# 🧠 Instruction Set

> **Version**: `0.5.0`
> **Total Instructions Supported**: `73`
> **Operand Size**: Up to **2 operands**, each of **64-bits**

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## 🧩 Operand Types

Instructions in SASM accept a variety of operand types:

??? example "Immediate Values"

```
0, 1, 2, 3
```

??? example "Constants"

```
M, N, O, P
```

??? example "Registers"

```
L0, L1, L2, L3
```

---

## 🗂️ Register Dereferencing

SASM registers are identified by **unique IDs**. Each register can be accessed either as a **reference** or as a **value** using *compile-time functions*.

```
ref(L1)  ; reference to register L1
val(L1)  ; value stored in register L1
```

> These are **compile-time functions** that tell the assembler how to interpret operands.

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### 🔗 Related References

- 📄 Compile-time Functions
- 📄 Register Reference

## Instruction Set - Quick Reference

=== "ARITHMETIC"

```
=== "INTEGER"

    | OPCODE | INST |
    |--------|------|
    | **13** | [ADDI](Arithmetic/Addition.md#__tabbed_1_1) |
    | **14** | [SUBI](Arithmetic/Subtraction.md#__tabbed_1_1) |
    | **15** | [MULI](Arithmetic/Multiplication.md#__tabbed_1_1) |
    | **16** | [DIVI](Arithmetic/Division.md#__tabbed_1_1) |
    | **17** | [MODI](Arithmetic/Modulus.md#__tabbed_1_1) |

=== "UNSIGNED"

    | OPCODE | INST |
    |--------|------|
    | **18** | [ADDU](Arithmetic/Addition.md#__tabbed_2_1) |
    | **19** | [SUBU](Arithmetic/Subtraction.md#__tabbed_2_1) |
    | **20** | [MULU](Arithmetic/Multiplication.md#__tabbed_2_1) |
    | **21** | [DIVU](Arithmetic/Division.md#__tabbed_2_1) |
    | **22** | [MODU](Arithmetic/Modulus.md#__tabbed_2_1) |

=== "FLOAT"

    | OPCODE | INST |
    |--------|------|
    | **23** | [ADDF](Arithmetic/Addition.md#__tabbed_3_1) |
    | **24** | [SUBF](Arithmetic/Subtraction.md#__tabbed_3_1) |
    | **25** | [MULF](Arithmetic/Multiplication.md#__tabbed_3_1) |
    | **26** | [DIVF](Arithmetic/Division.md#__tabbed_3_1) |
```

=== "UNDOCUMENTED"

```
=== "RELATIONAL"

    === "INTEGER"

        | OPCODE | INST |
        |--------|------|
        | **35** | [EQI](reference/missing) |
        | **36** | [GEI](reference/missing) |
        | **37** | [GTI](reference/missing) |
        | **38** | [LEI](reference/missing) |
        | **39** | [LTI](reference/missing) |
        | **40** | [NEI](reference/missing) |

    === "UNSIGNED"

        | OPCODE | INST |
```

```
        |--------|------|
        | **41** | [EQU](reference/missing) |
        | **42** | [GEU](reference/missing) |
        | **43** | [GTU](reference/missing) |
        | **44** | [LEU](reference/missing) |
        | **45** | [LTU](reference/missing) |
        | **46** | [NEU](reference/missing) |

    === "FLOAT"

        | OPCODE | INST |
        |--------|------|
        | **47** | [EQF](reference/missing) |
        | **48** | [GEF](reference/missing) |
        | **49** | [GTF](reference/missing) |
        | **50** | [LEF](reference/missing) |
        | **51** | [LTF](reference/missing) |
        | **52** | [NEF](reference/missing) |

=== "TYPE CASTING"

    | OPCODE | INST |
    |--------|------|
    | **57** | [I2F](reference/missing) |
    | **58** | [U2F](reference/missing) |
    | **59** | [F2I](reference/missing) |
    | **60** | [F2U](reference/missing) |

=== "MEMORY ACCESS"

    | OPCODE | INST |
    |--------|------|
    | **61** | [READ1U](reference/missing) |
    | **62** | [READ2U](reference/missing) |
    | **63** | [READ4U](reference/missing) |
    | **64** | [READ8U](reference/missing) |
    | **65** | [READ1I](reference/missing) |
    | **66** | [READ2I](reference/missing) |
    | **67** | [READ4I](reference/missing) |
    | **68** | [READ8I](reference/missing) |
    | **69** | [WRITE1](reference/missing) |
    | **70** | [WRITE2](reference/missing) |
    | **71** | [WRITE4](reference/missing) |
    | **72** | [WRITE8](reference/missing) |

=== "SEQUENCE CONTROL"

    | OPCODE | INST |
    |--------|------|
    |  **1** | [INVOK](reference/missing) |
    |  **2** | [RETVL](reference/missing) |
    |  **8** | [CALL](reference/missing) |
    |  **9** | [LOOP](reference/missing) |
```

```
    | **27** | [JMPU](reference/missing) |
    | **28** | [JMPC](reference/missing) |
    | **33** | [RET](reference/missing) |

=== "BINARY OPERATIONS"

    | OPCODE | INST |
    |--------|------|
    | **34** | [NOT](reference/missing) |
    | **53** | [ORB](reference/missing) |
    | **54** | [XOR](reference/missing) |
    | **55** | [SHR](reference/missing) |
    | **56** | [SHL](reference/missing) |
    | **29** | [ANDB](reference/missing) |
    | **30** | [NOTB](reference/missing) |

=== "MISC"

    | OPCODE | INST |
    |--------|------|
    |  **0** | [DONOP](reference/missing) |
    |  **3** | [PUSHR](reference/missing) |
    |  **4** | [SPOPR](reference/missing) |
    |  **5** | [SHUTS](reference/missing) |
    |  **6** | [SETR](reference/missing) |
    |  **7** | [GETR](reference/missing) |
    | **10** | [PUSH](reference/missing) |
    | **11** | [SPOP](reference/missing) |
    | **12** | [SWAP](reference/missing) |
    | **31** | [COPY](reference/missing) |
    | **32** | [DUPS](reference/missing) |
```

## INSTRUCTION DOCUMENTATION TEMPLATE:

[OPCODE] — *[OPERATION]* {#OPCODE}

```

```

=== "ADDF Example"

```
  ```linenums="1" hl_lines="1 3 5"

  ```
```

=== "ADDF Properties"

```
| Opcode | Operand Type        | Destination   |
|--------|---------------------|---------------|
|        | 64-bit       Value | L_ (implicit) |

Identified as memonic [#OPCODE](#OPCODE), OPCODE is used to
```