode>}	Disable specified interrupts, optional change mode.	Cannot be conditional.
		6	CPSIE <iflags> {, #<p_mode>}	Enable specified interrupts, optional change mode.	Cannot be conditional.
	Change processor mode	6	CPS #<p_mode>		Cannot be conditional.
	Set endianness	6	SETEND <endianness>	Sets endianness for loads and saves. <endianness> can be BE (Big Endian) or LE (Little Endian).	Cannot be conditional.
	Store return state	6	SRS<a_mode4S> #<p_mode>{!}	[R13m] := R14, [R13m + 4] := CPSR	Cannot be conditional.
	Return from exception	6	RFE<a_mode4L> Rn{!}	PC := [Rn], CPSR := [Rn + 4]	Cannot be conditional.
<b>Software interrupt</b>	Breakpoint	5	BKPT <immed_16>	Prefetch abort <i>or</i> enter debug state.	Cannot be conditional.
	Software interrupt		SWI{cond} <immed_24>	Software interrupt processor exception.	24-bit value encoded in instruction.
<b>No Op</b>	No operation	5	NOP	None	

# ARM Addressing Modes

## Quick Reference Card

Operation		\$	Assembler	Action	Notes
<b>Load</b>	Word User mode privilege branch (§ 5T: and exchange)		LDR{cond} Rd, <a_mode2> LDR{cond}T Rd, <a_mode2P> LDR{cond} R15, <a_mode2>	Rd := [address]  R15 := [address][31:1] (§ 5T: Change to Thumb if [address][0] is 1) Rd := ZeroExtend[byte from address]	Rd must not be R15. Rd must not be R15.
	Byte User mode privilege signed		LDR{cond}B Rd, <a_mode2> LDR{cond}BT Rd, <a_mode2P>	Rd := SignExtend[byte from address]	Rd must not be R15. Rd must not be R15.
	Halfword signed	4	LDR{cond}H Rd, <a_mode3>	Rd := ZeroExtent[halfword from address]	Rd must not be R15.
	Doubleword	4	LDR{cond}SH Rd, <a_mode3>	Rd := SignExtend[halfword from address]	Rd must not be R15.
	Pop, or Block data load return (and exchange)	5E*	LDR{cond}D Rd, <a_mode3> LDM{cond}<a_mode4L> Rn{!}, <reglist-PC> LDM{cond}<a_mode4L> Rn{!}, <reglist+PC>	Rd := [address], R(d+1) := [address + 4] Load list of registers from [Rn] Load registers, R15 := [address][31:1] (§ 5T: Change to Thumb if [address][0] is 1)	Rd must be even, and not R14.
<b>Load multiple</b>	and restore CPSR User mode registers		LDM{cond}<a_mode4L> Rn{!}, <reglist+PC>^	Load registers, branch (§ 5T: and exchange), CPSR := SPSR	Use from exception modes only.
<b>Soft preload</b>	Memory system hint	5E*	PLD <a_mode2>	Load list of User mode registers from [Rn]	Use from privileged modes only.
<b>Load exclusive</b>	Semaphore operation	6	LDREX{cond} Rd, [Rn]	Memory may prepare to load from address Rd := [Rn], tag address as exclusive access Outstanding tag set if not shared address	Cannot be conditional. Rd, Rn must not be R15.
<b>Store</b>	Word User mode privilege		STR{cond} Rd, <a_mode2>	[address] := Rd	
	Byte User mode privilege		STR{cond}T Rd, <a_mode2P>	[address] := Rd	
	Halfword		STR{cond}B Rd, <a_mode2>	[address][7:0] := Rd[7:0]	
	Doubleword	4	STR{cond}BT Rd, <a_mode2P>	[address][7:0] := Rd[7:0]	
	Push, or Block data store	5E*	STR{cond}H Rd, <a_mode3> STR{cond}D Rd, <a_mode3>	[address][15:0] := Rd[15:0] [address] := Rd, [address + 4] := R(d+1)	Rd must be even, and not R14.
<b>Store multiple</b>	User mode registers		STM{cond}<a_mode4S> Rn{!}, <reglist>	Store list of registers to [Rn]	
<b>Store exclusive</b>	Semaphore operation	6	STM{cond}<a_mode4S> Rn{!}, <reglist>^ STREX{cond} Rd, Rm, [Rn]	Store list of User mode registers to [Rn] [Rn] := Rm if allowed, Rd := 0 if successful, else 1	Use from privileged modes only. Rd, Rm, Rn must not be R15.
<b>Swap</b>	Word	3	SWP{cond} Rd, Rm, [Rn]	temp := [Rn], [Rn] := Rm, Rd := temp	
	Byte	3	SWP{cond}B Rd, Rm, [Rn]	temp := ZeroExtend([Rn][7:0]), [Rn][7:0] := Rm[7:0], Rd := temp	

# ARM Addressing Modes

## Quick Reference Card

Addressing Mode 2 - Word and Unsigned Byte Data Transfer			
Pre-indexed	Immediate offset	[Rn, #+/-<immed_12>]{!}	Equivalent to [Rn,#0]
	Zero offset	[Rn]	
	Register offset	[Rn, +/-Rm]{!}	
	Scaled register offset	[Rn, +/-Rm, LSL #<shift>]{!}	
		[Rn, +/-Rm, LSR #<shift>]{!}	
Post-indexed	Immediate offset	[Rn, +/-Rm, ASR #<shift>]{!}	Allowed shifts 0-31
		[Rn, +/-Rm, ROR #<shift>]{!}	Allowed shifts 1-32
	Register offset	[Rn, +/-Rm, RRX]{!}	Allowed shifts 1-32
		[Rn, +/-Rm, ROR #<shift>]{!}	Allowed shifts 1-31
	Scaled register offset	[Rn, +/-Rm, LSL #<shift>]	Allowed shifts 0-31
		[Rn, +/-Rm, LSR #<shift>]	Allowed shifts 1-32
		[Rn, +/-Rm, ASR #<shift>]	Allowed shifts 1-32
		[Rn, +/-Rm, ROR #<shift>]	Allowed shifts 1-31

Addressing Mode 2 (Post-indexed only)			
Post-indexed	Immediate offset	[Rn], #+/-<immed_12>	Equivalent to [Rn],#0
	Zero offset	[Rn]	
	Register offset	[Rn], +/-Rm	
	Scaled register offset	[Rn], +/-Rm, LSL #<shift>	
		[Rn], +/-Rm, LSR #<shift>	
		[Rn], +/-Rm, ASR #<shift>	Allowed shifts 0-31
		[Rn], +/-Rm, ROR #<shift>	Allowed shifts 1-32
		[Rn], +/-Rm, RRX	Allowed shifts 1-31

Addressing Mode 3 - Halfword, Signed Byte, and Doubleword Data Transfer			
Pre-indexed	Immediate offset	[Rn, #+/-<immed_8>]{!}	Equivalent to [Rn,#0]
	Zero offset	[Rn]	
Post-indexed	Register	[Rn, +/-Rm]{!}	
	Immediate offset	[Rn], #+/-<immed_8>	
	Register	[Rn], +/-Rm	

Addressing Mode 4 - Multiple Data Transfer			
Block load		Stack pop	
IA	Increment After	FD	Full Descending
IB	Increment Before	ED	Empty Descending
DA	Decrement After	FA	Full Ascending
DB	Decrement Before	EA	Empty Ascending
Block store		Stack push	
IA	Increment After	EA	Empty Ascending
IB	Increment Before	FA	Full Ascending
DA	Decrement After	ED	Empty Descending
DB	Decrement Before	FD	Full Descending

Addressing Mode 5 - Coprocessor Data Transfer			
Pre-indexed	Immediate offset	[Rn, #+/-<immed_8*4>]{!}	Equivalent to [Rn,#0]
	Zero offset	[Rn]	
Post-indexed	Immediate offset	[Rn], #+/-<immed_8*4>	
Unindexed	No offset	[Rn], {8-bit copro. option}	

ARM architecture versions	
<i>n</i>	ARM architecture version <i>n</i> and above.
<i>n</i> T, <i>n</i> J	T or J variants of ARM architecture version <i>n</i> and above.
<i>M</i>	ARM architecture version 3 <i>M</i> , and 4 and above, except x <i>M</i> variants.
<i>n</i> E	All E variants of ARM architecture version <i>n</i> and above.
<i>n</i> E*	E variants of ARM architecture version <i>n</i> and above, except x <i>P</i> variants.
<i>XS</i>	XScale coprocessor instruction

Flexible Operand 2		
Immediate value	#<immed_8r>	
Logical shift left immediate	Rm, LSL #<shift>	Allowed shifts 0-31
Logical shift right immediate	Rm, LSR #<shift>	Allowed shifts 1-32
Arithmetic shift right immediate	Rm, ASR #<shift>	Allowed shifts 1-32
Rotate right immediate	Rm, ROR #<shift>	Allowed shifts 1-31
Register	Rm	
Rotate right extended	Rm, RRX	
Logical shift left register	Rm, LSL Rs	
Logical shift right register	Rm, LSR Rs	
Arithmetic shift right register	Rm, ASR Rs	
Rotate right register	Rm, ROR Rs	

PSR fields (use at least one suffix)		
Suffix	Meaning	
c	Control field mask byte	PSR[7:0]
f	Flags field mask byte	PSR[31:24]
s	Status field mask byte	PSR[23:16]
x	Extension field mask byte	PSR[15:8]

Condition Field		
Mnemonic	Description	Description (VFP)
EQ	Equal	Equal
NE	Not equal	Not equal, or unordered
CS / HS	Carry Set / Unsigned higher or same	Greater than or equal, or unordered
CC / LO	Carry Clear / Unsigned lower	Less than
MI	Negative	Less than
PL	Positive or zero	Greater than or equal, or unordered
VS	Overflow	Unordered (at least one NaN operand)
VC	No overflow	Not unordered
HI	Unsigned higher	Greater than, or unordered
LS	Unsigned lower or same	Less than or equal
GE	Signed greater than or equal	Greater than or equal
LT	Signed less than	Less than, or unordered
GT	Signed greater than	Greater than
LE	Signed less than or equal	Less than or equal, or unordered
AL	Always (normally omitted)	Always (normally omitted)

Processor Modes	
16	User
17	FIQ Fast Interrupt
18	IRQ Interrupt
19	Supervisor
23	Abort
27	Undefined
31	System

Prefixes for Parallel Instructions	
S	Signed arithmetic modulo 2 <sup>8</sup> or 2 <sup>16</sup> , sets CPSR GE bits
Q	Signed saturating arithmetic
SH	Signed arithmetic, halving results
U	Unsigned arithmetic modulo 2 <sup>8</sup> or 2 <sup>16</sup> , sets CPSR GE bits
UQ	Unsigned saturating arithmetic
UH	Unsigned arithmetic, halving results

# ARM Addressing Modes

## Quick Reference Card

Coprocessor operations	§	Assembler	Action	Notes
Data operations	2	CDP{cond} <copr>, <op1>, CRd, CRn, CRm{, <op2>}	Coprocessor dependent	
Alternative data operations	5	CDP2 <copr>, <op1>, CRd, CRn, CRm{, <op2>}	Coprocessor dependent	Cannot be conditional.
Move to ARM register from coprocessor	2	MRC{cond} <copr>, <op1>, Rd, CRn, CRm{, <op2>}	Coprocessor dependent	
Alternative move	5	MRC2 <copr>, <op1>, Rd, CRn, CRm{, <op2>}	Coprocessor dependent	Cannot be conditional.
Two ARM register move	5E*	MRRC{cond} <copr>, <op1>, Rd, Rn, CRm	Coprocessor dependent	
Alternative two ARM register move	6	MRRC2 <copr>, <op1>, Rd, Rn, CRm	Coprocessor dependent	Cannot be conditional.
Move to coproc from ARM reg	2	MCR{cond} <copr>, <op1>, Rd, CRn, CRm{, <op2>}	Coprocessor dependent	
Alternative move	5	MCR2 <copr>, <op1>, Rd, CRn, CRm{, <op2>}	Coprocessor dependent	Cannot be conditional.
Two ARM register move	5E*	MCRR{cond} <copr>, <op1>, Rd, Rn, CRm	Coprocessor dependent	
Alternative two ARM register move	6	MCRR2 <copr>, <op1>, Rd, Rn, CRm	Coprocessor dependent	Cannot be conditional.
Load	2	LDC{cond} <copr>, CRd, <a_mode5>	Coprocessor dependent	
Alternative loads	5	LDC2 <copr>, CRd, <a_mode5>	Coprocessor dependent	Cannot be conditional.
Store	2	STC{cond} <copr>, CRd, <a_mode5>	Coprocessor dependent	
Alternative stores	5	STC2 <copr>, CRd, <a_mode5>	Coprocessor dependent	Cannot be conditional.

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### Change Log

Issue	Date	By	Change
A	June 1995	BJH	First Release
B	Sept 1996	BJH	Second Release
C	Nov 1998	BJH	Third Release
D	Oct 1999	CKS	Fourth Release
E	Oct 2000	CKS	Fifth Release
F	Sept 2001	CKS	Sixth Release
G	Jan 2003	CKS	Seventh Release
H	Oct 2003	CKS	Eighth Release